DATAMATION

62

August

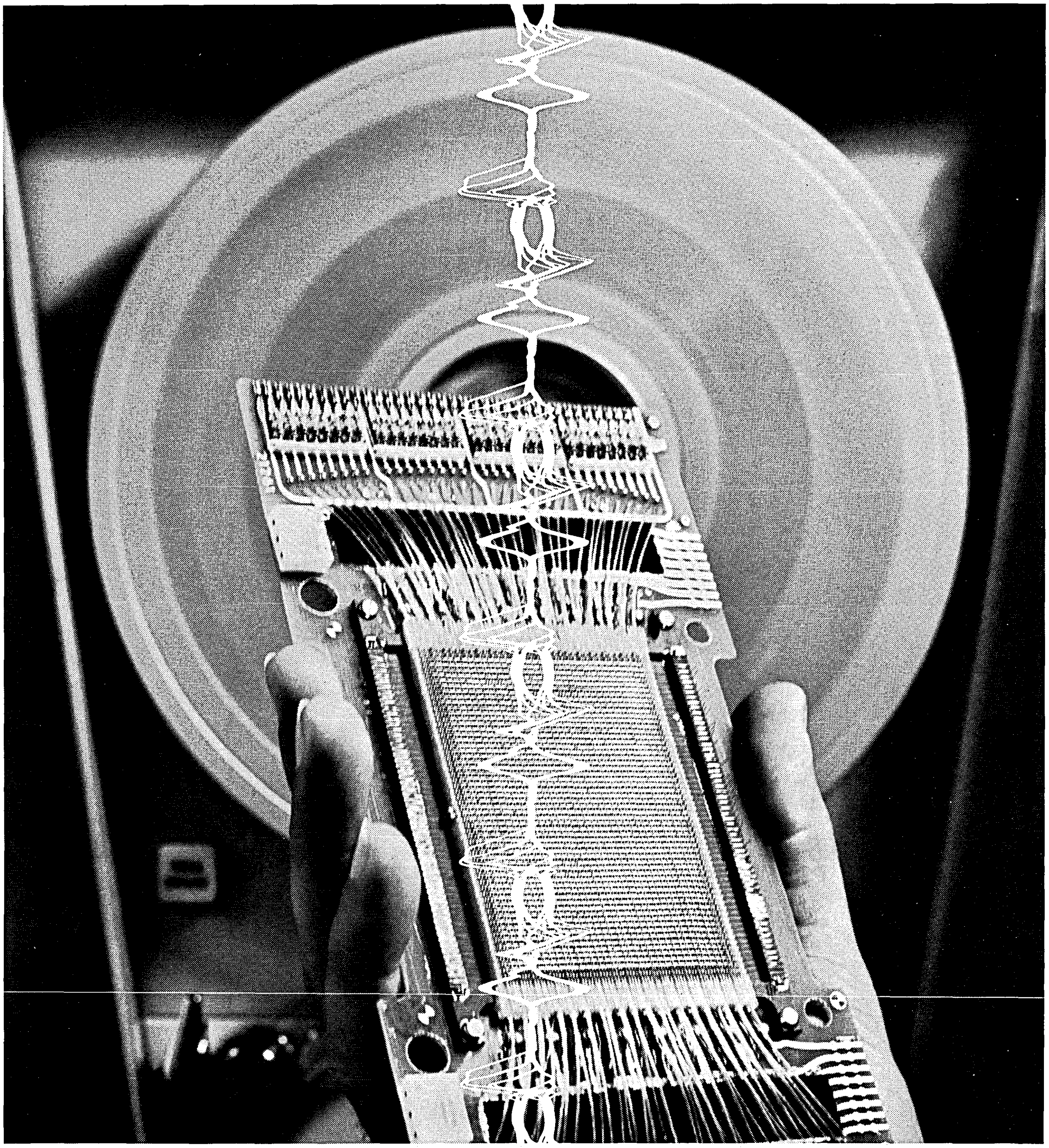
ifip

congress '62

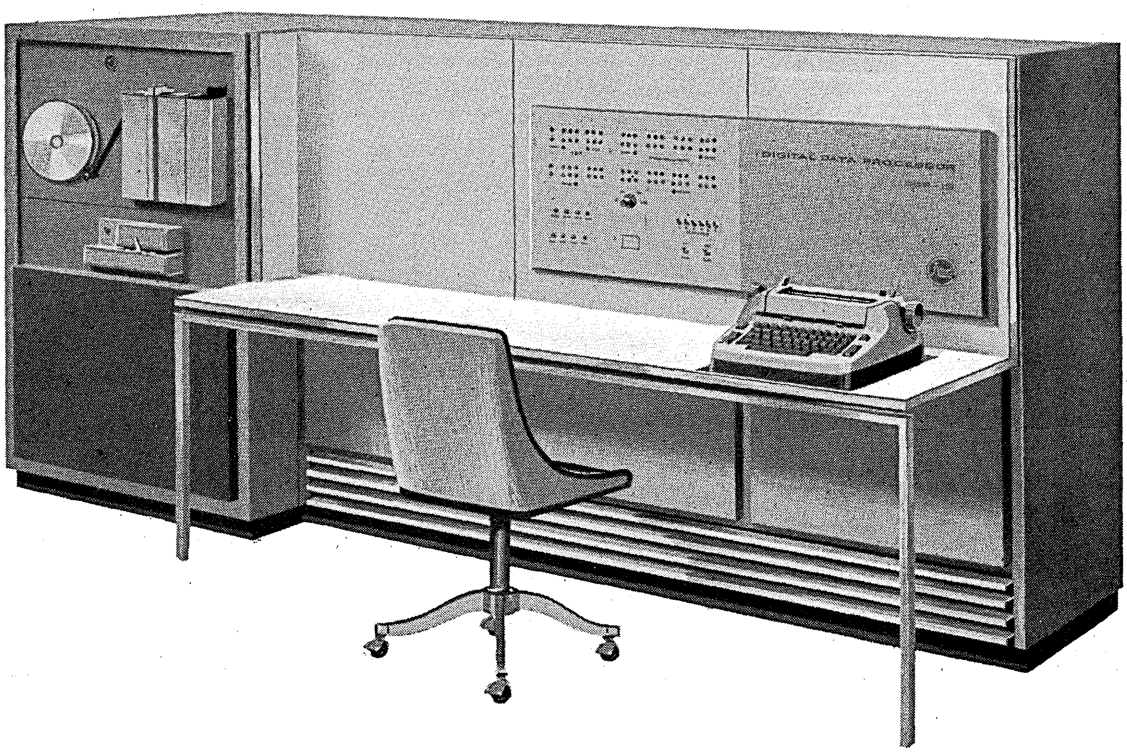
Munich

germany

august 27 thru september 1



DDP-19



Fastest real time medium-size computer

The DDP-19 Digital Data Processor handles complex on-line engineering data faster than comparable machines. Off-line too. Typical operation times, including instruction, operand access times:

ADD	10 microseconds
MULTIPLY	39 microseconds
DIVIDE	66 microseconds
DOUBLE PRECISION ADD	60 microseconds
FLOATING POINT — 37 BIT MANTISSA, 10 BIT EXPONENT:	
ADD	220 microseconds
MULTIPLY	347 microseconds
MEMORY CYCLE TIME	5 microseconds
MEMORY ACCESS TIME	3 microseconds

Computation speeds such as these are backed by a strong command structure with multiply, divide, and multiple precision commands, plus easy floating point operation. Indexing, of course.

RELIABLE. DDP-19 modules, 3C's standard S-PACs, have passed 800,000th PAC-hour of life test with no failures.

IN-OUT VARIETY. Program controlled data transfer. Multichannel interrupt with character buffers, word buffers, parallel transfer. Asynchronous full interrupt channels with 200,000 word/sec transfer rate. Fully buffered input-output channels with 200 kc word transfer rate — 3.8 million bits/sec.

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BASICS. DDP-19 Digital Data Processor is binary, parallel, single address. Core memory (4096 to 16,384 words), indexing, fixed point arithmetic, choice of 19, 22, or 24 bit word. Solid state. Brochure and applications portfolio available.

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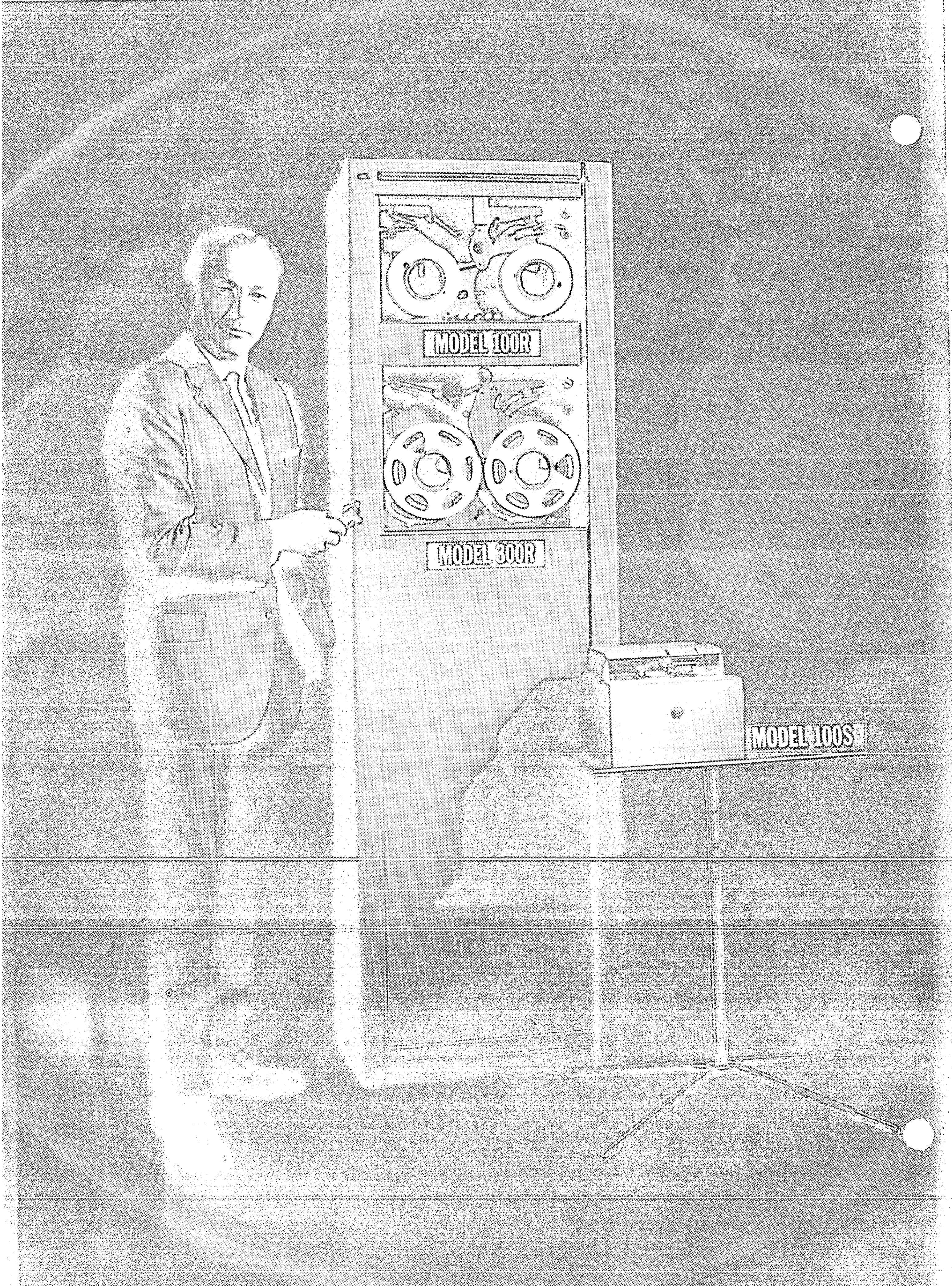
CIRCLE 6 ON READER CARD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MODEL 300R
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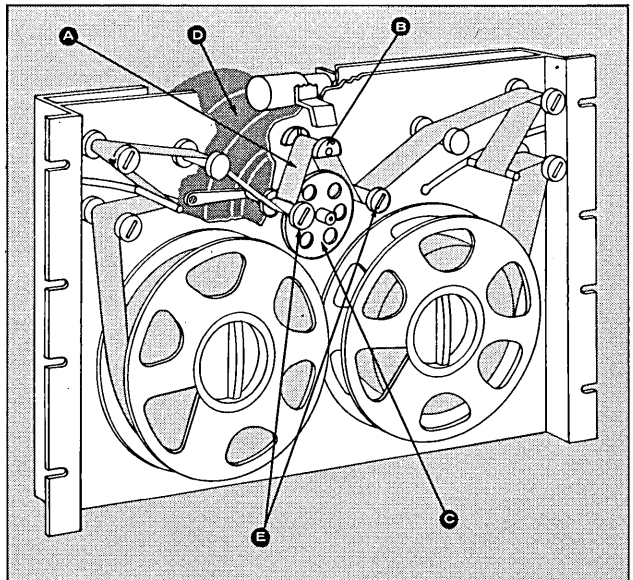

Line by line cycle: movement of tape (A) over read head (B) is controlled by drive capstan (C)—attached directly to shaft of PMI printed motor* (D); spring-loaded rollers (E) hold tape gently against capstan, keeping tape movement in exact accord with capstan rotation; advance command pulse accelerates motor, capstan, and tape; as read head detects next sprocket hole, a reverse pulse to motor halts capstan and tape with next character perfectly aligned in read head.

***U.S. Patents of Printed Motors, Inc. Pending.**

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CORPORATION
TAPE READER DIVISION
Glen Cove, N. Y.

CIRCLE 7 ON READER CARD

DATAMATION 62

the automatic handling of information

volume 8, number 8

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THIS ISSUE — 42,100 COPIES

DATAMATION®
August

Cover

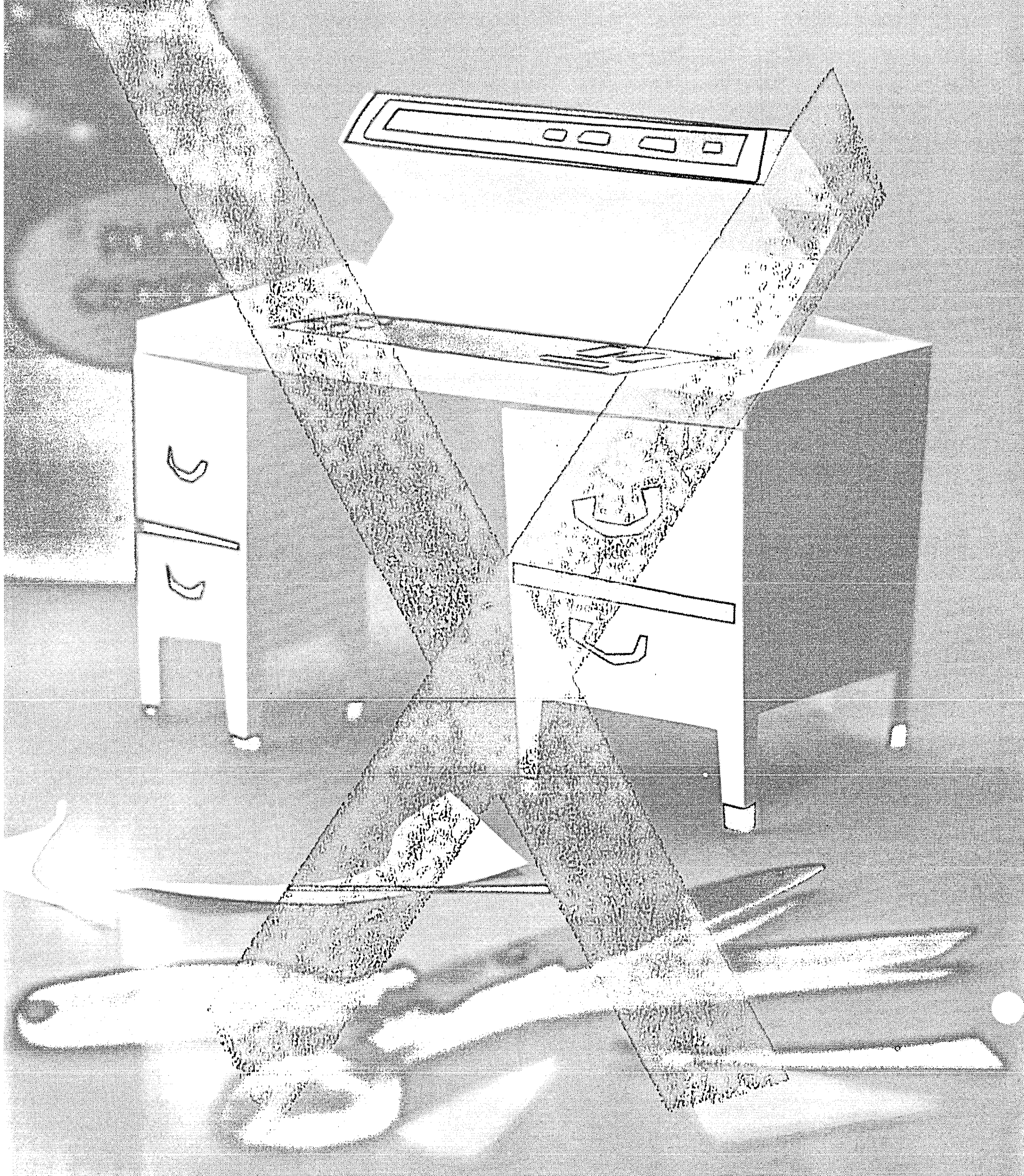
A colorful entre to the IFIP Congress, this month's cover, designed by Art Director Cleve Boutell, invites the reader to a comprehensive series of articles scanning the international scene and including a special preview of the Congress beginning on page 40.

Circulation audited by Business Publications Audit BPA

Member, National Business Publications NBP

DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, president. Executive Circulation and Advertising offices, 141 East 44th St., New York 17, N.Y. (MUrray Hill 7-5180). Editorial offices, 10373 West Pico Blvd., Los Angeles 64, Calif. (BRadshaw 2-0817). Published at Chicago, Ill. Accepted as controlled circulation at Columbus, O. Form 3579 to be sent to F. D. Thompson Publications, Inc., 201 N. Wells St., Chicago 6, Ill. Printed by Beslow Associates, Inc.

WHO SAID IT'S A PAPER COMPUTER?



...THE PHILCO 212 SYSTEM IS HERE NOW!

OFF PAPER!
ON SCHEDULE!
IN OPERATION!
IN PRODUCTION!
MEETS SPECS!

CHECK THIS PERFORMANCE!

On July 12th a Philco 212 ran this program* in 82 seconds.

```
      DIMENSION THETA (1200),
     1 THETAP (1200), BEG (1200)
      PAUSE 11111
      DO 11 K = 1, 1000
      B = -1.818
      EMD = .223 E-4
      ALPHA = 4.089
      EMO = 1500.
      T1 = 0.
      T2 = 0.
      B = B * 1.E-7
      KMAX = 1200
      STEP = .5 * 8.64 E4
   20 TIMD = 0.
      TIME = 0.
      DO 10 J = 1, KMAX
      TP = TIME - TIMD
      THETA (J) = ALPHA + B * TIME
      THETAP (J) = THETA (J)
      IF (T1 - TIME) 60, 61, 61
   60 IF (T2 - TIME) 61, 61, 63
   61 EMDT = EMD * TP
      BEG (J) = ALPHA/
     1 (EMO - EMDT)
      GO TO 10
   63 BEG (J) = 0.
      TIMD = T2 - T1
   10 TIME = TIME + STEP
   11 CONTINUE
      PAUSE 17777
      END (1, 1, 1, 1, 1)
```

*Program written by a Philco customer in FORTRAN source language for 211 computer timing purposes, and run on a 212 at Willow Grove, Penna.

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Computer Division, 3900 Welsh Road, Willow Grove, Penna.
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important DATES

• The 1962 WESCON will be held Aug. 21-24 in the California Memorial Sports Arena and Statler-Hilton Hotel, Los Angeles.

• The 1962 IFIP Congress is set for Aug. 27-Sept. 1 in Munich, Germany.

• The 1962 Symposium on Ballistic Missile and Space Technology sponsored by USAF and Aerospace Corp. will be held at the Statler Hilton, Los Angeles, Aug. 27-29.

• The ACM National Conference will be held Sept. 4-7 at the Onondaga County War Memorial Auditorium and Hotel Syracuse, Syracuse, N.Y.

• The 3rd annual Symposium on Switching Circuit Theory and Logical Design will be held Oct. 7-12 in Chicago, Ill. under the sponsorship of the AIEE Computing Devices Committee.

• The 15th annual International Systems meeting is scheduled for Oct. 29-31 at the Hotels Statler Hilton and Sheraton Plaza, Boston, Mass.

• The 1962 Fall Joint Computer Conference will be held on Dec. 4, 5 and 6th at the Sheraton Hotel, Philadelphia, Pennsylvania.

• The AIEE/IRE International Conference on Nonlinear Magnetics will be held at the Shoreham Hotel, Washington, D.C., April 17-19, 1963.

• The 1963 Spring Joint Computer Conference will be held May 28, 29 and 30th, 1963, at the Cobo Hall, Detroit, Michigan.

• The 1963 ACM National Conference will be held Aug. 28, 29, and 30th in Denver, Colorado.

• The 1963 Fall Joint Computer Conference will be held in Los Angeles, Calif., Nov. 12-14, 1963.

• The 1964 ACM National Conference will be held in Philadelphia, Penna., Aug. 25-28, 1964.

• The IFIP Congress 65 is scheduled for New York City in May, 1965. It is the first International Congress scheduled for the United States.

letters

compiler comparison, part 2

Sir:

An article in the May DATAMATION compared the compile time and running time of a FOTRAN source program which was run on various computers.

Lockheed Missiles and Space Company supplied us with a copy of the program. Your readers might be interested in the relative speed on the IBM 7070.

The program compiled in three minutes using "Basic FORTRAN" and eight minutes with the "Full FORTRAN", using the FORTRAN compilers supplied by IBM. It took 23 seconds to compile using a GOTRAN for the 7070, which was written by Mr. John Pomeranz, a lower classman at the University of Rochester. The object program took 7.5 minutes to execute on a machine with floating hardware and tape output.

PHILIP W. BAUMEISTER
Asst. Prof. of Optics
University of Rochester
Rochester, N.Y.

objectivity at Duke

Sir:

"ALGOL at Duke" (June DATAMATION) does justice neither to ALGOL nor to FORTRAN.

1. If "every correct Duke ALGOL program is a correct ALGOL 60 program," where in the ALGOL 60 report is the WRITE statement mentioned?
2. The sample program does not "display that which FORTRAN does best." Rather, it points up that in FORTRAN the fixed point mode is required for subscripts and DO indexing parameters.
3. Basic programming rules dictate that the statement

   X = I

   be located between the two DO statements instead of following them.
4. My paperbound FORTRAN manual indicates that the coding required to float O, I, and J could be replaced by a proper FORTRAN program reading:

```
S = 0.
X = 0.
DO . . .
X = X + 1.
Y = 0.
DO . . .
Y = Y + 1.
```

5. The comparison times quoted for

poor FORTRAN versus Duke ALGOL are such that the poor FORTRAN version still would be the more efficient if the program were executed more than once.

I am sure that many installations — including academic institutions — would rather not "compile a number of times for every execution." Some attention to efficient programming might well lead to the ability to run after only one or two compilations.

Though I risk being called anti-ALGOL, I ask only for more objective reporting of the facts.

H. Paul Rogoway
Advanced Information Systems
Los Angeles, Calif.

Kludge failure

Sir:

I must strongly protest the dissemination of misleading and erroneous information to the youthful of the profession. I refer to the Organization Chart in "How To Market A Kludge" (p. 64, May). The first year is critical in business and industry and the young must not be led astray. Please print a correction.

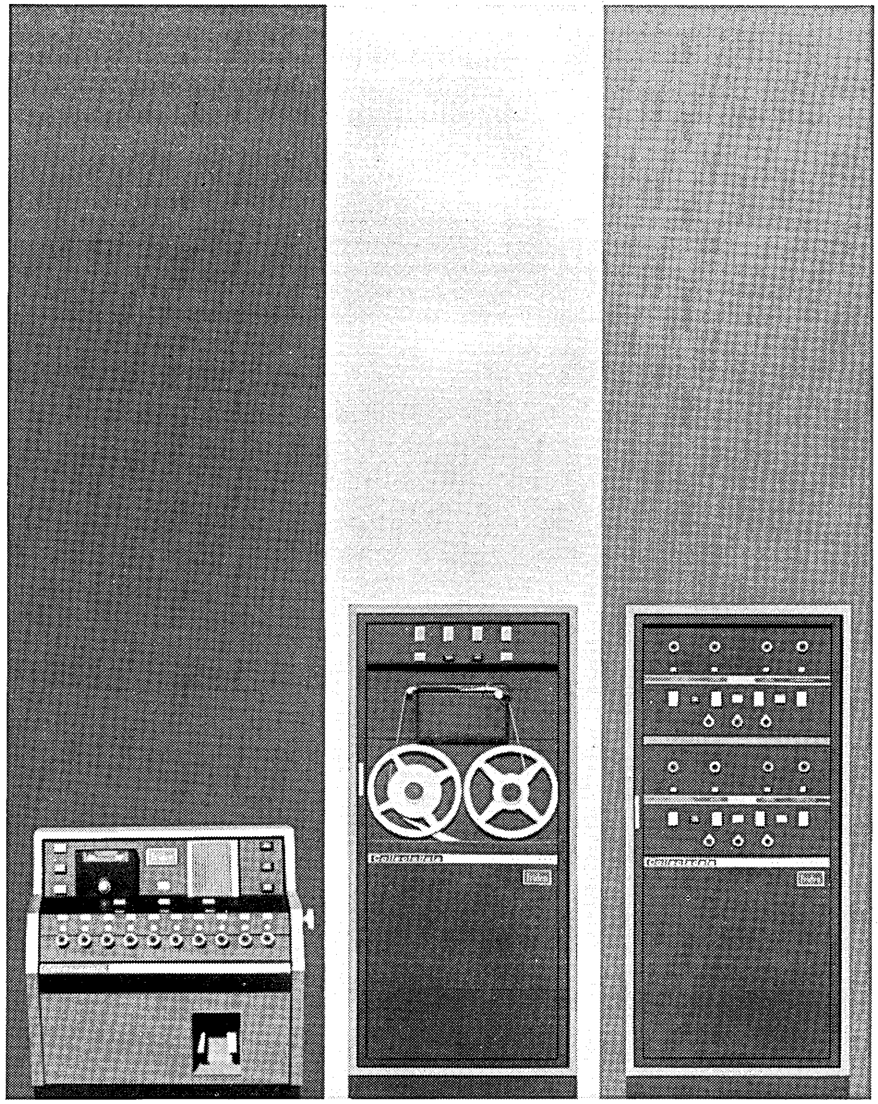
The Chart fails miserably to indicate the essential fact of corporate (profit and non-profit) organization: Circularity. No matter how dead-ended or isolated any function may be, it will inevitably see the same job again, and again, and AGAIN. You know this, I know this, and the neophyte will soon know this (so maybe no correction is required after all).

C. A. Ranous
Associate Professor
Dept. of Electrical Engineering,
The University of Wisconsin
Madison, Wisconsin

NEXT MONTH IN DATAMATION

Unpublished, unheralded and yet widely acknowledged as the cornerstone for internally programed computers is the conceptual report on "The Princeton Machine." In September, DATAMATION will publish part one of "A Preliminary Discussion of the Logical Design of an Electronic Computing Instrument" by Arthur W. Burks, Herman H. Goldstine and John von Neumann, written at Princeton's Institute for Advanced Studies in 1946.

More contemporary offerings on tap for September include an evaluation of ALGOL in a FORTRAN perspective by Herbert Teager of MIT; a discussion of multi-computing by Walter Bauer; a staff report on the Western Data Processing Center at UCLA, and an unusual description of a compiler for demonstrations ONLY.



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Bendix Computer Division

CIRCLE 13 ON READER CARD

WHEN

■ *will someone design and build a computer system that schedules and controls its own operations so completely that operator intervention is the exception rather than the rule?*

■ *will a computer manufacturer design a system so that hardware and software—including operating system, programing languages and compilers—are completely integrated?*

■ *will a computer eliminate the traditional concept of an "order code" but include in its circuitry and software the facility to solve problems stated in algorithmic and common business oriented language?*

■ *will a computer be able to change its information processing language so that it can easily and rapidly assimilate new terms defined by the user?*

■ *in other words, will you be able to order a computer which meets the specifications set forth by prominent computer experts as their conception of a "next generation" computer?*

When? Now. The manufacturer? Burroughs Corporation. The computer? The new Burroughs B 5000 Information Processing System—a development as revolutionary as was the introduction of the very first computer.

This totally new computer concept has a Master Control Program that handles, all by itself, assignment of input/output units, file identification, job scheduling, machine interrupt conditions and multiprocessing of several programs at the same time.

This Master Control Program, along with the B 5000's ALGOL and COBOL Compilers, all other software and all hardware were conceived and designed as one integrated entity by Burroughs Corporation.

The B 5000 brings an end to unnecessary intermediate operations which have heretofore interfered with the use of problem-oriented languages. It has replaced the traditional "order code" with Polish-prefix logical notation as its machine language. This, in combination with a "stack" or "first in, last out" information holding structure, enormously facilitates use of these languages.

One final "when": When will you investigate the advantages of the B 5000 for your company? Just call our nearby office. Or ask for detailed information by writing to us at Detroit 32, Michigan.

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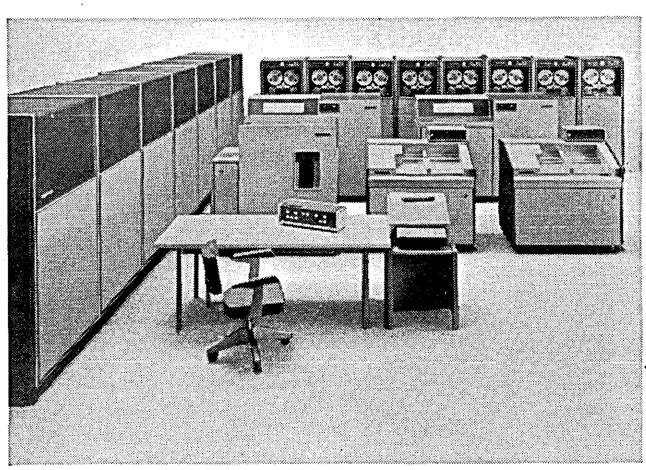
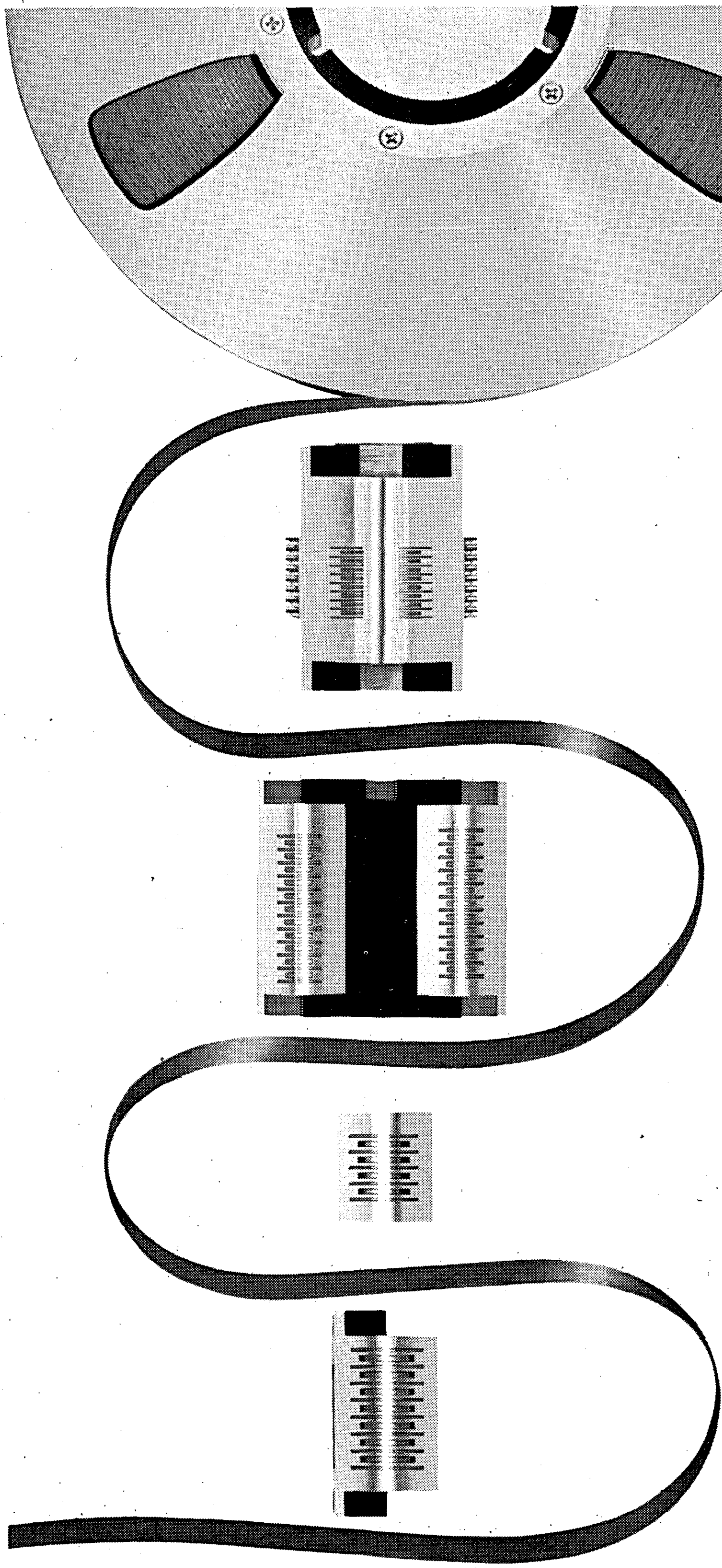


Burroughs Corporation

CIRCLE 15 ON READER CARD



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BUSINESS & SCIENCE

NAVY ADOPTS SDC's JOVIAL

The winner in a hotly contested language wrestling match is System Development Corp.'s procedure-oriented JOVIAL, at least as far as the U.S. Navy is concerned.

In a recent letter from the Chief of Naval Operations, JOVIAL has been adopted "for use on all naval strategic command systems" including "the Naval Command Systems Support Activity (NAVCOSSACT), the Operation Control Centers (OPCONCENTER) for Commander in Chief, Pacific (CINCPAC) and Commander in Chief, Atlantic (CINCLANT), Navy Information Center (NAVIC) and the National Emergency Command Post Afloat (NECPA)."

While this policy does not extend to the tactical data systems, it was emphasized that "problems involved in obtaining compatibility between the strategic and tactical systems will be the subject of further study."

Derived from ALGOL 58, JOVIAL compilers presently exist for the IBM 709/7090, CDC 1604, Philco 2000, AN/FSQ-7, and the AN/FSQ-31. At a 1604 users meeting last month, SDC presented the language to the Co-op library.

A subject of much professional discussion, it is contended that procedure-oriented languages such as JOVIAL and NELIAC are suited only to the specific job for which they were designed and that for other applications, they will prove inefficient tools. As yet however, acceptable yardsticks for measurement have not been agreed upon.

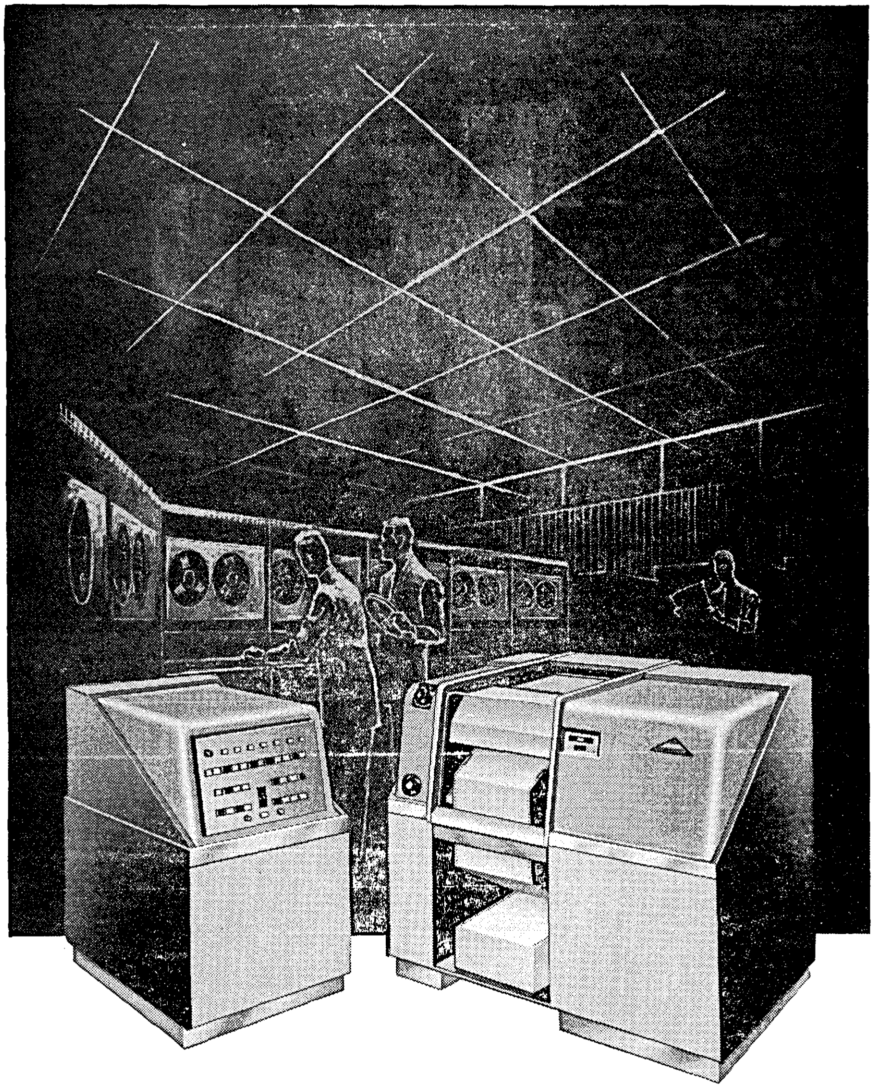
The JOVIAL adoption is opposed by NELIAC advocates who contend that their language was originally designed for the Navy and could be used more easily by personnel of less experience than would be required with JOVIAL. In addition, a recent study by Computer Usage Corp., commissioned by the Navy, indicated much faster compiling and executing speeds for NELIAC over JOVIAL.

IBM VOTES "NO" ON SEVEN BIT CODE

A seven bit binary code, proposed as one of the first American standards in data processing by ASA's X3.2 subcommittee, has received the wholehearted dis-approval of IBM.

Reason for the rejection as stated by IBM's Group Director of Standards W. E. Andrus, Jr., is the heavy user investment in the present BCD Interchange Code.

Andrus estimates that in 1961 "there were approxi-



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CIRCLE 45 ON READER CARD

mately 20,000 users of data processing equipment and they consumed over 100 billion cards punched in the BCD code." He adds that in an IBM study on the costs of code conversion "implementation of the proposed code would add 20-30 per cent to the cost of equipment.

"We are convinced," Andres concludes, "that the X3.2/1 proposal can only increase the financial burden on the user." A counter suggestion voiced by Andrus is that "the BCD Interchange Code is, and must be formally recognized as a standard because of its wide use both in punch cards and magnetic tape. . . ."

However, IBM's position is obviously not shared by others in the industry. When the new code was presented at the ASA's national convention late last year, I. C. Liggett, former director of systems standards for IBM and now with Computer Usage, emphasized that ten years ago the 80-column card served its purpose of translation from card code to computer code, but "this type of computer code does not adequately meet the desired requirements for today and tomorrow's data processing and communication needs."

Liggett explained that the recommended standard is a single seven bit dense binary code "representing the smallest set that can adequately meet our interchange requirements. We recommended subsets and a superset of the seven bit code to meet the varied demands of data processing. These are four, six and eight-bit dense binary codes which are easily transferred into the seven bit communication standard."

In sharp contrast to IBM's present position, Liggett concluded, ". . . Likely reduction in manufacturing costs and increased communication possibilities make the adoption of the new standard code economically feasible."

At recent meetings of the DP Engineering Group of the Business Equipment Manufacturers Association (BEMA) and ASA's X3.2, it was decided to extend the voting period on the new code from July 11th to Aug. 21st and to amend the seven bit code for wider adoption overseas. There was some discussion on recognition of de facto codes such as the BCD but no formal measures were introduced.

This action (or lack of it) seemed to indicate that despite IBM's negative decision and influence, the consensus of opinion was optimistic for adoption of the new code.

As for user implementation of the seven bit code, Charles Phillips of BEMA suggests that several years would be required before the new standard (if adopted) would be widely used.

UNANNOUNCING NEW HARDWARE

A discernible trend of late has been the lack of fanfare in new main frame announcements; in fact, several machines have seemingly been "slipped" into existence.

Well known for its customary profusion of press conferences, IBM announced the 7040/44 in December, and the 7094 in January, through the medium of the news release and a small selection of photographs. Since specs on this equipment had been widely known prior to the announcement, it was felt that this may have been one consideration in not raising rainbow-like banners.

Two months later, Honeywell followed this pattern with its 1800 announcement. Their press release however, was far shorter than many of their installation stories, and there were no photographs, brochures or even a complete exposure of basic specs. Unlike the IBM machines, the 1800 was very much of a surprise and to many professionals, it was unknown for several months after the announcement.

In June, UNIVAC announced its 1004 by distributing brochures and showing a film at the NMAA conference. News releases were received by some press representatives after the conference. Aimed at the lucrative, punched card market, the 1004 was greeted by a rumor of over 200 sales even before its announcement.

The topper however, is Control Data's 6600 which has not been formally announced although a news release issued last month discusses a 5½-megabuck contract for delivery of the 6600 to Livermore in Feb., 1964. The release discusses the fact that the 6600 will be "faster than any existing machine," has a central memory of 61K words, and that the high speed is obtained "through the use of semi-micro instructions and multiple transistor registers for temporary storage."

In May, 1961, initial specs on the 6600 were published in DATAMATION. As of July, 1962, no announcement date has been set.

OF BULLS, BEARS & EDP

As part of the general stock fluctuations during the past months, computer manufacturers have viewed their corporate quotations with more than a modicum of anguish. In virtually all instances however, the effect of edp sales or lack of them have had no direct correlation with depressed stock or the resulting bullish and bearish reactions common to the market.

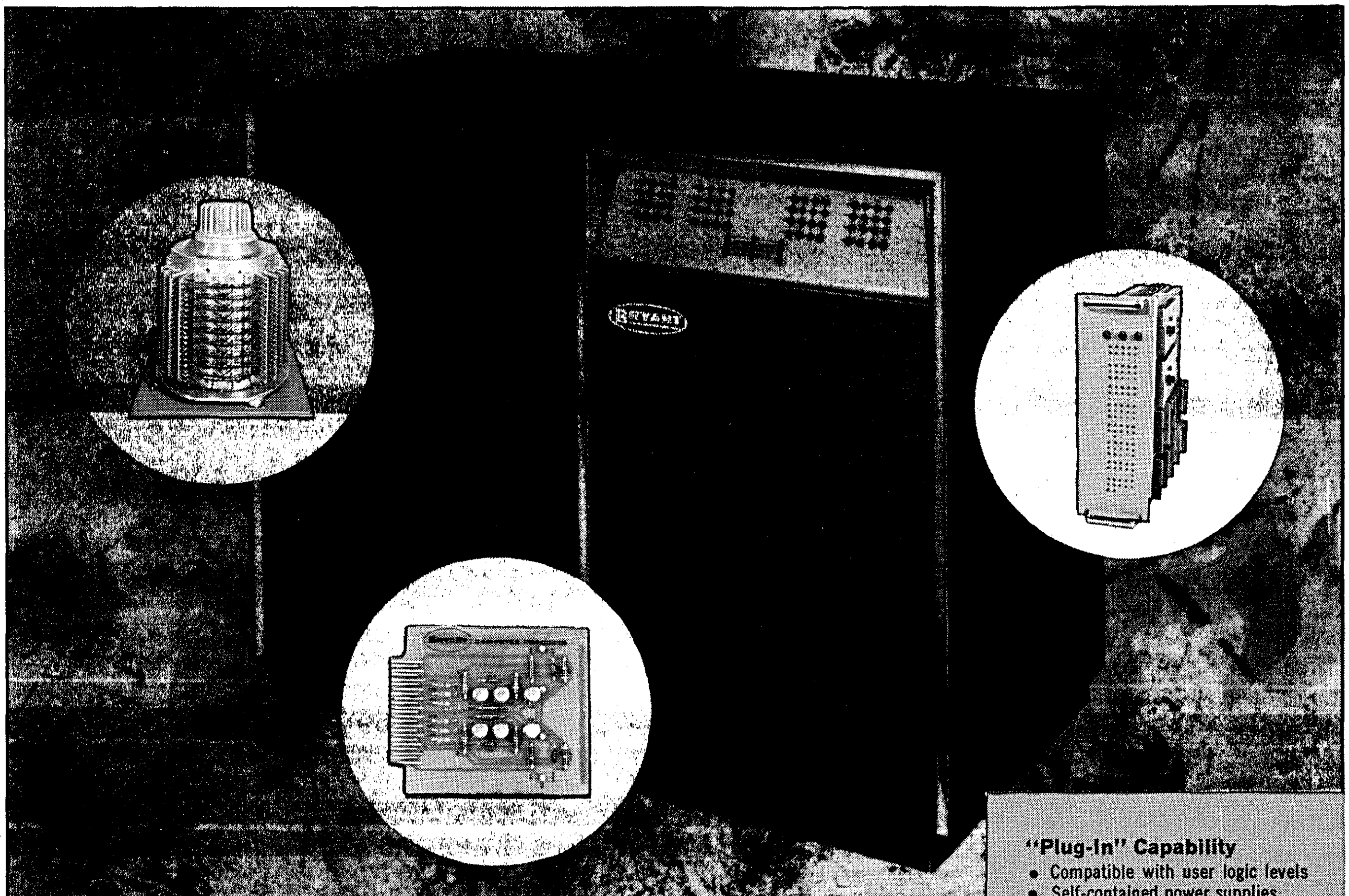
For the few firms substantially involved in edp, a 50 per cent drop in stock prices has occured over '61 which has been followed by slight recoveries. Analysts predict a levelling off when the earnings-to-stock-price-ratio finds a less inflated balance.

Ahead of the field in sales, IBM increased its lead in the stock decline to 300, a 50 per cent loss over last year's high of 607. Last month, the stock rebounded to 367½, and is expected to level off when the price is brought more closely in line with '62 earnings projected at $8.50 per share.

In Minneapolis, Control Data also slipped from a high of 52 early this year to a low of 23. By late July it had improved to 27½. Earnings in '61 were 24 cents per share and for '62 a rate of 34 cents is projected.

At the bottom of the scale and still classed as a new recruit to the computer field, Advanced Scientific Instruments has suffered a drop from 7 to 1 5/8, although this is still higher than the initial sale last year at $1.15.

BRYANT SYSTEMS AND CIRCUITS REDUCE DATA STORAGE COSTS



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Typical Specifications (Read Amplifier Model 6002)

No. of Circuits per board	1
Frequency of operation	DC min.; 500 KC max.
Input signal required	10 MV to 500 MV
Output drive capabilities	20 MA "And" current; 7 MA "Or" current
Current requirements per board	
@− 20 V	30 M.A.
@+ 7V	30 M.A.
@− 7V (Clamp)	10 M.A.
Output wave form rise time	less than .1 usec
Output wave form fall time	less than .1 usec
Logic Levels	0v and −7v
Temperature Range	0°C to +55°C

62-42CP

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CIRCLE 19 ON READER CARD

EDITOR'S READOUT

THE TIME OF ORWELL

A popular sport sometimes confined to lower laymen classes and ultra-upper computerites is the projection of a man-machine interface to the time of the fictional von Neumann, George Orwell and his year of the Big Compiler: 1984.

Distorted perhaps, these ruminations on moon computing may nevertheless result in a sharper perspective on contemporary frivolity particularly when cast in the shadow of today's professional mores.

In the year 1984 computers have become essential to every form of life and livelihood. A current hardware census lists 3,642,076 main and minor frames. There are 16 million programmers and no operators.

Nanosecond or third generation technology is far too slow for 1984. This is the year of the eighth generation. The first all-ESP machine has been announced by Burroughs. IBM is holding back because of SHARE's heavy investment in seventh generation software with which ESP is not compatible.

The used computer market is burgeoning particularly in Southern California. Consultants were first to recognize the potentials of merchandising used equipment in 1968 and have promoted their dealerships under old-fashioned alliterations such as "Homely Harry's Hot Hardware," and "Mischievous Morton's Multiplying Machines."

1984 is a year not without its share of bitter problems. The average programmer receives $34,500 annually and there is rumor of Jimmy Hoffa's son attempting to organize the SDC staff . . . The world's smallest computer, produced by Librascope, cannot be seen or touched. It was mislaid last month while researchers were contemplating I/O equipment . . . Bathing apparel is being worn at the RAND Corp. . . .

New applications first predicted in 1962 have blossomed into functional reality. Convicts at Sing Sing and San Quentin have been recruited for the first computerized medical diagnosis . . . Legal decisions by computer have been accepted for suits concerning software penalties to DOD, divorce hearings, and in cases of medical malpractice in criminal institutions . . . The Library of Congress is stored in the world's smallest computer, produced by Librascope.

In the professional societies, a vociferous group of undoctored rowdies has become prominent in ACM functions and has scheduled the 37th annual conference for Tia Juana.

AFIPS has reelected its original slate of officers. This was the only action taken this year.

At the computer conferences, a dramatic shift has taken place in the presentation of technical papers. A cocktail lounge has been opened in the main amphitheatre; chess sets and playing cards made available to attendees, and old, funny cartoons first shown at the 1961 EJCC are displayed on a giant screen. In a small, adjoining room, attendees may view the conference proceedings on individual slide projectors. There are no speakers.

The National Machine Accountants Association has reapplied for membership in the ACM. They now have 12,354,098 members. Keynote speaker for their annual meeting is Elizabeth Taylor who is also president of IFIPS.

On the standardization front, X3.4.5.9.0 has dropped all work on the forthcoming Glossary. Many of the terms have been found unacceptable to the Arab bloc of nations.

Users have been especially active in 1984. At Livermore, the world's fastest and largest general purpose computer, ICK (Increased Capacity Kludge), is now on a firm order basis. It is constructed out of a new plastic material and folds up into wafer-thin cubes. This order brings Livermore's total to 2,953 completely different types of machines . . . North American has placed an order for an ALWAC XIX, their first non-IBM machine . . .

Standard Oil, Socony Mobil and Union Carbide have merged and completely automated their facilities. There are no employees and their new building is modelled after a giant gas pump of the early '60s.

But the first truly closed loop operation has been perfected for the Hunt Foods ketchup division. It is here that a TRW computer controls tomato growing and vinegar brewing. The entire operation is on-line with a newly completed Big Inch pipe lashup between Tampa and Seattle through which ketchup flows at the rate of 250 million computer controlled bottles daily.

Far more sophisticated than ketchup control and still the world's major hardware user, the military continues its explorations of the unknown in edp. At the United Nations, a world wide command and control network is kept on a 24-hour duty cycle as each alert station asks the preceding station, "Who Are You?" Total appropriation for this network remains unestimated.

In the business field, pocket sized computers are being carried by every important executive for instantaneous decision making. These machines double as dictating devices, electric razors, and portable television sets. Advanced models may also be inflated into full scale, 500 HP sports cars. Manufacturers contend that this development in small scale hardware permits full utilization of their production and sales capacities which had previously experienced a period of awkward decentralization.

Unlike the early '60s when manufacturers' profits were limited to IBM and Control Data, 1984 has proven one of the industry's most successful years and many new firms have entered the competition. General Electric has announced its entry into the general purpose computer field, and RemRand has merged with ALWAC. RCA, true to its 1961 predictions of activity in the field of bionics, has produced the first working model of a machine which looks, behaves and tastes like a lobster.

In super-ultra-high-speed circuitry, Philco engineers have developed a device of the macro-atomic type, with a negative switching speed. They have incorporated this device into a circuit they call an "IF" gate, which emits an output pulse one pico second before receiving an input pulse. Practical applications are uncertain.

Still a thorny problem for all manufacturers is the language explosion. There are presently 4,620,367 dialects. In a recent news release IBM has announced FORTRAN XXV and adds that an earlier FORTRAN compiler for the 704 is almost checked out. There is however, some semantic disagreement over the use of the words "checked out." Do they really imply that the compiler must perform useful work or does "checked out" indicate an initial tape shipment? CODASYL is discussing the problem.

In northern Sweden, a small group of select computologists are employed on the implementation of ALGOL 60. Their identities are unknown and they wear masks.

For business data processing, COBOL-83 (there will be no COBOL-84) will not be implemented for the Burroughs ESP machines. Groups of Esperanto advocates at Honeywell and NCR have joined the anti-COBOLites in favor of the FACT-INDEED compiler. There is confusion in this area.

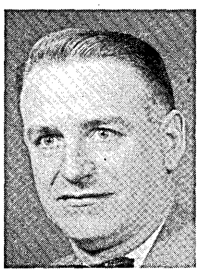
At the universities, a demand is growing for an increase in grants-in-aid, scholarship funds and other gratuities which manufacturers have been forced to provide in order to secure the acceptance of free hardware. MIT, Carnegie and other top prestige schools have been so successful in research on self-reproducing automata that the machines originally given to them by various manufacturers have been returned in duplicate. Cornell is no longer hiring instructors.

Epilogue: *To prevent a trip to Orwellian regions is hardly a modest undertaking. However, if a moral may be assigned to this task it is simply that the first step in changing one's destination is to recognize it.* ■

WHERE ARE COMPILER LANGUAGES GOING?

a user's view

by HARRY N. CANTRELL, Manager, Computer Systems & Applications, Large Steam Turbine-Generator Dept., General Electric Co., Schenectady, N.Y.



There is really no question that a good, high-level programming language, backed up by a good, efficient compiler, is almost always more efficient than machine language programming. Programming languages have proven their usefulness. But what is a good language, and, perhaps more important, what are the characteristics of a good compiler?

This paper discusses some of the characteristics of good languages and good compilers and then measures our current crop of languages and compilers against these criteria.

what do we want to get from a programming language?

All advertising implications to the contrary, no one really expects to eliminate all programming costs and problems by using programming languages. The languages help, but there is still a lot of thinking and planning to do. We don't expect languages to solve all our problems but we do want to get the following benefits from using these languages:

Program Planning. Some languages, such as those incorporating decision tables, can be used to replace flow charts in the program planning process. This is particularly useful. The planner is led to make complete, explicit and final plans because he can compile the final version as a part of the program.

Communication. We want to use programming languages as a communication medium between programmers and the engineers, accountants, manufacturing people, etc., who are having jobs programmed for them. We also want to use these languages to communicate between programmers working on the same large job.

Coding. We want to use programming languages to free programmers from the details of machine language coding and increase the speed and accuracy of coding. To a considerable extent these languages should automatically overcome hardware limitations which otherwise add a great deal of complexity to the machine language programming job. Essentially, we want to write down fewer characters while we remember and take care of fewer details not related to the application.

Program Checkout. We want to achieve faster and more accurate program checkout through fewer errors, and easier and more accurate detection and correction of errors.

Documentation. The statement of the problem in a programming language should form an important and rigorous part of the documentation of the program. It should be understandable, not only to the computer and the programmer, but also to other programmers and to the managers and men for whom the program was written and who use it.

Changing Computers. A programming language should provide a substantially non-machine oriented statement of the job which can be converted to another machine with little effort provided the language has been implemented on that machine.

Computer Productivity. We may or may not incur some loss in computer productivity by using programming languages. Compilers usually cannot write programs that are as efficient as hand-tailored machine language programs written by expert programmers. But most of our programs are not written by expert programmers with several years of experience. There are too few of these people. A compiler that produces 80% efficient programs compared to the experts may well be producing more efficient programs than the average programmer would, using machine language.

The compiling process itself uses computer time. But if our programmers make fewer errors and correct them faster, we may not incur a net loss in computer time in the compiling and checkout process.

In general, we would like to have compilers fast enough and efficient enough to enable us to breakeven on computer productivity as compared to hand coding by average programmers.

what characteristics should a language have to satisfy these general requirements?

Learning the Language. Using the difficulty of learning machine language programming as a base, the programming language should not be much harder to *learn* to *use* than machine language programming. About one tenth as much effort should be required to *learn to understand or read* (but not write) the language.

Non-machine Oriented. The language should not be overly oriented toward a particular machine. Some such bias is inevitable but it should be held to a minimum and preferably confined to a particular section of the language, such as the ENVIRONMENT Division of COBOL.

Computer Productivity. The language should include features which are essential to computer productivity in important types of work. Some examples are:

- List processing. Essential to manufacturing simulation and other important applications.
- Facility in subroutine setup and organization of the program into subroutines. Essential for organization of large, complicated problems.
- Variable length logical records on secondary storage (tapes, discs, etc.). Essential for many data processing applications.
- Program storage overlays. Essential in many large problems.
- Character and bit manipulation. Essential in many special applications including compiler writing.

Some of these may be features of a general-purpose language while others may be satisfied by special-purpose languages.

Character Set. A language is meant to be read by people, both before and after machine processing. Thus, the language should use the character set available on the hardware.

Growth and Change. The language should be designed so that it can be changed or have features added without scrapping the language or requiring extensive reprogramming of old programs.

Implementation Requirements. The language should be designed with implementation in mind. It is probably true that any language that is precise, complete, and unambiguous can be implemented on any computer, but the implementation may fall so far short of the requirements of a good compiler that the language is useless for practical programming.

what requirements must a compiler system satisfy?

Available on Time. The compiler must be operating satisfactorily with all important features when the computer is delivered and preferably sooner so that the user can start debugging his programs in advance of delivery.

Source Language Debugging. The compiler system must facilitate source language debugging. In general, a programmer follows this procedure in checking out a program:

(a) Make a test run with sample data.
(b) Detect errors.
(c) Make changes or corrections in the program and repeat from (a).

If the programmer makes these corrections to the program in the original source programming language, this is called source language debugging. If, to save compiling time or waiting for extra passes on the computer, the programmer makes changes in machine language to the previously compiled program, then this is machine language and not source language debugging. In actual practice, programmers and programming management are usually under severe time pressure and will choose the debugging method which gets them checkout passes in the shortest elapsed time. The compiler system must compete in speed and ease of use with machine language debugging. Usually this means the system must compile and run a debug shot in one pass on the computer.

Why is source language debugging so important? Why can't we make corrections in machine language and then update the source program later, when we have time? The answer is that this just doesn't work in real life. Machine language corrections are different from the instructions the compiler would produce so that when we do update the source deck we have to check it out all over again. This can as much as double program checkout time. Experience with machine language debugging followed by source language updating shows that source programs are almost never up to date and checked out. If programming languages are to be useful in:

Program Checkout
Documentation, and
Changing Computers

which together account for about half the value of using these languages, then we must be able to do source language debugging. Our objective is to get a checked out source program, not just a working machine language program.

High Compiling Speed. By "compiling" we mean the entire process between the source language program and the operating or "object" program, regardless of how many passes this takes or what they are called. We can measure compiling speed in terms of the number of machine language instructions produced per minute by the compiling system. But how fast is fast? What do we require in compiling speed? These are hard questions to answer but perhaps we can make some estimates. Certainly the amount of compiling time we use on our machine will be proportional to the number of programmers we have making debug passes on the machine in source language at any one time – the more programmers, the more debug passes. Similarly, the total compiling time should be proportional to the size of the average program being compiled – the more machine instructions in the program, the longer the compiling time. If we want to budget some total number of hours per day for compiling time and some number of debug passes per day per programmer, then we can estimate the required compiler speed in instructions per minute from the formula:

required compiler speed = (No. of programmers) x (No. of debug passes/day) x (avg. prog. size) / (compiling hours/day x 60

For example, suppose that I have 15 programmers debugging at any one time and I want each to get two debug passes per day on the machine. I don't know the average program size but the memory size of my computer is 32,000 words. As an upper limit the average program size is probably not greater than 16,000 instructions, allowing room for subroutines and data. Finally, I would not want to spend more than two hours per day on compiling. Then my required compiler speed would be:

$$\text{speed} = \frac{15 \times 2 \times 16{,}000}{2 \times 60} = 4000 \text{ instructions/minute}$$

This is a rough estimate which is probably on the high side because the average program size used is closer to a maximum size than an average. But at least I know that I need a compiling speed somewhere in the thousands of instructions per minute. Four-hundred instructions per minute would not be fast enough. For a smaller computer with fewer programmers and smaller programs, my required compiling speed would be lower.

A compiler system which permits us to recompile a small part of a program and merge the results in with the other, previously compiled, parts of the program could have a much slower compiling speed and still achieve the same overall result.

Efficient Object Programs. The compiler should produce efficient object programs. Par for this course is probably about 80% as compared to expert hand coding. As previously mentioned, this is equivalent to about 100% as compared to average hand coding. If the efficiency is much worse than this, the wasted machine time cost of using the language begins to outweigh its advantages. At 50%

efficiency the use of the language is questionable and at 10% it is intolerable.

Work Within Production Monitor. From the point of view of the computer operations, compiling is just another job. If regular production work is controlled by a monitor or automatic operating system, then the compiler should be designed to operate within this system just like any other program.

how well do our current languages meet these criteria?

Learning the Language. The current COBOL and ALGOL families of languages are very elaborate and sophisticated languages. They are very general and give the programmer the option of several different ways of expressing the same thing. This generality is accompanied by a profusion of rules and regulations on what can and cannot be done in writing programs. As a result these languages are considerably harder to learn to use effectively than more simple languages.

ALGOL, with its many special symbols, is fairly hard to *learn to read.* COBAL PROCEDURES statements are relatively easy to read but the reader has to be well educated to understand the DATA DESCRIPTION statements.

The "English Language" design of COBOL makes it a verbose language. Many more characters must be written in the program than are actually necessary to describe the function being performed. The programmer has been relieved of machine details only to be faced with the problems of spelling words correctly and learning the exact meanings of some 256 "key words" in a new vocabulary. Often each word has several different meanings depending on its context. All of these must be learned. This is not English but "pseudo-English" with its own specific grammar.

There are many other languages outside of the COBOL and ALGOL families which are much simpler to learn and easier to use. Many of these appear to be just as effective programming languages as COBOL and ALGOL; so it is difficult to see what we have gained by going to much more elaborate languages.

Non-machine Oriented. Both the COBOL and ALGOL families and most other modern languages are adequately non-machine oriented. FORTRAN is considered to be a somewhat machine oriented language but it has been successfully implemented on a greater variety of computers than any other language.

Computer Productivity. Most of our available languages are fairly good in that we can usually express what we want to do and the way we want to do it in these languages. But our newer languages, such as COBOL, have not added features to do things which we could not do in our older languages. Instead they have added more and fancier ways of doing things which we could do fairly well anyway. We do not appear to be developing better languages, only fancier ones.

The CODASYL Systems Group has developed a Decision Table feature to be added to COBOL, but this development is still a long way from being officially accepted as a part of COBOL.

ALGOL does have many desirable new features, but, unfortunately, ALGOL, or at least these features of ALGOL, are not being implemented on some computers as yet. The word, ALGOL, is often used to mean any algebraic language. Many of the ALGOL like languages appear to be closer to FORTRAN than they are to ALGOL.

Character Sets. Most languages, outside of ALGOL, use the character set available on the hardware. ALGOL uses a very extensive character set which is not available on any hardware other than special typewriters. At the present time it appears doubtful that much more than half of the full ALGOL character set will ever be implemented on any computer hardware.

Growth and Change. So far we do not appear to have solved the problem of designing languages so that they can grow and change in an orderly manner. At present, language changes usually require reprogramming to bring old programs up to date.

Implementation. COBOL and ALGOL and their derivative languages appear to have been designed on the basis that anything can be implemented and that the consideration of compiler requirements in language design would lead to somewhat more machine oriented languages. We might say that this language design method is really no concern of the user. He doesn't have to use all of those fancy features if he doesn't want to. But when slow compilers, producing inefficient object programs come out a year or two late, the user begins to suspect that he would have been better off without all these frills. The user could never afford to buy hardware that was designed without any consideration of the cost of manufacturing it. It appears that he can hardly afford to wait for, and then waste computer time with, languages which were not designed for the best compromise between language utility and implementation requirements.

how well do our current compilers meet these criteria?

Available on Time. This is the sore point of the industry. A *good, efficient* compiler for a new language or a new computer or both, that has been produced on time is really rare. Compilers produced one to two years late are the rule, rather than the exception. The situation is so bad that many practical, conservative users will buy only obsolete machines which have been in service for two or three years so that they can be confident that the languages will be available. Other users resort to machine language coding for a large part of their work while others simply refuse to use their machine or pay rent on it until the compilers are delivered in working order.

This is a sorry situation which every manufacturer is determined to correct. The users hope the manufacturers can correct it and eagerly await some evidence of success.

Source Language Debugging. Source language debugging is not generally recognized as an important requirement of a compiler system. Perhaps only people who have used a programming language for some years, and then tried to update their old source programs to compile them for a new computer, fully recognize the importance of source language debugging. It is quite disturbing to suddenly face the prospect of having to check out the source language versions of dozens of old programs that have been running successfully for years in machine language.

Compilers are essentially large data processing programs which almost always exceed the memory capacity of the computer and require the use of tapes. Thus a compiling run on the computer requires a tape setup. On a small or medium sized computer, with few programmers debugging, this tape setup time may not be a serious problem and, given a reasonably fast compiler, source language debugging may be practical. On a large, fast computer, with many programmers debugging, tape setup time for compiling may bottleneck the whole operation. In fact, with a fast compiler it may take longer to make the setup and tear down than it does to make the compilation and debug pass. One solution is to rent extra tape units and keep the compiler and its libraries mounted and ready for use at all times. The random access memories now appearing on the scene promise a better and less expensive solution.

In summary, source language debugging is practical with some compiler systems and not practical with others but future prospects look good.

High Compiling Speed. Compiling speed varies enormously from compiler to compiler. Some compilers are very fast while others are hopelessly slow. Differences in machine speeds do not begin to explain differences in compiler speeds. Five to ten to one differences in compiling speeds for substantially the *same* language on computers of about equal speed are not uncommon. The only conclusion we can draw from all this is that some people have set out to write fast compilers and succeeded while others have either not tried or have tried and have been unsuccessful.

At the moment the most reliable source of information on compiler speeds is the scuttlebutt of the computer business. This is usually fairly accurate but there is every reason for specifying compiler speeds as one of the important features of a computer system. One manufacturer does advertise his high compiling speed as a selling point.

Efficient Object Programs. The situation here is much the same as for compiling speeds. Many compilers produce quite efficient object programs. Others are not so good. Horror stories of 10% to 20% efficient object programs are passed from user to user. Unfortunately many of these stories are true.

Object program efficiency is very difficult to measure; so we probably cannot expect to see direct efficiency data published. But we can ask for comparative data on the same problem programmed for the same or different machines using different compilers. One user is reported to have asked several manufacturers to compile and run the same COBOL program on their machines. He then bought the machine-compiler system which produced the fastest running programs. If very many users do this we should soon see an across-the-board improvement in the efficiency of compiler produced object programs.

conclusions

Programming languages are here to stay but we still have a long way to go in language development and simplification, and in compiler system performance. The user needs more from his language and compiler than just "COBOL on this computer." The users' requirements are not easy to satisfy but they can be satisfied. Some languages and compilers have done it. Users have the responsibility of making their requirements known, in detail and in writing, in the public literature so that language designers and compiler writers know of these requirements and can make intelligent compromises in satisfying them. The manufacturers have the responsibility of publishing the performance characteristics of their compilers so that users are not forced to rely on scuttlebutt for this vital information.

If we all understand the users' requirements and the state of the art in satisfying these requirements, then perhaps we can point our language and compiler development efforts in more worthwhile directions. ■

THE UNIVAC 1004

for punched-card data processing

Training its sights on the potential 1401-user market, RemRand UNIVAC has introduced its new UNIVAC 1004 Card Processor, which features a 961-character addressable core memory with eight usec access time, an external program plug-board, and simultaneous read, punch, write capabilities.

Three models with varying program capacities will be available, with a rental price from $1,150 to $1,500 monthly. Sales prices are from $46K to $60K. First deliveries are scheduled for February, 1963.

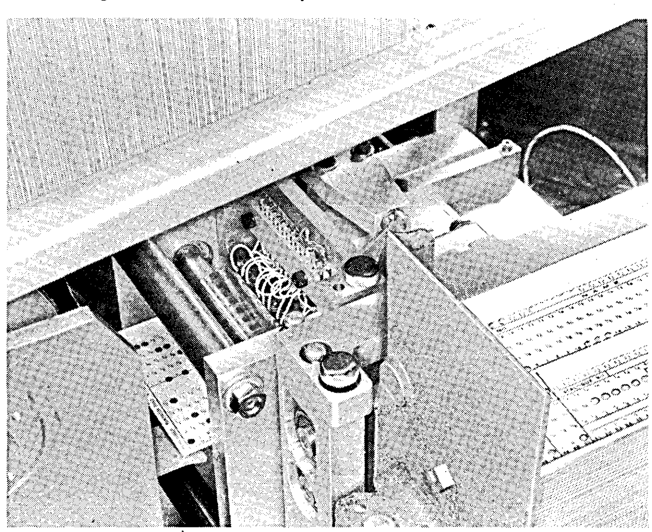
The 1004 is designed to perform alpha-numeric comparisons, numeric magnitude comparisons, addition, subtraction, program multiplication and division, sign tests and program variations.

Specifications of the 1004 include: card reading speed of 300 CPM for either 80 or 90 column cards (up to 400 CPM is possible when less reading capability is required); add or subtract time of six digit numbers of 176 usec; 128 usec character transfer time; 8.9 msec multiplication time: 4.6 msec division time; 300-400 LPM printing speed; multiple fields of I/O data, including those requiring the maximum 1004 print line of 132 characters may be edited in one program step. Cards may be punched on an optional card punch, which utilizes a hole-count checking system for verification, at 200 CPM.

Applications are programmed in segments called "steps," with one program step defining two operands. Up to 62 program steps are available to direct routines, and as many as nine processing actions may occur on any single step.

An "add to memory" technique in performing additions and subtractions enables any working storage location to be utilized for total accumulation. This capacity is limited by the memory locations assigned by the program. ■

Data punched in a 90 column card is sensed by the photoelectric reading station (center of photo) in the UNIVAC 1004. As the card travels from reading station to stacker (above), another card from the input magazine (lower right) is moved into position.



Attracting a bristling profusion of rumors, counter-rumors and the eager advances of personnel recruiters, Bendix Computer has been confronted with no small order in untangling its recent professional image. Its problems however, have been all too common throughout the industry: top management resignations, a new orientation in marketing, and the painful contemplation of a breakeven point.

The fact that rumor vendors rarely trouble to verify their output prompted DATAMATION to reference the point of attack; namely, the division's new general manager, CHARLES EDWARDS. A series of questions most typically exploited by the rumor-mill were tossed in rapid succession at Mr. Edwards. His replies, tape recorded and edited largely for editorial cohesiveness, follow.

PERSPECTIVE AT BENDIX

a rumor repellent

based on a taped interview with Charles Edwards,
General Manager, Bendix Computer Division
by HAROLD BERGSTEIN, Editor

Q: Several months ago, The Bendix Corporation issued a news release referring to "consolidation" of its Computer Division. Could you amplify the specific intent of the release?

A: The release was concerned with the consolidation of sales offices. I believe that the use of the word "consolidation" has been kicked around so much that it has been a matter of individual interpretation on the part of the reader.

Earlier this year we recognized that we needed to change our marketing approach, and to establish our future plans and objectives we decided that we had offices in locations where we just weren't getting any payoff. From a strictly economic standpoint we decided to discontinue those offices and reassign personnel to current offices that were in existence or to new locations. We closed five offices and opened three. We have placed people in positions that we consider the most strategic strictly from the point of our present commercial markets.

Q: There has been considerable comment in the industry directed at the turnover of personnel at Bendix. Is this attributable solely to the consolidation of sales offices?

A: There is a time phase relationship here that has to be kept in mind. There were some marketing people who left prior to our regrouping of the marketing force. These people simply got better opportunities or decided they wanted to work in a different area. In one or two of the trade papers, three or four of these people were linked with M. W. Horrell's leaving (former general manager of Bendix). This was an entirely separate matter.

When we reoriented our marketing effort we did lay off some people. We have had a turnover rate which might be slightly above normal for us, but this may be attributed in part to a chain-reaction resulting from the change in our program and a general turmoil throughout the industry . . . There has been a lot of pulling of people. We are presently recruiting both for replacements and additions to the staff.

Q. Do you feel you have received adequate corporate suppor for the Computer Division?

A: Bendix management is a conservative management. It doesn't speak to the outside world about all its problems to the extent that some other managements do. But from an internal standpoint, all the top corporate people have devoted a lot of time and attention to be Computer Division and to its future plans. The financial support which we have received is very substantial. You just can't be in this business at all if you don't receive substantial support.

Q: Would you be able to state emphatically that 10 years from now Bendix will be still in the computer field?

A: For me to make such a prediction that far ahead would be inappropriate since business conditions vary considerably and I don't believe we know whether or not we are going to be in auto pilots, for example, 10 years from now.

Q: And if we shortened the period of prognostication to five years?

A: I would say there is no prospect of our leaving the computer field in that period of time.

Q: What is the present status of the G-15?

A: We are currently running a production line refurbishing G-15s which return from our leasing agreements and these machines are either updated in accordance with modifications or simply gone over to get them back into first class operating condition. There are currently more than 350 G-15s in use and we have been successful in converting roughly 50% of the leased machines to sales.

Q: Do you ultimately expect a stockpile of G-15s with customers converting to competitive solid state systems?

A: So far we have been very successful in maintaining a fairly constant number of users. At present we are actually behind schedule in getting refurbished machines out in the field.

Q: Has the company made money on the G-15?

A: As of June, yes. Assuming that we can maintain the position we are presently in with regard to converting and continuing to keep them on lease, we are in the black on the 15.

Q: Do you have any plans for a successor to the G-15?

A: Our present plans do not call for a direct replacement of the G-15, per se. The timing is inappropriate for that as far as the development of a new machine is concerned. There are other alternatives that we are considering where we might be able to provide customers with a machine that could represent both a replacement and growth potential item.

Q: Are you implying that there is an active research program for a new machine?

A: You might catalog this in the nature of an acquisition approach.

Q: Of another machine design or another company?

A: Something of this nature. I don't feel free to disclose specific plans at the present time. Let us say that we are looking at other possibilities. The timing is the critical factor. If we are going to expand the market that we have in the 15, we have to do it fairly quickly.

Q: What is the current status of the G-20?

A: We have installed 16 computers with two retained by the Division. Our monthly production rate is one to two machines.

Q: How many G-20s would have to be sold for Bendix Computer to breakeven?

A: About 50.

Q: When do you expect to reach this number?

A: Our present plans call for at least 50 G-20 installations by the end of 1963.

Q: What percentage of the present G-20 installations are utilized in business as opposed to scientific data processing?

A: The majority of the machines are in combined applications. However, we have some installations which are purely engineering and some which are purely data processing.

Q: When do you expect the SPACE programming package for the G-20 to be completed and checked out?

A: Except for COBOL, the basic software systems will be completed within the next month or two. As with any package of this scope there will be continued implementation to take advantage of hardware modularity. The COBOL effort has been strengthened with contractual support from Battelle Memorial Institute.

Q: It was announced recently that Bendix is expanding

into the military market. In what aspect of this field are you specifically interested?

A: The computer division has been designated by the corporation as the cognizant division on ground-based, shipborne type computers. We have been concentrating on command and control type applications as a definite area where the G-20 could be applied immediately.

Q: Have you any orders in the house for the G-21 (a complex of G-20s)?

A: No, but we expect results from proposals that are currently active.

Q: Are you planning to add any additional hardware to your present line of equipment?

A: Yes. We have definite plans for new computers in the general purpose area. At the same time we are extending G-20 peripheral equipment.

Q: It is our understanding that a G-25 computer was in the R & D stage last year but was dropped. Would you care to comment as to the reasons for this decision?

A: Discontinuance of the G-25 was not due to any lack of support on the part of the corporation. It was more a matter of our long-range planning. There was general agreement that the development of this machine should be reconsidered as part of our re-examining the whole area of our activity, as well as the development of additional machines in a "state of the art" not necessarily that of the G-25.

Q: Within the general purpose field, what size or position does Bendix Computer envision for itself?

A: If we use the number of machines as a projected barometer of our size we are planning for an organization that has of the order of three or four and perhaps five machines. Volumewise, it's difficult to provide an accurate figure. I would say that from a commercial standpoint, I am thinking about a yearly income of about 20 to 40 million dollars.

Q: Do you feel that Bendix will specialize in any particular area of the general purpose field?

A: Our best opportunity is in combined types of applications where a unique piece of hardware can be appreciated by both business and scientific users.

Q: Do you have any plans for expansion of overseas sales?

A: We already have a mechanism for marketing our computers overseas through our International Division and CDC in Canada. At present, we have four foreign G-20 installations.

Q: What do you consider the chief competition to the G-20?

A: The G-20 has occupied a unique position in the field. There hasn't been any real direct competition.

Q: Not even the IBM 7040 and 7044?

A: The 7040 and 44 have just recently been announced so they haven't been competitors. They could be in the future.

Q: Why do you feel that the G-20 is superior to much stronger competition from the standpoint of financial backing and field support?

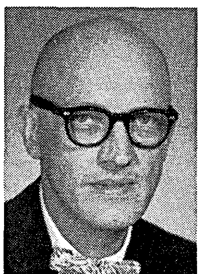
A: The true measure of computing systems' worth to the customer is the amount of computing per dollar that he realizes from his installation and to my knowledge, we still have an edge on the competition in this area. Based on a federal government formula for evaluating engineering computers, using a typical theoretical trajectory problem, the G-20 delivers approximately twice as many operations per dollar as any system in customer use today.

Q: Has there been any recent consideration to selling the Computer Division?

A: I have not been involved in any such activities and I might add that I have no qualms about indicating to our customers and prospects full support of their hardware installations and software requirements. ■

HOW TO HIRE A PROGRAMMER

by JACKSON W. GRANHOLM, Thousand Oaks, Calif.



Finally the time has come! Your new LDZ-40 computer is on order, and you have just discovered that it needs air conditioning which you have to plan and pay for. Now it is time to turn your attention to setting up the programming staff.

Naturally you are not going to get caught way off base by this simple requirement. You are no weenie. You have read, "Programming the Business Computer," by Pouble, Reebe, and von Hunger. Over a year and a half ago your Feasibility Study section subscribed to the Journal of the Metacomputer Society, and, one of these days, you may even get around to reading one or two copies of it. Of course, it is full of Greek letters and things like that, and it keeps telling about "strings" and "processes." You are not sure you have any strings, but you probably have processes around somewhere.

In order to set up a programming staff, you will have to choose a head for it. Joe is the obvious choice. Joe has been on the Feasibility Study for over a year, and his previous experience in the mail room gave clear indication of his promise. Besides, Joe has a lot of seniority now, and it would not do to bring in some rank outsider. That would not look good. Joe has too many brownie points in the retirement fund, and he is secretary of the junior supervisors' basketball league.

So Joe it is! The first step is to get Joe together with the personnel manager so they can write some impressive requisitions and get the hiring process started to bring programmers into the fold.

It turns out there is a month or so lost in educating the personnel manager. For a while it looks like he may quit rather than write such an unusual sounding job write-up. Finally, however, he is persuaded, and your very own recruiting ad for programmers appears in the Los Angeles HERALD-TROMBONE:

<u>CHALLENGING OPPORTUNITY IN OUTER SPACE - - -</u>
The scientific staff of the Ball-of-Wax Manufacturing Company has a limited number of select openings for qualified mathematicians, scientists, and/or engineers to join our staff of research numerical analysts who are engaged in implementing new design concepts in ball-point pens for use by astronauts and other encapsulated crew members of one of the Nation's foremost outer space research endeavors. Other challenging problems, including research implementation in accounts receivable awaits the lucky person who replies to this offer now! B.S. in Mathematics, Physics, Engineering (or what have you?) required. Write or wire Elmo Zorch, Ball-of-Wax Manufacturing Company, Massive Object Division, San Scusatemi, California. (Cable Address: BALOWAX)

Strangely enough, after three weeks, no replies have come in to this ad. A conference is held. Some drastic action must be taken, for you are now a week past the time when study effort should have begun on WAXTRAN, your own, in-house compiler. To date, not a wheel has turned, for Joe is not just sure where to start, and, besides, he hates to start alone. It is decided to send Joe on a personal recruiting trip to the Western Disjoint Computing Conference.

The Western Disjoint is held in the voluptuous Sir Francis Gander Hotel, San Francisco. Joe is given the company air travel card, a modest supply of traveler's checks, and you wave goodbye to him at the airport.

The President is a little worried when publicity photos come in from the Western Disjoint showing Joe, obviously a trifle gassed, hanging precariously on the outside of a fake cable car as it rounds the corner of Post and Gatty in downtown S.F. However, the cable car (really a '29 Ford truck) is placarded with Western Disjoint signs, so Joe is obviously at the right meeting. Besides, he probably has to make some sacrifices to get the job done.

Later a picture makes the front page of the San

Francisco DAILY FLUGELHORN. The President gets positively livid. The picture shows Joe dancing the twist in the lobby of the Sir Francis Gander with "Miss Softwares of 1962," a young participant of the WDCC. The picture is captioned, "Scientists Relax at Local Meet." By this time, though, Joe is on his way home.

Joe does indeed come home. In fact he has application blanks with him — three of them. When all of Joe's bills come home to roost, the tab to date for programmer prospect recruiting is $1700 per candidate.

During the next two weeks the prospects fly in one at at time at Ball-of-Wax expense. They are carefully interviewed by Joe and the personnel manager, working in relays.

The first candidate is Sebastian Echo from Oyster Garden, Maine. Sebastian is a graduate of Maine Polytech with major in Steam Plant Management. His grades are up and he is a member of Beta Upsilon Nu.

Sebastian needs a haircut and a bath. His shoes are muddy. He has a shifty-eyed look and is very uncommunicative. He refers to his former professors as, "a bunch of jerks." Sebastian has had no experience in programming, but he prefers to work all by himself. Manifestly Sebastian is top-calibre material. An offer is made to him on the spot which he accepts after the second martini at lunch. He goes off to Maine to pack his trunks.

The second candidate to arrive is female — Miss Sallyann Bunch from East Passerk, New Jersey. Sallyann has had a lot of computer-related experience: two years in the key punch pool of the Unforgiveable Assurance Association of North America, Newark, and seven months in charge of tab board wire storage with Automobile Catastrophic Statistical Society, Orange. Also she is a graduate of Princeton (South Princeton Philosophic Junior College) with a major in Oriental Basketry.

Sallyann wears flat shoes, and she is a little crosseyed. Her figure resembles a full potato sack. Her dress and makeup indicate that she is a solid, plain-thinking person with no frills at all. Miss Bunch is the spitting (she chews Copenhagen) image of a lady programmer.

A munificent offer is made to Sallyann, and she goes home to ask her mother about it.

The third candidate, Ignatius Tyne, hails from Drawbar, North Dakota. He is a graduate of the Mathematics Department of The North Dakota College of Teachers and Bartenders, Williston. His grades are abominable — barely passing. However, he has other attributes:

Ignatious has been a roving programmer-consultant, specializing in opcode research, with the Corporation for Really-Way-Out Research. In that capacity, over the past three years, he has worked with the DOD, the Bureau of Canals and Waterways, Space Ectoplasmic Labs, Inc., and the Institute of Human Foibles, Harvard. His programming background is magnificent, and his current salary is way up there, indicating expensive performance.

Ignatious indicates that he will accept any reasonable offer providing that no contact whatsoever is made with his present employer, for security reasons. Ignatious is hired with no further horsing around. Besides, he is exceedingly good looking, and the secretary to the personnel manager is going to send out an offer no matter what anyone else says.

After a brief three-and-a-half weeks, Sebastian, Sallyann, and Ignatius are all on the job and raring to go. Joe sets up an interminable series of conferences on WAXTRAN planning. A PERT chart is drawn up in detail, defining all critical paths and milestones of the pre-flowchart phases of WAXTRAN. Sebastian, Sallyann, and Ignatius are all given air travel cards and a free hand to recruit all their friends. The project is well under way, including negotiation of 6000 hours of pre-delivery computer time on a cost-plus-ridiculous-fee basis with the manufacturer of the upcoming LDZ-40.

At this point, however, a terrible thing occurs. Actually, with proper spying, it might have been forseen as an expected manifestation of today's programmer market. However, someone has goofed.

Joe has turned in his resignation. He has been stolen out from underfoot by the Inscrutable Atomic Corporation. Inscrutable has offered Joe two-and-a-half times his current salary to head up their in-house programming staff. Joe's outstanding experience at heading programming groups has been recognized. At Inscrutable, 378 people will report to him.

In his exit interview, Joe speaks quite frankly. The real reasons for his defection come out. First, there is the stingy travel policy of the company which limited his expenses so drastically at the Western Disjoint Computing Conference. If Joe had not been so strapped for funds, he might have done a truly effective recruiting job. Second is the complete lack of reality in expecting him to plan a job like WAXTRAN with three second-rate programmers. Third, there is the ridiculous choice of the LDZ-40 for which Joe had not voted on the feasibility study team.

Those of you at Ball-of-Wax Manufacturing have learned a costly lesson. But, maybe, it has been worthwhile. You are not going to make the same mistake again. By now you know that a programmer is a man to be reckoned with.

Meanwhile it is time to burn the midnight oil. A recruiting ad must be written. Travel orders must be prepared so Ignatius can be sent to the Eastern Disjoint Computing Conference. There is not time to horse around. The Ball-of-Wax Manufacturing Company needs a new head for its Computing Laboratory and Programming Staff. For some lucky person there exists a challenging opportunity in outer space. ■

"WELL!.... HOW ABOUT THAT!"

PROGRAMMED INSTRUCTION IN COMPUTING

a proponent's view

by JAMES ROGERS, Manager, Systems Documentation, Burroughs Corp., Pasadena, Calif.

Since its earliest days, the computer industry has found itself deeply involved in the business of teaching. Before a data processing system can be used, programmers (the user's as well as the manufacturer's) must learn the details of the programming language, and the operating characteristics of the computer itself. It is no exaggeration to say that a necessary part of the successful sale and application of each data procesing system is the thorough and expeditious training of a very large number of people. Although this article discusses the training of programmers, the observations made here apply also to areas such as the training of field service engineers and machine operators. In the computer industry we have good reason to be concerned with *any* developments which might improve our training situation, and programmed instruction is certainly the most promising of these developments to appear in a long time.

First, it may be well to review some of the features of programmed instruction which distinguish it from traditional training methods. The typical class for computer programmers is run very much like a class in a college or high school. An instructor lectures to the students, who take notes and ask questions. Manuals and reference materials are provided, which the trainees are expected to study (usually outside of class time). Exercises and projects are assigned, and quizzes and tests are given. At the end of the course, the students are expected to know how to program, even though they may not have run any actual problems on the hardware.

Training computer programmers under these more or less standard conditions is subject to all of the drawbacks and inefficiencies found in the standard classroom. The instructor presents the material at a rate aimed at an assumed average level of proficiency in the group. As a result, the more proficient (or more experienced) students may be bored by the lack of any real challenge to their capabilities. The situation is worse for the less proficient (or less experienced) students, whose failure to understand a small portion of one lesson makes it increasingly harder for them to master the succeeding work. Often the result is that an initial, very small difference in ability becomes amplified during the course of instruction into an increasingly larger and more serious deficiency.

As is the case in other educational situations, the instructor in a computer course has all he can do to *present* the material, leaving the *learning* of the material to the "ability," "interest," etc., of the student. Under standard classroom conditions, the instructor simply does not have the time to insure that each detail is grasped by each student. The best he can do is to give sporadic quizzes, covering selected portions of the material. Even where the dedicated instructor gives, and then has to correct, frequent quizzes, there is an unavoidable lag between the student's response—his attempt to use the information to which he has been exposed—and the reinforcement—the information as to whether or not his attempt was successful. In a typical computer class the DIVIDE command may be covered during the lecture on Tuesday. On Tuesday night the student uses DIVIDE for the first time in a homework exercise, which he hands in to the instructor on Wednesday morning. The instructor corrects the group's exercises Wednesday night, and returns the paper Thursday morning. Under the best conditions, then, our student programmer finds out on Thursday whether or not he actually learned this one detail of the material presented to him on Tuesday. Clearly, there are improvements which could be made in these conditions.

What improvements can be made, and how they might be accomplished, were first suggested by the Harvard psychologist B. F. Skinner. As a result of years of experimentation in learning, Skinner pointed out that every aspect of the learning situation improves when

(a) the student responds much more often — that is, the subject matter is broken down into many, small, incremental steps, and the student is made to participate at each one;
(b) reinforcement occurs immediately after each response — errors are not allowed to accumulate; and
(c) each student is allowed to respond at his own rate — no one is penalized for pausing to reflect.

The most obvious way of insuring that these conditions are met is to program the material by arranging it into a series of discrete frames, each of which requires a response on the part of the student. These frames are then printed on a paper roll, and encased in a machine. The machine presents one frame at a time, advancing to the next frame only after the proper response has been made to the present one. This, in its simplest form, is a teaching machine. Comprehensive studies of its use in schools, industry, and the armed forces indicate conclusively that Skinner's suggestions work: students learn better, learn faster, retain more, and like it better. The slower students may take longer to cover the material; but at no time are they under the pressures of trying to keep up with "the average." The brighter students finish quickly, and are free to investigate some of the interesting topics suggested by the material they have just learned. The instructor is freed of the machine-like aspects of his job, and can turn his energies to more important tasks. With this necessarily brief background, let us return to our more immediate subject.

Early in 1961 Burroughs' interest in programmed instruction became serious when one of our customers — Schering Corporation, drug manufacturer of Bloomfield, N.J. —used a programmed text to train part of its sales staff in the technical details of Fulvicin, a new fungicide. Each drug manufacturer must teach the clinical background of each of his products to a widely dispersed sales representative force, and these training problems are strikingly similar to those we encounter in the computer industry.

When the results of the Schering pilot study were released, we were convinced that the technique merited a thorough test, and it was decided to employ programmed instruction for training sales representatives and computer programmers in the use of COBOL for the B 5000.

Once this point had been reached, we then were confronted with an array of alternatives from which decisive choices had to be made:

Should the programmed material be put into a machine, or presented in the form of a printed text?

Does anything about the subject matter or its presentation favor the composition or the selection of responses?

Should we program the material ourselves, or have it done by an outside firm?

The remainder of this article discusses the factors which determined our choices of these alternative courses of action.

machine vs. text

While the teaching machine itself — one form or another of the device whose functions are described above — has been the focal point of publicity concerning programmed instruction, it is the *program* which accomplishes the teaching: the most elaborate hardware is useless without a proficient program (an observation which has been made often and with equally good reason in the computer field). It was recognized early in the game that the frames of a program presented through the window of a teaching machine could also be presented in the form of a textbook. The decision to use a text for COBOL was based upon the following considerations:

The two major advantages of enclosing a teaching program in a machine are that it prevents the student from looking ahead at the proper response, and that it provides a means of recording any errors in the student's responses. Preventing the student looking ahead is important where his self-discipline cannot be assumed (for example, in working with very young pupils), but is not relevant training for personnel such as computer programmers. Providing a means of recording errors is important where the emphasis is on revising and perfecting programs. For our purposes, however, the testing of the program itself will be done before it is published. In our proposed use of programmed instruction, therefore, we are not interested in the advantages offered by the machine.

The disadvantages of machines for our application are many. We want to reach each one of a large, widely dispersed audience simultaneously. To provide each man in the sales and programming force with his own machine would be prohibitively expensive and unnecessarily complicated; to avoid this expense by centralizing machines in fewer locations would forego the advantages of decentralization. All of these disadvantages would be magnified if, in addition, we were to attempt to use machines for customer training.

When we publish a programmed text on a subject such as COBOL, we will mail copies to our sales and sales technical representatives. Each man will work with his own text at his own convenience: in the office, at home, on a plane, etc. When a prospect for a computer system reaches the stage at which he wants to start his own application studies, we will send him the required number of copies of the relevant programmed texts, and the training will begin as soon as his programmers read the first frame. This flexibility requires that low-cost, expendable programs be available simultaneously, in quantity, and at widely dispersed points. The programmed text is clearly the better answer than the teaching machine for these specific purposes.

composed vs. selected response

At its present stage of development, the automated teaching field is led by two major contesting groups, the Skinnerians and the Crowderians. The essential difference between programs written by these two groups is the kind of response they require the student to make. The Skinnerians require the student to respond by *composing* material: he is asked to fill in one or more blanks in a sentence, label the parts of a diagram, construct (or fill in the missing parts of) a table, compose a sentence using certain words, compare two concepts by listing similarities and differences, etc. The Crowderians, on the other hand, require the student to *select* the appropriate response from among two or more alternatives — the multiple choice technique. Either type of program can be presented in a teaching machine, or in the form of a programmed text.

Much of the literature and discussion about automated teaching employs the terms "linear" and "branching" as labels for the Skinnerian and Crowderian methods. This confusion is due to the fact that a program of composed responses usually proceeds linearly, taking each frame in sequence, while a program of selected responses usually branches the student to remedial material if he makes any of the wrong choices. A moment's consideration shows, however, that branching can easily be built into a program of composed responses: after the student fills in the blank, he turns the page of the text (or the crank of the machine) and might find, in addition to the correct entry, a number of plausible but incorrect entries. The instructions following the correct entry take him on to the succeeding material, while the instructions after each incorrect entry branch him to the appropriate remedial subprograms. Thus, while either composed- or selected-response programs can employ branching as a feature, the essential difference between the two methods is the kind of response required of the student.

In choosing the response mode for our program, we were guided by the observation that an important requirement of any kind of instruction is the closest possible match between the student's behavior while he is learning and the behavior which will be expected of him as a result of having learned. Thus, when we wish to train a sorter or console operator, it is not enough to have the student read the manuals: most of his training actually takes place on the equipment (or a suitable simulation of it). These considerations were paramount in our choice of composed rather than selected responses. The behavior we want the student to learn is the composition of programs in COBOL, and the programmed text should require participation of the student in the composing of COBOL programs.

The use of selected-response programs *is* called for where the terminal behavior itself involves selecting. One would probably want to use multiple-choice techniques to teach material such as quality-control inspection, electronic circuit trouble-shooting, or the playing of certain games, such as bridge. If the COBOL programmer's job consisted of choosing the correct one out of a group of already-writen COBOL programs, then a programmed text consisting of multiple-choice selections would be appropriate. As it is, we will use the composed response method.

how to get the programming done

Perhaps the single most perplexing question facing those who recognize and want to exploit the advantages of programmed instruction is how to get the programming done. The programming of instructional material is a specialized skill, and is only now beginning to shake down into a body of knowledge and practice which is itself teachable. There is more to the job of programming than merely breaking the subject into small parts, and putting each one into a frame. It is all too easy to produce an instructional program which guarantees that the student will fill in all the proper answers, but without guaranteeing that he will have learned the subject matter.

A classic demonstration of low error rate combined with no learning was carried out in August of 1961 at the Basic Systems programming office in New York. The program used was a 30-frame section on the delta-epsilon definition of limits, lifted out of a larger program on college mathematics (a program which is being aggressively marketed door-to-door by a well-known company). The subject in the experiment was a 15-year-old boy who had dropped out of school in the 10th grade. While the subject could read and write English, his mathematical training consisted of having been exposed to arithmetic. In preparation for the experiment he was shown what a frame is, and where he might look in a frame for the words and numbers to be copied in the blanks. With this background, he correctly completed 26 out of the 30 frames in the section. Since the subject had no knowledge of the technical terms in the frames, his 11.5% error rate was clearly a function of something other than his learning or understanding of the material.

The problem in writing a good program is to insure not only that the proper response occurs, but also that it occurs for the right reason; the student's response should be a function of the subject matter itself, and not a function of extraneous cues in the material. The hallmarks of badly designed programs are formal cues, and sequential and syntactical prompts, which interfere with the learning process. Clearly, the design of a good program requires meticulous care in the writing, and close scrutiny in the editing, of every single frame.

In addition to the details of actual frame design, the authors of a programmed text must recognize and be prepared to deal with the problems of avoiding confusion between related concepts, insuring the retention of new material, incorporating the proper number of review frames in the program at the proper points, relating examples to general rules, etc.

The computer manufacturer who wants to write his own programmed texts needs two kinds of people: the subject matter experts, and the text programming experts. For several obvious reasons, the most practical approach is to teach the subject matter experts how to write a programmed text. It is also practical to combine an in-house capability with one of the many outside programming services now available or to utilize the latter solely for this work.

the lack of helpful experimental results

Those who are considering the use of programmed instruction are immediately concerned with the question of the relative effectiveness of different methods of programming, presenting the programs, etc., for a particular application. While the literature abounds with reports of experiments purporting to establish such measures, some of these reports are not very helpful. Many of the experiments one encounters suffer from the same drawback: the use of very short programs.

A good example is the report entitled *Response Mode, Pacing, and Motivational Effects in Teaching Machines* published by the U.S. Naval Training Device Center. It concludes that the effectiveness of programmed learning is not sensitive to such factors as whether the student makes overt or covert responses, is paced in his responses, constructs a response or makes no response at all (just reads the material), or uses a text or a machine. However, despite the detailed statistical treatment (including 17 tables showing means and standard deviations, and analyses of variance) the report is based upon a program of only 87 frames. The objection to short programs is that the smaller the amount of material to be taught, the less difference does it make what technique is used.

Consider the limiting case of a single frame: if the goal set for an experiment is to teach a single item by means of a single frame, it clearly is not going to make any statistical difference in later tests if the subjects read the frame from the page of a text or the window of a machine, what kind of response is required, or whether a response is called for or not. With a short enough program it can probably be shown that the effectiveness of calling the subject and giving him the information over the telephone does not differ from the effectiveness of any of the above teaching methods.

The point is that in industry we have many teaching tasks which involve large amounts of material, some of which is quite complicated. What we would like to see are comparisons of learning effectiveness — *including retention studies* — for different methods of writing and of presenting programs which are designed to teach a lot of fairly complicated material. While this is, admittedly, a large order, it is probably fair to point out that the needed data might now be available had greater past effort been directed to the writing of programs rather than to the other features of the experimental situation.

Sometimes the reports one find require careful interpretation. In choosing between selected- and composed-response programming techniques our first concern was their relative effectiveness, and we looked to the literature for guidance on this matter. One of the best known and most widely circulated papers in this area is the report of the Automated Learning Research Project carried out by the UCLA Department of Engineering. Among other conclusions presented in this report is the statement that there is no significant difference in the learning effectiveness of multiple-choice and free (composed) response programs. This conclusion is based upon the criterion test scores of 67 subjects who completed 192-item linear programs on college level elementary probability, presented in teaching machines. In reading the details of the experiment, we were puzzled by the fact that there were precisely 192 items in each of the programs — normally, a composed-response program has more items than its selected-response counterpart. A comparison of the two programs revealed that the only difference between the frames was that multiple-choice answers were provided in one of the programs and not in the other. Almost all of the frames followed the selected-response format — they covered a rather large section of material (out of the sample of 17 frames, one contained 81 words and an equation), the tone was chatty, etc. On the basis of the details provided in the report, it appears that the investigators first wrote the multiple-choice linear program, then simply deleted the choices and reproduced it in order to obtain its composed-response equivalent. In the face of this technique, one is forced to suggest that there was no significant difference in the test results because there was no significant difference in the programs.

To justify the conclusions stated in the UCLA report, the investigators should have proceeded as follows. Having written the multiple-choice program, they should have written the composed-response program covering the same subject matter, which would differ from the multiple-choice program in these particulars:

(1) the amount of material in each frame would be less; no frame would try to cover more than one discrete item;

(2) there would be more frames, about 2000 to adequately teach elementary probability; and

(3) in addition to blanks to be filled, the frames would ask such questions as

- explain the relation between A and B
- compose a sentence using the expressions A, B and C
- compare A and B, naming two similarities and two differences
- give all the examples you can of A
- fill in the missing parts of the table (or diagram)
- list all the conditions you know under which A could occur
- explain why B is not an example of A, etc.

A comparative study of this nature would then provide the data which is now lacking, and which we all would like to see. ■

FOR BIBLIOGRAPHY CIRCLE 106 ON READER CARD

COMPUTING HIGHLIGHTS AT WESCON 62

L.A. to be scene of Aug. 21-24 show

The 1962 Western Electronic Show and Convention (WESCON) featuring five special technical sessions and 21 regular sessions, in addition to the 1250-booth electronics exposition, will be held in Los Angeles from August 21-24. All technical sessions will be held in the Statler-Hilton Hotel, while the exposition will be presented at the Los Angeles Sports Arena.

Major national spokesmen on five electronics and aerospace topics will present papers at the special sessions. Of particular interest to the computing field will be "Weather Satellites and Data Processing," by David Johnson, deputy director of Meteorological Satellite Activities, U. S. Weather Bureau. (August 22, 1:30-3:00 p.m., Pacific Ballroom.)

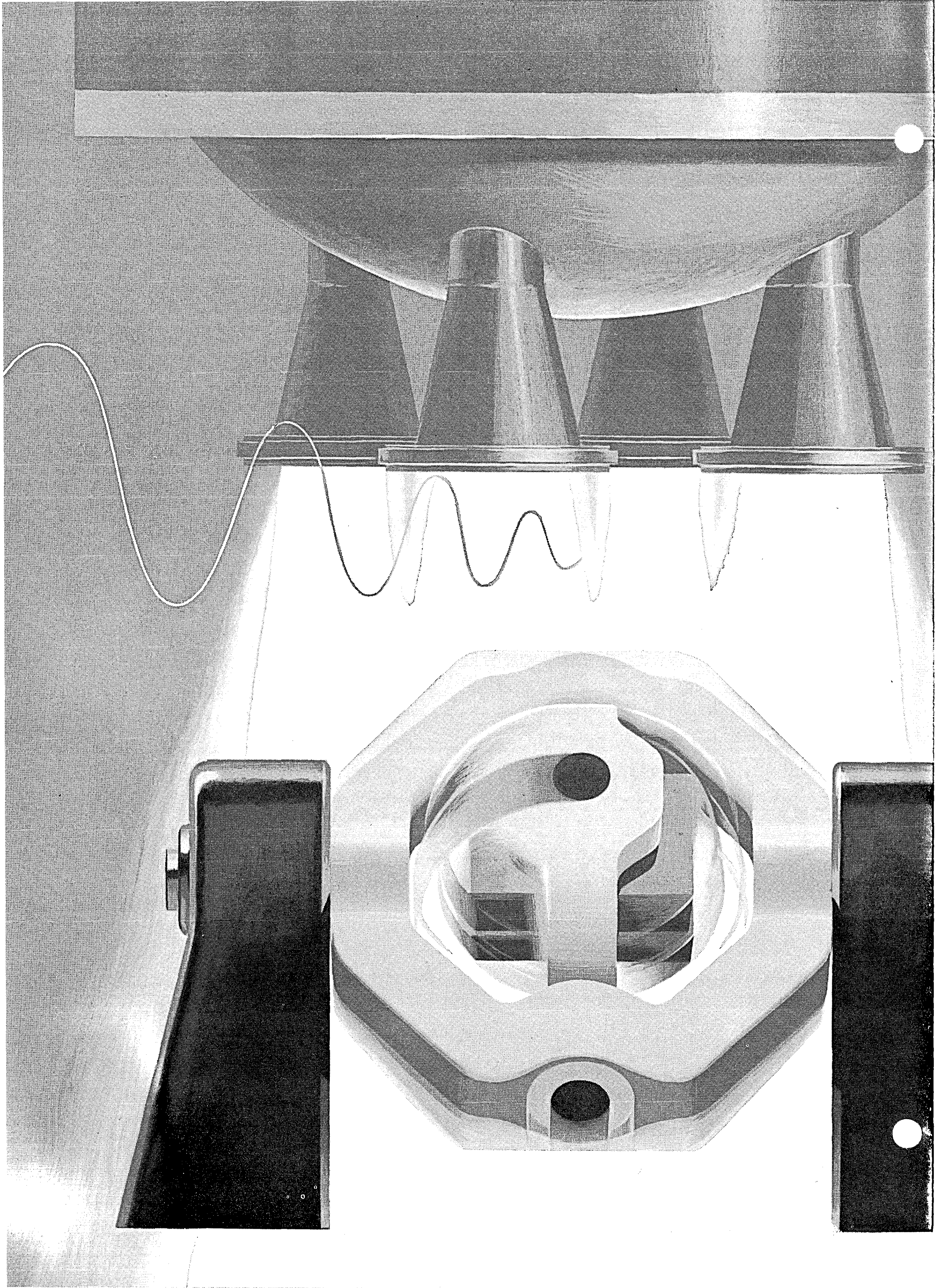
Other computer-oriented topics to be covered during the regular sessions, include: "Computer Memories," August 21, 9:00-11:30 a.m.: *A Practical Non-Destructive Random Access Tunnel Diode Memory,* James Y. Payton, Litton Systems, Woodland Hills, Calif.; *The Design of a 4096 Word One Microsecond Magnetic Film Store,* J. B. James, B. J. Steptoe, and A. S. Kaposi, ICT Ltd., Stevenage, Hertfordshire, England; *Inductive Coupled Read-Only Memory,* J. G. Wamsley, IBM, N. Y.

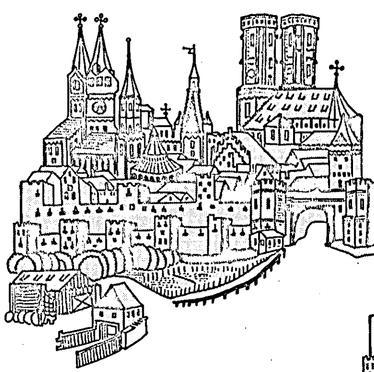
"Pattern Recognition," August 22, 9:00-11:30 a.m.: *An Optical Decision,* R. D. Joseph, P. M. Kelly and S.S. Viglione, Astropower, Inc., Costa Mesa, Calif.; *A Recognition Logic Designed for Hand Printed Characters,* Seymour Spilerman, IBM, N.Y.; *The Application of Integral Geometry to Machine Recognition of Visual Patterns,* Geoffrey H. Ball, ITT Federal Laboratories, Palo Alto, Calif.; *A Machine for Performing Visual Recognition By Use of Antenna-Propagation Concepts,* Harry Blum, Cambridge Research Lab., Bedford, Mass.

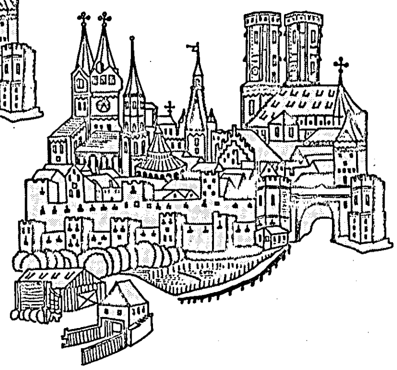
"Computer Mechanization," August 22, 9:00-11:30 a.m.: *Theoretical & Experimental Evaluation of RZ and NRZ Recording Characteristics,* Irving Stein and M. F. Barkouki, Ampex Corp., Redwood City, Calif; *A Unified Approach to the Design of Solid-State Integrated Logic Elements,* R. H. Beeson and O. R. Baker, Signetics Corp., Sunnyvale, Calif.; *Experimental 100-mc Tunnel-Diode DDA,* E. R. Beck and G. A. Brumm, Bendix Corp., Southfield, Mich.

"Computer Theory," August 23, 9:00-11:30 a.m.: *The Standardization of Peripheral Interfaces,* Marvin Jacoby, Rem Rand UNIVAC, Blue Bell, Pa.; *A Real Time Function Analyzer-Synthesizer Using Orthogonal Polynomials,* Arthur H. Ballard, Bernard Electronics Co., Washington, D. C.; *Inexpensive Control Via Modal Computers,* Floyd George Steele, Modal Systems, Inc., La Jolla, Calif.

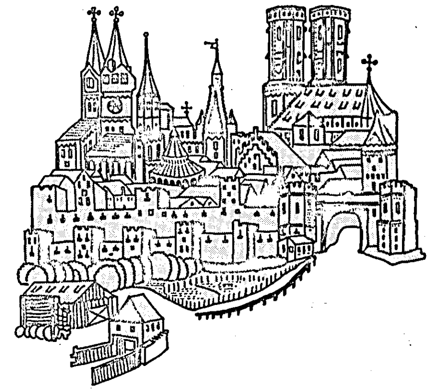
Seven field trips have been scheduled, including: Litton Systems, Inc. (August 21, 1-4:30 p.m.); Rocketdyne (August 22, 8 a.m.-1 p.m.); ElectroData Div. of Burroughs and Consolidated Electrodynamics Corp. (August 22, 1-5 p.m.); U. S. Navy Missile Cruiser (August 22, all day); Jet Propulsion Laboratory (August 23, 8:15 a.m.-12:30 p.m.); Hughes Semiconductor Division (August 23, 1-5 p.m.); and NBC Color Studios (August 24, 8:30 a.m.-12:30 p.m.). ■







ifip congress 1962-aug. 27-sept. 1



a significant catalyst

by ISAAC L. AUERBACH, President,
International Federation of Information Processing

The IFIP Congress 62 convenes at the Technische Hochschule in Munich, Germany, on August 27th, until September 1st. This international congress has been organized by the International Federation of Information Processing (IFIP), a society of 20 national technical societies. It will be recalled that the first international conference was organized by UNESCO with the help of technical consultants in Paris in June 1959. This meeting gave birth to IFIP.

These international meetings, which take place every three years, are particularly significant. They provide the only truly international forum to bring computer scientists and computer users together to exchange ideas and knowledge in the information processing technologies. This field with its myriad applications, is one of the most rapidly expanding of all scientific activities today; the digital computer is becoming a commonplace tool for all branches of physical science, social science, behavioral science, medicine, business, and government. It is conceivable that in the not too distant future, more people will be taught to program and use computers than have been taught to use slide rules. It is clear that the digital computer and its application to information processing will have a greater constructive impact on mankind during the remainder of the 20th century than any other technological development of the past two decades.

IFIP Congress 62 will have many interesting facets, including formal lectures, symposia, and panel discussions. An international exhibition will be held concurrently with the Congress and will display computer oriented products from seven countries. The 40 exhibits will range from complete systems to advanced research work on new techniques. Three special sessions on hardware and software will be held in conjunction with the exhibit, with particular emphasis on equipment. Educational motion pictures from various countries will also be shown at the exhibition hall.

The program for the IFIP Congress 62 will be supplemented with multilingual abstracts and preprints of the accepted papers. Proceedings will be published shortly after the Congress and will include abstracts, all accepted and invited papers, summaries of the symposia and panel papers, and discussions.

Following the Congress there will be prearranged tours to laboratories and factories in Germany, Italy, France and England. Reservations for these tours will be limited due to the necessity to pre-book hotels and transportation.

The sponsor of the Congress (IFIP) is the world's first international technical body to actively foster the growth and exchange of knowledge in the information processing sciences. Since its inception in January 1960, IFIP has organized Technical Committee 1 on Terminology and Symbols under the chairmanship of G. C. Tootill of the U.K. This committee is compiling a multilingual glossary in cooperation with the International Computation Centre (ICC) in Rome at the specific request of the International Standards Organization (ISO). Technical Committee 2, on Programming Languages, was established just seven months ago and is under the chairmanship of Heinz Zemanek of Austria. This committee, in turn, organized Working Group 2.1 on ALGOL to assume the responsibility for the development, specification, and refinement of ALGOL. This ALGOL Working Group is under the chairmanship of W. van der Poel, of the Netherlands. This is the first time an international technical organization has attempted to act as caretaker for a programming language.

Ideas know no boundaries. Wherever technically proficient people are working, they will create, invent, and develop ideas. One group may be especially proficient in mathematics, another in logic, a third in industrial applications, a fourth in hardware development—each has something to contribute to the total body of knowledge. Thus, IFIP Congress 62 provides that invaluable catalyst that enables men from all parts of the world to meet others working in similar or diverse fields with whom they can exchange thoughts on their work.

the congress program:

26 countries represented

by E. L. HARDER, Chairman, U.S. Arrangements

In the 50 technical sessions comprising the Munich Congress, the entire field of digital data processing will be explored. Because of the popularity of the symposia and panel discussions at the Paris Congress in 1959, most subjects will be treated in this manner to permit discussion of current developments at the time of the Congress. These sessions parallel the plenary sessions in which some 85 papers have been selected out of over 650 submissions, which best describe the most important developments in information processing throughout the world. In addition, there are three equipment sessions associated with the exhibit describing specific hardware developments.

Keynote speeches will be given by I. L. Auerbach, president of IFIP, who will open the Congress with "The Impact of Information Processing on Mankind," and Dr. A. Walther, Germany, whose subject is "The Spectrum of Information Processing."

Thirty internationally recognized authoritites have been invited to give special lectures and presentations which will be associated with the plenary sessions dealing with these subjects, and in a special survey session at the conclusion in which Dr. John McCarthy of the U.S., Dr. E. Stiefel of Switzerland, and Dr. H. Gumin of Germany will speak.

While the largest section of the program deals with advances in computer technology itself, and programming techniques for communication with the computer, a notable change from the first international meeting in Paris three years ago, is the broader treatment of the whole field of information and its processing. This includes Information Retrieval and Business Applications as well as the very great interest now in Artificial Intelligence. The latter is covered by three plenary sessions on Automata Theory, Machine Learning and Artificial Perception, and three symposium sessions on Pattern Recognition, and Artificial Intelligence. Invited lecturers Arthur Burks from the University of Michigan (Automata) and Allen Newell, Carnegie Institute of Technology (Problem Solving, Learning and Generality) also contribute in this field.

The truly international character of this Congress is illustrated by the fact that more than 26 countries will be represented in the presentation of the program. The official languages are French and English with simultaneous translation into German, Russian, French and English for the plenary sessions.

For the organizing of the Congress, the entire field of information processing was broken down into the ten major subjects, and six sub-headings:

Major subjects:
Business Data Processing
Scientific Data Processing
Real-Time Data Processing
Information Storage and Retrieval
Language Translation and Linguistic Analysis
Digital Communications
Artificial Perception and Intelligence
Advanced Computer Technology (Hardware & Programming)
Education In and By Computers, and
Miscellaneous

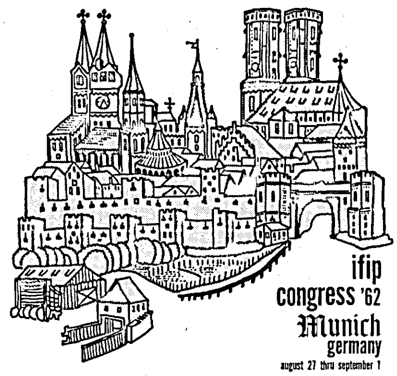
Sub-Categories:
Applications
Programming
Systems
Logic
Equipment, and
General

The International Program Committee is headed by Niels Bech in Copenhagen, and consists of the IFIP Council except for the United States, Germany and Sweden who are represented by Dr. E. L. Harder, Dr. Fritz Bauer, and C. E. Froberg, respectively. The U. S. Program Committee consists of:

E. L. Harder, Westinghouse Electric (chairman); J. R. Anderson, Stanford Research Lab.; P. Armer, RAND Corp.; M. M. Astrahan, IBM; W. F. Bauer, Informatics, Inc.; R. Bemer, Univac Div., Sperry Rand Corp.; G. L. Hollander, Hollander Associates; A. S. Householder, Oak Ridge National Lab.

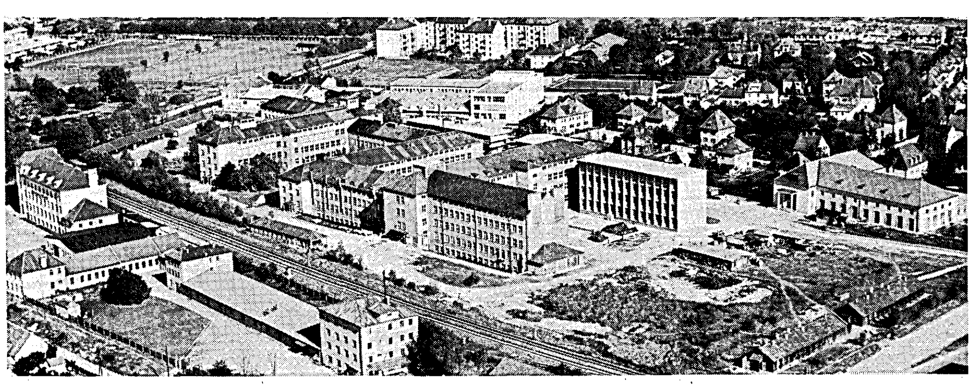
W. W. Leutert, Laurel Ledge Park, Stamford, Conn.; J. D. Madden, System Development Corp.; J. C. McPherson, IBM; J. Rajchman, RCA; D. T. Ross, MIT; M. Rubinoff, University of Pennsylvania; N. R. Scott, University of Michigan; V. N. Vaughan, AT&T; and F. M. Verzuh, Boston, Mass.

This committee, assisted by 25 other reviewers, made preliminary reviews of the 350 American papers offered, and assembled suggestions for panels and symposia, although all final selections were made by the International Committee.



the city & the planners

Above left (l-r): E. L. Harder and J. V. Garwick. Above right (l-r): A. van Wijingaarden, M. V. Wilkes, and A. A. Dorodnicyn. Below left l-r): H. Billing and W. van der Poel. Below right (l-r): N. I. Bech, J. G. Santesmases, and B. Langefors. Photographs were taken during meetings in Munich and Copenhagen.



the exhibitors at interdata

A. E. G. Berlin-Grunewald, W. Germany
Ampex International Operations, Inc., Redwood City, Calif.
Anker-Werke AG, Bielefeld, W. Germany
Auerbach/The Bureau of National Affairs, Washington, D.C.
Beckman Instruments, Fullerton, Calif.
Centre National d'Etudes des Telecomunications, Paris, France
Compagnie des Compteurs, Montrouge, France
Compagnie des Machines BULL, Paris, France
Compagnie Européenne d'Automatisme Electronique, Boulogne, France
Compagnie Francaise Thomson-Houston, Paris, France
Compagnie Industrielle des Téléphones, Paris, France
Control Data Corp., Minneapolis, Minn.
DATAMATION, Los Angeles, Calif. and N.Y.C.
Deutsche AMP GmbH, Dusseldorf-Benrath, W. Germany
Deutsche Monroe Sweda GmbH, Dusseldorf, W. Germany
Electronic Engineering S. A., San Francisco, Calif.
Electrologica GmbH, Dusseldorf, W. Germany
Eurocomp GmbH, Minden/Westfalen, W. Germany
Facit GmbH, Dusseldorf, W. Germany
Ferranti Ltd., Hollinwood, England
Friden GmbH, Nuremberg, W. Germany
Hewlett-Packard Vertriebs-GmbH, Frankfurt/main, W. Germany
International Business Machines Corp., New York
ICT, England
Munzig International, Los Angeles, Calif.
National Registrier-Kassen GmbH, Augsburg, W. Germany
Olivetti C. Ing & C.S. p. A, Ivrea, Italy
Potter Instrument Co., Inc., Plainview, Long Island, N. Y.
Sepsea-Societé pour l'Exploitation des procédés S.E.A., Putneaux, France
Siemens & Halske AG, Munich, W. Germany
Societé Alsacienne de Constructions Mecaniques, Paris France
Societé Europeenne pour le Traitement de l'Information, Montrouge, France
Societé d'Exploitation & de Recherches Electroniques, Paris, France
Solartron Elektronik GmbH, Munich, W. Germany
Sperry Rand International Corp., Lausanne, Switzerland
Standard Elektrik Lorenz AG, Stuttgart, W. Germany
Svenska Aeroplan AB, Sweden
Telefunken GmbH, Ulm/Donau, W. Germany
Wandel u. Goltermann, Reutlingen/Wurtt., W. Germany
Zuse K. G., Bad Hersfeld, W. Germany

# of tours & trips

Five tours of computer manufacturing plants are scheduled to be held during and after the IFIP Congress. Firms to be visited are:

a. Munich: Siemens & Halske. One half-day during the Congress.

b. Germany: IBM Deutschland, Sindelfingen; Standard Elektrik-Lorenz, Stuttgart-Zuffenhausen; Telefunken, Heilbronn. Begin at Munich on Sept. 3 and end at Heilbronn on Sept. 5.

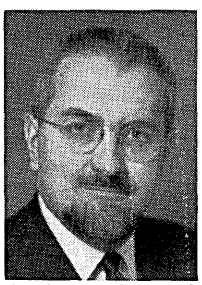
c. England: International Computers and Tabulators Ltd.; Elliot Automation Ltd.; EMI Electronics Ltd. Begin at London on Sept. 6 and end at London on the following evening.

d. France: Cie. des Machines BULL; Cie. Industrielle des Téléphones; Cie. Européenne d'Automatisme Electronique; Societé pour l'Exploitation des Procédés S.E.A. Begin at Paris on Sept. 6 and end at Paris on the following evening.

e. Italy: CEA-PEREGO Milano; Olivetti Divisione Commerciale Elettronica, Milano. Sept. 6, one day. ■

AN INTONATION ON INTERNATIONALISM

by H. R. J. GROSCH, Contributing Editor



Three and a quarter years ago the famous, the resourceful, and the carefree of our fraternity met in Paris. It was the first great international gathering of the clans, and a memorable one. This month we come together again, in a different ambiance (say "Ler-vn-broy", not "bee-air!"

The number of opinions brought to such a meeting is approximately the triple product of the number of specialisms in our field, the number of different computers delivered and on order, and the number of entries in our gazetteer; the number taken away is legion. I have asked myself over and over again what topic could possibly appeal on such a gala occasion, and to such a variegated assembly. Should I mope about standards, or mow about languages? Too specialized: the heuretist doesn't care about tape widths; the superconductivity expert ignores COBOL. What can I write about that will interest the archimandrite and the zoomorph, the man from Adelaide and the girl from Zurich, the abacus-designer and the Zen-programmer?

If no piece of our profession will do, if no single expoundable aspect is sufficiently universal, I could of course ascend to generalities: "Computers — Blessing or Bane?" or some such. This goes over much bigger on TV, especially live TV where you can't watch yourself later. In print? Hardly!

There remains, however, a favorite topic. If we exclude the whole *and* its parts, there yet remains the topology, the connectivity: our organizations. Faithful DATAMATION readers may recall my dismay at the formation of IFIP, at its proposed one-nation-equals-one-society-equals-one-vote government, and at its picayune financing. No consideration was ever given to the radically different formulation that has served several scientific unions so well for half a century, nor to alternatives whereby manufacturers and other commercial supporters might contribute. But such objections are now rather futile; IFIP is sufficiently viable — *just* sufficiently viable — to mount a second congress and commit itself to a third.

Instead of obsolete recriminations, I'd like to review the growth picture for our field: growth for individuals, for national and specialized organizations, and for supernational groups. This picture clearly indicates two types of open meshes in our network, and I hope by suggesting a new kind, a new level, of society relationships to supplement the strength and clarify the pattern of computer organization everywhere.

First of all, let's think about size. AFIPS represents, through its three founding member societies, over 10,000 individuals, excluding "multiple" members. Add to this user-group members who don't belong to ACM, analog and simulation people, and the NMAA types, and there would be upwards of 30,000 in all. This is a reasonable share of the 100,000 men and women now working at specialized jobs in the computer field. With the American penchant for joining, there could be customer engineer associations, salesmen groups (*not* Hundred Per Cent Clubs, please!) and military outfits forming out of that forlorn 70,000 any day. I would expect a 25-30 per cent annual growth rate in professional memberships, in spite of an annual growth of only say 20 per cent in total computer personnel. In the three years between IFIP congresses, then, as the AFIPS net is cast more widely and as IBM balloons, U. S. membership should double, or more than double.

In the countries of Western Europe, in Australia, in Japan, the rate of growth could be much higher. The limiting factors are likely to be educational rather than economic; these limits will not become too serious for membership growth, although they certainly restrict entry of novice personnel and total computer usage. Membership on the Continent, in Australia, in Japan, and probably in Latin America and South Africa, can be expected to double every *two* years for awhile; for Britain, the U. S. pattern is more likely.

In 1968, then, I expect the professional societies represented in IFIP (excluding such incommensurabilities as Academies of Science) to include 100,000 individuals, only half of whom would be American.

Two major patterns of association have already been demonstrated in addition to the "national" or catch-all group most clearly exemplified by the British Computer Society. One is the special-interest organization: information retrieval, nuclear codes, medical applications. The other is the User Group, of which SHARE was the prototype. These orthogonal arrangements can quite readily be imbedded in the texture of a national group like BCS, in spite of the regrettable failure to do so in ACM or AFIPS. One can imagine a hypothetical international array like a core memory; the planes would be all-inclusive societies; X-selection would get you an applications organization; Y-selection would yield fellow machine users. Alas! the U.S. array includes more than half the "cores," and at least a plurality for decades. And its special pattern messes up the regularity, renders it relatively valueless. If only we could have rebuilt ACM before joining IFIP — but I said that years ago.

There is no way at present for NMAA (an oversize special-interest group) or SHARE (an oversize machine-user group) to act upward on IFIP. That's an American fault, not the fault of IFIP. It could be wiped out if there were an International Computer Union modelled after the Astronomical Union and its younger brothers, with self-perpetuating commissions of distinguished individuals. Or it could be wiped out if there were a Union of committees and subcommittees whose "members" were the corresponding committees and subcommittees of national or regional societies. But IFIP is born, and the American flaw exists; a radical change is not likely until the accoucheurs depart.

Now let's shift perspective and look at the picture from above, not from underneath. How do the big groupings, the international patterns, appear? There are two varieties: the isolated pioneer and its satellites, and the aggregation. The first case is typified by the United States and Canada; another example is Australia and New Zealand; a third, the U.S.S.R. and its associates. The second case is obviously that of Western Europe, and Latin America will go that way in time. Japan and South Africa stand alone, and there are border cases like Mexico and Israel. Can these regional groupings be clearer? We have to be political realists as well as technological idealists; for years to come, and with the best will in the world on the part of our confreres in the countries involved, we cannot have Israel and Lebanon, or South Africa and Nigeria (or the United States and Cuba!) in the same region.

Assume a region of roughly-equal Western European countries, and let the Israelis and Turks join in. Assume a Latin American aggregation fairly soon, and let Mexico head that way if she chooses. Assume, some years from now, an African aggregation, with the Near East included, but with South Africa excluded. Of the other kind of region, the U.S.-Canada type, Australia would add South Africa to New Zealand, and Japan would draw in "neighbors" like Hong Kong. That leaves only India completely alone, and as a natural market for Japanese medium-scale machines (Mahalanobis' URAL to the contrary) she might choose to turn that way, or of course toward Australia.

As each of these regions, of either type, reaches a useful size, a regional federation should be formed. The North American, the Western European, the Southern (Australia, South Africa, New Zealand), and I imagine the Soviet, regions are ripe. The Latin American, Far Eastern, and African would follow in approximately that order. At some propitious time the *regional* federations would take over the management of IFIP; perhaps not for ten years, but ultimately. The basic framework of the superfederation need not change, and the more even constituent memberships and finances of the regional federations finally comprising the pinnacle group would make the approved tasks of standardization and management far easier.

About meetings: I would suggest a grand international jamboree every second year, each regional federation playing host in turn over a twelve or fourteen or sixteen year cycle. Suppose that is on odd-numbered years, starting with 1967 (Soviet or Southern region). On even-numbered years, starting with 1966 or even 1964, every region would hold a meeting, with member countries playing host in less rigorous rotation than in the case of the world meeting. And each country of each region would hold annual meetings, of course.

The annual national meetings and the biennial Summit would be much as they are now: BCS-like in Britain, JCC-like in America, and IFIPsical regardless. But the regional meetings would reflect a fundamental difference. Where the superfederation concerns itself, and would continue to concern itself, with world-wide matters like hardware and software standardization, the regional meetings would bring together, and provide the highest forum for the applications groups or committees or societies and the machine-user groups or committees. At the Summit, the emphasis would be on plenary sessions, ceremonials, invited addresses, and multilingual socializing; at the regional meetings, parallel working sessions, many of them closed, would hear and coordinate the reports of national groups with closely similar interests. There would be little ceremony. Identical working groups in different regions would keep in touch directly, and would cross-report important developments to each other, rather than through IFIP.

It all sounds most complicated and artificial, doesn't it? But look at a few of the immediate benefits:

1. An urgently needed international exchange for European data-processing communities.
2. A channel upward for the NMAA and for user groups in the United States.
3. More frequent but less expensive international assemblies, closer to home.
4. An overlay of the scientific union type of organization, without major dislocation of the current arrangement.

And in the long run, the regional federation would provide:

5. An organization capable of handling hundreds of thousands of individual members from fifty or sixty countries.
6. And doing so with far less disparity of representation than the current one-country-one-vote- method.

There are still national and subnational problems, of course. Whither AFIPS, if IRE and AIEE merge; whither SHARE, whither ALGOL and COBOL, whither BEMA and ASA, whither NMAA? And, need I say, difficult problems of growth and economics and especially education are also present in the European and in all the other regions. This concept is just one of many tools which can help us build higher; it can hardly overcome weak or tottering foundations. But equally, we cannot build higher unless we plan ahead, and imaginatively. Always in the past our growth has outrun our preparations; as we expand into a fourth continent and a third decade, we should do better. ■

u.s., u.k. & western europe surveyed

DATAMATION'S INTERNATIONAL COMPUTER CENSUS

DATAMATION is pleased to present its first census of computer installations in the United States, Great Britain, and Western Europe. A total of 9,337 computers are reported in operation in the U.S., and 1,622 in England and Western Europe, for a grand total of 10,959. West Germany leads in overseas computing installations with 472 systems, while Great Britain runs second with 389.

Since an undertaking of this nature is dependent on the cooperation of the firms engaged in manufacturing data processing equipment, DATAMATION called on the respective suppliers to contribute installation figures.

All quantities shown in the chart were provided by the manufacturers, with the exception of IBM and Autonetics, where company policies prohibit the dissemination of this information.

In lieu of omitting installation figures for IBM and Autonetics, which, in the case of IBM, would have completely invalidated the census, "guesstimates" were compiled by DATAMATION and offered for analysis to ten industry experts. The installation figures for these firms, therefore, are a consensus and not official totals.

European statistics were prepared by DATAMATION correspondents, whose estimates for overseas IBM installations reflect the approximations offered by European manufacturers and other sources.

While other censuses show "on-order" figures, it was felt that this type of information has proven consistently inaccurate and does not reflect on the computing power of systems installed and operating.

To arrive at a world-wide computer census, one would add approximately 2K to the U. S. and Western European total of 10,959 for a grand total of 12,959.

Installations reported by manufacturers were as of July 1, 1962, and are listed in the order of Adams' Computer Characteristics chart.

A census of computers will be published by DATAMATION as a regular semi-annual feature. ■

MFR.	U.S.	BENELUX	FRANCE	GERMANY	GREAT BRITAIN	ITALY	SCAN.	OTHERS[3]	TOTAL
ACE					1				1
Advanced Scientific: 210	2								2
AEI					1				1
Autonetics: Recomp II	132								132
Recomp III	28								28
Bendix: G-15	350					3		1	354
G-20	13							4[5]	17
BULL: Gamma 300		13	22	7	2	24	4	13	85
Gamma 30[1]			3	1			6	5	15
Gamma 60		1	9			1			11
Gamma ET		18	73	5		15	1		112
Gamma MDE					4				4

Key to foreign manufacturers: Great Britain: ACE—built by the National Physical Laboratory; AEI—Associated Electrical Industries Ltd.; CE—Computer Engineering Ltd.; EEC—English Electric Co. Ltd.; EMI—E.M.I. Electronics Ltd.; Ferranti—Ferranti Ltd.; ICT—International Computers & Tabulators Ltd.; Leo—Leo Computers Ltd.; MADAM—Mark I: built by Manchester Univ. with Ferranti; Mark II: built by Ferranti; Metrovick—developed by the former Metropolitan Vickers Organization; Stantec—Standard Telephone & Cables Ltd. France: BULL—Cie. des Machines BULL. Germany: Siemens—Siemans & Halske Akt.; Standard—Standard Electrik Lorenz AG; Telefunken—Telefunken GmbH; Zuse—Zuse K. G. Italy: Olivetti—Olivetti Divisione Commerciale Elettronica. Sweden: Facit—Facit Electronics AB; SAAB—Svenska Aeroplan AB. Netherlands: Electrologicia. (See footnotes on page 48.)

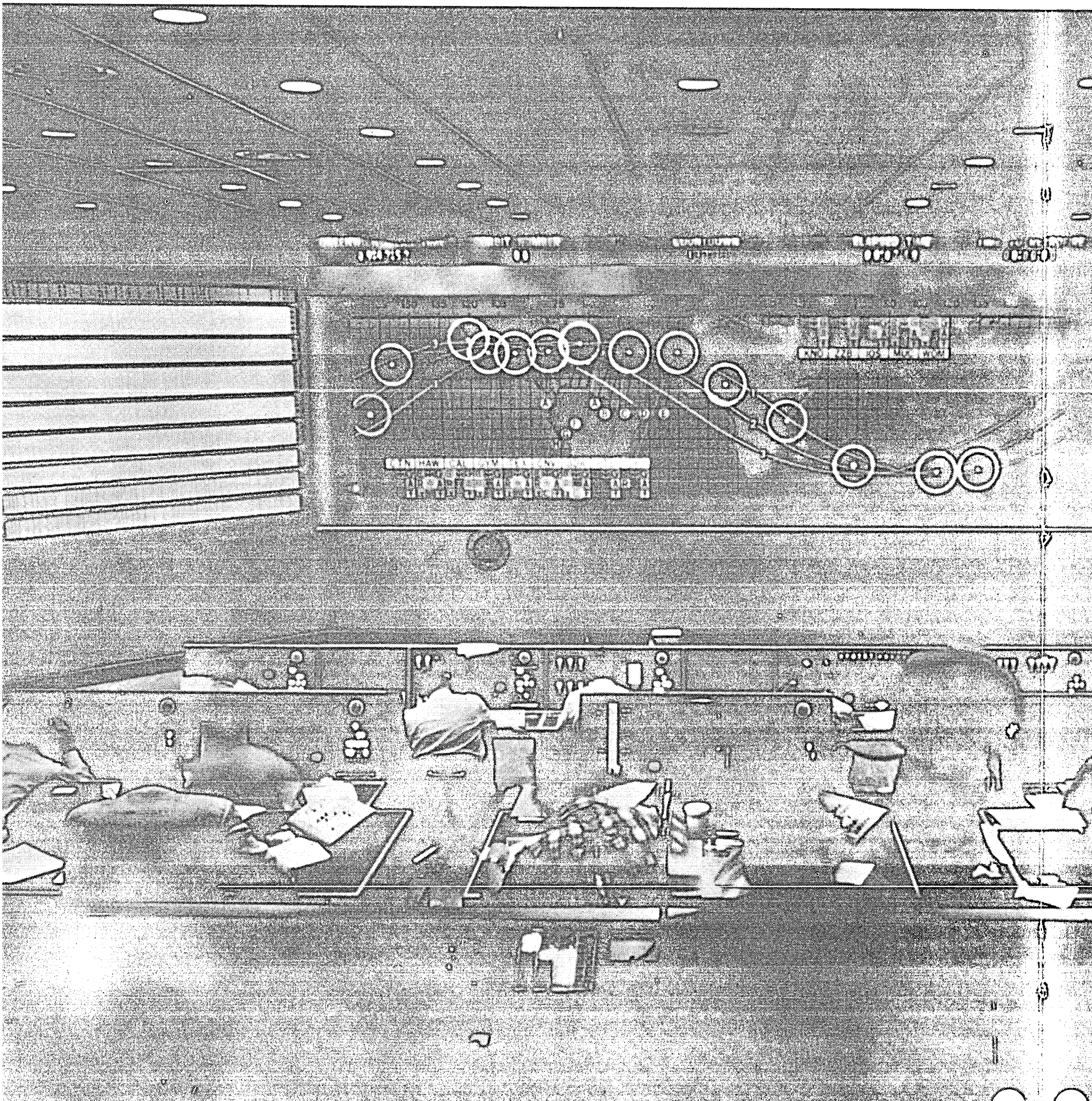
MFR.	U.S.	BENE-LUX	FRANCE	GERMANY	GREAT BRITAIN	ITALY	SCAN.	OTHERS[3]	TOTAL
Burroughs: B220	55							3[5]	58
B5000	0								0
B205	85							13[5]	98
B270	1								1
B280	0								0
B260	0								0
B250	14								14
CE: 55					1				1
102					1				1
Clary: DE 60	61				1				62
Computer Control: DDP-19	1								1
CDC: 1604	36								36
160, 160A	195								195
3600	0								0
6600	0								0
Digital Equip. Corp.: PDP-1	35								35
EEC: Deuce					29				29
KDN 2					1				1
KDP 10					2				2
KDF 9					0				0
Electrologica: X-1		6		9					15
Elliot: 401					1				1
402					8				8
403					0				0
502					1				1
503					0				0
802		2			3				5
803			1	7	25		1		34
El-Tronics: Alwac IIIE	41						13[2]		54
EMI: Special					1				1
Emidec 1100					9				9
Emidec 2400					2				2
Facit: EDP 2							4		4
EDP 3							2		2
Ferranti: Apollo					1				1
Argus					2				2
Atlas					1				1
Mercury		1			14		1		16
Orion					0				0
Pegasus				2	30		1		33
Perseus					0				0
Sirius					2				2
Mark I		1				1			2
GE: 210	50								50
225	55								55
Gen. Precision: RPC 4000	69								69
LGP 30	432				1				433
Honeywell: H1800	0				1				0
H800	38								39
H400	13								13
IBM: 7030	2				1				3
7094	0								0
7090	180				2	1			183
7080	28								28
709	41				1				42
704	87				1	1			89
705	144	1	8	1	1	2			157
7074	0								0
7040/44	0								0
7070	184	1	11	12		6	4		218
7072	0								0
650	967	20	60	70	19	24	13		1173
1410	18		2	5	1	1			27
1401	2585	10	125	130	21	18	7		2896
305	787	5	20	50	8	25	3		898
1620	1114	2	6	40	1	4			1167

MFR.	U.S.	BENE-LUX	FRANCE	GERMANY	GREAT BRITAIN	ITALY	SCAN.	OTHERS[3]	TOTAL
ICT: PCC					0				0
555					0				0
1301					1				1
1501					0				0
1500					1				1
1200					6				6
1201					33				33
1202					12				12
LEO: I					1				1
II					11				11
III					1				1
MADAM: Mk. 1					0				0
Mk. 2					5			2	7
Metrovick: 950					3				3
Monroe: Monrobot IX	135							9[5]	144
Monrobot XI	130							10[5]	140
NCR: 304	29								29
315	7								7
310	19								19
390	160	3	1	2	1		4	2	173
Nat. Elliot: 405					30				30
405M					1				1
Olivetti: 9001						1			1
9002						1			1
9003						6			6
6001						2			2
6005						0			0
Olympia: Omega				1					1
Packard-Bell: PB-250	100		1		1				102
Philco: 2000-212	0								0
2000-210	8								8
2000-211	10								10
RCA: 601-604	0								0
501	80						2		82
301	107						3		110
Ramo-Wooldridge: RW 530	12								12
SAAB: D21							0		0
SARA							1		1
Scientific Data: 910	0								0
920	0								0
Siemens: 2002				17			1	2	20
Standard: ER 56		1		5					6
DB 70				0					0
Informatic				2			2		4
Stantec Zebra		15		1	16		1		33
Telefunken: TR 4				1					1
TR 5				1					1
Univac: LARC	2								2
1107	0								0
1100 Series	32								32
U I, U II	65								65
490	3								3
U III	0								0
File (O & I)	77								77
SS 80, 90, Step	518	10		41	5	27			601
SS II	0								0
Zuse: Z 22				45				5	50
Z 23				17				3	20
Z 31				0					0
TOTAL	9,337	110	342	472	389[4]	163	74	72	10,959[4]

NOTES:

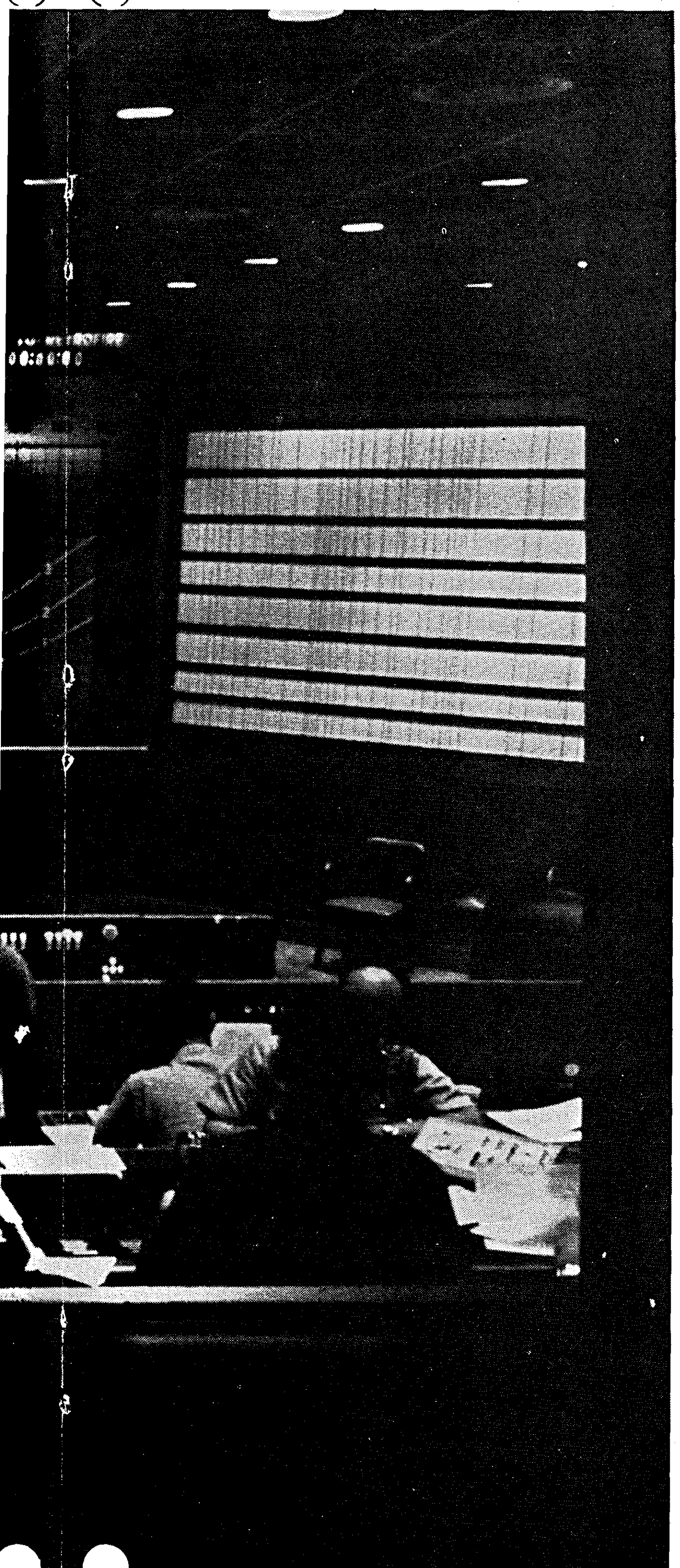
[1]Gamma 30 is the RCA 301, made in the U.S. and modified in France
[2]Sold in Scandinavia as the ABN 1000
[3]Switzerland, Spain, Austria, etc.
[4]Total includes 60 unspecified computers installed since Jan. 1, 1962
[5]Total for all Western Europe and Great Britain; breakdown not available

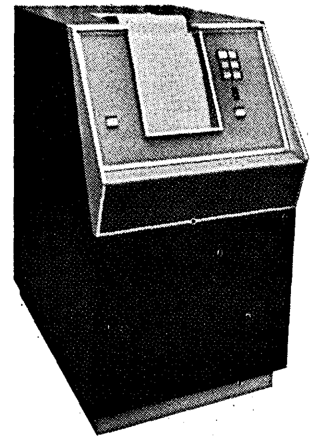
THE CREATORS OF THIS FAMOUS NERVE CENTER U



Challenging career opportunities at General Dynamics|Electronics - San Diego. Above is the NASA Project Mercury Control Room created by General Dyanmics|Electronics under con

R UNDERSTAND COMMAND AND CONTROL PROBLEMS

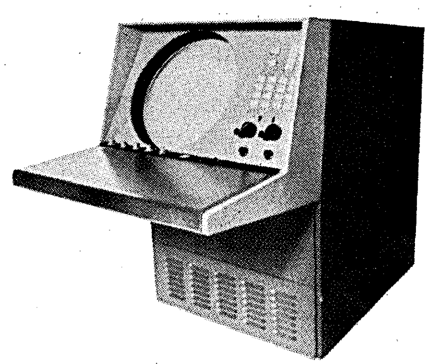




Two new communications tools, perfected by General Dynamics | Electronics research and experience, offer marked advantages to a wide variety of users in the command and control systems field. They are the 3070 Communications Printer and the 1090 Direct View Display.

The 3070 Communications Printer operates at speeds from 400 to 5000 words per minute using standard computer or communications codes over telephone, telegraph and microwave links. The unit prints asynchronously utilizing an electrostatic process to produce highly legible, permanent copy. It is compact, reliable and quiet enough to use in an office.

The 1090 Direct View Display combines high speed, high resolution, compact dimensions, low cost and large 19-inch CHARACTRON® Shaped Beam Tube capable of displaying 1000 flicker-free characters simultaneously anywhere on the tube face. The unit is capable of tabular, situation or graphical presentations and is ideal for computer intervention, monitoring and retrieval jobs; laboratory, simulation, traffic control and surveillance work. If you would like more information about how these units can help you solve your command and control problems, write General Dynamics | Electronics, Dept. C-63, P. O. Box 127, San Diego 12, California.



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GENERAL DYNAMICS | ELECTRONICS
SAN DIEGO

...s under ...contract to Bell Telephone Laboratories for Western Electric Company.

CIRCLE 21 ON READER CARD

a lament

THE MARKET IN GREAT BRITAIN

by R. E. WILLIAMS, Managing Director,
Computer Consultant, Ltd., London, England

The question we must face today is not really whether Britain has lost her opportunity in the world computer market, but whether in fact she is reaching a state where even her own domestic market is in danger of being dominated by foreign installations.

A few weeks ago the number of computers installed in America overshot the 8,000 mark. In Britain the number of computers installed to date is 383 of which 281 were home produced, 102 were imported. A total of 95 British computers have been exported.

The rate of installation of computers in Britain up to the end of 1961 was as follows:

1953	1
1954	1
1955	13
1956	12
1957	39
1958	62
1959	43
1960	63
1961	89
Total	323 plus 1962 to date 60 = Total 383

It is expected that there will be an additional 170 computer installations made in Britain during 1962 and that during 1963 there should be 233 computers installed. Beyond this point, the situation should change considerably and the "guestimated" number of installations for the following years will, we believe, be something as follows:

1964	625
1965	880
1966	900
1967	980
1968	400
1969	300
1970	700

Other figures relating to British computers at the present time are as follows:

Number of different types installed and available in Britain	65
Total number installed in Britain	383
Value of total home produced	$65.8 million
Value of total imported	$23.8 million
Total number exported	91
Value of these exports	$11.9 million
Total on order for installation in Britain and export by Britain	329
Value of these exports	$2.8 million
Value of home installations on order	$64.4 million
Value of imported installations on order	$58.8 million

Computer peripheral equipment is being imported on an ever increasing scale and the value must be of the order of $4.8 million per annum at present, with our similar exports virtually nil. We are well aware of the dangers of generalizing but the figures quoted above are as factual as it is humanly possible for them to be intelligently collected. Furthermore, they are prepared with the willing cooperation of all the computer manufacturers.

We have heard recently of the cost of our foreign commitments, in particular the cost of maintaining our troops in Germany. At present our imports of computers are running at about one-third of the total annual cost of the maintenance of these troops and if present plans materialize, these figures will become much worse.

Imports of the IBM 1401 for existing sales will amount to about $40.5 million. These machines are built in Germany. Their larger machines are built in the U. S. and France and only their obsolete 650 computer is at present built in Britain. While IBM has extensive factories in Britain, we do not know the balance of the imports and exports of their other products in and out of Britain.

The new arrangements which ICT has concluded to buy American computers will eventually substantially worsen the situation. No allowance is made for this in the figures quoted above. Other large American companies like Honeywell Controls, Burroughs Machines, etc., and the French BULL organization, will soon be increasing their efforts and computer sales in Britain.

The sponsoring of computer development by the British Government was left in the hands of the National Research Development Corporation who got off to a bad start. It has taken a long time to convince them that there was any future in building commercial computers at all. Ample evidence of this exists and of the unfortunate outlook of those in charge in the early critical days.

The Government has purchased a very limited number of computers. They have at present installed 18, mostly small ones, against the U. S. Government's 900, mostly large ones. No substantial development projects are in hand, beyond incompleted ones such as the ATLAS project, and they can ill afford to rest on any past laurels.

The National Physical Laboratory which is one of the official research organizations and an offshoot of the Department for Scientific and Industrial Research, have two old computers as their tools and have one not very exciting small computer on order. The activities carried out on two small old computers at the Royal Aircraft Establishment at Farnborough are even less exciting and the computer development work turned out by Farnborough is pitiful in its value and content.

There is far too little appreciation of the fact that while to develop 95% of a computing system can cost X pounds, the last vital 5% could cost 100X pounds and that this last step decides the whole effectiveness of the project.

While undoubtedly the British Government has not played its part well in development so far, the blame can also be spread more widely. By and large, management in Britain is elderly and very much of the "I am waiting for my pension" outlook. Those in general authority are responsible for a great deal of lack of initiative and one can carry "unflapability" too far and so disguise plain laziness and lack of initiative.

As well as needing more active management, not only for computers but also of a general nature, we do need very desperately, to form a group who can press on nationally with computer development and the essential follow up manufacture. Really good people should be chosen not because they are "names" but because of their proven ability or administrative capacity and the fact that their potential is not exhausted. Such men exist in Britain and are known by name. The lead should come centrally from the Government, and we should be proud to pay them large salaries and to arrange their salaries in such a way that they can receive more than the boss.

We must stop our best brains being used to the advantage of our foreign competitors. And they need not leave the country to do this.

IBM World Trade Laboratories has a staff of 500 top line British electronic engineers in their laboratories in Winchester. Their activities have no direct liaison with the IBM British company and the work they do is purely for the benefit of their American owners, to be used anywhere in the world they decide.

Following the recent tie-up between ICT and RCA, new mergers are very much in the air and there are rumors of link-ups between EMI, Ferranti and others. Making electrical groups of this sort even bigger is certainly not the answer and equally so, size alone is not the answer. It can make things worse.

ICT, which has the best computer selling organization in Britain, was able to sell its 1301 computer off the drawing board to a comparatively large number of customers, even when it was known that developments were going badly and that plans were behind schedule with no equipment in a demonstratable condition. The irony of it is that ICT who could best sell, had in many ways the poorest equipment, until it very recently tied-up with RCA and went American.

The office equipment market in Britain is dominated by the United States. Not all the office machine firms are, however, American and there are some excellent British organizations which are not small and which are not of foreign parentage. Eighty percent of the punched card market in Britain and the Commonwealth is still in the hands of ICT.

Other good British firms who have excellent office machine sales organizations, are Lampson Paragon, Block and Anderson and Fanfold Limited. Unfortunately, these are now all turning their eyes to America and at the recent Computer Exhibition, Block and Anderson were exhibiting American Clary computers, but may well in the meantime, have had second thoughts.

We have left until the end the most important possible crux of this whole matter, which is finance. People who hold the money bags in Britain still want balance sheets for the last six years before they lend you any money and also ample proof that you do not really need to borrow.

The pattern of finance requires radical reappraisal and the situation in which we have found ourselves, where most of the people with large sums of money to lend are in a position of trust and have to abide by our inadequate trustee rules, is unfortunate.

Up to the nineteenth century, fortunes were made and lost by individuals who owned money. They could and did take risks. Now the position is different. So different that foreign finance companies, large and small, are providing funds to fill the vacuum.

There is no lack of money in Britain but there is a lack of foresight to make the best use of it and many of the basic economic laws are completely ignored. People tend, too easily, to forget that money has no value in itself. This type of thinking has to be radically changed.

All the above comments apply to digital computers but are equally true of analog computers. The largest selling analog computer in Britain at present, and still likely to be so in the future, is the PACE which again is American.

The majority of British companies are producing substantial losses on their computer activities. They can at present afford to do this because they are so large and the rest of their activities can carry the loss. Ironically, from an overall tax position, it may pay them to produce these losses, but it certainly does not lead to general effectiveness and there will have to be a limit to this type of trading.

Other British computer companies are so small that they can exist on crumbs from the rich man's table. They may stay in business for many years to come but the industry as a whole cannot thrive on this type of operation.

a suggestion for the future: tariff

Regretfully, it seems to us that there are few methods left to maintain, let alone improve, the position of British computer manufacturers. One effective solution might be for the Chancellor in his next Budget to impose a considerable import duty on foreign computers. This might provide a breathing space and help to stop the immediate rot.

It would, however, only be appropriate where the British manufacturers can offer equipment, not necessarily functionally identical, but able to do the job for which the imported equipment is intended. At this point in time we are dependent on American printers and magnetic tape decks of particular performance; though this might not always be so, those items of peripheral equipment should by this time continue to be available to British manufacturers without heavy impost. There is clearly no British market advantage if everybody's equipment is dearer!

There will have to be an overall reappraisal of the situation and positive steps taken as sketched above to seize the opportunity to correct the situation, and within the breathing space that a tariff barrier might grant us.

Apart from needing to build and export our own computers, we need their use. By denying ourselves buying foreign machines cheaply, we are holding up the advantages to be gained from generally using computers.

We have not been defeated in war in Britain for centuries but if the present trend continues, we shall be bought out by the foreign countries, who are prepared to invest their money. Money in America is largely in the hands of the women and it is a terrible thought that in the foreseeable future, British men, as well as American men, will be dominated by American women! ■

THE MARKET IN WESTERN EUROPE

by JOHN G. VOGELER, Paris, France

A relative newcomer in the field, the European computing community has made remarkable strides forward, nurtured by its own aggressive equipment manufacturers, the omnipresent IBM World Trade organization and other American firms with overseas interests.

There are now approximately 2,800 computer systems installed and on order in Western Europe, not including Great Britain. This is remarkable progress when one considers that the first machine was installed on the Continent as recently as 1955.

Activities of IBM World Trade are characterized not only by greatly increased sales, but also by huge investments in future development of the European market. Sales of IBM World Trade for 1961 were $497,601,962—a 33% increase over 1960. Net earnings for the first quarter of 1962 showed another one-third increase over the same period in 1961. During 1961, IBM more than doubled its investment in World Trade which now stands at $179,117,052. This is evidence that the company is acting on its belief that World Trade income will equal that of the domestic operations by 1970.

Reasons for this growth of computing in Western Europe are not hard to find. Most significant is the industrial growth of the area which, while having slowed down slightly, is still much greater than that of the United States or Great Britain. This has been stimulated by the Common Market accords, which almost compel ECC manufacturers to expand into other markets in order to compensate for the threat from foreign competitors to domestic markets. The other most important stimulant to EDP sales is the widespread shortage of labor in Western Europe, at all levels.

important developments

IBM has been selling and delivering 1401 systems at a rapid pace, now that its plant in West Germany is on a full assembly line basis. The new IBM plant in France is now delivering 7000 Series systems and is well on the way to making 1410 deliveries within "normal" time lags. These plants are a further extension of the IBM switch from component manufacturing to making complete units within a single plant, a move that followed tariff reductions among Common Market countries. IBM has also enlarged production facilities in Sweden and is expanding World Trade research facilities, which now include development engineering laboratories in France, Germany, Netherlands and Sweden.

Remington Rand Univac has commenced operations in France, with emphasis on large-scale machines.

The *RCA-BULL* accords have paid off with a total of 74 Gamma 30 (RCA 301) sales to date. RCA also has agreements with ICT for European sales.

Siemens, the giant West German electrical and electronic company, has introduced a new range of EDP equipment.

National Cash, in conjunction with its British-based affiliate abroad, Elliott Automation, is extending operations in France.

Trends in applications follow the U.S. pattern, but applications are considerably behind in some areas. Such accepted computer functions (in the U.S.) as financial forecasting and Operations Research are receiving increased interest in Europe, but are not in common use. BULL believes that production control offers considerable opportunity for computer utilization. Remington Rand is interested in process control installations for the 490 real time systems. In this connection, a firm called Intertechnique, the TRW affiliate in France, has sold some RW-300 systems, largely to the French Atomic Energy Commission.

The "international" EDP firms are all stepping up efforts, which is creating a highly competitive situation. There are only four firms which are active in most of the countries of Western Europe. According to a recently published estimate they share the European computer market as follows: IBM – 70%; Remington Rand – 8%; BULL – 8%; ICT – 6%. The other 8% is shared among firms with primarily local operations.

country-by-country

France

The computer story here can be told in terms of 1) large nationalized industries; 2) General DeGaulle's efforts to make France an important military power; 3) a battle for sales between IBM and Compagnie des Machines BULL, which share almost all of the market in France.

IBM France has delivered an estimated total of 125 1401 systems and has another 125 on order. It has also delivered about a dozen 7070/72/74 machines and has orders for about six more. A handful of 1620 installations include the IBM Service Bureau in Paris and C-E-I-R. Another dozen or more 1620s are on the order books. The 1410 is also selling well in France.

Negotiations have also been reported between the French government and IBM for one of C-E-I-R's cancelled STRETCH machines.

BULL is an aggressive firm with excellent government connections. It is well managed, but appears to have taken somewhat of a bath in the computer field recently. The value of BULL stock has depreciated 60% since the 1961 high — even more than IBM at this writing. The Gamma 60 has cost BULL a considerable sum, although according to company spokesmen, it can be justified on other than prestige grounds. The "building block" design philosophy of the Gamma 60 has been incorporated into the new 300 Series. BULL reports 11 Gamma 60s installed (nine in France) and as many on order. One Gamma 60 was installed at Assurance Generale Vie (a life insurance company) but was subsequently removed.

Gamma 30 sales have been impressive. As of June, 15 out of a total of 74 sales had been installed. The figures for France are three installed and 35 more on order. These machines are, of course, RCA 301s, manufactured in America and modified in France. BULL expects its new plant in Angers to be completed in October, and to start producing Gamma 30s by the end of 1963. Some of the Gamma 30 orders started out as orders for the 300 Series Magnetic Tape system, indicating that some difficulties with the 300 Series mag tape units existed at the time.

The 300 Series, BULL's answer to the 1401, has had some success, but not as much as one might have expected a year ago. The ratio of installations to "on orders" is reversed in the case of this machine, with 83 installed and only 44 on order. Of these, 22 have been installed in France and seven are on order.

BULL believes the most important aspect of its relations with RCA is the full access to all RCA present and future technical developments.

The company is continuing its expansion in other countries, and is currently supplying Burroughs with 300 Series read-punch units in the U.S. BULL has also sold to GE, NCR and RCA, but is still looking for the perfect partner to handle its line in the U.S.

As mentioned, RemRand has established the UNIVAC Division in France. The termination of RemRand-BULL agreements last year made this move possible, and UNIVAC intends to concentrate on the market for larger machines with its 1107, 490 and Univac III models. These machines will be capable of using either 80 or 90 column cards, with either BULL or IBM codes.

UNIVAC prospects in France appear to be good. The company has been successful elsewhere in Europe and now claims 150 computer installations (almost all SS 80) and 35 "on orders" for SS 80 and 90 systems. It also has 14 orders for the UNIVAC III. These sales have largely emanated from West Germany, Switzerland and Italy.

One French firm that deserves attention is Societé d'Electronique et d'Automatisme (SEA), a relatively small military computer firm which also makes central processors and magnetic tape units. It has sold between 50 and 75 CAB 500 systems (IBM 1620 class). A business computer in the RCA 301 class called the CAB 3900 has been sold to 25 users.

ICT has been established in France for some time with punched card systems, but seems to be having difficulty in the computer race there. ICT installations in France include three 1202 systems.

France is still far behind West Germany in computer utilization, but the gap is narrowing.

West Germany

The acceptance of computers in West Germany follows the U.S. pattern closer than any other country in Europe. Again, it is IBM well in the lead with over 400 installations and as many as 300 on order. BULL's most notable achievement in Germany is 15 orders for the Gamma 30 (only one installed to date). UNIVAC has 33 SS 80/90 installations.

Royal McBee's recent divestment of its equity in Royal Precision has apparently not stopped Eurocomp in Minden from continuing with the LGP-30 and other Royal Precision computer equipment.

The major German firms (Siemens, Telefunken, and Zuse) are selling some systems, but seem to lack the sales organization needed for market dominance. The only other area where these firms have made any inroads is in Scandinavia, where German products of all kinds are gradually pushing out long-established British lines.

Benelux

Belgium, Holland and Luxembourg have accepted electronic data processing about as well as France, and have mainly installed IBM and BULL equipment, with some sales going to NCR (Elliott), UNIVAC and Standard.

Scandinavia

The Scandinavian countries probably do not have more than a total of 130 EDP installations and these are of a great variety. ICT and other British companies have done relatively better in Scandinavia than anywhere else in Europe. Scandinavians accept imported products quite readily, but as a result, they are offered goods from practically every European country, and have become quite discriminating.

Italy

Italy has upwards of 250 computer installations. Most of these are IBM, with BULL and Olivetti sharing the rest of the market. It is interesting to observe that BULL has installed more Series 300 systems in Italy (24) than it has in France!) BULL and Olivetti are second cousins, at any rate, both being financially tied into the Michelin Tire empire.

conclusion

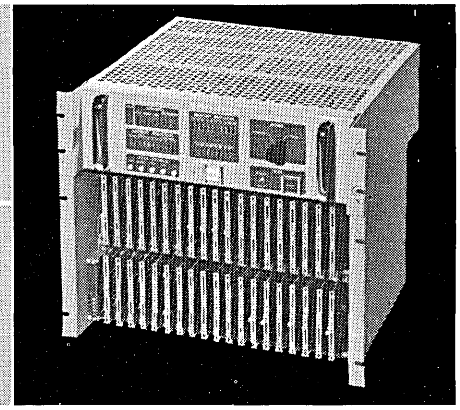
The European computer market is still booming, but the financial burdens that U.S. firms have experienced are also being felt on the Continent. Europe certainly presents a logical market through which American firms can spread development costs, but selling there presents problems U.S. firms are finding difficult to overcome.

The major problem is personnel, which should be European if real effectiveness is to be achieved. While it is difficult enough to find qualified people, the problem of training them still remains. U. S. computer firms have some brilliant engineers and programming experts — but if they can't communicate their knowledge to French, German and Italian speaking representatives, their effectiveness abroad is severely limited.

In spite of the problems, however, until Europe fills its present urgent need for automation in the administrative and engineering fields, the market for computers will be "open-ended." ■

COINCIDENT CURRENT MEMORY SYSTEMS

SERIES	M		L	K	J	I	H	G	F	E	D
CYCLE TIME	10µ sec (Full Cycle)	10µ sec. (Half Cycle)	5µ sec. (Half Cycle)	6µ sec. (Full Cycle)	3.3µ sec. (Half Cycle)	5µ sec. (Full Cycle)	2.5µ sec. (Half Cycle)	3.3µ sec. (Full Cycle)	2µ sec. (Half Cycle)	2µ sec. (Full Cycle)	1.1µ sec. (Half Cycle)
DATA ACCESS TIME	3.5µ sec.	4µ sec.	3.5µ sec.	2.5µ sec.	2.5µ sec.	2µ sec.	2µ sec.	1.5µ sec.	1.5µ sec.	1.0µ sec.	0.70µ sec.
CAPACITY ... (Any bit length desired)	AS REQUIRED			AS REQUIRED		AS REQUIRED		AS REQUIRED		AS REQUIRED	
ACCESS MODES	Random Access Sequential Non-Interlaced Sequential Interlaced Random/Sequential Non-Interlaced Random/Sequential Interlaced			Random Access Sequential Non-Interlaced Sequential Interlaced Random/Sequential Non-Interlaced Random/Sequential Interlaced		Random Access Sequential Non-Interlaced Sequential Interlaced Random/Sequential Non-Interlaced Random/Sequential Interlaced		Random Access Sequential Non-Interlaced Sequential Interlaced Random/Sequential Non-Interlaced Random/Sequential Interlaced		Random Access Sequential Non-Interlaced Sequential Interlaced Random/Sequential Non-Interlaced Random/Sequential Interlaced	
OPERATIONS	Load Unload Clear/Write Read/Restore	Load Unload	Load Unload	Load Unload Clear/Write Read/Restore	Load Unload	Load Unload Clear/Write Read/Restore	Load Unload	Load Unload Clear/Write Read/Restore	Load Unload	Load Unload Clear/Write Read/Restore	Load Unload



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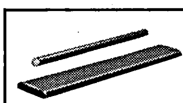
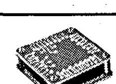
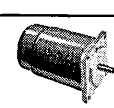
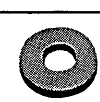
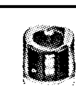
 FERRITES	 MICROSTACKS®	 MINIATURE MOTORS	 PERMANENT MAGNETS	 TC CORE ASSEMBLIES

CIRCLE 22 ON READER CARD

1,000 installations estimated

A COMPUTER SURVEY OF THE SOVIET UNION

by V. P. CAPLA, Prague, Czechoslovakia

Construction of large computers was initiated in the Soviet Union in 1948. The first small electronic computer, MESM, was completed at the Mathematical Institute of the Ukrainian Academy of Sciences in Kiev, under the direction of Academician S. A. Lebedev. At almost the same time, Academician Lebedev built a large electronic computer, the BESM, at the Academy of Sciences of the Soviet Union in Moscow. This computer belongs to the same class as the IBM 700 series. The BESM was completed in 1952. A few months later, in 1953, in the Laboratory of the Construction Bureau of the Ministry for Machine-Building and Automatization of the Soviet Union, a second large computer, the STRELA, was completed under the direction of Professor Yu. Ya. Basilevski. The principal difference between the BESM and STRELA is that BESM is about two and a half times faster than STRELA. However, STRELA has the larger memory capacity.

The Soviet newspaper, *Krasnaia Zvezda* of 26 March 1960 stated that the computer M-20 had been completed by Academician Lebedev; as the number 20 indicates, it does 20,000 operations per second. To support punched card machines, a computer, EV 80-3 is being built. The number indicates that this is a machine for 80-column punched cards and is model 3.

construction of medium and small computers

In the Laboratory for Switching and Controlling Systems of the Academy of Sciences of the Soviet Union, a small electronic computer, M-1 (Machine No. 1), was built in the Spring of 1952 under the direction of corresponding member of the Academy of Sciences, I. S. Bruk. In December, 1952, a second machine, this one a medium-sized electronic computer was completed, and became operational toward the end of 1954. In 1953 in the Laboratory for Switching and Controlling Systems of the Academy of Sciences, a medium-sized computer called the Digital Electronic Machine, TsEM-1, was completed. This computer serves for the solution of mathematical problems of the laboratory in which it was built. In 1954

First publication of this survey was in Mathematik Technik Wirtschaft, Helft 1, Jan., 1961. It has since been revised by author Capla. In the characteristics chart, a considerable amount of new information has been added. Translation from the German was by Richard Stahl. In October, another report will be published based on a Datamation staff visit to the USSR.

in the Laboratory of the Scientific Research Institute of the Ministry for Precise Mechanics, a small electronic computer, URAL, was completed under the direction of engineer B. I. Rameyev. Since that time, up to five per month have been manufactured in serial production. In 1957 in the Laboratory for Switching and Controlling Systems of the Academy of Sciences, a small computer, M-3, was built in cooperation with the Scientific Research Institute for the electrotechnical industry. Up to five per month are now being produced.

In the Computing Center of the Academy of Sciences of the Ukrainian Soviet Republic in Kiev, a modern electronic computer, KIEV, was completed in 1959. This is a multi-channel computer on which several problems can be solved simultaneously. Its control, memory, and arithmetic units are completely independent of each other and operate asynchronously. The computer occupies a space of 40 square meters and is capable of deciding the optimal control of sequence operations. It serves to solve large scale mathematical problems, as well as to direct and control technological processes in the metallurgical chemical, oil industry, etc. The computer is equipped with 2,000 miniature tubes and belongs to the class of medium-sized machines. The second KIEV machine has been installed in Dubna near Moscow for the purpose of atomic research in the nuclear power station. In the capital city of the White Russian Soviet Republic, two computers, MINSK-I and MINSK-II, are being built. Young graduates of the Moscow University and young scientific members of the Energetics Institute built a small computer in 1958, named after the small Setun river in Moscow. It became operational at the end of 1959; and is now in the Computer Center of Moscow University. Input and output are decimal, but a subroutine translates the decimal numbers into base-3. This means that levels +1, 0, and −1 are used.

Class 1 (Large)
- BESM-1, -2
- STRELA
- M-20

Class 2 (Medium)
- M-2
- CEM-1
- KIEV
- URAL-2

(Small)
- MESM
- M-1
- M-3, M-3M
- URAL-1
- SETUN

The computer URAL (at a rate of five per month since 1955), and the machine M-3 (at the same rate since 1957) are presently in mass production. One can assume that by the end of June, 1960 about 350 URAL computers, and about 150-200 M-3 computers have been completed. Including other machines, such as the BESM and STRELA, the total number of computers in the Soviet Union can be estimated at around 1,000 machines.

modernization of soviet computers

With advancing techniques and technology, all computers become antiquated within two or three years and have therefore to be modernized. In the Soviet Union the following computers have been modernized. In the BESM the cathode ray tube memory has been replaced by a ferrite core memory. The vacuum tubes have been partially replaced by semiconductors. The speed was thereby increased and is now 10,000 operations per second. The computer STRELA also has experienced many changes and one speaks now of a STRELA-1½. Nearly every user of a STRELA computer has effected certain changes. The most signfiicant modernization, however, has been made with the computer URAL. This computer originally had a very low speed of 100 operations per second. Now URAL-2 is 6,000 operations per second and the URAL-4, which is to be completed in 1962, is supposed to have a speed of 10,000 operations per second. In most of the computers input and output equipment has been increased.

special computers in the soviet union

Beside the general-purpose computers, several special computers have been built in the Soviet Union. The purpose of many special computers is evident from their names. For instance, the computer KRYSTALL serves for the calculation of molecular structures; the machine GRANITE, for the tabulation of statistical results of mass calculations, and the computer POGODA, for the tabulation of meteorological predictions. In the laboratory of the Mathematical Institute of the Ukrainian Academy of Sciences in Kiev under the diretcion of the Academician S. A. Lebedev and his scientific collaborator Z. L. Rabinovitch, a special electronic computer, SESM-I, was completed. It serves for the calculation of complicated hydrodynamic and hydro-technical buildings and construction. This was the first computer in Europe on which linear algebraic equations with up to 400 unknowns could be solved. In an eight-hour shift, the computer SESM-I replaces the work of 20 mathematicians working with mechanical calculators. The SESM-I, compared to a general-purpose computer, has only about one-tenth of the equipment and occupies an area of eight square meters. One engineer and a technician are used for maintenance and operation. For optical tabulations, the computer LUCH was built. Recently the Soviet Union was divided into 105 economic districts which have been equipped with their own calculating centers which will have punched card machines, and computers. Also, individual academies of sciences and universities own computing centers equipped with BESM or STRELA or other machines. The tabulating center of the Academy of Sciences in Tiflis, Georgia, is now building a large computer which will be installed in a special building. The Academy of Sciences in Tashkent has built a computer fashioned after the URAL for their own tabulating center. In the capital city of Armenia, Yerevan, there is a research institute for mathematical machines with facilities in which computers are being built. Also in Rozda, a computer is in the process of being built.

automation of technological processes

In the Soviet Union great care and attention is being given to the automation of technological processes. For instance, a tabulating center is being built for the petroleum industry and the chemical industry. The machine tool industry of Baku is to be equipped with digital and analog computers. In a scientific research institute in Tiflis, Georgia, a special computer is being built which is intended to be used for the automation of steel furnaces. The switching and controlling machine MARS 300, is equipped with an analog-to-digital converter for the regulation of technological processes. In the Soviet Union there exists very many computers for the control of machine tools. Various linear interpolators and differential analyzers are also used for this purpose. ■

CHARACTERISTICS OF SOVIET COMPUTERS

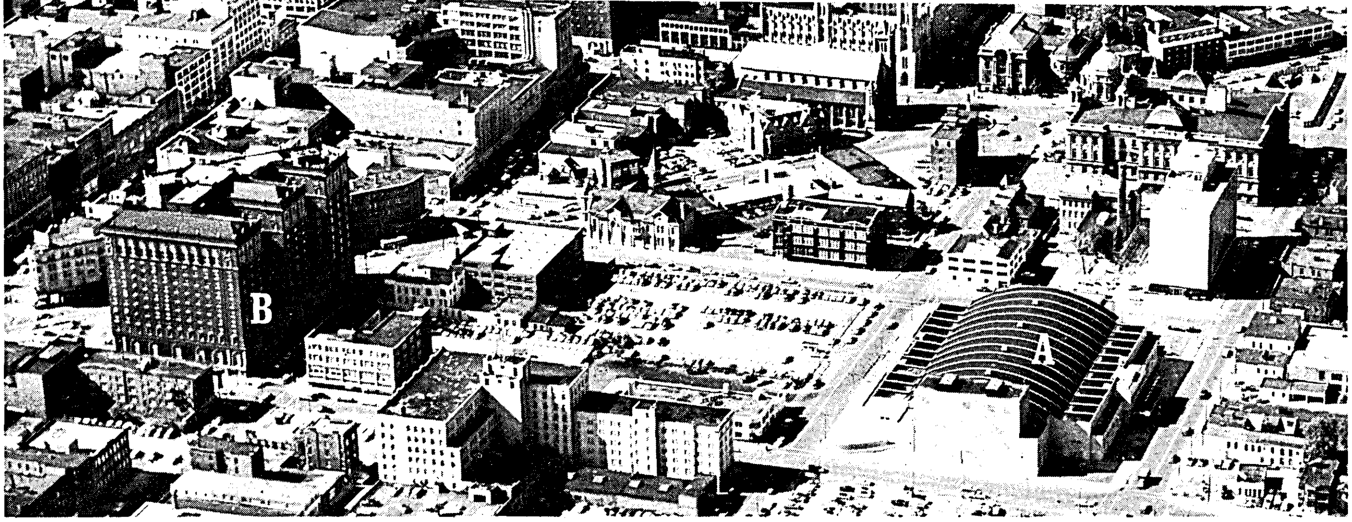
Machine	Year	Components	KW	No. System	Type	Address	Digits	Dec. Point	Ops/Second	Memory Words	Memory Type	I/O	Application
BESM-1	1952	5000 T 10,000 D	75	bin.	P	3	39	Fl.	ADD: 77-182 usec MPY: 270-288 usec	1023 376 5120 120K	Wi D MT MB	LS MB SD	Sci., Eng.
BESM-2	1959	4000 T 5000 D 200,000 Fe	——	bin.	P	3	39	Fl.	8-10K	2047 2x5120 120K	FK MT MB	LS MB SD	Sci., Eng.
STRELA	1953	6000 T 60,000 D	90	bin. or dec.	P	3	36	Fl.	2-3K	2047 2047	Wi FK	LK	Sci., Eng.
M-20	1960	D, TR	——	bin.	P	3	45	Fl.	20K	—— —— ——	FK MT MB	LK LS MB SD	Sci., Eng.
M-2	1954	1676 T 5000 D	29	bin.	P	3	34	Fix	2-3K	512 512 30K	Wi MT MB	LS SD	Eng.
TsEM-1	1953	1900 T	14	bin.	S	2	31	——	ADD: 495 usec MPY: 232 usec	496 4096	Hg MT	LK	Res.
URAL-1	1954	900 T 3000 D	7.5	bin.	SP	1	36	Fix	100	1023	MT	LS MB KY	Sci., Eng.
URAL-2	1959	2500 T 13,000 D Fe	35	bin. or BCD	P	1	40	Fix & Fl.	6K complex or 12K simple	2048 8x8192 10x100K	FK MT MB	LS MB SD	Sci., Eng.
M-3	1957	770 T 3000 copper oxide diodes	8	bin.	P	2	31	Fix	100	2048	MT	LS	Math.
M-3 M	1960	same as M-3	8	bin.	P	2	31	Fix	1500	1024 2048	FK MT	LS	Math.
Minsk-1	1960	T, D	14	bin.	SP	2	31	Fix	2-3K	1024 60K	FK MB	LS SD	Sci., Eng.
SETUN	1958	40 T 300 TR 8310 D 7000 Fe	2.5	Ternary, 0, + 1, —1	S	1	18	Fix & Fl.	ADD: 180 usec MPY: 384 usec	162 half words 3888 half wds.	FK MT MB	LS FS	——
KIEV	1959	2000 miniature T	——	bin.	——	3	41	Fix	5500	1024 12K	FK MT	LS SD	Sci., Eng., Control
ARAGATS YEREVAN RAZDAN	1960	T, TR	——	bin..	——	——	——	——	2-15K	——	FK	LS SD	Sci., Eng., Control
Multi-purpose Control Computer (KIEV)	1961	——	——	bin.	——	——	26	——	6-8K	512 4x512 100K blocks	FK MB	LS LK SD	Real-Time Control

KEY

T — Tubes
D — Diodes
Fe — Ferrite cores
TR — Transistors
Fix — Fixed decimal pt.
Fl — Floating decimal pt.

P — Parallel
FK — Magnetic cores
FS — Teletype
Hg — Mercury memory
KY — Typewriter keyboard
LK — Punched cards

LS — Punched tape
MB — Magnetic tape
MT — Magnetic drum
S — Serial
SD — High speed printer
SP — Series Parallel
Wi — Williams tube



An aerial view of downtown Syracuse, scene of the forthcoming ACM Conference. "A" indicates the War Memorial Auditorium where the general sessions and exhibits will be held. "B" is the Syracuse Hotel, conference headquarters where attendees may register and hear the technical papers.

17th ANNUAL ACM CONFERENCE & EXHIBIT

1,700 expected in Syracuse september 4-7

More than 1,700 delegates are expected to attend the 17th annual conference of the Association for Computing Machinery (ACM) to be held Sept. 4-7 in Syracuse, New York. Planned for presentation at the conference is a technical program of 70 papers scheduled for 30 sessions.

At Syracuse's War Memorial Auditorium, an International Data Processing Exhibit will display the wares of more than 20 firms. Inaugurated in 1961 at the ACM's Los Angeles conference, the supplier's exhibit produced a satisfying profit for the Association and set the precedent for this year's show.

Since Syracuse is far less of a population center than Los Angeles, the 1962 attendance figure is expected to be under last year's by several hundred with a proportionate drop in exhibitors (35 to around 20).

General sessions and invited papers will be presented in the Lecture Hall of the War Memorial Auditorium with the technical papers and panel discussions arranged for various rooms in the Syracuse Hotel.

Opening the conference will be R. S. Jones, Sylvania Electric Products, Inc., the general conference chairman. He will be followed by the retiring ACM president, Harry D. Huskey, of the University of California. A. J. Perliss, Carnegie Intsitute of Technology, president of ACM for 1962-1964, will deliver the incoming president's address. W. W. Finke, president of Honeywell EDP, will be the keynote speaker. His topic is "Social and Economic Aspects of EDP." An account of the IFIPS Conference in Munich, and a report on education for information processing, by George G. Heller, IBM Federal Systems, will close out the morning's session.

The advance registration fee for ACM members is $9; at-conference fee will be $12. Pre-registration fee for non-members is $12 and $15 at the conference. Students will be charged $2 in advance of the conference, and $5 at the conference. All registrants (except students) will receive a copy of the "Digest of Technical Papers" without charge.

Tours have been scheduled to the following facilities: Data Processing Center of Sylvania Electric Products, Inc.; Electronics Park of General Electric Co.; Syracuse University Computer Center; Griffis Air Force Base, Rome, N. Y.; Analog Computer Installation at General Electric Defense System Department.

A Ladies Program has been planned, featuring a welcoming coffee hour; golf, tennis, and swimming at Drumlins Country Club and Green Lakes State Park; bus trip to the Finger Lake area; tour to Syracuse China Co., Salt Museum, French Fort, State College of Forestry, Stickley Furniture Co., and a lunch and TV fashion show at the Syracuse Hotel.

Blocks of rooms have been reserved for conference registrants at selected midtown hotels and outlying motels, including the Syracuse Hotel, conference headquarters.

The technical program arrangements were supervised by R. W. Beckwith, GE, and J. P. Menard, Syracuse University; R. K. Walker, GE, was screening committee chairman, and J. H. Wegstein, National Bureau of Standards, was chairman of the ACM national program committee. Other committee members included B. G. Flanagan, treasurer; J. A. Iverson, publicity; W. Warmuth and E. G. Hill, arrangements; E. W. Kelsey, secretary; J. Banas, exhibits, and L. Winner, conference and exhibits consultant.

ACM TECHNICAL SESSIONS

Eleven fields of interest will be surveyed in ACM technical sessions, covering information retrieval, artificial intelligence, education and training, numerical analysis, applications in the physical sciences, engineering applications, automatic programming and compilers, artificial languages, business and management data processing, real time information processing, and computer design.

Two panel discussions will be held, *ALGOL In Use,* scheduled for Tuesday, 3:40-5 p.m., in the Grand Ballroom, and *Social Responsibilities of Computer People,* Thursday, 4-5:30 p.m., Lecture Hall of the War Memorial Auditorium.

The first discussion will be moderated by G. E. Forsythe, Stanford University. Panelists are: C. Thacher, Jr., Argonne National Laboratories; J. E. L. Peck, University of Alberta; D. D. McCracken, consultant, Ossining, N. Y.; and R. W. Floyd, Computer Associates, Woburn, Mass.

L. L. Sutro, MIT Instrumentation Laboratory, will preside over the second panel discussion, whose members are: A. W. Jacobsen, Detroit Research Institute; D. R. Brown, the MITRE Corp., and C. C. Abt, Raytheon Co. Formal comments will be made by Brown on *Computers in Advanced Defense Systems,* and Abt on *Computer Applications to Arms Control.*

Seven invited papers will be presented in the Lecture Hall of the War Memorial Auditorium. These are: *Legal Implications of the Computer Revolution,* Roy N. Freed, of the Philadelphia law firm of Blank, Rudenko, Klaus and Rome (Wednesday, 10:40 a.m. to noon); *Toward Better Programming Languages,* H. Yngve, Research Laboratory of Electronics, MIT., *History of Writing Compilers,* D. E. Knuth, California Institute of Technology (Wednesday, 2-3:20 p.m.); *Decision Table in Systems Design,* B. Grad, IBM, White Plains, N. Y.; *Information Processing Military Command,* W. F. Bauer, Informatics, Inc., Culver City, Calif. (Thursday, 10:40 a.m.-noon); *The Theory of Multipoint Iteration Functions,* J. F. Traub, Bell Telephone Laboratories, Murray Hill, N. J. and *Table Look-Up Procedure in Non-Numerical Processes,* G. W. King, IBM, Yorktown Heights, N. Y. (Thursday, 2:30-3:40 p.m.).

A brief selection of papers representative of the 30 technical sessions follows:

Experiments with a Heuristic Compiler, H. A. Simon, Carnegie Institute of Technology; *Mathematical Consideration of Real Time Digital Simulation,* I. M. Salzberg, ACF Electronics Div., Riverdale, Md.; *An Auto-Instructional Text for IBM 1401 Programming,* W. S. Plette, United Research Services, Sierra Vista, Arizona; *External Language KLIPA for Digital Computer Ural-2,* M. Greniewski and W. Turski, COPAN, Warsaw, Poland; *Keyword in Context (KWIC) Indexing on the IBM 7090 DPS,* R. V. Wadding, IBM, Owego, N. Y.; *A Digital Nonlinear Function Generator,* R. A. Cowan, Bell Telephone Labs, Whippany, N. J.; *A Report on the Status of SMALGOL,* E. L. Manderfield, Computer Sciences Corp., Palos Verdes, Calif.; *Clinical Applications in Medicine,* T. D. Sterline and E. L. Saenger, University of Cincinnati; *The Chaining Technique for Associate Sentence Retrieval,* L. C. Clapp, Arthur D. Little, Inc., Cambridge, Mass.; and *Applications of Redundancy to Improve the Accuracy of Binary Systems,* E. J. Farrell, RemRand Univac, St. Paul, Minn.

"The Halls of Discussion" sessions, sponsored by Special Interest Groups, and inaugurated in the 1961 ACM Conference, will again be presented. Subjects and moderators are: *marketing,* W. L. Witzel, Computer Concepts, Inc., Washington, D. C.; *installation management,* K. W. Kolence, North American Aviation, Los Angeles; *business data processing,* J. A. Postley, Advanced Information Systems, Los Angeles; *information retrieval,* H. R. Koller, U. S. Patent Office; *programmer training,* Gloria M. Silvern, Litton Industries, Woodland Hills, Calif.

With the exception of invited papers scheduled for the War Memorial Auditorium, all of the technical sessions will be held in the Syracuse Hotel's Grand Ballroom, East Room, or Caravan Room.

THE EXHIBIT

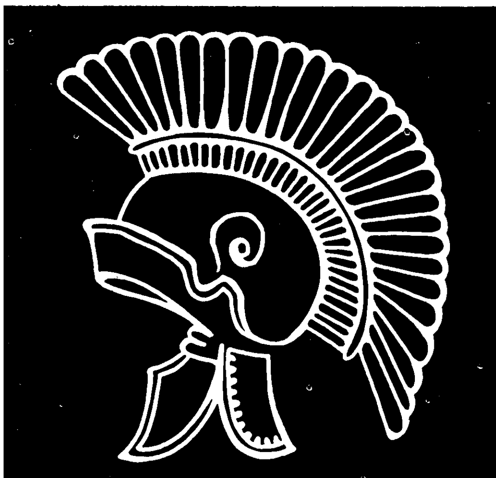
Some 20 firms will be represented at the International Data Processing Exhibit, to be held at the War Memorial Auditorium. At press time, the list included:

Addressograph-Multigraph; Bendix; Burroughs; California Computer Products; C-E-I-R; Computer Associates; Control Data; DATAMATION; Digital Equipment Corp.; Electronic Associates; GE; Harvey Wells Electronics; IBM; NCR; New York Telephone Co.; North American Aviation; Prentice-Hall; Service Bureau Corp.; Soroban Engineering, and Standard Instrument Co.

In addition to the Exhibit, a special display of university-operated data processing and computing installations and systems will be featured. Schools taking part in the exhibit are: University of Massachusetts, University of Akron, Southern Illinois University, University of Michigan, University of Pittsburgh, Syracuse University, University of Houston, and Duke University.

Scheduled to be shown is an information retrieval system; a computer facility as used in conjunction with course work in programming; a total systems approach to university administrative, research, and instructional uses of computing equipment; an audio-visual tour of computing center activities; and teaching materials and library programs.

Attendees not registering for the conference and desiring to visit the exhibition *only* will be charged a $2 fee.



Principles of Neurodynamics: Perceptions and the Theory of Brain Mechanisms

Authored by Professor Frank Rosenblatt of Cornell University, this book sets forth the principles, motivations, and accomplishments of Perception Theory in their entirety. It will also serve as a self-sufficient text for all scientists interested in a serious study of Neurodynamics. Appendices are included to serve as an aid for cross-referencing equations, definitions, and experimental designs which are described in the various chapters.

640 pages   Illustrated $6.50

Machine-Independent Computer Programming

Authored by Maurice H. Halstead, Head, Naval Electronics Laboratory, San Diego, California, this text is based upon a course at the University of California described as "Neliac, a dialect of Algol." This book is designed to teach how to write to computers in the Neliac language and then to teach how to teach the computer to read Neliac, if it does not already know.

288 pages   Illustrated $6.50

Redundancy Techniques for Computing Systems

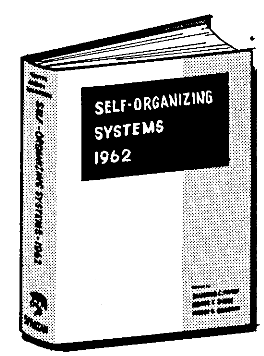
Edited by Richard H. Wilcox, Head, Information Systems Branch, Office of Naval Research and William C. Mann, Electronics Division of the Westinghouse Electric Corporation this book is based upon Symposium on Redundancy Techniques for Computing Systems, which was held February 6 and 7, 1962. The objective of this symposium was to focus attention toward new ideas, research, and developments which would lead to the sound introduction of redundancy techniques into forthcoming computing systems.

416 pages   Illustrated $10

SELF-ORGANIZING SYSTEMS – 1962

Edited by: MARSHALL C. YOVITS
GEORGE T. JACOBI
GORDON D. GOLDSTEIN

CONTENTS INCLUDE:
A Note on the Organization of Organization; On Self-Organizational Systems; Self-Organization in the Time Domain; On Integrative Processes; Information Input Overload; Learning Signal Detection; Optimization through Evolution with Sexual Recombinations; On the Automatic Formation of a Program which Represents a Theory; Natural and Artificial Synapses; Logical Aspects of Neuristor Systems; Some Probabilistic Aspects of Automata with a Pushdown Memory; Efficient Adoptive Systems and their Realization; Empirical Laws and Physical Theories, Discussion of the Respective Roles of Information and Imagination; Majority Logic; Interaction Between a Group of Subjects and an Adaptive Automation to Produce a Self-Organizing System for Decision Making; Cybernetic Ontology and the Transjunctional Operator; Some Problems of Basic Organization in Problem-Solving Programs; Training Sequences for Mechanized Induction; Adaptive "Neuron" Memory System; A Comparison of Several Perceptron Models; A New Class of Multi-Layer Series in Coupled Perceptrons; Simple Tests for Linear Separability as Applied to Self-Organizing Machines; Remarks on the Algebra of Functors; Some Similarities Between the Behavior of a Neural Network Model and Electrophysiological Experiments; On the Representation of Information by Neural Net Models.

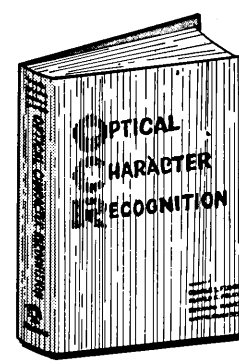


560 pages   Illustrated $12.00

OPTICAL CHARACTER RECOGNITION

Edited by: GEORGE L. FISCHER, JR.
DONALD K. POLLOCK
BERNARD RADACK
MARY ELIZABETH STEVENS

CONTENTS INCLUDE: The RCA Multi-Font Reading Machine; Some Elements of Optical Scanning; Developments in Character Recognition Machines at Rabinow Engineering Company; Character Recognition Techniques for Address Reading; Reading Russian Scientific Literature; An Evaluation of Vidicon Scanning Techniques Coupled with Area Analysis Recognition; A Typed Page Reader for Elite Type; Wide Tolerance Optical Character Recognition for Existing Printing Mechanisms; Design Consideration For a Stylized Font Character Reader; Some Important Factors in the Practical Utilization of Optical Character Readers; Character Recognition as Signal Detection in Noise; Automatic Reading of Cursive Script; Digital Pattern Recognition by Moments; Analytic Approximation and Invariance in Character Recognition; Weighted Area Scanning Techniques for Character Recognition; Recent Developments in Optical Character Recognition at M.I.T.; Recognition of Mixed Font, Imperfect Alpha-Numeric Characters; A Scheme for Recognizing Patterns From an Unspecified Class; Linear Decision Functions with Application to Pattern Recognition; Multi-Font Print Recognition; Use of Autocorrelation For Character Recognition; The Search to Recognize; Users Requirements—A Panel Discussion; and Horizons—A Panel Discussion.



416 pages   Illustrated $10.00

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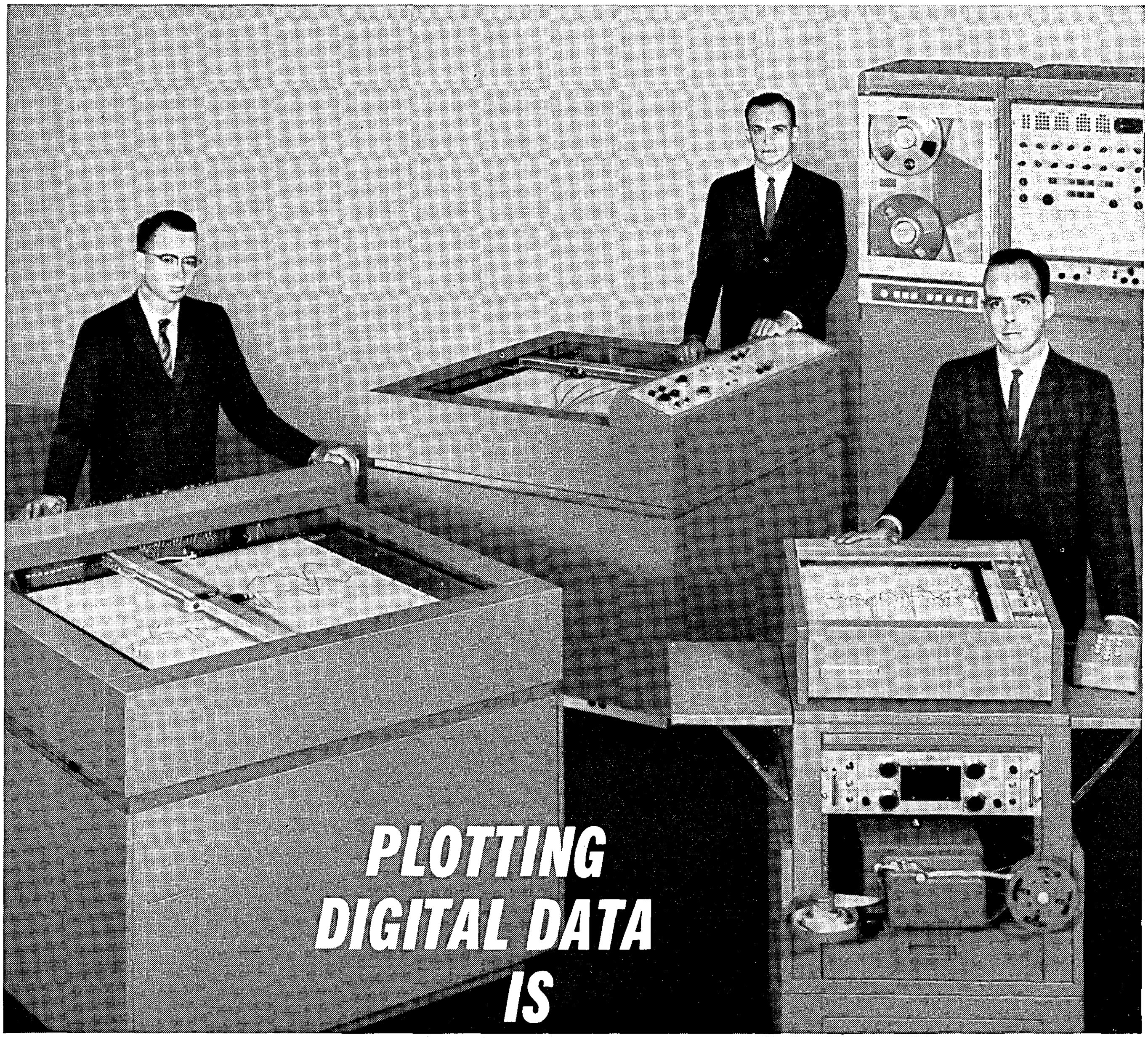
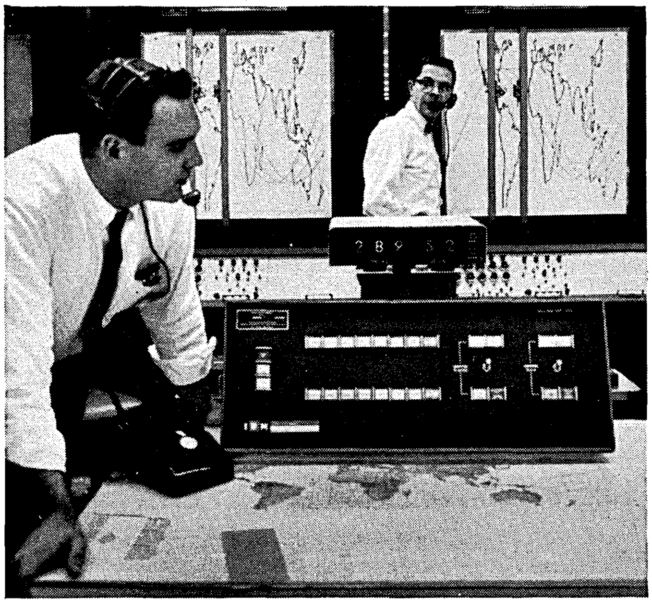
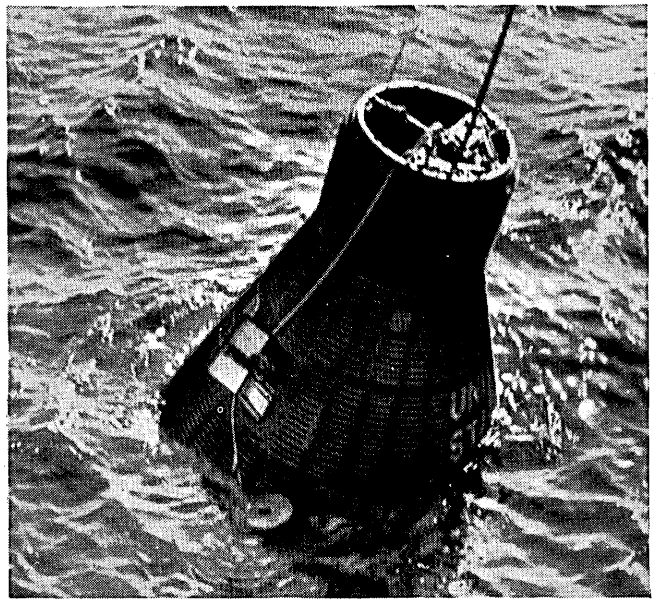


IBM® asks basic questions in space

Where will it be next?



This plotting board, driven by an IBM computer, tells PROJECT MERCURY control personnel the exact location of the MERCURY spacecraft at any time in its orbit.



Throughout each orbital flight, the PROJECT MERCURY Control System continuously predicts the point where the MERCURY spacecraft will eventually return to earth.

Manned satellite tracking requires up-to-the-second information. To tell us where a MERCURY spacecraft is now and where we should look for it next, an IBM computer system at the NASA-Goddard Space Flight Center has been linked to ground tracking stations. This system connects sensors, real-time communications channels, data processors, and displays into an information network. It transforms data from space into continuous predictions of flight—from launching, through orbit, to impact.

Space information systems must squeeze thousands of complex computations into split seconds. To reduce computation time requirements, IBM engineers are investigating the application of advanced computing techniques—such as associative memory and auxiliary storage of precalculated data—to space systems. To enable tracking systems to operate in real time, they have developed special communications channels for PROJECT MERCURY and other projects, speeding data into central computers and back to tracking stations around the world. In another area, under contract to the Radio Division of the Bendix Corporation, IBM has designed a data processing system for real-time control of an Electronically-Steerable Array Radar (ESAR). This new approach to handling data in radar systems makes it possible to switch the direction of radar beams with far greater speed than was possible by using mechanical methods—so that one radar can track many satellites and space vehicles simultaneously.

Tracking systems will improve as we learn more about space. Present atmospheric models are static. Their failure to reflect the ebb and flow in the density of the air forces us to approximate orbital permutations due to atmospheric drag. By feeding data from satellites traveling through the atmosphere into an IBM 7090 computer at the Smithsonian Astrophysical Laboratory, IBM scientists are plotting air density as a function of deceleration. The dynamic atmospheric model which emerges from their work will make predictions of space flight in the region lying between 50 and several hundred miles from earth more accurate . . . an important step toward the precise control needed for the space systems of the future.

If you have been searching for an opportunity to make important contributions in space, software development, manufacturing research, solid-state development, or any of the other fields in which IBM scientists and engineers are finding answers to basic questions, please contact us. IBM is an Equal Opportunity Employer. Write to: Manager of Professional Employment, IBM Corporation, Department 701U, 590 Madison Avenue, New York 22, New York.

NEWS BRIEFS

JUG-CODASYL TO SPONSOR DETAB-X SYMPOSIUM

The Joint Users Group (JUG) and the Conference on Data Systems Languages (CODASYL) will hold a symposium on decision tables (DETAB) at the Barbizon Plaza Hotel, New York City, on September 20. The program will describe decision table techniques, and emphasize actual user experience, such as in design engineering, manufacturing and accounting.

On the following day, tutorial sessions will be directed to potential users of decision tables. DETAB-X (Decision Tables, Experimental) developed by the Systems Group of the CODASYL Development Committee and employing COBOL 61 as its language, will be presented.

The fee for the symposium only (including lunch) is $20; for the symposium and tutorial session, $45. For further information, contact Leonard Parent, Trunkline Gas Co., Box 1642, Houston, Texas.

DP EXPORTS/IMPORTS HIT NEW HIGH IN '61

Exports of computers and related machines by the U.S., the Common Market Countries, and the European Free Trade Association countries were valued at more than 405 megabucks during 1961, accounting for nearly 50% of the total exports of business machines. This represented an increase of 35.6% over 1960, and is an all-time high.

Imports of computers among the same groups reached 198 megabucks, accounting for 35.6% of the total imports of business machines, and was an increase of 24.5%.

The Business and Defense Services Administration of the U. S. Department of Commerce reports that should the current rate of increase continue, total exports of business machines in 1962 may surpass the $1 billion mark and imports may reach $750 million.

AIEE MEMBERS APPROVE MERGER WITH IRE

The proposal to merge the American Institute of Electrical Engineers (AIEE) with the Institute of Radio Engineers (IRE) to form the Institute of Electrical and Electronic Engineers (IEEE) has been approved by the AIEE membership by a vote of 29,464 for and 4,381 against. It is expected that the IRE membership will vote its approval for the merger, which would be effective as of January 1, 1963.

The Boards of Directors of both groups had approved the merger principles earlier this year, which would include these provisions: IEEE would consist of seven regions in North America, and an eighth which would include members in other countries. Each region will be represented on the IEEE Board of Directors.

RCA'S MICROFERRITES EXPECTED TO EQUAL THIN FILM SPEEDS

The technology for building computer memories which can achieve speeds 15 times faster than those currently available has been announced by RCA. The technique, which involves the use of newly-developed microferrites, is expected to produce memory speeds equal to those which can be attained by thin films.

Initial mass-produced microferrite memories will be medium capacity types actuated by low driving currents and capable of processing two million bits of information per second —about five times the speed of present commercial memories. The first units, to be produced by the Memory Products Operation of the RCA Semiconductor & Materials Division, will have a capacity of 32 words, with 30 bits per word, or multiples thereof.

The experimental microferrite memories were described as ferrite squares, assembled in flat mosaics and interconnected by evaporated metal paths. Each square has two central holes, with diameters of "one-eighth the diameter of a human hair" through which pass all signals to or from the memory.

The development of the microferrite technology was carried out at the RCA Laboratories, Princeton, N. J., under the direction of Dr. Jan A. Rajchman, director of RCA's computer research program.

CIRCLE 100 ON READER CARD

UNIVAC DEVELOPS 3K BIT THIN FILM MEMORY

UNIVAC Military Operations, St. Paul, Minn., has announced the development of an operational 3,072-bit thin film Search memory with 100 nanosecond access time. Said to be the largest of its type, the memory is made up of 128 24-bit words. It was also reported that UNIVAC now has the technology to build Search memories with up to 10K words.

The application of the Search memory to radar target track correlation was described, in which the memory, functioning with a tracking computer, achieved a speed-up factor of 400 times over the UNIVAC LARC, which was used as a basis for comparison.

CIRCLE 101 ON READER CARD

SWITCHING SYSTEM LOCATES ITS OWN TROUBLE POINTS

Bell Laboratories has announced development of an electronic telephone switching system which diagnoses its own failures and prints out the locations of the trouble-spot. The location is listed in a "dictionary," which catalogues 6,500 transistors and 45,500 diodes in the central control unit.

To prepare the dictionary, the system was programmed to make over 900 different tests on each of 50K simulated failures. The system recorded the test patterns for each failure and the identity of the faulty components. A computer sorted the failures in numerical order and printed them in a four-volume dictionary totaling 1,200 pages.

C-E-I-R REPORTS 2nd QUARTER GAINS

Total sales recorded by C-E-I-R, Inc., for the first six months of fiscal 1962 amounted to $7,896,259, an increase of 47% over 1961. Although last year the firm reported a net income loss of $538,851, or $.42 per share, president

NEWS BRIEFS . . .

Herbert W. Robinson told shareholders that the company "resumed profitable operations in the second quarter" as the 18-month expansion program neared completion. He expects total sales for 1962 to exceed 18 megabucks.

In his message to shareholders, Robinson explained C-E-I-R's position in cancelling STRETCH.

"Negotiations with IBM lead us to believe that the net cost to C-E-I-R of any penalties involved in cancellation would be nominal," Robinson stated. "On the other hand, C-E-I-R has been budgeting approximately $750K for STRETCH proprietary programs, the need for which has now been removed."

● A "Seminar in Search Strategy" will be given October 8-26, at the Drexel Institute of Technology library school, Philadelphia, and will evaluate which computers are suitable for particular tasks in information handling. Mrs. Claire K. Schultz, research associate of the Institute for the Advancement of Medical Communication and president of the American Documentation Institute, will conduct the seminar. Deadline for applications is September 15. For more information, write to Mrs. M. H. Davis, Seminar in Search Strategy, Graduate School of Library Science, Drexel Institute of Technology, Philadelphia 4, Pa.

● A new Burroughs computer users organization will be formed in October through the merger of DUO (Datatron Users Organization) and CUE (Cooperating Users Exchange.) The former is composed of 205 users, the latter of 220 users.

● Completion of the Decomposition Mathematical Programming System (DECOMP) for the IBM 7090 has been announced by Bonner & Moore Associates, Inc., Houston consulting firm. The program, developed under the joint sponsorship of Atlantic Refinning Co., Phillips Petroleum Co., and Bonner & Moore, will be used to solve large mathematical programming problems. DECOMP is said to be suitable for corporate or multiple facility simulation and certain time staging models.

CIRCLE 102 ON READER CARD

● A special purpose IBM computer system is now monitoring the Standard Oil Company of California's fluid catalytic cracker at its El Segundo refinery on an around-the-clock basis. The system detects any changes and provides the operator with the necessary information to take action and improve performance. The process control unit currently scans at an average rate of 40 points of information per minute. The computer's ultimate scanning capacity is 20 points per second.

● General Precision, Inc., has been awarded a $1.8-million contract by the Federal Aviation Agency for work to be done on air traffic control data processing and display equipment at the National Aviation Facilities Experimental Center near Atlantic City, N. J. The contract calls for putting into operation readiness part of the Transition/Terminal area development equipment previously delivered for evaluation.

● A Thompson Ramo Wooldridge RW-300 has been installed at Continental Oil's new "ALFOL" alcohol process plant at Lake Charles, La. The system computes various unit operation factors; monitors and logs data during and after plant startup; follows trends through digital printouts of both measured and calculated variables, and monitors and checks instruments and equipment against known values.

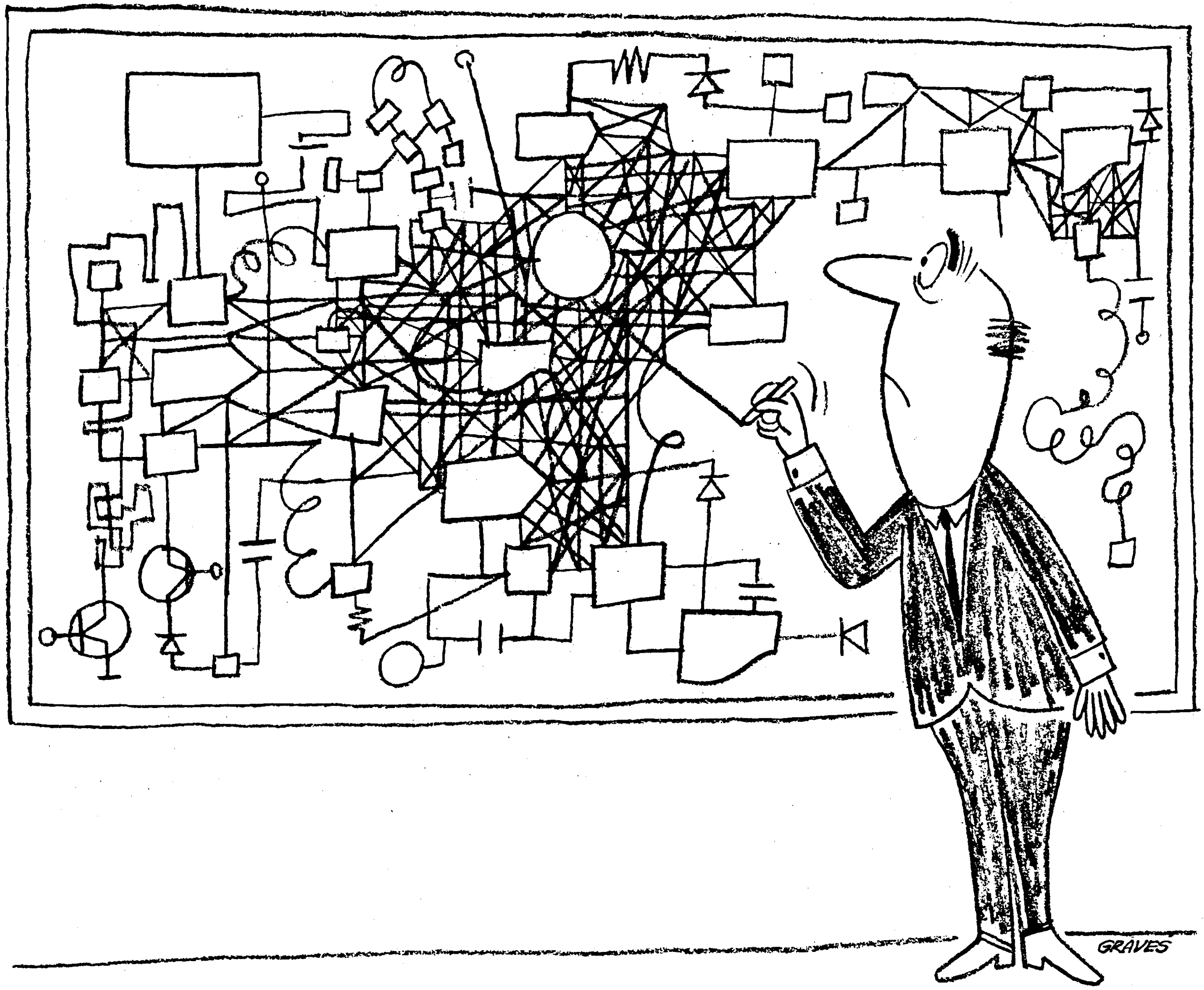
● A $3,710,000 contract for computer program integration of Air Force satellite control programs has been awarded to System Development Corp., Santa Monica, Calif. SDC will integrate and systematize existing programs involving satellite guidance, stabilization, command control, telemetry, payload and data reduction. The program, which runs through December, 1962, will be conducted by SDC's Satellite Control Department.

● Scientific Data Systems, Santa Monica, Calif., has received a contract for the design and fabrication of a digital instrumentation system for the Deep Space Instrumentation Facility of Jet Propulsion Laboratory. The system includes SDS 910 and SDS 920, in addition to other SDS analog and digital instrumentation devices. System price was reported to be more than $330K.

CIRCLE 103 ON READER CARD

● An ASI 210 has been sold to Chance Vought Corp., Dallas, Texas. This is the fourth order for a 210 received by Advanced Scientific Instruments. The first three were sold to NASA. Chance Vought's purchase price was $113K.

CIRCLE 104 ON READER CARD


GRAVES

● Conversion of Teletypesetter tapes into mag tape is available from the Computer Tape Conversion Center of the Electronic Engineering Co. of California, Santa Ana. According to the firm, the application enables typographers to produce mag tape which can be employed by computer-controlled libraries and in information retrieval systems. When specific items are required for reproduction, the computer locates and retrieves the data on mag tape. By playing back the tape through special equipment, a new paper tape is punched in the format for automatic typesetting. The service is available for use on IBM, Burroughs, RemRand, or RCA computers.

CIRCLE 105 ON READER CARD

● The U. S. Department of Interior will install a GE-225 at the Mining Research Center of the Bureau of Mines, Denver, Colorado. The computer, scheduled to be delivered next month, will be leased from GE with option to buy. Computer service will be available to Bureau of Mines researchers throughout the country on an open shop basis. Time will also be provided to other Interior Department bureaus and offices. The installation will be used for developing advanced techniques for mineral evaluation and rock behavior.

● The National Machine Accountants Association has changed its name to the Data Processing Management Association.

Elmer F. Judge, newly-elected International President, said "the widening use of digital computers and associated electronic equipment, as well as the rising managerial status of our membership has made this change necessary."

Organized in 1951, the association now numbers 16,000 members in 183 chapters.

● The British computer manufacturing firm of International Computers and Tabulators Ltd. (ICT) has bought the data processing division of EMI Electronics Ltd. for a reported purchase price of 275,000 shares of ICT common stock.

Not involved was EMI's analog, military, or process control computers, which will continue to be developed and manufactured. EMI also is engaged in manufacturing basic computer components.

ICT is one of Great Britain's prime computer manufacturers, with approximately 60 installations reported in England. Around a dozen EMI systems are installed in the U.K.

people IN DATAMATION

■ Scientific Data Systems, Inc., Santa Monica, Calif., announces three additions to its programming group: Emil R. Borgers is named manager of programming, and will be assisted by Richard S. Resnick and A. W. England. Borgers was formerly with Packard-Bell Computer, where he was manager of programming; Resnick was with the Librascope division of General Precision, in program development, and England's previous position was senior programmer at Packard-Bell Computer.

■ William L. Sullivan has been appointed manager of programming research in GE's Computer Department. In the newly-created position, he will be in charge of research in programming techniques for present and future GE dp equipment. Formerly, Sullivan was responsible for computer operations and systems development at the George C. Marshal Space Flight Center, Redstone Arsenal, Huntsville, Ala.

■ Dr. Morton M. Astrahan of IBM, San Jose, will join the IBM World Trade Corporation in Paris as senior technical adviser to M. E. Femmer, manager of WTC laboratories. Dr. Astrahan has been with IBM since 1949, and was first chairman of the IRE Professional Group on Computers in 1952-53, chairman of the National Joint Computer Committee, 1956-58, and chairman of the NJCC delegation to Russia in 1959. Currently, he is chairman of the finance committee of the American Federation of Information Processing Societies.

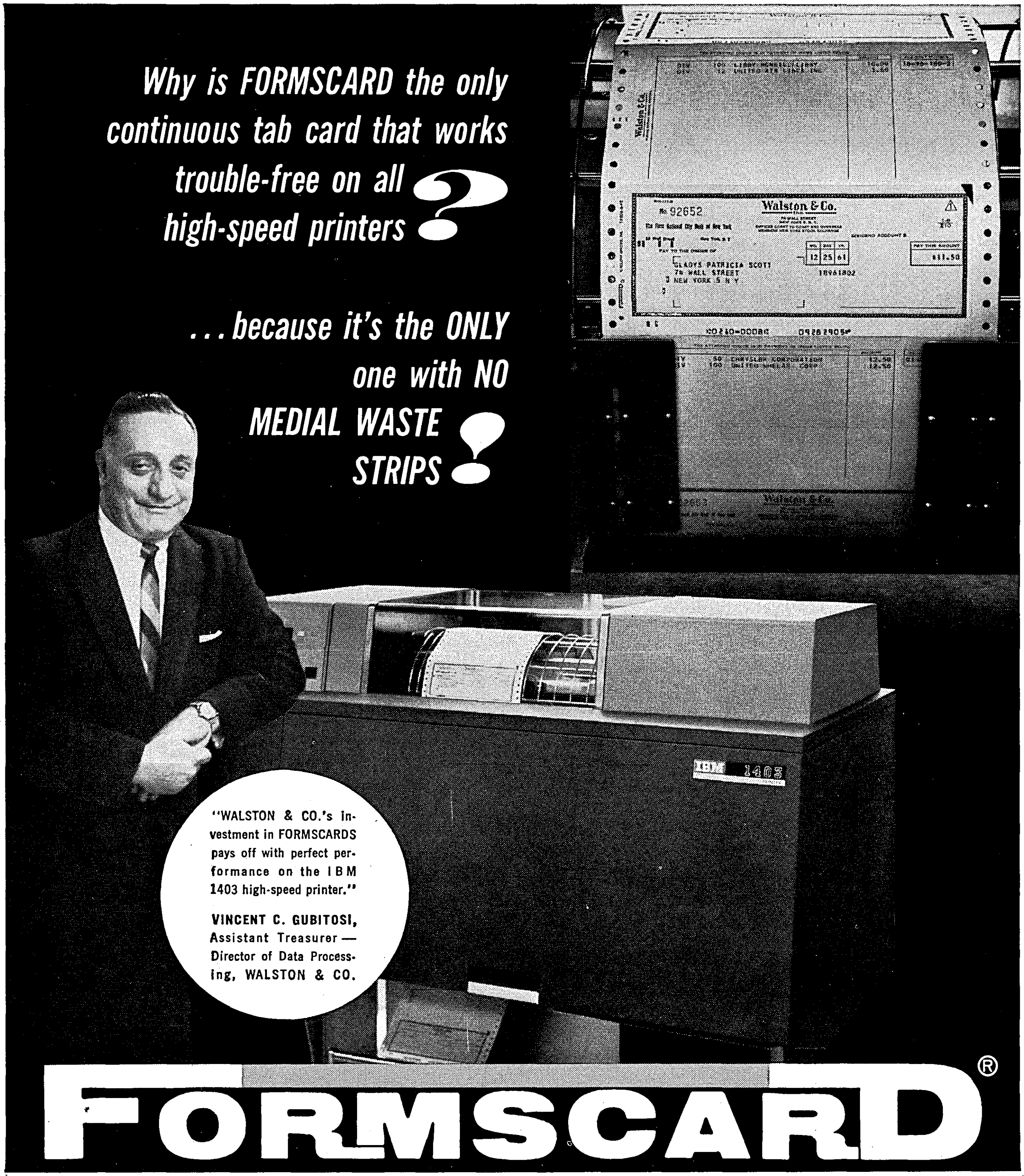
■ J. Chuan Chu has been appointed associate director of the product planning division of Honeywell EDP. He was former director of engineering for UNIVAC and was chief engineer on the LARC project. Prior to 1956, Chu was senior scientist and manager of the computer department, Argonne National Laboratory; professor of electrical engineering, Fournier Institute, senior engineer for Reeves, and research associate and instructor, University of Pennsylvania.

■ Dr. Robert Brown has resigned as director of the Computing Center of the University of Southern California, Los Angeles, and has joined Aerospace, El Segundo, Calif., as a department manager in the Systems Research and Planning Division, a support activity of the Computing and Data Processing Center. He replaces Samuel D. Conte, who has accepted the directorship of the Computing Center at Purdue University.

■ The new position of director of scientific applications at Computer Usage Co., Inc., New York, has been filled by Dr. F. John Payers. Prior to his affiliation with CUC in October, 1961, Dr. Payers was an associate professor of engineering at the University of California.

■ Phyllis R. Huggins has been appointed public information director for the American Federation of Information Processing Societies (AFIPS), and will work directly with J. D. Madden, System Development Corp., AFIPS PR chairman.

Miss Huggins, public relations coordinator for Bendix Computer, will work for AFIPS under a one-year contract and will continue in her present position at Bendix on a time-shared basis. The AFIPS post is the first paid staff position to be created by AFIPS or its predecessor, the National Joint Computer Committee.



Regardless of the number of carbon copies required, FORMSCARD is manufactured to specifications producing perfect operation on all high-speed equipment. And FORMSCARD also delivers these other outstanding advantages:

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- Easy Separation manually or on any burster
- Vouchers of any length, side, top or bottom

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Forms inc

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Manufacturers of line-hole continuous business forms. Samples on request—sales representatives in principal cities.

CIRCLE 33 ON READER CARD


How reliable are
you, Computape?
Come clean now.
Come clean? Penelope, I come clean-est.
So clean, I guarantee *556 or* 800 bits per inch
with no dropouts for the most severe computer
applications. How's that for reel-liability?

NEW PRODUCTS

data collector

The redesigned 180 now has transistorized circuit control, a photo-electric reader and is packaged in modules that are pluggable and accessible. Input is acceptable from cards, dials or a clock, and output is on punched paper tape.

Cards containing alphanumeric data can be read at a rate of 16 cps. CONTROL DATA CORP., PERIPHERAL EQUIPMENT DIV., 7801 Computer Ave., Minneapolis 24, Minn. For information:

CIRCLE 200 ON READER CARD

buffer/memory units

Three types of operation offered by a new line of buffer/memory units, built around the model 4-20 high-speed magnetic drum, provides for data buffering or an addressable memory at a cost of $.15 per bit. Data inputs of 150 cps or higher with an equivalent buffer output can be effected on a random basis, random-sequential, or a sequential-sequential system. Using the internal control system, character rates up to 62,000 per second may be read in or out. COGNITRONICS CORP., 100 Chestnut St., Springfield, Mass. For information:

CIRCLE 201 ON READER CARD

terminal equipment

The model 600 transceiver permits transmission of computer output data to plotters located at any point where standard series 200 Dataphone equipment is available. Output data is accepted for either on-line or off-line operation. Model 620 receiver recovers information at the receiving end and provides the proper inpulses for driving the plotter. The 600 and 620 have a speed of 18,000 line segments per minute with Dataphone subset 201A, and 12,000 line segments per minute with subset 202A. CALIFORNIA COMPUTER PRODUCTS, INC., 8714 E. Cleta St., Downey, Calif. For information:

CIRCLE 202 ON READER CARD

tape channel adapter

The A-50 is a standard option which allows the S-C 1090 direct view display to be driven directly from computer tape or tape control units. The option adapts the S-C 1090 to the tape units of any computer using standard six-bit words and accepts the words in parallel from the tape or tape control units and formats this data into 36-bit words. The A-50, which operates either on-line or off-line, accepts data rates of 15 kc, 22.5 kc, 41.6 kc and 62.5 kc. GENERAL DYNAMICS/ELECTRONICS, P. O. Box 127, San Diego 12, Calif. For information:

CIRCLE 203 ON READER CARD

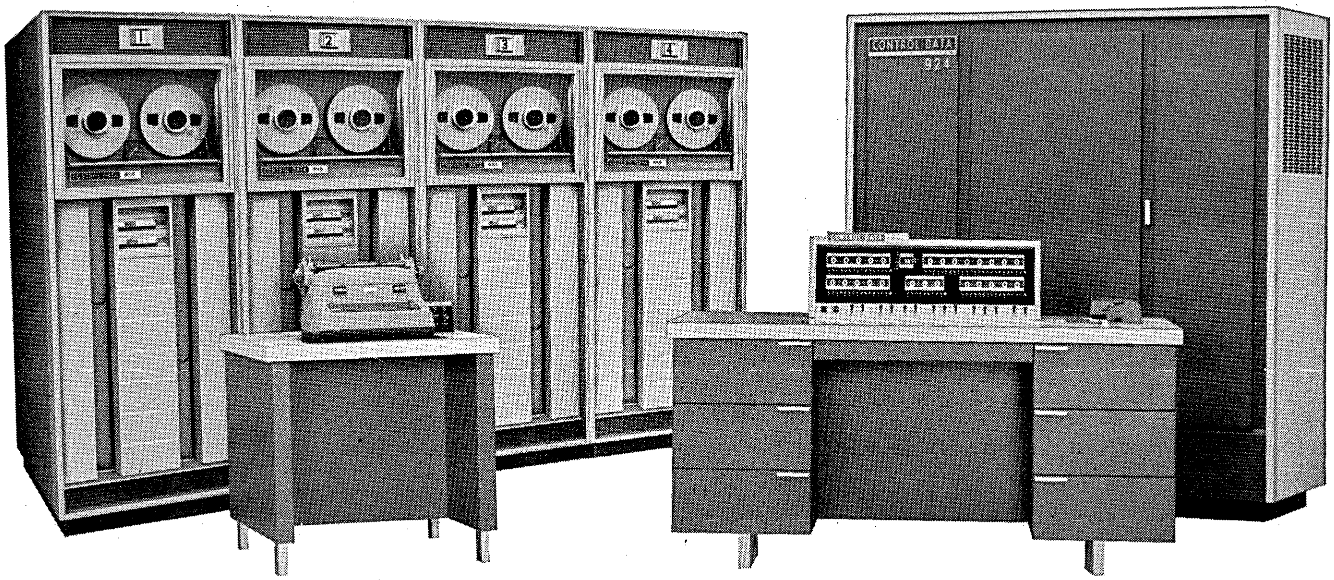
printer/plotter

The 9041 videograph printer/plotter simultaneously prints a permanent paper record of both alphanumeric data and analog curves at speeds up to 10 inches per second. As a page printer, the unit prints out a format of 72 columns with 10 characters per inch, five to seven lines per vertical inch, at a rate of 3,600 lines per minute. A. B. DICK CO., 5700 W. Touhy Ave., Chicago 48, Ill. For information:

CIRCLE 204 ON READER CARD

logic-lab

These universal digital logic units can be used for rapid digital system synthesis, logic circuit checkout, digital computation and educational applications. Model LL-101 contains 25 standard logic cards and flip-flops, NOR gates, shift registers, AND gates, inverters, power drivers, counters, and



NEW CONTROL DATA 924 COMPUTER

Built for speed...priced for economy

The Control Data 924 is a medium-scale computer classed between the desk-size 160-A and large-scale 1604-A computers. Field-proven reliability, performance, and design techniques of these two computers are incorporated in the 924.

The Control Data 924 is exceptionally adaptable to applications carried out in control and data reduction systems. For example, the 924 has an input-output rate of 2,400,000 bits/second. Where A-to-D and D-to-A equipments are used in these systems, the 24-bit word length of the 924 is ideally suited. Internal speeds of the 924 are extremely fast, and include both built-in multiply and divide. Average multiply time is 23.5 μs; average divide time is 32.9 μs; average add time is 9.2 μs. The many other outstanding features of the 924 are included below:

SUMMARY OF FEATURES

- Stored program, general purpose digital computer.
- Parallel mode of operation.
- 24-bit word length.
- Single address logic, one instruction per word:
  6-bit operation code
  3-bit index designator
  15-bit execution address
- Six index registers.
- Program interrupt.
- Indirect addressing.
- 8192 words of magnetic core storage (expandible to 16,384 or 32,768 words):
  Independent 4096 word banks, alternately phased
  5.3 microseconds average effective cycle time
  1.8 microsecond access time
- Versatile input/output facilities: capable of receiving or transmitting up to 2,400,000 bits per second:
  Three 48-bit buffer input channels
  Three 48-bit buffer output channels
  Both channels are completely buffered, compatible with all 160-A and 1604-A computers and peripheral equipment such as card readers and punches, line printers, magnetic tape systems, and, when properly interfaced, A/D and D/A converters, telephone, microwave, telemetry, and special displays.
- Binary arithmetic—Modulus 2^{24}-1 (one's complement, parallel addition in 1.2 microseconds without access).
- Real-time clock.
- Completely solid state, diode logic, transistor amplifiers, magnetic core storage.
- Small size (basic system requires less than 100 square feet).

924 INPUT/OUTPUT EQUIPMENT

Provided as standard equipment on the 924 console are the Control Data 350 Paper Tape Reader and the Model 110 Teletype Paper Tape Punch. Optional Control Data input/output equipment available for the 924 includes: the 161 Typewriter; the 165 Plotter; the 166 Buffered Line Printer (medium speed); the 167 Card Reader; the 1610-A Control Unit for a Card Read/Punch System; the 1612 Line Printer (high speed); and the 606 Magnetic Tape Transport which operates in conjunction with the 1615 Tape Synchronizer.

PROGRAMMING FEATURES

Sixty-four flexible instructions are available for programming the 924 Computer . . . including instructions for performing arithmetic, shift, transfer, logical search, indexing, jump, stop, and execute operations. There are, however, features which provide even greater programming flexibility, as follows:

Jump Instructions	Fault Condition
Search Instructions	Real-Time Clock
Masking Instructions	Program Interrupt
Shift Instructions	Buffer Operation
Scaling	External Function

For additional information, write for publication No. BR-1

8100 34th Avenue South,
Minneapolis 20,
Minnesota

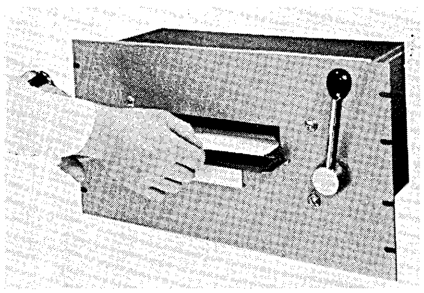
CONTROL DATA
CORPORATION

CIRCLE 36 ON READER CARD

a 250 kc clock are included. Additionally, it has one program board of 680 holes, a plug-wire kit of 208 assorted plug wires to make 564 terminations, an integral power supply, schematic diagrams and complete programming instructions. COMPUTER LOGIC CORP., 11800 W. Olympic Blvd., Los Angeles 64, Calif. For information:
CIRCLE 205 ON READER CARD

static card reader

The 4000 can read from one to 960 circuits simultaneously, and reads 80 columns through 960 individual contact pins without any change in card



position. Price for the model 4000 begins at $1,090. INDUSTRIAL TIMER CORPORATION, Highway 287, Parsippany, N.J. For information:
CIRCLE 206 ON READER CARD

memory system

The SEMA 2000 can utilize from one to five memory drums, each with a capacity of 2000 ten-digit words and two flags per word. Using a control switch, memory capacity can be doubled to 4000 five-digit words with one flag per word. Purchase price of a SEMA 2000, with a single magnetic memory drum is $22,500. HRB-SINGER, INC., 396 5th Ave., New York, N. Y. For information:
CIRCLE 207 ON READER CARD

card punch

The 26 interpreting card punch, alphabetical model 21, is a three-in-one card punch capable of interpreting as well as punching and printing data. This mechanism can interpret in a single line up to 80 columns of data stored in pre-punched cards at the rate of 18 columns per second. Purchase price is $5,350. IBM CORP., DP DIV., 112 E. Post Rd., White Plains, N.Y. For information:
CIRCLE 208 ON READER CARD

magnetic core memories

A new product line of coincident current magnetic core memories, SEL, has been designed to meet the requirements of general purpose digital systems. Memories are capable of command rates up to 100 KC and

NORTH ELECTRIC

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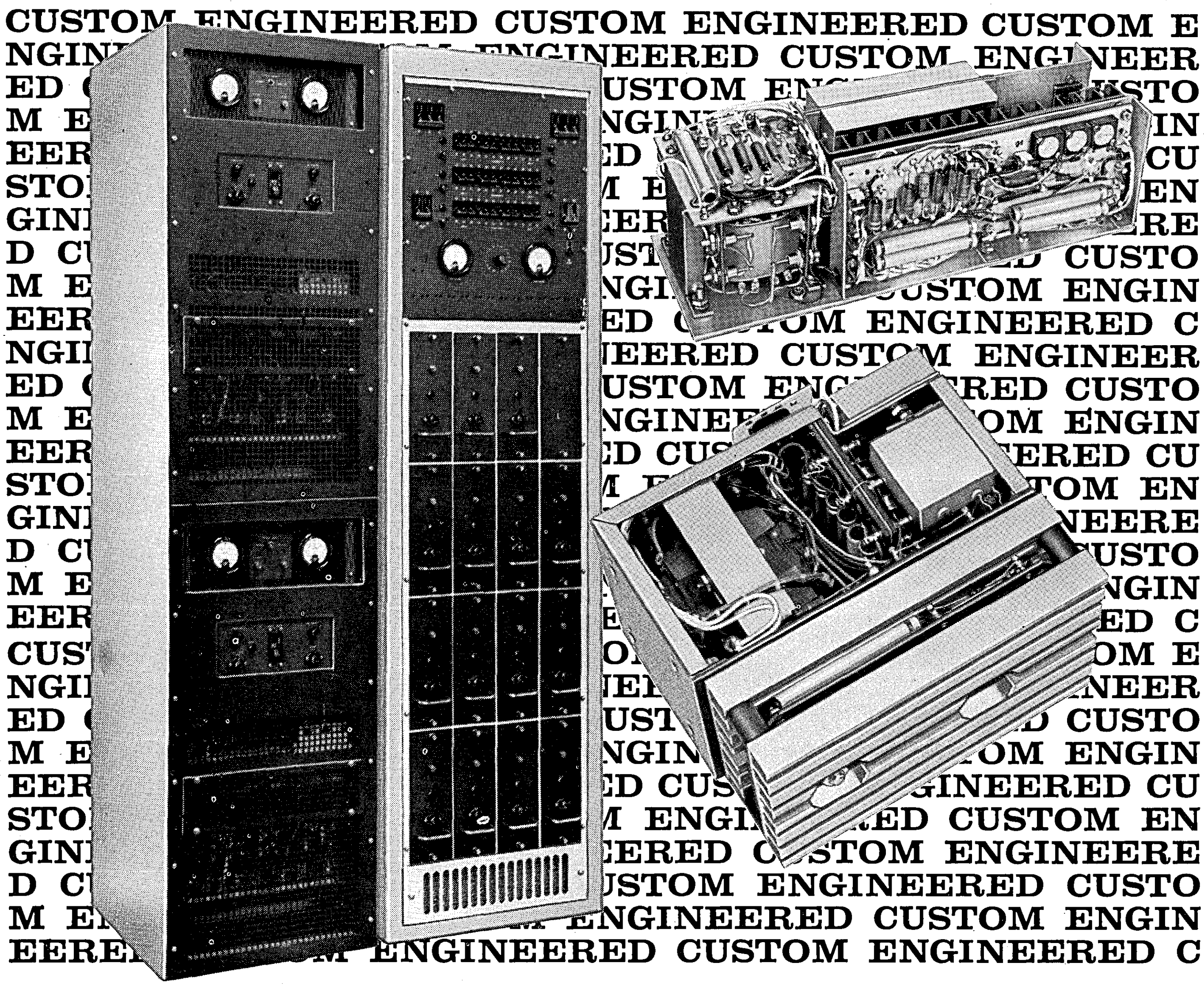
SINCE 1884 . . . INTO THE FUTURE



POWER SUPPLY SYSTEMS

highest reliability. . . shortest lead time

Power Equipment Company custom engineered power supplies are proving around-the-clock reliability in many military defense networks, including Nike-Hercules, Nike-Zeus, SAGE, BMEWS, and 412-L Air Weapons Control Systems. Utilizing its vast capabilities developed since 1935, PECO meets military reliability standards **and** delivers prototype and production units in the shortest possible lead time.

These same capabilities are available to you! As the largest custom engineered power supply manufacturer in the world, PECO has unmatched research and development, engineering, prototype and production facilities to fill every power supply requirement for computer, communications, and automatic control systems.

Commercial or military—whatever your needs may be in reliability, fast delivery and economy—certainly you will want to depend on the company already filling these demands for others.

PECO also manufactures a complete line of battery chargers and eliminators for military, industrial and utility applications.

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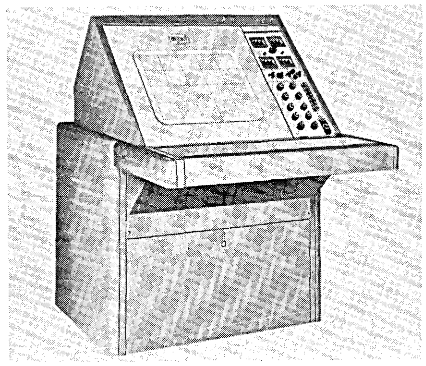
CIRCLE 39 ON READER CARD

NEW PRODUCTS . . .

capacities of up to 4096 words with word lengths up to 32 bits are available. Random access, sequential and sequential-interlace operations are available. SYSTEMS ENGINEERING LABORATORIES, INC., 4066 N. E. 5th Ave., Ft. Lauderdale, Fla. For information:
CIRCLE 209 ON READER CARD

analog display

This display system, designed for use with all repetitive analog computers, functions in the same manner as conventional real time devices. Readout



accuracy is plus or minus 0.25%. Up to 10 inputs may be viewed as functions of time. COMPUTER PRODUCTS, INC., 21 Broad St., Manasquan, N. J. For information:
CIRCLE 210 ON READER CARD

low power silicon modules

The 3200 line consists of nine different transistor logic circuits plus a five bit magnetic shift register and shift register driver module. They will operate over a temperature range of $-55°$ C to $+100°$C-C & K COMPONENTS, INC., 103 Morse St., Newton, Mass. For information:
CIRCLE 211 ON READER CARD

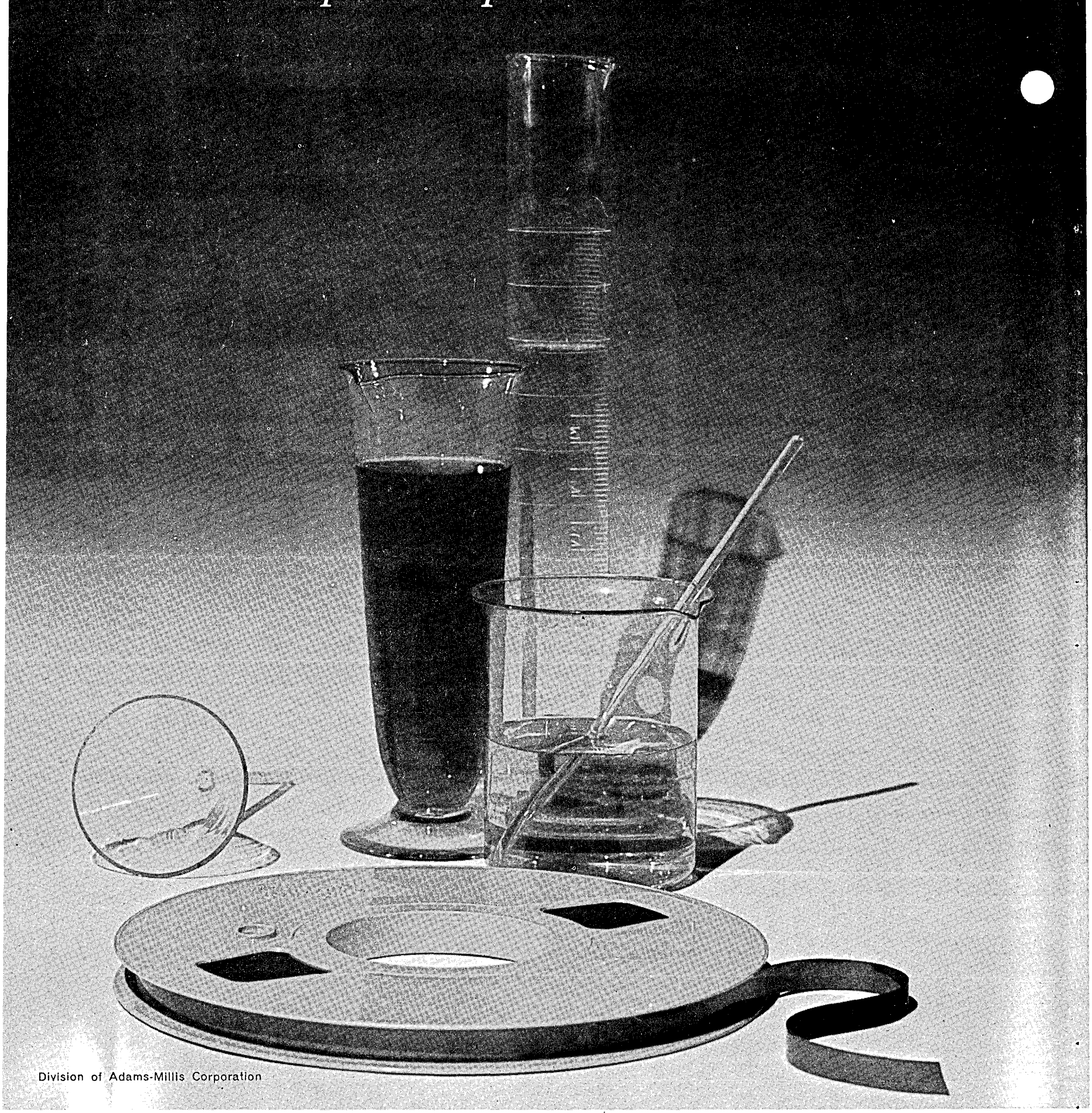
solid state multiplexers

The MU-series of analog switches have been designed for data gathering and other high speed switching applications. These multiplexers settle to 0.01% in less than 15 microseconds and have over-all accuracies of 0.015%. Price for a typical 64-channel system is $5,300. SCIENTIFIC DATA SYSTEMS, INC., 1542 15th St., Santa Monica, Calif. For information:
CIRCLE 212 ON READER CARD

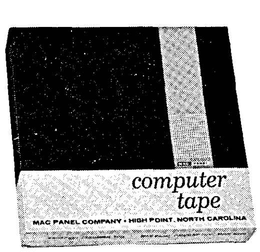
high speed print station

This off-line system, designed for printing from magnetic tapes, operates independently of the computer and will print from both high and low density tape. A choice of printing speeds of 1,000 or 667 lines per minute is offered. Both FORTRAN, scientific characters, and COBOL, business

MAC PANEL *computer tape* . . . ASSURED PERFORMANCE



Chemistry and Computer Tape Chemical research, analyzing and blending oxides, elastomers and resins, led to the development of an improved oxide formulation that would give you *assured performance* by MAC Panel Computer Tape. This unique formulation insures permanent coating adhesion, hard-shell toughness and flexibility under all conditions. The chemistry involved to achieve this is combined with a new method of applying an even, uniform coating of oxide to the polyester web; precise, close tolerance slitting and



ultrasonic cleaning at two stages of production to lend further assurance against tape-caused system malfunction. You can rely on MAC Panel Computer Tape, because every reel is *Manufactured for Performance . . . Tested for Performance . . . Packaged for Performance.* To learn how this new magnet tape can help you in your IBM computer installation, ask your MAC Panel representative and write for the informative booklet: "MAC Panel Computer Tape . . . Assured Performance."

MAC PANEL COMPANY ☐ High Point, North Carolina

CIRCLE 42 ON READER CARD

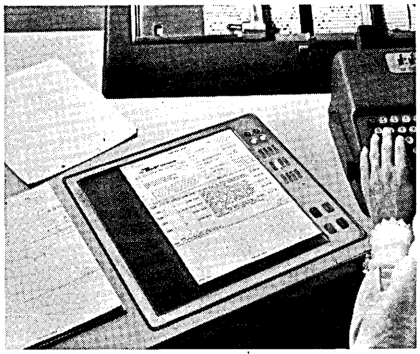
NEW PRODUCTS . . .

oriented characters, are provided in each unit. ANELEX CORP., 150 Causeway St., Boston 14, Mass. For information:

CIRCLE 213 ON READER CARD

automated data input

DATAFINDER indicates to the card punch operator the information to be punched from the source document by lighting the field in proper sequence. It is also able to indicate the numbers



of columns to be punched in the card for each field and whether the next field to be punched is alphabetic or numeric. TAB PRODUCTS CO., 550 Montgomery St., San Francisco 11, Calif. For information:

CIRCLE 214 ON READER CARD

mag tape transport

The M101/B101 has a speed of three inches per sec., a recording density of 400 bits per inch and a BCD character density (eight levels per character) of 24 per inch. Each character is checked for the proper total on ones and zeros and an alarm is actuated if the count is incorrect. Prices are $750 and $1500. KENNEDY CO., 2029 N. Lake Ave., Altadena, Calif. For information:

CIRCLE 215 ON READER CARD

magnetic storage drum

The operating frequency of the C-675 at 1800 RPM is 73.5 kc, with a maximum of 2450 bits per track on 12 tracks. One read/write head serves each track, and any head or track may be used for timing. Total price with 12 heads and mounting blocks is $478. BRYANT COMPUTER PRODUCTS, 852 Ladd Rd., Walled Lake, Mich. For information:

CIRCLE 216 ON READER CARD

slave clock

Model DCSC1151 consists of a four-stage high gain diode-clamped amplifier and is particularly applicable where increased clock fan-out capability is required, or as a power amplifier and secondary clock. Typical fanout is standard loads at 10 MC and 40 standard loads at five MC. SOLID STATE ELECTRONICS CORP. 15321 Rayen St., Sepulveda, Calif. For information:

CIRCLE 217 ON READER CARD

deflection amplifier

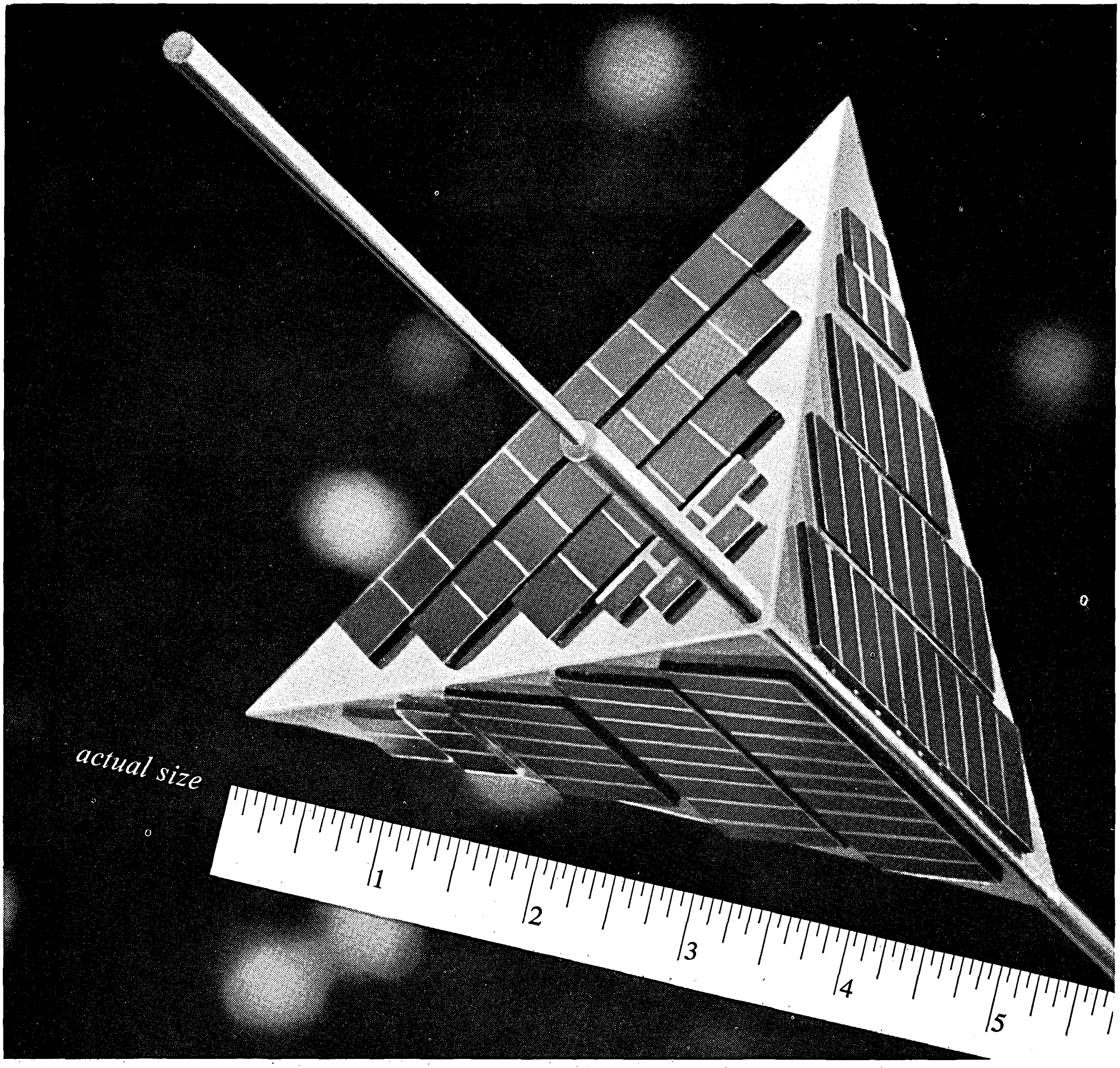
This wide band, transistorized electrostatic deflection amplifier has been designed for use with dual deflection cathode ray tubes. When used with the CURVILINE character generator, this bandwidth permits characters to be written at rates up to 50,000 per second. Prices begin at $370. RMS ASSOC., INC., 805 Mamaroneck Ave., Mamaroneck, N. Y. For information:

CIRCLE 218 ON READER CARD

core memory testing

Model 701 core memory matrix and stack tester has combined equipment and circuitry into a single relay rack. The 701 can simulate the operating characteristics of computers and other dp equipment employing magnetic core memory planes. The basic model is able to evaluate planes up to 64 x 64, and sells for $25,000. INTERNATIONAL COMPUTER, INC., 4241 Redwood Ave., Los Angeles 66, Calif. For information:

CIRCLE 219 ON READER CARD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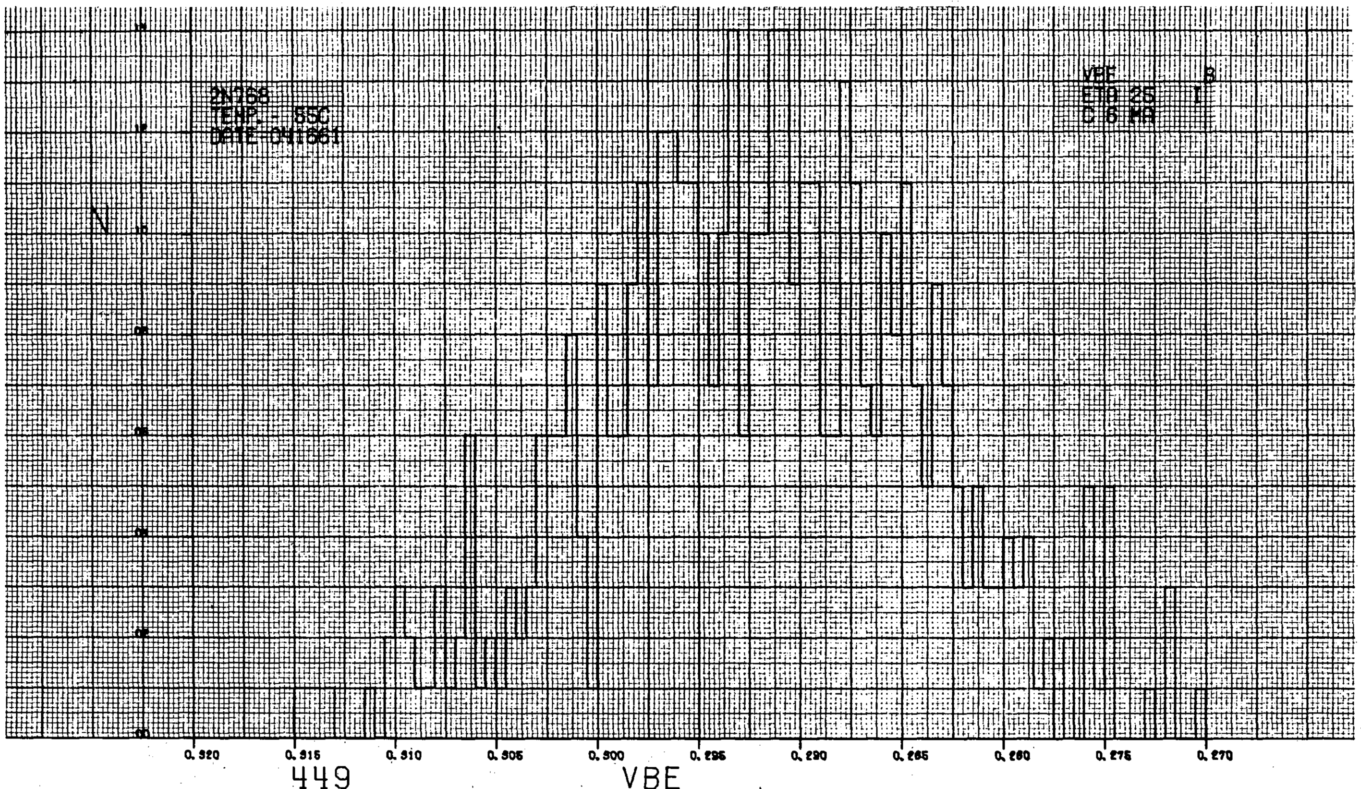

CALCOMP PLOTTING

VERSATILE • ECONOMICAL • RELIABLE

CalComp digital plotters and plotter systems are uniquely capable of continuous, round-the-clock, *unattended* production of instantly available multiple plots. ■ Compatible on-line with any general purpose medium-scale digital computer, and off-line with most general purpose large-scale digital computers. ■ Plots *automatically annotated* in alphanumeric characters and *any* symbols. ■ No skilled personnel required. CalComp equipment *never* requires calibration, and produces plots continuously on roll-fed paper automatically maintained in precise alignment. ■ CalComp plotting equipment has operated for *years* with no maintenance other than replacing the paper and filling the pen. ■ CalComp equipment operates on 100-125 volts 50 or 60 cycle a.c.

ON-LINE. CalComp 560-R plotter produces plots at 12,000 line segments per minute 11 inches wide and up to 120 feet in length. Price: $3,300.

CalComp 563 plotter produces plots at 12,000 line segments per minute 29½ inches wide and up to 120 feet in length. Price: $8,000.

CalComp 565 plotter produces plots at 18,000 line segments per minute 11 inches wide and up to 120 feet in length. Price: $4,550.

OFF-LINE. CalComp 570 Magnetic Tape Plotting System, including any CalComp plotter. Price: $24,500 to $44,200 depending upon choice of plotter and type of computer.

PROGRAMS. We will be happy to provide information on CalComp programs for your computer.

REMOTE PLOTTING. CalComp Digital Data Terminal equipment permits controlling any number of remotely located digital plotters from a single computer or Magnetic Tape Plotting unit via conventional telephone company Dataphone. Price: CalComp 600 Transceiver $8,780. CalComp 620 Receiver $5,180.

PAPER. CalComp 120-foot rolls of paper are available either plain or with preprinted arithmetic or logarithmic grids. Price: $5 per roll (12-inch width), $20 per roll (30-inch width). Quotation on preprinted special designs and catalog of stock design paper samples available on request.

DEMONSTRATIONS. Demonstrations of CalComp plotting equipment at your installation arranged on request.

CALCOMP

CALIFORNIA COMPUTER PRODUCTS, INC.
8714 CLETA STREET • DOWNEY, CALIFORNIA

Send for your free subscription to DIGITAL PLOTTING NEWSLETTER

See CalComp equipment demonstrated at Munzig International Booth No. 5, I.F.I.P. Conference, Munich, Aug. 27 to Sept. 1.

NEW LITERATURE

COMPUTER SERVICE: This bulletin describes a new computer service which provides data processing in the field of survey research. General specifications of the survey dp program, comparative cost studies and other statistical programs available are described. THE SERVICE BUREAU CORPORATION, 425 Park Ave., New York 22, N. Y. For copy:
CIRCLE 130 ON READER CARD

REQUIRED COBOL - 1961: This brochure gives information on a self-teacher course in Required COBOL-1961 and outlines the benefits of a programmed text which is used. AUERBACH CORP., 1634 Arch St., Philadelphia 3, Pa. For copy:
CIRCLE 131 ON READER CARD

1962 SJCC PROCEEDINGS: The *Proceedings* of this year's Spring conference includes subjects on Study of Business Information Systems, Theoretical Problems of Artificial Intelligence, Man-Machine Cooperation and World Peace and the Role of Computers. The cost of this hardbound edition is $6. THE NATIONAL PRESS, 850 Hansen Way, Palo Alto, Calif.

315 COMPUTER SYSTEM: This brochure provides a complete description of the 315 computer series with special emphasis on CRAM. NATIONAL CASH REGISTER CO., DATA PROCESSING SYSTEMS & SALES, Dayton 9, Ohio. For copy:
CIRCLE 132 ON READER CARD

PROGRAM BOARD: This catalog contains all electrical and mechanical data on the Sealectoboard. Functional layouts of this cordless programming concept are illustrated and explained. SEALECTRO CORP., 139 Hoyt St., Mamaroneck, N. Y. For copy:
CIRCLE 133 ON READER CARD

SALARY ADMINISTRATION: This manual describes each step necessary in the development of a comprehensive salary evaluation program for data processing personnel. All necessary forms and procedures needed to develop this program are contained in this edition priced at $22.50. THE BUSINESS PRESS, DIV. OF OA BUSINESS PUBLICATIONS, 288 Park Ave., W. Elmhurst, Ill.

SOLID STATE MULTIPLEXERS: This bulletin on the MU-Series for data gathering and other high speed switching applications contains complete specifications, features and prices of the series. SCIENTIFIC DATA SYSTEMS, 1542 15th St., Santa Monica, Calif. For copy:
CIRCLE 135 ON READER CARD

DESIGN PARAMETERS CHART: This chart offers information on surface speeds of various diameter magnetic

EAST
vs.
WEST

DIAGRAMS
vs.
EQUATIONS

THE COMPUTER'S ANSWER TO A LONG-STANDING COMPUTER ISSUE.

For a decade East Coast and West Coast computer designers have been using different methods of representing computer logic—the Easterners with diagrams, the Westerners with equations.

LBSMI =
(LXA1)(LXA2*)(LFCA*)
+(LXA1*)(LXA2)(LFCA*)
+(LXA1*)(LXA2*)(LFCA)
+(LXA1)(LXA2)(LFCA)
LFCAJ =
(LXA1)(LXA2)
LFCAK =
(LXA1*)(LXA2*)

In the example illustrated here, the diagram and the equation tell us exactly the same thing. Either represents a serial full adder where the sequence of pulses at the output, LBSM, will represent a serial binary number that is the sum of two serial binary input numbers occurring at LXA1 and LXA2. (The asterisks indicate binary complements; for example, whenever LXA1 is energized LXA1* is not, and vice versa. LFCA is a carry flip-flop.)

There are persuasive arguments on both sides. Eastern proponents of diagrams point out that the logical interconnections can be seen at a glance and followed through any number of stages by eye. The logical structure of an entire system can be understood from a diagram more directly and intuitively, they maintain, than from a set of equations.

The Western argument for equations goes like this. It's not true that diagrams communicate better to the viewer's intuition, except at first exposure. The human mind is highly adaptive. After working analytically with the equations for a while, the mind begins to operate intuitively in that symbology. Then the intrinsic superiority of equations over diagrams begins to make itself evident. One advantage, say the Westerners, is that equations can represent the same information more compactly and efficiently, as our illustration shows. Another is that equations lend themselves better to computer manipulation of logical design information.

As evidence of the latter advantage Westerners point to a recent achievement of some Litton Systems people: a completely mechanized procedure for translating logical designs into wiring lists, including operational simulation of the design to verify its accuracy. A procedure enormously facilitated by the computerizability of logical equations. It's easy to picture the benefits in cost, delivery schedules, reliability, price. Using only a partial development of this method Litton Systems recently brought a major computer system from concept to operation in less than a year.

Now under consideration at Litton: a machine that will accept as inputs a supply of standard computer components and a set of coded specifications defining the logical functions desired, and will crank out completely fabricated systems.

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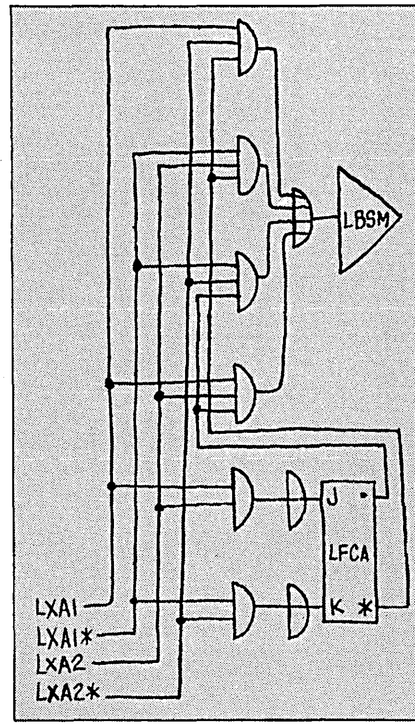

imagination-stretching atmosphere generated by Litton management's appreciation of the rewards of creative controversy. We have a few excellent opportunities for computer design people. Ask for Harry Laur at Litton Systems, Inc., Data Systems Division, 6700 Eton Ave., Canoga Park, California.

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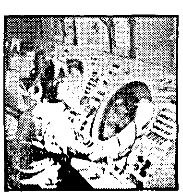
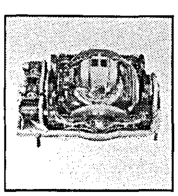


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NEW LITERATURE . . .

memory drums at common rotational speeds, bits per track at representative logic frequencies, and bit density per inch vs. bits per track per revolution of different diameter drums. DIGITAL DEVELOPMENT CORP., 7541 Eads Ave., La Jolla, Calif. For copy:
CIRCLE 136 ON READER CARD

BATCH PROCESSING: This bulletin explains the features of batch assembly of business data processing programs as compared to the single program assembly technique. Specific examples of both methods are given. MINNEAPOLIS-HONEYWELL REGULATOR CO., EDP DIV., 60 Walnut St., Wellesley Hills 81, Mass. For copy:
CIRCLE 137 ON READER CARD

TRANSISTOR/DIODES: This eight-page brochure describes the product capability and features of these transistor/diode multiple devices. Forty of these devices are diagrammed in the brochure. FAIRCHILD SEMICONDUCTOR, 545 Whisman Rd., Mountain View, Calif. For copy:
CIRCLE 138 ON READER CARD

MULTI-PURPOSE COMPUTER: This illustrated brochure highlights the PACE PC-12 line designed for on-line processing computations. Two examples of how the PC-12 can be used to control industrial processes are given. ELECTRONIC ASSOCIATES, INC., Long Branch and Naberal Aves., Long Branch, N. J. For copy:
CIRCLE 139 ON READER CARD

COMMUNICATIONS EQUIPMENT: This booklet includes a discussion of wire and tape-to-tape transmission, accuracy checking systems, and wire leasing costs. All of the company's communications machines are described. FRIDEN, INC., 97 Humboldt St., Rochester 2, N. Y. For copy:
CIRCLE 140 ON READER CARD

COMPUTER SERVICES: This booklet provides information on services which are offered to users of data processing systems. These include applications analysis, equipment selection, systems design, programming, installation audit, and a series of educational courses. COMPUTER DYNAMICS CORP., American National Bank Building, Silver Spring, Md., For copy:
CIRCLE 141 ON READER CARD

DATA PROCESSOR: This brochure highlights the 025 real-time data processor and gives statistics on the input/output, central processor, memory storage, magnetic drum storage and automatic channel selection. Also included is a survey of central computer operations and multisequence operation. ITT FEDERAL LABORATORIES, 500 Washington Ave., Nutley, N. J. For copy:
CIRCLE 142 ON READER CARD

CORE HANDLERS: This technical brochure presents three models of an automatic ferrite core handler which test up to 36,000 cores per hour. Included is a complete description of the operation of the core handlers including the vibratory feed systems, electrical drive, output test circuits and the solenoid operated mechanical linkage. RESE ENGINEERING INC., A & Courtland Streets, Philadelphia 20, Pa. For copy:
CIRCLE 143 ON READER CARD

S-PAC DIGITAL MODULES: This 28-page catalog contains technical descriptions, schematics, and specifications of two complete series of approximately 60 different, compatible plug in modules for digital computers and systems at any operating frequency from dc to 1 and 5 mc. COMPUTER CONTROL CO., INC., 983 Concord St., Framingham, Mass. For copy:
CIRCLE 144 ON READER CARD

NEW LITERATURE . . .

G-20 ACCESSORIES: Specification sheets describe the LP-12 high-speed line printer, the MT-10 magnetic tape module, the DM-10 disc memory, the PC-10 card and printer coupler, the CB-11 control buffer and the DC-11 data communicator. BENDIX COMPUTER DIVISION, 5630 Arbor Vitae St., Los Angeles 45, Calif. For copy:
CIRCLE 145 ON READER CARD

1800 SYSTEM: This brochure discusses the features of the 1801 central processor, including parallel processing and orthotronic control, the 1801B floating point arithmetic option, various I/O equipment and automatic programming aids. MINNEAPOLIS-HONEYWELL, EDP DIV., 60 Walnut St., Wellesley Hills 81, Mass. For copy:
CIRCLE 146 ON READER CARD

340 CONTROL SYSTEM: This brochure details the 340, a new process control system which is able to perform over 20,000 operations per second. TRW COMPUTERS CO., DIV. OF THOMPSON RAMO WOOLDRIDGE INC., 8433 Fallbrook Ave., Canoga Park, Calif. For copy:
CIRCLE 147 ON READER CARD

SEMICONDUCTOR PRODUCT GUIDE: This 12-page brochure highlights the company's full line of silicon rectifiers, special computer diodes, tunnel diodes and varactor diodes. RCA SEMICONDUCTOR & MATERIALS DIV., COMMERCIAL ENGINEERING, Somerville, N.J. For copy:
CIRCLE 148 ON READER CARD

ENVIRONMENT CONTROL: Controlling environment for edp facilities is the topic of this illustrated pamphlet. Ten requirements for control described are temperature, humidity, air cleanliness, acoustics, power supply, lighting, safety, dependability, appearance and flexibility. THE AUSTIN CO., 3650 Mayfield Rd., Cleveland 21, Ohio. For copy:
CIRCLE 149 ON READER CARD

DIGITAL MAGNETIC MEMORY DRUM: This leaflet describes the DYNSTAT which features fixed signal level, regardless of speed; parallel or series readout and no contact between magnetic heads and the drum surface. CONSOLIDATED CONTROLS CORP., Bethel, Conn. For copy:
CIRCLE 150 ON READER CARD

CUSTOMER TRAINING COURSES: This complete 1962 prospectus outlines scheduled dates, enrollment procedures, reservations and course descriptions for this year's Data Processing and Graphic Arts Customer Training Programs. FRIDEN EDUCATIONAL CENTER, 31 Prince St., Rochester 7, N. Y. For copy:
CIRCLE 222 ON READER CARD

COMPUTER SERVICE: This eight-page booklet presents several case histories which show how a 1401 data processing service has aided various clients including an insurance firm, a computer manufacturer and a savings and loan association. Typical applications for the 1401 are also listed. STATISTICAL TABULATING CORP., 104 S. Michigan Ave., Chicago 3, Ill. For copy:
CIRCLE 223 ON READER CARD

PROCESS CONTROL: This eight-page application bulletin describes how conventional instruments tie in with digital computers for process control. FISCHER & PORTER CO., 171 Jacksonville Rd., Warminister, Pa. For copy:
CIRCLE 224 ON READER CARD

HIGH-SPEED TAPE SPOOLER: This bulletin highlights model TS-405 which is able to wind tapes at up to 50 inches per second for photoelectric and other high-speed tape readers. ELECTRONIC ENGINEERING CO. OF CALIF., AUTOMATION DIV., Box 58, Santa Ana, Calif. For copy:
CIRCLE 225 ON READER CARD

X-Y PLOTTER: This eight-page booklet gives information on the GP-30-DX-Y plotter which is able to plot to ±.002″ and repeats to ±.001″ over its 30″ x 30″ working surface. THE GERBER SCIENTIFIC INSTRUMENT CO., P. O. Box 305, Hartford, Conn. For copy:
CIRCLE 226 ON READER CARD

DIGITAL PATTERN GENERATOR: This bulletin contains information on applications, features, general description, specifications and optional equipment and accessories of the model B, DPG. CYBETRONICS, INC., 132 Calvary St., Waltham, Mass. For copy:
CIRCLE 227 ON READER CARD

10 MPPS DIGITAL CIRCUIT CARDS: This catalog contains information about the company and its products, particularly the G-series extended service digital circuit modules. ENGINEERED ELECTRONICS CO., 1441 East Chestnut Ave., Santa Ana, Calif. For copy:
CIRCLE 228 ON READER CARD

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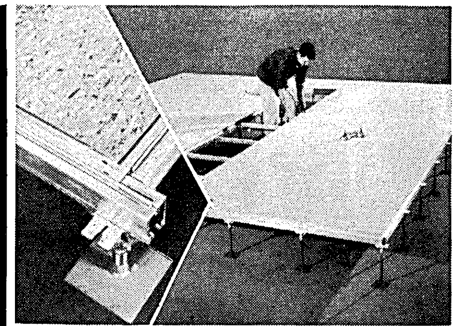

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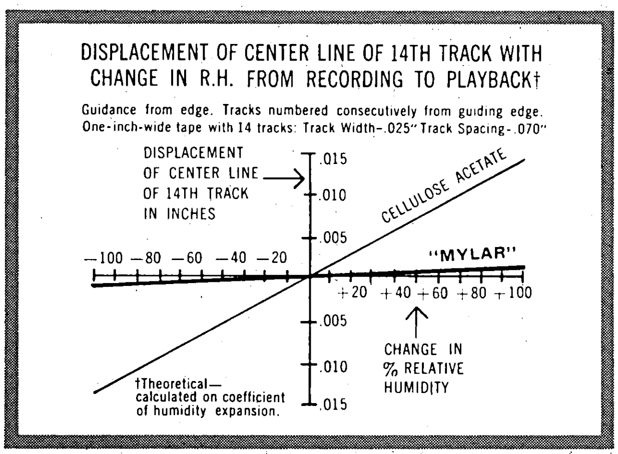

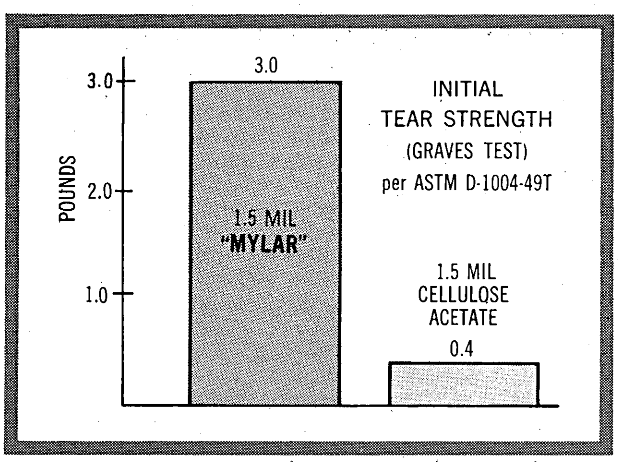

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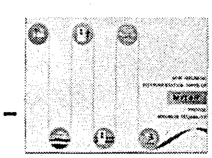

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DATAMATION'S FEATURE INDEX
JANUARY-JUNE, 1962

five-page systems classification by transmission speed and input/output media is presented.

Computer Transmission At Memory Speeds pg. 54
by Niel Clark
Results of tests in which all equipment in this CDC system which were operated for several hundred computer hours are given in addition to the programming sequence.

Microwave Transmission At North American pg. 59
by Kenneth R. Parsons
An operative description of a microwave hookup between three divisions of North American Aviation in Los Angeles tying together over 33 computer systems is presented.

Stock Broker Utilizes Real Time Data Transmission pg. 61
This illustrated article highlights the 1410 Brokerage Teleprocessing System, which has been installed by the brokerage house of Thomson and McKinnon.

Error Detection and Correction pg. 62
by R. G. Matteson
Illustrated explanations are given of an error correction system using decision feedback and forward-acting error correction.

APRIL

An Interview With Eckert and Mauchly pg. 25
by Harold Bergstein
This six-page transcript provides reflections on the birth of the computing industry, the existing software lag, and predictions for the future.

COBOL At Westinghouse pg. 31
by Arthur J. Whitmore
This paper presents the company's corporate policy with regard to the early implementation of COBOL.

Improving Debugging Efficiency pg. 33
by Edward C. Arbuckle and Emil J. Saxberg
The results of recent studies concerning the level of computer program-testing service are offered in this three-page presentation.

Joining Fortran Subprograms pg. 40
by Ascher Opler and Martin E. Hopkins
Features, problems and methods of subprogramming are described in this illustrated three-page article.

Pitfalls and Safeguards in Real-Time Digital Systems pg. 43
by W. A. Hosier
Part one of a two part feature includes topics on organization of a real time system, initial development, selection and design of central digital equipment and interface definition.

Computing Characteristics East vs. West pg. 48
by Ken Kolence
The pros and cons of computing's geographic sociology is highlighted in this one-page article.

MAY

A Computer Curriculum For The High School pg. 23
by George G. Heller
A large-scale experiment in which high school students in Montgomery County, Md., were tested on their ability to understand and use computers is described.

Computing In The University pg. 27
The findings of two statistical surveys concerning the employment of edp equipment in institutes of higher learning is presented.

Traffic Flow Simulation pg. 31
A description of an experimental program utilizing data processing and display equipment to simulate traffic flow in a major city is the subject of this three-page report.

The Language Proliferation pg. 34
by Christopher J. Shaw
A plea for language standardization is offered.

A New Home for ALGOL pg. 44
by Daniel D. McCracken
This report on the Rome Symposium on Symbolic Languages consists of news on ALGOL, some impressions of European computer conferences and a sketch of the International Computation Centre.

Finke, Fact and the Changing Face of Honeywell pg. 57
by Harold Bergstein
An interview with the president of the edp division of Honeywell points out the present posture of and projections for the company.

How To Market A Kludge pg. 63
by Oswald I. Orthmutt
A humorous depiction of the shrewd way to introduce and market new equipment.

Pitfalls and Safeguards In Real-Time Digital Systems pg. 68
by W. A. Hosier
The second article in a two-part series emphasizes the process and hazards of creating a working system program. Included are characteristics peculiar to real-time programming, and commentaries on design effort, form and content of the system program, assembly, testing, administrative monitoring and some contractual aspects.

JUNE

Medical Data Processing And Computer Automated Hospitals pg. 25
by Dr. Myrvin H. Ellestad, Charles J. Roach and Raymond B. Lake
A clinical view of the state-of-the-art includes problems related to computers in medicine and a plan for integrating a computer-based system in a hospital.

A View From The Bridge pg. 29
by H. R. J. Grosch
DATAMATION's contributing editor presents his views on the state-of-the-art in Europe.

ALGOL At Duke pg. 33
by Brenda Balch and Tom Gallie, Jr.
A progress report on the completion of an ALGOL compiler for the 7070 is presented. The status of the compiler and its format are given.

A Brief Guide To Hardware Rental pg. 36
This chart includes information on the contract term, hours usage before overtime, and overtime rate.

Let's Measure Our Own Performance pg. 37
by Robert L. Patrick
The need for stepping up the rate of training and establishment of performance measures is the topic of this article.

How To Maintain A Kludge pg. 40
by Austin O. Arthur
A third in the series of Kludge articles presents step-by-step rules for the upkeep of this equipment as well as the treatment of maintenance personnel.

Shoebox—A Voice Responsive Machine pg. 47
by W. C. Dersch
This four-page article presents the background and operation of an experimental, voice recognition device.

Information Processing For Military Command pg. 58
by Lee S. Christie and Marlin G. Kroger
This article deals with the problems of where computers should be used in command and control systems, analyzes the information processing needs of a military command, computers in decision making, research and development, and language standardization.

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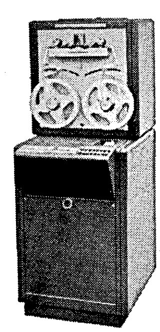
Modern business needs the speed, accuracy and freedom of the Dial-o-verter data transmission system. It takes your data on punched cards, magnetic tape, or paper tape, and transmits it around the country as fast as 2500 words per minute (25 times faster than conventional equipment). It uses the Bell System Data-Phone and the regular dial telephone network — even your private lines. Savings? Alert managements are using this high speed, error-free communications equipment in 30 cities right now to make vital data available almost instantly to branch offices, computer centers, warehouses, and production plants. And, most important, Dial-o-verter allows direct "talk" between punched cards, paper tape, and magnetic tape. No need for "mix-and-match" equipment. That's why so many leading corporations like Socony Mobil Oil Co., Mohasco Industries, Martin Co. and Canadian Pacific Railway Co., to name a few, have installed the Dial-o-verter system. For more information contact: Digitronics Corporation, Albertson, N. Y.



DIGITRONICS DIAL-O-VERTER

Takes the distance <u>out</u> of data processing

*Typical example. A Digitronics District Sales Manager will be happy to work out your savings.

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