May, 1966

computers and automation

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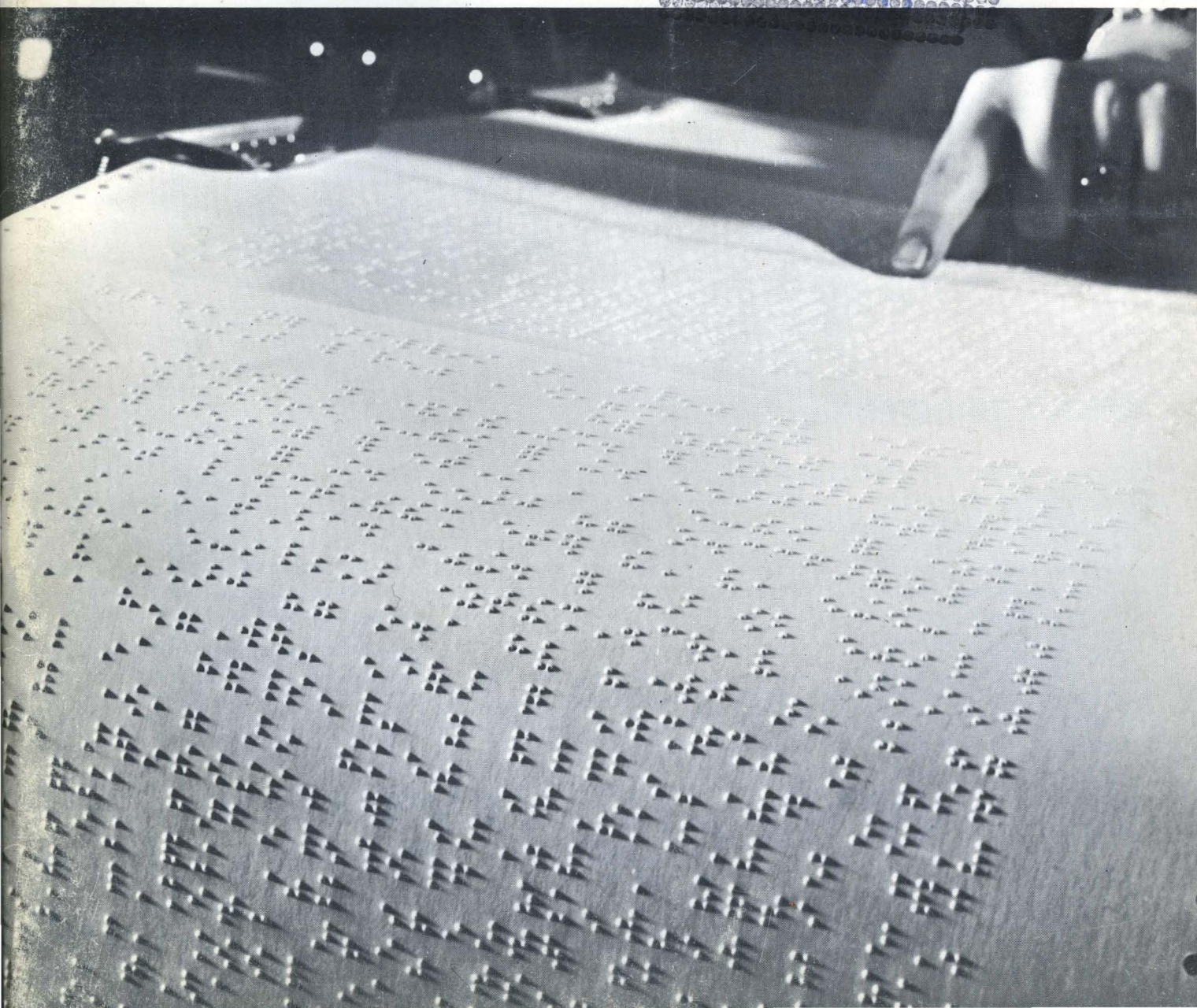

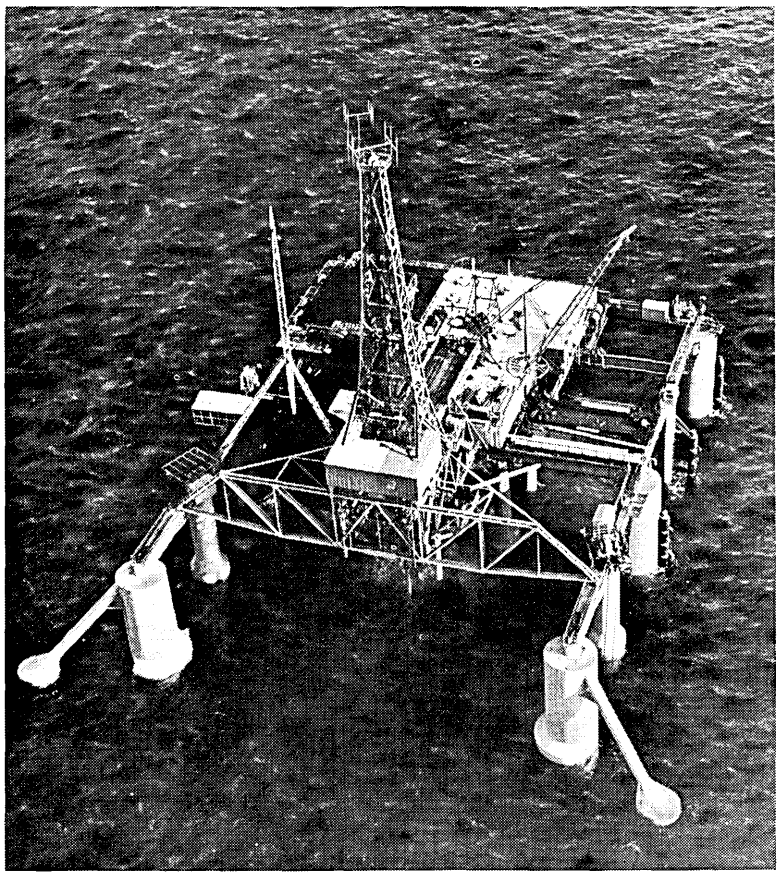

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Ocean Drilling & Exploration Company of New Orleans has engineers, 300 miles away, who have to know. Otherwise, supplies and decisions needed for daily drilling operations could be delayed, which might result in costly downtime.

Bell System Data-Phone* service is the vital link in the chain of communications.

The information flows from the nine offshore drilling rigs to the company's warehouse via radio, and on to headquarters in New Orleans over Data-Phone data sets.

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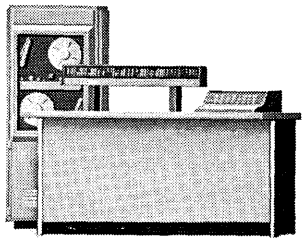
NCR



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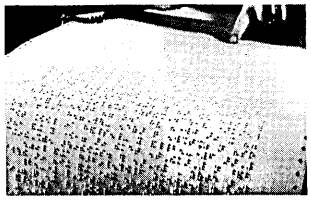
The front cover shows a Braille record for the blind to read, produced by a computer. For more information see page 45.



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In This Issue

Special Feature: Data Communications

In Every Issue

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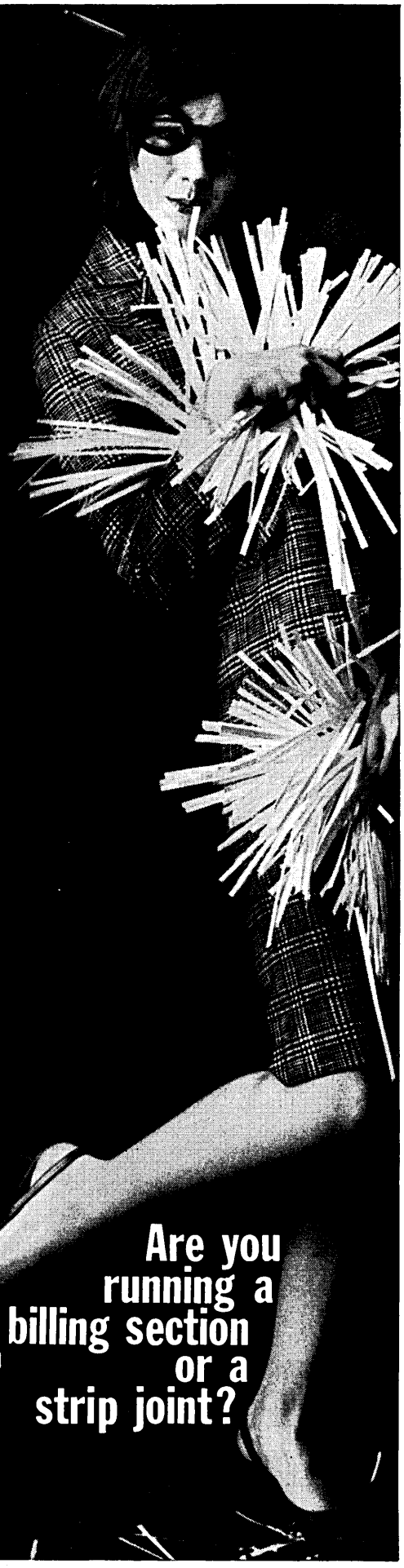


Are you running a billing section or a strip joint?

Only your data processors know for sure. Ask them what happens to those useless strips of paper that run between continuous tabulating cards. They'll show you overloaded trash cans; floors that would make even a litterbug cringe. To make matters worse, this daily strip routine wastes time and can put a real crimp in your processing operations.
In the long run you pay for this wastepaper. All that excess baggage costs you money. Perhaps it's time you were introduced to FORMSCARDS, the only continuous tabulating cards that have no wasteful medial strips. Every inch is workspace; and when you get what you pay for, that's good business. So cut out the strip in your office. Let FORMSCARDS help you keep it clean. Forms, Inc., Willow Grove, Penna. Phone: OLdfield 9-4000 Area Code 215.

MAN/COMPUTER INTERFACE

A few days ago, a friend of mine received the following response from a magazine publisher (names have been changed):

> Thank you for the subscription to ABC Magazine that you entered through XYZ Clearing House.
>
> To serve you in the most efficient way possible, we are converting our fulfillment service to one that employs the most modern automated computer available today.
>
> Because of this, delivery of your first issue may be delayed. You will of course receive the full term of the subscription you ordered.

In other words, "to serve you in the most efficient way possible . . . your first issue may be delayed" and, instead of starting your subscription when you wanted it, impliedly it may start late!

Is this a typical case? Is it necessary that the changeover from noncomputer methods to computer methods lead to distortion of customers' wants and delay in fulfilling them?

Recently I was talking with an able member of Project MAC at Mass. Inst. of Technology about the playing of games of skill with a computer. Among other things we discussed to some extent methods for translating a list of some 50 principles of strategy in chess into the problem-oriented computer language LISP. Examples of the principles are:

> Bring all your pieces to bear.
> Accumulate small advantages — in position, mobility, development, etc.
> Prefer lasting advantages to temporary ones.
> In a tournament, if you see a good move, look five minutes for a better one.
> Place your pieces if possible where they cannot be disturbed or removed.
> Develop first; attack afterwards.
> Attack only if based on a better position and a heavier force.
> Aim to effectively isolate the king.
> Beware of bait.

(If any reader would like a copy of the full strategy list, please designate 1 on the Readers' Service card.)

We agreed that it would take an enormous amount of effort to convert these principles, which many clever human chess players can understand and apply, into principles that a computer could understand and apply. In fact, we agreed that a good human chess-player would continue to beat a good computer program for playing chess, for a number of years — just because it would be much easier for him than the computer to apply strategic principles of this kind.

Is this a typical case? Is it necessary that it be very difficult to translate such concepts as these principles of strategy in chess, into computer language?

Both these cases are examples of the intellectual interface between men and computers, which as machines for handling information have very different equipment. Both these cases are examples of the hard work of changing operations and operation principles from a language and behavior which a human being understands into a language and behavior which a computer understands. For example, how do you tell a computer what is "bait"?

Is it necessary that the intellectual interface between men and computers be so hard to pass through?

Looked at historically, the intellectual barrier between men and computers is being broken more and more and more. In the long run, there is no doubt that the interface will be as easy to pass through as is the interface between man locomotion and motorized locomotion.

But in the short run there is a vast demand for study and work. One thing that would certainly help would be a dictionary of several thousand ideas expressed in words and propositions, each associated with the guidelines for converting that idea into problem-oriented computer programming languages. Of course, ALGOL, COBOL, and some similar languages have begun in this area. But it would be good to have something like a Roget's Thesaurus adapted for translation of human ideas into computer language.

Edmund C. Berkeley

EDITOR

COLLOQUIUM ON INFORMATION RETRIEVAL — THIRD ANNUAL NATIONAL COLLOQUIUM

A. W. Speakman, Publicity Chairman,
Colloquium on Information Retrieval
E. I. DuPont de Nemours & Co.
Wilmington, Del.

We would like to ask that you announce the program of the third annual National Colloquium on Information Retrieval, which is taking place at the University of Pennsylvania, Philadelphia, Pa., May 12 and 13, 1966. The program has only recently become available:

Theme: Information Retrieval — A Critical View

Rowena Swanson — Air Force, Office of Scientific Research Directorate of Information Sciences, "Information Networks, or, On Workers in the Hives"

H. P. Burnaugh — System Development Corp., "The BOLD (Bibliographic On-Line Display) System"

Earl G. Fossum — UNIVAC Engineering Center, "Associations and Thesaurus — Implicit Relationships"

Sally F. Dennis — International Business Machines Corp., "The Design and Testing of a Fully Automatic Indexing-Searching System for Documents Consisting of Expository Text"

William D. Mathews — Mass. Inst. of Technology, "The TIP Retrieval System at MIT"

David Lefkovitz — ICR, University of Pennsylvania, "CIDS System and Demonstration"

N. Raver — International Business Machines Corp., "Performance of IR Systems"

Alan M. Rees; Douglas G. Schultz — Western Reserve University, "Psychology and Information Retrieval Systems"

Marjorie R. Hyslop; H. David Chafe — American Society for Metals, "User Appraisal of Information System and Services through a Program of Joint Applied Research"

T. W. Olle — Control Data Corporation, Computer Division, "INFOL, A Language for Generalized Information Storage and Retrieval Applications"

Theodore H. Nelson — Vassar College, "Getting It Out of Our System"

M. E. Maron — Rand Corporation, "Relational Data File I: Design Philosophy"

R. Levien — Rand Corporation, "Relational Data File II: Implementation"

B. A. Marron; P. A. D. de Maine — U. S. Department of Commerce, National Bureau of Standards, "Storage and Retrieval of Information I. A General Method for Organizing and Searching Files"

THE COMPUTER AND THE ARTS

L. Mezei, Director
Computer Science Programs
York Univ.
Toronto 12, Ont., Canada

Mr. Leo S. Packer's welcome comments in the March 1966 issue of Computers and Automation move me to make a few further observations:

1) The Institute for Research in Human Behavior at the Indiana State University under the direction of Dr. Daniel C. Jordan has plans to use computers in the area of the visual arts.

2) An International Association for Empirical Aesthetics was formed last year in Paris, and is actively interested in the use of computers in research in this area.

3) Professor Sally Sedelow and Professor Floyd R. Horowitz of the University of Kansas have plans to publish a Journal of Computer Studies in the Humanities.

4) Mr. Edmund Bowles has published a list of current projects of computerized research in the humanities, in the Newsletter of the American Council of Learned Societies (Vol. XVI No. 5, May 1965). Included are: Anthropology and Archeology, History, Language and Literature, Music.

5) Dr. Gary Carlson of Brigham Young University has compiled a Bibliography of Literary Works in Machine Readable Form.

6) The Institute for Computer Research in the Humanities at New York University publishes a monthly newsletter. They also maintain an automated bibliography on "Writings on the Use of Computers in Music."

7) The response to my request about ongoing computer projects in the arts has been very good. I will soon be ready to publish the results.

8) The job of compiling bibliographies, lists of ongoing projects, and mailing lists of interested parties is onerous. A job of coordination is required, possibly by a different group for each subject. I plan to transmit the information I have received on music to the New York University Institute, on literature to Mr. Bowles or Professor Sedelow, and to concentrate personally on the visual arts. I would welcome any further items in this area.

9) There are three levels of activity in this area:

(i) artistic creation
(ii) study of the artistic process
(iii) scholarly research on the art product.

Most work involving computers is related only to the last category, although computers can be helpful in the first two as well.

10) One of the problems which is only slowly being solved is bringing the humanist scholar, the practicing artist, and the interested computer scientist together. The meetings the one goes to, the others do not; the magazines and journals the one sees, the others do not. Yet this is a most important area of computer application, not only because it is a humanistic endeavor, but also because it helps bridge C. P. Snow's "Two Cultures."

COMPUTING: ARCHIVES FOR ELECTRONIC COMPUTING

Springer-Verlag

Vienna, Austria

"Computing," which will start publication in early 1966, is an international journal whose bilingual character is expressed in its two subtitles: Archives for Electronic Computing — Archiv für Elektronisches Rechnen. It is the combined effort of outstanding authorities on both sides of the Atlantic. This journal will publish original, and possibly review, papers in German and English in the following fields:

- Numerical applications of computers: new methods of handling mathematical, physical, technical, chemical, and other problems by the use of computers, numerical procedures, algorithms, function tables, etc.
- Nonnumerical applications of computers: language translation, learning processes, teaching machines, data storage and retrieval, etc.
- Programming languages: translation of formulas, symbolic programming, coding, etc.
- Operations research: linear, nonlinear, and dynamic optimization, game theory, systems analysis, etc.
- Problems pertaining to: information theory, automatic control and data processing.

One volume of four issues will be published each year. The editors are: E. Bukovics, Vienna; R. Inziger, Vienna; W. Knödel, Stuttgart; and J. Menkes, Arlington. This journal is a continuation of the earlier "Zeitschrift für Moderne Rechentechnik und Automation." The publisher is Springer Verlag.

WORKSHOP IN MULTIPROGRAMMING

Joseph A. O'Brien
The Mitre Corporation
P.O. Box 208
Bedford, Mass. 01730

The Computer Programming Committee of the IEEE (Institute of Electrical and Electronics Engineers, Inc.) is planning to hold a Workshop on Multiprogramming in Eastern Pennsylvania in October, 1966. Attendance will be limited to approximately 30 people. Anyone interested in attending should send an abstract (100-200 words) of his proposed paper and a short summary of his current work in multiprogramming to me.

Many workers are currently engaged in various aspects of multiprogramming (interleaved or simultaneous execution of two or more programs by a single computer.) The much-publicized area of "Time-Sharing," for example, is a special case of multiprogramming in which additional time constraints are imposed. The purpose of this workshop is to promote a timely discussion and a critical assessment of the state-of-the-art by people actively engaged in the field. All discussions will be off the record since no proceedings of the workshop will be published.

AUSTRALIAN COMPUTER SOCIETY

The Australian Computer Society, formed on 1st January, 1966, by the amalgamation of five State Computer Societies (in A.C.T., N.S.W., Queensland, South Australia and Victoria), held its first Council Meeting in Canberra on 2nd February, 1966. Professor J. M. Bennett, of Sydney University, was elected President, Mr. T. Pearcey, of C.S.I.R.O., Vice-President, and Mr. R. W. Rutledge, of C.S.R., Honorary Secretary-Treasurer.

The total membership of the Society is approximately 1,500. It is hoped that other branches will soon be formed in other parts of Australia.

The plans of the Council include the holding of regular short symposia on specialized topics and the establishment of a Journal of high quality. A committee of the Council is also being set up to investigate the establishment of objective standards of professional competence, acceptable to industry, business and government, for persons seeking Australian Computer Society membership.

AUTOMATIC WAREHOUSING AND INVENTORY CONTROL — COMMENTS

Rauno Lindholm
Systems Manager
Kesko Oy (Finnish Retailers Wholesale Center)
Helsinki, Finland

I was extremely interested in Mr. R. Dallimonti's article, Automatic warehousing and inventory control, in your February issue of Computers and Automation.

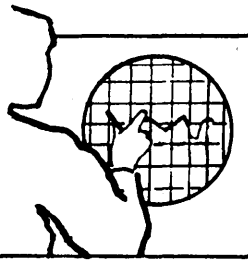
I, myself, am the Systems Manager of Kesko Oy, the largest wholesale company in Finland (with an annual turnover of appr. $400 million).

We have had a pre-invoicing computer system running here for more than two years now. This system covers 23 warehouses and utilizes off-line data transmission over telephone lines. The computer installation consists of two 40 K RCA 301 computers (44 million char. disc file, 12 magn. tapes, printer and paper tape reader) and two 20 K 301's (4 tape decks, paper tape reader and printer).

This January the company's new central warehouse was put into operation. This warehouse is designed to hold more than 30,000 various articles (total volume of the building is 11.2 million cu. feet) and to be capable of a daily despatching of up to 500 tons of goods. Listing and loading of goods are controlled by the computer by means of various lists used during the operation. The company also has plans now at an advanced stage for a total management information and comprehensive inventory control system.

Therefore the subject of Mr. Dallimonti's article was of particular interest to me.

(Please turn to page 52)



c & a MARKET REPORT

SIGMA 7 SIGNALS SDS'S EXPANSION INTO MARKET FOR MULTI-USE SYSTEMS

In mid-March Scientific Data Systems introduced its new Sigma 7 computer, the first unit in a series of real-time computer systems designed for "multi-usage" environments. Other members of the Sigma series (three smaller and perhaps one larger) are expected to be introduced starting next year.

Sigma 7, billed as a computer with three times the computation power of any machine in its price class, is a medium-sized system priced at $200,000 to $1 million, depending on the configuration. Initial deliveries are expected late this fall.

The motivation behind the design of Sigma 7 is well summarized by one of the system's planners, Jerry Mendelson, Manager, Product Planning at SDS; "Main frame performance levels (of third generation computers) have so far outstripped the capabilities of other elements of computer systems that the keynote of system design has become one word -- Multi-usage. Sigma's design objective is to permit any combination of real-time operation, time sharing, multiprogramming and multiprocessing within a single operating system and at a cost that makes such a system available to the broadest segment of the market".

Technical Features

The processing elements of Sigma 7 are primarily constructed of monolithic integrated circuits. Some of the key technical characteristics of the system are:

Memory Capacity:	524,288 8-bit bytes (4,096 to 131,072 words). Expandable in increments as low as 4K words into 32 different memory sizes.
Memory Cycle Time (Microseconds):	1.2 except 0.7 when access overlapping occurs.
Word Size:	32 bits (four 8-bit bytes plus parity
Registers:	16 - expandable in blocks of 16 to a total of 512
Major Instructions:	110; also optional floating point hardware.
Instruction Execution Speeds (Microseconds):	Load word 2.0 Multiply 4.9 Add 2.0 Divide 12.5
Maximum Number of External Priority Interrupts:	224
Special Features:	Overlapping, interleaving, mapping, multiple register blocks, memory protect, real time clocks, input/output processors, asynchronous operation, monolithic integrated circuits
Maximum Number of Input/Output Devices:	256

Multi-Usage Concept

Sigma 7 is essentially a memory-oriented system containing a central processor, one or more I/O processors, and one or more memory modules. SDS expects it to perform capably on a real-time basis in each of three main operating modes:

Multi-processing: simultaneous execution of one or more programs in a single computing system containing two or more processors, using a common memory pool.

Multi-programming: time-multiplexed operation of two or more independent programs in the same processor.

Time-sharing: on-line, interactive use of the processor and supporting software by separate users working at remote consoles.

For example, SDS foresees a Sigma 7 system processing matrix and inventory control problems on a batch basis while servicing at the same time scores of nationwide users at remote consoles in such a way that each thinks he has the complete attention of the computer.

For such real-time applications, a computer must be able to recognize and respond to external signals, preserve the current status of the system, and maintain control over all peripheral devices. Sigma 7 offers several advanced features to accomplish this. For example, when a new set of interrupt initiated events occur, Sigma 7 promptly stores the operating status of the current program, such as program address, current general register block, memory protection key, etc., in a 64-bit program status double word. A single instruction stores this word anywhere in memory and loads a new one to establish a new environment. This includes the assignment of a new block of 1632-bit general registers which serve as the accumulator and index registers for the new program being processed by the computer. Thus Sigma 7 can completely change its operating environment in the execution time of this one instruction: 6 microseconds.

Sigma 7 also offers three advanced techniques of memory operation: overlapping, interleaving, and mapping. Overlapping allows the computer to do calculations on data from one of its memory modules while sumultaneously performing other operations such as peripheral control in other memory modules.

Interleaving memory addresses permits Sigma 7 to distribute memory accesses among as many as four independent memory modules. Combined with overlapping, interleaving can almost double the effective access time of Sigma 7's memory.

Mapping provides a memory management feature critical in time-sharing operations. By mapping, the computer routes 512-word sections (pages) of each user's program into available portions of memory, no matter how scattered these may be. The mapping feature automatically adjusts addressing so that the program appears to the user as though it occupies a single contiguous block of memory. Mapping also allows the same program to flow in and out of memory many times, occupying different fragments each time.

Software

As one would expect, the multi-usage potential of SDS's new computer requires that it have substantially more software than any of the previous computers in the company's product line. For example, SDS's first computer, the 910, had only 4000 instructions in its complete operating software. Sigma 7 is expected to have some 80,000 instructions in its software when first delivered and eventually to have over 250,000 instructions in its software when all programming levels are available.

Four programming levels are being developed for the Sigma 7. The Stand Alone version is designed for minimum configurations that are used for a single function at a time. Emphasis at this level is placed on minimizing core storage requirements. A Basic level is designed for real-time operations concurrent with background general-purpose processing. The Batch level is designed for the typical production environment where jobs are being processed from a job queue. Universal level permits batch processing to proceed concurrently with interactive time-sharing operations.

Operating Systems include:

Basic Control Monitor: permits simultaneous operations of real-time foreground programs with general purpose background processing.

Batch Monitor: permits background and foreground operation simultaneously with concurrent I/O operations.

Universal Time-Sharing Monitor: supplements the batch monitor capabilities with automatic swapping to and from secondary storage, tertiary mass memory control, and tasking in a time-sharing environment.

Compilers for PL/I, the new programming language created by IBM for the 360, and for FORTRAN IV are being written for Sigma 7. Both these implementations will offer extended features for real-time and interactive computer use. Assemblers with Sigma 7 include both a basic symbolic assembly program as well as a meta-symbol assembler which provides for procedure and function handling within the basic assembly system.

Business software includes MANAGE, a system for data file organization, creation, processing and management. A report generator and a sort/merge package is also offered.

Peripheral Equipment

Peripheral equipment offered with Sigma 7 includes a keyboard printer, paper tape reader and punch, card readers and punches, random access disc file, 7 and 9 channel magnetic tape, 600 and 1000 line per minute printers, visual display units, and communications interface equipment.

Compatibility

Sigma 7 is not directly program compatible with any of SDS's previously announced computers nor with any competitive equipment. However, its bit structure, data codes, and floating point arithmetic are compatible with IBM 360 computers thereby allowing direct data interchange through a communications link. Also, source level program compatibility will exist with a competitive computer to the extent that Sigma 7's implementation of PL/I and FORTRAN IV is similar to that used with the other equipment.

Current Market Position

SDS currently has over 450 of its 900 series computer systems installed in some 20 countries. A large number of these are employed as "processor modules" in process control systems, event simulators, data reduction systems, character recognition units, etc....situations where a minimum amount of software support is required. Only a small percentage of SDS computers have been used as truly general-purpose problem-solvers. Largely because of this the Federal Government has accounted for 60-65% of SDS's computer sales in the past.

Sigma 7's multi-usage concept should allow SDS to compete in computer market areas with a considerably larger potential than those to which SDS has been confined in the past. SDS's President Max Palevsky expects that Sigma series sales will help push the value of SDS computer equipment shipped during 1970 to $200 million, an increase of four times over the $50 million shipped in '65. As such, Palevsky foresees SDS capturing 3% of the computer market by 1970 when he expects annual shipments for the industry to top $7 billion. SDS has shipped over $100 million worth of computers since its founding in 1961; at its current shipping rate it is accounting for approximately 2% of the annual volume in the industry.

SDS's strategy in introducing the higher end of the Sigma series at this time appears to be to garner the publicity and prestige associated with announcing a sophisticated computer system designed to serve users pioneering such advanced computer concepts as time-sharing. However the introduction of a Sigma 2 or Sigma 3 in the $25,000 to $100,000 price range will allow SDS to continue to participate in its traditional, and currently profitable, market areas.

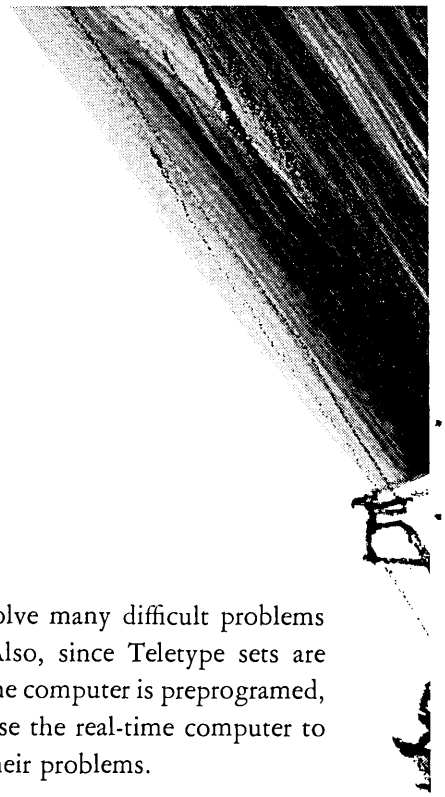
Prospects

SDS's success with the Sigma series will, we believe, depend on four factors: new mass random access storage devices, capable people, capable software, and adequate control on leasing ratios.

A critical requirement for a computer system offered in the market for multi-user time-sharing systems is adequate mass random access storage space. Currently SDS's only home-built disc file has a maximum storage capacity of only 8 million characters per unit ...hardly enough to handle 20 users in a time-sharing environment, not to speak of the 200 SDS claims its Sigma 7 processor can accommodate. Although SDS says IBM data cells and disc files can be hooked up to its system, such a configuration puts a large share of the value of the system in the hands of a competitor. SDS is currently developing its own mass storage system with a capacity of upwards of 100 million bytes.

(Please turn to page 28)

how to avoid waiting for computer time



This designer practically has a computer at his fingertips to help him solve tough engineering problems. Actually, he uses a Teletype Model 33 ASR (automatic send-receive) set to communicate on-line directly to a computer—even though it may be in another building or another city. A computer with real-time capabilities could be working on other engineering problems, as well as on a variety of administrative data—all at the same time, and all because of data communications.

Teletype Models 33 and 35 equipment provide communications with computers and other business machines, because they use the same permutation code (ASCII) approved by the American Standards Association for information interchange. And, the 4-row keyboard of this equipment makes it easy for anyone to use since it is similar to that of an ordinary typewriter.

Solves Problems In Minutes A major auto manufacturer uses Teletype machines to put engineers in touch with a real-time computer on a time-sharing basis. This not only simplifies the solution of complex engineering problems, but enables engineers to retrieve information stored in the computer's 2-million word memory within microseconds.

Their engineering vice president reports this has helped cut the time required to solve many difficult problems from weeks to minutes. Also, since Teletype sets are relatively inexpensive and the computer is preprogramed, the engineers are able to use the real-time computer to speed up solutions to all their problems.

Data Communications Capabilities Many companies are taking advantage of the data communications capabilities of Teletype machines to put them in contact with data processing centers.

For instance, a New England data processing center is sharing time on its computer with 22 companies ranging from a clothing manufacturer to a liquor distributor. A typical transaction consists of a company transmitting by Teletype set to the computer center its identification number, stock number of an ordered material, and the customer delivery date. The computer processes the information, and sends back by Teletype machine the invoice description, noting the current inventory, as well as the customer credit rating.

New Brochure Available These capabilities of Teletype Models 33 and 35 page printers and automatic send-receive sets are why they are made for the Bell System and others who require reliable communications at the lowest possible cost. Additional applications on how Teletype equipment helps solve other business information problems are contained in our new brochure, "WHAT DATA COMMUNICATIONS CAN DO FOR YOU." Write Teletype Corporation, Dept. 88E, 5555 Touhy Avenue, Skokie, Illinois 60076.

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John F. Macri, Manager
Data Communications Systems
RCA Electronic Data Processing
Radio Corporation of America
Camden, N. J.

"Virtually every major organization in industry, in the Federal, state, and local governments, and in the military, have applications that require the integration of the data-processing function and the communication function."

Computer manufacturers, their customers, and the general population at large are almost wholly dependent upon the common carriers — short and long-distance telephone lines — insofar as interstate and intrastate voice and record communication facilities are concerned.

Private microwave systems are available from many manufacturers, including the Radio Corporation of America, but there are presently only a few companies with a sufficient concentration of communication traffic along a specific route to justify the cost of these systems.

The most frequently used communication facilities, and the traffic conditions to which they are best suited, are usually classified as being either Telegraph or Voice Grade quality. The basic difference in the two types of services is in the frequency range of the circuits which are utilized. Telegraph circuits use a bandwidth of about 170 cycles and normally operate with 5-level codes at transmission speeds of 6, 7.5, or 10 characters per second. Voice grade circuits use a bandwidth of approximately 3000 cycles and operate with 5, 6, 7 or 8-level codes at transmission speeds ranging from 10 to 300 characters per second.

Telegraph

This service provides for written communication between two or more points via common carrier telegraph-grade circuits. A telegraph-grade circuit can be provided by using a standard telegraph transmission line or by subdividing a telephone circuit, divided into approximately 12 telegraph circuits, depending on the desired transmission speed.

Private (or Leased) Line Service

Private (or Leased) Line Service provides a user with unlimited use of a circuit during a designated time period based on a fixed monthly charge. Private Line Telegraph Service is offered almost exclusively by the Bell System and the Western Union Telegraph Company. Although Private Line Telegraph circuits can be laid out in a variety of patterns, all circuits fall into one of two categories:

Point-to-Point — The circuit consists of only two terminal locations with transmission flow subject to the capabilities of the devices installed.

Multipoint — The circuit has three or more stations attached to it. Unless some type of station selection equipment is used, each location will receive all traffic placed on the circuit.

These networks are normally best suited for use by customers who have a *large volume of traffic concentrated between specific points.*

Dial Service

Public Subscription Service (dial up) is offered by both the Bell System and Western Union. The Bell System offers TWX (Teletypewriter Exchange Service — TWX) and Western Union provides TELEX Service. Each service provides its users with two-way communication with any other subscriber to this service on a 24-hour-a-day, 7-day-a-week basis. Calls on TWX and TELEX networks are paid for on a per-use basis plus a minimal monthly charge.

These networks are normally best suited for use by customers who have *wide-spread low-volume traffic requirements.*

Voice Grade

Long Distance Telephone Service provides two-way conversation with every other exchange telephone in the United States or Canada. It is available 24 hours a day, 7 days a week. Since calls are paid for on per-use basis by distance, its cost will vary with usage. Long Distance service is the most economical and efficient way a customer has for sending a *low volume over a wide area of the country.*

Direct Distance Dialing (DDD), now installed in many locations, provides long distance service without the intervention of an operator. This is of great significance to those interested in data transmission because the widely dispersed telephone network can be used to transmit data virtually anywhere in the United States.

Wide Area Telephone Service (WATS) is similar to Long Distance in that it provides two-way conversation between a large number of telephones. However, it has a more economical rate treatment than Long Distance for larger volumes. Wide Area Telephone Service permits a customer to contact a large number of telephones within a specified area.

There are two types of rate treatments for WATS: Measured service for those customers whose requirement is limited to 15 hours a month, and full time service which is unlimited at a fixed monthly rate. The rate also has a flexibility in that service may be purchased in given areas of the country based on the customer's location and call distribution.

WATS is a one-way service; that is, only calls placed by the originating station to the area subscribed to are included in the rate. Incoming calls are not received on WATS lines.

WATS service is basically for the customer who has *widespread large volume of outgoing traffic.*

Private Line Service

Private Line Telephone Service (PLT) provides two-way communication between two or more points. The operation of this service is limited to those points that are connected to the Private Line. It is used when a customer has a large volume of traffic between certain specific locations. This service is provided on a 24-hour-a-day, 7-day-a-week basis, at a given monthly charge based on distance.

Private Line Service is an economical means of handling a *large volume of traffic concentrated between specific points.*

TELPAK is provided to fulfill the requirements for *large capacity communication* facilities *between specific points.* Communication paths of various sizes or widths may be provided as a single wideband channel for high-speed data or facsimile transmission or subdivided, into smaller channels, for telephone, teletypewriter or low-speed data services.

Channels are furnished on a two-point or multi-point basis, 24 hours per day, 7 days a week. Monthly charges are based on the size of the TELPAK channel and the distance involved. Terminal charges are also applied at each location for each individual service in the TELPAK channel.

TELPAK A Channel has a maximum equivalent of 12 telephone grade channels. When used as a single wideband channel the entire equivalent of the 12 telephone channels is utilized. (Bandwidth-48 KC)

TELPAK B Channel has a maximum equivalent of 24 telephone grade channels. Presently, there are no known requirements for a wideband channel equivalent to the entire TELPAK B channel. (Bandwidth-96 KC)

TELPAK C Channel has a maximum equivalent of 60 telephone grade channels. When used as a single wideband channel, the entire equivalent of the 60 telephone channels is utilized. (Bandwidth-240 KC)

TELPAK D Channel has a maximum equivalent of 240 telephone grade channels. When used as a single wideband channel the equivalent of 228 telephone channels are utilized. (Bandwidth-960 KC)

DATA-PHONE Service provides for the transmission of data or text over private line facilities, the regular telephone exchange network (Long Distance Service) as well as on Wide Area Telephone Service facilities.

The device necessary to connect the Bell System and other type business machines to the telephone channel is called a DATA-PHONE data set. The telephone accepts sound waves from the human user, converts these to electrical signals for transmission and reconverts the electrical signal back to sound at the far end. Similarly, the DATA-PHONE accepts data signals from business machines, converts them to appropriate tones and delivers data signals to the business machine at the distant location.

A series of DATA-PHONE data sets are available to accommodate a wide range of business machines which include variations in speed, code structure, and transmission technique.

Industry Acceptance

These kinds of record communication services were accepted by industry because of their relatively low cost, ease of installation and use, general availability, and minimal special training requirements. A study of the use of these services in industry reveals a wide distribution with tremendous concentrations in the giants of industry.

However, many users have recognized the fact that only the integration of the communication and data processing functions would provide the responsiveness desirable in existing applications and necessary in many proposed applications.

These users exerted considerable pressure on computer manufacturers to tie these services and systems provided by common carriers directly into computers. While technically feasible, this presented numerous problems. The communications industry had its own terminal devices which did not necessarily interface with data processing equipment. Each of the computer manufacturers also offered communication terminals which included significant differences in code construction, transmission techniques and channel coordination procedures. In addition, the systems were human operated and error prone, which would cause frequent interruptions when connected directly to a computer unless error detecting and correcting measures were incorporated.

These factors led to expedient, expensive hardware arrangements at the computer in order to achieve the necessary degree of accuracy in handling data transmissions. This was true throughout the EDP industry.

Impact on Computer Manufacturers Planning

Once data transmission was put into its proper perspective, the computer manufacturer had to analyze user-application requirements to determine the types of service and terminals to be included in the system. This included cost performance analysis for a variety of applications and considered communication facilities as well as computer and terminal equipment.

It was then possible to establish guidelines for the systematic integration of selected services and terminals during the planning of the computer.

In many cases, this meant that the computer manufacturer had two tasks: he had to tie in his own communications terminals to a common carrier facility through appropriate data sets; and he had to provide also for common carriers' and competitive computer manufacturers' data communication terminals.

This factor was recognized at the outset in planning for the RCA 3301 computer system as well as for the Spectra 70 series of computer systems RCA recently announced. In the Spectra 70 systems, as an example, requirements of 30 communications services and terminals were included as elements of the computer system. These were not adjuncts to the computer, but rather inherent parts of the communication system which were incorporated at the time the basic processor was being conceived.

These systems also included remote visual display devices and several new random-access file equipments to improve system responsiveness and increase control file storage capacity (up to 5 billion characters). This advanced planning offered increased systems flexibility and improved efficiency for users requiring an integrated computer-communications system.

Areas of Application

Virtually every major organization in industry, in the Federal, state and local governments, and in the military, have applications that require the integration of the data-processing function and the communication function. The applications will often combine many types of communication services with a wide range of communication terminals which are provided by numerous manufacturers. The selection of the communication service and communication terminal for the various locations within the system is based on factors such as functions to be performed, traffic requirements, geographic considerations, and economic justification.

A review of some of these applications follows, noting pay-off areas, use of recently announced communication terminals, and their scope:

Airlines — The airlines, traditionally pioneers for new and more rapid communications, have installed numerous flight-reservation systems. These systems provide reservation personnel in offices throughout the country with direct access to central files containing currently updated flight-status information. Many airlines are including visual display devices as communication terminals to improve the accuracy and system responsiveness. The industry, in addition to increasing the number of such systems, is also expanding the scope of these systems. Plans call for including the distribution of message traffic between stations and offices of the user airline as well as those of competitive airlines.

Banking — The banking industry has installed numerous on-line savings-bank systems which provide tellers at remote branches with direct access to central office files containing customer account information. The banking industry is extending these systems to demand-deposit accounting and centralized bookkeeping. These systems will take full advantage of special devices and audio-response equipment to minimize the costs of communications terminals. The availability of low-cost terminals will extend greatly the size of these systems. It is now feasible to tie many small businesses directly to a central-processor system so that functions such as customer billing can be accomplished. This type of service may eventually be extended to individuals, greatly reducing the need for associated paper work and check writing.

Insurance — The Casualty Insurance Industry is in the process of installing systems to perform the function of on-the-spot claim adjustment. These systems will provide claim adjusters throughout the country with direct access to centrally located files containing information about customers' policies; for example, they will operate in the following way:

> An insured motorist is involved in an accident (anywhere in the U. S.). He contacts his insurance company claim adjuster in that area. The claim adjuster makes a direct interrogation via a communication link into the central file to ascertain policy status and coverage. With this information, he proceeds to the scene of the accident and makes immediate adjustment.

Some of the larger insurance companies anticipate yearly savings in the millions of dollars made possible by the reduction of paperwork and the dollar value of claim adjustments.

Many companies prefer visual display terminals as the remote communications terminal to be used by claim adjusters throughout the country. These devices offer advantages in flexibility, accuracy, and high transmission speed. Input information can be visually verified before transmission and responses include display of the complete policy information. These systems will be nationwide in scope.

The insurance industry also is installing systems to provide for remitting premium payments. These systems will link branch offices throughout the country to a central processing center. The processing center prepares customer bills which include a machine-readable stub. Customers send remittances and the machine readable stubs to their local offices. The local office using machine readable stub transmits the information to the central processing center. These systems will improve customer service, and reduce costs by providing increased responsiveness and eliminating manual entry of remittance information. Nationwide in scope, the systems will link as many as a thousand branch offices to the processing center.

Manufacturing — This industry has installed numerous systems to provide status on customer orders, inventory availability, etc. These systems often include data-gathering equipment to improve the responsiveness of the system and to reduce errors in input data. The automotive industry is installing systems associated with car warranty. The systems will link the particular manufacturer's service centers to the manufacturer while the warranties continue in force for the cars that have been sold. Visual display terminals will be utilized at each service center to permit interrogation to the central file and a visual display of the desired warranty record.

Military — Many systems have been installed, the most comprehensive of these being AUTODIN (Automatic Digital Information Network). AUTODIN is a high-speed data-transmission-and-switching network involving high capacity telegraph and communications which link remote transmission stations to automatic switching facilities. The switching centers carry out military communications among members of the network by acting as "clearing houses" for messages on a priority basis. Subscribers can communicate with each other despite differences in their native codes, formats, speeds, and control and operational requirements. The present network includes over 350 subscriber locations (military and commercial) such as the Defense Industrial Supply Agency (DISA) in Philadelphia, and nine switching centers. Eventually the system will include over 2000 subscribers and 10 additional overseas switching centers.

The system utilizes FIELDATA eight level code and a sophisticated procedure for channel coordination.

Many subscribers have a requirement to link their data processing systems on-line to the AUTODIN switching centers. Noteworthy is the Defense Industrial Supply Agency which has doubled input speed by linking the data processing system on-line to the AUTODIN system.

Government — Federal, State and Municipal governments have installed many systems in such areas as Security Employment, Traffic Control, Motor Vehicle Bureau and Air Pollution.

The Air Pollution systems provide enforcement officers with a communication link to a central processor file containing records on thousands of commercial and industrial concerns. Areas requiring investigation are indicated by air monitoring devices located throughout the area linked directly into the processor, or by telephone complaints to clerks who enter the information into the processor. The processor interrogates the file and retrieves any available information and sends it to a dispatch clerk who directs the appropriate air pollution enforcement officer patrol car. The officer investigates the complaint and transmits his findings to the processing center.

The processor records the findings and produces the necessary follow-up including the issuance of violation notices. The system will include visual display devices which will be utilized by the system director, dispatch clerks and control clerks. The system will reduce the time of processing a complaint from the present several days to hours.

(Please turn to page 50)

REDUCE YOUR ANALOG GRAPHICAL DATA DIRECTLY TO 7-CHANNEL, 556 BPI, COMPUTER-COMPATIBLE MAGNETIC TAPE WITH THE CALMA MODEL 302 DIGITIZER

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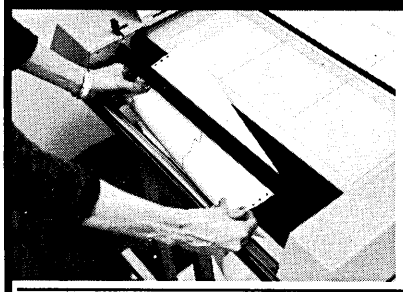
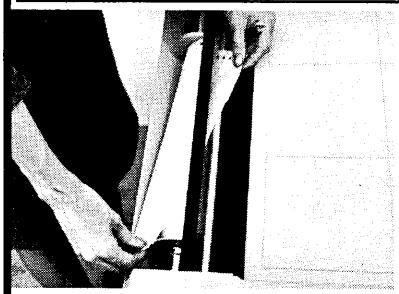
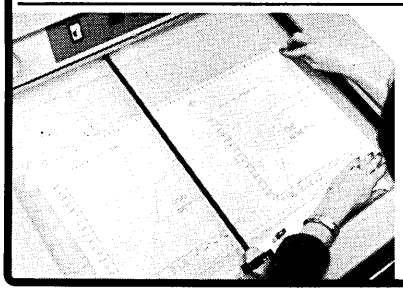


Fanfold Charts

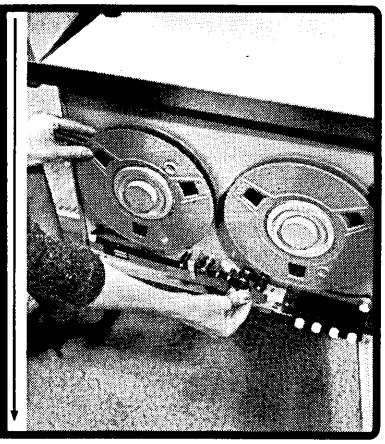


Rolled Plots

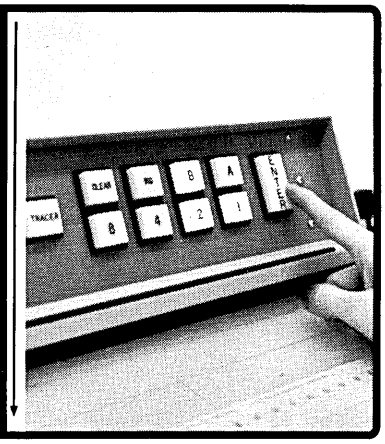


Sheet Data

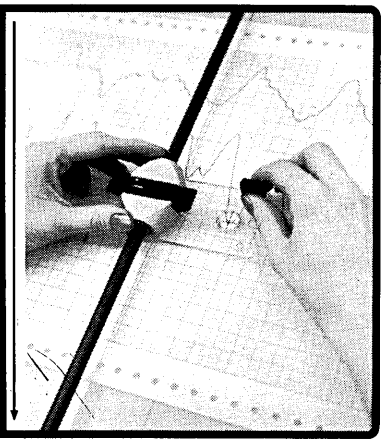
2. Load The Output Tape



3. Enter Identifiers



4. Manually Trace The Data Curve With The Low-Mass, Low-Friction Stylus



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A DATA COMMUNICATIONS CONTROLLER: SOME DESIRABLE FEATURES

Dennis W. McGee
Communications Specialist
Information Systems Marketing Operation
General Electric Company
Phoenix, Arizona

"A present-day communications controller can significantly improve the performance of the central processor per character of thruput."

In a short period of time, business, education, industry and government have jumped from batch-processing and management reports which were historical in nature, to closely-integrated data communications/processing facilities which are capable of furnishing up-to-the-minute information for current management decision-making and control.

The quick advance into total management information systems has also tended toward placing an added burden on the already overloaded central computer, which is often asked to handle data communications activities as well.

To reduce the added demands on the computer — and the cost-per-character of computing — more efficient means of data-communications control have evolved.

This article will describe some of the current ways computers are connected to the communications lines, some of the procedures and line disciplines which must be followed, and will bring to light some features in a communications controller which can reduce the computer overhead, thereby providing more computing time per character throughput and greater available spare time.

One of the first commercial communications controllers was a single-channel device with multiple channels to remote terminals. Upon command from the host computer the controller examined repeatedly all of the communication lines, searching for a *request access* character. Upon detecting this character, the scan process stopped, the computer was notified, thru a program interrupt, of the access request and on which line it occurred. The controller then entered a *rest state* awaiting further command from the computer.

If the computer desired input from the channel, a command to go ahead was given. The controller then signalled a "go-ahead" to the requesting terminal, and entered a "receive state" awaiting data from the terminal. All input data from the channel was stored in the memory of the computer, one character per memory word, until the sending terminal ceased transmission. If the input data exceeded the specified memory area, an interrupt was given to the central processor, which next assigned a new memory area for the controller.

After the activity finished on a line, the computer issued another *scan* command and the process of *scan, lock-on, receive* and *transmit* continued.

Contemporary Communications Controllers

Communications controllers of today can terminate more lines, with a greater variety of speeds and codes, and can achieve simultaneous input and output. The precise command sequence requirement of the earlier controller has thereby been eliminated.

Many other refinements have been added, such as: hardware *end-of-message* (EOM) detection, *start-of-text* (SOT) detection, *synch character recognition, parity checking and generation, open-line* detection, *idle character* discards, and so forth.

There is one striking similarity between the communications controllers of today and the earlier controller mentioned previously. *All of the trivial control, testing and decision must reside in, and be performed by the host computer.*

Message-Switching/Time-Sharing Environment

Today, message-switching is becoming more thoroughly integrated into the data processing world. Efficiencies gained in this area will improve total system capacity.

A typical message-switching system usually consists of a number of communication lines with multiple Teletype stations on each line. The controlling computer center polls periodically all of the stations on each line to invite new messages into the system, and, after receiving each message, routes it to stations specified in the message. The computer selects the appropriate line and addresses the correct station, after first sending a "selection" message with a call direction code (CDC), to assure that the station is operating correctly.

In polling to invite traffic, a "poll message" is sent which selects a specific terminal and asks if the station has traffic to send. Upon completion of the transmission of the poll pattern, the computer must examine the same line to look for an "answerback."

An answerback can be one of three types: *traffic* (an input message), *no answerback* (equipment malfunction) or it can be a *no traffic* response, in which case the computer may or may not poll the next station of the line.

In looking for an answerback, the computer must establish a "time-strobe" in order to correctly detect a valid answerback. The answerback character should arrive at the computer no sooner than X milliseconds, and no later than Y milliseconds, after sending of the poll message is completed. The arrival of an answerback prior to X milliseconds would indicate that it probably did not originate at

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He joined General Electric in 1959 as a quality control technician in the Computer Department, specializing in the testing, debugging and maintenance of computer systems. As an engineering programmer, he handled logic design and software for the first Datanet-30® data communications processor. Later, as a communications analyst he designed and implemented real-time data communications systems for various customer applications.

McGee attended Phoenix College; he is the recipient of a G. E. management award for outstanding competence in design and implementation of a complex data communications system.

the selected terminal, thus pointing to an error. Any or all of the multiple lines in any given message-switching system may be polled at any instant. Therefore, a separate "clock" (containing the expected answerback arrival time) must be maintained for each pollable line.

If a communications controller can interrupt its computer on an end-of-message character only, then some portion of the resident software must periodically examine each and every line to see if there is or is not a character present.

Even when traffic has started into the system on a line, the software must continue to perform this task, since a jammed tape reader or faulty communication line can cause a halt in transmission without an EOM signal. If this occurs, the input processing program, which is waiting for a sufficiently large amount of text or an EOM, would not be aware of the error condition.

On transmission outbound from computer to terminals, the same type of answerback clocking must be performed. After the computer has sent the "selection message", in most systems, it must also look for an answerback. Again, the answerback must fall between the time limits, or an error condition is indicated.

This does not attempt to cover all conditions which must be timed or all the disciplines to be considered. For example, very simple functions requiring additional computer overhead are the timing delays following mechanical action at the terminals. On numerous Teletype systems, form-feed Teletype units are used, which, when given the control characters to *skip-to-top-of-form* (vertical tab) *skip-to-position* (horizontal tab), must also be given a delay or interruption in transmission until the mechanical action is completed. In order to do this, the computer must examine for these control character sequences, all data to be output, and insert the appropriate number of null characters for the delay.

Several communications processors in use today, do not employ communications controllers. Rather, the computer periodically services the communications line buffers at a rate which is faster than the filling (or emptying) rate of the communications line. On a computer of this type it is relatively simple to establish line clocks, since the time of every computer service of the line buffers will approximate one bit or character time.

The ability to insert delay characters following a form or tabulation control is fairly simple, since the processor is passing a character at a time to the line buffer unit and can easily enter a *delay state* for the correct period of time.

Because of the computer time occupied in accumulating and distributing each character, the ease of implementing line clocks and tabulation delays in a computer of this type is gained at the expense of increased overhead.

With the advent of the highly interactive time-sharing systems, and their accompanying quick response time, the criteria for an efficient communications controller changes.

In the message-switching environment, the system is oriented to unit messages; little if any computer processing of the input data has to be done following the polling/selection until there either is an end-of-message signal or until enough data has been put in to warrant processing.

In the time-sharing mode of operation, in order to keep the waiting time to a minimum for all users, the central computer system must react immediately to single character inputs. In some instances, the response time must be within one character time; otherwise the system will have to pay the penalty of additional editing and compression passes after the data has been input. Some of these trivial responses which place severe time restraints on the system are the *backspace* function, the *delete line* function, *stop* or *abort, status, time used,* and the like.

Many systems include mixtures of terminals such as, Teletype Models 28, 35, and 37 or their equivalent and CRT devices such as Datanet-760*, which have differing code sets. Usually, for the purpose of system uniformity and to provide more efficient storage utilization, all data is converted to a standard character set for processing, and converted back to the original character set when the data is to be output.

Let us now look at the type of hardware which can be most helpful in reducing the central computing system overhead associated with the communication lines and terminals.

Description of a Multi-Line Controller

Today's more advanced data communications controller, the Multi-Line Controller (MLC), should have the following features:

- Software accessible timing clocks for each line maintained by the MLC.
- Ability to insert variable-size strings of characters into the message stream when control characters have been detected.
- Notification to the computer when any selected character has been transmitted by a terminal.
- Automatic subroutine call or link on any input character or status change.
- Automatic code conversion from and to any character set.
- Character packing into computer words on receive and unpacking on transmit.
- Automatic *character delete* (backspace), *string delete* (delete line) or ignore.
- Two types of notification to the central processor, one for functions requiring immediate attention and the other for less important functions which can be handled on a periodic basis.
- Automatic chaining or linking of all input and output message blocks.

Logically, the MLC consists of three major areas: the channel interface, the common control logic, and the communications line buffers. The channel interface connects to the input/output channel of the processor and provides a path for data and command interchange between the central processor and the MLC. The common control provides a means of multiplexing data to and from the line buffers, executes commands from the processor with regard to the line buffers, and generally controls the operation of the buffers.

*DATANET, Reg. Trademark of The General Electric Co.

A general description of the sequence followed by the MLC in carrying out its function follows. (The receive cycle was arbitrarily chosen; the transmit cycle is essentially the inverse of receive.)

The MLC is initialized by means of a command from the central processor placing a specific channel in the receive mode. When this is done, no further action is required until data from a remote terminal begins coming in to that channel. The buffer, with its storage, will convert the received bit stream to a character. When a character is assembled, the buffer will request service from the common control area.

When the service request is granted, the buffer will present the table number of a character control table (CCT) plus the received character. This combination becomes the CCT address as shown in Fig. 1.

This address will be used by the control logic to address memory and the contents of that memory location will be read by the MLC. The low order bit positions of the accessed CCT will be stored in memory in place of the actual received character. Thus, automatic code conversion is accomplished. In order to store the converted character in memory, the MLC will access a Data Control Word (DCW) associated with the channel. Using the DCW as an address and character count, the converted character will be stored in the proper position and location. This will complete the normal service routine for a character.

Departures are possible at several points in the normal cycle. The first of these is when the converted character is received from memory by the MLC. If the converted character has a control function, a bit indicating the action to be taken is set in the word containing the converted character, such as *ignore* or *backspace*. If the DCW, when received from memory, indicates that the memory area is either full or empty, the MLC will access memory a second time to obtain the next DCW, and use it as described above. If the converted character is a control character and it indicates an end-of-message, the MLC will store status and generate an interrupt.

The one significant difference between the transmit cycle and the receive is the insert function. This is described later.

Program Interrupt

The MLC will issue a program interrupt to the central processor when program attention is required. Status storage will be in one of two circular queues, an Immediate Attention Queue (IAQ) and a Periodic Attention Queue (PAQ). A program interrupt will be issued each time an entry is stored in the IAQ, while an IAQ status storage and a program interrupt will be issued at 0.5 second intervals if a status entry has been stored in the PAQ within the past 0.5 seconds.

When stored, these status words will contain the line number associated with the status storage, a pointer to first block of the message if this status storage was caused by an EOM, notification of character and/or block parity error, a flag to indicate that a backspace character requires backspacing out of presently assigned input message area, notification of line-clock time-out, and status of the line, such as *phone ring*, or *carrier on*. Individual input characters can cause interrupt with a link to a specific subroutine or program, thus eliminating the need for the software to scan all data for specific characters.

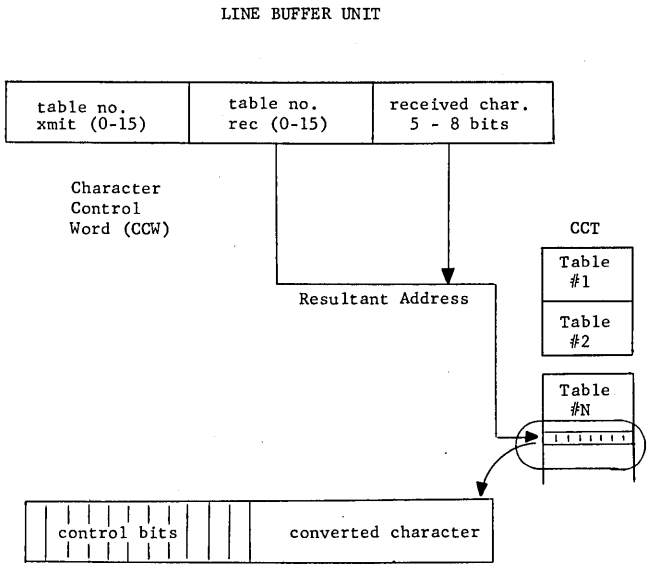


Figure 1

Character Control Tables (CCT)

The CCT is used for code conversion and for MLC initiation of defined functions. An entry in a table is addressed by the base address of the memory area containing the tables, a table number specified in the character control word (CCW) of the line buffer unit, and the character which is being converted.

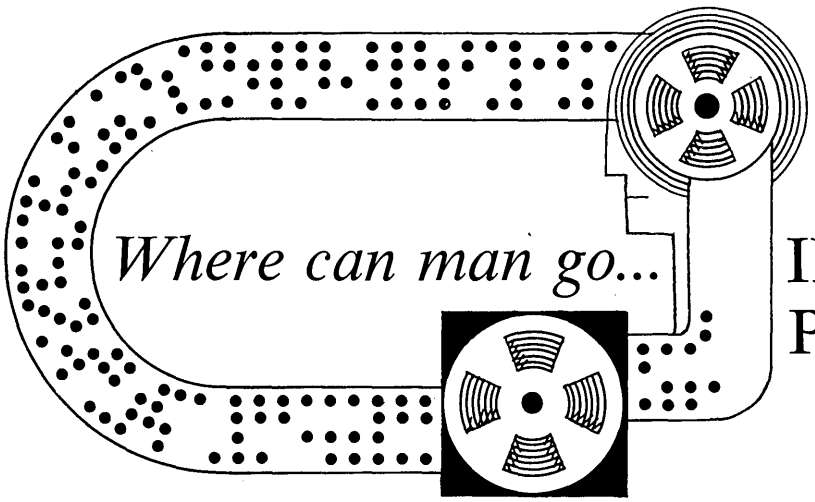
Some of the functions which can be specified in the CCT are:

- Insert bit — all other control bits except the EOM bit are ignored. A string of characters is inserted in the character stream, using the low order bits of the extracted word from the CCT as the number of characters and the starting address of the string of characters to be inserted. At the completion of this insertion the next character in the normal data stream will be transmitted unless the EOM bit was set along with the *insert* bit. In that case, EOM action will take place after the last insertion character has been transmitted.
- EOM bit — When set, the next message area will be used for subsequent characters. Status will be stored in the IAQ.
- Status bit — The MLC will store status in the interrupt queue as defined by the PAQ/IAQ bit. The least significant bits of the converted character are stored in the link field of the PAQ/IAQ word along with the line number causing the status storage.
- PAQ/IAQ bit — This bit defines the interrupt queue into which status is stored when the status bit is set.
- Suppress bit — When this bit is set, the converted character will not be transmitted or stored in memory.
- Backspace Receive — The MLC will decrement the DCW by one character position; however, if this requires changing message areas, a status will be stored as defined by the PAQ/IAQ bit.
- CCW bit — This bit, when set, will cause the MLC to access the next full word in the message area. This word will then be loaded into the line buffer unit to become the new CCW. This thereby changes the transmit and receive table numbers.
- Start/Stop Clock Bits — When set, these bits start and/or stop the line clock maintained by the line buffer unit.

Line Buffer Units

Each line buffer unit, in addition to its storage for buffering data to and from the communications line, contains the

(Please turn to page 50)



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TELECOMMUNICATIONS AND SUPERVISORY CONTROL PROGRAMS

Robert S. Dines
Product Administrator, Programming Systems
Data Processing Div.
International Business Machines Corp.
White Plains, N. Y.

"The supervisory control program integrates computer equipment, programming, remote stations, and operations so that these elements — which used to be thought of as separate entities — are now one."

The supervisory control program for computers sprang essentially from two developments, in the evolution of electronic data processing.

The original impetus came from engineering-oriented data processing centers, which are called on to handle a volume of "one-shot" jobs. Though the great majority of these jobs require no more than a few minutes on the computer, much time was lost between the completion of one job and setting up for the next one. In such situations, the supervisory control or monitor program serves as a "bridge" between two batch jobs, minimizing operator intervention and materially increasing throughput.

Second, as the use of computers extended into telecommunications, the function of the supervisory control program broadened to serve as the bridge between batch processing and service to remote locations. The resulting supervisory control program can be used to control a system which processes batch programs only, or a system dedicated to the control of telecommunications devices, or any combination of these two.

To efficiently handle on-line inquiries or data entering the data processing center from remote locations, the needs of the remote devices must be satisfied quickly. This means that the computer's batch processing must be suspended when the interruption from the remote device occurs. To gain efficient system operation the control program must provide this service automatically.

The supervisory control program is the nucleus of the computer operating system. In this discussion the supervisory control program and the operating system talked about are those of the IBM Operating System/360.

The operating system consists of a comprehensive set of processing programs and control programs. The processing programs consist of language translators, service programs, and user-written problem-solving programs. The control programs manage data, jobs, and tasks. All these programs operate under an integrated set of control routines, the supervisory control program.

The original concept of the supervisory monitor, therefore, has been extended beyond its requirement as a "bridge" between jobs or different data processing requirements. It is now an integral part of the operating system; its major objectives include increasing throughput, faster turnaround, and assistance to the data processing manager and the programmer.

The operating system's control program governs the continuous flow of jobs within the system and the scheduling and operation of its input/output units. It manages processing and solving of problem programs with little or no operator intervention. It enables several tasks (units of work which can be processed independently) to be performed at the same time. To accomplish this, the supervisory control program performs several major functions: job management; task management; and data management.

Job Management

Job management is performed by the control program's job scheduler and master scheduler. The job scheduler either introduces jobs sequentially or permits several jobs to be processed concurrently. Some versions of the job scheduler can read jobs from several input devices simultaneously and record output simultaneously on several output devices. This can be done either independently of, or at the same time as.

actual job processing. Other job schedulers can alter the order in which jobs are processed.

Master Scheduling

The master scheduler is a two-way communication link between operator and system. The operator uses it to alert the system to changes in the status of the various input/output units, to alter operations, or to request information.

The supervisor manages tasks and is the control center of the operating system. It coordinates and governs the system to ensure efficient use of available physical and programmed resources. It prevents parts of the system from interfering with each other or with the control program itself.

To perform its functions, the supervisor receives control of the central processing unit by an interrupt. The interrupt may arise from a specific request from another part of the operating system, from a problem program, or from an automatic interruption occurring at the end of an input/output operation.

The control program provides the operating system with the ability to maintain control over the integrated system. To extend the operating system for telecommunications applications, telecommunications access methods are devised to control messages and data received from remote locations through communications devices.

Data Management

Data management facilities are an integral part of the operating system. They include a variety of facilities for identifying the data to be used, locating it, and simplifying the process of reading and writing. In telecommunications applications, telecommunications access methods provide macro instructions that give the user direct terminal and line control. This control may be basic or comprehensive, including extensive control, editing, and queuing routines. These routines are assembled into a message control program by the use of a set of macros in message control language, which let a user rapidly define telecommunications system and message control procedures. In addition, a set of macro instructions can process messages.

Message Control

The message control language is compiled by the assembler program working from a set of macro-instructions and parameters. The language is specifically designed for easy use in describing line procedures, line configurations, buffering, and polling procedures.

The message control program serves as an intermediary between the remote terminals and any message processing programs. It enables the terminals to be referred to indirectly, in much the same way as local input/output devices are referred to, using standard language statements such as GET, PUT, OPEN, and CLOSE. Detailed functions, such as the actual sending or receiving of messages, buffer allocating, message routing, message code translating, message formatting, and error checking are performed automatically by the message control program.

The message control program may be executed as a separate task and concurrently with any message processing programs. As input messages are received, they are routed (after translating, checking, etc.) to one or more message queues in main or direct-access storage. Message processing programs take them from there to the work area for processing. When a message is to be sent to a terminal by a processing program, it is placed on an output queue in main or direct-access storage. The message is then sent by the message control program to its destination. In the case of message switching, a message processing program may not be required. The message control program can route an inbound message directly to an appropriate output queue.

A telecommunications job is entered into the system in the same way as any other job. The job scheduler of the operating system, therefore, can be used to allocate any input/output devices and direct-access storage space required for message logs and message queues and to schedule the job for processing. Since some operating system configurations permit more than one job to be run concurrently, other jobs can share the physical resources of the system with a telecommunications job, thereby improving efficiency, particularly during periods when message traffic is low.

A message control program can be designed for one or more types of applications including inquiry (or transaction) processing, data collection, job processing, and message switching.

Inquiry Processing

In inquiry processing, messages are received from a number of remote terminals and routed by the message control program to one or more processing queues. The messages are picked up from the queue and processed by a message processing program. After the message is processed, a reply can be sent to the terminal from which the inquiry originated or to any other terminal. The reply is placed on an output queue by the message processing program and transmitted to the terminal by the message control program.

In this type of application, the system can directly control activities and process transactions as they occur. For example, the system may be used to service, from a central location, a geographically dispersed banking activity. In such a system, master files that contain account records for thousands of depositors are stored in direct-access storage. By entering pertinent data into the system, tellers at remote locations can check balances, update passbook records, and handle similar transactions, all within a few seconds.

The message processing program that responds to inquiries must be designed for the specific application. In designing the program, all of the facilities of the operating system are available including language processors, service programs, and data and task management facilities.

The processing of messages can be performed sequentially, that is, a new task is not begun until the current one is completed, or more than one message can be processed concurrently and they can share the basic resources of the computing system.

In some applications, a message processing program requires access to data and routines stored in direct-access storage. In such applications, it is often feasible to process several messages concurrently as separate tasks. Consequently, as the processing of one message is delayed while access is being gained to direct-access storage, another message could be processed. By processing several messages concurrently, the total message throughput of the system can be significantly increased.

Robert S. Dines graduated from the University of Pittsburgh, Pa., with a B.S. in mathematics. He joined IBM in 1955 as an assistant data processing representative. After an educational leave to attend Harvard Graduate School, he returned to IBM.

He has held several positions, including systems manager of operations and technical assistant to the vice president of sales in the Service Bureau Corp., prior to his present position.

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Job Processing

In job processing, jobs like those that are entered into the system locally are received from one or more remote terminals. The jobs may be entered at the remote location via input devices such as punched card readers. Data which is processed by the job can enter with the job itself or can be retrieved from a library.

All operating system facilities available to the local programmer may also be available to the programmer at the remote location. The operating system, in fact, is designed for use at remote locations as well as for local use. The data cataloguing and management facilities of the system, for example, enable individual programmers to compile, store, test, update, recompile, link, and execute programs within the confines of the operating system.

Jobs that are received from remote locations are placed by the message control program on a processing queue in direct-access storage, in a format acceptable to the job scheduler. The actual processing of the jobs can be performed later, or the jobs on the processing queue can be read and scheduled by the job scheduler in the same manner as a job read from a local device.

Growth of the Operating System

The operating system can grow in a flexible and orderly way. These are the factors which enable growth:

- A modular design with a common system of intercommunication and control that enables the system's facilities to be combined in a variety of ways;
- An open-ended design that permits easy incorporation of problem programs and data;
- Programming compatibility as the system grows;
- Enabling programs to refer to data and other programs without regard to specific I/O configurations;
- A variety of programming facilities.

Time-Sharing System

IBM's recently announced System/360 Model 67 Time-Sharing System (TSS) and its monitor were developed to meet the specific requirements of many remote users for dynamic relocation and conversational compiler support. This system places emphasis on telecommunications by making computer facilities available to remote users in a conversational mode. Each user can enter high-level program source statements and get almost immediate verification of statement validity. Source language compatibility allows the same programs to be used with the non-conversational compilers of the Operating System/360.

The time-sharing system also provides prompt computer access and the ability to control multiple interconnected systems and to reconfigure automatically in the event that part of one system is unavailable. Since a time-shared operation may not provide a steady full workload, this system allows for background batch jobs to be run when the time-sharing load is light.

Conclusion

In summary, it is possible to say that the supervisory control program performs the essential control function in real-time operations, encompassing every aspect of operations. The supervisory control program integrates computer equipment, programming, remote stations, and operations so that these elements — which used to be thought of as separate entities — are now one.

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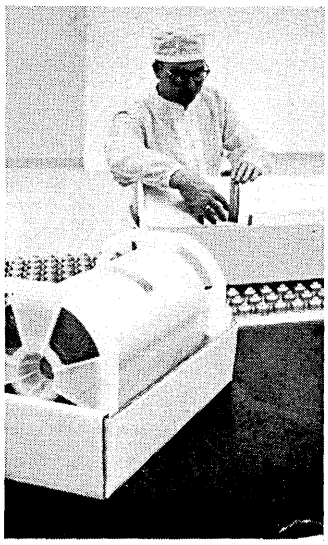

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CELANESE

THE USE OF COMPUTERS IN CONVEYOR BELT DESIGN

L. S. Kraft
Senior Development Engineer
Conveyor Belt Development
The Goodyear Tire & Rubber Company
Akron, Ohio

"The geometric progression of computer growth in industry is due to the fact that computers are filling a need and filling it well."

Selecting the proper conveyor belt construction for a particular industrial application may seem like a fairly simple task, for most conveyor belts are rectangular in shape, black in color, and contain several plies of fabric reinforcement. However, those in the belt industry — who must call on all their past experience and who must research diligently into their handbooks in order to work up the belt engineering required for a price quotation — know from experience that this is far from true.

The fact is that almost every conveyor belt sold is custom made. If we consider only the carcass we find a choice of over 25 belt fabrics in the line of standard conveyor belts of just one rubber company, our own. Add to this the many standard elastomeric combinations, 12 or so common belt widths and an almost infinite variety of cover gauges, and it is apparent that a belt could be ordered every day for a number of years without repeating any construction.

With so many variables entering into belt construction and belting installations, it was only logical that computers be used to determine the optimum combination of these variables that would result in the most efficient product. Goodyear is the first belting manufacturer to use the computer approach.

The basic job in conveyor belt selection is the determination of an optimum carcass consisting of a certain number of plies of the selected fabric. This, in turn, is dependent in part upon the maximum tension the conveyor belt will be subjected to during its operation.

Maximum belt tension is made up of four components:

1. Tension necessary to overcome the friction of the *belt* moving over the trough idlers.
2. Tension necessary to overcome the friction of the *load* moving over the trough idlers.
3. The tension created by the belt weight on the incline on any conveyor other than a horizontal one.
4. The tension necessary to elevate the load on any conveyor other than a horizontal one.

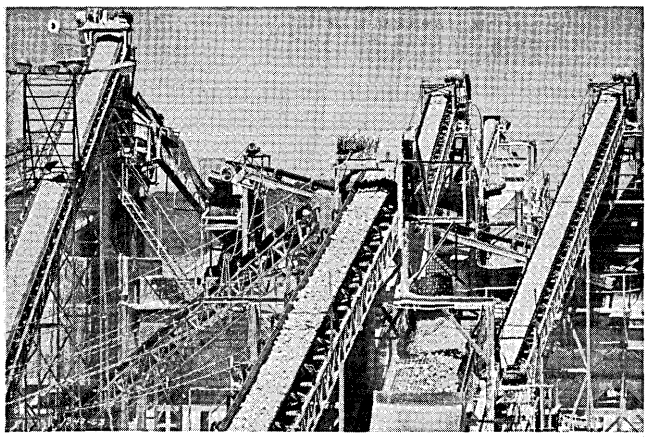
These four components not only vary over the length of a conveyor profile, but their rate of variation is different. Also, the maximum tension in a belt is not necessarily created when the belt is fully loaded. In large overland conveyors, many different, load-no-load conditions are considered in order to determine the most severe combinations of loading. As an example, on an incline-decline-incline-decline type of conveyor, greater maximum tension would be created with only the inclines loaded than would be created with the entire belt loaded.

Conventional practice is to graphically or algebraically add the four tension-producing components along a profile, producing a tension diagram or analysis. A separate tension diagram must be produced for each loading condition, that is, fully loaded, empty, declines only loaded, inclines only loaded, first half loaded, or other conditions which may appear to govern the maximum tension.

All of the tension diagrams drawn must then be "balanced out" by using a common value of counterweight with each. This, of course, simulates the actual operating condition in which a constant value of counterweight is used on the conveyor regardless of the loading conditions.

It has always been a time-consuming and tedious task to calculate, then plot to scale the results of the calculations to arrive at maximum belt tension. Checking the resulting tension diagrams required the equivalent of a second series of calculations. Extensive optimizing was limited by time considerations. Original assumptions often were not refined to the degree we would have wished after the first calculations were made.

Here, we felt, was an ideal place to apply our computer. We realized, however, that to communicate with a computer in its binary language would be a difficult and long process.



L. Seelbach Kraft, an engineer in Goodyear's Industrial Products Division, Akron, Ohio, first joined the company in 1950 in a cooperative program with the University of Louisville. During two years of his studies at the university's Speed Scientific School, he alternated between classes and research and development assignments at Goodyear. After graduation in 1953, and two years with the Air Force Research and Development Command, he came to Goodyear full time. He has worked on moving-sidewalk belts, power turn conveyor belts, synthetic fabric belts, etc. He was an award co-winner in the 1963 Design in Steel Program.

So we took advantage of those intermediate languages that have been developed which are part way between the computer binary system and the English language. We chose one of the more popular of these intermediate languages for engineering and scientific work, Fortran, for use on our IBM 1620 computer.

After many hours of program writing, testing, and rewriting, we completed our first program: "Conveyor Belt Tension Calculation — Multiple Grade Conveyor-drive at any Location." It is designed to handle up to four different loading conditions, calculating the tension on both the top and bottom run at as many as 29 stations on each loading condition. The drive may be located at the head pulley or at the tail pulley, or at any location on the return run between the head and tail pulleys. The counterweight also may be at any location on the return run, and need not be at the drive location.

Among the items considered in the calculation are the weight of the moving parts, total horizontal length, peak tons per hour, belt speed and weight, and friction factors and length factors for both power requiring and regenerative condition. Also required for the input data is the allowable sag between idlers, idler spacing at point of lowest tension on carrying side and drive factor. The stations along the conveyor where it is desired to calculate the tension are located in the program by X-Y coordinates.

Resulting information obtained from the computer includes the tension on the carrying side at discharge, calculated minimum loaded and empty tension, counterweight tension, effective tension, and horsepower required or generated. In addition, the maximum tension in the belt and its location are printed.

THE GOODYEAR TIRE AND RUBBER COMPANY
CONVEYOR BELT TENSION CALCULATION
MULTIPLE GRADE CONVEYOR - DRIVE AT ANY LOCATION
ISLAND CREEK COAL COMPANY DECLINE BELT NOVEMBER 14, 1963 MEK

GIVEN DATA -

1. TOTAL HORIZONTAL LENGTH (LT) =	3720.00
2. BELT WEIGHT IN POUNDS PER FOOT (B) =	7.20
3. FRICTION FACTOR LOADED CONDITION (C2)=	.030
4. FRICTION FACTOR REGEN. CONDITION (C1)=	.012
5. LENGTH FACTOR LOADED CONDITION (LO2) =	150.00
6. LENGTH FACTOR REGEN. CONDITION (LO1) =	475.00
7. WEIGHT OF MOVING PARTS (Q) =	23.00
8. TONS PER HOUR PEAK (T) =	350.00
9. BELT SPEED IN FEET PER MINUTE (S) =	300.00
10. DRIVE FACTOR (K) =	.3300
11. ALLOWABLE SAG BETWEEN IDLERS (HSAG) =	.0400
12. IDLER SPACING ON CARRYING SIDE (LID) =	6.00
13. STATION LOCATION OF DRIVE =	1
14. STATION LOCATION OF COUNTERWEIGHT =	2
15. TOTAL NUMBER OF STATIONS =	2

The program was written not only to produce the results of the calculations but also to print out the input information. This serves a dual purpose. It allows us to be sure that there is no error in filling in the data sheets or punching the data cards. The values the computer used were the ones shown on the output.

A second advantage of this system is that it provides a permanent record of all the information available on each conveyor belt design.

CALCULATED DATA -

1. MAXIMUM TENSION IN BELT =	11800.65
2. HORIZONTAL LOCATION OF MAXIMUM TENSION =	1
3. TENSION ON CARRYING SIDE AT DISCHARGE =	5184.99
4. EFFECTIVE TENSION =	-4662.29
5. CALCULATED MINIMUM LOADED TENSION TO =	5184.99
6. CALCULATED MINIMUM EMPTY TENSION TO =	810.00
7. HORSEPOWER GENERATED =	42.38
8. COUNTERWEIGHT TENSION =	5184.99
9. C AND LO USED WERE FOR CONVEYOR GENERATING POWER	

STATION	HORIZONTAL DISTANCE	VERTICAL DISTANCE	LOADED OR NOT LOADED	LOAD SIDE TENSION	RETURN SIDE TENSION
1	0.00	200.00	1	11800.65	7138.35
2	3720.00	0.00	0	5184.99	5184.99

Through the use of our Conveyor Belt Tension Calculation program, we have found the five following advantages in using a computer for belt calculations:

1. *Speed.* This is the most obvious advantage. The engineer's time is only required in filling out the data sheets. Computer time is about two minutes per load condition.
2. *Accuracy.* The only place an error can be made is in giving the computer the improper input data.
3. *Consistency.* Each calculation is made using the same built-in parameters. There is no chance of error by incorrect calculation methods.
4. *Versatility.* The program allows the engineer to investigate various speeds, drive locations, friction and other factors, and see how these changes affect the final tension. Formerly, all assumptions had to be made first, as time permitted only one set of tension diagrams to be drawn.
5. *Sophistication.* The computer program allows us to investigate the tension, sag between idlers, idler spacing, and other items much more deeply than we have before. In many cases we will be able to recommend a more economical belt with only minor changes in the conveyor.

The more we learned about the capabilities of computer programming, the more applications were obvious for this new tool of industry. A few of our currently operating programs, with a brief description of each, follows:

Conveyor Belt Capacity Calculation

This program calculates the cross section area in square inches of the load on a conveyor belt at any trough angle and any angle of repose on any belt width. The program is designed to handle conventional equal-length roll idlers or long-center roll idlers. The parameters involved in the calculation appear in our "Handbook of Belting."

Calculation of Vertical Curves

The purpose of this program is to calculate the minimum

radius required on concave or convex curves along a belt profile when the belt profile direction is changed.

For concave curves, a radius is calculated based on limiting belt centerline tension to 1.05 of rated tension, a radius is calculated to prevent lifting of the belt off the trough idlers, and a radius is calculated to maintain a minimum edge tension. The largest radius is then automatically used to further calculate the projected horizontal curve length for this radius. A set of X-Y coordinates is also printed out, based on a parabolic curve joining the two tangent lengths of the belt.

For convex curves, a radius is calculated based on limiting edge tension to 1.05 of rated tension, a radius is calculated to limit idler pressure to a predetermined value, and a radius is calculated to maintain a minimum center tension. As before, the largest of these three radii is used to calculate a projected horizontal curve length, and a set of X-Y coordinates is printed out based on a parabolic curve joining the two tangent lengths of the belt.

Conveyor Belt Pulley Diameter Calculation

Based on the elastic modulus and ultimate tensile strength of the selected carcass fabric, the number of plies, ply thickness, and maximum pound per ply inch rating, this program calculates a minimum pulley diameter recommendation for 110, 100, 80, 60, and 40 per cent tension rating conditions.

CALCULATED DATA -

1. MAXIMUM TENSION IN BELT = 7908.39
2. HORIZONTAL LOCATION OF MAXIMUM TENSION = 1
3. TENSION ON CARRYING SIDE AT DISCHARGE = 5184.99
4. EFFECTIVE TENSION = 2670.30
5. CALCULATED MINIMUM LOADED TENSION TO = 5184.99
6. CALCULATED MINIMUM EMPTY TENSION TO = 810.00
7. HORSEPOWER REQUIRED = 24.27
8. COUNTERWEIGHT TENSION = 5184.99
9. C AND LO USED WERE FOR CONVEYOR REQUIRING POWER

STATION	HORIZONTAL DISTANCE	VERTICAL DISTANCE	LOADED OR NOT LOADED	LOAD SIDE TENSION	RETURN SIDE TENSION
1	0.00	200.00	0	5238.09	7908.39
2	3720.00	0.00	0	5184.99	5184.99

Determination of Conveyor Belt Specification and Price

This is by far the largest program we have run. It required three passes through our 40,000-position 1620 computer.

Our specification and price program is actually an extension of our tension calculation program. After the maximum tension in a belt conveyor has been calculated by our first program, it, along with the belt speed, belt width, tons per hour and material weight, are fed into the specification and price program.

The output produced lists up to sixteen different carcass constructions that will satisfy the built-in rating tables, minimum and maximum ply tables. Along with each carcass construction is listed the belt price of each. Selection of a belt becomes only a matter of selecting the most economically priced construction.

This program is unique in that as much information as is known is put into the computer. This can be as few as the five items listed above or can be as many as 20 items. As an example, if the trough angle is known, i.e., 20°, 35°, 45°, or any other angle, the angle is filled in on the data sheet. If the angle is not known, that blank is left empty, and the computer assumes a value of 20°.

The angle of repose for the load is assumed to be 27.5° if that blank is left empty. Any other angle inserted will override the programmed 27.5°.

A table of center roll lengths for equal-length trough idlers has been built in. If some other type of trough idler is being used, such as long-center roll, it is only necessary that the length of the center roll be filled in. If left blank, the program reverts to the built-in table for the center roll length corresponding to the belt width used.

Types and quantities of breaker may be specified or may be left blank. Blanks revert to a built-in belt specification. This same system is also used on top and bottom cover gauges, belt quality, and rating for the carcass.

The geometric progression of computer growth in industry is due to the fact that computers are filling a need and filling it well. Judicious selection of computer hardware along with a small amount of training will produce a valuable tool which rapidly and efficiently performs mathematical calculations and simple logic decisions. At present, a computer will not invent a new product; but it does allow the engineer to do a better job faster, and to work at the level for which he was trained.

(Continued from page 11)

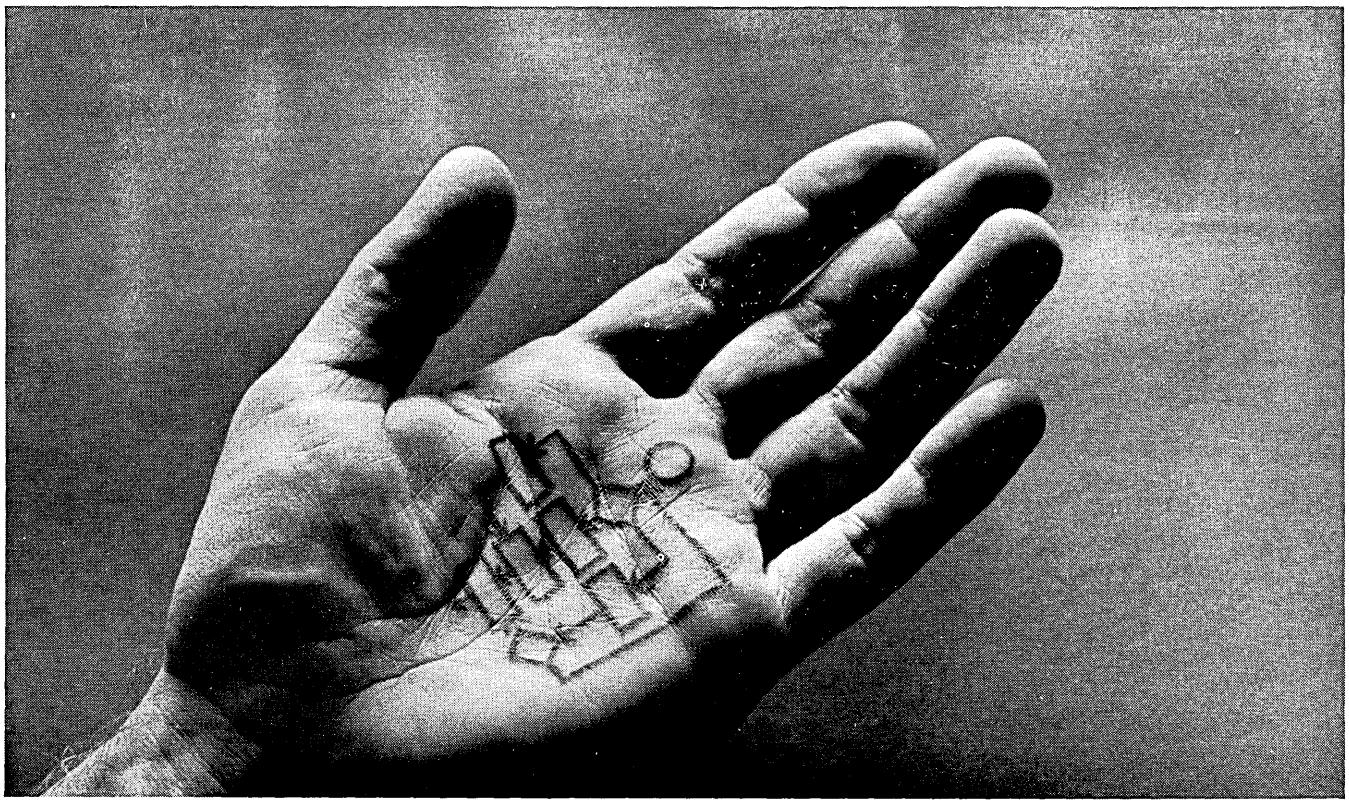
MARKET REPORT

If they can make this unit reliable and deliver it within the next eighteen months, their competitive position in the time-sharing market will be taken a great deal more seriously.

The need for capable people and the need for capable software go hand in hand in shaping the success of the Sigma series. The most limited resource in the computer industry today is skilled, experienced people who can design and create the programming systems needed for the effective use of sophisticated computers and trained, competent people who can sell, service and manage the use of these computer systems. The programming investment for Sigma 7 software is likely to exceed $1.5 million; how effective this investment is depends on the quality of the people SDS is able to attract and employ to do this work. SDS has been able to acquire excellent people in the past by offering the freedom and challenge of a small company environment along with extensive use of stock options. Now a maturing company with over 2500 employees, SDS's ability to offer these attractions to creative people is being steadily reduced. Yet the quality of software support will will no doubt be the critical factor in the successful marketing of a medium-sized system such as Sigma 7 in the scientific/industrial market against its two leading competitors, IBM and Control Data.

The use of a high percentage of SDS 900 series computers as processor modules has allowed SDS to sell outright over 60% of their systems. Computers in the price range of Sigma 7 and used for general purpose applications are usually over 70% leased. If SDS does install $300 million worth of Sigma equipment by 1970 at these higher leasing ratios, they will need to make an investment of over $100 million for the production of computer systems leased to customers. To limit the size of this investment SDS will have to control the percentage of customers it accepts on a short term leasing basis. Without this control, additional capital will have to be raised and/or long term debt considerably increased in order to finance SDS's intended growth without dangerous restrictions in the firm's working funds.

As the only company in the computer field outside of IBM which has shown a profitable position during each of the last three years, SDS will be a company to be watched and weighed with respect in the years ahead.



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A COMPUTER IN POLICE COMMUNICATIONS

Donald Croteau
State of New York
Executive Department, Division of the Budget
Albany, N.Y. 12224

Real-time message switching and file inquiry is one of the fastest growing computer applications at the present time. This growth has been the result of the relatively recent availability of specially designed hardware and software systems in the past couple of years. These systems feature multiplexor control units which allow interweaving of a large number of low-speed peripherals on a single computer channel, high-speed direct-access on-line storage devices, and sophisticated monitor or executive software packages which provide input-output control and which service multilevel interrupts.

This article examines the message switching and file inquiry applications of the New York State Police. This examination covers the problems inherent in the previous manual system, the solution of these problems on a real-time computer, and the selection process which was used to acquire the new system.

The New York State Police teletype network consists of 134 teletype terminals on 56 separate circuits. These terminals are located in State and local police stations through the State. This network is used to communicate police information quickly and accurately between jurisdictions. Typical messages on the network include stolen motor vehicles, hit and run drivers, missing persons, robberies, holdups, homicides, assaults, and criminal investigations.

Description of Previous System

The previous teletype communications network consisted of a torn-tape switching center at each of 6 troop centers; Batavia, Oneida, Malone, Hawthorne, Sidney and Loudenville. An electro-mechanical paper-tape-buffered system at Division Headquarters in Albany connected the various troop centers and provided torn-tape access to the New York State Departments of Motor Vehicles and Correction and the Interstate network.

On this network a typical message originating at a local station was switched a total of three times, twice manually, before delivery. For example, the stations of Horseheads and Painted Post which are only 15 miles apart are nevertheless in different troops. A message sent between these two locations had to be manually handled at the originating troop headquarters; then it had to await its turn at Division Headquarters before it was forwarded to the receiving troop headquarters, where it was again manually handled before being sent to its ultimate destination.

Workload characteristics of the network frequently caused excessive delays at each switching center. One characteristic is peak loading of message traffic every afternoon. This peak traffic frequently exceeds normal conditions by a factor of three. Also, about 60% of the messages generated on the system are multi-destination messages. The most common multi-destination message is the General Alarm which must be delivered to all circuits in the network. Delays exceeding four hours were common during peak loading on the system. The average switching time for all messages was 40 minutes.

Another problem area in the system was its limited control capability. Each station was responsible for maintenance of its own message numbering series. There was no automatic central control to assure that all messages were delivered. Also there was no workload measurement system in use. It would have been impractical with existing equipment to install continuing measures and control of message delay times, network loading, circuit loading, message numbering, and message accounting.

In addition each troop headquarters and Division Headquarters maintained a file of all messages referring to stolen cars, cars used in the commission of a crime, and stolen license plates. These files were in plate number sequence and were used in conjunction with the radio system to give inquiry capability to troopers on patrol. These files did not contain complete information because not all stolen car or crime reporting messages were delivered to every troop; they

contained redundant information because many messages were repeated in every file; they were slow to access because a manual search was required for information.

The basic hardware configuration of the old teletype system was as follows: Typical stations had keyboard teletypewriters connected with one or more other stations by a 75-word-per-minute half-duplex circuit to the troop headquarters. A half-duplex circuit allows information to flow in either direction. Each troop served from 4 to 7 half-duplex lines with keyboard teletypewriters and paper tape reperforators and a manual switchboard which allowed these machines to be hooked on to any circuit. A paper tape transmitter was used by each troop to transmit messages along a 100-word-per-minute duplex circuit to the Division Headquarters switching center. A duplex circuit allows information to flow in both directions simultaneously. Incoming messages were received on paper tape reperforators and keyboard machines at troop headquarters.

At Division Headquarters a paper-tape-buffered reperforator-transmitter unit was provided for each troop. Each of these units was serviced individually by an allotter, and the messages were merged on the 100-word-per-minute duplex circuit provided to the various troop headquarters. At full loading of the troop circuits the Division Headquarters was capable of receiving up to 700 words per minute on seven reperforator-transmitter units while being able to transmit only 100 words per minute. This was the basic cause of message delays at Division level.

Description of New System

The new teletype communications system was installed in February 1966. The basic characteristics of this system include centralized automatic message switching, automatic reporting of traffic loading for central control, store-and-forward message handling, 24-hour message logging, on-line license plate inquiry, and central control of message numbering.

Under the new system all circuits terminate at Division Headquarters. The hardware configuration of the switching center at Division Headquarters is a Univac 418 processor with 16K word memory, two modular Fastrand drums with individual capacities of 11 million characters, a console with a keyboard printer, and two communications terminal module controllers with a total capacity of 64 teletype circuits. Significant operating characteristics of this equipment include 4 microsecond memory, 50 millisecond average access to the drum, and 200 KC drum transfer rate. This processor scans the header information of the message, determines the circuits over which it is to be sent, assigns the next sequence message number for the originating station, adds the time of day that the message was received, and stores the contents of the message until one or more of the receiving circuits is available. The message is then sent over each of the receiving circuits as it becomes available until the message is completely delivered.

Whenever a message is sent over a circuit, a message number is assigned to the message by the processor. This number is a sequential increment of the number assigned to the previous message. Receipt of a message with a number out of correct sequence signals the loss of a prior message. Lost messages may be retrieved from the processor by stations automatically within 24 hours after delivery by means of an on-line inquiry.

As each message is handled, the processor records in report form some basic information for management control. For example, each message is recorded as traffic on every circuit over which it is sent by the time of day, length of message, switching time required, and message type. Periodically, or on demand, the processor generates, automatically, a number of reports. These reports include analyses of average and maximum queues for each circuit, calculations of average and maximum delay times, totals of traffic volumes by hour and type, and summaries of overall traffic patterns.

The system also recognizes stations and/or circuits temporarily out of service due to either physical failure of the facility or willful removal from on-line service. The switching center stores messages for these locations and delivers them properly when the station or circuit is back in service. Records of this type of condition are generated at Division Headquarters for control purposes.

Messages containing license plate information in connection with reported stolen vehicles or vehicles used in the commission of crimes are automatically entered into the license plate file. This file, which has a capacity of 50,000 messages, is maintained on-line for direct inquiry by specified terminals. Inquiry stations are located at Division Headquarters, each troop headquarters, and in a few of the major cities throughout the State. The stations are operated by individuals in direct radio contact with all the state police on patrol in the area. Entering a plate number through the inquiry station generates a search of the plate file and a response by the switching center in less than two seconds.

The cost of this system was kept very low (under $8,000 per month) because of a decision not to establish a duplexed facility. We determined, since the Univac equipment has a reliability in excess of 99%, that a backup of manual switching equipment would be sufficient to cover the anticipated system down time of less than 1%. This backup would handle only the most urgent messages and the automatic plate file inquiry capability would be suspended temporarily.

Advantages

The new switching system completely eliminates manual switching operations at troop and division levels and it frees valuable manpower to patrol and radio duty. The average message is delivered in three minutes or less on the new system, a significant improvement over the previous average of 40 minutes. Management control over the communications function has been increased by the automatic message traffic reporting and analysis capabilities of the system. Also, the on-line license plate file eliminates duplicate and incomplete manual files while providing accurate and practically instantaneous access to each file record.

The new system also has the advantage of being cheaper to operate over the previous system by about $16,000 annually over the first five years of operation.

Also, this system is completely modular. It will handle all the foreseeable future needs of the Division in the communications area. Moreover, if the need arises, this system may be expanded to handle batch data processing problems for the Division.

Selection Process

The Division of State Police selected their new system after an extensive feasibility study of the old system. This study produced the recommendation that an electronic processor be acquired for message switching and license plate inquiry. Detailed specifications were prepared for the new system. These specifications contained a general description of the State Police organization, a description of the then existing teletype system, a detailed description of the proposed "model system", an outline of the proposal requirements from manufacturers, and a presentation of traffic volumes and flow patterns. These specifications were sent to 12 manufacturers of communications-oriented processors on June 16, 1965. The specifications stipulated that all equipment proposed had to be demonstrated functionally to the evaluation committee in

(Please turn to page 51)

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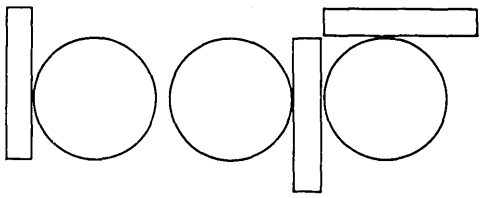

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CAPITAL REPORT

A Special Report from C&A's Washington Correspondent

A national crime prevention system based on computers is moving toward reality in the Federal Bureau of Investigation and has received the explicit backing of President Johnson in his 1966 crime message to Congress.

Initially, names and other data on persons wanted for serious crimes will be entered into the system, along with information on stolen cars, guns, television sets, and other items that carry serial numbers. Further in the future would be the storage and retrieval of fingerprints in digital form.

The application of computers to crime is one of the few areas in which the Federal Government has lagged behind states and cities. Many well-publicized systems are in use around the country, but they are dissimilar. This lack of standardization is actually serving to push the FBI program a little faster, and the FBI, in turn, is pushing for standards among the systems. The work is going on in the Committee on Uniform Crime Records of the International Association of Chiefs of Police.

As envisioned, the FBI crime system would be centered in Washington in a large computer system known as the National Crime Information Center. It would be linked by high-speed circuits to terminal interchanges in San Francisco, Chicago, Omaha, Atlanta, Austin, Tex., Albany, N. Y., and New York City. Other circuits will tie these interchanges to automated crime files in state capitals and other cities with their own systems, such as Los Angeles.

Once the National Center is in operation, it will receive continuous information from police forces around the country and, possibly, from other Federal investigative agencies. It is estimated that by early 1967, a dozen large cities and three dozen states will have computer-based crime files. Through the national network the FBI will be able to exchange information with these cities and states to cut the crime rate.

The Fleet Numerical Weather Facility in Monterey, California, has ordered a Control Data 3200 and three 3100 computers to help Navy meteorologists make faster, more accurate weather predictions.

The Weather Facility is responsible for forecasting meteorological and oceanographic conditions affecting naval operations that cover half the globe. Over 500 forecasts are prepared every day.

Hundreds of thousands of values of variables pour into Monterey each day from 4,000 observation stations throughout the world. Some record conditions at altitudes up to 100,000 feet and ocean depths down to 3,000 feet. The data cover barometric pressure, temperature, humidity, visibility, clouds, wind, wave heights, and precipitation. Undersea observations include temperature, salinity, sonar range, currents, and bottom effects.

Approximately six billion mathematical computations must be performed each day to process this information. The output from the computers helps prepare charts or maps for several hundred operational Navy units serviced by the Facility.

At the present time, the flow of weather data into Monterey is controlled by five Control Data 160A and two 3100 computers at remote stations. A 3200 is used to organize and perform preliminary calculations on incoming data, and the final analysis is performed by a Control Data 1604 computer.

Two of the new 3100 computers will expand the data-handling capabilities of important remote stations at Rota, Spain, and Guam. The third 3100 and the new 3200 will support the central computer at Monterey. Remote stations at Norfolk, Va., and Pearl Harbor already have 3100's.

Control Data equipment seems to be popular with weathermen. Recently the U. S. Weather Bureau, which is part of the Department of Commerce, installed a large-scale 6600 system in Washington at its Pennsylvania Ave. Circulation Laboratory. The system is used to study the makeup of weather by simulation techniques.

The largest data center in the Air Force was dedicated in March at Wright-Patterson Air Force Base, Ohio. The center is located in the basement of the Air Force Logistics Command Headquarters and houses 19 computers.

Headed by Col. Loyd Boatright, the AFLC Data Center is responsible for support of systems tests for Air Force development programs and for processing management information furnished by AFLC logistics managers. It is open 24 hours a day, seven days a week to keep tabs on 1,600,000 Air Force items in 86 countries.

The 19 computers represent three manufacturers — IBM, Univac and RCA — and range in size from a Univac 1004 to an IBM 7080. The 20th computer, another 7080, will be added this October.

James Titus

JAMES TITUS

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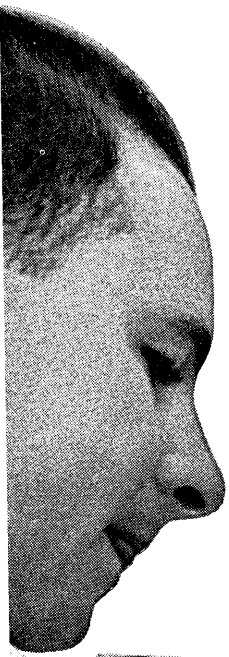

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"ACROSS THE EDITOR'S DESK"

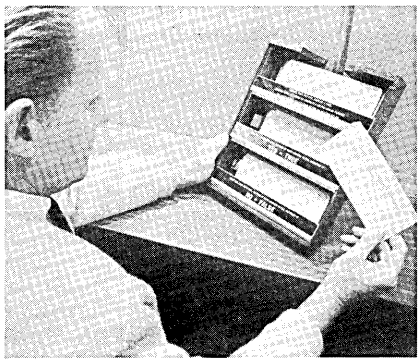
Computing and Data Processing Newsletter

TABLE OF CONTENTS

APPLICATIONS

COMPUTER HELPS DETECT UNSUSPECTED DISEASES

At the Kaiser Foundation Medical centers (Oakland and San Francisco, Calif.), comprehensive medical profiles — stored in an IBM computer — now make it possible for doctors to detect a wider range and a greater number of unsuspected diseases among apparently healthy people. These centers presently examine 4000 patients monthly (on a 40-hour weekly schedule) through their computer-equipped multi-test laboratories.

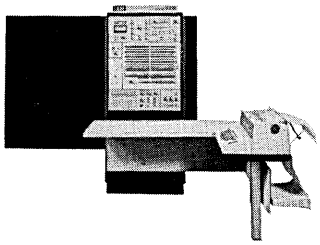


When a Health Plan member comes to a medical center to receive a multi-test health examination, the member, after registering at window 1 (top left in picture), proceeds through 19 other stations within an automated laboratory. He also is given a clipboard containing a medical questionnaire and a deck of pre-punched cards which are used to enter test results into a computer. The woman, at left, has just completed all phases of the test and is making an appointment to see a physician for a physical examination.

A nurse (top right) prepares one of the tests — this one for glaucoma — for a member. Using the pre-punched IBM cards (bottom left), this member answers medical questions by placing cards in either a "yes" or "no" section of a box. These cards will be entered into the computer.

The computer room (bottom right) at Kaiser's Oakland Medical Center gathers all information about each member who has been given a multi-test health examination. The computer prints out preliminary "advice" concerning each patient for a doctor's review. Information from Kaiser's San Francisco Medical Center is transmitted over telephone lines to the computer in Oakland.

The tests and measurements given Health Plan members are more extensive and thorough than most medical examinations. Tests are organized in such a way that most results will have been entered into the computer before the examination is completed. Certain phases of the examination — electrocardiogram, X-rays, retinal photographs — take longer to evaluate and compile for computer processing. When these are completed, the computer prints out a summary of all test reports and all questions that were answered "yes". The internist receives this summary prior to the patient's office visit.



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Newsletter

By making available, at reasonable cost, periodic health examinations to Kaiser Health Plan members, it is possible to: reduce examination time for the patient by integrating the many tests and procedures on an efficient time schedule; retrieve information from the computer to permit research previously not possible; and improve the quality of testing through the use of automated laboratory equipment at the medical centers.

GRADUATE RÉSUMÉ ACCUMULATION AND DISTRIBUTION (GRAD)

Millions of college graduates now have available a new range of employment opportunities as a result of a computerized data retrieval system developed and operated by the College Placement Council, Bethlehem, Pa. Called Graduate Resume Accumulation and Distribution (GRAD), the system links college placement offices from coast to coast with employers in business, industry and government. Because of time-sharing, costs are nominal to both candidate and prospective employer.

The key to the effectiveness of the system is one of the most inclusive thesauruses of job skills yet devised. Consisting of thousands of entries, it was collated from the skills bank donated by a score of major employers. The thesaurus is the source book used by the Council staff members for extracting information on candidates for input into the computer. In order to facilitate the matching of candidates with job openings, employers use the same thesaurus in developing the qualifications for the positions they seek to fill.

In operation, the GRAD system is uncomplicated. An alumnus interested in finding new employment communicates directly with his college placement office. If the placement staff feels that the GRAD program will be of value to the individual, the candidate is given an instruction sheet and four-page resume form which, upon completion is sent to the CPC office in Bethlehem, Pa., with a $10 service fee. Here, at the CPC Data Center, 21 selector factors are culled from the resume and transmitted to a newly-developed electronic file for later retrieval. Here the full resume is converted to a microfilmed aperture card and filed in a random retrieval system. Here, on order from employers, the microfilmed card is retrieved and used to print out full sized 8½ x 11 resumes which are mailed to the employer.

An employer has two roads to the GRAD System. By renting his own desk-side teletype equipment, he may search the computer directly. (It is estimated that the average employer search consumes about three minutes.) Or, by using standard forms available om the Council he may request the CPC Data Center, by mail, to conduct his search for him.

Executive Director of the College Placement Council, Robert F. Herrick, pointed out that GRAD is not an employment system. "It is another tool to relieve placement directors, already overtaxed, of time-consuming paper work and provide them with more opportunity for efficient and effective placement of college alumni," he said. Candidates now can make their qualifications known to a broad spectrum of employers. Employers, for their part, can locate experienced college graduates with remarkable selectivity, in record time, and economically. That the employer is in New Orleans, the placement office in Richmond and the alumnus in Salt Lake City no longer matters.

At the outset, GRAD will be available only to the experienced graduate of four-year degree granting institutions. The Council, through cooperation with the Association for School, College and University Staffing, will provide a similar service for teachers and professors in the summer of this year. As soon as possible, it is anticipated that graduating seniors will have access to the system — possibly by the Class of 1967 and probably no later than the Class of 1968.

BRAILLE BY COMPUTER IN USC PROJECT

The University of Southern California has unveiled a number of computer-based programs "expected to open a new era of employment for the blind and harness the power of the computer to prepare reading material for those who cannot see." William Mitchel, director of USC's Computer Sciences Laboratory said USC's major "blind" projects are the Federally-funded Instructional Materials Center and CITAB (Computer Instruction and Training Assistance for the Blind). Project directors for CITAB are Mitchel and Dr. William Reid, associate professor at USC's

School of Education. Reid also is director of the Instructional Materials Center.

The Instructional Materials Center, dubbed the "Library" project, will provide educational information and materials as rapidly and efficiently as possible to teachers of the handicapped throughout the nation, Mitchel said. The Library project has been funded since August, 1964, by the Division of Handicapped Children and Youth of the U. S. Office of Education. Reid said one of its goals is to make available to any school in the country a rapid and efficient menas of obtaining Braille Texts, magazine articles, speeches or any other "written" material needed by blind students. Initial emphasis has been development of instructional guides for multiple handicapped children.

Project direction has now changed from development to distribution of instructional materials. The center will expand to include: (1) collection, through purchase or donation, of all types of materials dealing with instruction of exceptional children; (2) cataloging each item and storing the information on magnetic computer tape for later retrieval and use; and (3) making specific textual materials quickly available to teachers. Key to the project is a Honeywell 200 computer (donated to USC by the firm) which has as part of its equipment a new Braille printer able to produce 300 Braille cells a second (see New Products, Input-Output).

"This we believe to be a very major step in making Braille material available as required by blind persons," Mitchel said. It was explained that prior to the Honeywell Brailler printer, nearly every request made for one or a few copies of a previously-untranslated text — whether for a fourth grader or a doctoral candidate — required a sighted volunteer to sit down with the 'ink print' text and manually translate it into Braille with a typewriter-like Brailler that makes three Braille cells a second. This can take as long as four or five months, and if two or more copies are requested, each takes as long to produce as the first. With the new Brailler printer, the computer can translate 'ink print' on a one-time basis, store and index it on magnetic tape for easy retrieval and produce Braille on demand. Requests can be filled in as few as 24 hours.

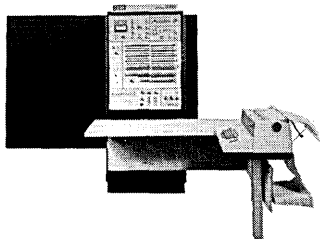
Not only can Braille now be produced by a computer, Mitchel said, but "input" material for the computer can now be prepared on a special Braille-teletype machine developed by Ray E. Morrison, supervising engineer of the Illinois Bell Telephone Co., Chicago. The new unit can be operated by anyone who can type and is being used to prepare information for the H-200.

FLIGHT RESERVATIONS AND INFORMATION SYSTEM

A new flight reservations and information computer system capable of handling up to 30,000 inquiries per hour has been placed in operation by Braniff International. Braniff reservationists serving 30 major traffic-producing cities are now furnished electronic push-button devices and can check the inventory record on two Bunker-Ramo 235 computers at Dallas (Texas) in a matter of seconds to determine seat availability on any Braniff flight up to three months in the future. Braniff Vice President R. H. Burck pointed out the reservationists can also use the computer to obtain arrival and departure information on flights for the current day.

The computers' records are updated each time a reservation is made or cancelled. The computers also can read, process and respond automatically to reservations teletype messages. This capability enables any Braniff reservationist on the airline's 17,000-mile teletype network to use the system, even if his office is not equipped with the special push-button devices. The new network employs a combination of high-speed voice circuits and economical telegraph circuits to tie the 30 major cities to the two real-time computers at Dallas. They are general-purpose machines and will make reservations data accessible to Braniff personnel around the clock, 365 days a year.

Braniff was the first airline to use a computer to centralize control of seat inventories on all its flights. The original system, installed in 1957 by Bunker-Ramo (then Teleregister Corporation), was the first airline system able to process alphabetic as well as numeric characters.



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John M. Randolph, John G. Arbour, Gerald J. Murphy, Cornelius T. Ryan, Robinson R. Whiteside

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NAME

TITLE

COMPANY

STREET

CITY STATE

Newsletter

NEW CONTRACTS

FROM	TO	FOR	AMOUNT
U.S. Post Office Department	Philco Corp., Philadelphia, Pa.	8 additional ZIP-Coded Address Readers — the Optical Reading Systems will be installed for field tests and evaluation in post offices of six major cities: two each in Boston and San Francisco; one each in Houston, Minneapolis, Seattle and Portland (Ore.)	$3.5 million
Martin-Marietta Corp., Aerospace Division, Orlando, Fla.	Adage, Inc., Boston, Mass.	AMBILOG 200 signal-processing computer for solving real-time simulation problems related to the design of new generations of highly maneuverable guided missiles	—
Virginia Electric and Power Company (VEPCO)	Leeds & Northrup Company	A digital computer system (LN4000 System) to be installed in utility's dispatch office in Richmond	$400,000
Manufacturing Technology Div., Air Force Materials Laboratory, Wright-Patterson AFB, Ohio	Norden, division of United Aircraft Corp., Norwalk, Conn.	Converting off-line design system into an on-line computer-aided system that may be used by Air Force and by Air Force contractors, to provide minimum design and delivery time of special, optimized integrated circuitry in "hours or minutes"	$237,400
NASA; Bendix Corp.; and U.S. Air Force	PEMCO, Palo Alto, Calif.	24 high performance mobile/portable data records; most for use in advanced airborne applications, including SST sonic shock research and the Apollo program	$316,000
U.S. Office of Education	System Development Corp.	18-month research effort to determine how computer technology can be applied to vocational counseling	—
Cleveland Browns	General Electric Information Processing Center	Keeping track of all seats in Cleveland Stadium: accept orders, print all tickets remembering seats taken for season, and maintaining mailing list of all Browns season ticket holders	—
Omaha Public Power District, Nebraska	Leeds & Northrup Company	LN4000 Control system for new Unit No. 5 turbo-generator of the North Omaha Power Station	$600,000
Photographic Management Div., Navy Bureau of Weapons	Nortronics Division of Northrop Corporation, Palos Verdes Peninsula, Calif.	Digital code writing device capable of recording flight data on aerial film more accurately and 30 times faster than present systems	—
Department of State	Informatics Inc., Bethesda, Md.	Implementation of an Automated Inquiry System	—
New York Stock Exchange	Computing Technology Inc., Tuxedo, N.Y.	Development of computer programs for computer-based "back-office" accounting system	—
Electronic Associates, Inc., West Long Branch, N.J.	Servo Corporation of America, Hicksville, L.I., N.Y.	A special "computer language translator"; device will become part of large hybrid computing system to be used in simulation studies involving supersonic transport and helicopter design	$33,000
Stanford Research Institute	Planning Research Corp.	Subcontract to assist in definition of automatic data processing requirements for command and control system of the United States European Command (USEUCOM)	—

NEW INSTALLATIONS

AT	OF	FOR	FROM
U.S. Internal Revenue Service, Detroit Data Center, Detroit, Mich.	Two Honeywell 200 systems	Handling data processing activities ranging from measurement of taxpayer compliance to the Treasury Department's 90,000-man payroll	Honeywell EDP
Physics Department, University of Freiburg	PDP-8 computer	Use on-line in experiments with one or two molecular beam machines	Digital Equipment GmbH of Munich and Cologne
Bowmaker Ltd., Bournemouth, England	Honeywell 200 computer system	Processing hundreds of thousands of accounts for finance firm's more than 100 branch offices throughout the country	Honeywell EDP, Newhouse, Scotland

AT	OF	FOR	FROM
Phillips Petroleum	Control Data 3300 computer system	Providing complete data processing system for every type of application in the petroleum industry	Control Data Corp.
General American Transportation Corp., Sharon, Pa.	IBM System/360	Production control; materials and inventory management; and management reporting, as well as financial data processing tasks	IBM Corporation
Datapro Corp., a subsidiary of Treadway Inns Corp.	NCR 315 computer system	Expansion of computer service	National Cash Register Company
Vereinigte Flugtechnische Werke (United Aircraft Research Organization)	EAI 8800 Analog/Hybrid Computing System	Aircraft flight simulation involving problems of aerodynamics that effect the design and structure of aircraft	Electronic Associates, Inc.
Deutsche Forschungsanstalt fur Luft-und Raumfahrt (German Research Institute for Air and Space Travel)	EAI 8400 Digital Computing System	General purpose aircraft simulation	Electronic Associates, Inc.
U.S. Air Force, Air Force Eastern Test Range, Cape Kennedy, Fla.	Computer system, using Control Data 3100, called "Bioastronautics Laboratory Research Tool" or BLRT	Evaluating and aiding scientists in development of improved techniques for biomedical monitoring and display; also to monitor astronauts environmental and physiological parameters	Control Data Corp.
Intra Bank, Beirut, Lebanon	NCR 315 computer system	Processing demand deposit, savings and foreign currency accounts as well as for general accounting	National Cash Register Company
Courtaulds Ltd., Coventry, England	Honeywell 2200 computer	A management reporting system using new programming technique called CRESTS, for Courtaulds Rapid Extract Sort and Tabulator System	Honeywell EDP
State Capitol Bank, Oklahoma City, Okla.	NCR 315 computer system	Demand deposit savings and general bank applications	National Cash Register Company
The Citizens Bank, Hamilton, Ohio	NCR 315 computer system	Demand deposit accounting initially, followed by savings and small loans	National Cash Register Company
Northwest Bank and Trust Company, Davenport, Iowa	NCR 315 computer system	Automating demand deposit accounting	National Cash Register Company
IBM's Field System Center, San Francisco, Calif.	IBM 1130 computer	Use primarily for testing the programs of IBM customers who are awaiting delivery of their own 1130s	IBM Corporation
Denver Division, The Martin Company	Control Data Transacter Data Collection System	Data collection in Detail Manufacturing, Electronic Manufacturing, Tool Manufacturing and Production Control Departments followed by automatic assembly into up-to-the-minute reports for management personnel	Control Data Corp.
Hart Schaffner & Marx, Chicago, Ill.	IBM System/360 Model 30	Use initially in production planning and control	IBM Corporation
French National Railway Company (SNCF), Auteuil Railroad Station, Paris, France	A second UNIVAC 1108 Data Processing System	$4 million electronic data processing center for the French Railroad using dual UNIVAC 1108 System	Sperry Rand Corporation's UNIVAC International Div.
U.S. Naval Air Station, San Diego, Calif.	PDS 1020	On-line testing data for gyro and accelerometer calibration; and cutting problem solving from two days to 2½ minutes	Pacific Data Systems
Data Corporation, Dayton, Ohio	NCR 315 computer	Special science and engineering applications, including the development of programs for numerically-controlled machine tools	National Cash Register Company
Tabulating & Business Services, Inc., New York, N.Y.	IBM System/360 Model 40	Additional EDP capabilities in scientific, engineering and more complex business data processing areas	IBM Corporation
Capital Bank and Trust Company, Baton Rouge, La.	NCR 315 computer system	Handling demand deposit, savings and installment accounts — approximately 30,000 transactions daily	National Cash Register Company
Gamble-Skogmo, Inc., Minneapolis, Minn.	Control Data 3300 computer system	Primary use by the firm (one of nation's leading retailers) will be for solutions of problems connected with the movement of goods	Control Data Corp.
Zayre Corporation, Natick, Mass.	IBM System/360 Model 30	Merchandise control, sales analysis, payroll preparation, and statistical reports	IBM Corporation
Steamships Trading Co. Ltd., Port Moresby, New Guinea	NCR Series 500 system	Inventory control	National Cash Register Company

Newsletter

ORGANIZATION NEWS

HONEYWELL INC. TO ACQUIRE COMPUTER CONTROL COMPANY

Honeywell Inc. and Computer Control Company, Inc. announced that they have agreed in principle to the acquisition of the assets of Computer Control Company by Honeywell. James H. Binger, Chairman of the Board of Honeywell, and Benjamin Kessel, President of 3C, said agreement has been reached for an exchange of Honeywell's common stock for the assets of 3C at the rate of one share of Honeywell for each three and a half shares of 3C.

The agreement is subject to final approval by the Boards of both companies and by the Shareholders of 3C.

It is intended that the present 3C organization will operate as a separate unit of Honeywell and that present management and personnel will continue.

READER'S DIGEST AND SYLVANIA FORM JOINT STUDY PROGRAM

Formation of a joint study group to investigate the potential of electronic systems in the broad field of education has been announced by The Reader's Digest Association, Inc. and Sylvania Electric Products Inc. (a subsidiary of General Telephone & Electronics Corporation). According to the announcement, the program is designed to "combine Sylvania's know-how in the fields of electronics and communications with the writing, editing, and publishing skills of Reader's Digest for the purpose of developing advanced methods of instruction that will improve educational programs."

Representatives of both companies will serve on the joint study group which will work closely with educators, school systems, and universities in determining the present and anticipated needs of the public, educational institutions, industry, and government for educational systems of all kinds.

The group also will analyze and appraise the possible joint use of electronic equipment and publications in such areas as the organizing, storing, and retrieving of information, the presentation of instructional information and material by audio-visual methods, and the rapid handling of information in print or audio form by electronic techniques. Consideration will be given to the requirements of such specialized fields as medicine and the physical sciences.

NEW FIRM SPECIALIZES IN DIGITAL-ANALOG-HYBRID COMPUTER CONSULTING SERVICES

Computer Research Incorporated, a new firm specializing in digital-analog-hybrid computer consulting services, has been formed by Maxwell C. Gilliland, formerly Manager of Computer Operations of Beckman Instruments. Associated with Dr. Gilliland as directors of CRI are three professors of electrical engineering who are specialists in electronic computers. They are doctors Granino A. Korn of the University of Arizona, Walter J. Karplus of the University of Southern California, and George A. Bekey, also of USC.

Dr. Gilliland explained that CRI was formed as a highly skilled computer consulting firm offering its services to users of computers as well as manufacturers of digital-analog-hybrid systems, software specification and development, real time programming systems, computer courses, and market development.

Inquiries regarding CRI's services can be addressed to Maxwell C. Gilliland, 4 Charles Hill Road, Orinda, Calif.

HONEYWELL WILL MARKET EDP SUPPLIES TO USERS

Honeywell's electronic data processing division has announced its entry into the EDP supplies and accessories business. It will market a line of consumable supplies to computer users in the United States and in seven overseas markets, according to C. W. Spangle, vice president and general manager of the firm's EDP division.

William T. Lee, former administration manager of Honeywell EDP's O.E.M. sales division, has been named operating manager of the newly-formed supplies division which will be responsible for merchandising and coordinating the program. The products will be sold to Honeywell and non-Honeywell computer users by the firm's worldwide EDP marketing organization. They will be sold at prices that are "highly competitive," Lee said.

Major products include half-inch and three-quarter inch magnetic tapes, high-speed printer ribbons, and a full line of customized computer system supplies and accessories including tabulating cards and programming forms. Additions will be made to the supplies line in coming months.

LEEDS & NORTHRUP LISTED ON NEW YORK STOCK EXCHANGE

Leeds & Northrup Company, Philadelphia, was approved for listing by the Board of Governors of the New York Stock Exchange. The electronic instrument company's common stock, previously traded over the counter, was scheduled to be admitted for listing on April 4. Leeds & Northrup planned to list 2,024,126 shares of which 1,900,996 were presently issued.

Leeds & Northrup produces precision measuring instruments and automatic control systems, including analog and digital computers, for a wide variety of industrial processes and research applications.

SDS, SCS SETTLE LITIGATION

Scientific Data Systems, Santa Monica, and Scientific Control Systems, Inc., Dallas, jointly announced settlement of the mutual litigation between the two companies by an understanding that "the equipment of SDS and SCS is not directly program compatible or directly input/output compatible". The announcement was made by Max Palevsky, President of SDS and John B. Baird, President of SCS.

SCS has decided to change its trade name at a future date to Scientific Control Corporation (SCC) in order to avoid any possible confusion between the names of the two companies. Both companies will continue to market their separate product lines.

COMPUTING CENTERS

HOSPITALS SHARE COMPUTER TO AID PATIENT SERVICE

A cooperative program that allows hospitals to share common computer facilities for the purpose of improving patient service and hospital administration has gone "on-line" in St. Paul, Minn. Eight hospitals in the Minneapolis-St. Paul area are initially participating in the program, which is the first operating system of its type in the United States. Its goal is to develop a statewide information network which will include many of Minnesota's 180 hospitals. "We view this program as the forerunner of a nationwide hospital information system that will profoundly benefit patients, hospitals and the entire medical profession," Richard T. Crist, president of Minnesota Hospital Service Association (Blue Cross) said.

Honeywell Inc. donated four full-time systems experts for a period of two years to assist in technical phases during the development of the computer-shared facility. Two Honeywell 200 computers, installed in 1965 along with communications equipment and a random access drum provide immediate "real-time" response for patient billing. Minnesota Blue Cross did the computer systems work and programming, funded the development of the program and will run the computer center.

Patient accounting is the first task assigned to the computer-sharing program. It involves preparation of 35 different types of reports which are issued to hospitals "on demand", or on a daily or monthly basis. Inventory control, Purchasing of more than 2500 types of hospital supplies and non-perishable foods, will be the next application added to the computers. Applications more directly related to patient care management will be developed in gradual stages in coming years. A dietary management program is now being designed as well as a laboratory test reporting system.

Cost of the service, for a 300-bed hospital, is $2200 per month, which includes computer usage, staff, communications costs and equipment rentals, and incidental charges. By contrast, a hospital leasing its own computer would pay substantially more for just computer rental alone. Based on 1200 patient admissions per hospital per month, the cost of handling patient accounting amounts to less than five cents per patient.

FIRST COMPUTER UTILITY IN MIDWEST

The first computer utility service in the midwest will become available to business, industrial and educational subscribers this summer, it was announced by COM-SHARE, INC., Ann Arbor, Mich. An SDS 940 computer, manufactured by Scientific Data Systems, Santa Monica, Calif., will be the key element of the system.

COM-SHARE will provide full scale computer services for both business and scientific applications by linking individual subscribers to the SDS 940, located in Ann Arbor, via telephone and telegraph lines. As many as 32 users can be working with the SDS computer simultaneously without significantly slowing the system's response time to any subscriber.

The first customers for COM-SHARE service (more than 25 subscribers have already contracted to use the service) will be in the Southern Michigan area. Initially, some 150 subscriber terminals will have access to the system. Capacity for the first 940 installation will be about 350 subscribers. More computers will be added to meet the demand as COM-SHARE's service expands within an area bounded by Chicago, Buffalo, Cincinnati and Toronto.

ITT DATA SERVICES DOWNTOWN SUBSCRIBER CENTER

A new computer and data transmission center has been opened by ITT Data Services (a division of International Telephone and Telegraph Corp.), New York, N.Y. Linked by high-speed data communications lines directly to the ITT division's Eastern Regional Computer Center in Paramus, N.J., the new data center provides business, engineering and other organizations in downtown New York City, for the first time, with local access to large-scale, multi-purpose computers, according to Robert A. Leonard, Executive Vice-president and General Manager of the ITT division.

Called the ITT Data Services Downtown Subscriber Center, the new facility is equipped with an IBM 1460 computer system and an IBM 7711 data transmission system which feeds problems and data at the rate of 5000 characters per second to a large IBM 7094, and other large computers, in Paramus where they are immediately processed and the solutions transmitted back at the same high speed. While the Data Services Division has been servicing companies for some five years, the direct high speed lines to Paramus make it possible to do in ten minutes what used to take three hours.

Establishment of this Downtown Subscriber Center represents a major step in a long-range ITT Data Services program designed to "bring the computer to the user" Mr. Leonard stated. The ITT program will ultimately lead to the establishment of direct on-line communications between customers in their offices and giant centrally located "time-shared" computers, in much the same way that we now communicate with each other by telephone and telegraph, he added. (For more information, designate #41 on the Readers Service Card.)

EDUCATION NEWS

SBC OFFERS COURSES IN COMPUTER PROGRAMMING

A series of day and evening courses covering the various analytical and operational skills required to manage modern computers is being offered by The Service Bureau Corporation (SBC), New York, N.Y.

The curriculum covers a wide range of topics including statistics, management science, engineering and operations research, to name a few. All courses will include "hands on" training during which time students will actually run case studies on IBM computers.

Classes will meet at SBC's Data Processing Center. Evening sessions are held from 6:00 p.m. to 9:00 p.m. two and three nights a week. Daytime courses are offered five days each week, Monday through Friday, 9:00 a.m. to 4:30 p.m. (For more information, designate #42 on the Readers Service Card.

Newsletter

TRAINING PROGRAM FOR SKILLED WORK — NOT LABOR

A training program in key punch operation was launched last fall by the Institute for Technological Training, Chicago, Ill., operating in cooperation with the Cook County Department of Public Aid. The training program is unique in that — for the first time to our knowledge — unskilled and disadvantaged young people are offered white collar rather than menial skills and training in an expanding rather than obsolescent field. For the first time the acquired job skill can be used as the basis for future personal growth.

Self-confidence is built not only by the acquisition of a new skill, but by training in grooming, business etiquette and business procedures, and the scheduling of personal problem-solving "self-analysis" sessions — a kind of group therapy.

Because the County recovers the entire cost of training — and more — through the reduction of assistance rolls, and because even exceptionally difficult cases have been given a new, constructive morale, Raymond M. Hilliard, director of the Department of Public Aid, considers the program "a great success". The County pays the training cost only after a graduate has proven herself on the new job for 30 days.

For the first time, business executives can obtain from one source a sizeable number of properly trained IBM key punch operators with actual on-the-job training. (At present there are 8000 unfilled openings in the Chicago area, a situation duplicated in other major cities.) Students acquire their new skill in a framework of displine and responsibility; time clocks are used and unexplained absenteeism can result in dismissal from the program.

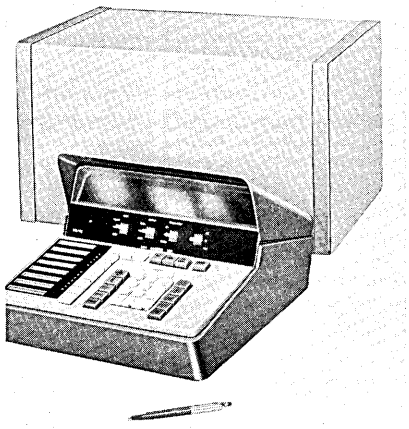
Thus far, of 59 students completing the course, about half have been placed in well-paying ($66-$100 per week), responsible jobs with private industry. The balance will remain in school perfecting their key punch skills, until they are employed. As use of computers and other electronic record-keeping systems increases, the job category will expand, in marked contrast to the shrinking numbers of elevator operators, domestic servants, straight typists, page girls and charwomen.

NEW PRODUCTS

Digital

MODEL DAC-512 DESK TOP COMPUTER

Data Acquisition Corporation of Hamden, Conn. has announced the introduction of its new, low-cost computer, the Model DAC-512. Especially suited for scientists, engineers and research personnel, the DAC-512, is priced at $9500, therby bringing a stored program computer within reach of many project, research and laboratory budgets. This unique, protable computer provides the user with the major convenience of programming and solving problems at his desk and facilitates immediate check-out of computations.



An outstanding feature of the DAC-512 is its ease of operation. The computer has been designed to operate according to simple algebraic rules. No prior programming knowledge or experience is required. Each computer is supplied with a complete software program package.

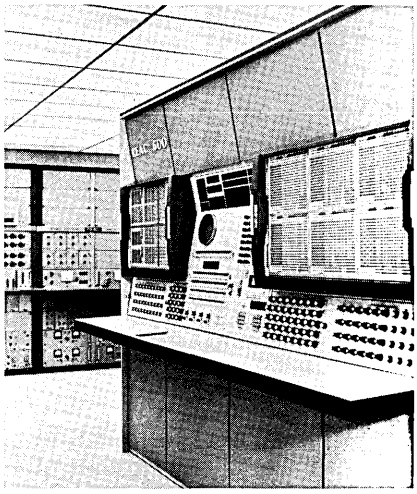
The number capacity of the new computer ranges from 1×10^{-49} (smallest number) to 1×10^{49} (largest number). Arithmetic is floating point with 12-character words consisting of 9 decimal digits, sign and 2 digit exponent. All numerical information and computer conditions are displayed via a large, easy-to-read indicator panel.
(For more information, designate #43 on the Readers Service Card.)

Analog

"SEVENTH GENERATION" REAC® COMPUTER

The Reeves Instrument Company, Division of Dynamics Corporation of America, which in 1947 introduced the world's first commercial electronic analog computer, has announced its latest competitive development for the $50 million analog market, the "seventh generation" of its well-known REAC® analog computer. The new computer, known as the REAC-600, is entirely solid state, has many times the problem-solving capabilities of any of its predecessors, and can operate up to 1,000 times faster than "real-time" in simulating the behavior of equipment.

The new REAC-600 computer was developed especially to meet the need for faster, more accurate design of complex space and industrial systems. It can be used either by itself — for "simulation" in design, or industrial process control — or in combination with a digital machine in a hybrid system.



The standard model of the REAC-600 contains 300 solid state operational amplifiers of a new high speed type, giving it many times the problem-solving capacity of previous REAC models. End uses of the REAC-600 include design of space, automotive and other systems, automated railroad switching and many types of industrial and scientific research.
(For more information, designate #44 on the Readers Service Card.)

Memories

MONOLITHIC MEMORY UNIT SHOWN AT RCA IEEE EXHIBIT

A high-speed memory device, described by Radio Corporation of America engineers as "potentially one of the simplest and most economical approaches to producing complex computer memory systems," was shown by RCA Electronic Components and Devices at the 1966 IEEE Show in New York. G. J. Janoff, Manager, Marketing Department, RCA Commercial Receiving Tube and Semiconductor Division, said this monolithic ferrite device offers computer manufacturers not only the advantage of a full-cycle time as low as 200 billionths of a second, but adds to this small size and production economies.

The monolithic unit, he said, is a "batch-processed" ferrite memory which eliminates the tedious task of core-stringing and hand-wiring, prime cost factors in memory systems for computers. He explained that to simplify connector wiring, the device incorporates an integrated diode selection matrix or "indexing circuitry" which also reduces the number of peripheral components. The new production process employs tissue-thin layers of ferrite material fired into a solid monolithic ferrite wafer one-inch square and five one-thousandths of an inch thick. Each wafer contains 4096 theoretical cores, with each core having an effective diameter of only 5 mils -- or about the diameter of a human hair.

The new monlithic ferrite unit has been designated RCA MF-2100. In this device, two wafers are interconnected with an integrated silicon diode selection matrix of 128 diodes. This 4.5-inch x 3.75-inch module has a memory capacity of 4096 bits in two-'core'-per-bit linear-select operation. The monolithic construction of this new ferrite memory device makes possible the future design of fully integrated memory systems for computers and offers a packing density much higher than conventional memory assembly techniques.
(For more information, designate #45 on the Readers Service Card.)

TWO NEW MEMORIES FROM LOCKHEED ELECTRONICS

Lockheed Electronics Company, Los Angeles, Calif., exhibited their new LEC Model CD50-2 1/2D Memory System and the Model CI-300 Integrated Circuit Memory System at the Spring Joint Computer Conference held in Boston on April 26, 27 and 28.

The Lockheed CD 50 Memory system is a completely self-contained random access, ferrite core storage system with a read-write cycle time of 750 nanoseconds and an access time of 300 nanoseconds. This system utilizes the so-called "2 1/2-D" memory organization with three wires, X, Y and sense, through each core. The CD 50 provides a large word capacity (to 65,536 words) and long word lengths (to 80 bits per word). Clear/write, read/restore and read/modify/write are standard operating modes.

The Model CI-300 is a completely self-contained random access, coincident current, ferrite core memory system which makes maximum use of integrated circuits in all logic and control functions. It was sepcifically designed to meet MIL-E-5400 and for applications requiring a lightweight (less than 6 pounds), and low power memory system capable of operating in extreme environmental conditions. The CI-300 operates in either a read/restore or clear/write mode with a cycle time of 3 microseconds and an access time of 800 nanoseconds. Word capacities to 16,384 words with word lengths to 32 bits are available.
(For more information, designate #46 on the Readers Service Card.)

DISC FILE SYSTEM STORES 3.8 BILLION BITS

Bryant Computer Products (a division of Ex-Cell-O Corporation), Walled Lake, Mich., has announced the availability of a new on-line, real-time mass storage disc file system capable of storing 3.8 billion bits of data with an average access time of 100 milliseconds.

Designated the Model 2A, Series 4000 Disc File System, the modular on-line mass memory system is available in three basic machine sizes with standard Bryant electronic interfacing. Each basic machine size is modular on a disc basis with the capability of offering up to 3.8 billion bits of data storage. The Model 2A incorporates design concepts of its predecessors the Model 1 and Model 2 Series 4000 Disc Files. Increased capacity of the Model 2A is reliably achieved through increased track density to 128 tracks-per-inch and increased bit density to 800 bits-per-inch.

The new system has self-contained environmental control, standard Bryant 8000 Series electronics, and an improved direct addressable Digital Head Positioning System. Dual access capability is offered as an optional feature. Deliveries of the new Model 2A Disc File will begin in the last quarter of 1966.
(For more information, designate #47 on the Readers Service Card.)

Software

NEW LIBRARIAN PROGRAM BY CONTROL DATA

The Data Centers Division of Control Data Corporation, Minneapolis, Minn., has developed a new computer program, known as AESOP, for use in maintaining source and object decks on magnetic tape.

AESOP (Administers Editing of Source and Object Programs) is a coordinated system of computer programs written for the Control Data 3600 Computer System. It provides users with a computer program and data file librarian service. AESOP will serve as librarian for any source program or data file which consists of 80 character records, with characters (columns) 73 through 80 performing identification and sequence numbering functions, and for any object program created by COMPASS, COBOL, or FORTRAN. The librarian service also includes file maintenance features.
(For more information, designate #48 on the Readers Service Card.)

GE/PAC FREE-TIME SYSTEM

General Electric, Phoenix, Ariz., has introduced a new software package for its GE/PAC 4000 process computer line which makes possible 100 per cent usage of the computer's logic and arithmetic capabilities. Called GE/PAC Free-Time System, it makes possible both

off-line and on-line computations in a single computer.

With the new system, scientific calculations, language processing and debugging, production and inventory control, and related functions can be time-shared on a lowest priority basis while the GE-PAC computer continues its first order of business — controlling a process to strict standards to increase production and improve quality.

In a typical process applications, the computer is not engaged full-time in reacting to process demands. Because the computer must be powerful enough to react to peak process demands, there are times when it is operating at less than its full capacity. As the process control use fluctuates according to demand, free-time computations automatically adjust to fill the unused capability. The process never suffers from lack of attention because the entire Free-Time System is assigned the lowest priority in the real-time MONITOR, an ECP (executive control program). (For more information, designate #49 on the Readers Service Card.)

REAL-TIME MONITOR REDUCES COMPUTER IDLE TIME

A new, general purpose real-time monitor (RTM) developed by Computer Control Company, Inc., Framingham, Mass., allows programmers to increase the efficiency of their computer system. "To present and potential users of real-time digital control systems, the monitor will mean not only greater machine utilization but greater justification for the use of computers," according to Dr. Robert Cowan, 3C Computer Software Manager.

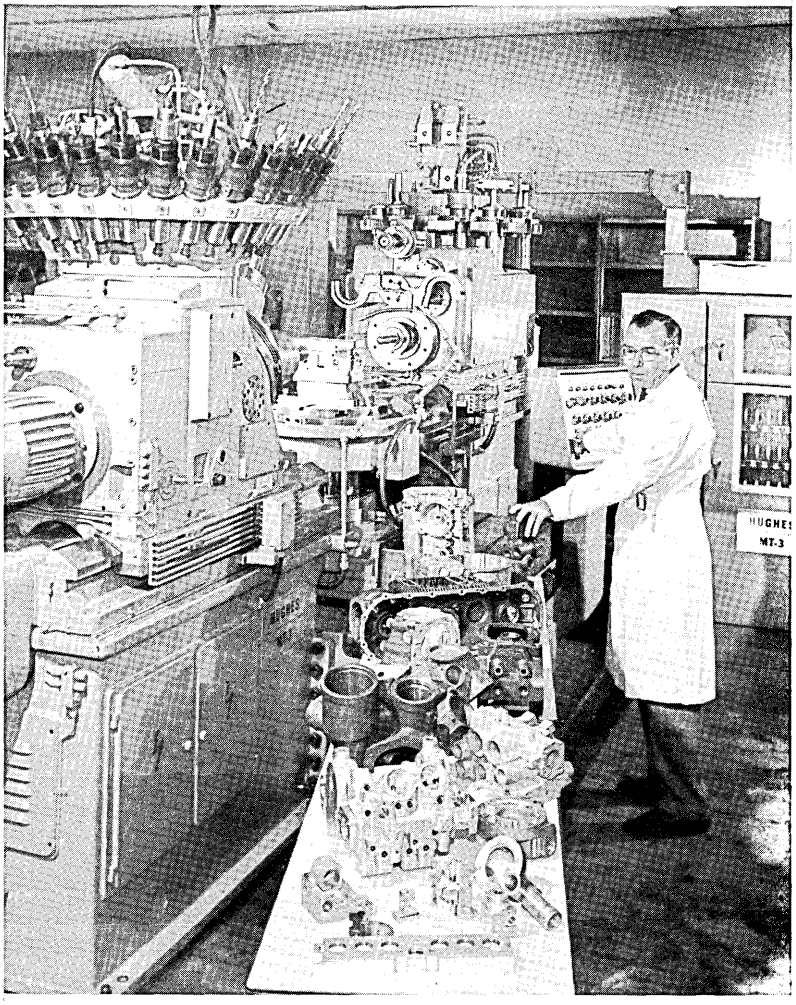
The primary functions of RTM are: to schedule and control the execution of all application or free-time programs, to process all interrupt signals, and to control all input and output operations. The RTM is designed to operate with programs written in either FORTRAN IV or 3C's Assembler Language (DAP).

The RTM is designed to work on computer systems having at least 8,192 words of core memory, typewriter, paper tape reader and punch, or punched card reader and punch, plus memory lockout (including relocatable sector zero for 16-bit computers.) 3C's DDP-116 low-cost, general purpose digital computer, will soon feature the RTM as a standard item. The monitor will also be available for use on 3C's DDP-124 and DDP-224 computer systems. (For more information, designate #50 on the Readers Service Card.)

Numerical Control

HUGHES ELECTRONIC NUMERICAL CONTROL SYSTEM

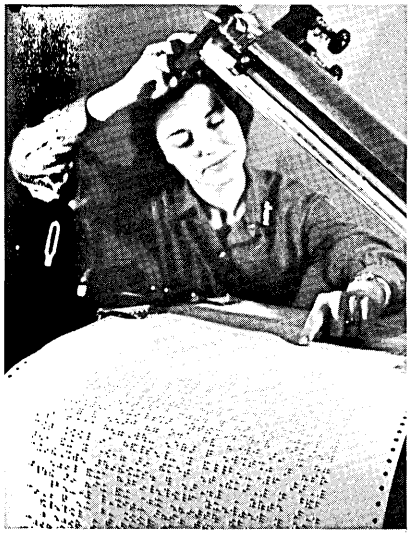
Metal parts of myriad shapes and sizes are cut — and milled and bored and drilled and reamed and tapped — by Hughes Aircraft Company's tape-controlled MT-3 Machining Center, which can save manufacturers more than $15 an hour or $56,000 a year compared to conventional single-purpose machines. Sample parts (in foreground) of aluminum, cast iron, steel and magnesium represent many industries including aerospace, automotive, industrial pumps, hydraulic assemblies and pneumatic assemblies. The universal drilling, tapping and boring head (upper left) not only can hold 30 different tools but can change from one tool to another automatically in less than three seconds. At right center is a face milling head and a precision boring head with a 14-tool-capacity changer. An operator directs the MT-3 functions with the Hughes electronic numberical control system at far right. Twenty-two of the MT-3 machines — products of the Hughes Industrial Systems Division in Los Angeles, Calif. — are in operation at various industries across the United States. (For more information, designate #51 on the Readers Service Card.)



Input-Output

HONEYWELL BRAILLE PRINTER

A computerized Braille printer, said to be 100 times as fast as any standard device currently being used to produce single-copy "written" material for blind persons, has been announced by the electronic data processing division of Honeywell Inc., Wellesley Hills, Mass. The announcement said the next fastest standard device produces three Braille cells per second — compared with 300 cells per second for the Honeywell printer. Primary applications for the new Brailler printer are expected to be in "short-order" production of educational materials for the blind and as part of computer-based libraries of Braille textual material that can be produced on demand for students and other blind persons (see Applications).



— Fontaine DeLuca, Honeywell secretary, scans Braille printout before first unit was shipped to the University of Southern California.

The new device is a modified H-222 high-speed printer; a standared peripheral device in Honeywell's Series 200 product line and used with computer systems such as the H-200. The printer produces 300 Braille cells a second on standard Braille paper (although other paper type also can be used) by replacing the normal "hammers" and "print rolls" used in the standard H-222 printer with a "ball-and-cavity" assembly. It's speed is equivalent to approximately 400 lines of 44 cells each per minute. The Honeywell Brailler printer produces Braille "face up", making it possible to read the printout while it is still in the machine. When the computer instructs the printer to produce a Braille cell — six embossed dots in two columns of three each — the correct hammers are activated and the balls mounted on them strike the paper and drive it through into the matching cavities.

The modified H-222 printer can be easily converted in a few minutes between Braille or regular 'ink print', making it possible for one printer to handle both types of printing. The conversion kit to do this will be available to Series 200 computer users on a special order basis.
(For more information, designate #52 on the Readers Service Card.)

OFF-LINE PRINTER SYSTEM EXHIBITED AT SJCC '66 BY POTTER INSTRUMENT

A new, low-cost, off-line printer system designed to relieve general purpose computers of the burden of routine printing operations was exhibited at the Spring Joint Computer Conference in Boston, April 26-28, 1966. The PS-6000 series offers the first low-cost, off-line printer systems with high print quality characteristics and precise vertical registration of a chain printer, together with program and format flexibility.

Models are available which provide full control of the print format by allowing horizontal tabbing, vertical tabbing, advance N lines, advance to line N, and top-of-form. Since these facilities are provided through the use of a stored-program processor, complete felxibility in format control may be achieved through programming changes. The processor has a 4K-character memory which is used for both program storage and buffering, allowing multiple print lines to be packed into a tape record in order to increase tape efficiency. Arithmetic capabilities are also provided in the processor, allowing the print station to tabulate running totals, line counts, and other such operations. Code conversion is also performed.

The new Potter system, PS-6000 series, sells for a fraction of the price of a typical supporting computer, or can be leased for less than $900 per month.
(For more information, designate #53 on the Readers Service Card.)

EAI 8880 DISPLAY UNIT

A new precision display system designed for instantaneous visual presentation of several computer problem variables simultaneously on a 16-inch cathode ray tube has been introduced by Electronic Associates, Inc., West Long Branch, N.J. Analog or hybrid problem solutions continuously regenerated by the computer are displayed on the EAI 8880 Display Unit for immediate investigation by the computer operator. As problem parameters are changed by the operator, the resulting effects are displayed instantly on the CRT. Variables may be shown plotted against time or against other system variables, thereby permitting quick understanding, investigation and optimization of the system under study.

Typical applications where the EAI 8880 can aid analog or hybrid computing systems in attaining optimum efficiency include: the determination of parameter sensitivities; optimization and boundary value problems; the fitting of theoretical curves to experimental data, and the solving of complex partial differential equations.

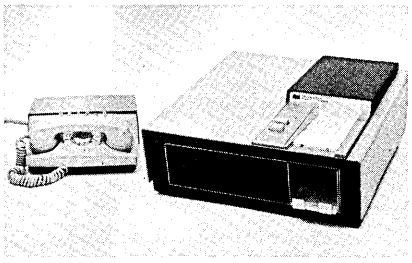
The device is compatible with the company's large-scale EAI 8800 Analog/Hybrid Computing System or with the smaller EAI 680 Analog/Hybrid Computing System. It also can be used with any other computer capable of high-speed repetitive operation.
(For more information, designate #55 on the Readers Service Card.)

NEW OPTICAL MARK READER

The first in a family of new optical mark readers to facilitate transmission of original data without intermediate manual operations was introduced at the Spring Joint Computer Conference (Boston) by the International Control Machines Division of Hewlett-Packard Company.

The small, desk-top device performs alphanumeric reading within a variable card format. It is compatible with all customary communication and output devices such as Dataphone, magnetic tape, teletypewriter, paper tape, computer, etc.

Speed is variable according to output requirements. Besides eliminating keypunching operations, the



new device leaves the original document with the sender for permanent record-keeping. A number of readers can be connected to a central receiver. The reader is only 15" x 20" x 11" overall and weighs 40 pounds.
(For more information, designate #54 on the Readers Service Card.)

EVENT RECORDER PUNCHES SELECTED INFORMATION ON COMPUTER-READY TAPE

A punched tape event recorder, developed by the British company Deakin Phillips Electronics Ltd., records only while an event is taking place. During uneventful periods, the system records only a simple time marker, using only one foot of tape for each "quiet" hour. In this way information can be presented in a very compact form, the manufacturer says.

The logger, which uses solid-state transistor logic units and printed circuits throughout, punches tapes suitable for processing by computer. It has a maximum capacity of 125 channels, with an additional channel for time recording. If more channels are required, the system can be duplicated and the records distinguished by different timing codes. The AC powered system is designed to operate unattended for indefinite periods.

Applications include time and motion study, fault logging, telephone line utilization and statistical analysis of events.
(For more information, designate #56 on the Readers Service Card.)

NEW PHOTOELECTRIC PAPER TAPE READER BY OMNI-DATA

A new, low-cost paper tape reader that offers the benefits of photoelectric operation to the data processing industry at the price of mechanical readers, has been announced by Omni-Data, Division of Borg-Warner Corp., Philadelphia, Pa. Designated the Omni-Data PTR-60 Paper Tape Reader, this device reads opaque tape, such as metallized mylar or black paper, asynchronously at the rate of 150 characters per second. An optional feature permits reading of translucent tapes also.

The outstanding feature of the PTR-60 is its combination of performance and low cost, which make it highly competitive with mechanical readers while offering the user the additional benefits of high speed, reliability, and maintenance-free operation resulting from the photoelectric principle of operation. Typical applications are in data processing equipment and machine tool control.
(For more information, designate #57 on the Readers Service Card.)

NEW LITERATURE

SDC REPORT ON STUDY FOR NATIONAL DOCUMENT-HANDLING IS AVAILABLE

The need for a national document-handling system for scientific and technical information was emphasized in a study by the System Development Corporation (SDC) reported recently to the Federal Council for Science and Technology. The SDC report was prepared by a study team headed by Dr. Launor F. Carter, SDC Senior Vice President and former Air Force Chief Scientist. The team worked with a task group from the President's Federal Council for Science and Technology, Committee on Scientific and Technical Information (COSATI). Chairman of the task group was William T. Knox, Office of Science and Technology, who also is chairman of COSATI.

The study is considered one of the most comprehensive ever undertaken on national document-handling programs. It was conducted to help provide the framework for a total national network of information systems in science and technology.

The two-volume SDC report, Recommendations for National Document-Handling Systems in Science and Technology, is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151. It carries the number PB 168 267, and costs $3.50.

HANDBOOKS AVAILABLE FOR STUDENTS, ENGINEERS USING DIGITAL LOGIC

Digital Equipment Corporation announced the completion of its most comprehensive FLIP CHIP Module publication, a 352-page handbook incorporating material from its catalogs, logic handbook, Logic Lab workbook, application notes, and computer brochures. Stanley C. Olsen, module manager for the firm, said the quarter-million initial printing order for the new handbook should make it possible for everyone concerned in his daily work with digital logic to have a copy. The list of those who can make use of the handbook ranges from the student first encountering new number systems to the original equipment designer.

The new handbook includes 14 application notes, specifications and price information for more than 150 FLIP CHIP Modules and accessories for them, extensive notes on analog-digital conversion theory and techniques, and several experiments for use with the Logic Laboratory.
(For more information, designate #58 on the Readers Service Card.)

MEETING NEWS

SECOND STONY BROOK COMPUTING CONFERENCE

The Computing Center at The State University of New York (SUNY) at Stony Brook, and the Long Island Chapter of The Association for Computing Machinery are jointly sponsoring The Second Stony Brook Conference on "Advances in Computing" to be held at Stony Brook on June 10, 1966. IBM Corporation is providing financial assistance for the Conference.

A group of distinguished speakers has been invited to examine the current state of the art in selected fields of the computing sciences, describe experimental and operational frontier projects and attempt to define future ad-

vances. This annual conference, by drawing a proper perspective on where we stand today and were we are possibly headed, should be of great interest to all members of the profession.

A brochure and registration form are available from Sol Broder, Stony Brook Computing Center, SUNY, Stony Brook, L.I., N.Y.

1966 INTERNATIONAL DATA PROCESSING CONFERENCE AND BUSINESS EXPOSITION

Eight of the nation's leading accounting firms will participate in the 1966 International Data Processing Conference and Business Exposition to be held in Chicago, June 21-24. Sponsored by the Data Processing Management Association, it is the data processing industry's outstanding annual event.

H. I. Romnes, president of America's largest utility — American Telephone & Telegraph Co. — will keynote the Conference. The eight nationally-recognized accounting firms will participate jointly in a series of seminars to be called "Data Management Guidelines". Individually, their topics will cover a broad range of subjects, vital to the operation of an efficient and effective data processing facility.

Over 20,000 people are expected to attend the 1966 International Data Processing Conference and Business Exposition, which will be held at the Conrad Hilton Hotel. These people represent management-level personnel associated with the processing of business information, whether by computer or unit record equipment, in government, commerce and industry.

BUSINESS NEWS

FEDERAL GOVERNMENT OK'S USE OF PURCHASE-LEASEBACK DEALS

A recent decision by the U.S. Comptroller General (CG) has given the General Services Administration (GSA) approval to buy data processing equipment currently being rented by Government agencies, transfer title to a leasing firm, and then lease the equipment back at rates often considerably lower than the manufacturers.

The Comptroller General's letter of policy on this transaction states that savings to the Government from these deals could run between 10 to 50%, of expected total rental, depending on the length of use of the equipment. Annual savings of $3 million on unit record equipment and $10 million on computers are anticipated by the CG from the use of this plan.

Currently some 22 computer models have been approved for such purchase-leaseback activity, although it is not yet clear how many purchase-leaseback firms will be acceptable to the GSA as third parties in this transaction.

THREE COMPUTER FIRMS FILE STOCK REGISTRATION STATEMENTS

Three computer firms filed stock registration statements with the U.S. Security Exchange Commission recently.

Informatics, the software subsidiary of Data Products Corp., filed for registration of 70,000 shares of common stock. Mitchum, Jones and Templeton, Inc., Los Angeles, will offer the shares at $10 per share maximum. Funds from the offering will be used to repay short-term borrowings from Data Products, which owns 91.9% of Informatics outstanding stock.

Randolph Computer Corp., a computer leasing firm specializing in leases of System/360's, is seeking registration of 100,000 shares of common stock. C. E. Unterberg, Towbin Co., New York, will handle the public sale at $20 per share maximum. Proceeds will be used to buy and leaseback additional computer hardware.

Management Assistance, Inc., another purchase-leaseback firm, is seeking registration of 973,762 shares of common stock. Of this, 150,000 will be offered for the first time and 823,762 is from present holders. The public offering will be handled by White Weld & Co., New York at $40 per share maximum.

CALCOMP EARNINGS DROP

California Computer Products had earnings for the first half of FY66 ended January 2, 1966 of $175,629 on gross revenues of $2,497,386. This compares with earnings of $226,725 on gross revenues of $2,006,923 for the same period last year.

Selling, general and administrative expenses were increased to $781,416 from $432,827 for the corresponding period a year ago, reflecting a major increase in effort in the area of software support, field services, and gneral sales support, Calcomp's financial report noted. Further increases are planned to increase sales of graphic output devices in the expanding computer market and to properly exploit new products being developed by the Company, the report said.

MEMOREX '65 EARNINGS, SALES UP

Memorex Corporation reports net earnings for the year ended December 31, 1965 as $1,331,000. This compares to $1,002,000 for 1964, a 30% increase. Net sales of the precision magnetic tape manufacturer were $13,099,000 in 1965, compared with $8,042,000 in 1964, a 63% increase. The decline in the % of net profit resulted from increased marekting, product development and administrative expenses according to President, L. L. Spitters.

The growth by more than 50% of Memorex's business in 1965 was attributable to the success of new products, wider geographic coverage, and capture of a larger share of markets, Mr. Spitters commented.

RECORD HIGHS MADE BY MOORE EARNINGS, SALES

Moore Corporation, Ltd. reports the highest earnings and sales in the company's history. Net earnings increased 18.8 per cent and sales showed a gain of 12.4 per cent over 1964, the previous record year.

Net earnings in 1965 were $22,378,584 compared with $18,832,680 in 1964. Net earnings per dollar of sales in 1965 were 9.3¢ compared with 8.8¢ for 1964.

Sales totaled $241,312,517, compared with $214,628,635 the previous year. Sales of business forms accounted for 90.1 per cent of the total; custom packaging sales for 6.9 per cent; and machinery and equipment sales 3 per cent. Of the reported sales, 87.4 per cent were in the United States, while Canada accounted for 11 per cent, and other countries the remaining 1.6 per cent.

MONTHLY COMPUTER CENSUS

The number of electronic computers installed or in production at any one time has been increasing at a bewildering pace in the past several years. New vendors have come into the computer market, and familiar machines have gone out of production. Some new machines have been received with open arms by users — others have been given the cold shoulder.

To aid our readers in keeping up with this mushrooming activity, the editors of COMPUTERS AND AUTOMATION present this monthly report on the number of general purpose electronic computers of American-based companies which are installed or on order as of the preceding month. These figures included installations and orders outside the United States. We update this computer census monthly, so that it will serve as a "box-score" of progress for readers interested in following the growth of the American computer industry, and of the computing power it builds.

In general, manufacturers in the computer field do not officially release installation and on order figures. The figures in this census are developed through a continuing market survey conducted by associates of our magazine. This market research program develops and maintains a data bank describing current computer installations in the United States. A similar program is conducted for overseas installations.

Any additions, or corrections, from informed readers will be welcomed.

AS OF APRIL 10, 1966

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Advanced Scientific Instruments	ASI 210	Y	$3850	4/62	24	0
	ASI 2100	Y	$4200	12/63	7	1
	ADVANCE 6020	Y	$4400	4/65	8	6
	ADVANCE 6040	Y	$5600	7/65	3	6
	ADVANCE 6050	Y	$9000	2/66	1	4
	ADVANCE 6070	Y	$15,000	10/65	2	6
	ADVANCE 6080	Y	$13,000	4/66	0	0
Autonetics	RECOMP II	Y	$2495	11/58	44	X
	RECOMP III	Y	$1495	6/61	10	X
Bunker-Ramo Corp.	BR-130	Y	$2000	10/61	159	5
	BR-133	Y	$2400	5/64	19	4
	BR-230	Y	$2680	8/63	15	X
	BR-300	Y	$3000	3/59	37	X
	BR-330	Y	$4000	12/60	34	X
	BR-340	Y	$7000	12/63	20	X
Burroughs	205	N	$4600	1/54	49	X
	220	N	$14,000	10/58	40	X
	E101-103	N	$875	1/56	145	X
	B100	Y	$2800	8/64	135	15
	B250	Y	$4200	11/61	95	4
	B260	Y	$3750	11/62	227	8
	B270	Y	$7000	7/62	148	12
	B280	Y	$6500	7/62	122	16
	B300	Y	$8400	7/65	72	85
	B5500	Y	$20,000	3/63	50	10
	B8500	Y	$200,000	2/67	0	1
Clary	DE-60/DE-60M	Y	$525	7/60	355	4
Computer Control Co.	DDP-24	Y	$2500	5/63	70	8
	DDP-116	Y	$900	4/65	50	45
	DDP-124	Y	$2050	3/66	4	12
	DDP-224	Y	$3300	3/65	22	22
Control Data Corporation	G-15	N	$1600	7/55	310	X
	G-20	Y	$15,500	4/61	23	X
	LGP-21	Y	$725	12/62	98	X
	LGP-30	semi	$1300	9/56	295	X
	RPC-4000	Y	$1875	1/61	50	X
	160*/160A/160G	Y	$1750/$3400/$12,000	5/60;7/61;3/64	450	1
	924/924A	Y	$11,000	8/61	30	X
	1604/1604A	Y	$45,000	1/60	58	X
	1700	Y	$2200	5/66	0	38
	3100	Y	$7350	12/64	66	33
	3200	Y	$12,000	5/64	99	9
	3300	Y	$15,000	9/65	6	32
	3400	Y	$25,000	11/64	19	2
	3500	Y	$30,000	9/66	0	5
	3600	Y	$58,000	6/63	50	7
	3800	Y	$60,000	2/66	1	18
	6400	Y	$40,000	5/66	0	11
	6600	Y	$110,000	8/64	9	8
	6800	Y	$140,000	4/67	0	2
Data Machines, Inc.	620	Y	$900	11/65	6	32
Digital Equipment Corp.	PDP-1	Y	$3400	11/60	60	X
	PDP-4	Y	$1700	8/62	55	2
	PDP-5	Y	$900	9/63	112	1
	PDP-6	Y	$10,000	10/64	17	6
	PDP-7	Y	$1300	11/64	59	45
	PDP-8	Y	$525	4/65	210	280
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	21	X
Electronic Associates, Inc.	8400	Y	$7000	6/65	4	6
Friden	6010	Y	$600	6/63	540	85
General Electric	115	Y	$1375	12/65	45	420
	205	Y	$2900	6/64	45	7
	210	Y	$16,000	7/59	50	X
	215	Y	$6000	9/63	56	2
	225	Y	$8000	4/61	155	10
	235	Y	$10,900	4/64	62	8
	415	Y	$7300	5/64	105	66
	425	Y	$9600	6/64	56	42
	435	Y	$14,000	10/64	24	18
	625	Y	$14,000	12/64	13	26
	635/645	Y	$45,000	12/64	7	30
Honeywell Electronic Data Processing	H-120	Y	$2600	1/66	40	300
	H-200	Y	$5700	3/64	625	95
	H-400	Y	$8500	12/61	122	5
	H-800	Y	$22,000	12/60	86	3
	H-1200	Y	$6500	2/66	3	42

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Honeywell (cont'd)	H-1400	Y	$14,000	1/64	12	1
	H-1800	Y	$30,000	1/64	18	6
	H-2200	Y	$11,000	1/66	4	45
	H-4200	Y	$16,800	3/66	0	8
	H-8200	Y	$35,000	3/67	0	3
	DATAmatic 1000	N	$40,000	12/57	4	X
IBM	305	N	$3600	12/57	164	X
	360/20	Y	$1800	12/65	100	4200
	360/30	Y	$7500	5/66	1100	3200
	360/40	Y	$15,000	4/65	700	1000
	360/44	Y	$10,000	9/66	0	400
	360/50	Y	$26,000	8/65	40	360
	360/62	Y	$55,000	11/65	1	X
	360/65	Y	$50,000	11/65	5	110
	360/67	Y	$54,000	9/66	0	55
	360/75	Y	$78,000	2/66	1	55
	360/90 Series	Y	$140,000	6/67	0	9
	650	N	$4800	11/54	235	X
	1130	Y	$1000	11/65	150	2200
	1401	Y	$6000	9/60	6600	250
	1401-G	Y	$1900	5/64	1450	50
	1410	Y	$14,200	11/61	750	35
	1440	Y	$3300	4/63	3000	220
	1460	Y	$9000	10/63	2000	150
	1620 I, II	Y	$2500	9/60	1700	30
	1800	Y	$3700	1/66	5	150
	701	N	$5000	4/53	1	X
	7010	Y	$22,600	10/63	192	25
	702	N	$6900	2/55	8	X
	7030	Y	$160,000	5/61	7	X
	704	N	$32,000	12/55	37	X
	7040	Y	$18,000	6/63	118	8
	7044	Y	$35,200	6/63	125	20
	705	N	$30,000	11/55	60	X
	7070, 2, 4	Y	$27,000	3/60	335	5
	7080	Y	$55,000	8/61	80	X
	709	N	$40,000	8/58	11	X
	7090	Y	$63,500	11/59	45	1
	7094	Y	$72,500	9/62	126	5
	7094 II	Y	$78,500	4/64	120	15
Monroe Calculating Machine Co.	Monrobot IX	N	Sold only - $5800	3/58	150	X
	Monrobot XI	Y	$700	12/60	580	100
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	X
	NCR - 310	Y	$2000	5/61	20	X
	NCR - 315	Y	$8500	5/62	388	45
	NCR - 315-RMC	Y	$12,000	9/65	13	25
	NCR - 390	Y	$1850	5/61	1100	35
	NCR - 500	Y	$1500	10/65	250	850
Philco	1000	Y	$7010	6/63	20	0
	2000-210, 211	Y	$40,000	10/58	18	1
	2000-212	Y	$52,000	1/63	11	1
Radio Corporation of America	Bizmac	N	$100,000	-/56	3	X
	RCA 301	Y	$6000	2/61	645	5
	RCA 3301	Y	$11,500	7/64	50	14
	RCA 501	Y	$14,000	6/59	99	2
	RCA 601	Y	$35,000	11/62	5	X
	Spectra 70/15	Y	$2600	11/65	23	95
	Spectra 70/25	Y	$5000	11/65	12	60
	Spectra 70/35	Y	$7000	4/66	0	60
	Spectra 70/45	Y	$9000	11/65	5	125
	Spectra 70/55	Y	$14,000	5/66	0	12
Raytheon	250	Y	$1200	12/60	172	2
	440	Y	$3500	3/64	14	3
	520	Y	$3200	10/65	8	7
Scientific Control Systems	650	Y	$500	12/65	0	2
	660	Y	$2000	10/65	2	1
	670	Y	$2600	12/65	0	2
Scientific Data Systems Inc.	SDS-92	Y	$775	4/65	39	44
	SDS-910	Y	$2000	8/62	172	13
	SDS-920	Y	$2700	9/62	116	10
	SDS-925	Y	$2500	12/64	15	22
	SDS-930	Y	$4000	6/64	110	30
	SDS-9300	Y	$7000	11/64	41	12
	SIGMA 7	Y	$10,000	12/66	0	14
Systems Engineering Labs	SEL-810	Y	$750	9/65	4	13
	SEL-840	Y	$4000	11/65	2	3
UNIVAC	I & II	N	$25,000	3/51 & 11/57	29	X
	III	Y	$20,000	8/62	83	1
	File Computers	N	$15,000	8/56	18	X
	Solid-State 80 I, II, 90 I, II & Step	Y	$8000	8/58	275	X
	418	Y	$11,000	6/63	70	38
	490 Series	Y	$35,000	12/61	90	62
	1004	Y	$1900	2/63	3350	160
	1005	Y	$2400	3/66	0	155
	1050	Y	$8000	9/63	290	70
	1100 Series (except 1107)	N	$35,000	12/50	12	X
	1107	Y	$60,000	10/62	30	2
	1108	Y	$65,000	9/65	7	16
	LARC	Y	$135,000	5/60	2	X
				TOTALS	33,792	16,699

X = no longer in production.

* To avoid double counting, note that the Control Data 160 serves as the central processor of the NCR 310. Also, many of the orders for the IBM 7044, 7074, and 7094 I and II's are not for new machines but for conversion from existing 7040, 7070, and 7090 computers respectively.

(Continued from page 20)

table numbers of the CCT for receive and transmit, information concerning character size in memory (6 or 8 bits), block and/or character checking and generation control, and the line clock which is incremented at regular time intervals.

Data Control Words (DCW)

One DCW for each line buffer unit is located in memory, and is used by the MLC to control the transfer of data to and from memory.

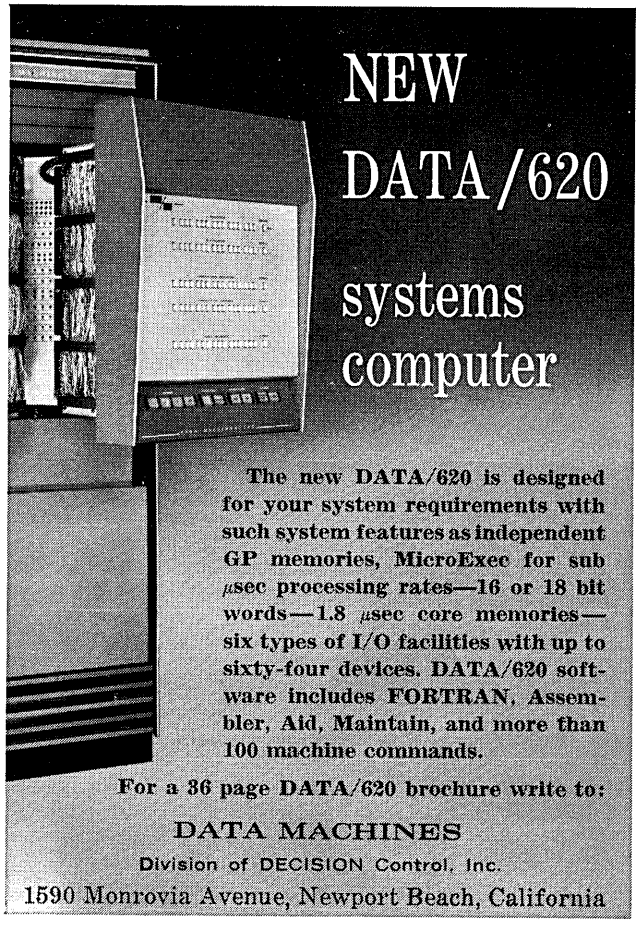
The DCW contains a pointer to the starting memory location of a message area, plus the number of characters in that memory area.

When a DCW indicates the memory area is full on receive, the MLC will automatically assign a new memory area and link the full area to a new area. A new DCW pointing to the new memory area is then generated and assigned.

When a memory area has been emptied on transmit, the MLC will extract the link word from the empty area and use this link to generate a new DCW which points to the trailing message areas.

Conclusion

Thus the communications controller has the ability to pack, unpack and code-convert all characters to and from memory, maintain individual line clocks, perform trivial control and edit functions on individual characters, notify the central processor thru flexible interrupt queues, of any software-specified status changes, and to handle all of the housekeeping functions for scatter-gather input and output. So a present-day communications controller can significantly improve the performance of the central processor per character of thruput.



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(Continued from page 16)

Future Developments

In looking toward the future, the EDP industry is fully aware of the shortcomings of the past. As an example, no commercial transmission facilities are available between 300 and 5,100 character-per-second rates of speed. Also, spadework is necessary in the field of direct sensors, such as the automatic measuring and control of oil and gas well flow, where only facilities in the in-between speeds can properly perform. Much work also remains for the computer manufacturer and common carrier in determining services and systems to fill in the gaps in commercially available data transmission. A corollary to this could be a restructuring of the tariffs, to permit more economical and efficient use of data-transmission facilities as they relate to time. A good start has been achieved by committees of the Business Equipment Manufacturers Association, which include representatives from manufacturers, common carriers, and users. These groups are planning to propose industry standards for interface compatibility, codes, character structure, etc.

Many industries are already feeling the impact of the emergent data transmission requirements.

The dozen or so major computer manufacturers face increasing competition among themselves, as well as from smaller electronic manufacturing companies and companies whose main stock in trade a few years ago was providing microwave systems, radio equipment, and the like. The computer manufacturer group must consider expanding its data communication capabilities, and be ready to sell a total system concept rather than merely computers to solve a growing number of data processing problems. This is especially true in the development of new and ingenious remote devices which will be required for the next major breakthrough in the data processing industry in order to expand the use of computers to the data source so that new and different applications may be implemented economically.

Common carriers have also felt this impact and have prepared for it by a continuous plant expansion program to handle communications traffic. Spokesmen for this industry estimate that by the decade of 1970 they will be handling more data traffic than voice traffic. Communication satellites will provide additional voice record and television facilities on a world-wide basis.

There are as many different avenues of approach to computer-communication systems as there are users; but each successful evolution has been guided by considerable forethought — both by the manufacturers, common carriers, and the user. In the past, computers were acquired to solve a specific problem. Then at a later date, additional peripheral pieces of equipment were added as new tasks occurred. This procedure is no longer good enough.

In the future, the entire information-handling system must be planned and developed, with the enumeration of objectives to be accomplished and specific target dates. This includes central file requirements, a traffic analysis, and the selection of remote devices and communication facilities that will provide desired results at the lowest total cost. The computer should then be selected, based upon its ability to efficiently and economically implement the system, according to the total operational plan established by the user.

Finally, it is clear that the most important element in regard to data transmission and computer systems is the orderly provision in present day computer systems for the integration of a wide spectrum of existing and proposed communication services, systems, and terminals, regardless of manufacturer. Once linked together in a unified on-line computer-communications system, one might consider the computer as merely an element of a total system that has many and varied remote input and output devices.

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CROTEAU–POLICE COMMUNICATIONS

(Continued from page 31)

order to qualify for selection. Each manufacturer who submitted a proposal was required to include: detailed presentations of equipment characteristics; complete cost schedules for purchase and all available leasing arrangements based on 24-hour-7-day-week usage; all available maintenance arrangements including requirements for preventive maintenance; recovery procedure in case of equipment failure; availability of replacement equipment in case of failure; requirements in the proposed system for operating staff; systems support to be provided by the manufacturers; facilities for pre-installation testing; and all modular capabilities of the proposed equipment. Also, each manufacturer could, on an optional basis, submit a proposal for an alternate solution to the specifications if such a proposal would have a significant cost advantage over the model system. The model system contained in the specifications was developed after a detailed study of the traffic flow patterns and peak loading conditions of the then existing system. This data was then modified by anticipated future growth in traffic volumes. A table of traffic volume and flow patterns was included in the specifications as a guide for manufacturers who might consider presenting alternate solutions to the specifications.

Four manufacturers submitted complete proposals by the announced deadline, August 1, 1965. IBM proposed 360 model 30 system, Univac proposed a 418 system, General Electric proposed a Datanet 30 system, and Control Data proposed a 3100 system. Each of these proposals was evaluated on the following three basic criteria:

(1) Hardware and software characteristics;
(2) Modularity;
(3) Cost.

The evaluation of significant hardware and software characteristics of the proposed equipment included processor core storage capacity, on-line file capacity, file transfer rate, file average-access time, processor cycle time, and I/O circuit capacity. This analysis, combined with the equipment demonstrations, proved to the satisfaction of the evaluation committee that the Univac 418 system was the most appropriate configuration to meet the State Police needs.

A separate detailed analysis of the comparative modular capabilities of the proposed systems was conducted. Based on the assumption that all major components could be increased 50% in capacity, each system was compared on the cost of this increase. The Univac 418 system cost less to expand to meet this test case.

The final and deciding factor of evaluation was the overall cost of the proposed systems. Again the Univac 418 system was significantly more desirable than the other systems.

Examples of Operation

Some examples of the effectiveness of the new system are reported below.

Case 1. A trooper spotted an out-of-state vehicle with four suspicious male occupants. Keeping the vehicle under surveillance, he made a radio inquiry of the Stolen Car file at Division Headquarters. The inquiry revealed that the car had been stolen in Fitchburg, Massachusetts, the day before. Upon interception, the four men jumped from the car and ran into the nearby woods. They were subsequently apprehended with the help of other patrols called in for assistance. The occupants of the car proved to be escaped felons from a New Hampshire Reformatory.

Case 2. A trooper on night patrol apprehended two young women, ages 16 and 15, in possession of a 1962 convertible which an inquiry of the Stolen Car file showed to have been reported stolen within the hour.

Case 3. While on routine patrol on the Thomas E. Dewey Thruway, a trooper checked out a suspicious vehicle which proved to be stolen. This inquiry resulted in the recovery of a stolen vehicle as well as three arrests for grand larceny, two arrests for possession of narcotics, and one arrest for forgery. The occupants of the vehicle were en route from New York City to Utica to answer charges there for grand larceny for which charges they were out on bail.

FORUM

(Continued from page 9)

TRAINING FOR BLIND COMPUTER SCIENTISTS

I. From George Hodi

Karpat utca
Budapest 13, Hungary

We know and study your very interesting magazine here in Hungary.

During our studious work we found among others an article of great importance to us. The article appeared in your issue December 1964, "Across the Editor's Desk," Education News: Computer Systems Institute Chosen for Training of Blind Computer Programmers.

I'm called to deal with the question.

Please be so kind and forward the enclosed letter to the right person, in order to be able to get a quick and needed answer.

II. The enclosed letter

Mr. Daniel W. Christian
Director of Education for
the Computer System Institute
of Pittsburgh,
Pittsburgh.

Dear Mr. Daniel W. Christian,

As a blind Hungarian engineer I'm studying Computer Programming.

A colleague of mine directed my attention to the news which appeared in Computers and Automation, December 1964.

I was very happy being insured that my conceptions are realizable and that there exists an Institute where blind persons can be trained as Computer Programmers.

I'm studying the ALGOL 60 Algorithmic language with the help of McCracken's book: "A Guide to ALGOL 60." I've worked out in Braille a code for the ALGOL SYMBOLS.

Allow me to ask you and please write to me:

1) what the program of your special class of blind students is,
2) how long does it last,
3) what facilities do you use in teaching, and
4) on which field do work those blind ones who are already employed as programmers, and
5) perhaps other important items.

I'm anxiously waiting for your kind answer.

III. From the Editor

Thank you for your recent letter regarding our article on computer training for the blind.

We have forwarded your letter to Mr. Daniel W. Christian, Computer Systems Institute of Pittsburgh, 300 6th Ave., Pittsburgh, Pa. We believe he will be able to answer your questions about this program.

NEW PATENTS

RAYMOND R. SKOLNICK,
Reg. Patent Agent Ford Instrument Co., Div. of Sperry Rand Corp. Long Island City, New York 11101

The following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington, D.C. 20231, at a cost of 50 cents each.

September 28, 1965

3,209,129 / Gunnar E. Sundblad, Bromma, Sweden / Svenska Dataregister AB, Stockholm, Sweden / Data Handling System.

3,209,133 / John W. Downs, Glen Cove, N. Y. / Sperry Rand Corp. / Data Storage With Rate Correction.

3,209,159 / Umberto F. Gianola, Florham Park, N. J. / Bell Telephone Laboratories, Inc. / Diode Shift Register.

3,209,163 / Richard E. Wendt, Jr., Edgewood, Pa. / Westinghouse Electric Corp. / Semiconductor Logic Circuit.

3,209,165 / Richard D. French, Arnold, and Harold D. Ausfresser, Baltimore, Md. / Westinghouse Electric Corp. / Tunnel Diode Nor Circuit.

3,209,329 / Eugeni Estrems, Saint-Mande, France / International Business Machines Corporation / Data Processing Apparatus.

3,209,330 / Steven A. Bonomo, Poughkeepsie, N. Y. / International Business Machines Corporation / Data Processing Apparatus Including An Alpha-Numeric Shift Register.

3,209,331 / Onley E. Arnold, Owego, and Gerald J. Watkins, Endicott, N. Y. / International Business Machines Corp. / Data Control Apparatus.

3,209,334 / Robert C. Paulsen, Poughkeepsie, and Philip J. Lima, Hopewell Junction, N. Y. / International Business Machines Corp. / Non-Destructive Read-Out Memory Element.

3,209,335 / Wilbert L. Shevel, Jr., Peekskill, N. Y. / International Business Machines Corp. / Magnetic Memory Array.

3,209,336 / Adolf J. Erikson, Norwood, and Lloyd B. Smith, Scituate, Mass., / Radio Corporation of America / Memory Matrix Assembly With Separate Interconnecting Arm Members.

3,209,337 / David J. Crawford, Poughkeepsie, N. Y. / International Business Machines Corp., / Magnetic Matrix Memory System.

October 5, 1965

3,210,528 / Jack Magill, 2121 Bryn Mawr Ave., Philadelphia, Pa., and Daniel Ashler, Philadelphia, Pa. /——————/ Binary Coded Ternary Computer System.

3,210,529 / William H. Hanson, Minneapolis, Minn., / Sperry Rand Corp. / Digital Adder And Comparator Circuits Employing Ternary Logic Elements.

3,210,729 / William B. Lozier, Jr., Vestal, N. Y., and William S. Rohland, Fort Meade, Md. / International Business Machines Corp. / Data Display System.

3,210,733 / John Terzian, Woburn, Watts S. Humphrey, Jr., Cochituate, and Franz M. Bosch, North Billerica, Mass. / by mesne assignments to Sylvania Electric Products Inc. / Data Processing System.

3,210,734 / Carroll A. Andrews, Poughkeepsie, and Wilfred D. Thoner, Hyde Park, N. Y., Roger D. Watson, Fort Worth, Texas, and Charles J. Tilton, Hyde Park, N. Y. / International Business Machines Corp. / Magnetic Core Transfer Matrix.

3,210,735 / Herman Jacob Heijn, Eindhoven, Netherlands / North American Philips Co. Inc., / Arithmetic Element For Digital Computers.

3,210,736 / Harry J. Tashjian, Rochester, Minn. / International Business Machines Corp. / Data Processing Apparatus.

3,210,737 / Edward L. Perry, Norfolk, and Channing D. Morrison, Burlington, Mass. / Sylvania Electric Products, Inc. / Electronic Data Processing.

3,210,739 / Paul M. Davies, Manhattan Beach, Calif. / by mesne assignments to TRW Inc. / Storage Circuits For A Self-Searching Memory.

October 12, 1965

3,211,925 / Woo F. Chow, Horsham Township, Pa. / Sperry Rand Corp. / Logic Circuit Utilizing Storage Diodes And Negative Resistance Diode.

3,212,060 / Arye Leib Freedman, London, England / Decca Ltd., a British Co. / Digital Processing Systems.

3,212,061 / Eugene E. Merfeld, Lexington, Mass. / Honeywell Inc. / Information Handling Apparatus.

3,212,066 / Robert W. Mowery, Columbus, Ohio / by mesne assignments to U. S. Steel Corp. / Circuits For Storing Information.

3,212,068 / Albert W. Vinal, Owego, N. Y. / International Business Machines Corp. / Magnetic Memory Instrumentation.

3,212,069 / Jacob Tellerman, Oakland Gardens and Robert J. Laird, Valley Stream, N. Y. / American Bosch Arma Corporation / Ferromagnetic Memory Unit.

3,212,070 / Harrison W. Fuller, Needham Heights, and Harvey Rubinstein, Lynnfield, Mass. / Laboratory For Electronics, Inc. / Magnetic Film Data Storage Apparatus.

3,212,071 / Milton Rosenberg, Santa Monica, Calif. / Ampex Corp., / Magnetic Memory System.

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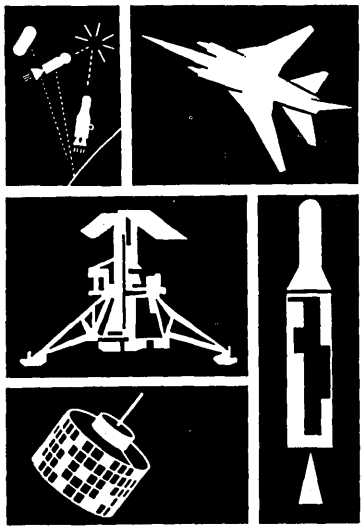

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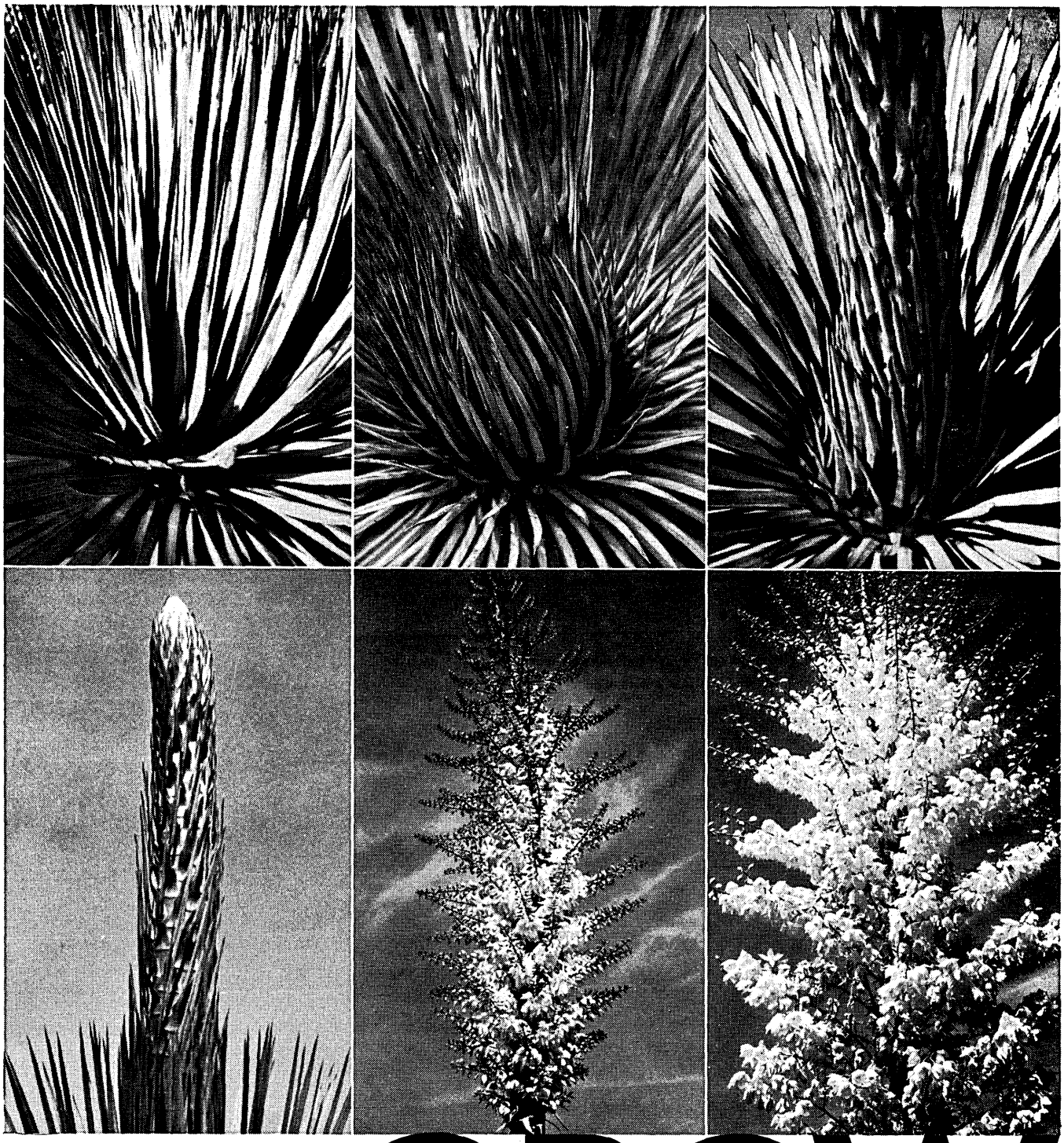

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BOOKS AND OTHER PUBLICATIONS

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Reviews

Chestnut, Harold / Systems Engineering Tools / John Wiley and Sons, 605 Third Ave., New York, N. Y. / 1965, printed, 646 pp, $12.95

The content of this book is well indicated by the chapter headings: Systems Engineering in Industry; Energy, Materials, and Information; Modeling and Simulation; Computing; Control; Probability and Statistics; Signals and Noise; Optimizing; Tolerances, Variations, and Disturbances; Engineering an Information-Handling System. The author was first president of the International Federation of Automatic Control. Although in places the book is technical, it contains a great deal of information for the thoughtful reader who is not a mathematician.

Schushman, Abe / Scientific Decision-Making in Business / Holt, Rinehart & Winston, New York, N. Y. / 1963, printed, 568 pp, price ?

This book is a collection of readings in Operations Research or Management Science, gathered from many sources, by an associate professor of marketing at Columbia University. The authors include some very distinguished people, such as Warren Weaver, Russell L. Ackoff, Horace C. Levinson, etc. The readings are very well chosen; many of them are very interesting; the topics included are very well explained, without requiring technical mathematical knowledge and difficult vocabularies.

McCracken, Daniel D., Harold Weiss, and Lee Tsai-Hwa / Programming Business Computers / John Wiley & Sons, Inc., 440 Park Ave. So., New York, N. Y. / copyright 1959, fourth printing 1963, printed, 510 pp, price ?

This book is for "the person who is interested in day-to-day application of computers to business problems and who does not have a mathematical background." It assumes a computer called DATAC which does not exist; this assumption was a reasonable compromise when the book was written in 1959; but is perhaps not valid as an assumption now.

Greenberger, Martin, editor, and many authors / Computers and the World of the Future / The M.I.T. Press, Cambridge, Mass. / 1962, printed, 340 pp, $10.00

This book is the record of the MIT Centennial lectures on computers from March 9 to May 22, 1961. I attended these lectures and found them very interesting and important. The persons who gave the lectures were C. P. Snow, J. W. Forrester, H. A. Simon, J. C. Kemeny, A. J. Perlis, J. McCarthy, G. W. Brown, and J. R. Pierce. Each lecture had two discussants, who contributed significantly to the interest of the lectures and their discussion. Much that was said here by top authorities in the computer field is of permanent interest.

Weinstein, Seymour M., and Armand Keim / Fundamentals of Digital Computers / Holt, Rinehart and Winston, Inc., New York, N. Y. / 1965, printed, 163 pp, $4.95

A short elementary book covering: history and philosophy of computers, number systems, basic computer operation, programming, computer logic, arithmetic and control units, and computer usage. A fictitious computer is used to illustrate the programming; it is designed for a one-term course or a self-teaching text. The authors have made an effort to leave out mathematical formulas.

Harrison, Michael A. / Introduction to Switching and Automata Theory / McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036 / 1965, printed, 499 pp, $16.50

A thorough and technical discussion of Boolean algebra, combinational switching circuits, minimization of Boolean functions, transformation groups and group invariance, tree networks, reliable design with unreliable components, sequential machines, probabilistic machines, the state-assignment problem, and an introduction to context-free languages.

Wilder, Raymond L. / Introduction to the Foundations of Mathematics, second edition / John Wiley & Sons, Inc., 605 Third Ave., New York, N. Y. 10016 / 1965, printed, 327 pp, $8.00

The first edition was published in 1952. The chapters of Part 1 are: The Axiomatic Method; Analysis of the Axiomatic Method: Theory of Sets; Infinite Sets; Well-Ordered Sets; The Linear Continuum and the Real-Number System; Groups and Their Significance for the Foundations. Part 2 is entitled "The Development of Various Viewpoints on Foundations," including as a last chapter "The Cultural Setting of Mathematics."

This book is basically a college textbook, and includes a number of advanced topics. It contains much more besides, and many thought-provoking ideas.

Stein, Marvin L., and William D. Munro / Computer Programming: A Mixed Language Approach / Academic Press, 111 Fifth Ave., New York, N. Y. / 1964, printed, 459 pp, $11.50

Dr. Stein is a former director of the Numerical Analysis Center at the University of Minnesota, and is now professor of mathematics there. Dr. Munro is acting director of the numerical analysis center.

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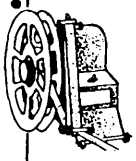

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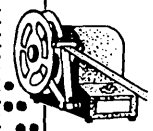

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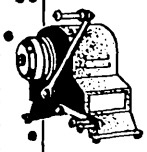

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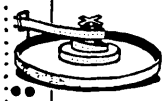

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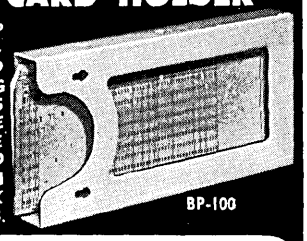

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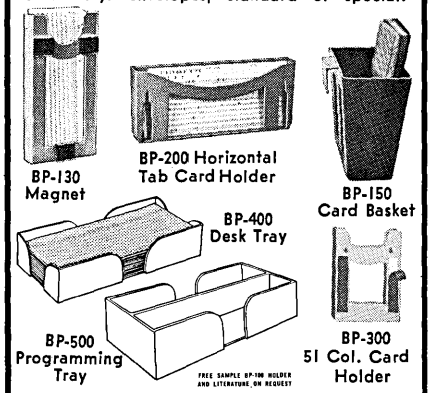

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This book is packed with information. But the authors have sympathy for persons learning programming, and have had a large amount of experience in doing and teaching computer programming.

Levin, R. I., and C. A. Kirkpatrick / Quantitative Approaches to Management / McGraw Hill Book Co., 330 West 42 St., New York. N. Y. / 1965, photooffset, 365 pp, price ?

This book is written for people in college and in business, who have only a modest background in mathematics, and who want an understanding of some of the quantitative methods used in management. The subjects included are: The Scientific Method, Breakeven Analysis, Probability Theory, Decision Making Under Uncertainty, Inventory Models, Vectors and Determinants, Marix Algebra, Linear Programming, Games and Strategies, Markov Analysis, Queuing. The authors say "our book contains none of the usual notation found in operations research texts"; they use mainly arithmetic *and the ideas* of operations research. Although computers are mentioned in the book, they are not mentioned in the index.

Martin, James T. / Programming Real-Time Computer Systems / Prentice-Hall, Inc., Englewood Cliffs, N. J. / 1965, printed, 386 pp, $11.75

The sections of this book are: The General Picture; The Types of Program; An Introduction to Supervisory Programs; The Mechanism of Control: Real Time Testing Techniques; Fitting the System Together; Management Problems. Among the 40 chapters are: Emergency Procedures — Fall-Back; Difficulties of Real-Time Program Testing. At the start of the book are two pages listing some 80 "basic concepts," and pages on which they are defined or explained in an introductory way. The next page (Figure 1) is entitled "How to read this book," and is a flow diagram guiding different kinds of readers to the chapters in which they might be especially interested. The book is useful and full of interesting and worthwhile information.

Ashley, J. Robert / Introduction to Analog Computation / John Wiley and Sons, Inc. / 1963, printed, 294 pp, $?

The purpose of this book is to teach the use of widely available electronic analog computing equipment. A background of college level physics and differential equations is assumed. The method of presentation is teaching by analogy, and is built out of solving sample differential equations with a computer. The chapters cover solution of differential equations, direct simulation, synthesis of servomechanisms, "useful computing circuits," iterative analog computation, etc.

Berkeley, Edmund C., and Daniel G. Bobrow, editors, and 14 authors / The Programming Language LISP: Its Operation and Applications / Information International, Inc., 200 Sixth St., Cambridge, Mass. 02142 / 1964, offset, 382 pp, $7.05

A set of papers describing the programming and mathematical language LISP (from LISt Processing) and its applicability are here presented. The effort to collect this information, which makes the language more understood and useful for programmers and mathematicians, is part of a contract for the U. S. Dept. of Defense Advanced Research Projects Agency. Part I of the book includes five articles and papers written primarily for persons with little or no prior knowledge of LISP. Among the titles: "LISP — A Simple Introduction," which discusses 7090 and PDP-1 versions of LISP, gives a simple example of LISP usage, and explains many LISP expressions and symbols; "LISP — 240 Exercises with Solutions"; and "Notes on the Debugging of LISP Programs." Part II includes eight papers written for persons with a substantial knowledge of LISP. Among the titles: "Techniques Using Lisp for Automatically Discovering Interesting Relations in Data," "METEOR: A LISP Interpreter for String Transformations," "LISP as the Language for an Incremental Computer," and "An Auxiliary Language for More Natural Expression — the A-Language." Six appendices include, "The LISP Program for METEOR," "The LISP Implementation for the PDP-I Computer," and "Index for Parts I-VII of the LISP 1.5 Programmer's Manual."

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Rall, L. B., editor, and five authors / Error in Digital Computation, vol. I, Proceedings of an Advanced Seminar, Mathematics Research Center, Univ. of Wisconsin, Oct., 1964 / John Wiley & Sons, Inc., 605 Third Ave., New York, N. Y. 10016 / 1965, offset, 324 pp, $6.75

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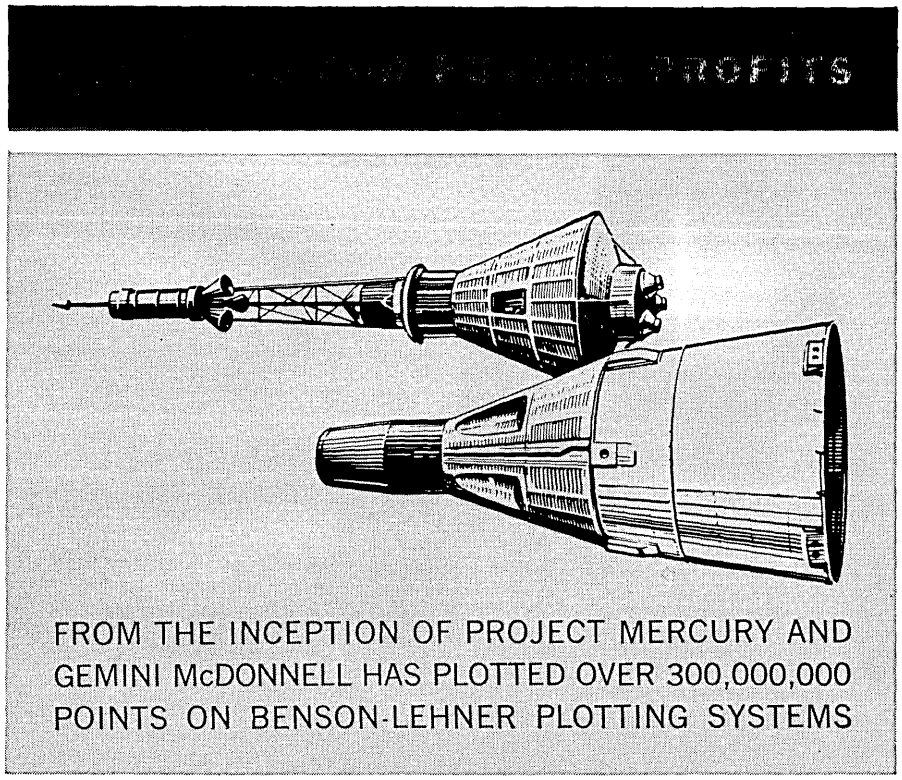

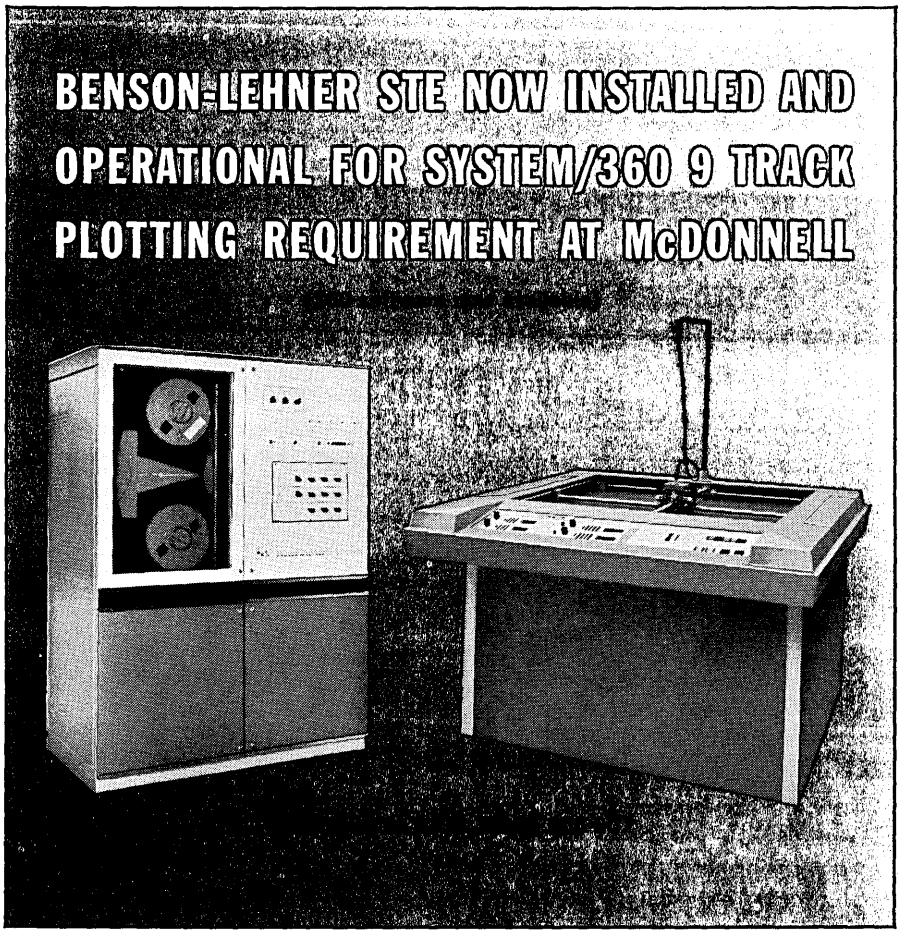

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CALENDAR OF COMING EVENTS

April 25, 1966: 3C Users Group (CAP), Sheraton-Plaza Hotel, Boston, Mass.; contact Lorraine Heath, Computer Control Co., Old Connecticut Path, Framingham, Mass. 01702

April 26-28, 1966: Spring Joint Computer Conference, War Memorial Auditorium, Boston, Mass.; contact AFIPS Hdqs., 211 E. 43 St., Rm. 504, New York, N.Y. 10017

April 28-30, 1966: SDS Users' Group, Sheraton Boston Hotel, Boston, Mass.; contact Hal Tuens, Scientific Data Systems, 1649 17th St., Santa Monica, Calif. 90404

May 3-5, 1966: Bionics Symposium, Dayton, Ohio; contact Bionics Symposium 1966, P.O. Box 489, 300 College Park Ave., Dayton, Ohio 45409

May 3-5, 1966: British Joint Computer Conference, Congress Theatre, Eastbourne, Sussex, England; contact Public Relations Officer, Institution of Electrical Engineers, Savoy Place, London, W.C.2, England

May 4-6, 1966: The Honeywell 400/1400 Computer Users Association, King Edward Sheraton Hotel, Toronto, Canada; contact Gordon P. Brunow, Olin Mathieson Chemical Corp., New Haven, Conn.

May 10-12, 1966: Annual National Telemetering Conference, Prudential Center, Boston, Mass.; contact Lewis Winner, 152 W. 42 St., New York, N.Y. 10036

May 12-13, 1966: Annual National Colloquium on Information Retrieval, University of Pennsylvania, Philadelphia, Pa.; contact Mr. Ashley W. Speakman, E. I. DuPont Co., Centre Road Building, Wilmington, Del. 19898

May 16-18, 1966: Annual SHARE Design Automation Committee Workshop, Jung Hotel, New Orleans, La.; contact Joseph Behar, Secretary, IBM, 425 Park Ave., New York, N.Y. 10022

May 16-20, 1966: Australian Computer Conference, Canberra, A.C.T., Australia; contact S. Burton, Honorary Secretary, P.O. Box 364, Manuka, A.C.T., Australia

May 18-20, 1966: National Meeting of the Operations Research Society of America, Los Angeles, Calif.; contact Dr. John E. Walsh, System Development Corporation, 2500 Colorado Ave., Santa Monica, Calif. 90406

May 24-27, 1966: GUIDE International, Queen Elizabeth Hotel, Montreal, Canada; contact Lois E. Mecham, GUIDE International User Organization, c/o United Services Automobile Association, 4119 Broadway, San Antonio, Texas, 78215

May 25-27, 1966: Spring Joint Conference of the Univac Users Association and the Univac Scientific Exchange, Royal York Hotel, Toronto, Canada; contact Murray Hepple, UUA Secretary, c/o Harris Trust & Savings Bank, 111 Monroe St., Chicago, Illinois 60690

May 30-June 1, 1966: National Conference of the Computing and Data Processing Society of Canada, Banff Springs Hotel, Banff, Alberta, Canada; contact Mr. K. R. Marble, Mgr., Systems and Computer Services Dept., Western Region, Imperial Oil Ltd., Calgary

June 15-17, 1966: IEEE International Communications Conference (Sequel to Globecom Meetings), Sheraton Hotel, Philadelphia, Pa.; contact Lewis Winner, 152 W. 42 St., New York, N.Y. 10036

June 15-17, 1966: Federal Government Accountants Association National Symposium, Radisson Hotel, Minneapolis, Minn.; contact Federal Government Accountants Association, 1560 Rand Tower, Minneapolis, Minn. 55402

June 20-23, 1966: Annual Meeting of American Society for Engineering Education, Washington State University, Pullman, Wash.; contact Lewis Winner, 152 W. 42 St., New York, N.Y. 10036

June 20-25, 1966: Congress of the International Federation of Automatic Control, London, England; contact American Automatic Control Council, c/o Dr. Gerald Weiss, Electrical Engineering Dept., Brooklyn Polytechnic Institute, 333 Jay St., Brooklyn 1, N.Y.

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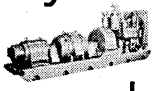
... It made all sorts of useful things  like d/c battery chargers...  air cooled engine-generators...  emergency standby electric power supply units... electric plants on wheels  and other fascinating equipment. In fact, this company still does. Many of you know the company we're talking about—UNITED STATES MOTORS CORPORATION. Giants of industry and those responsible for our defense posture did business with it you know when—AND NOW! It continues to build quality products—more sophisticated of course—but then what isn't today! It has highly sensitive "No-Break" MICRO POWER Electrical Plants  ...Standby Emergency Power Equipment  on wheels... without wheels  ...and in capacities ranging from only 500 watts to 750 KW. Its plant is modern  inside and outside  . Its equipment is used in communications systems  ... computer systems  ...in hospitals and  schools, and by industrials to protect special processes from losses due to power outages. Applications are virtually unlimited. Let's get together. Our sales and service centers are—

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