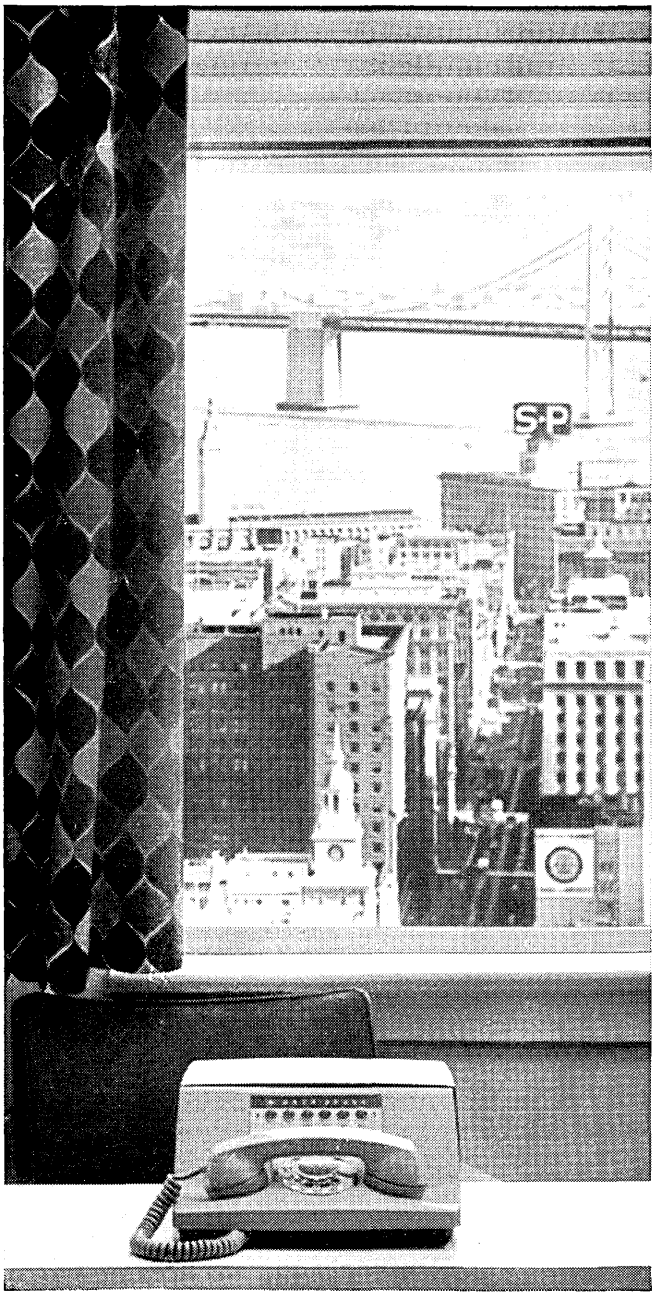
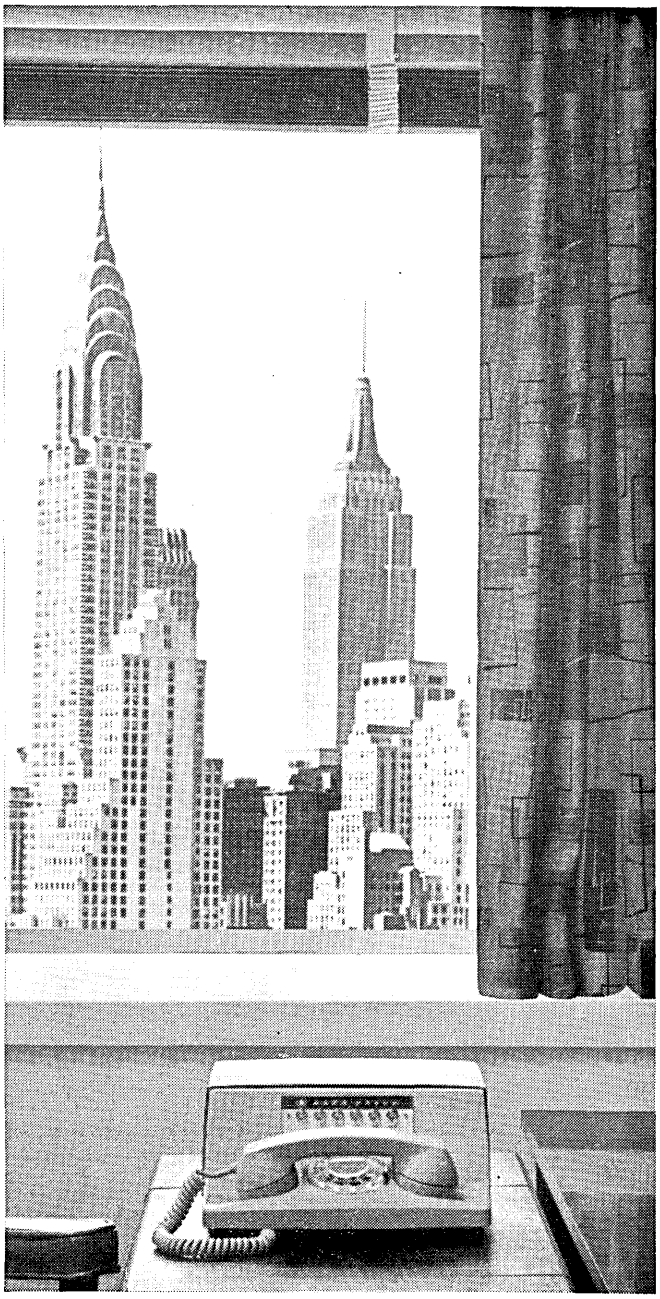
July, 1963

computers and automation

1963

STANDARDS FOR INFORMATION PROCESSING





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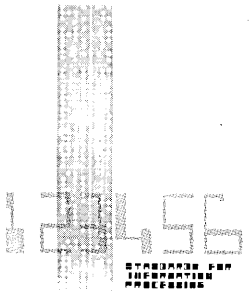
Think how DATA-PHONE service can save you time and money in shipping vital word and figure data to and from all your business locations. See one of our Communications Consultants about it. Just call your Bell Telephone Business Office and ask for him.

Bell Telephone System

In case your eye hasn't the agility of an optical reader,
the title on our cover reads "Standards for Information Processing."
It is lettered by our artist in an imaginative font
that parallels the more familiar MICR numerals.
The standards question is covered from two views in this issue.
For those already actively following developments
in this controversial field,
Dick Utman of BEMA presents a report on current progress on page 8.
For those "just getting into the know,"
a Primer on Standards for IP begins on page 13.



computers and automation

JULY, 1963 Vol. XII, No. 7

computers and data processors:
the design, applications,
and implications of
information processing systems.

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c & a
EDITORIAL

Computer Translation From Chinese to English, and Some of Its Implications

Elsewhere in this issue of **Computers and Automation** is a report on work done at International Business Machines Corp. under a contract with the Air Force on translation from Chinese to English. The evidence is clear that fairly good translation by a combination of human being and computer is being accomplished.

In the first step in the process, persons who do not know Chinese employ a typewriter-like machine and a geometric-recognition technique, for recognizing first the top and bottom of the Chinese character, then the character as a whole, and then translating it into an 18-bit code. Second, the computer by means of a program makes a fairly good translation into English. Third, this translation, if desirable, can be edited (by a fluent Chinese-English interpreter called a "post-editor") into satisfactory English, conveying the same meaning as the original Chinese.

This is a truly remarkable scientific achievement. And the more so, because the structure of Chinese is markedly different from the structure of any Indo-European tongue such as English or Latin, German, or Greek.

Even if the degree of perfection of the translation is short of a hundred per cent, there are not many human beings who know Chinese, know English, and are able to translate as fluently and in as many contexts as the computer.

This achievement intimately associates clever people designing the program and the "stupid but powerful beast" of a computer, which can do almost any elementary reasoning operation at speeds of more than 100,000 per second.

This successful association forecasts more possibilities of importance and interest. Among these possibilities is the power of an adequately programmed computer to deal not only with words but also with ideas.

Take for example, recognizing the ideas expressed in words independently of the words which say them, and then reacting to the ideas in intellectual ways, such as clarifying them, removing inconsistencies, or summarizing them.

The first step in this process would be to make the words listed in the vocabulary with their several meanings carry context labels next to each meaning. For example "shuffle, trick, deck, suit" have one meaning in the context of the game of bridge, and entirely different meanings in other contexts. Context labels for meanings for words are already necessary in machine translation from one language to another.

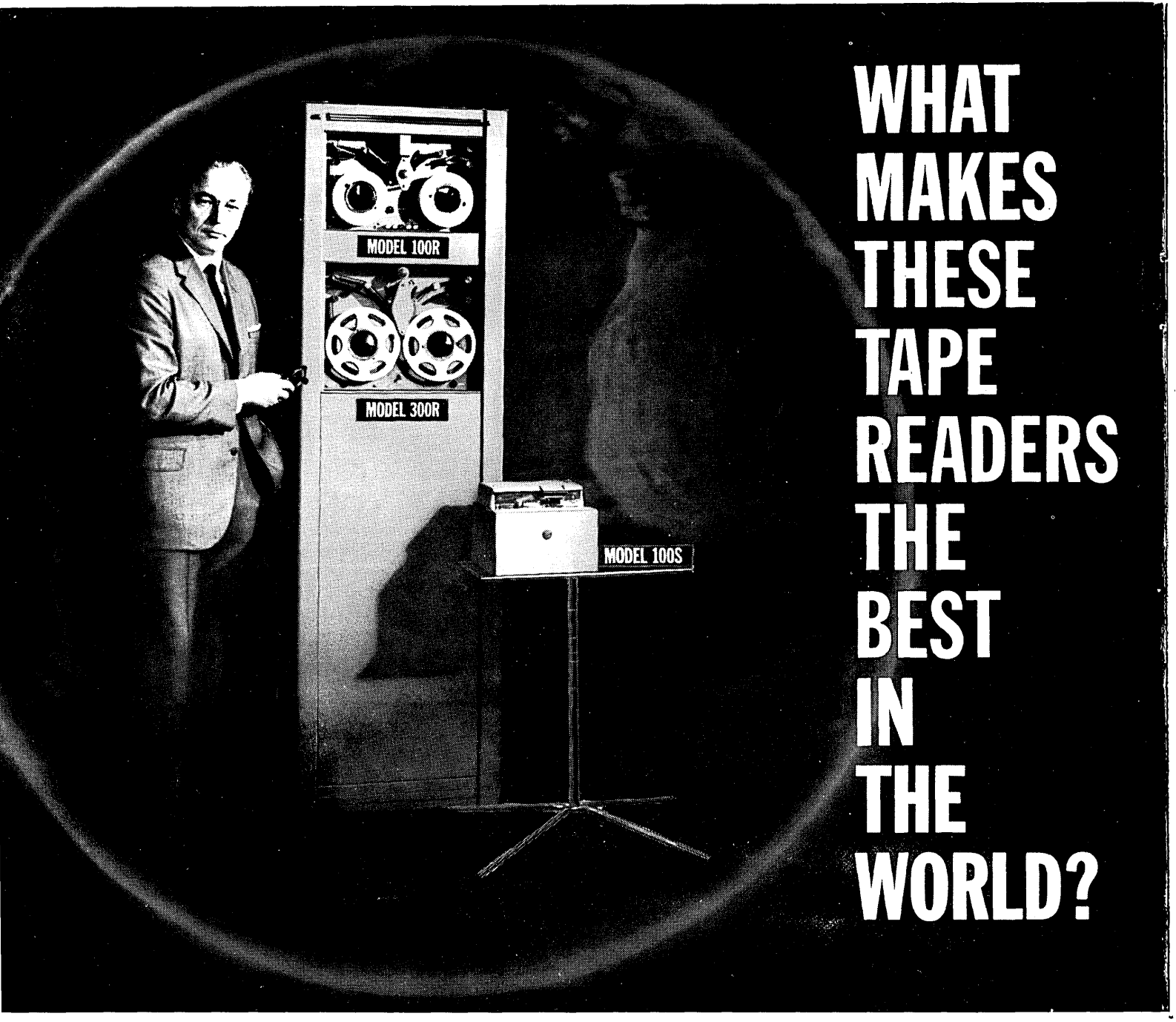
The second step in this process would be to denote the sequence of meanings asserted by the succession of words in the sentence, and to identify the subject and the predicate. Thus the computer would attribute to each sentence the meaning with the highest probability of being the intended meaning. Already single-meaning words and single-meaning sentences occur in mathematics, logic, and computer programs; it should not be too hard to extend the number of subjects in which this fruitful condition exists.

The third step is to make specific in terms of computer programs the meanings of such intellectual operations as clarifying, making consistent, summarizing, etc. This should not be too hard—because (1) many human beings learn to do this in high school English courses, and (2) this process does not involve the operation especially baffling for computers of looking at a wide field of objects and of scenery, and selecting what needs to be attended to, such as an approaching car or a traffic light.

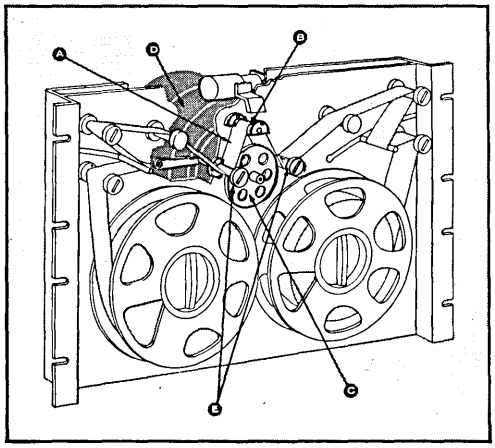
And so we will be further along the road of making all the language of thought calculable like mathematics.

Edmund C. Berkeley

EDITOR



WHAT MAKES THESE TAPE READERS THE BEST IN THE WORLD?

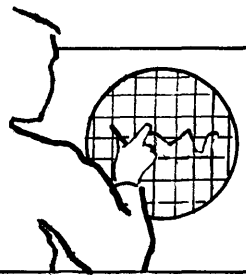


Mechanical simplicity . . . which yields a degree of reliability unattainable by any other paper tape reader! Simplicity made possible through the utilization of the revolutionary PMI printed motor direct drive servo. Movement of the tape through the read head is achieved by merely starting and stopping a printed motor. The brakes, clutches and pinch rollers that cause big trouble and down time in conventional tape transports are completely eliminated.

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

PHONE, WIRE OR WRITE FOR COMPLETE INFORMATION

Photocircuits
CORPORATION
TAPE READER DIVISION
Glen Cove, N. Y.



c & a EDITOR'S SCRATCHPAD

Members of "Computers & Automation" staff, like nearly everyone else, like to boil thoughts off the top of their minds from time to time. Up to the present there has hardly been a suitable place in the magazine for this distillation. So we have invented this page for the output.

The purpose of "Scratchpad" is to express comments, notes, observations, and opinions that relate in some way to the computer field, yet which fail to fit into a regular category, or which consist largely of personal opinions, and at times even opinions out on a limb. Elsewhere in this issue appears a Danish proverb worth repeating here, "Prediction is difficult, especially where the future is concerned."

We hope that you, our reader, will find this page interesting and provocative, and we invite your comments and opinions with a light pen, so that we may have the benefit of your reactions...volatile or distilled.

Edmund C. Berkeley

1963 - ONE LAP TOO MANY? The computer field may well remember 1963 as the big year of "drop-outs" in the race to capture a sustaining sector of the computer market. As we turn past the mid-year pole, we see several firms waving the white handkerchief and going back to the pits.

The movement was headed last year by General Mills' brief, but notable, turn round the track. After about one year of contention, General Mills ran out of financial fuel for its low-horsepower marketing drive on the AD/ECS-37 computer, and retired from the competition in the Fall of '62.

As the '63 stretch began, Advanced Scientific Instruments, Inc., after almost two years of independent steering, lost control, and was taken over by Electro-Mechanical Research, Inc., of Florida. Its ASI-210, and ASI-420 computers are continuing to be marketed through EMR.

By far the biggest change in the race pack this year has been the fusion of the Computer Division of the Bendix Corp. with Control Data. After almost nine years of competition, with the familiar G-15 and G-20 capturing over 360 installation sites, Bendix turned the engine over to that impressive young contender, Control Data, in mid-March. Now the CDC-15 and CDC-20 are new banners in the computer field.

The following month, the Autonetics Division of North American Aviation waved the white handkerchief on its RECOMP line of computers. After gearing up with a spirited marketing campaign in the past two years, Autonetics decided that the rewards for entrants in the scientific and engineering sector of the small computer market were too meager to justify the effort. They are looking for spectators who are willing to help them part with an estimated two RECOMP II computers and eight RECOMP III computers still in the shop.

Most recently, an escape hatch has been opened by El-tronics, Inc. when it announced that its ALWAC division was for sale. This "little david" in a competition of goliaths, has been holding to a niche in the market for over ten years. The industry had been expecting the oft-rumored ALWAC-IV to replace its vacuum tube ALWAC-IIIE, but new model plans have been sidetracked till after potential acquirers of

the division have been sounded out. As of presstime, there was no word of any serious offers for the small, but steadfast competitor.

With a full half-lap more to go this year, there are speculations about who else may be involved in making a terminal pit stop. Rumors persist that Burroughs may be acquired by a large automotive corporation, that UNIVAC will definitely be sold this year to just about any billion dollar corporation you can mention, that Philco will draw back completely from the commercial market and concentrate on military computers, and that Packard Bell may be bleaching its bandanna.

The flagman waving the contendors past the 1964 gate will undoubtedly be in for some major surprises.

THE SOVIETS TRY A "DECADENT" CAPITALISTIC STEP in their efforts to open a market in Western Europe for their Ural II digital computer and MN-7 analog computer: "ADVERTISING"!

A recent full page ad in a Soviet export magazine published in the Netherlands extolled the virtues of the Ural-II as "absolute accuracy", "a split second to do the most complicated problems", and "convenience and simplicity of servicing".

The Automatic Data Processing Newsletter of the Diebold Group, which first reported the ad, suggests that since the Ural-II is a vacuum tube machine, obsolete by Western standards, this may be an effort to "dump over-runs or inventory of an old machine" on a curious West.

Our records show that to date ten Ural-II's have been installed outside the Soviet Union: Red China, 1; Czechoslovakia, 2; Ghana, 1; India, 1; Poland, 3; Roumania, 1; and Syria, 1...namely, entirely to satellite nations and underdeveloped areas. We shall watch with interest, but with little optimism, the prospects of the Soviet's competing in the already overcrowded European computer market.

SPEAKING OF ADVERTISING, UNIVAC is letting loose with some high-explosive copy in its new ad campaign in the computer field, and shelling that legend of the industry...the IBM sales force. According to UNIVAC's ad approach, IBM is clubbed as being the "most advertised", "most publicized", "most quoted" and "most promoted", while UNIVAC humbly claims the shibboleth "most advanced". Other ads in the series, largely aimed at that mythical class top management, brand the IBM salesmen as being the sharpest talkers, the warmest handshakers, the steadiest backslappers, and the men you always have with you. UNIVAC merely claims that its less effective salesmen have a more effective product. We understand that since the campaign began UNIVAC has added free psychiatric care for its sales force, as a fringe benefit.

As yet no stirrings have been heard from the munition room below the august guns of White Plains.

WE GAZE WITH AWE at the wonders of the computer field which, no matter how hard we try, seem to escape our grasp.

For example we marvel at the computer produced by asexual methods, e.g. "...data, converted into electrical pulses, ran into one of the world's fastest computers, so complex it was designed and built by another computer". (from "The Death of Nike-Zeus" by E. Ubell and S. Loory, Saturday Evening Post, June 1, 1963).

...we marvel at the availability of computers, and their ease of use, which allows AFIPS to state that "Computers in the United States are available to everyone -- in government, industry, universities -- even students can have access to a machine". (from "Fact Sheet On The Electronic Computer Industry", prepared by AFIPS Public Information Office, March, 1963).

...we marvel at the dedication of people in the computer field, such as that of Herb Maneloveg of BBDO who recently charged co-workers in the media field to "ask not what the computer can do for you, but what you can do for the computer". (from speech at the Boston Ad Club, May 14, 1963).

Conducted by Leichtlicht Schreibfeder

WHO SAID THAT THE COMPUTER DOESN'T THREATEN MAN?

The threat of computer-stimulated automation becoming the doom of man has hardly ever been more vividly illustrated than in the above "photo study." David Mayes appears to be a victim of an information explosion, carried on the medium of seven-channel paper tape. Possible "suffocation" occurred during a test run of the Creedomat, a new high-speed tape-punching/tape-reading typewriter produced by Creed & Company, Limited of Croydon, England.

INFORMATION BUREAU ON COMPUTER SCIENCE

An information bureau has been established by the American Federation of Information Processing Societies to provide people in communication fields and public agencies with accurate, authoritative, unbiased information on all phases of computer science and technology.

Seventy-five scientists in the computer field have been selected for their depth of knowledge, perspective, and ability to communicate, and have pledged to participate. They will participate by explaining, upon request, the meaning of new developments, by translating technical terms, and providing viewpoints on the implications of developments. The spread of rapidly developing computer technology has made it difficult for editors of technical publications and general media to maintain up-to-date knowledge of new advances; and this Bureau should be of assistance.

The Information Bureau has no present plans for distributing prepared materials but will serve on a "question and answer" basis and to refer responsible existing literature to meet the specific needs of individual journalists and public agencies. Among the topics which the Bureau plans to cover are the following:

- Analog Computers
- Artificial Intelligence
- Automata
- Automation and Control
- Automation Processes
- Business Data Processing
- Coding
- Computer Elements
- Computer Programming
- Computer Reliability
- Computer Standards
- Computer Systems
- Data Acquisition and Transformation
- Data Processing
- Design Automation
- Digital Computers
- Education
- Effects of Computers
- General Computer Concepts
- Hardware
- History and Future of Computers
- Humanities Applications
- Hybrid Computers
- Information Retrieval
- Linear Programming
- Logic
- Machine Translation
- Mathematical Applications and Aspects
- Medical Applications
- Numerical Analysis
- Operations Research Applications
- Programming Languages
- Scientific and Engineering Applications
- Simulation
- Switching Circuits

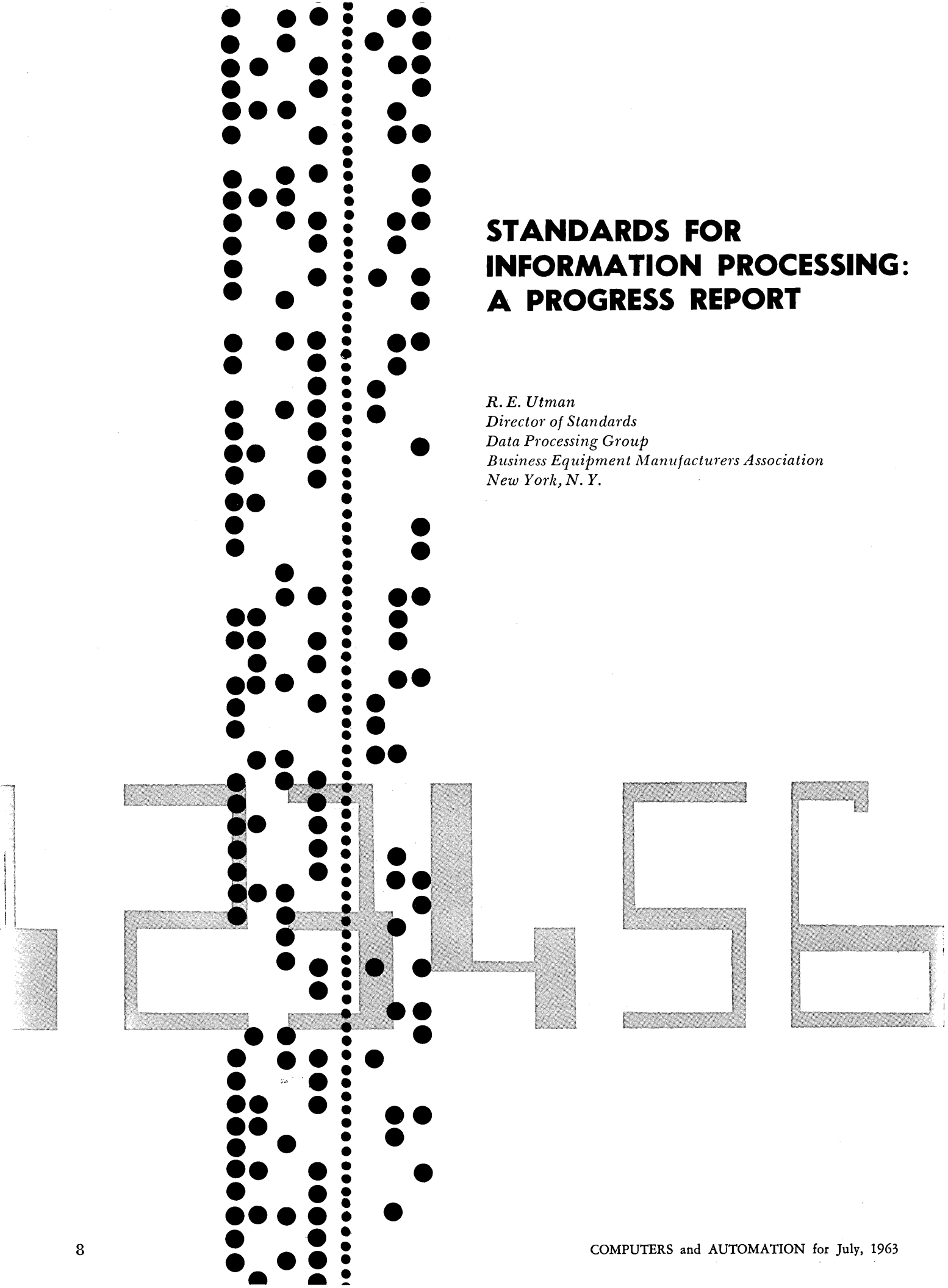
Queries for the Information Bureau may be made to Mrs. Phyllis Huggins, Public Information Director, AFIPS, P. O. Box 55, Malibu, California (Phone: (213) 394-6412), who will then direct the questioner to the participating scientist.

ASSOCIATION FOR COMPUTING MACHINERY NATIONAL CONFERENCE, DENVER, COLO. AUGUST 27-30

One hundred thirty computer-oriented scientists and mathematicians will deliver papers and conduct panel discussions at the 1963 Conference of the 14,000-member Association for Computing Machinery to be held in Denver, Colorado, August 27-30, 1963. Speakers will include a number of eminent scientists, industrialists, and teachers from the United States and abroad.

Latest designs in computer systems and peripheral equipment will be displayed in the Denver Hilton hotel, conference headquarters. Exhibitors will include manufacturers of both "hardware" and "software" equipment, prin-

(Please turn to Page 22)



STANDARDS FOR INFORMATION PROCESSING: A PROGRESS REPORT

R. E. Utman
Director of Standards
Data Processing Group
Business Equipment Manufacturers Association
New York, N. Y.

Probably no subject in the computer field has stimulated as much discussion and controversy in the past year as "standards." The author, who guides standards work for the association of computer manufacturers, presents a comprehensive review and projection of current activity in the development of standards for information processing.

The data processing industry developed through the 1950's without the discipline of standardization. Although this led to today's stiff competition which has rapidly given the user more and more for his dollar, it also entailed many headaches and increased unnecessary costs both for him and the manufacturer, such as these:

1. Representation of data by different code sets caused files to be ordered in different ways and reports to change format when different computers were used.
2. Incompatibility of magnetic tapes has caused manufacturers to design and produce, and users to pay for, converters which could have been eliminated altogether in a more disciplined framework.
3. The re-programming problem has made it expensive and time-consuming to switch from one computer to a better one with different logic.

The time was right, then, in 1960 for standardization, particularly of glossary, character sets and codes, languages, and input-output media, for the exchange of information between information processing equipments and humans. For this reason, the American Standards Association (ASA) and the International Organization for Standardization (ISO) decided in 1960 to form committees nationally (X3) and internationally (TC 97) on Computers and Information Processing, whose scopes:

> "Standardization of terminology, problem description, programming languages, and communication characteristics of computers and information processing devices, equipments and systems,"

were adopted in organization meetings held in 1960 and 1961. ISO assigned the Secretariat of TC 97 to the United States and the ASA, which in turn recognized the Business Equipment Manufacturers Association (BEMA) as sponsor of X3 and TC 97, with X3 to develop proposed draft standards both for the U. S. and the world.

Nearly simultaneously with the ISO formation of TC 97, the International Electro-Technical Commission (IEC) decided to form TC 53 to propose standards related to the electrical characteristics of Information Processing Equipment. The IEC also assigned the Secretariat for this work to the USA, and the ASA-US National Committee of the IEC selected the Electronic Industries Association (EIA) as sponsor, and formed Sectional Committee X6 to handle this work nationally. The scope of X3 was then clarified so as to include standards of a logical and physical or non-electrical nature. Also formed in 1960-61 were ISO/TC 95 and X4 on Office Machines standards, including the input-output media of such. The Office Machine Group of BEMA was selected as sponsor; to coordinate work of common interest among these bodies, joint steering committees were finally created at the national and international levels.

Optical Character Recognition

In order to break its work down into pieces of manageable size, X3 has seven working subcommittees. The first of these is X3.1 on Optical Character Recognition (OCR). As an example of the amount of work going into the formulation of information processing standards, X3.1 has met twenty-two times in its less than three years of existence. Furthermore, it has Task Groups on Font Development, Printing, and Applications. These Task Groups have met approximately as many times as X3.1 itself. During its last year of work, X3.1 has made much progress in selecting a numeric font for which to develop specifications (principally the decimal digits and a few special OCR characters) for a proposed American and ISO standard. There has recently been much discussion as to whether there should be a numeric standard followed later by a compatible alphanumeric proposal, or the ultimate alphanumeric font as the first OCR standard. It was decided in the January-March 1963 meetings to recommend the numeric first. X3.1 is trying to complete its draft numeric proposal by the end of 1963. They have had to move very carefully because a less than rigorous subjective proposal would not be acceptable, or, if adopted, would cost some manufacturers heavily. A good standard, on the other hand, would be a fundamental to the OCR business, on which it may then move forward. OCR is a good example of a situation where a balance must be achieved between the choice of optimum parameters for two interrelated sets of hardware: in this case the imprinter and the reader. It will probably be mid-1964 before the subsequent draft standards are proposed for the letters and other characters.

Bank Check Specifications

Closely related to the work of X3.1, Optical Character Recognition, is the work done by X3.7 which assumed the work of the Office Equipment Manufacturers Committee in conjunction with the American Bankers Association on MICR (magnetic ink character recognition). In September 1962, X3.7 presented to X3 two proposed American standards on Print and Bank Check Specifications for Magnetic Character Recognition. Since these had already been adopted by the American Banking Association and had become de facto practices, they were approved unanimously by X3 and submitted to ASA for processing. A patent application by a manufacturer on the print specifications has since come to light, however, placing the two proposals in suspense until agreements are obtained to place the techniques in the public domain. Over six months have gone by and the agreements have yet to be reached, but it is hoped now that they will be reached shortly.

Internationally, the European Computer Manufacturers Association (ECMA) TC-4 and the European Bankers Association (EBA) are carrying out similar work in parallel to X3.1 and X3.7. It is hoped that ISO/TC 97/SC 3—Character Recognition—will compare the X3.1 work with the ECMA TC-4 work on a numeric and subsequent alphanumeric

font before proposing any international draft recommendation. X3.1 is also starting to work more closely with ECMA TC-4, though participation in their bi-monthly working parties is expensive liaison.

In MICR, the French proposal CMC-7, based on BULL equipment, has recently been adopted by the EBA as a European Common Market standard in preference to the proposed American Standards. This work assures multiple ISO standards, rather than the immensely desirable goal of a single international standard.

Character Sets and Data Formats

In the basic technology of Character Sets and Data Formats, X3.2 from its inception took as its main goal the realization of an American Standard coded character set for the exchange of information between information processing (IP) systems and between IP systems and associated equipment. Using a 19-point set of criteria, the Subcommittee presented a 128-character set (not all characters assigned as yet) to X3 in November 1961 in the form of a proposed American standard. The proposal was accompanied by several appendices which show the design considerations and criteria which led to the set and describe related sets and adaptations.

The proposed set is not the same as any of the many sets already in use, nor could it be. Compelling reasons dictated various changes to existing practices. Here are just a few of the many design considerations which were used:

Set Size: Need for letters; digits; programming language characters of COBOL and ALGOL; data processing characters like @, $, %; transmission characters like null/idle, delete/idle, "Who are you," start of message; carriage control characters like bell, carriage return, horizontal tab. It was decided that 128 was a reasonable set size, requiring a 7-level binary coding scheme.

Collation Sequence: Although no collation sequence is specified, much effort was devoted to requirements of ordering, a few of which are: digits should be consecutive, letters should be consecutive, "Johns" should collate ahead of "Johnson," control characters should collate together, where possible the upper case—lower case arrangement of characters on a typewriter should correspond to a single bit difference between characters of such a pair, etc.

International Considerations: Provision was made for expansion of the alphabet.

Dissent

During much of 1962, dissenting papers were considered, resulting in minor changes to the proposal and rebuttals by X3.2. Then on September 14, 1963, X3 voted to submit a proposed draft standard to ASA. X4, however, voted against this draft standard as inappropriate for office machines use. BEMA, as sponsor of X3 and X4 recommended delay in submission to ASA until representations of the code in the principal media of punched cards, perforated tape and magnetic tape could also be proposed. In January 1963, however, X3 approved immediate submittal to ASA, and the code standard was formally submitted to ASA. The ASA Miscellaneous Standards Board has since approved it as an American Standard, and as a final step the ASA Standards Council is now reviewing all aspects of its development and processing. It is expected to become a Standard of fundamental significance shortly.

Future work by X3.2 in 1963 and later will include expansion and elaboration of the originally adopted set, resulting in draft proposals for its representation in the principal media. A perforated tape proposal is expected to be available to X3 in three months, magnetic tape in nine months or less, and punched cards in mid-1964.

International Character Set

Internationally, the TC 97/Subcommittee 2 corresponding to X3.2, proposed at its October 1962 Paris meeting that its 6- and 7-level coded character set (whose 7-level is almost identical with that of X3.2, if you interpret $ as a special case of the general currency symbol) be distributed as a draft proposal for an international standard. It also plans to work on the representation of the coded set in the various physical media, beginning at a Fall 1963 meeting.

Digital Data Transmission

In digital data transmission standards work, there is considerable overlap between X3.3 and EIA's TR-27.3. To avoid wasteful duplication, the two groups have been holding joint meetings. X3.3 has created six Task Groups to reflect its current work and objectives: Liaison, Glossary, Data Transmission Formats, End-to-End Control Characteristics, System Performance, Digital Data Transmission Speeds. In June of 1962, it presented X3 with a proposed American Standard on Signaling Speeds for Data Transmission, which cleared promptly through X3, BEMA and ASA and, on August 8, 1962, became the first American Standard in the Information Processing field. It is now being circulated internationally by ISO/TC 97/SC 6 for vote as a draft Future Guides on Signaling Speeds of Data Transmission, to be available as such to the ISO-IEC mailing list, including the International Telegraph and Telephone Consultative Committee (CCITT), which claims pre-eminence in this special field of international standardization.

Programming Languages

As an important area for standardization, programming languages (X3.4) are certainly among the most difficult. Reflecting the common User desire for such standardization, three languages, which are to some extent machine independent, have realized wide national and to some extent international recognition: FORTRAN, COBOL and ALGOL. FORTRAN, originally designed for one machine, became so useful that it has been implemented for about 50 machine types. Needless to say, partly because of different machine parameters (memory size, numbers of tape transports, etc.), partly because the original standardizing body SHARE was set up for a single machine family, there is tremendous variation in these various FORTRANS. Only with FORTRAN is the body of American usage experience significant. COBOL, and to a less extent ALGOL, are as yet too young. Nevertheless, there are also about 50 compilers for each of them, and ALGOL is achieving wide usage as a standard language for the publication of algorithms. Much experience for these compilers and languages will become available during 1963 and 1964.

Task Groups

X3.4 is addressing itself, with great respect for the difficulty of the task, to the job of standardizing Programming Languages. It has several Task Groups. The first, X3.4.1, has the function of specifying how to specify a language. A paper by its Chairman, Saul Gorn, illustrates the variety of approaches that could be used. Recently, progress has been made toward solution of the problem of recognizing ambiguities and inconsistencies in languages. This is not a trivial problem. The second, X3.4.2, is charged with reviewing draft standards proposed by other X3.4 subcommittees for completeness and acceptability, and also for establishing USA positions in regard to ALGOL. X3.4 recently reaffirmed its desire that the USA support ALGOL first as a potential international standard, and when and if the need arises to propose

AMERICAN
CHART OF PROGRESS

X3 SC-	Proposed American Standard	Date of X3 Working Group Complete Devel.	Draft	Dates of Approval By SC-	X3	Sponsor	ASA Standards Board	ASA	Abbrev. Title pAS-
X3.1	OCR Numeric Font, Print Specifications	62-63	12/63	12/63	4/64	5/64	7/64	8/64	NFOCR
X3.1	OCR Alphanumeric Font, Print Specifications	62-64	Late '64						
X3.2	Code for Information Interchange	61-62	11/61	11/61	1/63	3/63	4/63	5/63	CII
X3.2	Addenda to the pASCII--								
X3.2	Extension Rules (Escape)	62-63	6/63	8/63	10/63				CII_{Rev-E}
X3.2	Controls, Definition of	63	6/63	6/63	10/63				CII_{Rev-C}
X3.2	Subsets, Related	63	8/63						CII_{Rev-S}
X3.2	Unassigned Area, Use of	63	8/63						CII_{Rev-U}
(X3.3)	Controls for Synchronous Data Transmission	63	8/63						CII_{Rev-CS}
X3.2	Input-Output Media--								
X3.2	Perforated Tape Code	62-63	5/63	6/63	10/63				PTC
X3.2	" " Physical - Dimensional Spec's (1")	60-63	6/63	8/63	10/63				PTS-1"
X3.2	" " " " " (11/16")	60-63	6/63	8/63	10/63				PTS-11/16"
X3.2	Magnetic Tape Code	62-63	10/63	12/63					MTC
X3.2	" " Physical-Dimensional Spec's (1/2")	60-63	10/63	12/63					MTS-1/2"
X3.2	Punched Card Physical-Dimensional Spec's (80 & 90 Col.)	61-63	6/63	8/63	10/63				PCS-80/90
X3.2	Edge Punched Card Physical-Dimensional Spec's	63-64							EPCS
X3.2	Punched Card Code, ASCII Direct Representation	62-64							PCC-D
X3.2	" " " , ASCII Hollerith Extension	62-64							PCC-H
X3.2	*NMTC Perforated Tape Code	60-64							NMTCCPT
X3.2	NMTC Magnetic Tape Code	63-65							NMTCCMT
X3.7	MCR (Numeric Font) Print Specifications	60-62	7/62	8/62	9/62	9/62			PSMCR
X3.7	MCR Bank Check Specifications	60-62	7/62	8/62	9/62	9/62			BCSMCR
X3.7	MCR Error Correction Techniques	63-64							$PSMCR_{Rev-E}$
X3.7	MCR Bank Check Serial Number	63-64							$BCSMCR_{Rev-S}$
X3.3	Signalling Speeds for Data Transmission	61-62	3/62	4/62	6/62	7/62	7/62	8/62	SSDT
X3.3	Data Transmission Formats	62-64							DTF
X3.3	Bit Sequencing of the ASCII (7-level)	62-63	8/62						$ASCII_{Rev-BS}$
X3.3	" " " " " Related Subsets	62-64							$ASCII_{Rev-SB}$
X3.3	Graphic Presentations of Error Statistics of Rates	62-63	8/62						GPESRDT
X3.4	FORTRAN II	62-64	10/63						FORTRAN II
X3.4	FORTRAN IV	62-64	10/63						FORTRAN IV
X3.4	ALGOL	64							ALGOL
X3.4	COBOL	63-65							COBOL
X3.4	APT	63-65							APT
X3.5	Glossary for Information Processing	63-64	2/64						GIP
X3.6	Flowchart Symbols for Information Processing	61-63	3/63	5/63	8/63	10/63	11/63	12/63	FSIP

*NMTC = Numerical Machine Tool Control

INTERNATIONAL
CHART OF PROGRESS

ISO/IEC	Draft Recommendations		Date of ISO/IEC Devel.	WG Complete Draft	Dates Approved By WG	SC-	ISO/IEC Draft #1 Proposal	Draft #2 Proposal	Draft Rcmnd'n	ISO/IEC General Approval
TC97/SC 1	Glossary	Multi-lingual Vocabulary	60-64	1/64	4/64	5/64				IFIP/ICC Vocabulary
TC97/SC 2	Codes	6 and 7 Bit Coded Character Sets for Information Interchange	61-62	10/62	10/62	10/62	6/63			CCSII
TC97/SC 3	Char. Recog.	OCR Numeric Font	62-65							OCRNF
		OCR Alphanumeric Font	62-67							OCRAF
		MCR Numeric Font (E 13 B)	62-65							MCRNF
		MCR Alphanumeric Font (CMC 7)	62-66							MCRAF
TC97/SC 4	I-O Media	Punched Cards Physical-Dimensional	62-64							PCS
TC97/SC 5	Prog. Lang's	ALGOL	62-64							ALGOL
		FORTRAN	63-65							FORTRAN
		COBOL	63-66							COBOL
TC97/SC 6	Data Trans.	Guide for Future Signalling Speeds for D.T.	62-63	10/62	10/62	10/62	6/63			SS Guide
TC95/SC 8	I-O Media	Perforated Tape, Physical-Dimensional	63-64							PTS
IEC/ TC53/SC D	I-O Media	Magnetic Tape, Physical-Dimensional	63-65							MTS

the ISO standard as an American Standard ALGOL.

X3.4.3 FORTRAN was created in August 1962 and is hard at work defining two levels of FORTRAN as a draft American Standard. Membership in X3.4.3 and its task groups is open to an Implementer and a User Group representative associated with every USA compiler. Associate membership is also available to representatives of non-USA FORTRAN compilers.

X3.4.4, COBOL, was formed in January 1963 to prepare a COBOL proposal for processing as an American standard. The COBOL Maintenance Committee of CODASYL will remain the maintenance and defining body for COBOL, whereas X3.4.4 will create test problems and prepare the specifications of the draft standard. Close coordination with CODASYL is assured through a joint steering committee, and internationally with ECMA/TC-6-COBOL through periodic meetings.

X3.4.5 is the American secretariat and delegation to TC 97/SC 5, Programming Languages. Preparations are nearing completion for the fourth meeting at the ISO/TC 97 level, to be held in June in Berlin.

X3.4.6 works on Glossary concepts in the Programming Language field.

Internationally, TV 97/SC 5 has prepared a Programming Language Survey which is now being published in professional journals, and has invited IFIP/WG 2.1 (a Working Group of the International Federation of Information Processing Societies) and X3.4 to provide draft proposals for ALGOL, FORTRAN and COBOL for consideration as international draft recommendations. It is about to conduct a depth survey on these three languages.

Glossary

In glossary work, under the new chairmanship of Martin Weik of the Department of Defense, X3.5 is working on plans to produce a proposed American standard glossary for information processing by the end of 1963. They are merging several major domestic and international vocabularies (ACM, IFIP, IRE, etc.) with the specialized glossary requirements of the other X3 subcommittees into an acceptable whole. These input definitions are punched into cards at BEMA, and the compilation process is mechanized, with merged listings resulting for X3.5 analysis. Their final recommendation, term-by-term, is then circulated to each X3 subcommittee for criticism and acceptance. For interim use by X3, the Government Interagency ADP Council Glossary has recently been approved by X3.5.

Internationally, TC 97/SC 1 has a different multi-lingual approach and objective. It recognizes the work of the IFIP-ICC glossary development effort, which proceeds by defining concepts to which specialists in each language (English, French, German, Italian) attach words. This work is rapidly gathering momentum and it appears that by May 1964 a fairly good international Information Processing vocabulary will be available. It will contain many coined words or words from one language adopted in another. X3.5 has recently formed a task group (X3.5.2) to coordinate USA participation in this IFIP/ICC effort.

Problem Description and Analysis

X3.6 on Problem Description and Analysis has devoted the last two and a half years and twenty meetings to the development of a proposed American standard flow chart symbolism for information processing, which is now about to be circulated to X3 for official vote on acceptability. The future of this subcommittee is as broad as its field of systems analysis and description. They are currently evaluating their field for the next most important need in standards.

Internationally, at the TC 97 October Paris meeting, the formation of a counterpart ISO/TC 97/WG G—Problem Definition and Analysis group was approved. It will also start by considering Flow Chart Symbol draft proposals from the Netherlands, IFIP, ECMA and the USA. No meetings have been scheduled yet.

Input-Output Media

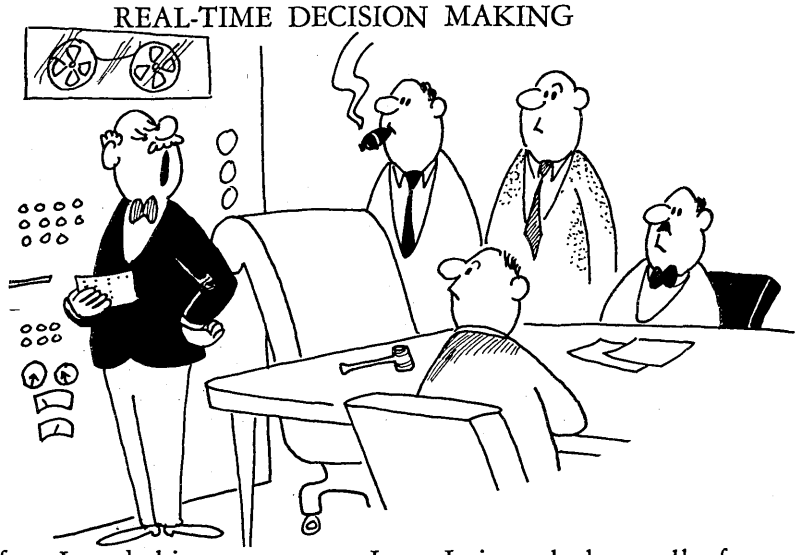
At the international level I-O media are the concern of ISO/TC 39-Machine Tools, TC 95-Office Machines, TC 97-Computers and Information Processing, and of IEC/TC 44-Electric Equipment of Machine Tools and TC 53-Computers and Information Processing. In the United States X3, X4 and X6 have been equally concerned in subcommittees X3.2, X4-A4, and TR-27.6. It is natural, therefore, that companies, countries and other interested groups who are finding it hard to man so many committees should have pressed for some simplification of the administrative procedures. The Joint Steering Committees at the national and international levels, created to solve such problems, have recommended formation of joint working groups to develop I-O media standards. These did not prove productive domestically. X3 recently recommended consolidation of X3, X4 and X6 I-O media responsibilities within X3, with the concurrence of X6, and conditioned agreement of X4. ASA then went further and assigned all I-O standardization responsibility to X3, including physical and electrical characteristics, equipment, and code representation. X3 in turn decided on May 2 to put all I-O and Codes responsibility into a reorganized X3.2, which will also be responsible for all USA participation in the numerous international working groups and subcommittees mentioned previously. It is hoped that this remarkable and rare opportunity for consolidation and simplification just experienced nationally can next be extended to the international level.

The new X3.2 is immediately confronted with processing draft American and international proposals for physical-dimensional standards in perforated tape, magnetic tape, and punched cards, and for numerically controlled machine tool punched tape code, resultant from four previous years of EIA and joint working group development. This processing and evaluation work will be undertaken as soon as qualified engineering becomes available within the membership of the new X3.2. Participation in several international working group meetings later this year must also be immediately organized, with delegates and USA positions or proposals provided.

Process Control

The scope of X3 was expanded formally in January 1963 to include responsibility for standards in the field of process control, including numerical machine tool control. X3 membership is in the process of expansion to include six new members from this industry and its users and general interests. X3.2 is expanding its membership to enable processing code and media requirements in process control systems. X3.4 has already begun a study project on the potential of APT (Automatically Positioned Tool) as a standard programming language for machine tool applications. This new X3 responsibility is expected to influence all subcommittees, and eventually require new groups for specialized needs.

REAL-TIME DECISION MAKING



"Before I read this answer, may I say I sincerely hope all of you gentlemen have bus fare . . ."

A PRIMER ON STANDARDS AND THE GROUPS PROPOSING THEM

Although the call for "standards" has been reaching increasing volume during the last several months, many people are still unaware of what standards are, who proposes them, and how they are reviewed, accepted, or rejected. Below is an outline of the groups active in standards for information processing in this country, the subjects they are working on, and their membership.

The American Standards Association (ASA) is a privately supported organization acting as the national clearinghouse and coordinating agency for voluntary standards in the United States.

ASA is a federation of 138 trade association and professional societies. Over 2,000 companies are sustaining members.

ASA's main functions are:

1. To provide systematic means for the development of American Standards
2. To promote the development and use of national standardization in the United States
3. To approve standards as American Standards provided they are accepted by a consensus of all national groups substantially concerned with their scope and provisions
4. To coordinate standardization activities in the United States
5. To serve as a clearinghouse for information on American and foreign standards
6. To represent American interests in international standards work

More than 2,000 American Standards have been developed and approved under ASA procedures. These standards apply in the fields of engineering, industry, safety, and consumer goods.

HISTORY

In 1918, five leading American engineering societies decided to form a national organization that could coordinate the development of national standards, founding the "American Engineering Standards Committee"—the forerunner of the American Standards Association. Three departments of the federal government, Commerce, War, and Navy, joined the organization as founding members.

In 1928 the American Engineering Standards Committee was reorganized and renamed the American Standards Association (ASA).

In 1948 ASA was incorporated under the laws of the State of New York. A Board of Directors is responsible for policy, administration and financial matters. A Standards Council, representing all member-bodies, supervises all technical activities and determines the over-all standards policy.

About 400 standards projects are currently active. Approximately 10,000 engineering, government officials, and representatives of various national groups are participating in these projects.

AMERICAN STANDARDS

An American Standard is a voluntary national standard, arrived at by common consent, and available for voluntary use.

It is a standard approved by the American Standards Association. Because ASA's procedures are based upon the principle of consensus from the initiation of work to its conclusion, an American Standard is accepted as the one national authoritative standard in its immediate field of application.

An American Standard can be developed by a committee set up under the auspices of the American Standards Association.

Also, trade associations and professional societies which have developed their own standards can submit these to ASA for approval as American Standards.

Approval of a standard as "American Standard"—no matter how or where developed—is given only if the standard is supported by a consensus of all national groups substantially concerned with its scope and provisions.

INTERNATIONAL STANDARDIZATION

The American Standards Association holds the U. S. membership in two international standardization bodies—International Organization for Standardization (ISO), International Electrotechnical Commission (IEC)—and the Pan American Standards Committee (PASC). In this way, ASA provides the channel through which American interests can participate in global and hemispheric standards projects. ASA also works with the British Standards Institution and the Canadian Standards Association through the "ABC" (American-British-Canadian) Conference on Unification of Engineering Standards.

The ASA library is a source of information on thousands of foreign standards. The Association supports U. S. foreign trade by promoting a knowledge of American Standards abroad.

HOW AMERICAN STANDARDS ARE ACHIEVED

American Standards come into existence through three basic methods.

1. Section Committee Method. A committee, composed of representatives accredited for the purpose by all groups and organizations substantially concerned with the scope of the standards project and organized under the rules of ASA for such committees, formulates the standard. The special utility of the method consists in the provision, in advance, of such representation that a consensus will be assured and self-evident when the members have approved their completed assignment.

2. Existing Standards Method. Under this method, an existing standard may be submitted for approval by any responsible body, and may be approved by ASA provided:
   (a) It is shown that the standard is supported by the necessary consensus of those substantially concerned with it
   (b) It does not conflict with any other American Standard

Approximately one third of the standards approved by ASA have been considered under this method.

3. General Acceptance Method. Comparatively simple standards that do not require prolonged committee work can be approved at a General Conference of all groups vitally concerned with the scope of the standard. The conference action is finalized through letter ballot action to establish the existence of the consensus required for approval by ASA.

ASA SECTIONAL COMMITTEE METHOD

The Sectional Committee Method, one of the methods recognized by ASA Procedure as meeting the basic requirements of the Association, consists in the formation, at the beginning of a project, of a committee to develop one or more standards under an assigned scope. The committee is composed of representatives accredited for the purpose by the various organized groups concerned with the project and, when desirable, companies and specially qualified individuals as general interests. Membership in a sectional committee may also be in the name of the organization as such, no individual being designated as representative or alternate.

ASA is prohibited by its constitution from formulating standards. It is not a technical society engaged in standardization work. It therefore cannot own any committees that formulate standards. Thus sectional committees can only be considered as belonging to the group of organizations having representation on the committee and which have agreed to cooperate, under ASA procedure, in the development of standards they all desire.

ASA SECTIONAL COMMITTEE SPONSOR

One or more organizations principally concerned with the work assigned to a sectional committee may be designated to give administrative support and direction to the committee. The sponsor organization is responsible for the administration and direction of the standards project. It organizes the sectional committee with the

advice and assistance of ASA; it ensures that the work is carried out continuously and effectively; it provides the necessary administrative services; and keeps ASA informed on the progress of the work. A project may have more than one sponsor.

X3 SECTIONAL COMMITTEE

X3 TITLE—COMPUTERS AND INFORMATION PROCESSING

X3 SCOPE—

Standardization of the terminology, problem description, programming languages, communication characteristics (1), and physical (non-electrical) characteristics (2), of computers and data processing devices, equipments and systems (3).

Note 1. Includes standardization of symbology, coded character sets and representations, input/output media and formats, character recognition.

Note 2. Includes standardization of the logical and physical characteristics.

Note 3. Includes process control systems and others as developed.

X3 MEMBERSHIP

Membership is by national association, society or organization, divided equally into three groupings by interest:

General Interest Organizations,
Manufacturer Associations,
User Organizations.

The following organizations are regular voting members of X3:

GENERAL INTEREST GROUP
(10 Votes)

American Institute of Electrical Engineers
Association for Computing Machinery
Association of Consulting Management Engineers
American Management Association
Data Processing Management Association
Department of Defense
Electronic Industries Association
Engineers Joint Council
Institute of Radio Engineers
Telephone Group

MANUFACTURER GROUP (10 Votes)

*Business Equipment Manufacturers Association

USER GROUP (9 Votes)

American Bankers Association
American Gas Association & Edison Electric Institute
American Petroleum Institute
Air Transport Association
General Services Administration
Insurance Accounting & Statistical Association
Joint Users Group
Life Office Management Association
National Retail Merchants Association

*At present one association, BEMA, represents the interests of manufacturers in X3. The ten votes of BEMA are held by ten member companies, selected annually, and including:

Burroughs Corporation
International Business Machines Corp.
Minneapolis-Honeywell Regulator Co.
Monroe Calculating Machine Co.
National Cash Register
Pitney-Bowes, Inc.
Radio Corporation of America
Remington Rand Division of Sperry Rand
Royal McBee Corporation
Standard Register Company

X3 OFFICERS

Chairman, C. A. Phillips, BEMA
Secretary, R. E. Utman, BEMA

X3 SUBCOMMITTEES

X3 has organized into seven subcommittees, responsible for the technical work of considering and providing for the initial standardization requirements of information processing:

X3.1—Optical Character Recognition
X3.2—Coded Character Sets and Data Formats
X3.3—Data Transmission
X3.4—Common Problem-Oriented Programming Languages
X3.5—Terminology and Glossary
X3.6—Problem Description and Analysis
X3.7—Magnetic Character Recognition

Each subcommittee has defined its range of technical responsibilities and activities in the form of scopes and programs of work approved by X3. In most subcommitees further subdivision into working groups has been necessary to the accomplishment of technical purposes (as shown below). In all subcommittees and working groups, members function as individuals rather than official representatives of organizations, although a reasonable balance of interests is desired.

X3.1 Title: Optical Character Recognition

Scope: Printed input and output to data processing systems for interchange of information between data processing and associated equipment. Humanly legible printed character sets, e.g., character recognition.

Chairman: J. J. Eachus, BEMA/Minneapolis-Honeywell
Secretary: Terrance Trickett, American Machine & Foundry Co.
USA Representative: E. Daniel Spina, BEMA/IBM
Working Groups:
X3.1.1—Font Development
X3.1.2—Printing Capabilities
X3.1.3—Format and Applications

X3.2 Title: Coded Character Sets and Data Formats

Scope: Recommendation of standards for coded character sets and recording formats (Note 1) for the interchange of information between information processing systems and between systems and associated equipment (Note 2). Such recommended standards are to include:

a. The machine sensible coded character set.
b. Such standard formats and format indicators as are required to define data fields, data records, program instructions and the like.

Note 1. Includes responsibility for the (logical) representation of codes in the several media, taking into account the need for error checking. It is recognized that media present physical limitations, and that close working liaison with other groups (I/O Media) will be necessary.

Note 2. Includes process control systems.

Chairman: L. L. Griffin, X3/DOD
Secretary: Rotates
USA Representative: John Auwaerter, Teletype Corporation
Working Groups:
X3.2.1—Code Representation/Magnetic Tape
X3.2.2—Code Representation/Perforated Tape
X3.2.3—Code Representation/Punched Cards
X3.2.4—Character Assignments/Unassigned area (pASCII)
X3.2.5—Coded Character Subsets and Applied Character Sets (related to pASCII)
X3.2.6—Definition of Control Character Functions (pASCII)

X3.3 Title: Data Transmission

Scope: Determine and define the operational characteristics governing the performance of digital data generating and receiving systems combined with communication systems.

Chairman: A. Stillman, BEMA/RCA
Secretary: E. H. Lohse, BEMA/Burroughs
USA Representative: F. Warden, BEMA/IBM
Working Groups:
X3.3.1—Liaison (EIA & CCITT)
X3.3.2—Glossary
X3.3.3—Description of Equipments
X3.3.4—Establishment of Interfaces
X3.3.5—System Performance

X3.4 Title: Common Programming Languages

Scope: Standardization of common program languages of broad utility through standard methods of specification with provision for revision, expansion, and improvement, and for definition and approval of test problems.

Chairman: R. F. Clippinger, BEMA/M-H
Secretary: K. Speierman, BEMA/Burroughs
USA Representative: H. Bromberg, BEMA/RCA
Working Groups:
X3.4.1—Language Theory
X3.4.2—Language Specifications & ALGOL
X3.4.3—FORTRAN
X3.4.4—Processor Specifications & COBOL
X3.4.5—USA in ISO/TC 97/SC 5
X3.4.6—Programming Glossary

X3.5 Title: Terminology & Glossary

Scope:

(a) To coordinate and advise the other subcommittees of ASA X3 in the establishment of definitions required for their proposed standards.
(b) To recommend to X3 a general glossary of data processing terms (for the professional community).

Chairman: Martin H. Weik, X3/DOD
Secretary: J. F. Traub, Bell Laboratories
USA Representative: J. F. Traub, Bell Laboratories
Working Groups:
X3.5.1—Definition Maintenance
X3.5.2—Glossary Advisory Committee

X3.6 Title: Problem Description & Analysis

Scope: Information Processing Problem Description and Analysis Standards to provide a systematic means of studying information processing problems, documenting, and preparing the required information for analysis.

Chairman: R. W. Green, BEMA/Standard Register
Secretary: J. W. Dresch, BEMA/UNIVAC
USA Representative: J. Pfaff, BEMA/Burroughs
Working Groups:
X3.6.1—Methodology
X3.6.2—Input/Output
X3.6.3—Data Transformation
X3.6.4—Glossary & Terminology
X3.6.5—Flow Chart Symbols

X3.7 Title: Magnetic Character Recognition

Scope:

1. Development of standards for MICR (present and future).
2. Resolution of problems which may arise in industry and the market place which involve the manufacturers and printers.

Chairman: T. M. Butler, X3/Burroughs

Secretary: G. A. Baird, BEMA/Burroughs
USA Representative: E. Daniel Spina, BEMA/IBM
Working Group:
X3.7.1—Technical

X3 ADVISORY COMMITTEE

X3-IAC Title: X3-International Advisory Committee
Scope:
1. To ensure that there is active participation by the U. S. in the working groups or subcommittees of ISO/TC 97.
2. To ensure that where the U. S. has the responsibility for the secretariat of working groups or subcommittees, the appropriate subcommittee of X3 is actively fulfilling its responsibilities.
3. Where there is not an exact correspondence between the scopes of ISO/TC 97 working groups or subcommittees and X3 subcommittees, to propose methods of ensuring active participation in, and representation on, the ISO/TC 97 working groups or subcommittees.
4. By coordination of the activities of the U. S. representatives on the ISO/TC 97 working groups and/or subcommittees to formulate for approval by X3 and the DPG Engineering Committee U. S. policy and to prepare, or have prepared, the U. S. contributions or recommendations to the Plenary conferences of ISO/TC 97.
5. To propose the U. S. delegation to such Plenary conferences.
6. To participate in liaison activities with other international organizations as requested by the secretariat of ISO/TC 97.
7. To recommend for approval by X3 and the DPG Engineering Committee all steps that should be taken to adequately fulfill the U. S. role in international standardization activities.
Chairman: B. W. Pollard, BEMA/Burroughs
Secretary: R. E. Utman, BEMA
Membership: USA Chairmen of ISO/TC 97 Subcommittees
SC 3—R. J. Mindlin
SC 5—R. F. Clippinger
SC 6—A. H. Stillman
USA Representatives
X3 Chairman (ex officio)

X3 IN JOINT ACTIVITY ON STANDARDS OF COMMON INTEREST

NJSC Title: National Joint Steering Committee
Scope: Provide guidance to joint standardization work of common interest among the Sectional Committees, X3, X4 and X6. Resolve jurisdictional problems.
Chairman: Rotates among chairmen of X3, X4 and X6
Secretary: Rotates among secretaries of X3, X4 and X6
Membership: Chairman, Secretary, Technical Advisor of X3, X4 and X6, ASA Miscellaneous Standards Board Secretary

NJWG/PC Title: National Joint Working Group/Punched Cards
Chairman: Charles Whitaker, NCR
Membership: EIA/TR 27.6 and ASA X3.2

NJWG/PT Title: National Joint Working Group/Punched Tape
Chairman: F. W. Williams, IBM
Membership: EIA/TR 27.6 and ASA X3.2

NJWG/MT Title: National Joint Working Group/Magnetic Tape
Chairman: Harry Hayman, NASA
Membership: EIA/TR 27.6 and ASA X3.2

Joint Activity on Data Transmission
Joint meetings of ASA X3.3 and EIA/TR 27.3 are held for purposes of standards in data transmission.
Chairman: Alternates between
ASA X3.3 Chairman—A. H. Stillman, BEMA/RCA
EIA/TR 27.3 Chairman—J. L. Wheeler, Xerox

BSRB Title: BEMA Standards Review Board
Chairman: Either Director OMG or Director DPG, as indicated
Secretary: R. E. Utman, BEMA
Members: Engineering Committees of OMG and DPG

BEMA/DPG Title: BEMA/Data Processing Group
Chairman (1963): R. G. Chollar, NCR
Vice Chairman (1963): M. G. Mengel, Burroughs
Director: C. A. Phillips, BEMA
Director of Standards: R. E. Utman, BEMA
Members:
Addressograph-Multigraph Corporation
Burroughs Corporation
Farrington Electronics, Inc.
Friden, Inc.
International Business Machines Corporation
Minneapolis-Honeywell Regulator Company EDPD
Monroe Calculating Machine Company
Moore Corporation Ltd.
National Cash Register Company
Pitney-Bowes, Incorporated
Radio Corporation of America
Remington Rand Division of Sperry Rand Corporation
Royal McBee Corporation
Smith Corona Marchant, Incorporated
Standard Register Company
UARCO, Incorporated
Underwood Corporation
Xerox Corporation

BEMA/DPG-EC Title: BEMA/DPG-Engineering Committee
Chairman: C. A. Phillips, BEMA
Secretary: R. E. Utman, BEMA
Members: Representatives of Member Companies
Scope: Acts for sponsor as administrative authority for ASA X3.

MANAGEMENT, AS A PROBLEM IN PROCESS CONTROL

Simon Ramo
Vice Chairman of the Board
Thompson Ramo Wooldridge Inc.
Canoga Park, Calif.

A leading exponent of the blending of the versatility of the human mind with the information-processing capacity of electronics addresses himself to a key question: "What will happen to management in an automated information world?"

We can expect that, in the future, the world's operations will become dependent upon, and will be designed around, a mass extension of the human intellect by electronics. It may take a decade or more, but eventually information will be stored efficiently and retrieved virtually instantaneously. It will be processed in accordance with specific, recorded rules. An orderly arrangement of the facts of the past will be compared to the happenings of the present to predict a substantial portion of the future with useful accuracy. Electronic systems will solve what today appears to be impending chaos in the paperwork necessary for the world's production, communication, transportation, professional, financial, and government operations.

Man-Machine Partnership

However, it is not correct to conceive of the world of the future as an automatic world in which intellectronics equipment has replaced all human brains and senses. Rather, as the word "intellectronics" implies, the human "intellect" will be extended by "electronics" to create a new man-machine partnership. Together, we and the machines, in a sensible co-operative pattern, will handle the greater amount of data required by the increasing size and pace of world activities, and we will accomplish this with greater ease. The electronic machines will largely take care of the matters of quantity, speed, and interconnection, and the human partners will then be able to elevate themselves to the more difficult, truly human, intellectual tasks.

In such a world, what will happen to "management"? Will managers be in part replaced by machines? Will managers have their brains "extended" by the new electronic tools available? Will management perhaps need to be redefined, when the decision-making, control, and planning functions in the world of the future change in form and in substance? It is such questions that we shall examine in this essay.

We must start by describing a few more highlights on the nature of the technological society ahead. Management, as we know it today, will change because, for one thing, the world will change, and not just because management itself will be seeking to make use of new technological tools. We must assume that everywhere we look in the environment of the latter decades of this century we shall see new devices for keeping track of all of the information needed to perform the tasks in which men and machines are today engaged.

There exists already sophistication in such problems as the automating of a chemical process by automatic measurement of the characteristics of the entering raw materials, the chemical that is produced, and the temperature, pressure and other physical parameters. We may expect this kind of application to grow in many ways, to be common rather than exceptional, to provide an optimum operation through a better matching of man and machine and a high degree of interconnection and integration with other aspects of the total operation. We should expect to see a growing corps of specialists controlling the local "on-line" operations, with "local" and "on-line" covering more and more territory. In addition, there will be another large class of man-machine combinations working to understand, design, analyze, and improve the operations in a broader, longer range sense.

Flows and Traffic

Similarly, we may expect to observe that the flow of people and things on the ground and in the skies, in city and country, will be dependent on networks of devices to sense the traffic, anticipate the conditions that will develop, figure out what signals should go out to modify and control the flow so as to achieve the greatest efficiency, capacity, and safety, and to communicate this information to the devices or the people that perform the operation. Again, we see two classes of problems. One is associated with the "on-line" operation itself, that is, relating the developing situation to the past and to a set of rules or equations, and, finally, originating new controlling signals. The other is the analysis and design of the operation. This function will also be a man-machine exercise whose purpose is to seek improved operation, better utilization of the total resources,

optimum application of machines and men in a harmonious ensemble, and to better define the goals of the operation.

Missile Test Flights

In engineering work, we already have reached the point of great dependence upon electronics to extend the brains of the scientist and the engineer. For example, it would have taken us some ten thousand actual test flights to prove out the design of an intercontinental ballistic missile without the use of electronic brains. Actually, on a crash basis, we did it in a few years and needed only some tens of flights. The large-scale digital computing systems and simulators enabled us to get the equivalent of tens of thousands of flights. We were able to work out the important interrelationships amongst all of the design variables in the laboratory, ahead of the modest full-scale flight tests that then confirmed the soundness of the design.

From Problem to Design

But in the future, we shall expect to go further. To do computation and simulation more rapidly by machine is only half of the ultimate potential. One day the engineer at his console will be able to proceed directly from an articulation of the needs, the problem to be solved; by tapping a huge but accessible file of scientific facts, laws, and fundamental interrelations, he will be able to arrive more quickly at basic conceptions of design. He will be able to compare alternatives and to know what range of solutions he can consider. He will be able to synthesize and create more quickly, doing a higher level of difficult thinking than, unaided, he can hope to attain.

Again we see the intellectronics age as one in which the activities can be considered as of two kinds. One involves the day-to-day operations within an existing and understood mode of operation, with the man and machine combined to do a much better job of handling the matter both as to quantity and as to rate. This covers situations that are common and recurring. They can be planned for ahead of time and covered by the stored information, the incoming information, and the existing logic of the system. Even the exceptions can be identified and called out for decision by the human operator. On the other hand, we have the possibility of the highly intellectual human operator using the electronic machines as partners to enable him to analyze the whole of what he is attempting to do, to improve his basic conceptions and goals, to redesign the entire operation, and to explore new possibilities.

Medicine

In medicine, we see some especially strong indications of how the intellectronics age may advance. The physician of the future will be able to take the data on a patient—his apparent condition as judged by tests and the physician's own observations, his history, the complaints or symptoms—and enter these into a national network of statistics and deliberative services. Almost instantaneously, the physician might have displayed to him pertinent comments from the system concerning this patient's possible diagnosis and possible treatments. He will get in part the equivalent of having consulted with thousands of other physicians. He will have pertinent facts and issues called to his attention. He can propose a treatment and have this criticized against the statistics for that patient's data.

A whole new profession, having to do with the statistical handling of medical facts, relating cause and effect, drugs and cures, will probably grow up. Considering the speed and capacity of conceivable national intellectronic systems in the future, such systems may have an impact on the practice of medicine comparable to the advent of surgery.

Again, there is the direct, immediate, day-to-day problem of the practicing physician which may change in nature because of the existence of a suitably designed intellectronics network. Also, we see again the possibilities of new, contemplative, longer range activities in the field of medicine made possible by the availability of a tremendous volume of facts, of the electronic means for the analytical examination of these facts, and of new intellectual skills that are brought into existence when the data and equipment become available.

Law

Similarly, in law, the attorney of the future, applying himself to the day-to-day activities of steering the actions of people, corporations, and government along lines prescribed by the nation's laws and rules, can expect radical changes and improvements. He will be able to take the facts related to a particular action with which he is concerned—such as a business deal, a contractual relationship between two people, or a petition for a license to perform some activity—and introduce these facts into the legal intellectronics network of the nation (and perhaps of the world, in some respects). Again, almost instantaneously, he will get back approval with confidence that what is proposed has been properly examined, is entirely consistent with the rules, is not in conflict with the claims of others or with the total facts as they are known to exist by the system, and is now properly recorded. Or he may receive an indication that the case is not complete, that information is lacking, perhaps that he has not properly portrayed the total situation, or that he is attempting to arrange something which is inconsistent and improper, or something that may be legal in part but that requires special called-out approval according to the rules.

In more complex situations, where there are differences to be resolved or problems that must be presented to deliberative bodies for action, the system helps to provide a definitizing of the differences in the case or the particularities that require judicial or other action. The attorney, in trying to see how to proceed, can present the gist of his case to the intellectronic system and receive back immediately a summary of similar cases. Indeed, the summary before him would indicate whether the cases presented are truly similar. If not, this will be notice to the attorney that he has not properly understood his case, because he apparently has not described the essence of it well enough to receive back pertinent comment.

Two Sets of Purposes

Again we see that man-machine, intellectronics systems can serve two classes of purposes. In one, the attorney can get help on his day-to-day, immediate operations. A man-machine system will do better in assuring that actions are legal and proper and that all activities of the world's operations are done in accordance with an orderly, predesignated set of rules. In addition, intellectronics can provide a fuller, up-to-date understanding of what goes on, and this is part of the job of improving the rules of the nation. This takes us from the day-to-day practice of law to the deliberative bodies that make and judge the laws. Here, the ready availability of all the facts and rules, and the ability to process these, allows analysis of what issues or situations present problems and seem to require new rules, of what it is that is creating inconsistencies and conflicts. The intellectronic systems of the future, with man and machine in proper relationship to one another, will make possible the study of needed legislation without so much guesswork and emotion.

Through this example, we are afforded an opportunity to observe another factor which will be a common one in the technological world of the future. The rules of opera-

tion as determined by the government will gradually be altered so as to take advantage of what technology affords, not only in the interconnected national library of facts and speedy information retrieval, but in the processing and examination of that information, especially in relationship to the rules.

Government

New patterns for the handling of the government functions of policing, refereeing, and control may be expected. Today, most things are done without reference to any central recording system, whether ultimately to be policed by government or not, and they are allowed to rest unless someone suspects or complains that there is a violation. Then activity or confusion results, and in one way or another the matter usually gets straightened out, or it dies, or occasionally someone sees how to alter the rules to avoid inequities or confusion. In the future, with the speed, interaction, and capacity of data collection and analysis so vastly increased, it becomes possible to set up controls to cover automatically a wide variety of situations. This has, of course, both good and bad implications. On the bad side, we could arrive at an overcontrolled society. But if it is done right, it means that we can have a clearer set of rules and a less chaotic, more orderly society. Furthermore, it means that, in the process of deciding what rules to have and how to get them changed, the investigations will be performed better.

It is even possible to imagine that the intellectronic system could be asked by the lawmakers what the situation would have been for, let us say, the previous five years, if the rules had been different along some proposed line. Then, the system, having tremendous speed and access to all of the information as to what has happened, could go through a simulation process with very considerable accuracy, and it would turn up with comparative data showing the consequences of changing the rules in various directions. Lawmaking and the nation's interest in lawmaking could thus undergo enormous revamping.

Management of a Business

Let us now start to deal more specifically with problems that have to do with the management of a business.

Day-to-Day Control

Clearly, again we shall see two kinds of problem areas. One aspect of management is concerned with the day-to-day control of the operation. Today, we do this by a combination of a sort of "on-line" control together with what might be called "conventional accounting," which means that we gather the facts as to what has happened after it has happened. In "on-line" control (and I do not refer here mainly to the concept of process control in a factory or refinery), the managers, who are aware of what is happening and who have some plans, biases, goals, or ideas as to what ought to happen, or what they wish were happening instead, more or less continually make decisions which alter the operation. They are constantly at work, sensing the operation and changing it. When it is possible to do this on a short time basis, we can think of it as "on-line" management. Presumably, the more complete the information as to what is happening, and the faster this information can be made available to the sensing system of the manager, the clearer the manager is on the relationships amongst all of the factors, and the closer he can get to "on-line" operation.

Delay in Knowledge

If the rules of the operation are quite complex, and if it depends on a rather vast amount of information, far beyond what one manager or even a host of human operators can hope to fathom with their brains and senses—then the control system is probably quite far from "on-line" management. To be sure, managers today are busy making decisions on matters that are brought to their attention. The average manager would probably tell you correctly that he is dealing with sudden, new facts every moment and having to adjust to them, often very rapidly, and, by gosh, he is on top of his operation. The point is, though, that a very large fraction of all the significant things that happen in his operation are actually made known to him quantitatively and completely only after a substantial period of time. He gets, in other words, an "accounting." The main descriptions of his operation, by and large, are those that go through the accounting process. And most of the machinery to improve the flow of data, and to increase the capacity and speed of processing, has to do with trying to give him a more complete accounting and to give it to him sooner.

Rapid Knowledge

Now, what happens in the future to day-to-day management as the information quantity and speeds are drastically increased? Suppose this information flow really enables a manager to control what will happen out of the available, understood, up-to-the-minute spectrum of choices. We are not talking about the local loops involved in some geographically or operationally rather isolated element of the total operation. That is, a particular machine in a factory, for example, may be run by a computer and a taped program; it has its own local detailed decisions to make. It is a form of "on line" management, and it may even involve a human operator in cooperation with the machine's automatic observation and programming capability, with the combination striving for some optimum utilization of the whole setup to turn out its product. In a similar way, in the banking business, we are not primarily concerned with such a local problem as a combination of human operators and machines to sort checks, insuring that they are flowing smoothly from one end of the line to the other. We are concerned with something that we have a right to call operating management and more particularly with controlling an ensemble of man and machine operations so that the system accomplishes what the managers want. However, we do not have to go to the other extreme of simply looking at the final result, the profit at the end of the year, or the return on investment. There is a tremendous range of operating management problems—above the small local ones and yet far away from the summary management—where better operations management is basic to over-all improvement.

Over-all Control

Before we go ahead to answer the question of what might happen to operating management in an automated information world, let us look briefly at the other aspect of management. Above the day-to-day operating control, there has to be a defining of the goals of the over-all operation, of goals for the operating management, and an assessment of operating management including the way in which men and machines are used. There must be an attempt to assure a better operation by attacking the fundamentals of the whole technique of management. As to this second category of management, we might expect it to be altered and improved, for one thing because the operation below will be better controlled, and the plan for the operation will be more quantitatively specified in the beginning. It will be a lot clearer what can or cannot be expected out of the operation. There will be some good estimates as to what goals are reasonable. The operation will be so managed that it will come a lot closer to the optimum that conditions allow than we have any right to expect of most operations today.

Next, we should note that the operation will be tied in more closely with other operations of the world. Integra-

tion and interaction will be much more a factor in determining the nature of operations in the future than at present. Raw materials will flow from a source, perhaps a distant one, to the processor or assembler in accordance with signals generated, in major part automatically, as a result of the operating "on-line" relations between the two plants. The shipping of a component from one plant will have been the result of an automatic announcement of the need for that component at some appropriate future moment in another plant. In addition, a tied-in, banking-accounting intellectronics system to which the manufacturer, the supplier, and, finally, the customer are all subscribers, will insure an appropriate and automatic charging of their accounts. Information on taxes, flow of funds, allocation of charges in banks and to various accounts, will all be transmitted by electrical signals, traveling through wires or through the air, perhaps even by way of communications satellites. A closely knit network of information flow will relate each separate organization with all the other groups with whom it has dealings, to assure that everyone gets what he needs at the right time and the right place. This whole chain will furnish the same kind of information to the government to insure that all is done in accordance with the rules, with an automatic calling out of any violations.

If you are bothered by having to fill in the social security numbers on all of your little dividend checks to conform to the new rules of 1963, then imagine the period of the future. Probably none of us, at least in urban areas, will deal with money. Identification by thumbprint in front of an electronic scanner will make possible the transfer of funds, whether you buy a house or a necktie. There will still be risks for those who live in that beautifully ordered period of the future, but they will be different, more "modern," risks than the ones that we have today.

Evaluation and Control

We thus are caused to observe that the higher level, analysis, goal-searching, evaluation functions of management in the future may involve people working with consoles, calling out information from the system and studying automatic displays of new combinations from that information, exploring possibilities, all somewhat aloof from the momentary "on-line" operations. The full powers of intellectronics will be available to remember, to consider the impact of modified rules and decisions, and to display these to the operators. One output of this higher level of management analysis will be a modification in the man-machine operating management system, both as a network and as to the controlling parameters. The more superior this top level job, the better will be the control and the less the deviations from plan in the day-to-day operations.

Let us now return to the "on-line" control management system of the future. We see that the primary function of conventional accounting for day-to-day operations should essentially disappear. The system becomes one which generates detailed plans, observes the deviations from plan as they occur, and takes action regarding these deviations. To some deviations, it reacts in accordance with plans for deviations from plan. For instance, suppose that a factory's plan is upset because a machine has had some sort of mechanical failure, or because workers fail to show up due to a sudden epidemic. Either the human managers are at this point brought in to make a decision amongst a group of alternatives, or they have already made a decision as to what will be done when these things happen. In the latter instance, it will be only when there is an even more "unplanned" and extraordinary deviation from plan that will require a human managerial input.

Optimizing Over-all Performance

We should mention briefly another rather important aspect of man-machine relationships in the future. Always in creating a system for control, we will have available as possible components the human mind and sensing system and electronic machines, either in existence or capable of being developed. A good system is one that so combines and mixes these as to optimize the reliability and over-all performance against the investment. There are many functions which the human mind and sensing system can do better than machines, because the human mind has the equivalent of some billion or more transistors in peculiar interconnections and has its own built-in power supply and is readily transportable. There are other things for which the human mind and sensing system are decidedly unsuitable. Thus often we would expect the best systems configuration to combine man and machine. But for the purpose of this discussion, we don't have to know the division of labor between man and machine, or the exact configuration of the system. We can assume that the man-machine system of electronic devices and human operators has the job of "on-line" control. This includes generating an operating plan, observing deviations from plan, introducing actions when such deviations are observed, and automatically generating new plans that are better—all in response to programmed goals and over-all assessments made by the top level of management.

Technology will make possible, as time goes on, the economical handling of a hugely increased amount of information that relates to any given operation. Furthermore, technology will provide economic means for processing and bringing the information virtually instantaneously to a human operator, wherever he may be, and to machines, in such form that the men and machines will be able to understand and use the information when it arrives. All this is basic to understanding the operation better so that it can be optimized, as well as being basic to on-line control. But simultaneously, we can abandon a good deal of other information that is now thought to be needed and is really concerned with conventional accounting.

In the future, as we develop systems that are able to generate optimum plans, we shall be interested much less in the normal daily details and much more in the deviations, and especially in the deviation-reacting system itself. We become less interested in what has routinely happened as we become more certain that what happens is the best that can be caused to occur. We will be more interested in understanding what we mean by "the best," and in improving the system for determining and adhering to this optimum. Operations will become more optimum, more quantitative, more understood in the sense sometimes called "scientific management" in the past. Management will be occupied increasingly with the goal of a truly "controlled" operation, with pushing forward the frontier of optimization, and with quantitizing the parameters of the operation to make these things possible.

The operations of the world can be expected to become more integrated, faster paced, with greater interactions. In that complexly interconnected world in which government, industry, the buying public, the money-accounting-tax-legal-policing elements are all tied together in a complex, tight network of electronic messages, cables, and computers—in that highly technological world of the future—it does not look like a very good place for the maverick or nonconformist. The isolated, separately and personally run operation would appear to find itself with difficulties in tying-in as it would have to according to the rules of the nation of that time. It would be almost like trying to bring a horse and buggy onto a fast-moving, high traffic density freeway.

You might be able to get to the on-ramp but you would never be able to get in between the cars in the first lane.

Originators and Creators

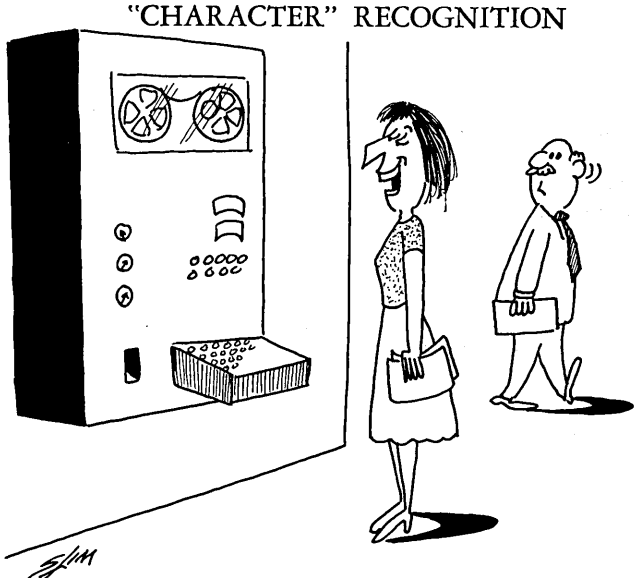
What then will the originators, the creators, the imaginative entrepreneurs in the managerial field do in that society of the future? Well, surely, if anyone really sees a problem here, then part of what I hoped would be apparent between the lines has been obscured by the speaker. Because, certainly, as information handling capacity, speeds, and interconnections grow, and as operations become more controlled and optimized, the increased number of parameters that determine the state of the business will make much more difficult the soul-searching for a better description of the goals. What will be asked of a manager, now that he has all of this information available, will be a more challenging task even than the task technology faces in providing the new tools. It will be like providing the biologist with such magically, vastly increased magnification for observing living matter that he becomes aware of many more forms of harmful viruses and more new diseases for which there are no cures. In time these new problems will be solved, presumably, but on the way the opportunities and possibilities will increase more rapidly than we will have the brainpower to exploit.

It must always be the case, with the unlimited mysteries of nature, that the new tools and skills given to the human mind for exploration will increase the area of exploration.

The challenges for the imaginative genius will be there in greater measure. Perhaps what information-automation will largely do is make possible such efficient handling of the mundane, high-quantity, high-rate intellectual tasks, which in principle are actually beneath the human brain, that the human intellect will be freed to rise to the higher tasks of life, leaving the lesser tasks to his machine partner.

(Based on a talk before the 5th Symposium on Process Automation, April, 1963)

"CHARACTER" RECOGNITION



"Computer, computer, on the wall, who's the fairest one of all?"

READERS' AND EDITOR'S FORUM

(Continued from Page 7)

cipally from the United States and Great Britain. ACM conferees will also tour the United States Air Force Academy at Colorado Springs and the National Bureau of Standards scientific laboratories at Boulder, Colorado.

A panel discussion of significant topical interest will be held on "Social Aspects of Computing: The Responsible Use of Computers in Politics." A number of provocative questions will be raised: "Does information provided in computer political analysis affect the integrity of the candidate in his campaign? Can highly sophisticated computer analysis so 'manipulate' the electorate as to constitute a violation of individual rights? Can computers have a programmed morality by feeding into them information on history, philosophy and religion?" Dr. Edward Bailey, professor of psychology at the University of Colorado, will be chairman of the panel. Other discussion leaders will be Dr. William McPhee, University of Colorado, Rev. Harry E. Hoewischer, Regis College, Denver, and Dr. Louis Sutro, Massachusetts Institute of Technology.

A number of new techniques are being introduced in the application of computers in medical diagnosis. Intricate problems are involved, not only in the collection of medical data but also in "mathematical model building"—the basis for computer "decision making" when the machine is faced with a diagnostic problem. Dr. Robert S. Ledley of the National Biomedical Research Corporation at Silver Spring, Maryland, will lead a panel discussion on this subject. Panelists include: Dr. Theodor D. Sterling, University of Cincinnati; Dr. Clifton F. Moutain, University of Texas; Dr. Caesar Caseses, U. S. Department of Health, Education and Welfare; Dr. Stanley Woodson, Lovelace Medical Clinic, Albuquerque, N. M.; and Dr. Joseph Balintfy, Tulane University.

Papers in 14 subject categories will be given: logic, compilers, numerical analysis, pattern recognition, mathematical programming, bio-medical programming and processing, education and programmer training, information retrieval, hardware, programming languages, software, language and learning, simulation and graphical output, and merging and sorting. The 33 sessions include 80 contributed papers, 8 invited papers, 7 panels, 3 halls of discussion and 3 evening tutorials. Those attending will be able to secure abstracts of all papers in advance of the conference.

Mr. William C. Norris, President of the Control Data Corporation of Minneapolis, will give the keynote address, "The Computer Industry—A Look Toward the Future."

Dr. Alan J. Perlis, director of the Computation Center and professor of mathematics at Carnegie Institute of Technology, Pittsburgh, Pa., is current ACM president. General Chairman of the conference is Dr. William H. Eichelberger of the University of Denver. Fred P. Venditti, chairman of the technical program, is also of the University of Denver, host institution.

ACM MEETING FEATURES "WILD WEST" TOUR

An example of Western hospitality, Colorado-style, is in store for people attending the 1963 ACM National Conference and International Data Processing Exhibit August 27-30 in Denver. W. H. Eichelberger of the Denver Research Institute, conference general chairman, reports a "colorful" program is in the making.

A highlight of the conference's special events is a big round-up to be staged at East Tincup, Colorado's recreated old mining town, done in the style of the West in the 1880's. Among the sights for computerites are: gas-lighted streets, watering troughs, blacksmith's shop, sheriff's office and jail, Boot Hill, the hangin' tree, "Old Tombstone," and gunfighters in action. The evening will also feature a Western Chuck Wagon Bar-B-Que and entertainment with Western songs and stories.

Several field trips are scheduled during the conference. One is to the United States Air Force Academy at Colorado Springs. Another is to the National Bureau of Standards at Boulder, including a look at the Colorado University campus. Tours of Martin-Denver will also be arranged during the conference. Activities for wives will include coffee hour socials on each day of the conference. Tours will be available of Denver, the mountain area, and Central City.

OBSOLESCENCE OF EXPERIENCED ENGINEERS AND SCIENTISTS

Careers Incorporated
New York 21, N. Y.

A study recently completed by Careers Incorporated and published in "Personnel Administration" indicates the existence of an alarming number of "obsolescent" engineers and scientists in the United States.

The study, which surveyed registrants at Career Centers in four metropolitan areas, revealed that 54 per cent of degree-holding registrants failed to receive a single interview bid from any of the defense contractors represented at the Centers. An average of over twenty major defense contractors had representatives at each of the four Centers surveyed.

The published text of the survey states: "There would seem to be considerable substance to the theory that our so-called technical manpower shortage is really just as much a question of proper utilization of our engineers and scientists as it is a question of a purely numerical shortage."

In an analysis of the engineering fields exhibiting the greatest degree of "obsolescence," the study revealed that civil engineers were the least in demand, with 91 per cent receiving no interview bids at all; 64 per cent of the chemical engineers and 51 per cent of the mechanical engineers similarly received no bids for interviews.

By contrast, 27 per cent of the data-processing specialists received bids from five or more employers as did 18 per cent of the physicists and 23 per cent of those in electrical and electronic sciences.

Another finding of the study was that 17 per cent of the degree-holding registrants were unemployed at the time they came to the Career Center. This figure is surprising, inasmuch as it has been generally assumed that virtually all engineers and scientists are employed, and that those who are job hunting are interested in changing jobs, not in simply finding jobs.

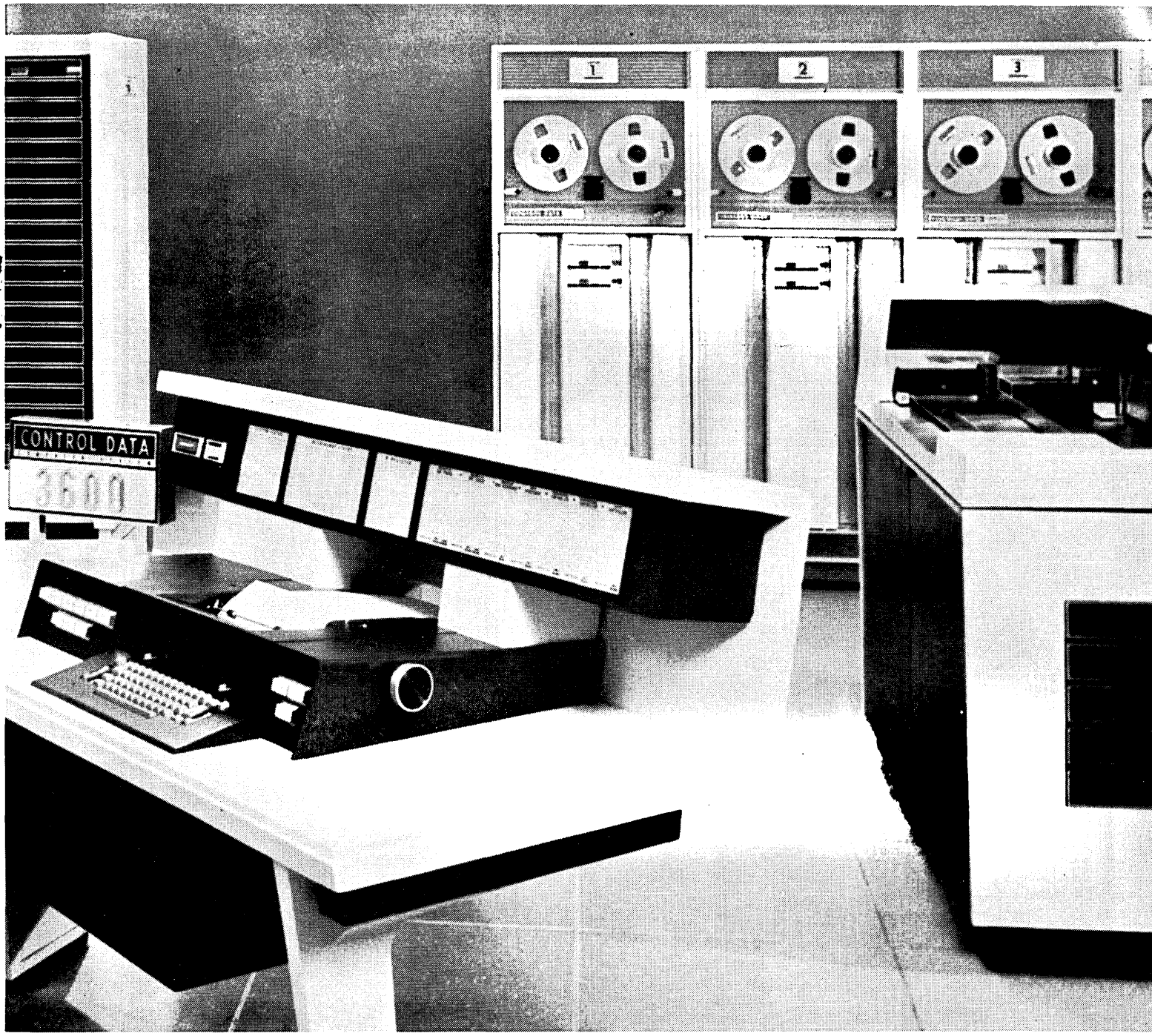
The Careers study underlines the recent emphasis that has been placed on obsolescence of scientific and engineering manpower, a condition which has led the Alfred P. Sloan Foundation to provide a $5,000,000 grant to Massachusetts Institute of Technology for the establishment of a center to up-date engineers in recent technical advances. According to Gordon S. Brown, MIT Dean of Engineering, "There are thousands of engineers now in their thirties and forties who studied what was essentially a pre-World War II curriculum. Many of them have had little or no opportunity for sustained advanced study in new areas of engineering."

The retraining of professional people is still a somewhat novel and unfamiliar concept, but it is worth a great deal more study and investigation by the Federal Government, the technical societies, industry, the universities, and all others interested in seeing that American technology and American technical manpower deliver the best of which they are capable.

CONTROL DATA® 3600 Computers Selected for

Real-Time Computer System

The Atlantic Missile Range will place in operation a dual CONTROL DATA 3600 real-time computer system to provide data for range safety at Cape Canaveral. High internal speed in the 3600 compute module is matched by the speed with which the CONTROL DATA 3600 can accept information from multiple sources, decide which is most accurate, then compute and transmit the results in the form of a missile impact point every 50 thousandths of a second. □ The major elements of the Real-Time Computer System are two standard CONTROL DATA 3600 computers, the world's most powerful computers commercially available. Along with its high speed, another major advantage of the CONTROL DATA 3600 is the provision for modularity built into the machine. Additional memory modules, compute modules, and input/output data



Atlantic Missile Range

channels can easily be included to handle increased data processing requirements as needed. This means that the Atlantic Missile Range will start out with a system commensurate with their requirements. As AMR's data processing needs grow in size and complexity, additional units can be included without replacing the original equipment. □ Control Data's total system capability for this real-time system is provided by the Company's **Government Systems Division**...and includes problem analysis, system design, hardware implementation, system integration, programming, installation and maintenance. □ To learn more about the 3600 and Control Data's total system design capability, contact the Control Data representative nearest you.

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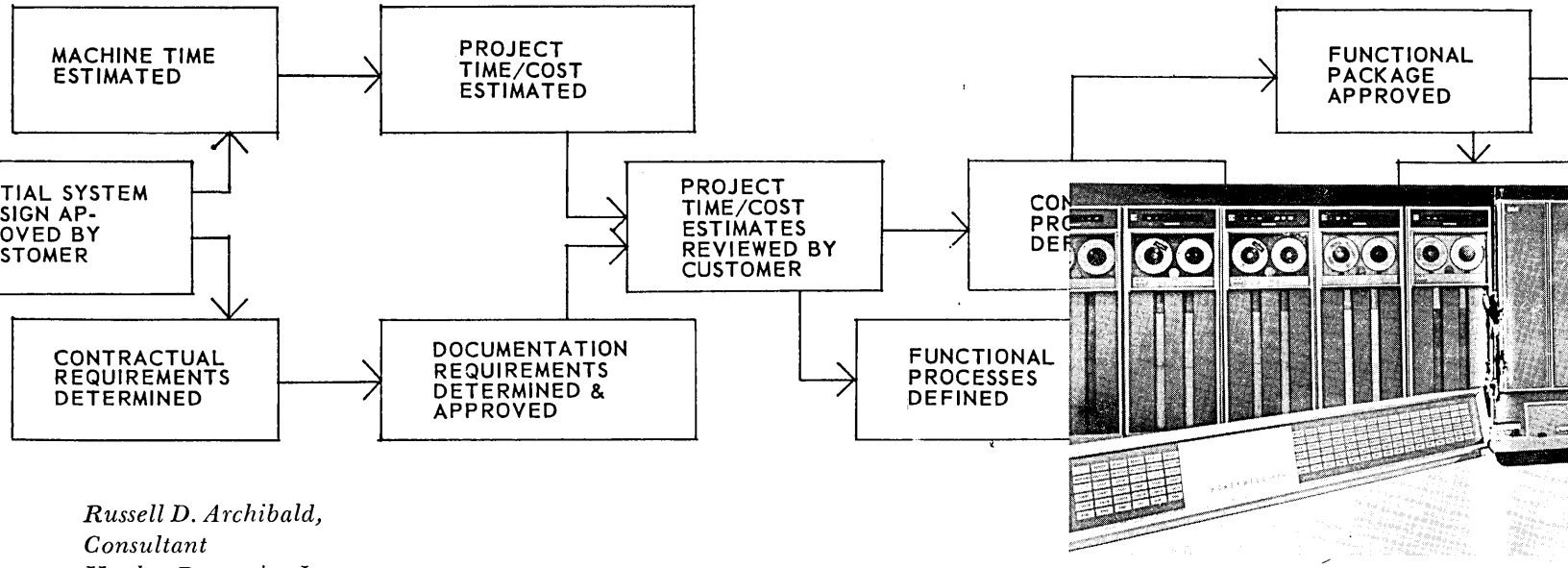

Russell D. Archibald,
Consultant
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PERT AND THE ROLE OF

Management information and control systems offer a leading application of computers in the next decade. A major element of this application is the use of network planning techniques such as PERT. The author provides an instructive analysis of the background, development and use of computer-assisted PERT programs.

PERT (Program Evaluation and Review Technique) has survived the critical scrutiny of realistic managers and is here to stay. Managers have found that PERT:

- Provides a way for planning on a uniform and logical basis.
- Provides follow-up assurance that planning has been done.
- Permits plans to be kept current.
- Lets management foresee the impact of variations from plan and take corrective action.

Background

The need for improved planning and progress evaluation in modern "massive engineering" projects became apparent in several industries—construction, process and defense—at about the same time. Evolution of the network plan or arrow diagram concept, which is the backbone of both the Critical Path Method and PERT, was a fundamental step forward in the development of better management information and control systems. It is illustrated in Fig. 1.

The CPM arrow diagram network evolved from detailed Gantt bar charts which were *job* oriented. Linking jobs together in dependent sequence produces the arrow diagram, often without identification of connecting points.

The PERT network evolved from a combination of bar charts with milestone charts (milestones are defined as special events, or instantaneous occurrences in time, of interest to management). Milestones are useful for progress evaluation, to determine if a job, represented on a bar chart by a long line, is ahead, behind or on schedule.

Network Elements

Two elements make up the network or arrow diagram: (1) the line or arrow, representing time-consuming activities or sequential constraint; and (2) the circle or rectangle, representing the beginning or end of an activity, or a milestone. The most widely used and accepted names for these are: (1) activity and (2) event.

An *event* is defined as a specified accomplishment (physical or intellectual) in the program plan, recognizable as occupying an instant in time. Events (also called nodes) consume neither time nor resources and are represented in the network by circles or rectangles.

An *activity* is defined as a time-consuming element in execution of a task. It is represented on a network or flow chart by an arrow. Events are separated from one another

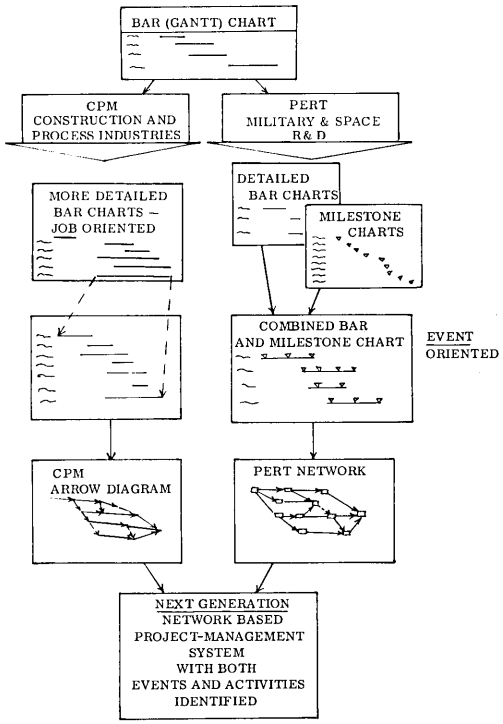
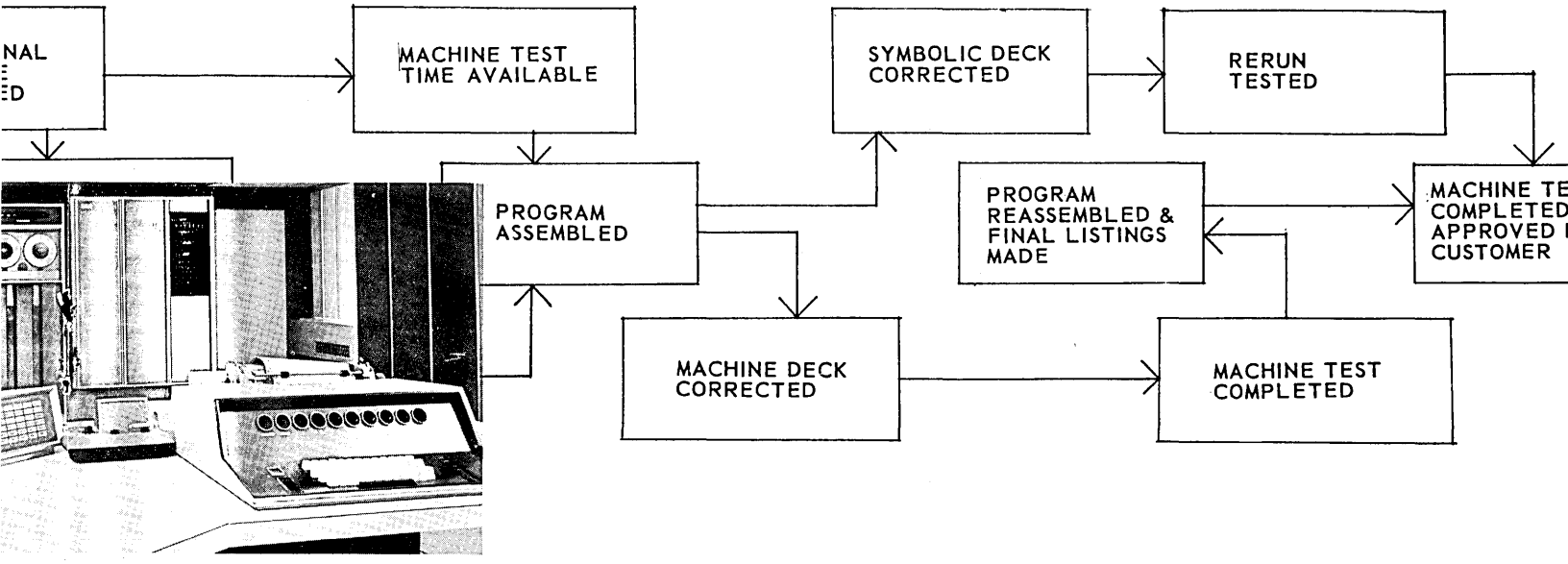


Figure 1 — Historical Evolution of the Network Plan



LE OF THE COMPUTER

by activities, and an activity cannot be started until its preceding event has been accomplished. Likewise, a succeeding event to an activity cannot be accomplished until that activity (also called task, job, arrow) is complete.

The final step in a network plan, as shown in Fig. 1, is addition of interdependencies between elements of effort which may be called *constraints* or *dummy activities*. Constraining activities may consume (1) insignificant time or resources or (2) significant time and essentially zero resources. Several practical difficulties are avoided if such constraining activities are so defined that no resources are expended on them, since they usually represent a transfer of paper, information or hardware from one organization to another.

Further refinement of the plan is achieved by adding more detail to the network. Long activities are broken up into short elements of effort, so that meaningful activity time estimates can be made. This requires definition of more events to correlate the beginning and end of the activities. Concurrent with this addition of detail, more interdependencies or interfaces may be identified and placed on the network.

A network plan is defined as a graphic portrayal showing time dependencies and the chronological sequence of events and activities leading to given end objectives.

A typical simplified network plan, showing a portion of an over-all computer installation program, is illustrated in Fig. 2. The broken lines indicate constraining "zero time" activities, and the heavy solid lines show the longest or "critical" path.

Use of the Network

The network plan is a basic management tool which can be used in a number of ways.

A. *Time analysis* of plans is accomplished through the following steps:
   (1) Estimate activity time spans
   (2) Add activity time spans forward through the network to determine "expected" dates
   (3) Subtract time spans from the end schedule date to determine "latest allowable" dates
   (4) Subtract "latest allowable" dates from "expected" dates to determine "slack" time (allowable slippage)
   (5) Locate "critical path," the longest series of events and activities through the network (this is the "least slack" path)

B. *Integration* of plans by linking together two or more networks.

C. *Progress Evaluation* through reporting of actual completion dates which are used for the next time analysis cycle.

D. *Computer processing* of the network is common because of the network's unique adaptability.

E. *Labor and cost estimating* and correlation to actual labor and cost can be accomplished with the PERT/COST network.

F. *Simulation and optimization* of project plans can be performed using the network as the project model.

Role of the Computer

The computer has been linked almost synonymously with PERT since its initial application to the Polaris missile program. The Critical Path Method, however, has not placed such reliance on the computer, instead encouraging manual network analysis methods. This is due largely to the difference in network size, the resulting mass of detailed PERT data in the typical defense industry application requiring a computer to handle the volume.

The network plan, with its events and activities, is uniquely adaptable to electronic data processing. By merely assigning numbers to events, the entire network structure can be fed into the computer and all arithmetic, statistical probability calculations, and logical operations can be performed. This adaptability is actually one of the major features of PERT for better planning and progress evaluation.

Not always do network plans require a computer, however, to generate desired analysis results. In many cases, it is cheaper and faster to calculate the various parameters by hand. Beyond a given size network or set of networks, however, this becomes impossible. Just where the breakpoint occurs cannot be set by a simple rule, but depends on number of elements in the network, up-dating frequency, number of changes being made to the network, availability of an operating PERT computer program and other similar factors. Detailed study is needed before recommendation can be made for a particular application.

The computer brings a variety of benefits and capabilities to PERT:

(1) Speed: calculations performed thousands of times faster than by a human

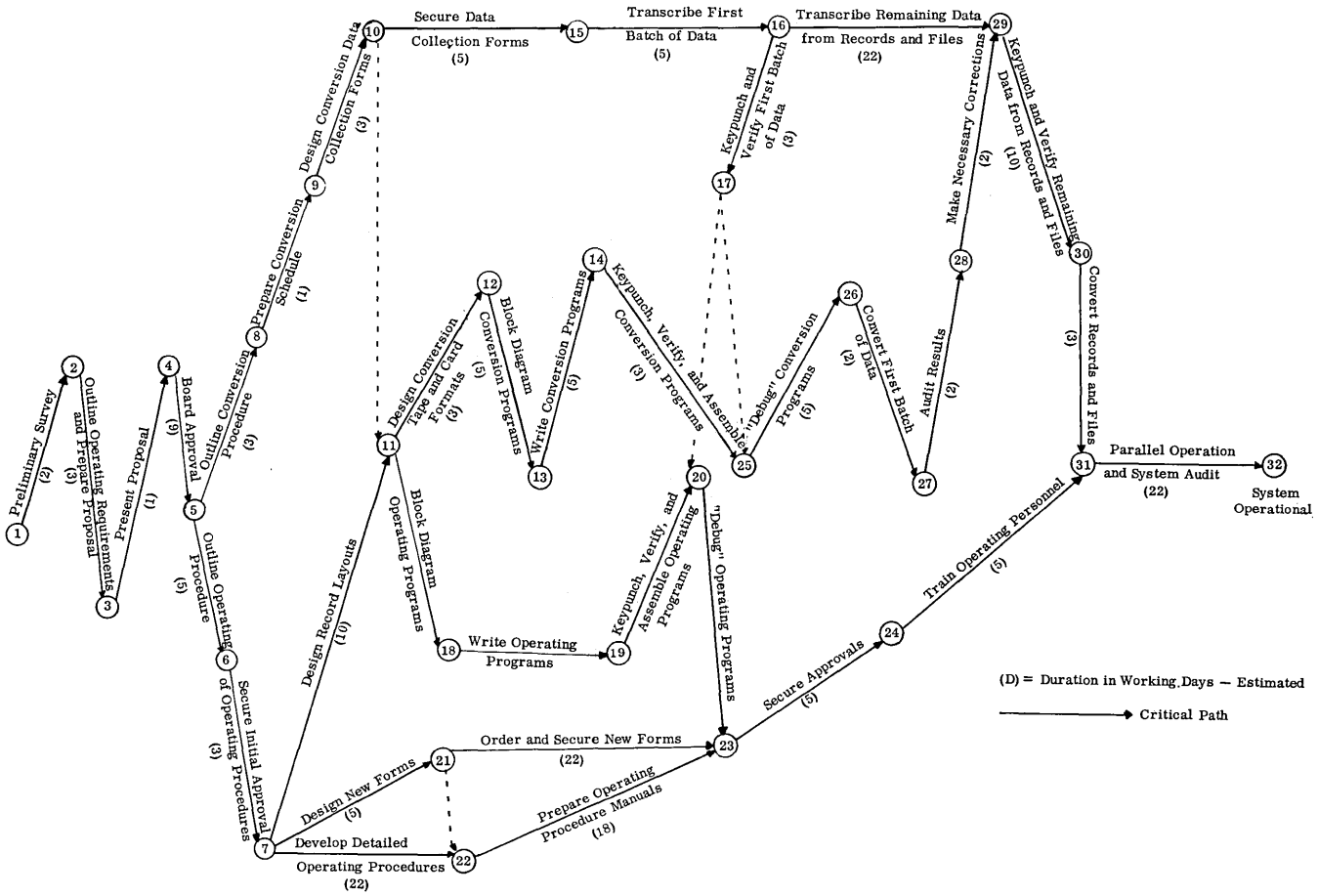


Figure 2 — Typical Critical Path Diagram, Showing Part of Computer Installation

(2) Accuracy: errors in calculations are essentially zero, much less than when performed by pencil and paper

(3) Large volume capability: very large networks (typically up to 5,000 activities) can be analyzed on current computer programs

(4) Legible results: computer prints legible results at rates of more than 600 lines per minute, eliminating burden on typists

(5) Partial interpretation: computer can select, edit, rearrange, summarize, compare and apply rules, providing partially interpreted results with large savings in manual effort; graphic charts and reports can automatically be prepared, eliminating manual art; an example is the common practice of printing results of network analysis in four or more ways:
   a) by slack path
   b) by organization code
   c) by event number
   d) chronologically (by expected, latest, or schedule dates)

Computer Problems

Benefits described are not always easily obtained. A number of problems may be encountered, including:

(1) Unfamiliarity with electronic data processing; unfortunately, an aura of mystery has developed (perhaps purposely) around computers and their use

(2) Computers seem expensive on a per-hour basis; care must be taken to compare true equivalent costs of network analysis by hand and by computer

(3) Proper computer is not always available

(4) Cost of preparing a new program for a given computer to analyze networks is usually very high

(5) Some speed gains may be offset by long administrative delays in getting data into and out of the computer

(6) A poorly designed computer program can be the source of great frustration and inefficient procedures

Programs

Computer programs for network analysis differ greatly. The size of the network is an important characteristic. The maximum network size which can be handled will vary from around 200 activities to 12,000 activities (largest operational program now available). This is a function of computer size as well as of the program itself.

The event numbering method used in early programs and in current ones for small machines, requires that events be numbered in ascending order (although not necessarily in strict sequence). Many later programs do not have this requirement, and events can be assigned random numbers without regard to network sequence. Random numbering is an advantage in large networks, since it is often difficult to maintain sequential numbering if large changes are made in a network. Resulting re-numbering of an entire network is a costly process.

Input formats and coding schemes are generally quite consistent, as well-designed input forms can reduce errors and save time and money. Output formats, on the other hand, in layout, legibility and usefulness will vary widely with different programs.

Wide differences exist in the processing efficiencies of various programs, even for the same computer. This can be significant in machine-running time and cost over a long period.

Input Data

In a typical PERT operation, activity time estimates are written on the network plan, usually on the line representing the activity. Numbers are written on the circle repre-

senting each event, and descriptions of events and/or activities are prepared. This data is then written on input forms, designed so that punched cards can be prepared directly from these sheets. Program control cards are prepared as necessary to precede input data. These tell the machine certain variable data and indicate that input data follow.

Transaction Codes

Common practice, following the initial Navy input format design, uses column 1 on the activity data card as a transaction code. Numbers used at present are not completely standard, but basic code types include: *new data, revised data, completion data* and *deleted data.* Other special codes are also used on some programs. Specific details of a particular program should be studied when its use is contemplated.

The common method of analyzing a network plan is to punch a deck of cards, one or more for each activity in the network, and in some cases, one for each event. This deck then represents the network to the computer, and is fed to the machine when an analysis is desired. When activity completions are reported or changes made to the network, it is necessary to punch new cards, search through the entire deck, pull out the old cards, and insert revised ones. This can be laborious and time-consuming. A better method, widely used, is to record the card deck on magnetic tape. When changes are made, a few new cards are fed to the machine, which searches for the proper record on tape, makes the change indicated, and the network is then ready for a new analysis.

Assuming that a computer is available with an operating PERT/CPM program, and that an input deck has been prepared, it remains only to obtain the actual computer run. This is typically accomplished by submitting the input deck with any required control cards to the computer operations office with a run request. This will usually call for the requestor's identification, type of run (PERT in this case), and an account number for charging computer time and cost. This request is then logged in, and the job is run in turn with other work. On completion of the run, the input card deck is returned together with copies of output reports.

Output Reports

Wide variation of output reports is to be expected, the result of the desire to print out most meaningful results for a given application. Basic results of a time analysis of the network plan are contained in essentially all the various types of output reports. Differences relate to the optional items of information, arrangement and legibility of the information, and types of *sorts* or methods of arranging results.

Output results can be sorted by any of the items of information given. A common type of output list is sorted by slack path. All activities having equal slack are grouped together, usually arranged by event number within each group or slack path. Typical output of this type, from the Lockheed IBM 7090 program, is shown in Fig. 3. Sorting may also be done by event numbers, by expected completion data, or by organization code number. Programs have been prepared recently which generate lists related to work breakdown structure of the project. Graphic bar charts, milestone charts and cost curves are also prepared by some programs.

Most current computer programs provide results relating to each activity in the network, and a few also provide event reports. Both types are important and useful for different purposes. The early (1959) Aerojet-General IBM 704 PERT program, probably the first operational PERT computer program, provided both types of reports. Current IBM 7090 programs prepared by both the Naval Weapons

(Please turn to Page 30)

PERT SYSTEM PAGE 1

RUN 7 ENDING EVENT 0000000-134 DATE 07-10-61
BY PATHS OF CRITICALITY
CHART HP HUGHES-PERT DEVELOPMENT PLAN

EVENT PREDECESSOR	EVENT SUCCESSOR	NOMENCLATURE	DATE DEP. EXPECTED	DATE ALLOWED	DATE SCHD/ACT.PROB	SLACK	EXP. TIME	EXP. VAR.
0000-001	0000-010	PERT FICTIOUS ACTIVITY		07-10-61	A07-10-61	+ .0 +		
0000-010	0000-012	DEV BASIC PERT COST EST FLOW DIAGRAM	07-24-61	07-24-61		+ .0 +	2.0	.1
0000-010	0000-011	DEVELOP NUMBER SCHEMES AND CODES	07-25-61	07-25-61		+ .0 +	2.1	.1
0000-011	0000-013	AGREE NO SCHEMES-CODES FOR BASIC PERT	08-08-61	08-08-61		+ .0 +	4.1	.2
0000-012	0000-014	PROGRAMMER ANALYSIS OF FLOW DIAGRAMS	08-14-61	08-14-61		+ .0 +	5.0	.2
0000-013	0000-016	STUDY REQUIREMENTS OF EXCEPTION REPORT	08-22-61	08-22-61		+ .0 +	6.1	.3
0000-016	0000-018	DEFINE AND DESCRIBE EXCEPTION MODEL	09-13-61	09-13-61		+ .0 +	9.3	.5
0000-018	0000-113	AGREEMENT ON EXCEPTION REPORT MODEL	09-27-61	09-27-61		+ .0 +	11.3	.6
0000-014	0000-110	PROGRAM BASIC PERT WITH COST EST	10-09-61	10-09-61		+ .0 +	13.0	.3
0000-113	0000-117	FORMULATE ALGORITHMS FOR EXCEPTION RPT	10-19-61	10-19-61		+ .0 +	14.4	.9
0000-117	0000-121	FORMULATE ALGORS FOR ORGAN RPT	11-10-61	11-10-61		+ .0 +	17.6	1.1
0000-110	0000-119	ADD COST ACCUM SYS TO BASIC PERT PROG	11-13-61	11-13-61		+ .0 +	18.0	.4
0000-121	0000-125	FORMULATE ALGORS FOR MANPOWER SCHED RPT	12-02-61	12-02-61		+ .0 +	20.8	1.4
0000-119	0000-123	PROGRAM SUMM-CONT-EVENT ORIENTED OUTPUT	12-11-61	12-11-61		+ .0 +	22.0	.6
0000-125	0000-130	STUDY FLOW DIAGRAM RQMTS MAN-SCHED RPTS	12-16-61	12-16-61		+ .0 +	22.8	1.5
0000-130	0000-134	ANALYZE FLOW DIAG MANPOWER SCHED RPT	12-30-61	12-30-61		+ .0 +	24.8	1.6
0000-123	0000-127	PROGRAM EXCEPTION RPTS INTO HUGHES-PERT	01-15-62	01-15-62		+ .0 +	27.0	.7
0000-127	0000-131	PROGRAM ORGAN RPTS INTO HUGHES-PERT	02-19-62	02-19-62		+ .0 +	32.0	.8
0000-131	0000-134	PROG MANPOWER SCHED INTO HUGHES-PERT	04-02-62	04-02-62		+ .0 +	38.0	.9
0000-121	0000-126	STUDY FLOW DIAG RQMTS ORGAN RPTS	11-10-61	11-18-61		+ 1.2 +	17.6	2.1
0000-126	0000-130	PREP FLOW DIAGRAM MANPOWER SCHED RPTS	12-08-61	12-16-61		+ 1.2 +	21.6	2.3
0000-117	0000-122	STUDY FLOW DIAG RQMTS EXCEPTION RPT	10-19-61	10-28-61		+ 1.3 +	14.4	1.9
0000-122	0000-126	PREP FLOW DIAG ORGAN RPTS	11-09-61	11-18-61		+ 1.3 +	17.4	2.0

Figure 3 -- Typical Slack Path Sequence, From Lockheed 7090 Program

PERT AND THE ROLE OF THE COMPUTER

[Continued from page 29]

Laboratory and the USAF Aeronautical Systems Division also provide both types of reports. Numerous programs for large, medium and small computers are now available. The latest of these provides a wide variety of tabular and graphic (bar-charts, milestone charts, networks) outputs.

Control by the Manager

Whether or not a computer is used, application of PERT/CPM may be weak and ineffective. The causes of this are centered on the control by PERT specialists. To get PERT away from the specialists and into the plant, management must take control of its application.

This can be accomplished if the manager:

- Understands the basic principles
- Supports the objectives
- Ensures the validity of the input data
- Uses the results for decision making
- Recognizes the limits of the technique in scope and manner of application

With an understanding of the basic principles, it is up to the individual manager to do the rest.

"ACROSS THE EDITOR'S DESK"

Computing and Data Processing Newsletter

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NEW APPLICATIONS

"LIVE COUPONS" READ BY HONEYWELL SCANNER

Honeywell EDP, Wellesley Hills, Mass., has reported that its optical symbol recognition system, Orthoscanning, has achieved a 99.17 per cent document acceptance rate in a "live coupon" processing test. Other systems which have been tested on live coupons have experienced rejection rates of between 5 and 15 per cent.

Proctor and Gamble Company provided the more than 125,000 coupons, which were scanned by the system at a rate of 1370 coupons per minute. The "live coupons" (redeemed by consumers and submitted by retailers for reimbursement) were considered completely representative in terms of coupon condition. Many were badly defaced from handling by the consumers and retailers. Typical defacement included water soaking that caused misshaping, spindling, tearing, partial obliteration of the codes, and holes in the documents. The coupons were standard punched-card documents on which was imprinted P&G data in Honeywell Orthocode.

-- Badly-defaced live coupons are examined by Honeywell EDP engineer.

Orthoscanning reads series of small vertical bars of varying widths, called Orthocode, which represent pertinent data. Conventional systems read letters and numbers. Orthocode also contains "ortho-correction" information that permits automatic and immediate regeneration of obliterated data. A Honeywell computer in conjunction with the document transport permits automatic regeneration of data at microsecond speeds.

EDP IN OPERATION AT MASS. REGISTRY OF MOTOR VEHICLES

At the Massachusetts Registry of Motor Vehicles, Boston, Mass., it is expected that taxpayers will be saved some $6 million a year in vehicle excise tax billing through the use of a GE 225 computer system. Included in the total savings will be: $3 million in revenue, which was formerly lost when vehicle owners moved out of the state ahead of the delivery of vehicle excise tax bills; $1.5 million in clerical economies; and $1.5 million in interest on loans formerly paid out by cities and towns. (Such loans were taken out in anticipation of tax revenues.) Earlier collections of excise taxes will improve free cash position of towns and cities by some $15 million.

Under this new tax billing system, two punch cards are prepared for each vehicle registered. They are read into the computer at a speed of 1000 cards/minute; the computer verifies the data and then writes it on to magnetic tape. (One tape may contain as many as 70,000 registrations.) A programming method, developed by GE computer personnel, assigns a valuation to each vehicle according to regulations of the Dept. of Corporations and Taxations. This valuation also goes on a magnetic tape file, at a speed of 60,000 vehicles an hour. At the rate of 18,000 an hour, excise tax bills are prepared and ready for mailing to vehicle owners by cities and towns. Under the old system, the time elapsing between original registration and receipt of the tax bill was about fourteen months -- time now required is about four months.

The new system will also be used to: (1) maintain on magnetic tapes registration records, police listings of vehicles, and information on drivers' licenses; (2) identify total vehicles; (3) assemble and analyze accident records for safety programs; and later, (4) to develop a master file of consolidated information connected with each Massachusetts driver.

The GE-225 system includes a central processor with an 8000 word memory; a 1000-card-per-minute card reader; a 250-card-

per-minute card punch; two high-speed printers (900 lines-per-minute); one output typewriter; and eight tape units.

WORLD'S LARGEST, MAN-MADE HARBOR GETS ASSIST FROM COMPUTER

In planning the world's largest, man-made port facility, a three million dollar computer system is being used at Computer Sciences Corp., El Segundo, Calif. The Univac 1107 computer at CSC will help to fill a J-shaped parcel of real estate extending over two miles into the Pacific Ocean from the present Long Beach shore line. The present site of Pier J lies 47 feet beneath the surface of the Pacific. In the construction of this pier, about 320 acres of ocean will be displaced by 3 million tons of rock and 33 million cubic yards of earth fill. CSC will use a General Dynamics SC 4020 digital plotter system to provide a graphic representation of the construction process as it is developed on the computer.

In addition to its ocean filling computations, the computer will handle a variety of management planning functions including: statistical evaluations of current operations at the harbor; dollar volume of various commodities; duration of ship stays; number of berths visited; and a daily census of ships in port. Statistical analysis of the reports will also be used in the planning and control of ship traffic in the transition from present to new facilities.

AUTOMATIC DRAWING OF PERT CHARTS

Automatic drawing of the charts which form the basis of PERT has been successfully demonstrated by North American Aviation, Inc., Los Angeles, Calif. PERT (Program Evaluation and Review Technique), a management planning and control technique, was developed by the Navy in 1958 for the Polaris program.

The extensive charts, or networks, which are the chief tool of PERT, show all activities which take place, the events which must be accomplished, and their interrelationships which lead to completion of a project. Adjustments must be made while the project is under way to keep the program operating smoothly. Keeping the networks up to date manually may become almost impossible, because of the complications.

North American Aviation, some months ago, placed a pilot system in operation which showed that automatic updating of PERT networks was possible. The system, called PERT-NAP for PERT Network Automatic Plotting, makes it possible to feed changes into a computer on one day and have updated networks back the next morning. Automatic plotting of the initial PERT network is also possible.

The company has now put a minimum operational PERT-NAP system into active functioning. By the first of next year, the company expects to complete a PERT-NAP system that can be applied to any of the widely diversified aircraft, space, electronics, nuclear and rocket propulsion activities of the company's six operating divisions.

NEW CONTRACTS

PRIME SYSTEM CONTRACTOR FOR THE RANGE SAFETY IMPACT PREDICTOR ON ATLANTIC MISSILE RANGE

Under a prime system contract, the Air Force will lease two CONTROL DATA 3600 Computer systems, from Control Data Corp., Minneapolis, Minn., for predicting impact points at the Atlantic Missile Range. The real-time computer systems associated input/output equipment includes the new CONTROL DATA 606 Magnetic Tape Transports. The entire system is valued at approximately $7 million. It will be installed in a new facility at Cape Canaveral with a direct tie-in to Central Control for Range Operations. Full operation of the system is not expected until mid-1964.

RIVERSIDE TRUST COMPANY BECOMES FOURTH BANKING CLIENT OF NCA

The Riverside Trust Company at Riverside, N.J. has contracted with National Computer Analysts, Inc., Princeton, N.J., to perform its demand deposit accounting at the NCA Datacenter in Princeton. It is expected that NCA will begin the performance of this contract by the beginning of July.

CDC RECEIVES CONTRACT FOR MORE THAN $2 MILLION

North American Aviation's Space and Information Systems Division, Downey, Calif., principal contractor for the Saturn second stage, has ordered high-speed digital computers from Control Data Corp., Minneapolis, Minn. The contract is expected to amount to more than $2,200,000.

The computers (designated Control Data 942s) will be used for automatic booster vehicle checkout at Seal Beach and the Santa Susana Test Facilities, Calif., the Mississippi Test Operations Center, and Cape Canaveral, Fla., test and checkout facilities. The contract provides for six computers, 24 tape units, two printers and other equipment required to check out the Saturn S-II launch vehicle.

NASA AWARDS CONTRACT TO GENERAL DYNAMICS/ELECTRONICS

The National Aeronautics and Space Administration has awarded a $68,400 contract to General Dynamics/Electronics-Rochester, Rochester, N.Y., for a study of a magneto-acoustic information storage system. As a result of research for more than a year, a new technique for temporary or permanent storage of data is being used, consisting of solid-state components, without moving parts. The system is expected to provide read-out rates of less than a microsecond.

THIN-FILM DEPOSITION TECHNIQUES UNDER STUDY BY SYLVANIA

Sylvania Electric Products Inc., Waltham, Mass., is conducting research on the properties of active thin-film microelectronic devices under a contract awarded by the United States Air Force, Aeronautical Systems Div., Wright-Patterson Air Force Base, Dayton, Ohio. The work is being performed at the microelectronics laboratory of Sylvania Electronic Systems.

Successful deposition of thin-film devices, such as diodes and transistors, on polycrystalline substrates would greatly reduce the production cost and increase the reliability of advanced microcircuits through the elimination of many of the man-made connections required with conventional methods.

Newsletter

NEW INSTALLATIONS

GREAT BRITAIN LEASES HIGH SPEED COMPUTER RECORDER FOR ATOMIC ENERGY AUTHORITY

An S-C 4020 high speed computer recorder has been leased from General Dynamics/Electronics, San Diego, Calif., by the United Kingdom Atomic Energy Authority, Aldermaston, England. The S-C 4020 will record, onto 35mm microfilm or 9½ inch wide photorecording paper, the results of calculations on an IBM 7020 computer.

NASA TO USE CONTROL DATA COMPUTERS FOR NIMBUS WEATHER SATELLITE

The National Aeronautics and Space Agency expects to install a CONTROL DATA 924 Computer system this month, for use in the Nimbus Project for weather research. The system will be utilized with an identical 924 system currently in operation. Each system consists of two 924 computers, 18 magnetic tape units and a variety of peripheral devices.

The computer systems will be located at Command and Data Acquisition stations at Gilmore Creek, Alaska, and Goddard Space Flight Center, Greenbelt, Md. (An additional station is being considered in eastern Canada.) At the stations, the systems will be used in gridding of picture data, real-time assessment of the Nimbus Satellite, and in long-term engineering evaluation of the satellite and its subsystems.

UNIV. OF MICHIGAN BUYS CONTROL DATA 160-A SYSTEM

Under a grant from the National Science Foundation, the University of Michigan, Ann Arbor, Mich., has bought a CONTROL DATA 160-A Computer System. The system, installed at the University's Meteorological Laboratory in June, will be connected to a large-scale analog computer by special interface equipment built by Control Data. The purpose of the research project, in which this hybrid system will be used, is to construct a computer model of atmospheric turbulence and diffusion. It will also be used in other phases of advanced weather research.

DIGITAL COMPUTER FOR OCEANOGRAPHIC DATA SYSTEM

Thompson Ramo Wooldridge Inc., Canoga Park, Calif., has delivered a TRW-130 (AN/UYK-1) Digital Computer and peripheral equipment to The Bissett-Berman Corp., Santa Monica, Calif., for use in a system for measuring, recording, and transmitting oceanographic data. The computers will be used as an integral part of a shipboard oceanographic system.

FIFTH COMPUTER INSTALLED AT BRITISH FINANCIAL EDP CENTER

The Financial Computing Center, St. Alphage House, London, England, has installed a fifth computer system, possibly making this center the largest and most completely equipped service of its kind. The newest processor, a National Cash Register 315 system, supplements an NCR already in use and three NCR-Elliott 803's. The 315 computers installed at the center include NCR's CRAM electronic filing system (Card Random Access Memory).

-- Section of British financial EDP center shows NCR-Elliott 803 computer in background. High-speed printer at right foreground, part of an NCR 315 system, is preparing a financial report at 680 lines a minute.

The center specializes in processing work for the British financial community, although it handles other commercial data processing as well.

UNIVAC SYSTEM DELIVERED TO U.S. ARMY CHIEF OF ENGINEERS

The office of the U.S. Army Chief of Engineers, Washington, D.C., has installed a UNIVAC 1004 Card Processor, at its data processing headquarters. The system will help keep pace with the increased data processing required in the office.

CBS WILL USE TWO TRW-330's FOR TV PROGRAM SWITCHING

The new CBS Broadcasting Center in New York City, (scheduled to go on the air in early 1964) will use two TRW-330 control computers to aid in performing all routine, preplanned program switching operations. Three distinct on-line functions which will be performed by the computer system are: on-air continuity switching, facilities assignment switching, and studio-lighting preset storage and retrieval.

CANADA'S BELL TELEPHONE USING HONEYWELL 400

The Bell Telephone Company of Canada has installed a Honeywell 400 system at its Montreal office. The system will be used to update, once a day, available information for all of its Yellow Pages directories. In addition, the Honeywell 400 will process Bell Telephone's stock transfer records and aid in the assignment of dial equipment in telephone exchanges throughout the Bell territory.

The H-400 system includes a central processor with 2048 words of memory, 4 magnetic tape units with a transfer rate of 96,000 decimal digits per second, a paper tape reader, high-speed printer, card reader and card punch.

COMPUTER INPUT/OUTPUT DATA LINK DELIVERED TO MELPAR, INC.

Adage, Inc., Cambridge, Mass., has delivered a computer input/output data link to Melpar, Inc., for use in pattern recognition research and information processing. This data link processes analog signals for digital entry into an IBM 1410 computer on a real-time basis. Speech analysis is one example of the use of this system. Melpar, Inc., has been actively engaged in speech research for some time and expects the Adage data link will open new frontiers in this and other areas.

ANALOG COMPUTERS INSTALLED AT HUGHES AIRCRAFT

Beckman Instruments, Inc., Richmond, Calif., has delivered two analog computers to the Hughes' Space Systems Division of Hughes Aircraft Co., El Segundo, Calif. The computers will be used to solve design problems in the con-

trol and guidance systems of the Project Surveyor space vehicle and to simulate landings of the space craft on the moon.

TWO CONTROL DATA SYSTEMS FOR AEC

Last month Control Data Corporation delivered the second of two high-speed computer systems to the U.S. Atomic Energy Commission for use by the Lawrence Radiation Laboratory, Livermore, Calif. Both systems are standard production models. One system is the CONTROL DATA 1604-A; the other is the CONTROL DATA 3600 with a 64,000 word memory unit. The two systems will be used by the laboratory, together with seven existing computer systems, in the solution of complex scientific problems.

ORGANIZATION NEWS

NEW ORGANIZATION CONCEPT FOR PHILCO

Philco Corporation as outlined plans for more fully using its large-scale computer capabilities in support of the expanding needs of defense, space and other government agencies:

1. The present Computer Division will be consolidated with the Communications and Electronics Division. Total systems capabilities are expected to be further strengthened by the consolidation.

2. Dr. S. Dean Wanlass, Philco vice president and former general manager of the Computer Division will become Vice President-Technical Planning, with responsibility for the whole corporation for coordinating, planning in computers, communications, command and control, and space systems.

The new organizational concept is designed to intensify Philco's efforts in the area of military and related command and control systems.

NAME CHANGE APPROVED FOR REEVES

Stockholders at the annual meeting of Reeves Soundcraft Corp., New York, approved a resolution to change the name of the company to Reeves Industries, Inc. Reeves Industries, Inc., listed on the American Stock Exchange, will continue the ticker symbol RSC. The name change was made necessary because of increasing diversification.

In addition to the name change, a new corporate identification system is being developed incorporating the use of a large "R", which will be used by all divisions as well as the parent company. The Soundcraft division will continue to use the established "Soundcraft" brand name on all of its recording products.

PRINTED CIRCUIT PLANT ACQUIRED BY CONTROL DATA

Control Data, Minneapolis, Minn. computer manufacturer, has acquired the assets and business of Beck's, Inc., St. Paul, Minn. printed circuit manufacturer. The New York Stock Exchange has approved 5823 shares of Control Data common stock for listing in exchange for all of the assets of Beck's, Inc.

The new printed circuit subdivision will make components: for military, space and industrial electronics; for Control Data computers and peripheral equipment; and to meet requirements for other electronic manufacturers.

HONEYWELL COMPUTERS MANUFACTURED, MARKETED IN JAPAN

Honeywell data processing systems are being manufactured and marketed by the Nippon Electric Company in Japan. Six systems, Honeywell EDP's entire line, are being marketed by the NEC sales force. The company also has begun production of its first Honeywell system, the H-400.

Under terms of a licensing agreement signed with Nippon Electric a year ago, the Japanese firm will produce and sell Honeywell computers under the Nippon Electric name. The systems are marketed as NEAC 2400, 3400, 2800, and 3800 corresponding with the H-400, 1400, 800, and 1800 names respectively. The recently-announced Honeywell 800-II and 1800-II systems will be called NEAC 2800-II and 3800-II.

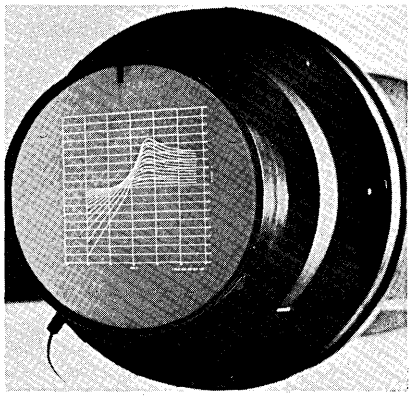
Initially, Honeywell EDP will supply NEC with many packages and components used in the systems. Later, Nippon Electric will manufacture its own components or obtain them from Japanese suppliers. All software will be provided by Honeywell on a continuing basis.

COMPUTING CENTERS

BUSINESS SERVICE BUREAU WITH A DIFFERENT CONCEPT

A new service bureau, operated jointly by General Dynamics/Electronics-San Diego, and Recordak Corp., a subsidiary of Eastman Kodak Co., Rochester, N.Y., has been opened in Washington, D.C. This facility is equipped to translate computer output codes directly into understandable language and drawings on microfilm and paper. Computer centers in Government and industry will be able to have high-speed conversion of computer "records" to a more usuable form on an hourly or job basis.

The heart of the new service bureau is the General Dynamics' computer recorder, known as the S-C 4020. This device transforms magnetic-tape recordings into usable language and graphics on both page-size photo-recording paper and on compact microfilm for instant accessibility and automated information retrieval. Complex, annotated, charts or drawings can be recorded in less than a second. Multiple film or paper copies are produced from the primary microfilm records, using Recordak equipment.



Magnetic tapes brought to the S-C 4020 are electronically converted into combinations of printed characters, lines and curves by use of a special cathode ray tube. Directly opposite the tube screen is a 16mm or 35mm recording camera and another optically aligned

camera for producing paper copies. Business forms, maps, company symbols or other fixed information may be superimposed on the film or paper by using automatic slide projection which is part of the basic unit. The S-C 4020 is compatible with existing automatic microfilm storage systems.

Data from magnetic tape is accepted at rates up to 90,000 six-bit characters per second; printout is at speeds in excess of 17,000 alphanumeric or symbolic characters per second.

GE EXPANDS CHICAGO CENTER

General Electric Company has installed a second GE 225 computer system in its Information Processing Center, Chicago, Ill. The new system makes the GE center one of the largest in the Midwest. It presently has a GE 225 and a GE 210 system.

The center handles: demand deposit accounting for suburban banks as well as Chicago's Cosmopolitan National Bank; payroll processing, inventory control, linear programming and Critical Path Method scheduling, for local customers.

COMPUTER CENTER TO BE ESTABLISHED AT AMERICAN UNIVERSITY OF BEIRUT

American University of Beirut has announced plans to establish the first major academic computer center in the Near East. The center will be located on the campus in Beirut, and will include an IBM 1620 scientific computer, an IBM 1410 data processing system, and associated units of punch card equipment.

The AUB, a privately-supported institution, has an international faculty of over 500 and a student body of almost 3000 from some 50 countries. The center represents a significant contribution to the long range development of the Near and Middle East.

EDUCATION NEWS

TEACH COMPUTER PROGRAMMING WITH NEW TECHNIQUE OF PROGRAMMED LEARNING

The new method of instruction called "reinforced learning", deriving from Prof. B. L. Skinner of Harvard Univ., has been applied to teach students how to program a computer. The course is designed for the NCR 390 computer.

The technique makes use of five psychological factors which have been found to accelerate learning:

(1) Information to be learned is broken into small steps -- the student absorbs only "one piece" of information at a time;
(2) Active response by the student to each item or step is encouraged, to stimulate interest and focus attention;
(3) Immediate response from the machine is provided, to "reinforce" correct answers and "extinguish" incorrect ones;
(4) Self-pacing is built into the course;
(5) A low-error rate is assured, serving to build confidence and keep interest high.

-- Susan Horstman takes new tape-recorded "reinforced learning" computer programming course. It can be given to a number of students simultaneously through earphones. The workbook is for students' responses.

The course will be offered by NCR's branch offices for training employees of 390 users in basic programming. The new approach will permit training of the employees "when and where it is most convenient for the user, with no limitation on the learning time required or the number of persons to take the course".

NCR also is using a reinforced-learning course to teach the operation of its new Class 450 bank proof system. This course has cut in half the training time previously required and has increased the confidence and ability of proof machine trainees.

BELL TELEPHONE SYSTEM BUSINESS COMMUNICATIONS SEMINAR

The Bell Telephone System is conducting an informational program for management, to assist business executives to understand ways that modern communications can contribute more effectively to corporate planning, growth, and profit. The facilities for the seminars are at present located at One East Wacker Drive, Chicago, Ill.

The continuing seminars are held in both one-day and two-day sessions. The sessions are planned for executives representing all types and sizes of business, government and military agencies and any type of organization that relies on business communications.

The seminars cover:

1. "The Information Explosion" -- an examination of the increasing volume of information that must be organized and understood by management;
2. "The Integrated Management Information System"
3. "Communications" -- its role in effective organizational planning, growth, and profit, with a practical explanation of the technical nature of communications;
4. "Planning an Integrated Communications System" -- with attention to function, volume, distribution, message characteristics, speed, accuracy, and cost;
5. "Building for Tomorrow" -- covering products of today's research, and inter-relationship of man and machines in the age of the "information explosion".

NEW PRODUCTS

Digital

IBM 7094 II — IBM'S MOST POWERFUL COMPUTER TO DATE

IBM Corporation
Data Processing Division
White Plains, N.Y.

Increased speed and processing power is provided in the IBM 7094, model II. Substantial increases in the internal processing speed have been provided by a new instruction processing unit, which reduces the number of cycles necessary for multiplication and division; and a new core storage unit, which allows a higher degree of overlapped operation in its 32,768 word memory. The system performs a basic operation cycle in 1.4 millionths of a second -- 30 per cent faster than the two-microsecond cycle of the 7094.

The higher degree of overlap is made possible by interleaved addressing in the new core storage unit, providing in effect, two separate memory banks, each with a capacity of 16,384 words. Two instructions may be retrieved simultaneously or one retrieved while the previous instruction is being executed. A continuous flow of overlapped instructions is possible until the sequence of instructions is terminated.

The 7094 II can execute, without change and at the higher speed, programs now being used with the 7094 and 7090 data processing systems.

MONICA MINIATURIZED COMPUTERS

Autonetics
3370 E. Anaheim Rd.
Anaheim, Calif.

Integrated solid-state circuits are being used in this company's new family of Monica microminiaturized computers. This division of North American Aviation, Inc. has developed the Monica line through its experience in the manufacture of airborne military computers.

Monica is a successor to the Verdan and the D-17 Minuteman real-time digital computers. It has small size, low weight, modular building blocks, parallel word transfer and operation, two memory sections, and two processing centers which rate independently. There is an internally stored program and an instruction list of 75 commands. The random access core memory of 8192 words is expandable to 32,768 words.

Monica is designed for use in inertial guidance, flight control and automatic checkout as required for missiles, space vehicles, advanced aircraft, and navigation systems for submarines. One member of the family, a navigational computer, will be ready late this year. Another, a central computer with larger capabilities, will be ready in the spring of 1964.

Digital-Analog

SDS DIFFERENTIAL EQUATION SOLVER

Scientific Data Systems, Inc.
8811 Alden Drive
Los Angeles 48, Calif.

This company has announced the DES-1, a differential-equation solver, which combines in a single machine features of both digital and analog computers. The DES-1 includes a central processor with 8192 words of overlapped memory, paper-tape reader and punch, input/output typewriter, console, real-time clock, and graph plotter. This gives it the problem-solving capacity of between two and three fully expanded analog computers.

The computer allows problems to be changed in minutes, without the tuning usually required in analog computers. Magnetic tape storage of problems and previous results, permits a library that minimizes programming effort. The computer performs real-time digital simulation while retaining the programming simplicity of analog computers.

The company expects to deliver the first DES-1 in February of 1964.

Software

AID FOR SIMULATION OF INVENTORY SYSTEMS

The General Electric Computer Department, Phoenix, Ariz., has developed a programming aid, called TRIM, for the simulation of inventory systems. The new software package is an analytical tool used by engineers in the design and implementation of improved inventory control systems -- basically a model which approximates the real system. The TRIM approach assures a workable system before it is built.

TRIM uses a GE-225 general purpose computer, causing it to behave like a complete, single-stage inventory system. It consists of six subroutines or operations, which are performed in sequence. The routines process customer demands, estimate future requirements, place and receive replenishment orders, purge overage inventory, and cancel overextended back orders.

The new programming has at least three significant features: (1) it performs much faster than an operating system on the factory floor, and it can simulate 50 time periods of activity in inventory systems in less than five minutes; (2) TRIM can explore inventory situations without risking monetary investment; (3) it is possible to try all alternatives and select the best method of operation.

In a series of tests within the company, TRIM has demonstrated inventory reductions of up to 30 per cent. Customer service has been given a lift, clerical costs reduced, and risks involved in designing new systems minimized. TRIM will be made available to current as well as future users of the GE-225.

COBOL COMPILER FOR HONEYWELL 400

Honeywell EDP, Wellesley, Mass., has relased to users a COBOL compiler for the H-400 data processing system. It contains all of the language elements of COBOL '61 as required by CODASYL, plus a set of elective features. Electives implemented in the compiler include: segmentation, MOVE corresponding, the ENTER verb, the USE verb and a variety

of input-output techniques, such as "DEMAND READ" and "DEMAND WRITE".

The compiler will operate under control of the Honeywell 400 monitor. Using Honeywell's program tape maintenance (PTM) software, object programs may be combined with EASY assembly system programs to create a mixed COBOL and EASY master program tape.

Major features of 400 COBOL include ability to accept batched source programs, automatic segmentation, and a competitive compile time, which averages 20-25 minutes for a typical 2048-word memory object program. The compiler can be used with any H-400 data processing system with a 2048-word memory or larger, and a minimum of four magnetic tape drives.

NEW COMPILER FOR RPC-4000 OF GENERAL PRECISION

ACT IV, a new algebraic compiler and translator, is now available for the RPC-4000 from the Commercial Computer Division of Information Systems Group, General Precision, Inc., Glendale, Calif.

The compiler is simple enough to be used after a few days' training. The computer can be used with the compiler without any knowledge of machine-language programming. Arithmetic and other sub-routines required for running the translated program are included.

A programming manual for the compiler defines the vocabulary and rules of language and includes operating instructions, error location and correction methods, sample programs, internal number representation for the computer, and reference lists and tables.

RAMPS FROM C-E-I-R

RAMPS (for Resources Allocation and Multi-Project Scheduling) is a software management tool which reduces costs and centralizes decision-making for business and industry. It has been introduced by C-E-I-R, Inc., Washington, D.C. RAMPS helps managers to decide in advance when and where men, machines, materials, and funds should be assigned, and to predict how much time will be required by each undertaking. Using IBM 7090 or IBM 7094 equipment with RAMPS, business and industrial management may allocate limited resources, including money, to competing activities in more than one large project simultaneously.

IBM 1401 CHANGES EASY WITH DATATROL PATCH GENERATOR

A new service program, available from Datatrol Corp., Silver Spring, Md., enables an IBM 1401 programmer to easily make patch corrections to an assembled 1401 program deck. The Datatrol Patch Generator (DPG) technique uses the 1401 to generate its own patch cards. With the DPG, the programmer compiles a list of corrections for punching in a format similar to Autocoder or SPS. Then the DPG is used to punch out any required number of patch cards in a single run. These patches contain up to four instructions per card and are placed either permanently or temporarily in front of the final transfer card of the program deck and it is ready to run.

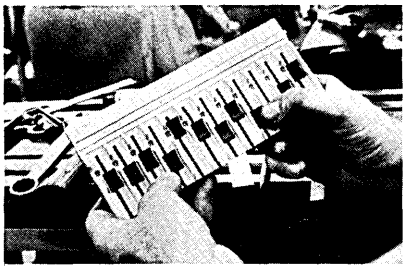
The advantages claimed for DPG are savings in programming time by reduction of time lost through clerical error, and savings in computer time spent on reassembly runs. A condensed operational program and instructions for using the DPG is available from this company.

Data Transmitters and A/C Converters

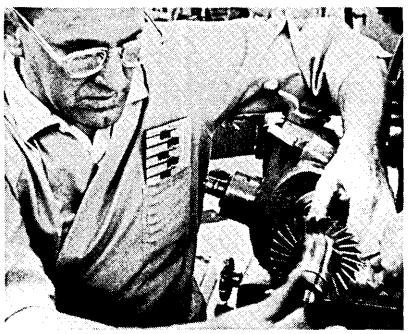
POCKET-SIZED RECORDING DEVICE FOR USE WITH IBM 1030

IBM Corporation
Data Processing Division
White Plains, N.Y.

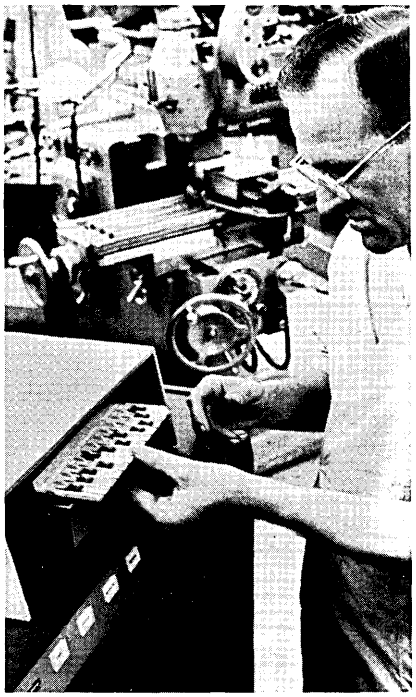
A pocket-size recording device has been developed by this company which now permits factory employees to enter production information into an electronic data-gathering system. The new IBM 1030 data collection system gathers information from electronic in-plant reporting stations and transmits it directly to a computer for immediate analysis. The computer may be located in the same building or thousands of miles away.



-- An employee at his work location logs information on the plastic cartridge.



-- He stores the cartridge in his pocket.



-- When he is ready to send information to the computer he can insert it in an electronic reporting station.

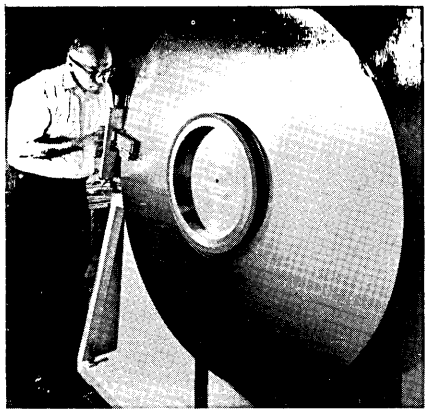
Memories

NEW MEMORY-STORAGE DEVICES

Information Systems Group
General Precision Inc.
Glendale, Calif.

Some new random-access storage units have been developed and are being marketed by this company. The fast-access, rotating memory-storage devices include three magnetic-drum and ten magnetic-disc models.

The Series L100 discs use one side for storage, while the L200 discs use both sides. Flying read/record heads are fitted to both. A read/record head is used for each track, eliminating the need for head movement. When the disc rotates, the flying heads float over the surface on a very thin cushion of air, automatically compensating for any variations caused by temperature or other factors. Sizes of the discs range from 4 to 24 inches in diameter. Disc-storage capacity ranges to a maximum of 7,680,000 bits.



-- A technician at the Information Systems Group of General Precision, Inc., test a read-write head that records and withdraws information from magnetically coated surface of a giant, 48-inch-diameter magnetic-memory disc. The disc is part of a six-disc memory system that can store up to 153 million bits of information and can retrieve information on the basis of content alone (rather than location of information) in 33 thousandths of a second. The memory system could be auxiliary to a computer or data-processing system.

The L500 series of magnetic drums range in capacity from 512,000 to 4,100,000 bits. Each of the three models is available in two types of different lengths. All models have an integral air-circulation system, and high-precision, lifetime-lubricated bearing assemblies.

Both of the new random-access storage units are now available for extending the capacity of computer systems used in commercial, industrial, and military applications.

FIRST TUNNEL-DIODE MEMORY UNIT IS INSTALLED IN OPERATING COMPUTER

IBM Corporation
Data Systems Division
Poughkeepsie, N.Y.

A tunnel-diode memory unit has been installed in an operating computer by this company. The tunnel diode, one of the fastest switching devices known today, has switching times measured in billionths of a second. A number of tunnel-diode circuits and devices have been proposed before, and some models have been built, but the new memory is the first reported to be used in an operating system.

The new memory is a small, high-speed register unit installed as a specially engineered feature in the IBM STRETCH computer used at the company's Poughkeepsie development laboratories. Its purpose is to modify instructions to the computer at extremely high speeds. In the STRETCH system, the memory fetches and stores data in a cycle time of 600 nanoseconds (billionths of a second). In engineering test, cycle times have reached 200 nanoseconds -- at least three times as fast as needed by any computer, including the STRETCH.

Its full capacity is 17 computer words of 74 bits each. At the 200 nanosecond cycle, the memory can process over 45 million letters or digits a second -- equivalent to 90 full-length novels.

The basic component in the IBM register memory is a tiny circuit containing a tunnel diode, a resistor and an inductor, all encased in a plastic cell. A total of 1250 of these cells are mounted on two 4½ x 16-inch printed-circuit cards, which are plugged directly into the computer.

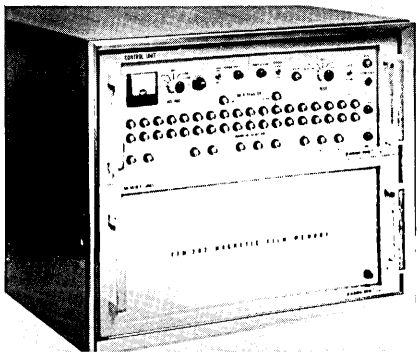
The new memory is being restricted to STRETCH where it can be studied further in an operating system. IBM does not plan to sell it in its present form in commercially available computers.

300-NANOSECOND CYCLE TIME MEMORY

Fabri-Tek Inc.
Minneapolis, Minn.

The FFM-202, a self contained magnetic film memory system, with a 300-nanosecond total cycle time is commercially available from this company. Read or write only time is 200 nanoseconds. Access time is 150 nanoseconds. Four operating modes are available: read only, write only, read restore, and read-modify-write.

It is a complete memory package, with its own power supply and will operate from any 115-volt, 60-cycle ac line.



Magnetic film memory elements are about 1000 angstroms thick and are packaged in multilayer laminated overlays containing all the drive and sense lines. A typical 8" x 10" memory plane contains 128 words of 36 bits each. Several of these planes connected together will permit a variety of memory sizes and word lengths.

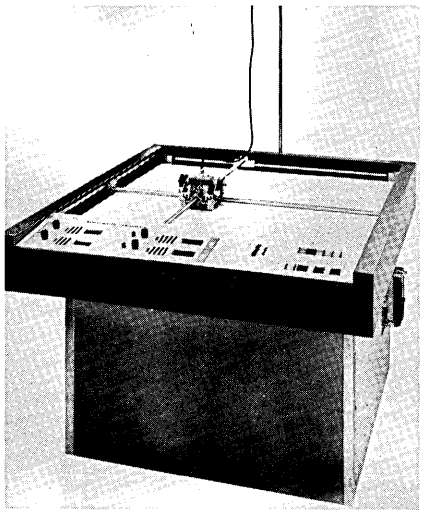
Input-Output

ELECTRONIC 'ARTIST' DRAWS STRAIGHT OR CURVED LINES

Benson-Lehner Corp.
Van Nuys, Calif.

This company has developed an electronic "Artist", called Electroplotter II, capable of drawing straight or curved lines automatically in graphs, charts or maps, in any combination of four colors, and annotating them with words or

symbols. The optional four-pen plotting head which permits drawing in four colors also permits four line widths. The full alphanumeric printing allows complete graphs to be drawn without subsequent hand operations. Electroplotter II accommodates graphs as small as 8½ x 11 inches and charts as large as 42 x 58 inches. No special operating skills are required.



The device can receive its design and color instructions from magnetic tape, punched cards or tape, or directly from a computer. It will operate under program control or operator control. Output FORTRAN subroutines are supplied with each plotter to aid in systems integration.

The plotter is designed for use in data processing centers, for graphing scientific, engineering, and economic data. A very wide range of applications is possible.

NEW, FOUR-ROW TELETYPEWRITERS

Bell Telephone System
Avenues of the Americas
New York 20, N.Y.

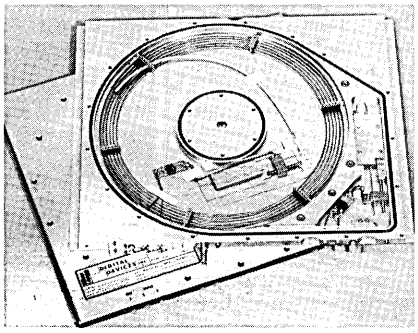
Teletypewriters with four-row keyboards and a 66-percent increase in speed on regular teletypewriter exchange service are now available from this company in two models. Both operate at 100 words per minute using a newly developed eight-level Data Interchange Code which provides 128 possible combinations for the formation of characters and eliminates many present information "interchange" problems. Both models also are equipped with dials for faster station calling without need for an operator. Speaker-phone units permit "hands-free" monitoring of call progress tones.

Components

MAGNETOSTRICTIVE DELAY LINES NOW PRACTICAL FOR AEROSPACE APPLICATIONS

Digital Devices Inc.
212 Michael Drive
Syosset, L.I., N.Y.

This company has recently introduced a new packaging concept making aerospace applications of magnetostrictive delay lines practical. The new technique uses solid castings of appropriate materials using circular contact areas to reduce stress concentrations and allow the use of standard O-ring type seals.



Provisions have been made in the new design for evacuating or purging with inert gases.

MULTIAPERTURE CORE USED IN NEW MAGNETIC LOGIC CIRCUITS

Lockheed Electronics Company
6201 East Randolph St.
Los Angeles 22, Calif.

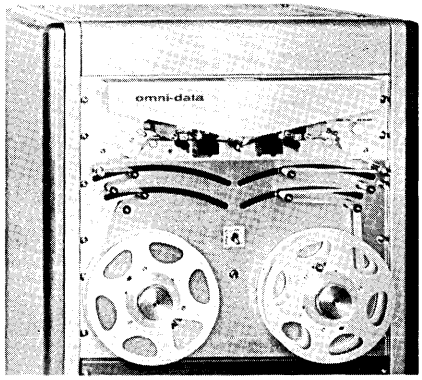
A new ferrite multiaperture device has been developed by this company for application in magnetic logic circuits. The new component, called MAD-5 wafers, is used in a line of magnetic logic modules offered for use as building blocks to construct computing and other digital equipment.

The MAD-5 devices, small 5-hole ferrite cores, are wired to form logic modules such as OR gates, AND gates, and other circuits assembled in easy-to-handle wafers. Encapsulated assemblies also are available for resistance to shock and vibration.

SPEEDS UP TO 100-INCHES/SECOND FOR NEW TAPE REELERS

Omnitronics, Inc.
511 N. Broad St.
Philadelphia 23, Pa.

This company has introduced a new series of tape reelers which permit continuous bidirectional or unidirectional operation of paper-tape equipment at tape speeds up to 100 inches per second. At ten characters per inch for conventional punched tape, this gives 1000 characters per second.



Double dancer arms on the new OMNI-DATA Model RS-500 (unidirectional with rewind) and Model RS-600 (bidirectional) reelers allow very high paper speeds without excessive back-and-forth motion of the arms. The new series is compatible with all OMNI-DATA readers and recorders and with all other paper-tape equipment. Both reelers normally accommodate NAB reels up to 8-inches in diameter.

AUTOMATION

TRANSLATION FROM CHINESE TO ENGLISH DEMONSTRATED AT IBM

An experimental system for automatic machine translation of Chinese to English recently was demonstrated by IBM Corp. The system is being developed at the Thomas J. Watson Research Center, Yorktown, N.Y., under a contract from Rome Air Development Center, Air Force Systems Command.

The demonstration was made with a limited vocabulary. A large Chinese-English "machine dictionary" is now in preparation which will permit translations of more extensive Chinese texts in the future.

The system uses a special input coding system and a large capacity storage unit with associated processing circuits. The input system enables a non-Chinese-speaking operator to encode 6500 different Chinese characters. Its capacity can easily be expanded to 16,000 characters or more if desired. The technique for classifying Chinese characters is presently being simulated by hand coding but will be embodied in a device under development.

The prototype for the translating system is based upon the Russian-to-English translation system previously developed at IBM. The major requirement in modifying the system to process Chinese is to build up a sufficiently large dictionary and to specify linguistic rules precisely enough so that an accurate and readable translation can be produced.

The input device being developed for the IBM Chinese language processing system is based upon a classification of Chinese characters by Dr. Lin Yutang, scholar and philosopher. The device uses a regular typewriter keyboard, but three keys must be struck one after the other, to determine one Chinese character. Output of the typewriter is punched paper tape which is fed into the translator.

The input device is being built jointly by IBM and the Mergenthaler Linotype Company for the Air Force Information Processing Laboratory. The linguists and engineers at the IBM Research Center are under the direction of Mr. Hsien-Wu Chang. Mr. Fang-Yu Wang, Yale University Institute for Far Eastern Languages, is serving as consultant on the project.

NEW RAIL CAR LOCATION AND INQUIRY SYSTEM

A computer inquiry system has been developed by Honeywell EDP, Wellesley, Mass., which permits railroads to verify the location of rail cars in transit. The system links a high-speed digital computer with the Bell Systems' nationwide teletypewriter exchange (TWX). Inquiries may originate at any of 60,000 TWX terminals in the U.S. and can be sent directly to a central computer. The computer processes, in seconds, a variety of information on rail car status, and automatically transmits the answer to the sending terminal.

近來發現磁心的開關時間可以縮短，故能用它來做更高速的存儲器了.

Word-for-Word Translation:

Recently discover/discovery magnetic core (de) switching time possible shorten, therefore use/consume it come make even high speed (de) storage device (le).

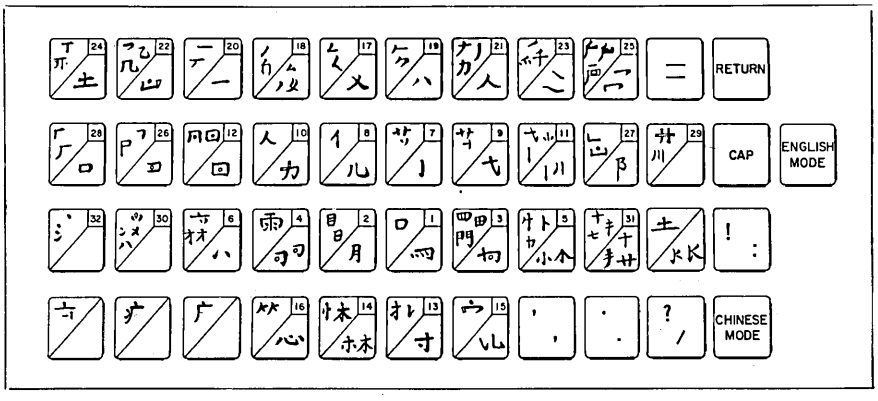
Machine Translation:

Recently discover switching time of magnetic core possible shorten, therefore possible use it in order to make storage device of even higher speed.

Human Translation:

It has been discovered recently that the switching time of magnetic cores can be shortened. They, therefore, can be used to make storage devices of even higher speed.

-- Above is an example of a Chinese sentence and translations made (1) word-for-word, (2) by machine, and (3) by a human translator. The words "de" and "le" have no direct English equivalents; they serve purely grammatical purposes in the sentence.



-- Above is the keyboard layout of the input device being developed for automatic Chinese translation. The marks on the keys correspond to portions of Chinese characters. The operator recognizes one of these characteristic marks at the top of the character and another at its bottom. When the two keys corresponding to these marks are depressed, the small group of characters containing both of them will be displayed on a screen in front of the operator. The operator will look at the characters and then press a third key specifying which of the displayed characters matches the desired one. The input device will then punch a code on paper tape for the particular Chinese character.

Newsletter

Information on specific car location, name of shipper and consignee, type of car, its owner and car number, and the commodities it is carrying, are maintained on a master storage file in the computer. Any of this information can be used to originate an inquiry. (Current rail inquiry systems require knowledge of the car numbers before additional information can be obtained.) The computer system can also be used by railroads to maintain records of the location and status of their rolling stock.

In a recent demonstration at the Terminal Railroad Association, St. Louis, Mo., the time from inquiry to response for typical cases was about four seconds.

The Terminal Railroad Association is a switching railroad jointly owned by 15 of the nation's railroads. TRRA maintains seven major classification yards in the St. Louis area, through which approximately one million loaded freight cars are handled each year. TRRA is participating with Honeywell EDP in a study of the application of computers and data communications in rail car accounting systems.

PEOPLE OF NOTE

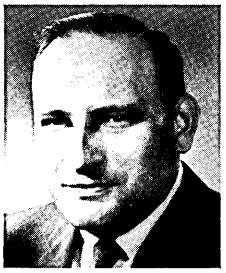
EDP CHAIRMAN ELECTED BY NOMA

Malcolm D. Smith, manager of the special programming projects department at Honeywell EDP, has been elected national committee chairman, data processing committee, of the National Office Management Association. As chairman, Mr. Smith will be responsible for disseminating, to chapters and membership, the latest information on automatic and EDP techniques. He also will supervise arrangements for data processing seminars, clinics and publications for domestic and international membership.

DIRECTOR OF SCIENTIFIC COMPUTING

Dr. Louis Robinson has been promoted to director of scientific computing for the Data Processing Division of IBM Corp.

Dr. Robinson will be responsible for developing and implementing new marketing programs for products and applications in the scientific computing area. He will coordinate exchange of information among IBM and its customers in advanced computing areas and also will supervise recruitment of graduate scientists for work on computing and programming systems for advanced scientific use.



TELEREGISTER NAMES EXECUTIVE VICE PRESIDENT

Luther A. Harr, Jr., has been named executive vice president of The Teleregister Corp., Stamford, Conn. He has been assistant to the chairman, John E. Parker, since January. Mr. Harr had previously been director of Univac operations for Europe, Africa, and the Middle East for Sperry Rand International Corp., Lausanne, Switzerland.

HUGHES COMPUTER DIVISION HEADED BY ALTERMAN

Francis J. Alterman has been appointed manager of the computer division of Hughes Aircraft Company's ground systems group. Before joining Hughes, Mr. Alterman was president of Advanced Scientific Instruments, Inc., in Minneapolis.

The computer division is currently engaged in the development of real-time computer systems for military and commerical application.

MEETING NEWS

SJCC EX POST FACTO PROFILE

What? Spring Joint Computer Conference

Where? Cobo Hall in Detroit, Mich.

When? May 21-23, 1963

Who was there? Over 2400 registrants, and 3000 visitors to the exhibition hall

What did they hear?

- Ray Eppert, president of the Burroughs Corporation, said in his keynote address that "electronic computation and information processing, supported by management and intelligently used, can and will write an effective economic accident policy.

  "Management must show that it is flexible and can adapt to changing times. New skills and abilities must be mastered to meet the spiralling demands of our expanding economy. In fact, business needs a weapons system concept, and computers are vital to such a program."

- Walter A. Rosenblith, Professor of Communications Biophysics at MIT, told the conference luncheon that "what is needed is not competition or coexistence between brains and computers. What is needed is skilled cooperation between the hardware and software of the computer expert, and the 'pinkware' of the physiologist to effect a fruitful marriage of the disciplines so that a better understanding will be obtained of both man and his tools."

- Also: a sequence of 37 prepared papers, and four panel discussions on computer programming, spacecraft simulation, data acquisition and display, etc., including the award-winning paper by Douglas T. Ross and J. E. Rodriguez of the MIT Computer-Aided Design Project on the theoretical foundation of the computer-aided design system.

What did they see?

- Over $12.5 million in computers, peripheral equipment, and services, displayed in 160 booths by 82 exhibitors.

- Notable among the exhibits was Burroughs' first public dem-

onstration of the B5000. The unit showed its capability to process two programs simultaneously. Control Data Corp. showed a new 1200 card per minute reader, and its CDC 818 disc file system. Digital Equipment introduced its new low cost computer, the PDP-5 principally for applications in process control. DEC also announced a PDP-6 computer, medium scale, designed to control experiments, collect, and analyze data. Western Union announced an optical character reader which reads typewritten material in any font and converts it into telegraphic code in the form of five-unit punched tape for immediate transmission. Addressograph-Multigraph disclosed details of its new high speed printer-processor.

Where can I get a copy of the Proceedings?

Address mail order requests to Spartan Books, 301 North Charles, Baltimore 1, Md. Members of AFIPS....$5 Nonmembers....$10

PRINCIPALS OPEN SJCC MEETING -- E. Calvin Johnson, general chairman of the 1963 SJCC prepares to cut the opening tape as Brian W. Pollard, chairman of the technical program, Willis Ware, chairman of the Governing Board of AFIPS, Ray Eppert, president of the Burroughs Corp., and J. Don Madden, president-elect of AFIPS, look on.

BEMA ACQUIRING SOME REAL MUSCLE, CHAIRMAN TELLS SPRING MEETING; STANDARDS STRESSED

R. Stanley Laing, chairman of the Business Equipment Manufacturers Association (BEMA), told about 100 attendees at the Spring Meeting, May 8-10, at the Seaview Country Club, near Absecond, N.J., "that a great deal has been done in a short time, and we now have a trade association with some real muscle, able to assume responsibility in representing this industry."

"For example, we have formulated some very specific plans with respect to our standards effort, both in this country and internationally. It is no secret that one of the principal reasons for the reorganization of this Association (formerly OEMI, Office Equipment Manufacturers Institute) was the necessity for us as manufacturers to exercise more aggressive leadership in creating workable standards for this industry."

Mr. Robert G. Chollar, chairman of BEMA's Data Processing Group's Advisory Committee on Plans and Policy, told the meeting that "I am convinced that progress in the overall standardization program has been considerable." However, Mr. Chollar warned that the interrelating responsibilities of the standards program demand extreme care and caution to insure that all economic and technical implications of a standards adoption are understood before final action. "On the other hand", he said, "this caution must be coupled with expediency in the rapidly changing field where lack of standard practice is and will continue to stifle growth and economic advance on national and international levels."

In his talk, Mr. Chollar estimated that in 1962, 12,750 man-hours were spent by BEMA member company technicians in the standards program, representing an investment of $2,400,000 and the time of some 700 individuals. Mr. Chollar commented on this with the paraphrase: "Think not of what the standards program will do for you! think of what the standards program will do to you if you don't participate."

At the luncheon talk on the closing day of the meeting, Dr. George W. Petrie III, Program Director of the IBM Executive School, remarked that the rate of technological change in the business equipment industry recalled the Danish proverb: "Prediction is difficult, particularly when dealing with the future."

Dr. Petrie commented that "management science offers a great many additional tools which management can use to sharpen its decision-making capabilities. Along with management science, a person very often thinks in terms of mathematical model building. Actually this is a simple kind of concept.

"For years people have used simple equations to describe the physical universe, the part that was the most easily understood. Nowadays people are building more complex mathematical models to illustrate some of the more complex activities. Simulators are actually being built that will allow management to take a broad look at the entire activities of the firm and see what the impact of reorganization will be on that firm. The horizon shows us vastly increased use of simulation and vastly more powerful types of simulators to be adapted to the needs of the firm."

BUSINESS NEWS

BOXSCORE OF SALES AND PROFITS FOR COMPUTER FIELD FIRMS

C&A presents below comparative operating results for firms of interest to computer people, as distilled from the latest group of news releases.

COMPANY	PERIOD	SALES Current period / Previous period	(%)	PROFITS Current period / Previous period	(%)	NOTES
Addressograph-Multigraph	Three months ending April 30, 1963	$48,811,000 / $45,957,000	(+6.0%)	$3,904,000 / $3,829,000	(+2.0%)	
Anelex	Six months ending March 31, 1963	$6,472,901 / $5,805,470	(+11.5%)	$287,661 / $308,320	(-6.8%)	President Anderson said that high R&D write-off caused the decline in earnings.
Burroughs	Three months ending March 31, 1963	$90,160,000 / $98,967,000	(-9.8%)	$1,722,000 / $2,120,000	(-18.0%)	President Eppert said reduced revenues was "due entirely...(to the) phasing out of certain defense programs".
Collins Radio	Nine months ending May 3, 1963	$117,356,000 / $144,607,000	(-18.8%)	$2,408,000 / $2,012,000	(+19.5%)	
Control Data	Nine months ending March 31, 1963	$38,435,937 / $27,665,535	(+39.0%)	$1,776,632 / $1,055,146	(+69.0%)	Figures do not reflect recent acquisition of the Bendix Computer division.
Data Products Corp.	Three months ending March 30, 1963	$1,179,000 / $1,234,000*	(-4.9%)	$6,600 / -$24,000 (Loss)		*previous quarter. Firm is just completing its first fiscal year.
Electronic Associates, Inc.	Three months ending March 31, 1963	$4,328,460 / $2,874,071	(+50.0%)	$350,780 / $249,570	(+40.1%)	
General Precision Equipment	Three months ending March 31, 1963	$48,200,000 / $48,300,000	(-0.5%)	$889,000 / $866,000	(+2.5%)	
Honeywell	Three months ending March 31, 1963	$147,582,300 / $135,145,562	(+8.9%)	$6,164,156 / $5,292,909	(+16.5%)	President Binger said "Improvement in profits ...due to EDP division where good progress is being made".
IBM	Three months ending March 31, 1963	$486,657,085 / $453,226,278	(+7.4%)	$63,087,363 / $56,264,982	(+12.1%)	At annual meeting, Chairman T. J. Watson, Jr., noted that IBM has grown an average of 13% per year since 1914.
ITT	Three months ending March 31, 1963	$270,868,000 / $241,964,000	(+12.0%)	$9,408,000 / $8,182,000	(+15.0%)	President H. S. Geneen said that sales in the United States increased by 22% during the period.
ITEK	Six months ending March 31, 1963	$16,054,000 / $20,060,000	(-20.0%)	$314,000 / $57,000	(+450.0%)	President Lindsay said that R&D is concentrating in graphic data acquisition and textual data processing.
Packard Bell Electronics	Six months ending March 31, 1963	$27,553,000 / $23,776,000	(+16.0%)	$752,000 / $662,000	(+12.6%)	

COMPANY	PERIOD	SALES Current period / Previous period	(%)	PROFITS Current period / Previous period	(%)	NOTES
Sperry Rand, Corp.	Fiscal year ending March 31, 1963	$1,227,085,610 / $1,182,554,230	(+3.8%)	$13,384,794 / $24,373,816	(-46.0%)	President Vickers sited substantial losses in the electronic data processing and office equipment divisions as reasons for the sharp decline in profits.
Thompson Ramo Wooldridge, Inc.	Three months ending March 31, 1963	$117,351,036 / $111,670,230	(+5.1%)	$3,090,749 / $2,878,166	(+7.7%)	President H. A. Shepard said increased shipments of computers for military and commercial applications caused revenue gains.

IMPORTS OF COMPUTERS INCREASED 69% IN 1962; EXPORTS UP ONLY 24% IN PERIOD

A recent U.S. Department of Commerce bulletin showed that imports of electronic computers have risen by 69% in 1962 to a dollar volume of $7,966,716 over $4,728,571 in 1961. According to the report issued by the Department's Scientific, Photographic and Business Equipment Division, the increase came in the face of an overall decline in the value of imports of business equipment to the U.S. of 6.6% in 1962.

Computer imports climbed from 4.9% of the total value of business equipment imports in 1961 to 8.9% in 1962. Canada is the largest single supplier of computers to this country, contributing $3,515,545 in equipment or 44% of total computer imports.

Exports of electronic computers from the U.S. rose 23.6% in 1962 to a dollar volume of $136,172,335 over $110,129,404 in 1961. In 1962, computers represented 42.1% of the total exports of business machines from the U.S., a considerably higher percentage than in imports. Exports of punch card calculating machines declined 13% in the same period from a dollar volume of $58 million to $50 million. Overall, exports of business machines, including typewriters, dictating machines, cash registers, etc., increased 4.2% in 1962 over 1961.

RECOMP LINE DROPPED BY AUTONETICS

The Autonetics Division of North American Aviation, Inc., has announced that it will discontinue the manufacture of its RECOMP line of computers.

"Although Autonetics is going out of the commercial RECOMP computer business it will of course continue its work on computers for military and space use which has constituted the great bulk of our computer activity," President John R. Moore said.

"RECOMP was designed for a small, specific market of industrial and scientific applications. It is a management decision not to continue in this field."

RECOMPS in inventory will be offered for sale, the company said. Trained service personnel will be absorbed in Autonetics' Computer and Data Systems Division, in order to continue to provide service for RECOMP users.

IPC UNDERGOES REFINANCING

Information Products, Inc., of Cambridge, Mass., has recently joined the rather populous "no cash" club of the computer field. The membership requirement is a propensity to lease rather than sell one's products. Members frequently are noted to engage in such recreations as merging, selling-out, and filing bankruptcy petitions.

The 2½ year old Cambridge maker of computer display equipment, coding keyboards, and symbol generators is seeking another out from non-exclusive "no cash" club, according to Hammond Ladd, president. By July 1, the firm is expected to complete refinancing with a major investment company. During the period of negotiations, Paul Atwood is serving as administrator of the company.

Ladd denied rumors that the firm is contemplating a merger with a major electronics company. Boston-based Raytheon has been mentioned as a likely recipient of the product line of IPC, since the large military electronics house has been actively seeking an "in" in the commercial computer display and data communications equipment field. The departure of co-founder S. Paul Blumenthal from IPC recently helped fan the flames of the merger rumor. However, Ladd told C&A that no merger, or sale of the company is being given serious consideration at the current time. Also, he said, no major change in the product line or in personnel are expected.

CONTROL DATA CORP. ACQUIRES CONTROL OF DUTCH FIRM

Control Data Corp. has announced purchase of a majority of the outstanding shares of Electrofact N.V. of Amersfoort, The Netherlands, in exchange for 39,950 shares of CDC's common stock.

The Dutch firm manufatures and markets a broad line of measuring, recording, and control devices and systems for use in industrial processes. However, its international marketing and service organization for marketing automatic control equipment in Europe is the primary reason for CDC's stock purchase, industry observers believe. Electrofact offers CDC a strong, established sales force in the Common Market.

Electrofact will continue its industrial control activities, but it will also provide facilities for the manufacture of CDC's computing equipment in The Netherlands. This is the first manufacturing facility for CDC within the Common Market area.

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 American-made general purpose computers installed or on order as of the preceding month. 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.

Most of the figures are verified by the respective manufacturers. In cases where this is not so, estimates are made based upon information in the reference files of COMPUTERS AND AUTOMATION. The figures are then reviewed by a group of computer industry cognoscenti.

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

AS OF JUNE 10, 1963

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Addressograph-Multigraph Corporation	EDP 900 system	Y	$7500	2/61	12	10
Advanced Scientific Instruments	ASI 210	Y	$2850	4/62	8	3
	ASI 420	Y	$12,500	2/63	1	0
Autonetics	RECOMP II	Y	$2495	11/58	125	X
	RECOMP III	Y	$1495	6/61	32	X
Burroughs	205	N	$4600	1/54	70	X
	220	N	$14,000	10/58	55	X
	E101-103	N	$875	1/56	160	X
	B250	Y	$4200	11/61	54	40
	B260	Y	$3750	11/62	33	46
	B270	Y	$7000	7/62	16	24
	B280	Y	$6500	7/62	20	21
	B5000	Y	$16,200	4/63	5	22
Clary	DE-60/DE-60M	Y	$675	2/60	105	3
Computer Control Co.	DDP-19	Y	$2800	6/61	3	X
	DDP-24	Y	$2750	-/63	0	3
	SPEC	Y	$800	5/60	10	0
Control Data Corporation	G-15	N	$1000	7/55	345	1
	G-20	Y	$15,500	4/61	22	3
	160/160A	Y	$1750/$3000	5/60 & 7/61	285	51
	924/924A	Y	$11,000	8/61	10	9
	1604/1604A	Y	$35,000	1/60	51	8
	3600	Y	$52,000	6/63	0	5
	6600	Y	$120,000	2/64	0	1
Digital Equipment Corp.	PDP-1	Y	Sold only about $120,000	11/60	42	9
	PDP-4	Y	Sold only about $60,000	8/62	13	14
	PDP-5	Y	Sold only about $25,000	11/63	0	1
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	32	X
General Electric	210	Y	$16,000	7/59	74	6
	215	Y	$5500	-/63	0	17
	225	Y	$7000	1/61	120	80
	235	Y	$10,900	-/64	0	3
General Precision	LGP-21	Y	$725	12/62	17	33
	LGP-30	semi	$1300	9/56	395	5
	L-3000	Y	$45,000	1/60	1	0
	RPC-4000	Y	$1875	1/61	68	17
Honeywell Electronic Data Processing	H-290	Y	$3000	6/60	10	3
	H-400	Y	$5000	12/61	53	64
	H-800	Y	$22,000	12/60	52	7
	H-1400	Y	$14,000	5/64	0	2
	H-1800	Y	$30,000 up	-/63	0	2
	DATAmatic 1000	N	-	12/57	5	X
H-W Electronics, Inc.	HW-15K	Y	$490	6/63	1	2

CHANGE . . . WHO US?

. . . no, not really . . . We only improve!

And if you are a regular reader of COMPUTERS AND AUTOMATION you have probably noted the recent improvements in our cover and typography.

The excitement and progress that is everywhere in the computer and electronic data processing field is a continual incentive to all of us . . . and we at C&A intend in the months ahead to help stimulate some of the excitement and progress by presenting articles, ideas, concepts, and graphics that reflect the vitality of the people who are leading the "Computer Revolution."

We welcome at all times the suggestions and comments of friends, both new and old, on what we **do** publish and what we **should** publish. We are a small organization with the independence and flexibility to have an alert and patient ear.

If you are not at present a subscriber to COMPUTERS AND AUTOMATION, this is a good time to come aboard, and join the growing numbers of well-informed people who receive a personal copy of C&A each month.

As our "thank you" for responding now to this invitation, we will send you at once a complete reprint of the "Survey and Study of the Computer Field" by the Investment Bankers Association, which appeared in the January and February issues. A copy of this authoritative report will be sent to you FREE if you act now and enter your subscription to the important issues of COMPUTERS AND AUTOMATION coming up. A postage-paid reply card is attached at right for your convenience.

There is no risk! If at any time you feel that COMPUTERS AND AUTOMATION is not supplying you with useful information and ideas worth many times the cost of the magazine, tell us and we will promptly refund to you the unmailed portion of your subscription. So may we hear from you?

EDMUND C. BERKELEY
Editor

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NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
IBM	305	N	$3600	12/57	810	X
	650-card	N	$4000	11/54	675	X
	650-RAMAC	N	$9000	11/54	195	X
	1401	Y	$3500	9/60	5950	3000
	1410	Y	$12,000	11/61	195	368
	1440	Y	$1800	4/64	0	950
	1460	Y	$9800	10/63	0	22
	1620	Y	$2000	9/60	1390	250
	701	N	$5000	4/53	4	X
	7010	Y	$19,175	2/64	0	32
	702	N	$6900	2/55	4	X
	7030	Y	$160,000	5/61	6	X
	704	N	$32,000	12/55	71	X
	7040	Y	$14,000	6/63	0	44
	7044	Y	$26,000	6/63	0	12
	705	N	$30,000	11/55	142	X
	7070, 2, 4	Y	$24,000	3/60	375	205
	7080	Y	$55,000	8/61	52	24
	709	N	$40,000	8/58	34	X
	7090	Y	$64,000	11/59	26	90
	7094	Y	$70,000	9/62	10	15
	7094 II	Y	$76,000	4/64	0	1
Information Systems, Inc.	ISI-609	Y	$4000	2/58	19	1
ITT	7300 ADX	Y	$35,000	7/62	6	2
Monroe Calculating Machine Co.	Monrobot IX	N	Sold only - $5800	3/58	160	1
	Monrobot XI	Y	$700	12/60	250	170
National Cash Register Co.	NCR - 102	N	-	-	28	X
	- 304	Y	$14,000	1/60	30	0
	- 310	Y	$2000	5/61	40	42
	- 315	Y	$8500	5/62	70	135
	- 390	Y	$1850	5/61	360	220
Packard Bell	PB 250	Y	$1200	12/60	150	15
	PB 440	Y	$3500	9/63	0	10
Philco	1000	Y	$7010	-/63	0	27
	2000-212	Y	$52,000	1/63	2	12
	-210, 211	Y	$40,000	10/58	25	9
Radio Corp. of America	Bizmac	N	-	-/56	4	X
	RCA 301	Y	$6000	2/61	262	250
	RCA 501	Y	$15,000	6/59	94	12
	RCA 601	Y	$35,000	11/62	6	9
Scientific Data Systems Inc.	SDS-910	Y	$1700	8/62	16	38
	SDS-920	Y	$2690	9/62	9	7
Thompson Ramo Wooldridge, Inc.	TRW-230	Y	$2680	7/63	0	8
	RW-300	Y	$6000	3/59	37	2
	TRW-330	Y	$5000	12/60	10	18
	TRW-340	Y	$6000	12/63	0	4
	TRW-530	Y	$6000	8/61	17	6
UNIVAC	I & II	N	$25,000	3/51 & 11/57	53	X
	Solid-State II	Y	$8500	9/62	12	25
	III	Y	$20,000	8/62	12	59
	File Computers	N	$15,000	8/56	65	0
	60 & 120	N	$1200	-/53	865	10
	Solid-state 80, 90, & Step	Y	$8000	8/58	550	130
	490	Y	$26,000	12/61	6	10
	1004	Y	$1500	2/63	100	1475
	1050	Y	$7200	9/63	0	2
	1100 Series (except 1107)	N	$35,000	12/50	25	X
	1107	Y	$45,000	10/62	3	15
	LARC	Y	$135,000	5/60	2	X
X -- no longer in production				TOTALS	15,766	8252

CALENDAR OF COMING EVENTS

July 15-17, 1963: 3rd Annual Rochester Conference on Data Acquisition and Processing in Medicine and Biology, Whipple Auditorium, Univ. of Rochester Medical Center, Rochester, N. Y.; contact Kurt Enslein, 42 East Ave., Rochester 4, N. Y.

July 22-26, 1963: 5th International Conference on Medical Electronics, Liege, Belgium; contact Dr. L. E. Flory, RCA Labs., Princeton, N. J.

Aug. 4-9, 1963: International Conference and Exhibit on Aerospace Support, Sheraton-Park Hotel, Washington, D. C.; contact F. K. Nichols, Air Defense Div. Directorate of Operations, DSC/O Hdqs., USAF, Washington 25, D. C.

Aug. 8-9, 1963: 6th Annual Summer Conference, Pacific Science Center, Seattle, Wash.; contact Harold Ostling, Secy., Northwest Computing Association, P. O. Box 836, Seahurst, Wash.

Aug. 20-23, 1963: Western Elec. Show and Conference (WESCON), Cow Palace, San Francisco, Calif.; contact WESCON, 1435 La Cienega Blvd., Los Angeles, Calif.

Aug. 27-Sept. 4, 1963: 2nd International Congress on Automatic Control Swiss Industries Fair, Basle, Switzerland; contact R. M. Emberson, Professional Groups Secretary, IEEE, Box A, Lenox Hill Station, New York 21, N. Y.

Aug. 28-30, 1963: Association for Computing Machinery, Annual Meeting, Denver, Colo.

Sept. 9-11, 1963: 7th National Convention on Military Electronics (MIL-E-CON 7), Shoreham Hotel, Washington, D. C.; contact L. D. Whitelock, Exhibits Chairman, 5614 Greentree Road, Bethesda 14, Md.

Sept. 9-12, 1963: 18th Annual ISA Instrument-Automation Conference & Exhibit, McCormick Place, Chicago, Ill.

Sept. 9-12, 1963: International Symposium on Analog and Digital Techniques Applied to Aeronautics, Liege, Belgium; contact M. Jean Florine, 50, Avenue F. D. Roosevelt, Brussels 5, Belgium.

Sept. 16-20, 1963: 2nd Institute on Electronic Information Display Systems, The American University, SGPA, The Center for Technology and Administration, 1901 F St., N.W., Washington 6, D. C.; contact Dr. Lowell H. Hattery, The American University, Washington 6, D. C.

Sept. 23-27, 1963: International Telemetering Conference, London Hilton Hotel, London, England; contact F. G. McGavock Associates, 3820 E. Colorado Blvd., Pasadena, Calif.

Oct., 1963: 10th Annual Meeting, PGNS 2nd International Symposium on Aerospace Nuclear Prop. and Power

Oct. 1-3, 1963: 8th Annual National Space Electronics Symposium, Hotel Fontainebleau, Miami Beach, Fla.; contact Hugh E. Webber, Martin Co., Orlando, Fla.

Oct. 7-9, 1963: 9th National Communications Symposium, Hotel Utica, Utica, N. Y.

Oct. 8-11, 1963: Int'l on Electromagnetic Relays, Tohoku University, Sendai, Japan; contact C. F. Cameron, School of Eng., Oklahoma State University, Stillwater, Okla.

Oct. 14-15, 1963: Materials Handling Conference, Chamberlain Hotel, Newport News, Va.; contact R. C. Tench, C & O Rlwy Co., Rm. 803, C & O Bldg., Huntington 1, W. Va.

Oct. 14-16, 1963: Systems and Procedures Association, 16th International Systems Meeting, Hotel Schroeder, Milwaukee, Wis.; contact Systems & Procedures Association, 7890 Brookside Dr., Cleveland 38, Ohio

Oct. 17, 1963: 4th Annual Technical Symposium, University of Maryland, Baltimore, Md.; contact Hugh Nichols, Dunlap and Associates, Inc., 7220 Wisconsin Ave., Bethesda, Md.

Oct. 21-23, 1963: East Coast Conference on Aerospace & Navigational Electronics (ECCANE), Baltimore, Md.

Oct. 24-25, 1963: Symposium on Automatic Production in Electrical and Electronic Engineering, The Institution of Electrical Engineers, Savoy Place, London W. C. 2, England

Oct. 28-30, 1963: 19th Annual National Electronics Conference and Exhibition, McCormick Place, Chicago, Ill.; contact Prof. Hansford W. Farris, Electrical Engineering Dept., Univ. of Mich., Ann Arbor, Mich.

Oct. 28-Nov. 1, 1963: Business Equipment Manufacturers Assn. Exposition and Conference, New York Coliseum, New York, N. Y.; contact Richard L. Waddell, BEMA, 235 E. 42nd St., New York 17, N. Y.

Oct. 29-31, 1963: 10th Annual Mtg. PGNS 2nd Intn'l Symposium on Plasma Phenomena & Meas., El Cortez Hotel, San Diego, Calif.; contact H. A. Thomas, Gen. Atomics Div., Genl. Dynamics, San Diego, Calif.

Nov. 4-6, 1963: NEREM (Northeast Research and Eng. Meeting), Boston, Mass.; contact NEREM-IRE Boston Office, 313 Washington St., Newton, Mass.

Nov. 10-15, 1963: 9th Annual Conference on Magnetism and Magnetic Materials, Chalfonte-Haddon Hall, Atlantic City, N. J.; contact Mr. C. J. Kriessman, Physics, Materials and Processes Sec., Box 500, Blue Bell, Pa.

Nov. 12-14, 1963: Fall Joint Computer Conference, Las Vegas Convention Center, Las Vegas, Nev.; contact Mr. J. D. Madden, System Development Corp., Santa Monica, Calif.

Nov. 18-20, 1963: 1963 Radio Fall Meeting, Manger Hotel, Rochester, N. Y.; contact EIA Engineering Dept., Room 2260, 11 W. 42 St., New York 36, N. Y.

Nov. 18-20, 1963: 16th Annual Conference on Engineering in Medicine and Biology, Lord Baltimore Hotel, Baltimore, Md.; contact Richard Rimbach Associates, 933 Ridge Ave., Pittsburgh 12, Pa.

Nov. 19-21, 1963: Fifth International Automation Congress and Exposition, Sheraton Hotel, Philadelphia, Pa.; contact International Automation Congress & Exposition, Richard Rimbach Associates, Management, 933 Ridge Ave., Pittsburgh 12, Pa.

Dec. 5-6, 1963: 14th Nat'l Conference on Vehicular Communications, Dallas, Tex.; contact A. C. Simmons, Comm. Industries, Inc., 511 N. Akard, Dallas, Tex.

Feb. 3-7, 1964: ASTM International Conference on Materials, Sheraton Hotel, Philadelphia, Pa.; contact H. H. Hamilton, American Society for Testing and Materials, 1916 Race St., Philadelphia 3, Pa.

Feb. 5-7, 1964: 5th Winter Conv. on Military Electronics (MILECON), Ambassador Hotel, Los Angeles, Calif.; contact IEEE L. A. Office, 3600 Wilshire Blvd., Los Angeles, Calif.

Feb. 12-14, 1964: International Solid-States Circuits, Sheraton Hotel & Univ. of Pa.

Feb. 26-28, 1964: Scintillation and Semiconductor Counter Symposium, Washington, D. C.

Mar. 23-26, 1964: IRE International Convention, Coliseum and New York Hilton Hotel, New York, N. Y.; contact E. K. Gannett, IRE Hdqs., 1 E. 79 St., New York 21, N. Y.

Apr. 22-24, 1964: SWIRECO (SW IRE Conf. and Elec. Show), Dallas Memorial Auditorium, Dallas, Tex.

BOOKS AND OTHER PUBLICATIONS

Moses M. Berlin
Allston, Mass.

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning **Computers and Automation.**

Nadler, Morton / Topics in Engineering Logic / A Pergamon Press Book, The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. / 1962, printed, 231 pp, $9.50

This important book is based on lectures given at the Indian Statistical Institute, Calcutta, in the Spring of 1959, which summarized the results of four years' work at the Institute of Computing Machinery in Prague. At Prague, the author came into contact with A. Svoboda's methods for the design of synchronous relay logical systems. Under this stimulus, the author attempted to find electronic systems with such properties that these methods could be applied with little change to the design of high-speed logical systems. The result is this attempt at a theory of synchronous electronic logical systems in which close attention is paid to the actual circuits employed. Seven chapters include: "Physical Considerations: Elementary Logical Circuits for Synchronous Systems," "The Minimal Form," "Codes and Matrices," and "Structural Redundance." Chapter seven, "Examples," illustrates the application of various topics of the first six chapters in actual design problems. List of references and an index are included.

Gibson, John E. / Nonlinear Automatic Control / McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. / 1963, printed, 585 pp, $16.50

The author of this work believes that a general method of synthesis for nonlinear problems is impossible. However, he believes one can develop a series of analyses that apply to restricted classes of nonlinearities and extend the usefulness of known techniques to a wider range of systems. Such is the approach of this text, written at the level of the first-year graduate student. Chapter three, "Sampled-data Systems and the z Transform," consists of a discussion of a special integral transform called the z transform, and modified z-transform techniques. It serves as an introduction to the z-form method discussed in Chapter 4, "Numerical Methods." Chapter 8, "The Second Method of Liapunov" is one of the first attempts to bring the Liapunov approach to the attention of control engineers in an English-language text. In all, the text contains 11 chapters. Five appendices include: "Derivation of the Dual-input Describing Function," and "An Analytic Approach to the Inverse Describing Function." Index.

Burroughs Corp., Staff of the Technical Training Dept., Radnor, Penna. / Digital Computer Principles / McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. / 1962, printed, 507 pp, $10.50

A nonmathematical explanation of digital computers, their operations and the components that make them work, is here presented. The main objective of this book is to evaluate the underlying concepts of computer logic and circuitry. It has been written primarily for the computer engineer, programmer, and technician. The book is divided into three sections as follows: "Computers and Transistors" (Chap. 1-7), "Computer Circuits" (Chap. 8-15), and "Computer Units (Chap. 16-24). Among the topics covered in section I are: basic concepts of computer logic, symbolic notation, and number systems. Section II provides an analysis of basic computer circuits. Each circuit is first analyzed with the vacuum tube as the active element and then the transistorized version of the circuit is analyzed. Section III shows how the logical elements described in the two previous sections are connected to perform major computer operations. Three appendices and index.

Vancil, Richard F. / Leasing of Industrial Equipment / McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 36, N. Y. / 1963, printed, 283 pp, $12.50

This book presents a specific thorough examination of the economics of equipment leasing. It is written first, for the executive responsible for making leasing decisions. The first three chapters and the last chapter give a thorough understanding of the subject without the analytical procedure to be used. The book is also addressed to the analyst who must prepare the comparative evaluation of leasing plans. Chapters four, five, and six give a detailed explanation of the analytical procedure to be used. Seven chapters include: "The Role of Leasing in Capital Budgeting," "Functions Performed by Leasing Companies," "Financial Leases: The Lease-or-Borrow Decision," and "Economic Life and Residual Value." Contains an appendix, "Internal (Divisional) Accounting for Financial Leases," and a bibliography. Also includes "Tables for the Analysis of Financial Alternatives and Capital Expenditures," pp 195-279—basically, interest tables with some new tabulated functions. Index.

H. S. Gellman, editor, and 32 authors / Proceedings of the Computing and Data Processing Society of Canada / Univ. of Toronto Press, Toronto 5, Ontario, Canada / 1963, photooffset, 293 pp, $6.00

This work contains the papers presented at the Third National Conference of the Computing and Data Processing Society of Canada, held at McGill University in Montreal, June 11-12, 1962. The theme of the conference was "The Computer as an Aid to Management." Thirty papers are included in this work, among which are: "Decision-Making Using a Computer: A Transportation Company," "Central Control of One Million Parts Locations," "Heat Exchanger Design," and "Computer Evolution to Aid Compilers."

NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent
Ford Inst. Co., Div. of Sperry Rand Corp., Long Island City 1, New York

The following is a compilation of patents pertaining to computer 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 25, D. C., at a cost of 25 cents each.

April 2, 1963

3,083,903 / Russell H. Larson, Wappingers Falls, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Data Translating System.

3,083,910 / George M. Berkin / Poughkeepsie, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Serial Adder and Subtracter.

3,084,286 / Robert E. Leo, Sunnyslope, Ariz. / General Electric Co., a corp. of New York / Binary Counter.

3,084,333 / William J. Greene, Scotch Plains, N. J. / Air Reduction Co., Inc., New York, N. Y., a corp. of N. Y. / Method and Apparatus for Transmitting Intelligence.

3,084,334 / Louis H. Martin, Concord, and Edward J. Lucas, Cochituate, Mass. / Avco Corp., Cincinnati, Ohio, a corp. of Delaware / Direct Access Photomemory for Storage and Retrieval of Information.

3,084,336 / Donald G. Clemons, Newark, N. J. / Bell Telephone Labs., Inc., New York, N. Y., a corp. of N. Y. / Magnetic Memory Construction and Circuits.

April 9, 1963

3,084,854 / Henry F. Schunk, Wakefield, and Joseph M. Welty, Natick, Mass. / Automatic Records, Inc., Natick, Mass., a corp. of Mass. / Data Processing System.

3,084,859 / Otto J. M. Smith, Contra Costa County, Calif. (612 Euclid Ave., Berkeley, Calif.) / ——— / Number Storage Apparatus and Method.

3,084,860 / Ben B. Jordan, Watchung, N. J. / Western Electric Co., Inc., New York, N. Y., a corp. of N. Y. / Decimal to Binary Number Translating Device.

3,084,861 / Allen W. Roberts, South Plainfield, N. J. / Bell Telephone Labs., Inc., a corp. of New York / Logic Circuitry.

April 16, 1963

3,086,118 / Frederick Arthur Summerlin, Isleworth, England / The Sperry Gyroscope Co., Ltd., Brentford, Middlesex, England, a company of Great Britain / Integrating Devices.

3,086,197 / John L. Anderson, Poughkeepsie, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Cyrogenic Memory System.

April 23, 1963

3,086,706 / Theodor E. Einsele, Sindelfingen, Germany / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Data Processing Machine.

3,086,708 / Howard Berkowitz, Cook County, Ill., and Bernard W. Moss, Baltimore County, Md. / The Martin-Marietta Corp., Baltimore, Md., a corp. of Maryland / Method and Apparatus for Automatic Digital Process Control.

3,087,074 / William N. Carroll, Rhinebeck, Roderick A. Coopper, Hyde Park, and Richard C. Counihan, Kingston, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Transistorized Logic Circuit Operative in the Pulse Mode.

3,087,076 / Carl O. Pingry, III, Lexington, Ky. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Logic and/or Gate Having Magnetically Induced Pulses as One Input.

3,087,142 / Robert D. Buck, Saugerties, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Binary Data Transfer Apparatus.

3,087,149 / Jack W. Malcolm, Gettysburg, Pa. / The National Cash Register Co., Dayton, Ohio, a corp. of Maryland / Decimal to Binary Conversion and Storage System.

April 30, 1963

3,088,056 / Ronald Tevonian, Flemington, N. J. / Western Electric Co., Inc., New York, N. Y., a corp. of N. Y. / Logic and Memory Circuit Units.

3,088,099 / Wilbur E. Du Vall, Gardena, Calif. / The W. W. Henry Co., Huntington Park, Calif., a corp. of Calif. / Data Communication System.

3,088,100 / Joseph W. Crownover, La Jolla, Calif. / Litton Systems, Inc., Beverly Hills, Calif., a corp. of Maryland / Diodeless Magnetic Shift Register.

3,088,103 / Leon Gryk, New Britain, Conn. / Royal McBee Corp., Port Chester, N. Y., a corp. of New York / Matrix Encoders.

May 7, 1963

3,088,688 / Abraham Harel, Framingham, Mass. / Radio Corp. of America, a corp. of Delaware / Binary Adder Employing Minority Logic.

3,088,671 / Robert L. Chase, Blue Point, N. Y. / U.S.A. as representated by the U.S. Atomic Energy Commission / Multiplier Circuit.

3,089,124 / Glenn E. Hagen, Manhattan Beach, Charles R. Williams, Palo Verdes, Arthur Y. Baker, Hermosa Beach, and Robert E. Jackson, Redondo Beach, Calif. / Alwac International Inc., a corp. of Panama / Computer System with High Capacity Random Access Memory.

3,089,126 / James C. Miller, Hamilton Square, N. J. / Radio Corp. of America, a corp. of Delaware / Negative Resistance Diode Memory.

3,089,127 / Leon J. Mintz, Brooklyn, N. Y., and Roland Yii, West Chester, Pa. / Burroughs Corp., Detroit, Mich., a corp. of Mich. / Magnetic Shift Register.

3,089,128 / Charles B. Smith, Vestal, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Magnetic Core Switching Circuit.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

Addressograph-Multigraph Corp., 1200 Babbitt Rd., Cleveland 17, Ohio / Page 4 / The Griswold-Eshleman Co.

American Telephone & Telegraph Co., 195 Broadway, New York 7, N. Y. / Page 2 / N. W. Ayer & Son, Inc.

Bellcomm, Inc., 1100 17th St., N. W., Washington 6, D. C. / Page 51 / N. W. Ayer & Son, Inc.

Control Data Corp., 8100 34th Ave., So., Minneapolis 20, Minn. / Pages 24, 25 / Erwin Wasey, Ruthrauff & Ryan, Inc.

Data Processing Equipment Exchange Co., 366 Francis Bldg., Louisville 2, Ky. / Page 50 / —

International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / Page 31/ Benton & Bowles, Inc.

International Business Machines Corp., Data Systems Div., Box 390, Poughkeepsie, N. Y. /Page 21 / Benton & Bowles, Inc.

Litton Industries, Guidance & Control Systems Div., 5500 Canoga Ave., Woodland Hills, Calif. / Page 49 / Ellington & Co.

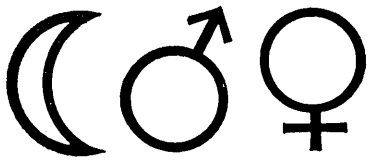
National Cash Register Co., Main & K Sts., Dayton 9, Ohio / Page 19 / McCann-Erickson, Inc.

Photocircuits Corporation, Glen Cove, N. Y. / Page 6 / Duncan-Brooks, Inc.

PrestoSeal Manufacturing Corp., 37-27 33rd St., Long Island City, N. Y. / Page 15 / —

Technical Operations, Inc., 3600 M St., N. W., Washington, D. C. / Page 30 / Edwin F. Hall

Valley Consultants, Inc., 716 York Rd., Towson 4, Md. / Page 30 / George C. Ruehl, Jr.



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BELL SYSTEM D-44

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who's who in the computer field - '63/'64

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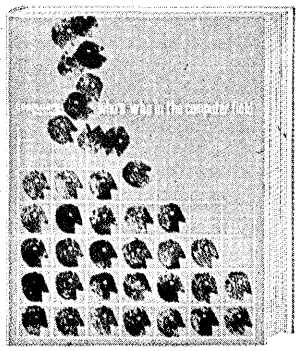

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