November, 1968

computers and automation

Special Feature: Graphic Data Processing

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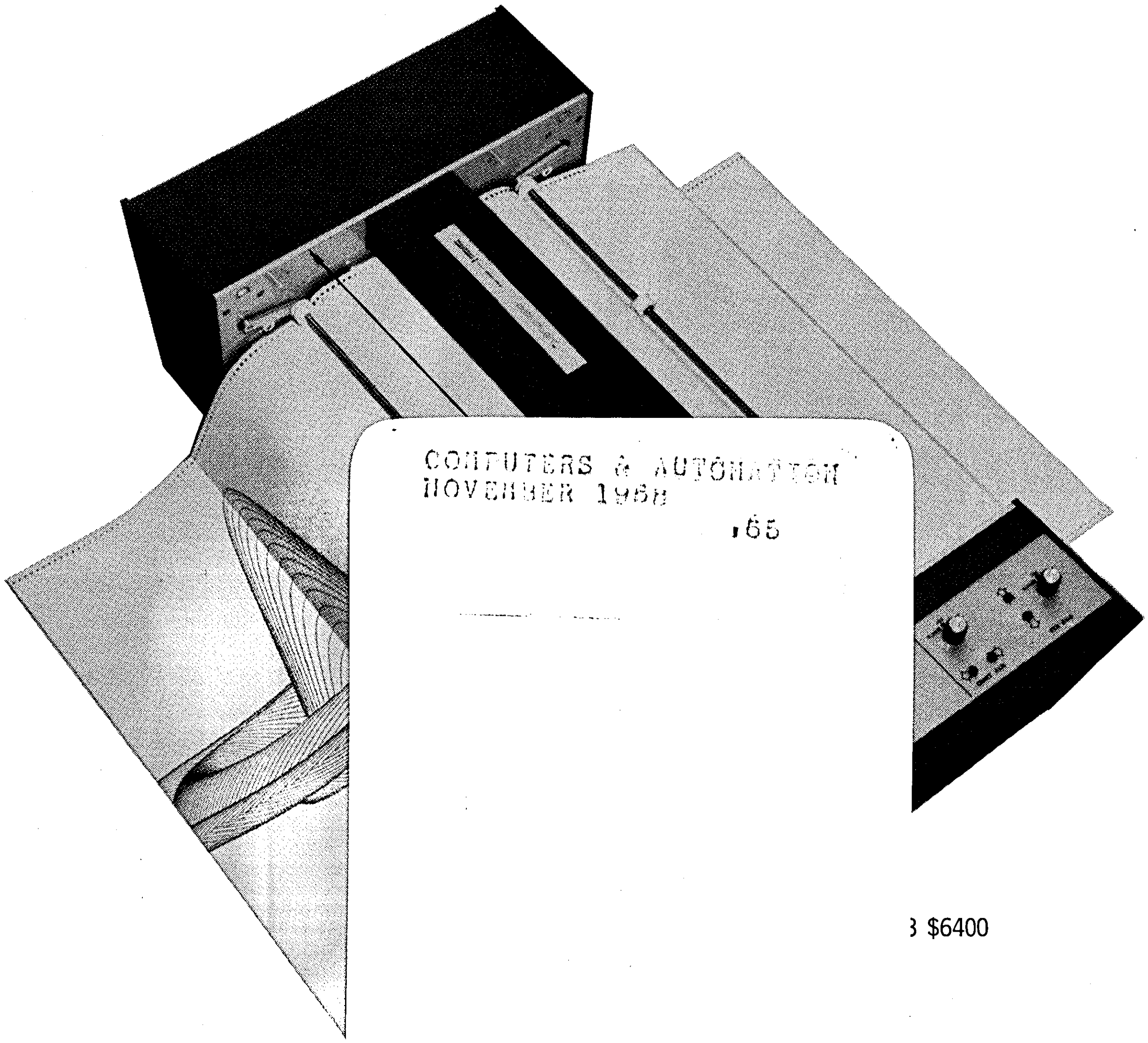

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Letters To The Editor

Automating Better Education

I seek to answer Charles Hutchinson, who wrote in your August 1968 issue, and all other mathematics educators: There *is* an organization devoted to automation, computers, data processing, and the mathematics educator. This is the Society for Automation in Science and Mathematics, a Federated Society of the Society for Automating Better Education.

There are also Federated Societies for Automation in other areas, such as Fine Arts, Business Education, English and the Humanities, Professional Education, and the Social Sciences.

The first Federated Society, the Society for Automation in Business Education (SABE), was formed in 1960 and now has some 750 members.

Dues of $5 a year include membership in the covering group and in one Federated Society, and a subscription to the organization's monthly *Journal of Data Education.* For more information, write: SABE, 247 Edythe St., Livermore, Calif. 94550.

ENOCH HAGA, *President*
SABE
Livermore, Calif.

Computer Art Reprints

I would like to know if it is possible to obtain a copy, suitable for framing, of any of the computer art entries shown in your August 1968 issue. If copies are available, I would appreciate receiving the necessary information for placing an order.

H. G. MARTIN
3M Company
St. Paul, Minn. 55101

(Ed. Note — *We are undertaking the reproduction and sale of some of the art which was published in our August issue. An announcement of which pictures will be reproduced and how much they will cost will be made in* Computers and Automation *as soon as the reproductions are available.*)

Proof Goofs

Your new feature, "Proof Goofs", which appeared in your September issue was most interesting to me.

In addition to the errors you pointed out, I believe "shipmates" in the second line of the third paragraph is an error. However, this could be considered an editorial error since it is a misuse of the word. According to Webster's New Collegiate Dictionary, shipmate is "one who serves on the same ship with another". Thus, the men aboard the *Docker* gave three hoarse cheers to themselves! The sentence should have been edited to: "The men aboard the *Docker* gave three hoarse cheers to the crews of the other ships, but the noise of the breakers drowned them out."

Now that you have started this feature, please keep it up. I'm sure you'll find an abundance of material.

WILLIAM A. BARDEN, *Director*
Defense Supply Agency
Alexandria, Va. 22314

Here are my corrections for the "Proof Goofs" in the September issue. The obvious ones are "reunited" and "terrestrial". Less obvious, and all too commonly overlooked: *Docker*'s, not *Docker's*. The apostrophe and "s" should be in roman, not italic, because they are not part of the boat's name.

GEORGE W. PRICE
Institute of Gas Technology
Chicago, Ill. 60616

Excellent Magazine

I understand you had an excellent article, "The Ford Computer Graphics Project", in your Nov. 1967 issue.

May I say, as a new subscriber, that I think you have an excellent magazine — one with more substantive material than any of the others that I see.

ARTHUR N. CONNER, JR.
President
Micromation Systems Inc.
Hyattsville, Md. 20781

(Ed. Note — *Tear sheets of Nov. article sent.*)

computers and automation

Vol. 17, No. 11 — November, 1968

Editorial Offices
BERKELEY ENTERPRISES, INC.
815 WASHINGTON STREET,
NEWTONVILLE, MASS. 02160

CIRCULATION AUDITED BY
AUDIT BUREAU OF CIRCULATIONS

COMPUTERS AND AUTOMATION IS PUBLISHED MONTHLY AT 815 WASHINGTON ST., NEWTONVILLE, MASS. 02160, BY BERKELEY ENTERPRISES, INC. PRINTED IN U.S.A. SUBSCRIPTION RATES: UNITED STATES, $15.00 FOR 1 YEAR, $29.00 FOR 2 YEARS, INCLUDING THE JUNE DIRECTORY ISSUE; CANADA, ADD 50¢ A YEAR FOR POSTAGE; FOREIGN, ADD $3.50 A YEAR FOR POSTAGE. ADDRESS ALL EDITORIAL AND SUBSCRIPTION MAIL TO BERKELEY ENTERPRISES, INC., 815 WASHINGTON ST., NEWTONVILLE, MASS., 02160. SECOND CLASS POSTAGE PAID AT BOSTON, MASS.

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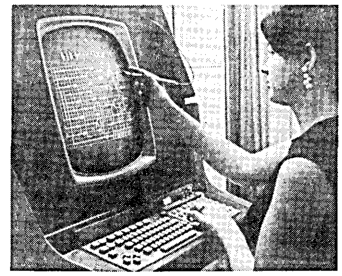
computers and automation

November, 1968, Vol. 17, No. 11 *The magazine of the design, applications, and implications of information processing systems.*

Special Feature:

Graphic Data Processing

Regular Features



The front cover shows a Univac graphic display which uses digital deflection. The digital deflection technique differs from the usual analog deflection technique in that: it is electromagnetic instead of electrostatic; it eliminates converting digital inputs into analog inputs; and it provides a more stable and accurate image. For more information, see page 55.

Departments

c.a

EDITORIAL

Operation Bootstrap In The Computer Field

In my mail on October 3 arrived the following notice, printed on the first page of the October issue of DATALINK, the monthly newsletter of the Los Angeles Chapter of the Association for Computing Machinery:

Program: The Ghetto and the Computer Professional

Speakers: Sam Feingold, System Development Corp.; Bob Hall, Operation Bootstrap

This month's program features a hard-hitting commentary on today's most relevant and pressing problem. Operation Bootstrap is a non-profit organization whose goals are to educate from within members of the Black Community. With the motto of "Learn, Baby, Learn", Bootstrap has set up cultural and educational activities which are meeting these goals. Mr. Feingold has been teaching computer programming at Operation Bootstrap. He will discuss the complexities of this work and the successes and failures which have been encountered so far. Bob Hall is a co-founder of Operation Bootstrap; he will represent them in the discussion. A feature in the program will be a movie about Bootstrap which tells it like it is in the ghetto, in stark details guaranteed to make you know it as it is.

This is one of the most controversial and timely topics facing today's professional groups.

Is it illusory and unfair to trainees to let them expect to work in professional areas without holding the engraved invitation of a college degree?

Do professional organizations have an obligation to solve social problems which fall outside of their narrow fields of special interest?

Or is a serious disservice being done to members of professional societies by developing technicians without full educational credentials?

A serious and complete discussion of these and other complex problems facing our society and its professionals is expected. Plan now to attend. Can you afford not to?

Place . . . .

Date: Wednesday, October 2, 1968. Time: . . .

I was a bit tempted to catch the next plane and go. But I did not have the capacity to imitate Miss Bright of Einsteinian fame:

There was a young lady named Bright
Whose speed was far faster than light;
She set out one day in a relative way
And arrived the preceding night.

Pleasantries aside, we think the Program Committee of the Los Angeles Chapter deserves much credit for arranging such a meeting, and for calling for discussion of this important area of the social responsibilities of computer people.

Our answers to the questions set by the Program Committee are:

- No, it is not illusory and unfair to trainees to let them expect to work in professional areas without a college degree — but the teacher of training must emphasize that more than just knowledge is needed: also, perseverance, responsibility, capacity to learn more, etc.
- Yes, all professional organizations have an obligation to bring their special professional capacities to bear on solving important social problems — especially (1) those which touch on their special capacities, or can use their general training as professionals, and (2) those where the problems are urgent.
- No, it is not a serious disservice to professional societies to develop technicians without full educational credentials, unless deception is practiced. Some technical credentials are better than none. And more technical credentials are better than a few.

The problem of helping untrained people from the ghettoes and similar people from underdeveloped countries is not easily solved.

It cannot be solved by doing nothing about it, simply letting time take its course.

Nor can it be solved by the attitude "That is none of my business. Let George do it."

Nor can it be solved by tolerating enormous diversion of government funds from productive activities to non-productive activities. The United States government is spending millions of dollars per day in bombing, napalming, and defoliating areas in South East Asia, trying to shore up a corrupt puppet government supported by far less than half of the people in the area it is supposed to govern. The government of the U.S.S.R. is spending millions of dollars per day in maintaining 600,000 occupation troops in Czechoslovakia, trying to prevent changes in a government, changes which are thirsted for by millions of the people in Czechoslovakia.

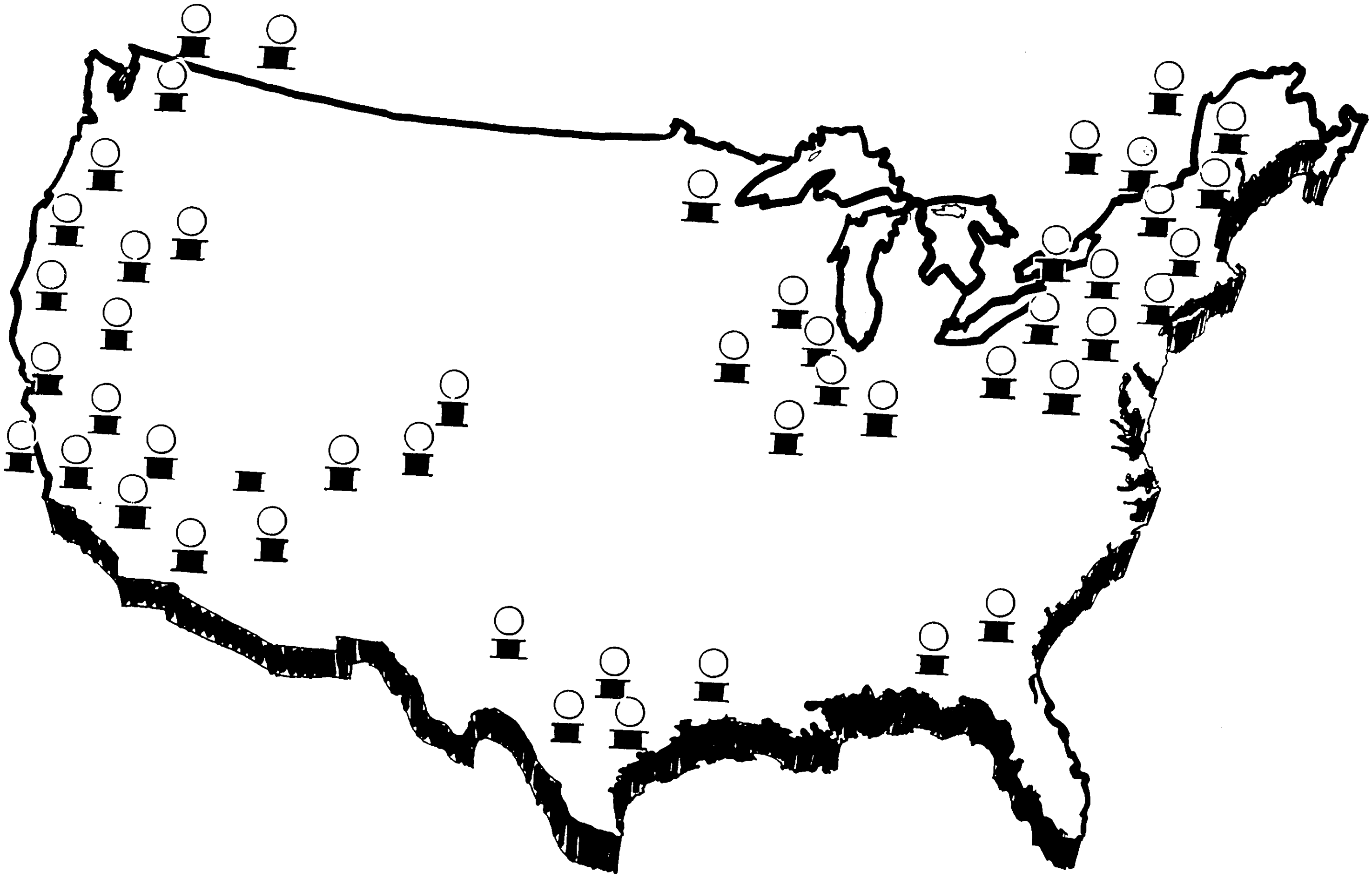
These enormous funds should be diverted from these unfortunate objectives and instead devoted to the benefit of people, ordinary people, common people, people here and there all over the world who need food, shelter, clothing — and training and education to equip themselves to work with more advanced industrial techniques. These funds should support an Operation Bootstrap all over the world.

Computers and Automation desires to publish from time to time discussion and argument about:

1. How can professionals in the computer field make sure that partially qualified persons from ghettoes receive opportunities to become more fully qualified in the computer field?
2. How can the ten-mile gap be bridged, between the suburbs where the computer professionals are, and the urban ghettoes where people of minority groups can become trained and useful?
3. How is an employer to establish fair and equitable rules to apply to both people from ghetto areas whom he wants to help, and his regular employees?
4. How can computer professionals usefully contribute their knowledge and experience for instruction and education of members of underprivileged groups?

Edmund C. Berkeley

Editor



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CALENDAR OF COMING EVENTS

Nov. 7-8, 1968: The Association for Precision Graphics (formerly The Precision Plotter Users Association), Second National Conference, The Univ. of Southern Calif., Los Angeles, Calif.; contact William G. Reimann, Nat'l Chmn., Assoc. for Precision Graphics, c/o Litton Systems, Inc., 5500 Canoga Ave., Woodland Hills, Calif. 91364

Nov. 10-13, 1968: Digitronics Users Association, Bourbon Orleans Hotel, New Orleans, La.; contact Digitronics Users Association, P.O. Box 113, Albertson, N.Y. 11507

Nov. 25-26, 1968: Society for Information Display (SID), 1968 National Technical Conference, Waldorf Astoria Hotel, New York, N.Y.; contact Richard Du Bois, Wagner Electric Corp., Tung-Sol Div., 200 Bloomfield Ave., Bloomfield, N.J. 07003

Dec. 2-4, 1968: Second Conference on Applications of Simulation (SHARE/ACM/IEEE/SCI), Hotel Roosevelt, New York, N.Y.; contact Julian Reitman, Norden-United Aircraft Corp., Norwalk, Conn. 06856

Dec. 9-11, 1968: Fall Joint Computer Conference, Civic Auditorium (Program sessions), Brookshall (industrial and education exhibits), San Francisco Civic Center, San Francisco, Calif.; contact Dr. William H. Davidow, General Chairman, 395 Page Mill Rd., Palo Alto, Calif. 94306

Dec. 12-13, 1968: Digital Equipment Computer Users Society (DECUS) 1968 Fall Symposium, Jack Tar Hotel, San Francisco, Calif.; contact Angela J. Cossette, Digital Equipment Computer Users Society, Main St., Maynard, Mass. 01754

Dec. 16-18, 1968: Adaptive Processes Symposium, Univ. of California at L.A., Los Angeles, Calif.; contact J. M. Mendel, Douglas Aircraft Co. Inc., 3000 Ocean Pk. Blvd., Santa Monica, Calif.

Jan. 15-17, 1969: Second Annual Simulation Symposium, Tampa, Fla.; contact Annual Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601

Jan. 28-31, 1969: International Symposium on Information Theory, Nevele Country Club, Ellenville, N.Y.; contact David Slepian, Dept. of Transportation, Washington, D.C.

Jan. 30-31, 1969: Third Annual Computer Science and Statistics Symposium of the Los Angeles Chapter of the Association for Computing Machinery (ACM), International Hotel, Los Angeles, Calif.; contact Business Admn. Extension Seminars, Room 2381, GBA, Univ. of Calif., Los Angeles, Calif. 90024.

March 24-26, 1969: 10th VIM meeting, (users group of Control Data 6000 computer series), Florida State University Union, Tallahassee, Fla.; contact Carol J. Richardson, Control Data Corp., 8100 34th Ave. So., Minneapolis, Minn. 55440

March 24-27, 1969: IEEE International Convention & Exhibition, Coliseum and N.Y. Hilton Hotel, New York, N.Y.; contact IEEE Headquarters, 345 East 47th St., New York, N.Y. 10017

March 26-29, 1969: 16th International Meeting of The Institute of Management Sciences, Hotel Commodore, New York, N.Y.; contact Granville R. Garguilo, Arthur Anderson & Co., 80 Pine St., New York, N.Y. 10005

April 1-3, 1969: Numerical Control Society's Sixth Annual Meeting & Technical Conference, Stouffer's Cincinnati Inn, Cincinnati, Ohio; contact Peter Senkiw, Advanced Computer Systems, Inc., 2185 South Dixie Ave., Dayton, Ohio 45409

April 15-18, 1969: The Institution of Electrical Engineers and the Institution of Electronic and Radio Engineers Computer Aided Design Conference, Southampton University, So 9, 5 NH., Hampshire, England; contact Conference Dept., IEE, Savoy Place, London, W.C.2

April 23-25, 1969: 21st Annual Southwestern IEEE Conference and Exhibition, San Antonio Convention and Exhibition Center, San Antonio, Texas; contact William E. Cory, Southwest Research Institute, Box 2296, San Antonio, Texas 78206

May 14-16, 1969: Spring Joint Computer Conference, War Memorial Auditorium, Boston, Mass.; contact American Federation for Information Processing (AFIPS), 345 E. 47th St., New York, N.Y. 10017

May 18-21, 1969: Power Industry Computer Application Conference, Brown Palace Hotel, Denver, Colorado; contact W. D. Trudgen, General Electric Co., 2255 W. Desert Cove Rd., P.O. Box 2918, Phoenix, Ariz. 85002

June 9-11, 1969: IEEE International Communications Conference, University of Colorado, Boulder, Colo.; Dr. Martin Nesenbergs, Environmental Science Services Administration, Institute for Telecommunication Sciences, R614, Boulder, Colo. 80302

June 16-19, 1969: Data Processing Management Association (DPMA) 1969 Internat'l Data Processing Conference and Business Exposition, Montreal, Quebec, Canada; contact Mrs. Margaret Rafferty, DPMA, 505 Busse Hwy., Park Ridge, Ill. 60068

June 16-21, 1969: Fourth Congress of the International Federation of Automatic Control (IFAC), Warsaw, Poland; contact Organizing Comm. of the 4th IFAC Congress, P.O. Box 903, Czackiego 3/5, Warsaw 1, Poland.

June 17-19, 1969: IEEE Computer Group Conference, Leamington Hotel, Minneapolis, Minn.; contact Scott Foster, The Sheffield Group, Inc., 1104 Currie Ave., Minneapolis, Minn. 55403

June 21-28, 1969: Second Conference on Management Science for Transportation, Transportation Center at Northwestern University, 1818 Hinman Ave., Evanston, Ill. 60204; contact Page Townsley, Asst. Dir., Management Programs, 1818 Hinman Ave., Evanston, Ill.

Aug. 6-8, 1969: Joint Automatic Control Conference, Univ. of Colorado, Boulder, Colorado; contact unknown at this time.

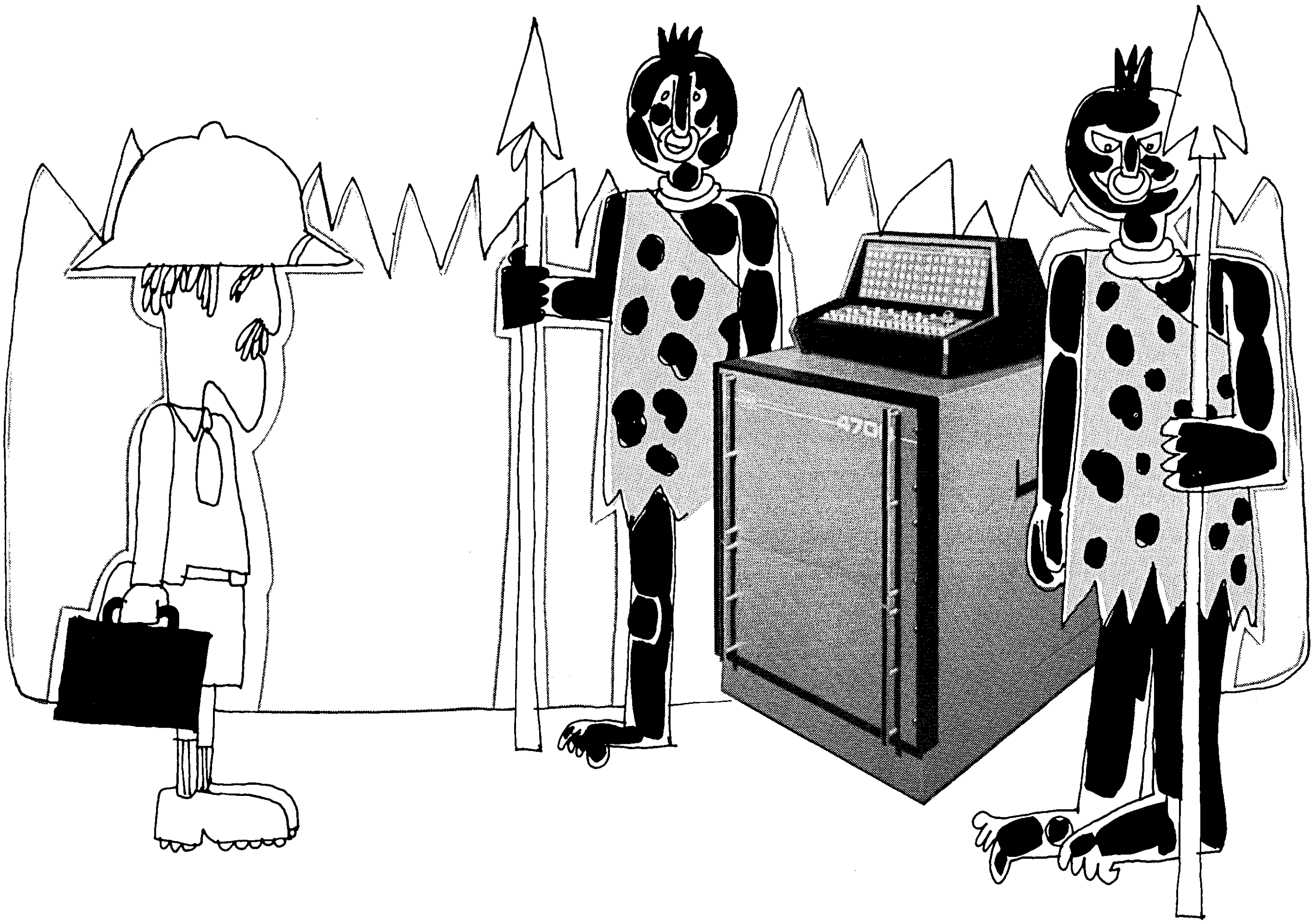
Aug. 11-15, 1969: Australian Computer Society, Fourth Australian Computer Conference, Adelaide Univ., Adelaide, South Australia; contact Dr. G. W. Hill, Prog. Comm. Chrmn., A.C.C.69, C/-C.S.I.R.O., Computing Science Bldg., Univ. of Adelaide, Adelaide, S. Australia 5000.

Aug. 25-29, 1969: Datafair 69 Symposium, Manchester, England; contact the British Computer Society, 23 Dorset Sq., London, N.W. 1, England

Oct. 6-10, 1969: Second International Congress on Project Planning by Network Analysis, INTERNET 1969, International Congress Centre RAI, Amsterdam, the Netherlands; contact Local Secretariat, c/o Holland Organizing Centre, 16 Lange Voorhout, The Hague, the Netherlands

Oct. 27-31, 1969: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, New York Coliseum, Columbus Circle, New York, N.Y. 10023; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017

Nov. 18-20, 1969: Fall Joint Computer Conference, Convention Hall, Las Vegas, Nev.; contact American Federation for Information Processing (AFIPS), 345 E. 47th St., New York, N.Y. 10017 ■



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You can pay $30,000 for a 16-bit machine with a 790 nanosecond cycle time. The 4700 does it in 920 nanoseconds, but it only costs half the price.

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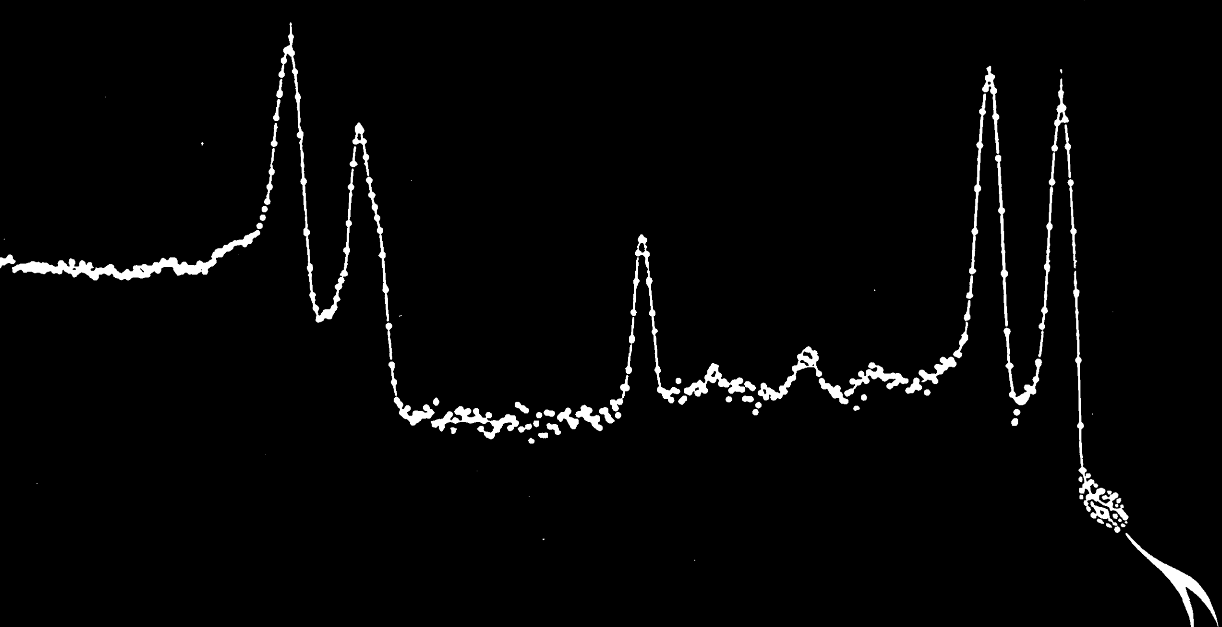

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MULTI-ACCESS FORUM

"COMMUNICATIONS DATA PROCESSING OR TIME SHARING" — COMMENT

Gordon R. Carlson, Technical Director
Computer-Research Div.
Booth Newspapers Inc.
200 E. 1st St.
Flint, Mich. 48502

The article "Communications Data Processing or Time Sharing" in the August 1968 issue of this magazine is another in a long list of "X" versus "Y" articles.

This type of article is ill-advised, in my opinion, for several reasons:

1. The reliability of a conclusion, based on a comparison of two or more items, is dependent upon the thoroughness and accuracy of the investigation. A discussion of complex topics, such as the above article covered, require a more thorough treatment of the items being compared than can be accomplished in a short article.
2. For too long a time, a major portion of the computing industry has regarded different aspects of computing (e.g.: business data processing; scientific computing; batch processing; multi-programming; time sharing; interactive dialog; on-line; off-line) as completely separate areas with little or no common relationships. This prevents cross-pollination of experiences and ideas. This type of article fosters and continues this situation, which is not in the best interest of the industry and user.

Rather than arguing "X" vs "Y", we should be discussing "What is X" and "What is Y" and how can these tools be applied to help improve our computing effectiveness. Until such time as users become knowledgeable enough to understand "X" and "Y", the tools they provide, and how to use these tools, we will continue to be faced with massive conversion efforts every several years with its corresponding waste of human effort when trying to increase our computing capability and effectiveness.

Hardware manufacturers are involved in software only to that extent which is necessary to sell their equipment. The quality and effectiveness of their product will be in direct relationship to the quality and effectiveness of our demands for use of their products and services.

Several points should be kept in mind in discussions such as this one, since these points often outweigh all other criteria in computing:

1. The name of the game is profitable and effective computing for organizations and increasing effectiveness of human beings.
2. The preliminary installation of computing equipment is usually based on a preliminary application which is only one aspect of the processing needs of an organization.
3. In order to maintain profitability and effectiveness, an organization must be dynamic and growing, and its computing needs reflect this. In order to properly handle an organization's computing needs, a system should be implemented on a basic framework which allows mixing of strategems and environments, with the ability to change the mix without a major conversion effort.

The problem that we face is learning how to make computing equipment and systems effectively respond to dynamic environments. To this end, we cannot afford to discount any techniques or ideas without proper investigation and experimentation. ■

THE MARKET FOR "CIVIL SYSTEMS" WILL EQUAL 10% OF THE GROSS NATIONAL PRODUCT IN 10 YEARS — A PREDICTION

Based on an interview with Dr. Simon Ramo, Vice-Chairman of TRW, Inc., reported in Electronic News September 16, 1968.

In recent years, problems such as ground and air traffic, transportation, pollution, and urban development have excited systems engineers in the aerospace industry, but the problems have not excited their profit-oriented management. In the past year, the situation has changed, and federal and state budgets are finding room to include development of "civil systems".

The change has come about primarily through public sentiment. Public understanding, even an "eagerness", has replaced apathy toward technology. People realize now that we have the power and the need to solve social problems. They have begun to ask, If we can land a man on the moon, why can't I get to the airport in less time than it takes to orbit the earth? If we can analyze a malfunctioning diode on the moon, why can't we monitor a heart with the same precision? If we can supply oxygen for astronauts on the moon, why can't we breathe the air here at home?

There is also a growing feeling that "technologists created the problems, so let them solve them."

In the past, America's priority list of technological developments has placed security (national defense) at the head of the list, with the space program number two, and civil systems running a poor third. But civil systems is moving into the number one spot, starting with the public, and spreading to their elected representatives. During the next decade, the civil systems market may well equal 10% of the gross national product, growing to an annual rate of $100 billion 10 years from now.

What about the hardware? The technology itself is now ready, but the systems engineer and the hardware developer must constantly work hand-in-hand. The systems problems can't be solved without knowing the hardware capability, but the hardware can't be specified without systems engineering first. They have to come along together.

The "old-fashioned" approach to marketing hardware, where you take a company product and try to specify it for new uses, is not valid in the civil systems field. The systems engineer has to know what hardware exists and then work it into a system which is economically feasible. But this does not mean that the large systems firms will, therefore, corner the market on hardware sales by specifying their own equipment. In the case of TRW's systems contract on a transportation system for the "Northeast Corridor", for example, the need is arising for a new type of lightweight passenger vehicle. When the specifications are completed, TRW might build it; but it is just as likely to be built by an aircraft or auto manufacturer.

The civil systems market will mean big business — the time has come when the aerospace industry can go out to play in the heavy traffic for profit rather than just for fun. ■

PROOF GOOFS AND PROOFREADING ERRORS — COMMENTS

I. From Enoch J. Haga

Foundation for Business Education
247 Edythe St.
Livermore, Calif. 94550

As a sometime writer and editor, and a former engineering writer, I found your September 1968 Editorial and other data on "Proof Goofs" to be fascinating. I personally believe that the last error will always be discovered in the first printed copies! Hence, a proper subject for discussion is the control of errors, not their elimination.

Just today I noticed in looking through a copy of the JOURNAL OF CHEMICAL EDUCATION, I believe the April 1968 issue, they have what appears to be a regular feature on "Textbook Errors." In this connection, it seems to me that more textbooks are being written, sans editing, than ever before. The same seems true in magazines and of course in newspapers.

In a sense, errors are responsible for computers. Charles Babbage, it should be recalled, was vitally concerned with the elimination of errors in printed tables. His Difference Engines and Analytical Engine were accordingly designed to produce printing plates directly from error-proof calculations. (See CHARLES BABBAGE AND HIS CALCULATING ENGINES, Dover Publications, Inc.; look in Index under "Errors".)

I want to take issue with the method of proofreading described in your Editorial. In practice, I have found it wanting in several respects. First, errors of punctuation are difficult to detect in this fashion. Second, it is almost impossible to get complete synchronization of the reader with the "follower." More could be said, but punctuation is far more vital than pronunciation. That is, errors detected by means of pronouncing the words seem less consequential than punctuation errors. Further, reader-follower proofreading tends to gloss over editing along with proofreading. Serious errors in structure or word sequence can be discovered by an alert proofreader. So, for many situations, I think that it is best for *one* person to read and compare. He sees all punctuation, he can match line for line in synchronization, and he can remain mentally alert so as to catch logical or structural errors in the content. Proofreading is not a low-level skill unless you are willing to settle for that! In fact, the "let's hurry up and read this" attitude probably promotes errors. Magazine editors, I think, should return proofs to authors for checking, in addition to running their own checks. Both magazine editors and book publishers should do more editing. Why correct errors in sloppy writing?

Proofreading errors can probably be detected on computers in a manner similar to that which Babbage proposed: Read in the manuscript directly to the computing equipment.

II. From the Editor

The amount of proofreading error which can be found is a function of many factors. One of these certainly is the alertness of the editor reading by himself and trying to catch errors which have slipped by the author and which are on a level such that no pair of ordinary proofreaders, one reading and one watching, could be expected to catch. Woe to the alertness of the editor, if he has eaten more of a lunch than he should and he feels sleepy at his desk later!

I think the exciting stimulus to a higher and higher level of alert solo proofreading is to know that errors will inevitably occur, and to be prepared to catch them when they do occur. The prepared mind makes important new discoveries in science — and the editor who is mentally fitting together the context of words as they are used becomes eventually prepared to find remarkable errors, such as the one shown in the Proof Goof in Walter de la Mare's poem which we publish in this issue. ■

WHAT IS A "SYSTEMS ANALYST"?

Carroll A. Hazen
Senior Systems Analyst
Pottawattamie County Board of Education
Council Bluffs, Iowa 51501

Sidney Davis' article ("A Flexible Concept for Recruiting Data Processing Personnel for the 1970's," page 22 in the September 1968 issue) and the philosophy it presented to American industry was very well done, up to the point of the subheading "Finding Systems Analysts." Here he becomes a victim of the gross popular misconception that a Systems Analyst is the captive talent and foster-son of the data processing profession!

Since this thinking has become so popular, I feel very strongly that the air should be cleared on this matter.

There are two distinct varieties of "Systems Men":

(1) The Systems Specialist — whose efforts encompass a specialized field, i.e., Programmer-Analyst, Forms Design, Work Measurements, Task-Analyst, Production-Analyst, and 37 other specialists; and

(2) The Systems Analyst — who by virtue of this title is a generalist and will have extensive experience in at least 4 "specialist areas" with more than just a nodding acquaintance with the other 38.

This means that those who honestly wear the title of "Systems [accent on the plural] Analyst" have considerable maturation both in business and years.

The statement

> . . . if they come from unrelated industries, (they) require a substantial amount of time to gain an understanding of your business

I would also take issue with. This is true in the case of the Systems Specialist, but as for the Systems Generalist, a most emphatic NO!

Environmental assimilation and perception are mandatory for the Systems Generalist. ■

IEEE TECHNICAL COMMITTEE ON COMPUTER PERIPHERAL EQUIPMENT SEEKS VOLUNTEERS

Edwin I. Blumenthal, Chairman
Peripherals Equipment Comm., IEEE Computer Group
Burroughs Corp.
Paoli, Pa. 19301

The Technical Committee on Peripheral Equipment recently formed by the IEEE Computer Group invites volunteers of professional stature to join in its work.

The scope of the committee's work includes the design of both peripheral devices and peripheral subsystems. The subcommittee on Device Design is primarily concerned with the design of input/output devices, and in general with the design of devices peripheral to data processing systems including mass storage, displays, and special purpose devices.

The subcommittee on Subsystem Design is concerned with: the design of peripheral subsystems; the buffering and control of peripheral equipment; and the trade-offs between hard-wired logic and small programmable computers for buffering and controlling combinations of input/output devices.

Interested volunteers should contact me at the above address, indicating their specific experience and on which subcommittee they are best qualified to serve. ■

WHO'S WHO IN THE COMPUTER FIELD, 1968-69 — ENTRIES

Who's Who in the Computer Field 1968-1969 (the Fifth Edition of our Who's Who), will be published by Computers and Automation during 1969. The Fourth Edition, 253 pages, with about 5000 capsule biographies was published in 1963. The Third Edition, 199 pages, was published in 1957.

In the Fifth Edition we hope to include upwards of 10,000 capsule biographies including as many persons as possible who have distinguished themselves in the field of computers and data processing.

If you wish to be considered for inclusion in the Who's Who, please complete the following form or provide us with the equivalent information. (If you have already sent us a form some time during the past eight months, it is not necessary to send us another one unless there is a change in information.)

WHO'S WHO ENTRY FORM
(may be copied on any piece of paper)

1. Name? (Please print)__________
2. Home Address (with Zip)?__________
3. Organization?__________
4. Its Address (with Zip)?__________
5. Your Title?__________
6. Your Main Interests?

Applications	( )	Mathematics	( )
Business	( )	Programming	( )
Construction	( )	Sales	( )
Design	( )	Systems	( )
Logic	( )	Other	( )
Management	( )	(Please specify)	

7. Year of Birth?__________
8. Education and Degrees?__________
9. Year Entered Computer Field?__________
10. Occupation?__________
11. Publications, Honors, Memberships, and other Distinctions?__________

(attach paper if needed)

12. Do you have access to a computer? ( )Yes ( )No
    a. If yes, what kind of computer?
       Manufacturer__________
       Model__________
    b. Where is it installed:
       Manufacturer?__________
       Address?__________
    c. Is your access: Batch? ( ) Time-shared? ( )
       Other? ( ) Please explain:__________
    d. Any remarks?__________
13. Associates or friends who should be sent Who's Who entry forms?

Name and Address

(attach paper if needed)

When completed, please send to:

Who's Who Editor, Computers and Automation,
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INTERACTIVE COMPUTER GRAPHICS

Henry J. Genthner
Control Data Corp.
8100 34th Ave. So.
Minneapolis, Minn. 55440

"Interactive computer graphics is no longer 'what's coming'. ICG is now playing an important part in efficient and economical design by allowing users to cut design costs, speed development work, and increase the profitability of products."

Interactive computer graphics (ICG) is one of the fastest growing areas in electronic and mechanical design.

The value of interactive computer graphics is revealed in its name. It enables the user to establish two-way, real-time communication with a computer in graphic language — and to make use of the machine's problem-solving capability at the same time.

Hierarchy of Languages

In order to understand the value of interactive computer graphics, we should consider a few basic principles of communications.

Languages convey thoughts. The most primitive language conveys a small portion of the total thought in a language unit.

Binary language is perhaps the most primitive language. The language unit is a "bit", and it takes many "bits" to convey a complex thought. Fortran and Cobol are higher level languages.

A picture or chart is a unit of graphic language. The cliche "one picture is worth a thousand words" describes the power of a unit of graphic language to express thoughts. To illustrate: often alphanumeric printouts of computer runs are plotted on graph paper to obtain the full meaning of the data. Until the alphanumeric data is plotted, various characteristics expressed by the data (e.g., noise, trends, extremes, etc.) are difficult to envision.

Plotters can provide one-way graphic communications with a computer by directly converting computer output to curve plots, diagrams, etc. Machines are also available which will convert graphic computer input directly to punch cards.

Henry J. Genthner is the director of product management for the Digigraphics Division of Control Data Corp. He holds a B.S. degree in Aeronautics from St. Louis University, and has over ten years' experience in the planning and integration of electronic data processing systems.

Using these mechanisms, engineers, project managers, and scientists, can communicate with a computer in their own language: charts, graphs, and diagrams. The process, however, is loaded with time lags. The user must submit graphics for conversion to punch cards, submit programs of data decks for processing, and go to off-line plotters for output.

The total process is like communicating with the problem solver (the computer) by mail. If the problem solver is working on a highly complex problem, with numerous input options, it is impossible to maintain what is sometimes called "thinking momentum."

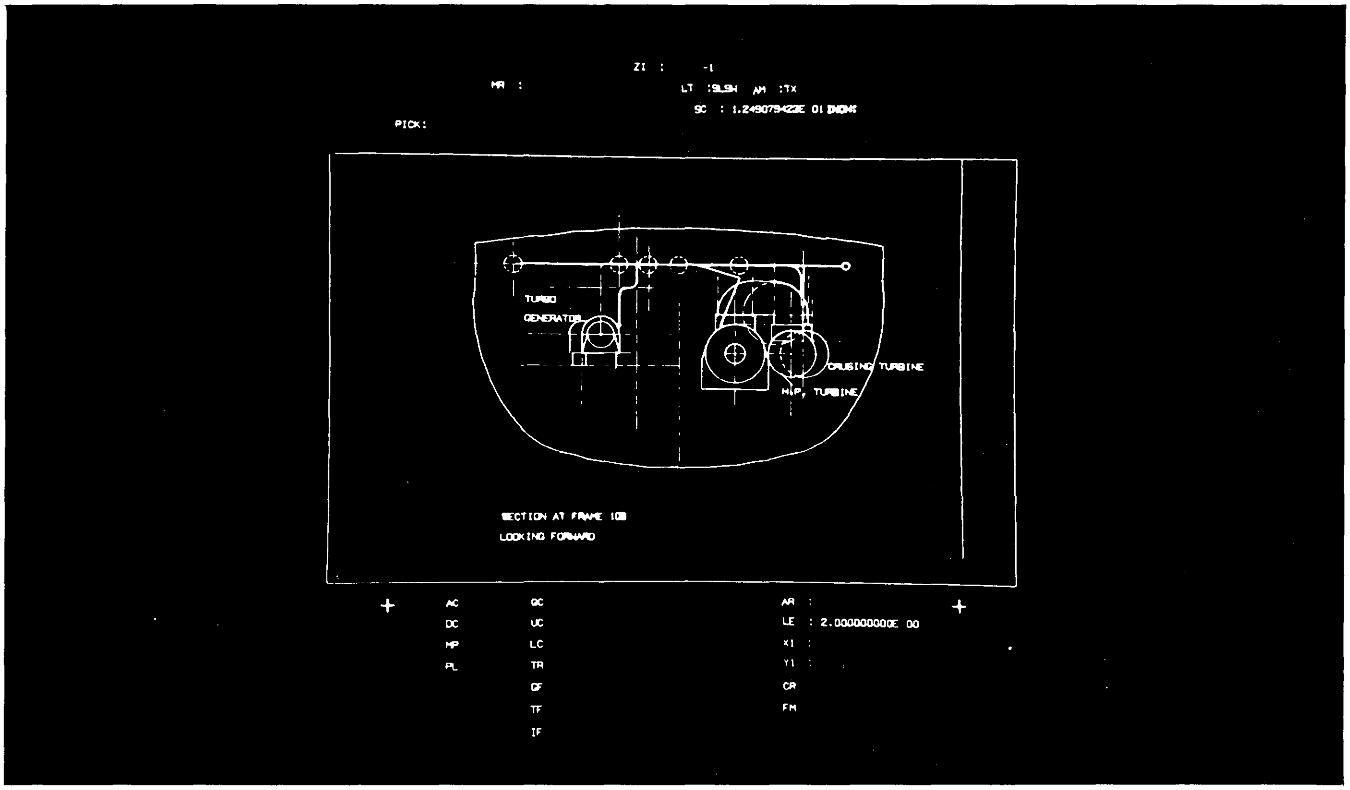
Real-Time Graphic Communications

Interactive computer graphics makes it possible to communicate with a computer in real-time. With such a system, a user can describe his problem in terms of charts, graphs, schematics, pictorial news, etc., and can read out the results of analyses in equaly descriptive form. Operating in a time-sharing mode, the user ties up the computing capability of the computer for only short intervals, to compute problem solutions and to process graphics, leaving the bulk of the computer time available for batch processing.

The user constructs the routines which translate the graphics to computer input, and reduces the computer output to charts, graphs, etc. The user is relatively unrestricted in that he can use such graphics as vector diagrams, system schematics, in fact whatever he needs, to describe input or output on the display.

In summary, interactive computer graphics automates the translation of a problem from engineering diagrams or schematics or graphs to a numerical description, the conversion to computer input medium (e.g. punch cards, tape), and the reduction of computer output to easily interpretable form. All of this is accomplished within a time which makes it possible to maintain "thinking momentum." It offers the user tangible savings by automating tedious tasks and reducing errors of translation, and the less tangible benefits of improved power to solve problems.

Display can view different positions of the construction grid. Enlarging, or "zooming" can define a large ship to .001 inch.



The Interactive Computer Graphic System

Two primary factors differentiate the interactive graphics terminal from a standard peripheral: (1) The functions performed by the graphic terminal are an integral part of the problem-solving process; and (2) In order to be economical, the interactive computer graphics terminal must operate in a fully time-shared mode.

For these two reasons, it is essential that the interactive computer graphics terminal be closely integrated into the total computer system.

System Hardware and Function

The graphics of an interactive computer graphics system are generated on the face of a cathode ray tube. The display may be tonal (generated by a raster scan, such as in television) or may be a vector type display (in which the electron beam can be moved in any direction across the face of the CRT). Both vector and tonal capabilities are available in advanced interactive display systems.

When using an interactive computer graphics system, the operator inputs either coordinate position information or alphanumeric data to the system. Several mechanisms are available for such inputs. These include the light pen, the 10-key numeric keyboard, the function keyboard, and a standard alphanumeric keyboard.

The light pen is the most widely used means of directly addressing points on the CRT face. The so-called light pen is actually a light detector which reads electron beam position. The detected beam position is related to the position of a graphic entity (e. g., circle, arc, curve) being displayed on the CRT face. Through the use of a tracking pattern (such as a tracking cross), the light pen can also be used to "draw" entities on the CRT face.

In order to treat very large physical entities graphically, the display surface can be set up to represent a window over a construction grid. For a particular application it may be desirable to draw on various portions of a very large construction grid, or "move" the display surface to view a different portion of the construction grid. A capability can also be provided to "zoom" in on a small portion of the construction grid (much in the way that a movie camera zooms in on an image) to get a closer view. Similarly, the capability can be provided to zoom back and take an overall view.

These manipulations give power to define large entities with fine precision. It would be possible, for example, to define an area the size of the United States to within a foot or smaller if necessary. A large ship can be defined to .001 inches.

Interactive computer graphics systems must provide for the storage of the mathematical description of the graphic entities used in any interactive computer graphics application. This includes the description of curves, graph grids, and geometric constructions. These graphic entities may be stored in the computer memory or in a peripheral buffer memory.

In general, a system which employs peripherally stored graphics represents a higher cost for peripheral equipment, but a lower overall system cost. In addition, peripherally stored graphics are protected from program errors, which often "wipe out" information contained in the computer memory.

There are various other minor design variations in interactive computer graphics equipment. One system may use hardware to display alphanumeric characters, while another may use software. One system may employ hardware to provide light-pen tracking, another might accomplish the same function with software. In general, hardware display control is faster, while software control is more flexible.

Systems Software

Those computing equipment manufacturers which market an integrated interactive computer graphics system (consisting of the computer, graphics equipment, standard peripherals, software, etc.) supply a graphics software package with the system. This package consists of a graphics executive program and a library of graphics routines.

The graphics executive program is resident in the computer during the running of any graphics application program. The function of this resident executive is to manage the running of the graphics application, and drive the display terminals. The library of graphic routines is generally carried on mass storage (disk, tape, etc.). They are brought into the computer memory from the mass storage file while the graphics application program is being run. These graphic library routines create, manipulate, or delete graphic entities (e.g. lines, circles, points, alphanumerics).

The graphic portions of the user's application program can assemble intricate graphic displays by combining the graphic entities available through the graphic library routines. For example, the user may create a graph grid, etc., from line entities, alphanumeric entities, and curve labels. He creates the curves by scaling analysis output to the graph grid and drawing small line segments with various line styles (solid, dashed, center lines, etc.).

Similarly he may wish to insert loads on a pictorial view of a structure. He sets up an application routine which will read various values which he has entered on the display into an analysis program. Graphic library routines are called to assist in entering the values on the display and connecting the values entered on the display to the proper form for analysis input.

The computer manufacturer tries to provide a graphics software package which occupies as little of the computer memory as possible and which provides a sound control of basic graphic entities. A well-designed software package is essential for an efficient, economical ICG installation.

Applications Programs

Graphic applications range all the way from the creation and maintenance of a drawing system to complex scientific and engineering analysis.

The creation and maintenance of a drawing system, in its purest form, involves computing only for the processing and storage of graphics. No analysis computation is involved in such an application.

At the other end of the interactive computer graphic applications spectrum are those programs which accomplish extensive mathematical operations to solve complex analyses. In this case, graphics is used as a means of inputting values to, and reading answers from, the analysis routines. In between these extremes is a range of applications which mix and combine analysis routines and graphic routines to accomplish circuit layout and analysis, tool design and production engineering, piping layouts, etc.

Interactive Computer Graphics for Design

Design is a major application area for interactive computer graphics. Today, interactive computer graphics is being used successfully in many phases of design from concept to the production of final hardware specifications. Some representative design applications of interactive computer graphics are described.

Automated Hardware Design and Numerical Control

Automated hardware design (mechanical or electrical/electronic) is one of the most obvious applications of ICG. The design process may involve some layout, some mathematical analysis, some test and evaluation, specification development, and the preparation of final drawings and production procedures.

It has been demonstrated that interactive computer graphics can be of extensive value in each of these phases of hardware design work. Let's look at a typical mechanical and a typical electrical design application.

Let's assume that the designer has to design a complex mechanism to fit in a limited space. He first draws the available space envelope. He then perhaps draws in key points such as drive points, pivot points, axles, etc. and the outline of various parts of the mechanism. In the process of drawing he can group various graphics entities (lines and circles) which make up a single piece part.

After the mechanism is defined, he may call on various application routines to simulate operation of the mechanism as it was drawn. He might simulate a variety of loadings to test deflection, operation under load, etc.

To do this he calls upon various analysis programs. These programs are very likely standard analysis programs which he used prior to the innovation of graphics. With the use of graphics, he sets the same programs up to take inputs from the CRT. In addition he provides routines which will display the program output in graphic form (curves, alphanumeric readout on a schematic, etc.).

The designer might analyze heat transfer problems or operation of the mechanism under various environmental stresses. He might for example, draw vectors to indicate loads on a specific point, or enter an alphanumeric description of temperature at a point. As flaws in the design become apparent, he can correct the drawing on the scope face.

Once he has satisfied operational requirements, he can proceed to develop the process for producing the mechanism. He can isolate various parts of the mechanism, then move graphic representations of various cutting tools over the part, operating the "tools" at various speeds, describing the cutting path, designating coolant flows, etc. In the process he may alter the part design to better facilitate fabrication.

Once he has completed the design, he can call for creation of numerically controlled tape directly from his design. At any time after the design is complete, the designer can recall his design from storage, insert changes, and re-run various design analysis.

Similarly, an electronic designer can proceed from concept through schematic layout, functional simulation, and physical layout to process engineering using computer graphics. He builds a circuit schematic. He calls application routines which perform basic circuit checks, such as open circuits, shorts, etc. He then specifies various inputs and environmental conditions and, using another application routine, observes the output of the circuit under anticipated operating conditions. Once he has satisfied the operating requirements for the circuit, he can proceed with circuit board layout, and the development of numerical control tapes to control production.

Data Reduction and Evaluation

Data reduction and evaluation is another prime application area for ICG. Aerospace and oil companies both generate extremely large batches of data. This data is most often associated with a single test (e.g., a space vehicle flight, or an oil well sounding). In both cases, the criteria for identifying and eliminating random and systematic data errors is difficult to define completely. Human judgment must find and eliminate such errors.

Consider, for example, the task of reducing the data from the flight of a launch vehicle. This job involves thousands of man-hours and is often accomplished on a crash basis.

The raw data tapes are read into an interactive computer graphics system. A display may consist of continuous curves or numerous single data points. The console operator can edit random errors in the raw data by picking various points or portions of a curve with a light pen and eliminating them from further consideration in curve fitting, statistical evaluation, etc.

He can eliminate systematic errors by translating groups of data relative to the coordinate system. This is done with the light pen and translate functions. Once the raw data has been edited, it may be converted to hardcopy, or passed on to statistical evaluation routines for correlation. The result is a direct saving in the time required to process a batch of data, and also assurance of more meaningful data for further analysis.

Evaluation of oil well seismic data also involves extensive subjective judgment. Seismic data contain a considerable amount of noise. A complete definition of the filtering which should be applied to each batch of data, and the frequency characteristics of the meaningful data would be very extensive. An experienced geophysicist can subjectively "filter" and evaluate data by viewing a display generated directly from digital tapes.

Computer graphics provides a rapid, direct transition from tapes to graphics. In addition, computer graphics eliminates the necessity of converting all data to hard copy before evaluation.

A further capability used for data reduction and evaluation is tonal display. This capability permits definition of areas of the CRT in various intensities. Data telemetered from satellites can be immediately converted from digital to picture images for evaluation, without waiting for photo processing. Additionally, the number of images eventually converted to hard copy can be limited to those of real interest.

Tonal display is also highly valuable in engineering and design analysis. It can be used to study flow and force field problems, 3-dimensional statistical distributions, etc.

Layout

The layout function is one which inherently involves subjective judgment. There may be a single optimum solution to each layout problem; however, the layout achieved by experienced layout engineers using subjective judgment is usually entirely adequate.

The primary problem encountered when designing a large complex system is to control the utilization of three-dimensional space during the layout process. In a large system the work of numerous specialists must be closely coordinated in order to assure that no two objects are placed in the same space, and that the interaction of layout and system characteristics does not unnecessarily degrade the performance of systems.

Ideally, everyone would work on one large drawing. As this hypothetical drawing is created, it would be correlated with analytical work (pipe layout would be correlated with pressure loss calculations, instrument layout would be correlated with thermal analysis, etc.). However, one large drawing — actually — is obviously impractical.

Using interactive computer graphics, however, it is possible for everyone to work on a "single drawing"; through linkage of the graphics with analytical programs, the correlation between layout of a system and the system performance characteristics is automatic.

The Digigraphics Division of Control Data Corporation has developed a software package which provides for the description of a system layout in 3 dimensions, and the direct correlation of layout with system performance. With this system, numerous designers can work simultaneously on a single, 3-dimensional layout drawing. As the layout is created it can be directly coupled to analytical programs such as piping pressure drop computations, etc. The interaction of separate systems is immediately obvious during the layout process.

The Economics of Interactive Computer Graphics

The ultimate measure of value of any innovation must be return on investment. In the past, interactive computer graphics capability has been fairly costly. Without time sharing and the features of a sophisticated operating system, the computer had to be dedicated completely to graphics during the running of an ICG application. Further, the number of consoles which could operate from a single computer was very small.

With the development of time-shared graphics, however, the cost per console hour can be reduced to a fraction of previous costs. In the near future, costs per console hour will be in the range of $12 to $15. In (5 to 10 years) costs per console hour of $1 to $2 may be anticipated.

Measuring the benefits of computer graphics is difficult. Most applications will produce both tangible and intangible benefits. Both are extremely important.

Tangible benefits derived by the user of ICG include: (1) reduction in the number of man-hours required to test a single solution to a problem; (2) reduced computer time due to the users ability with ICG to "zero in" on the correct answer; (3) direct saving of the man hours required to translate problem description into computer input; and (4) presentation of computer output as graphs.

An experimental application program run at Control Data Digigraphics Division produces 200 curves of system performance versus time. The preparation of input for each run of the program and the plot of output from each run, previously, would take 2 to 4 man-weeks. Using the CDC system the input is instantly controllable and the output instantly readable.

The intangible benefits are primarily in the area of problem solving. Is the end product improved by letting the designer work in an interactive mode? Does the designer produce a better design (or an equivalent design) in a shorter time if he can maintain thinking momentum? Will he discover a better answer if he can test more solutions in the given time using interactive computer graphics? Intuitively one would say "yes"; however, these advantages will have to be proved over a long period in a wide variety of situations.

The Future

In the hardware area, several features have been developed which may find general use. These include color, optical projection from the rear of the CRT, and fast "hard copy" of the displayed data. These features should stand close investigation of cost effectiveness before they are added to the system.

The interactive computer graphics terminal must eventually become a piece of office equipment (rather than a part of the computer installation). The display console will be smaller, and there will be fewer restrictions on remote location.

Development of additional profitable applications, reductions in hardware costs, larger display area, and more computer display capability, are also important objectives.

In system software, a larger library of useful functions will be developed. Software optimization will increase speed and reduce memory requirements.

Interactive computer graphics is no longer "what's coming" but what is. ICG is now playing an important part in efficient and economical design by allowing users to cut design costs, speed development work, and increase the profitability of products. ■

LOW COST GRAPHICS

Murray Rubin
Digital Equipment Corp.
146 Main St.
Maynard, Mass. 01754

"A complete, stand alone computer graphics system, with comprehensive user language programs, and full graphics input and output facilities, can now operate for costs between $16,500 and $20,000."

Recent advances in semiconductor and display technology have made possible complete computer graphics display systems selling for less than $20,000. This article will explore the techniques and limitations of these new low-cost systems, and possible areas for their application. A computer graphics system is defined as one with line drawing or point plotting capability, and excludes those devices that display alphanumeric characters only.

Refresh Approach

There are two basic approaches to the design of low cost graphics systems. The earlier approach is an outgrowth of television technology which utilizes the conventional Cathode Ray Tube (CRT) as the actual display device. This CRT does not contain any built-in memory; and so the picture must be repeated several dozen times each second to present a flicker-free image to the eye.

The absence of built-in memory in the CRT requires the use of some other form of memory (such as ferrite cores, magnetic discs or drums, or delay lines) and a high-speed controller and drive element capable of reading this memory and refreshing the picture. The controller and memory are quite expensive. Attempts at producing a low cost CRT graphics system have concentrated on reducing the cost of these components, and follow one of two paths. The controller could be designed to have fewer commands and operate more slowly out of a smaller memory, with resulting performance loss in command repertoire and low overall information density. Or else several terminals could be grouped together to share the cost of the central control and memory. This latter approach can offer more powerful performance, but obviously is only suited to applications where several terminals are required or can be justified, and where they can be easily connected to the central unit by high speed, low loss coaxial cables.

Low cost systems using the refresh CRT will offer bright displays of virtually any reasonable size and moderate to low overall information density. However, flicker will be a problem in applications requiring medium to high information density.

Techniques like light pens, dynamic motion, windowing, and subroutines are possible in refresh display systems. They usually must be implemented in hardware because of the high speeds of the processor and of information transfer. Because of the expense of implementing these with this hardware, such features will most likely not be found in a low-cost refresh-display system.

A characteristic of refresh-display systems which is retained in low-cost displays is the ability to rapidly update the display (ordinarily a few tenths of a second). This is desirable for applications involving line or text editing.

Storage Approach: Two Examples

A more recent approach to the design of low cost computer graphics systems is based on the Direct View Storage Tube (DVST). The DVST has the property of retaining a visual image as it is written, in the exact form in which it is written. Since the image need only be written once, the requirements for a separate refresh memory are eliminated. Also, the information rate requirements of the data source and its control and drive circuitry are greatly reduced. The combination of inherent memory and slow drivers results in tremendous overall savings in cost and complexity.

Figure 1 presents a block diagram of one form of computer graphics system built around the DVST. In this system, a small general-purpose computer operates by direct link to one or more "local" display terminals. All control functions originate in the computer under command from the terminal keyboards or graphic input devices or both. The DVSTs are driven from an analog function generator controlled by the computer, and are selected so as to unblank only one display at a time. The use of analog components in the design is the key to the low system cost, since they operate under conditions of high accuracy but low slew rate. These conditions are easily met by modern techniques using integrated circuits. A second key to low system cost is the heavy use of software, as opposed to hardware, to do nearly all data formatting and data control functions. Character generation is also performed by a software technique which permits the user to specify character fonts and repertoire.

The information transfer rates characteristic of the DVST permits the distribution of audio frequency analog and digital signals to terminals located up to several hundred feet from the computer via low-cost cables. This same multi-conductor direct link is another factor permitting the use of software in the manner described above.

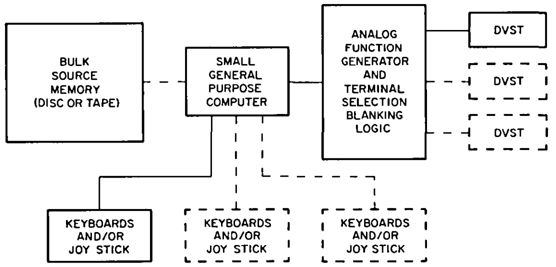


Figure 1

A stand-alone single or multi-terminal small graphics system using a general purpose computer processor, a central analog function generator, and selectively blanked terminals. Scope signals are distributed at low speed up to several hundred feet in analog form by a multi-conductor. Additional source memory in the form of tape or disc may be added for retrieval of bulk information.

The system illustrated in Figure 1 can operate as a complete, stand-alone computer graphics system, with comprehensive user language programs, and full graphics input and output facilities, for costs between $16,500 and $20,000. Expansion of the basic system to eight terminals produces a system cost below $7,500 per terminal. Bulk storage discs or tape can be added at costs ranging from $6,500 to upwards of $20,000 to satisfy applications requiring a large data source. Alternately, an interface may be added to complete a link to a large central computer for less than $5,000.

Also, the system in Figure 1 is highly attractive for general information retrieval and interactive graphic design. This is especially true in an environment permitting the local grouping of one or more terminals in the computer room (or rooms adjacent to the computer) in an application where a fairly rapid computer response is desirable.

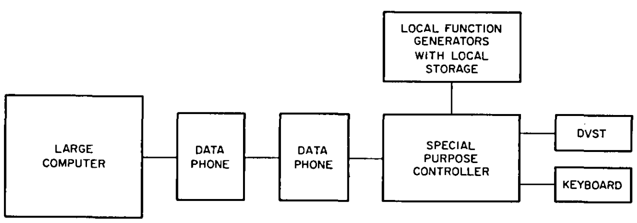


Figure 2

A remote stand-alone terminal system uses a special-purpose controller and local hardware function generators to overcome low bandwidth of the transmission path. Communication is usually by ASCII or a similar universal character code, over a standard dataphone link to the central computer.

Figure 2 illustrates another approach, still using a DVST. This system is structured to operate directly on a telephone line. The information rate of this system, approximately one to two orders of magnitude slower than the direct system in Figure 1, shows the penalty paid for using low bandwidth lines. This reduced rate makes a hardware character generator necessary at the terminal, as well as other hardware required to format vectors and control the telephone interface and keyboard.

All this special purpose hardware negates much of the favorable software/hardware trade off possible with the DVST, and produces a single terminal costing between $10,000 and $15,000. To this cost must be added the dataphone and line charges, and the central processor computer charges. This system represents a solution to the remote access graphic terminal problem where it is not feasible to have direct lines to the computer.

Characteristics of Storage System

Both of the DVST systems have similar performance characteristics except for response speed. The DVST now available produces a high-resolution image (over 4000 characters) of a size, quality, and information density comparable to that found on a standard 8½ by 11 inch page of text with standard borders. The display itself does not flicker. On the other hand contrast and brightness, while adequate for use with a hood or in a semidarkened room, are less than that achievable with refresh systems. No existing refresh system, however, can match the information density of the DVST. Its use is ideal for applications requiring high information density.

Limitations

There are some applications where the use of a DVST does present difficulties. Its use for true real-time applications, requiring essentially instantaneous response, is not possible. Also, the present DVST lacks selective erase capabilities, so that the entire frame must be rewritten if it is desired to alter any substantial part of the picture. Here the re-write time of one to five seconds for a system like Figure 1 may not be objectionable, but the 30 to 50 seconds for the remote system might be.

There are some program tricks which can be used to minimize the number of times the picture is rewritten. One of these is the use of a special text buffer area when doing text editing. In addition, there is the use of a partial refresh technique where the last few actions entered in the picture are drawn in a non-stored manner and are only stored upon verification by the operator. This latter approach is possible in a bistable storage tube, where it is possible to observe a visual image written on the screen at a writing rate too fast to be stored by the tube. This image does not affect any previously stored images. Thus, the tube used in this manner may permit the use of a light pen or a joystick to display and enter graphic data directly from the tube surface. The program to interpret this data, however, under some conditions is fairly complex. A technique which can be used in some programs is the tagging of what may be called target circles, or hot spots. The display is drawn with certain coordinates identified by a distinctive circle or other symbol. When a joystick is positioned so its generated non-stored spot appears at a target circle and the appropriate interrupt button is pressed, the program would read and identify the action associated with the target circle. Graphic input could also be read in from the joystick in a similar manner.

Summary

These are the techniques, system configurations, and limitations of some recently developed, low-cost computer graphic systems. Systems employing the direct view storage tube principle are generally less expensive and are capable of considerably greater information density than present refresh systems. However, they are only suited for applications where system response time from a few seconds (for the system of Figure 1) up to a minute (for the system of Figure 2) are acceptable. The limited refresh capabilities of the bistable storage tube permits live graphic input capability and some limited live vector functions to be performed, but is not sufficient for applications requiring dynamic motion.

Applications which can benefit by the use of the DVST include interactive design (but with limited motion requirements), bulk information retrieval, cartography, drafting, pattern generation, numerical machine tool contour design and validation, drafting, editing, and almost all applications involving the generation, manipulation and interpretation of graphical data or forms. ■

c.a IDEAS: SPOTLIGHT

Both "Encyclopedic, Tutorial" and "Information-Dispensing" Information Retrieval Systems Should Receive Emphasis

From: Kochen, Manfred, The Growth of Knowledge, *John Wiley & Sons, Inc. 605 Third Ave., New York, N.Y. 10016, 1967*

A seven-year-old child asks how an amphibian breathes. A space-suit designer needs to know the maximum and minimum temperature that a space-suit would attain at the surface of the moon at any time and spot. Providing suitable answers to these queries are services expected of information-retrieval (IR) systems. It is mostly the traditional library and the modern information center that provide information-retrieval services today. Neither would always provide the most satisfactory answer to the kind of question posed by either the seven-year-old or the space-suit designer.

An engineer, needing a high-intensity light source, wishes to know how a laser works. His query has more in common with that of the seven-year-old than with that of the space-suit designer. Both the engineer and the seven-year-old wish to satisfy their curiosity and to increase their understanding at a level commensurate with their ability to comprehend. The engineer will be as little satisfied by references to gas lasers, relay lasers, or injection lasers as the child would be by references to gills or lungs.

A historian's quest for the exact year of Homer's birth has more in common with the space-suit designer's query than with that of the seven-year-old. Neither of them seeks to modify significantly his image of an aspect of the world; they both seek a reasonably well-specified isolated datum. Both might be satisfied by pairs of numbers on appropriate scales.

The responses of an information-retrieval system to such queries as the four above may take many forms. Servicing the child's question is the task of what we shall call an *encyclopedic or tutorial information system.* An ideal form of response to the seven-year-old's query that such a system might make could be a television tape that describes, at a level of a seven-year-old, how amphibians breathe. The person to whom the query is posed would be able to display the answer on a readily available television set, furnished with a special tape reader, within at most a few minutes after the query is first expressed. The tape for a seven-year-old would differ from the tape for a ten-year-old asking the same question. Even if it were possible to catalog and use an immense library of such tapes in this way, it would still not be possible to anticipate all queries. Furthermore, the child should be allowed to interrupt the showing with his questions. He should be able to elicit from the IR system a response that may be composed of several prerecorded fragments. It may give the child a bird's-eye view, or it may go into as much detail as the child's curiosity demands.

This kind of encyclopedic information system would be able to sift, compile, evaluate, screen, combine, and tie together into a teachable, coherent whole what would have been to the child a bewildering mass of detailed facts. The need of a doctor for a good clinical picture of effects and side effects of a new drug for a certain type of cancer, the need of a lawyer to understand the use of the word "obvious" in patents, and the needs of a legislature in seeking to comprehend the attitude of Southern whites toward school integration are all best served by this type of information-retrieval system.

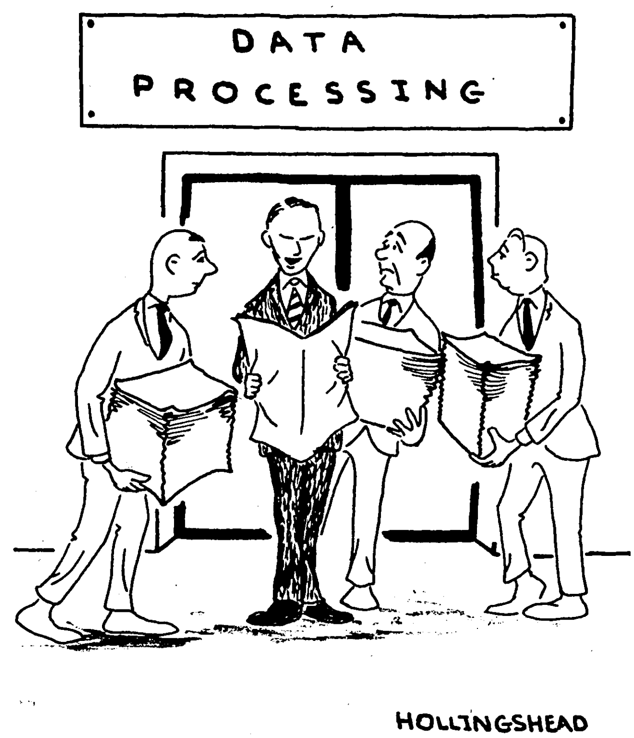
Servicing the space-suit designer's question is the task of what we shall call an *information-dispensing system.* Its function is to store and retrieve references to documents, to retrieve documents themselves, and to extract answers from relevant documents.

An ideal response to the space-suit designer's query might be a documented statement that gives the required maximum and minimum temperatures, as well as the pertinent references to documents on which the validity of these answers is based. The designer may wish to examine the documents. He may need photocopies or displays of the text on a cathode-ray tube or on the translucent screen of a microfilm or similar projector. He would need these with minimum delay and without the inconvenience of going to a library or to a special station with equipment. He will be irked if he has to wade through many pages of irrelevant or distracting material. He will be even more annoyed if, years later, he discovers the prior existence of a document with a more accurate measurement than any given him by his IR system. He is not interested in undocumented information.

Nearly all current efforts are directed toward developing the second type of information retrieval system — the information-dispensing system. There is little doubt that such a system serves many important needs.

But is this type of system worthy of *all* the resources, or even the larger part of the resources allotted to information retrieval? If an occasional reader who can influence the allocation of resources in this area is swayed by the comments presented here toward an increased emphasis on encyclopedic systems, a useful impact will have been made. ■

COMPUTER REPORTING



"How about that: 70% of all reports produced by computers are thrown away!"

A COMPUTERIZED PHOTOCOMPOSITION SYSTEM OF GRAPHIC ARTS QUALITY

Phillip P. Petron
Manager, Product Planning
Alphanumeric, Inc.
10 Nevada Drive
Lake Success, L.I., N.Y. 11040

"A computerized photocomposition system of graphic arts quality must: (1) be flexible enough to satisfy the needs of the printing and publishing industries as well as EDP users possessing files of information for internal or public dissemination; and (2) must be economically attractive when compared with competitive manual and automated equipment."

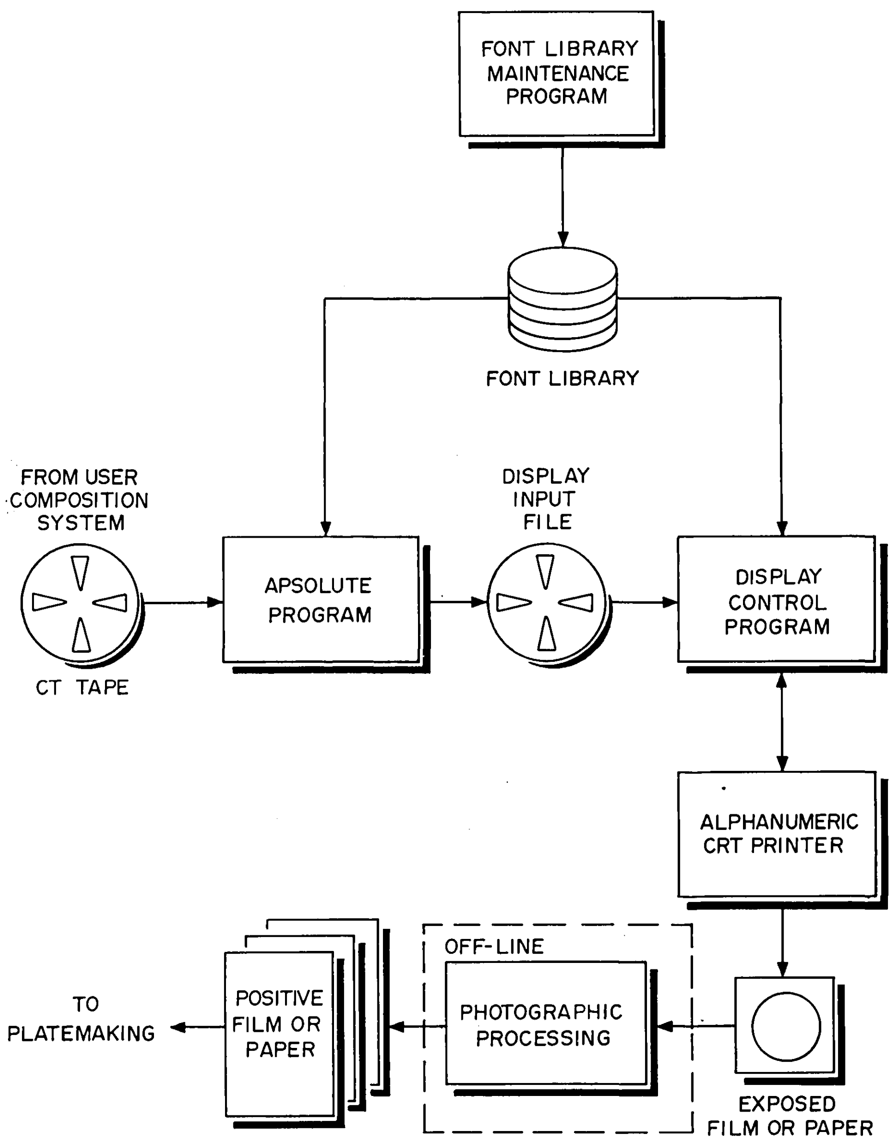
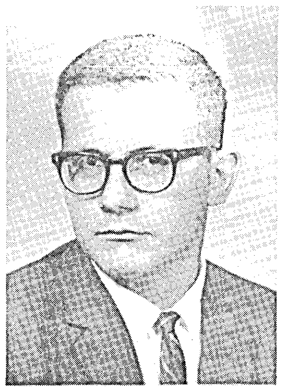


Figure 1. Alphanumeric Inc. Photocomposition System (APS)



Phillip P. Petron was born in New York City on September 11, 1931. He received his A.B. degree from New York University and his M.S. from Stevens Institute of Technology, Hoboken, New Jersey. He has done additional work at Brooklyn Polytechnic Institute, Brooklyn, N.Y., and was a doctoral candidate at New York University School of Business Administration.

Since 1955, he has been engaged in the EDP industry, initially with Western Electric Inc. and subsequently with System Development Corporation. Prior to joining Alphanumeric as Manager of Product Planning, he was employed by the Xerox Corporation, Rochester, N.Y., conducting product planning and business development in computer related fields.

One of the more recent applications of the technology of electronic data processing is in the graphic arts printing industry. Here cathode ray tube (CRT) devices have been used to generate alphanumerics, special characters, and symbols, with such flexibility and quality that they satisfy the composition requirements of the printing industry.

Our company has designed and manufactured a photocomposition system that phototypesets characters of graphic arts quality, at speeds up to 6,000 characters a second. Associated with the photocomposition hardware, a comprehensive set of computer programs have been developed to provide for text composition and operational support. Together with the phototypesetting hardware, these comprise the total photocomposition system shown in Figure 1. This system is currently operating. It is aimed at satisfying the needs in graphic arts composition of the printing and publishing industries, and also the needs of EDP users possessing files of information for internal or public dissemination.

In order to satisfy such a diverse set of applications, the photocomposition system must be economically attractive when compared with competitive manual and automated equipment. The system has been designed to handle a wide range of tasks for various customers. These tasks include: file maintenance; text composition; and the production of photocomposed output on photographic paper or film which is used to prepare either photo-offset or letterpress plates. The system may be used by companies who have their own fully edited input tapes, containing text information and graphic arts codes or parameters.

Properties

The system has the following properties:

1. Quality and appearance of type images, meeting the high standards of the printing industry.
2. Photocomposition printing speeds equal to and exceeding the speeds of current computer line printers.
3. An extensive type library of over 250 popular fonts. These are stored in digitized form on magnetic tape and on disk packs under computer control, and are retrievable at computer speeds.
4. The power to add additional fonts, characters, special symbols, or logos which may be designed or requested by the user.
5. Compatibility with a wide variety of input media including magnetic tape generated for line printer output, and other magnetic tape, punched paper tape and cards.

Photocomposition System

The photocomposition system comprises the CRT photoprinter and three software subsystems that together make up the Operational Support System as shown in Figure 1.

The photocomposition system phototypesets characters of 800 scan lines per inch. Output speed varies as a function of type font and point size. As in conventional printing systems, the number of characters that may be phototypeset depends on font complexity and on character size. The speed varies with point size; the larger the character, the more CRT beam scan lines are required to generate the character. Output speed usually ranges from 1000 to 6000 characters per second. These rates include the time required to process all control commands, move the recording medium, and phototypeset the characters. Figure 2 shows a sample output page phototypeset by the system.

Typesetting, Photocomposition and Computer Applications

The printing industry has been advanced by two basic innovations in the field of typesetting. The first was the development of movable type associated with Gutenberg and Caxton as early as the fifteenth century. Typesetting remained a slow, hand process of selecting individual pieces of type and returning them to their proper cases when the printing was completed.

Figure 2. Sample APS Page Output

Digitally encoded character patterns are stored in magnetic core memory in a manner graphically shown in enlarged form in Figure 3. The character pattern is formed by sequential vertical sweeps of the CRT electron beam. Digital coding determines when the beam is turned on during each vertical sweep. Characters up to ¼″ high can be phototypeset at any point on an output page with a high degree of vertical and horizontal accuracy. The maximum line width is 8 1/3″. The page length can vary up to the maximum storage capacity of the photoprinter, which is 800 feet of photosensitive medium.

Operational Support System

The operational support system allows the user to generate composed output; he may use composition systems that are device-independent; the input he provides is a magnetic tape expressing composed text. In effect, the operational support system allows users great latitude.

The system comprises three computer subprograms. The first subprogram converts the composed text to the specialized requirements of the CRT printer in three phases. The first phase validates and analyzes input text and control statements; the result together with the data in the font library, creates a matrix selection dictionary. The second phase allocates data from the matrix selection dictionary into core memory, for storage of matrix patterns for printing operations. The third phase creates the display input (DI File) used to drive and control the CRT printer.

The second subprogram, called the Display Control Program, executes all CRT printer operations. It accepts from the DI File detailed control and display parameters and specific instructions for loading all display patterns required for a given job from the font library. Both subprograms receive data from the font library, which is maintained by the third subprogram, the Font Library Maintenance Program. This program initializes disk packs and performs initial loading, adding, changing, and deactivating of font and character in the font library.

The Operation of Photocomposition

The operation of the system includes the storage of font and text information, the generation of characters by the CRT, and the recording of the CRT generated characters through a high-quality lens system onto a photo-sensitive medium. This medium is driven by a digitally controlled mechanism for film transport.

Appropriate signals are transmitted to the photoprinter to initiate the flow of characters and positioning data. These signals are processed by the printer to generate the character through repetitive, vertical CRT beam sweeps at the proper position on the tube face. The movement of the medium through this process is measured by a digital encoder. Correction signals are applied to displace the CRT beam proportionally to film movement. This produces, a text line of characters perfectly aligned, on the recording medium. This process allows a constantly moving film medium, and avoids time consuming start-stop techniques.

Circuitry and timing are utilized to ensure maximum speeds of movement of media, while keeping the beam within the prime quality area of the CRT face. Appropriate corrections are also applied to eliminate pincushion effects and distortions created by the flat tube face.

A character on the CRT face is generated by "painting" successive rectangular segments each 1.25 mils wide and from 1.25 mils to ¼″ in height resulting in a character resolution of 800 lines per inch.

The painting process is accomplished by moving the beam from top to bottom, incrementing one horizontal position unit each time the vertical sweep reaches bottom. The vertical beam may be turned on and off several times during each sweep. Blank spaces between characters shown as (a) and (c) widths in Figure 3 are not included in the painting process. To avoid consuming valuable CRT time, the (a) and (c) values are added to horizontal positioning data before and after each generated character. Gaps between characters and words required for line justification are processed similarly, to optimize the speed of output.

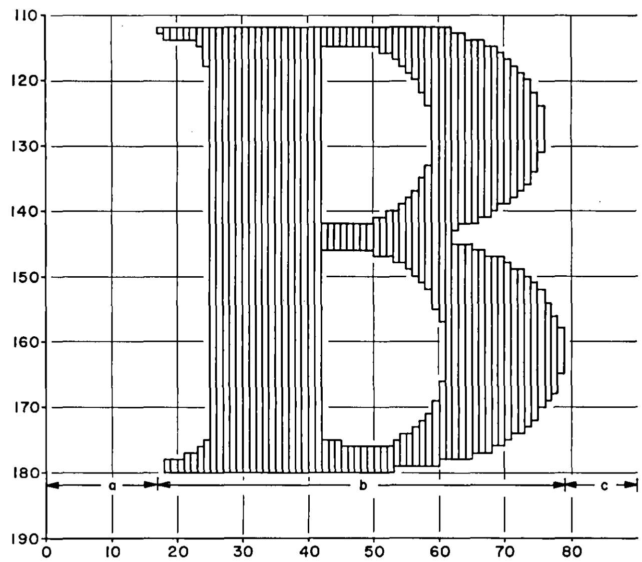


Figure 3. Typical APS Character Construction

By means of program commands, characters may be displaced above or below the base line, as in mathematical and chemical formulas. Or two characters may be set in one space, to achieve "kerned" characters. Or characters may be compressed or magnified up to plus or minus 32% in 0.25% increments.

Codes may be compacted to reduce memory storage, to suit what is economically feasible with currently available magnetic core memories. Straightforward coding of each element of a character pattern would require too much core memory. Storage requirements for individual characters range between 60 and 120 eight-bit bytes. This is within the core storage capacity necessary to process an entire job.

Applications

One application of these techniques is justifying and hyphenating text. More generalized text composition programs of this nature are being developed, for use in setting and adjusting to a wide array of possible formats for lines, pages, and jobs.

Another application is preparing catalogs, directories, and financial and legal printing where speed is a pressing need.

Another application is the generation of continuous line figures on a page to satisfy the artwork requirements prevalent in printed circuit boards, circuit diagrams, logic diagrams, line drawings, etc.

Specialized programs are being developed for automatically routing and mapping specially designed symbols that are sorted and combined to generate continuous lines from any point to any other point on a page.

Figure 4 shows a tabulation of individual symbols that have been stored in photoprinter memory to photocompose onto film the compact wiring paths of a multi-layer board shown in Figure 5.

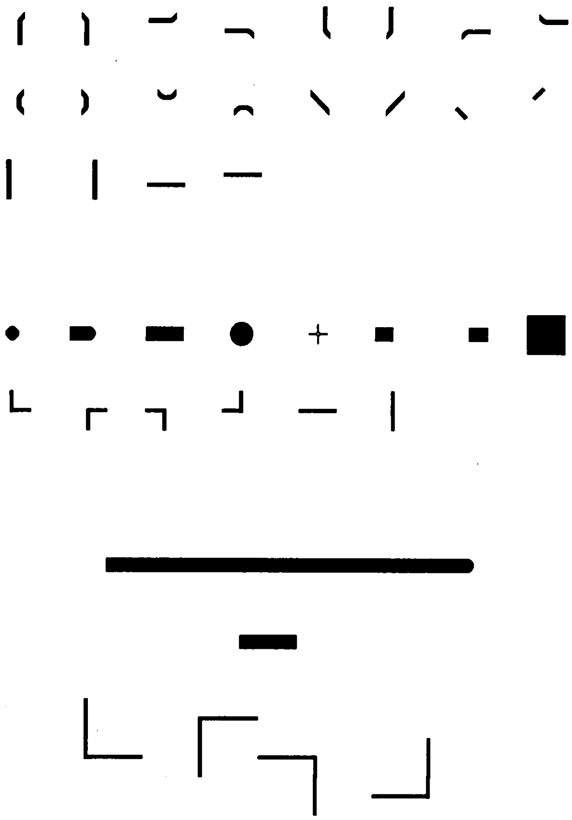


Figure 4. Printed Circuit Board Artwork Symbols

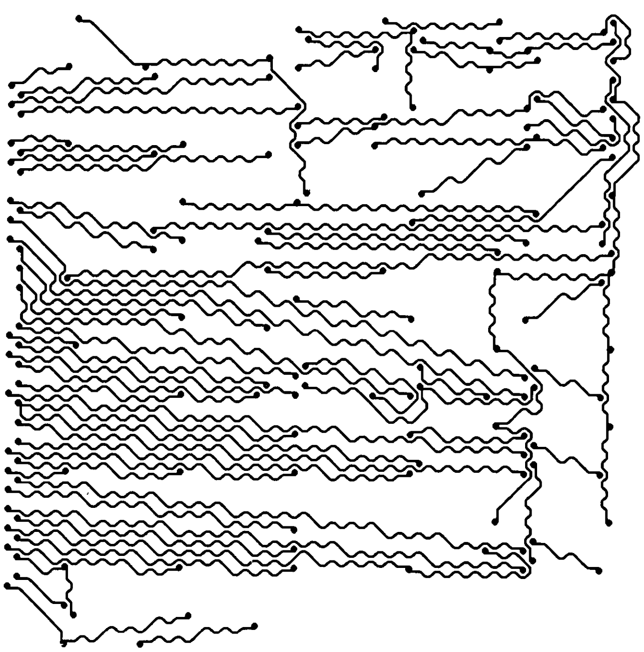


Figure 5. Typical Layer for Multilayer Board

Generalized programs are being developed to process non-alphanumeric figures and symbols, to produce line drawings, logic diagrams, program flow charts, etc. In this application special figures and symbols are processed by the photocomposition system. In actuality, the special symbols required for line generation are simply a special font composed of non-alphanumeric characters which are processed according to algorithms written to generate the desired output.

For example, for electronic drafting, two fonts have been developed; the electronic font consisting of the symbols for transistor, resistor, capacitor transformer, etc., and the logic font comprising the symbols for AND gate, OR gate, NAND gate flip-flop, etc.

Hyper-Symbols in Hyper-Fonts

The set of programs for generating line drawings utilizes the hyper-font concept, where the program assumes the existence of a macro type font containing combinations of the symbol found in the basic font. For example, a line 1/10″ in length may be a symbol in a line drawing font. A line of 1″ length can then be defined as a hyper font made up of ten 1/10″ line symbols. When the hyper font 1″ line is required, it can be requested by the composition program, and the necessary calculations are then made to produce the corresponding symbols in the proper geometric arrangement.

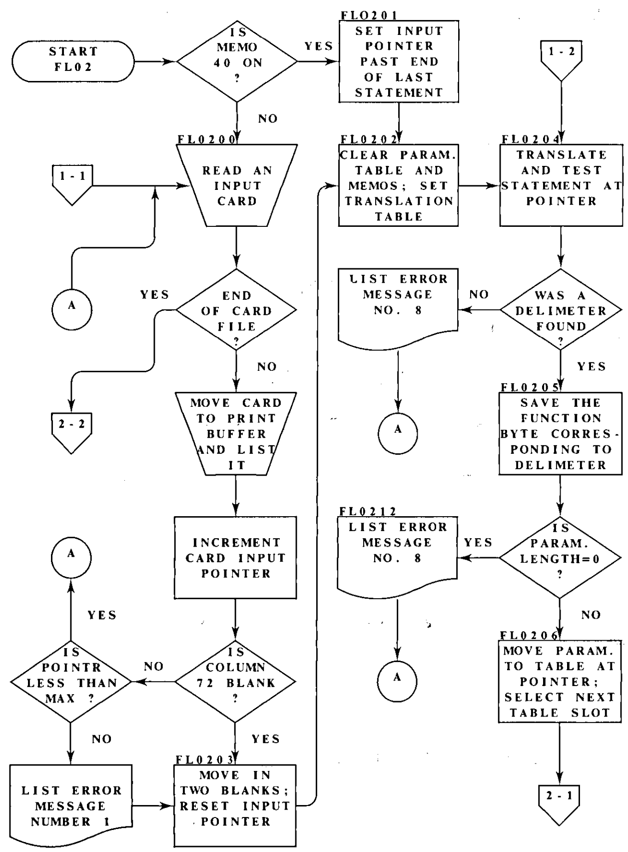


Figure 6. Program Flow Diagram from APS

Each hyper symbol can be used in turn to create a higher order hyper symbol composed of a series of lower order hyper symbols. Up to 20 levels of such symbol description can be utilized. Figure 6 illustrates a typical diagram produced with only 15 input statements.

A wide and exciting horizon of applications of computer photocomposition is being revealed.

Acknowledgments

The author wishes to acknowledge the technical and documentary contributions of E. Cuba, S. Manber, and H. Bechard.

This article is based, in part, upon a technical paper "Digitally Coded Alphanumeric Photocomposition System", which appeared in the special issue of IEEE Transactions on Engineering Writing and Speech, August 1968, and is published with the permission of the IEEE. ■

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 6811: SAVING COMPUTER TIME

"Do you think you might be able to run this program tonight?", Al asked with a slight wheedling note in his voice. "I could punch up the cards in five minutes."

Dan looked at the program Al had given him. "What crazy program is this?", he asked.

```
      R = 0
      A = 12.
3     B = A
      Q = SQRT (2.*B + 1.)
5     B = B - 1
      IF (B.NE.11.) GO TO 11
      IF ((Q - R).LT. .00001) GO TO 13
      R = Q
      A = A + 1
      GO TO 3
11    Q = SQRT ((2.*B + 1.) + (B - 4.)*Q)
      GO TO 5
13    WRITE (6, 14)Q
14    FORMAT (1H1, 6X, F12.4)
      STOP
      END
```

"It's a problem in our algebra assignment that I wasn't able to solve. We have to have it in by tomorrow so I thought I'd write a program to compute it."

"I might be able to save you some computer time." Dan made a few calculations. I'll tell you what — get me a cup of coffee and a doughnut at the snack bar, and by the time you're back I'll have the value of Q for you."

What is Q?

Solution to Problem 6810: A Chessboard Matrix

The numbers were 0, 1, 8, 9, 32, 33, 40, 41 and 1, 3, 5, 7, 17, 19, 21, 23. Every number from 1 to 64 can be expressed uniquely as the sum of two numbers, one from each group.

Readers are invited to submit problems (and their solutions) for publication in this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

NUMBLES

Number Puzzles for Nimble Minds — and Computers

Neil Macdonald
Assistant Editor

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits.

Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions.

Numble 6811

```
All          S H I P S
         x   L E A K
           I K S L E T
         K P L M L M
       K H L N M E
     A S E K N I                  T = P
  =  E T M K P L M K T
```

21274 02146 24084 3728

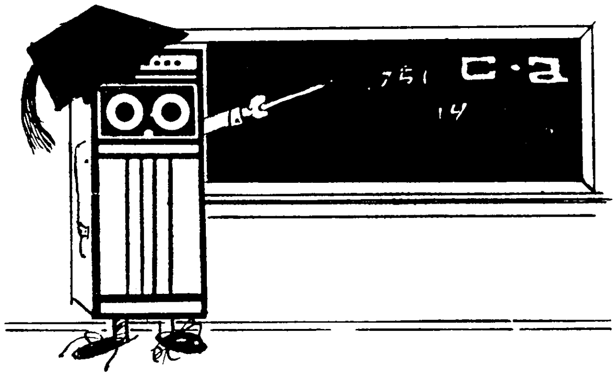
Solution to Numble 6810: Speech to Hide

In Numble 6810 in our October issue, the digits 0 through 9 are represented by letters as follows:

T = 0	I = 5
O,U = 1	D,G,M = 6
P = 2	H = 7
S = 3	A = 8
C = 4	E = 9

The full message is:

SPEECH was given to man to HIDE HIS THOUGHTS, and perhaps his face to show them.



Using a powerful, modern, small, general-purpose computer (a Digital Equipment Corp. PDP-9 which can perform 500,000 additions per second, etc.) which we have recently acquired -- and our experience since 1939 in many parts of the computer field, we have started to teach:

Course C12:

COMPUTING, PROGRAMMING, AND SYSTEMS FUNDAMENTALS FOR SUPERVISORY MANAGEMENT— WITH 'HANDS-ON-THE-COMPUTER' ORIENTATION AND EXPERIENCE

This course will be offered NOV. 13-15 (Wed. through Fri.), and from time to time thereafter, at the Computers and Automation Computer-Assisted Instruction Center, 815 Washington St., Newtonville, Mass. 02160. Computer time for course enrollees will be available, without additional charge, Wednesday through Sunday. The fee is $190; the enrollment is limited to 15.

After the lectures beginning at 9 a.m. each day, the course will center around study groups of three or four persons who will have access together to the computer for three hours at a time; while one person runs his program, the others will work out or correct their programs. The instructor will, of course, be regularly available for guidance.

WHO SHOULD TAKE COURSE C12?

In a recent article in Computers and Automation, Swen Larsen, now president of Computer Age Industries Inc., said:

> "In many companies, the top operating executive --the one who makes the key decisions -- came into his position of responsibility before the computer revolution. Of all the men in an organization, he is probably the one in the greatest need of knowledge of the computer. Two computer experts describe the manager's plight in this way:
>
> > 'The executive is likely to be baffled, or confused, or snowed. He has confidence in his firm's EDP manager, but he doesn't understand the jargon that he hears, nor does he comprehend what can be effected from the tools he controls.'"

Course C12 is directed squarely towards these people and this problem.

WHAT TOPICS ARE INCLUDED IN COURSE C12?

- Fundamentals of Computing, and Orientation in Computers and Programming, with "hands-on-the-computer" experience in: how to compute; how to program; how to edit a program; how to assemble a program; how to debug a program
- Some Powerful Concepts in Programming
- Introduction to Programming Languages
- Basic Principles of Systems in Computer Applications
- Applications and Nonapplications of Computers
- Some Natural History of Mistakes, and How to Avoid Them

WHO IS THE INSTRUCTOR?

The instructor for this course is Edmund C. Berkeley, editor and publisher of Computers and Automation since 1951, and president of Berkeley Enterprises, Inc., since 1954. He has been in the computer field since 1939. He took part in building and operating the first automatic computers, the Mark I and II, at Harvard University in 1944-45; he is now implementing the programming language LISP for the DEC PDP-7 and PDP-9 computers.

Mr. Berkeley is: a founder of the Association for Computing Machinery, and its secretary from 1947-53; the author of eleven books on computers and related subjects; a Fellow of the Society of Actuaries; and an invited lecturer on computers in the United States, Canada, England, Japan, the Soviet Union, and Australia. He graduated from Harvard College in 1930, A. B. summa cum laude, having concentrated in mathematics.

WE BELIEVE

that the experience of:

- sitting at a computer;
- having the entire machine at your command;
- being able to look into any register you choose, to see just what information is there;
- experimenting first with simple programs, then with more complicated programs; and
- having someone at your elbow to answer questions when you are perplexed;

is one of the most exciting, interesting, and instructive experiences of the computer age.

This experience is, we think, part of the essential background of supervisory management. With such experience, supervisors of data processing departments and divisions are better able to:

- make reality-based appraisals of computing and data processing;
- form sensible judgments that are relatively independent of what the computer professionals in their groups may tell them;
- avoid commitment to unworkable proposals and costly errors.

If you are interested, or have questions, or are considering enrolling, write, wire, or telephone:

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(617) 332-5453

COMPUTER GRAPHICS IN ELECTRONIC CIRCUIT DESIGN

J. Robert Logan, Manager
Design Technology Dept.
Guidance and Control Systems Div.
Litton Systems, Inc.
Woodland Hills, Calif.

"Combination of computer generated routing and one to one plotting has cut the time needed to produce a reproducible circuit design from 24 days to 8½ hours, for a typical eight-layer laminate."

As large scale integration (LSI) continues to be a dominant factor in electronic circuit design, engineers find that they must rely more and more on high-speed computers to maintain the capacity design that is in keeping with LSI technology.

Computer-Assisted Engineering

LSI circuits have become so complex that the engineer no longer can take the time to concern himself with such details as component layout or routing of interconnections, particularly where multi-layer laminates are involved. He now must confine his attention to the creative aspects of the design, letting the computer fill in the details needed to optimize the physical circuit configuration.

Computer-assisted engineering is at its best, of course, when there is an interactive "partnership" of man and machine, with direct two-way communication taking place. For some time terminals with alphanumeric keyboards have provided the interface needed for direct solution of equations and other engineering problems. Until recently, there was no simple, effective way to define the graphic information important in circuit design, such as the gridded layout of a circuit board and its components, in terms that could be processed by a computer.

Now, however, man-to-machine communication of graphic design is possible through use of a cathode-ray tube (CRT) display unit. Here the engineer can actually "draw", move, erase or change images on the CRT screen by means of an electronic "light pen".

This display method is particularly valuable in defining the graphic portion of circuit designs utilizing LSI technology, where single modules or chips perform several logical functions. For example, an engineer can use the display terminal to define and position: chips; individual pins; pin patterns; obstacles; feed-thru points; and other physical features. The circuit board on a grid pattern is projected on the television-like screen. Once defined, such data can then be processed by the computer to route the interconnects so that cross-overs will not occur and so that all logical functions of the design will be performed with a minimum of modules.

The Cover Layer Automated Design Program (CLAD)

At the Guidance and Control Systems Division of Litton Systems, Inc., display unit, equipped with a 21-inch CRT screen, alphanumeric keyboard, special function keys, and a light-sensitive pen, is now essential hardware for the division's Cover Layer Automated Design Program (CLAD). The display unit is on-line with one of the several computers in the division data center. With the display unit, individual engineers use the CLAD program as an automatic, graphic method of defining the cover of a multi-layer laminate.

Once the cover layer is defined graphically in the computer, it is transcribed to magnetic tape. Thereupon it becomes input to another computer program called Design Automation Routing Tool (DART), which automatically routes the interconnects of the laminate.

Prior Program

The CLAD program has replaced manual coding and keypunching procedures previously employed to provide input for the routing program; it has brought about a major saving in engineering manhours. In the earlier version of DART the user first had to prepare a gridded layout containing all pin and chip locations, obstacles to routing, feed-thrus, external pins, etc., that would appear on the laminate cover layer; and all rows and columns of the grid pattern then had to be numbered so that a coordinate identity could be established for every grid cell.

The user then had to go through a seemingly endless procedure of filling out data forms used to keypunch the cards which put cover layer description into the computer. The program required the punching of separate cards to describe each pin pattern, and for the placement of each module on the grid. Additional cards also had to be prepared for program instruction, and to define and locate external pins, obstacles and feed-thrus.

Accuracy

Previously it would take at least 12 hours of an engineer's time to prepare the coding forms for keypunching. Now the entire cover layer description for a typical laminate involves an average of four hours' work at the display unit. In addition, errors that previously were made in coding and keypunching have been eliminated, because the engineer can now inspect his graphic data on the screen immediately after it is entered, and satisfy himself that it is accurate and acceptable. If it is not, with the light pen he simply erases an error and makes a corrected entry; he does not have to change any other graphic data on the screen.

After receiving instruction in the use of the graphic display and the CLAD program, engineers can schedule computer time and use the display unit to convert the graphic portion of a laminate design into machine readable data. At present, about one-fifth of the computer's core capacity is set aside for the CLAD program.

In a few days a college student can re-do the calculations that took this man a lifetime.

Albert Einstein had, perhaps, the greatest mind of our time.

But he didn't have something many college students now have.

A UNIVAC® real-time computer system.

With a UNIVAC computer system, an average college student can work out problems faster than any man ever could. Even faster than a genius like Einstein.

Scientific and mathematical experiments that were once much too exhausting, or altogether impossible to perform on campus, have now become possible because of computer technology.

Students and researchers can use UNIVAC computers to analyze and study biological experiments while the experiments are still in progress.

In graduate business schools students gain practical management experience by using computers to simulate actual business conditions.

Faculty members also benefit from on-campus computers. They can spend more time teaching and less time administrating.

Industry and government are other benefactors of on-campus computers. Advanced projects are now under way in the textile, petroleum, design engineering and medical fields, to name a few.

Univac is at work on campuses throughout the world in administration, research and education.

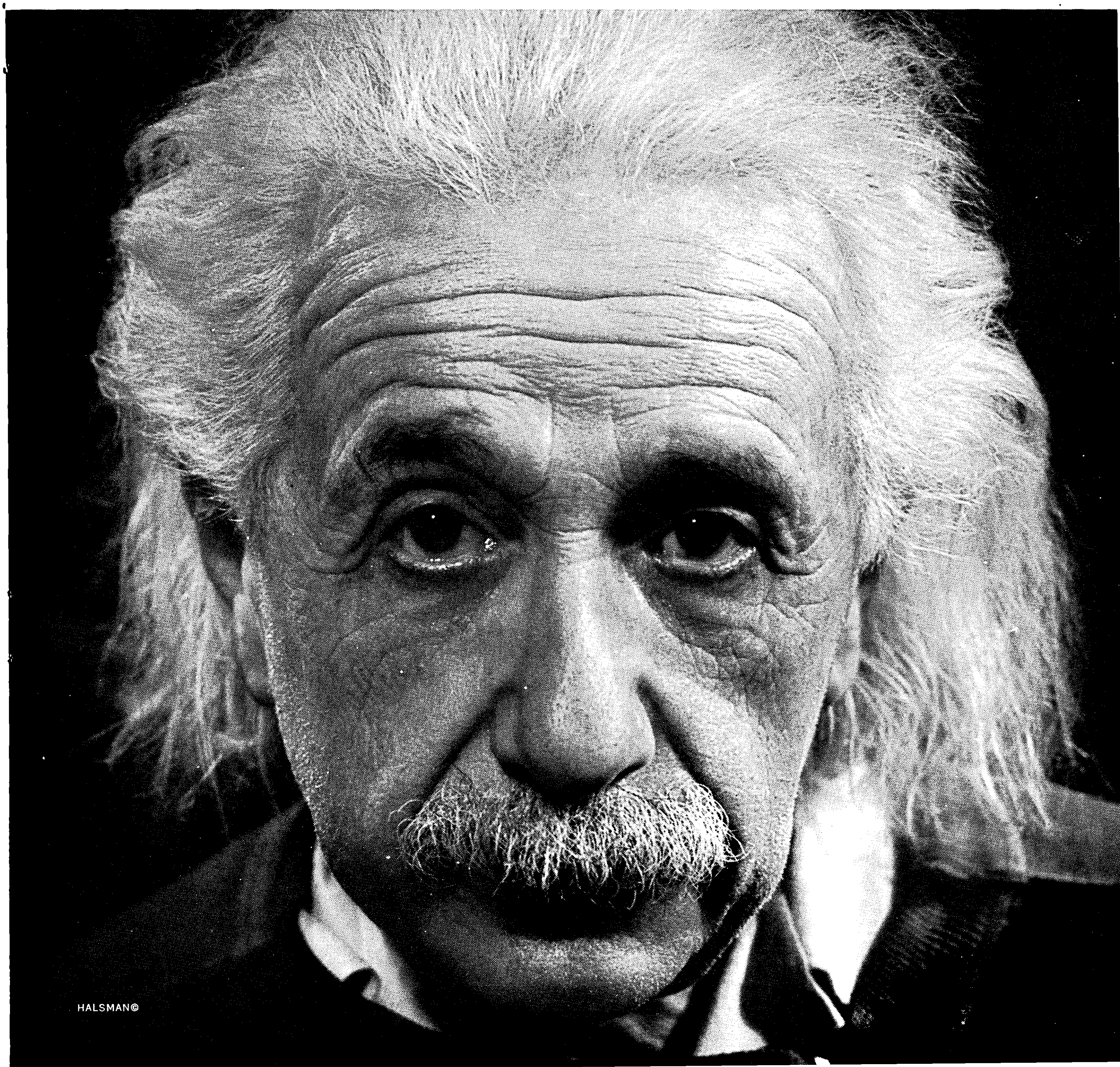
Can you imagine what the world would be like today if the University of Zurich had a computer, in 1904, when Einstein was a student.

UNIVAC

Univac is saving a lot of people a lot of time.

SPERRY RAND

Designate No. 8 on Reader Service Card



Locating Points on The Grid Pattern

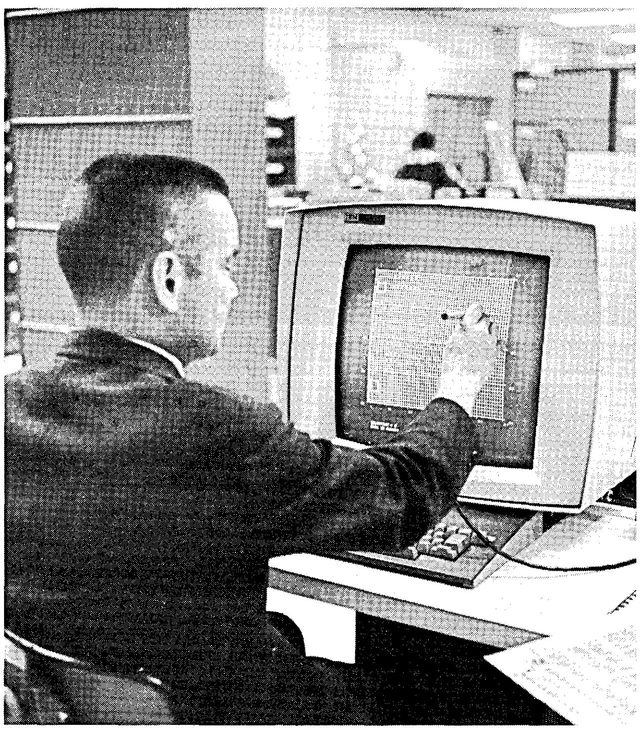
To define the cover layer of a laminate the engineer first activates the grid function key on the display unit. This calls in the grid pattern, which the computer selects from its magnetic disk storage system and projects on the 12 x 12 inch CRT screen. The CLAD program provides a 40 x 60 column grid section which contains from 1,000 to 1,500 usable positions or cells. The grid section can be set to any desired coordinates. By selecting the proper coordinates, the section can represent all or any portion of the total cover layer grid.

Guided by a layout sheet of the physical board, the user then uses the keyboard to enter the three-digit identity of each module or chip specified on the layout. Then by pointing the light pen at the correct cell on the grid and depressing the proper function key, the pin pattern and location of each chip on the grid is defined. Pin patterns and chips, which appear on the screen as symbols, can be repeated on the grid as many times as required, simply by repeating the light pen and function key routine.

cards which are input to another computer where the string list is generated and put on tape, also in the proper format for DART program input.

The DART program, which is run on this second computer, comprises several processing runs. The computer first associates the string list and CLAD laminate cover description to determine the coordinate assignment. It then determines the minimum number of interconnect trees needed, organizes the trees according to optimum distances and slope patterns, and then computes the actual routing, while assuring that no cross-overs will occur and that the interconnects described by the data are properly completed.

Finally, a plotting computation is made for each layer of the laminate and the data is put on magnetic tape. This tape becomes input to a precision plotter, where the actual interconnect routing for each layer is plotted one to one on a film negative by means of a light head, with the interconnect pattern recorded at the rate of 60 inches per minute. Film positives produced from the negatives are used as printing masks for actual production of the etched circuit laminate layers.



Using the light sensitive "pen", the user proceeds to define and locate pin patterns and modules on the grid section which is projected on the display terminal's television-like screen.

The film positive, made from the negative produced on the plotter, is used as the printing mask for the production of an etched circuit layer in a multi-layer laminate board.

Releasing Data to the Computer

Through proper use of the 32 function keys and light pen, pre-assigned connector pins and non-assigned external pins are located on the grid pattern, as are required feed-thrus and single-cell, vertical or horizontal obstacles. Chips can be moved from point to point on the grid at will, pin identification can be changed, and any symbol on the screen can be erased if necessary. Data can be released to the computer either upon completion of the CLAD program or at any time during the operation of the program. The cover layer data is stored on magnetic tape and is automatically updated in the proper format for use in the DART program.

Meanwhile, the logical functions of the circuit design have been mechanized, chip numbers and pin numbers are defined, and the interconnect data is transcribed to punch

Evaluation

Implementation of the two design automation programs has produced significant benefits. Man hours required for various production stages of the multi-layer laminates have been reduced, and engineering time has been saved through use of the display unit and CLAD.

For example, where it previously took an artist at least 24 working days to "tape" the interconnect pattern for a typical eight-layer laminate board, the same job now involves only about eight and a half hours, including computer routing and plotting of all eight layers. What's more, because the film mask is now plotted one to one and does not require photographic reduction, the one-week turnaround time, which was a major problem when manually produced drawings were used, has also been eliminated. ■

MACHINE-GENERATED SPEECH FOR USE WITH COMPUTERS, and the problem of fitting a spoken word into one half second

W. D. Van Gieson, Jr., and W. D. Chapman
IBM Corp.
Systems Development Div.
P.O. Box 12275
Research Triangle Park, N.C. 27709

"Machine-generated speech makes the computer available to countless numbers of people who never before have had access to the machine. Replies to routine requests for stock quotations, bank account balances, inventory status, or traffic routes and rates are now no farther away than a telephone call to a central computer."

A recent major step forward in computer technology has been the development of audio response units which assemble and transmit spoken messages in reply to queries keyed into a central computer over regular telephone facilities. The inquirer simply dials the computer's number on the telephone and then keys in his coded request on the parallel-tone attachment to his telephone. The computer extracts the required information from its storage files and codes a message which directs the audio response unit to transmit a sequence of spoken words answering the inquiry with the most recent data on hand. These words are drawn from a pre-recorded vocabulary stored in spoken form in the unit. Each vocabulary is created for the particular customer's application.

With this technique, the computer is now available to countless numbers of people who never before have had access to it. Applications of the audio response technique are almost unlimited, particularly in the world of business and industry. Replies to routine requests for stock quotations, bank account balances, inventory status, or traffic routes and rates, are now no farther away than a telephone call to a central computer.

The people making inquiries fall into two broad categories — those who are experienced listeners, and those who are not. A bank teller calling the computer is an experienced listener — he knows generally what to expect in the spoken reply from the audio response unit. On the other hand, a housewife dialing a neighbor whose telephone number has recently been changed is an inexperienced listener. She probably does not know or expect that a machine is providing the information needed to complete her call. The bank teller expects a machine response which is succinct and often rather cryptic. The housewife must be given a message that is natural and pleasant. Consequently, different kinds of audio response vocabularies must be created, depending on the use to which they will be put.

Since joining IBM in 1961, William D. Chapman has directed several projects in speech processing, including automatic speech recognition, speaker verification, and output of speech by a computer. He received the B.S.E. and M.S.E. degrees in electrical engineering and the M.S. degree in communications sciences, all from the University of Michigan, Ann Arbor. He is a member of the Acoustical Society of America, the Audio Engineering Society, the Linguistic Society of America, and the IEEE.

The Characteristics of Human Speech

In order to understand the techniques currently being used to create machine-generated speech, it is first necessary to review a few facts about some of the characteristics of human speech.

A speaker of English creates speech by using various combinations of about forty classes of sounds called *phonemes.* A phoneme can be defined as the smallest contrastive — or meaningful — unit in the sound system of a language. The sounds "t" and "d" in *tin* and *din,* for example, distinguish the two words. The vowels in *tan* and *ten* operate similarly to differentiate meaning. Thus, words are created by generating proper sequences of the various phonemes.

Spoken messages are made of sequences of sounds which, unlike printed words, are continuous and thus may blend together. That is, the words in a message typically are not

Walter D. Van Gieson, Jr. has been working in digital data transmission, audio response, speech analysis, and pattern recognition at IBM Corp. for nine years. He holds a B.E.E. from Manhattan College, and is a New York State Professional Engineer. Before joining IBM, he worked in the development of audio and video studio equipment for eleven years at RCA.

separated one from another as they are on the printed page. For example, a spoken message, such as "The number you have called is out of service," may not have appreciable separation beween words.

Speech is highly redundant in that most words contain sound segments or segments of silence which can be eliminated without affecting intelligibility. If the word "delinquent" is spoken slowly, for example, an instant of silence may be noticed as occurring between the "n" and "q" sounds. Such speech can be masked, filtered, or chopped in various ways and still remain highly intelligible.

Techniques for Producing Machine-Generated Speech

Several techniques have been devised to produce machine-generated speech. Truly synthetic speech, where the input has not been taken from human speech, has been created with fair success in the laboratory by working at the phoneme level. That is, a library of the speech sounds or phonemes has been established, and then the sounds have been properly sequenced to create the spoken words.

Other synthesis techniques have successfully extracted key information from recordings of human speech and have used this information to regenerate spoken messages. Here the system takes full advantage of the fact that human speech is highly redundant.

Another method is to maintain almost all the information in the speech signal by storing the signal from a human speaker where it can be economically accessed by the computer. The task of furnishing intonation, inflection, and pitch is determined by the speaker who makes the initial recording.

An audio response unit at the Systems Development Div. of IBM in Raleigh, N.C., employs this technique. The device stores up to 128 words on a pre-recorded magnetic drum that rotates once every half second (500 milliseconds). Each word is stored on one narrow track around the drum. The proper words for a response are electronically selected and sequenced, as directed by the computer, for transmission to the user over telephone facilities.

Creating Vocabularies

Vocabularies for this audio response unit are created by first having a professional elocutionist record the words individually and out of context in a rigorously controlled recording environment. The speaker is instructed to speak quickly and clearly with a very slightly rising pitch. Each word is spoken several times with a brief pause between repetitions to obtain a variety of samples from which a "best" utterance may be selected.

When a recording has been made, it is processed by technicians who select one of the utterances of each word, adjust it for the proper duration, and add the words to an ever-growing library of processed words.

Each discrete word to be used with the audio response unit must be less than 500 milliseconds or one half second in length. This time interval is long enough to include most monosyllables and some polysyllabic words. However, approximately 30 percent of the words as initially recorded are longer than 500 milliseconds and must be compressed in order to fit a single revolution of the drum.

Compressing Speech

Time compression of speech is possible because, in a given word, there are likely to be redundant segments which can be partially removed. Experience has shown that in a number of phonetic environments, substantial time segments may be removed without any apparent change in the pace of the word or in its intelligibility. Some of these environments and examples of them are as follows:

- The end of an unstressed vowel at the end of a word — alph*a*.
- The beginning of a nasal at the beginning of a word — *n*ine.
- Up to half of the gap of a stop consonant — sus*p*end.
- Up to one-third of a voiceless fricative — *s*ix.
- Up to one-quarter of long-duration diphthongs — l*i*ne.
- Up to one-third of short-duration vowels — *e*dit.

Device for Compression

The process of time compression is accomplished with a device known as a Speech Analog Compression and Editing Loop, or SPACELOOP.[1] It is essentially a highly sophisticated two-channel tape recorder which makes possible the storage of a spoken word on a tape loop for repeated examination and for extraction of time segments from any word too long for the half-second time slot on the drum.

Mechanically, the SPACELOOP consists of a 100-inch magnetic tape loop, a three-speed drive assembly, and ten magnetic heads (see Figure 1). Two of the heads — one erase and one record/playback — are mounted to operate on the upper track of the 1/4-inch tape and are used for timing information. The remaining eight heads operate on the lower, or audio, track. Six are used for playback alone, one for both recording and playback, and one for erase. The seven heads used for playback are mounted on sliders on a 20-inch track so that they can be moved and positioned at various points on the track.

Electrically, the SPACELOOP includes the circuitry for performing the obvious operations of recording and erasing, as well as that of playing back the signal from the loop using the seven movable playback heads, one by one, in a controllable sequence. It is these movable heads that constitute the unique characteristic of SPACELOOP, because, by moving them on the slider, the operator is able to remove very short time segments from a word.

When words in a vocabulary are being processed, the operator first listens to each of the several utterances of a given word in the original recording. After selecting the word that sounds best for clarity and completeness, he transfers the word to the SPACELOOP tape and plays it back. In order to determine whether the word requires compression, he examines visually the amplitude waveform of the word on a storage oscilloscope whose sweep is synchronized with the revolution of the SPACELOOP tape.

The oscilloscope time axis is calibrated with the total sweep duration equalling the 500 msec into which the word must fit. If the waveform extends beyond the time limits, the operator can observe the character of the amplitude waveform and can determine roughly the location of certain phonetic environments (such as those in the foregoing list) where deletions of minute time segments can be made.

The Extraction Process

The extraction process operates as follows:[2] After a word has been recorded on the tape loop, it may be reproduced by amplifying the signal from any one of the seven playback heads. The heads all reproduce the same signal, but at different times, the delay being proportional to the distance between the heads. On the SPACELOOP, the heads are numbered one through seven, beginning with the head which the signal passes last. When a word must be compressed, the operation is initiated by reproducing from Head #1 until a point is reached in the utterance where the beginning of a deletion is to occur. At this moment, the reproduce amplifier is switched rapidly from Head #1 to Head #2,

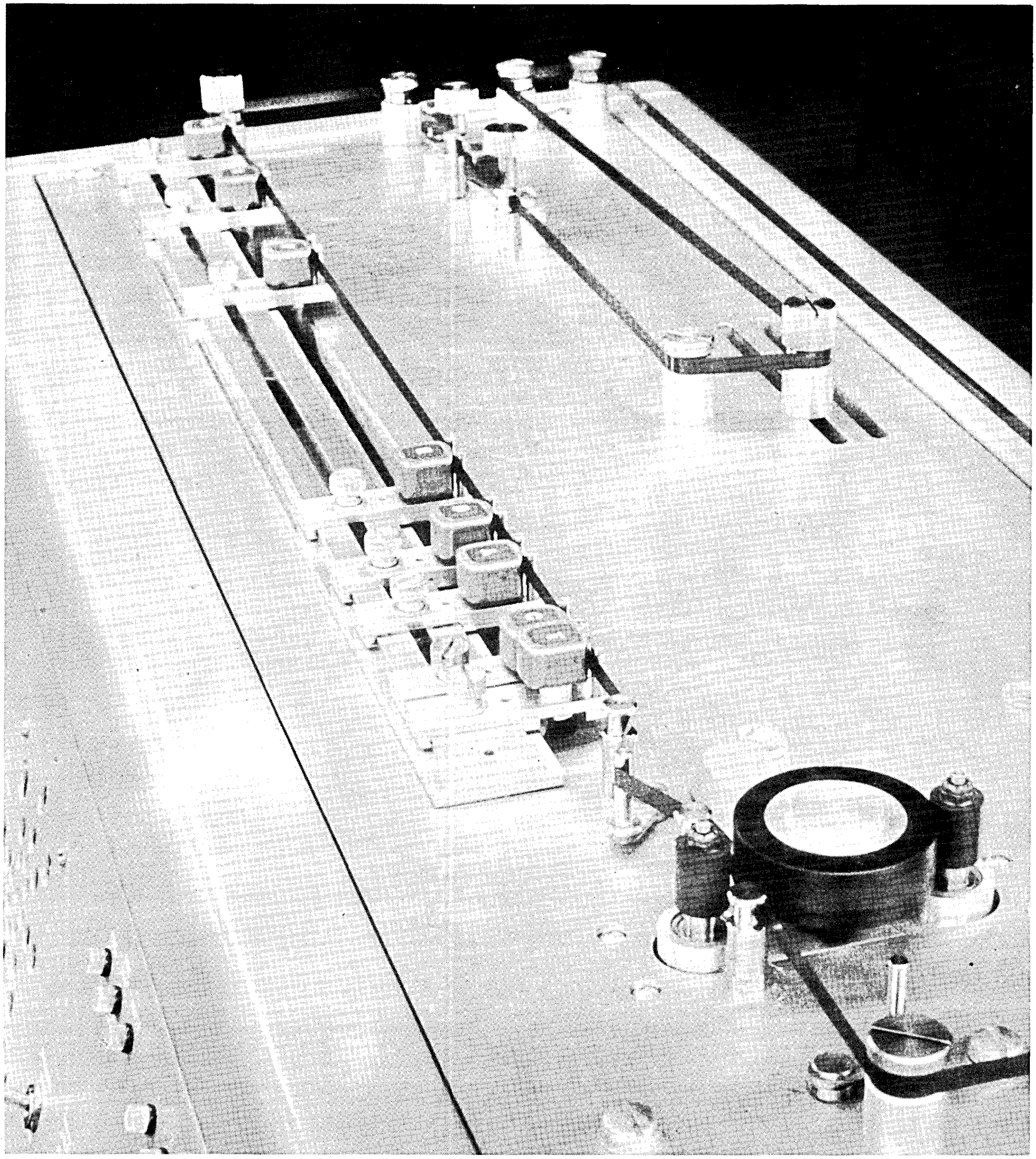


Figure 1

SPACELOOP showing the movable heads.

thereby skipping over and thus omitting the portion of the word between those two heads at the instant of switching. The deletion consists of the part of the sound signal that has passed Head #2 but has not yet reached Head #1. Reproduction continues from Head #2 until the beginning of a second deletion is desired. The amplifier is then switched to Head #3, and the portion of the word between Heads #2 and #3 is removed. The process is repeated until the desired number of time segments have been deleted.

For a given compression task, the tape velocity is held constant, so that the length of a deletion period is controlled only by the distance between the heads. The usual tape velocity is 100 inches per second, and the total length of the tape is 100 inches. Thus the tape rotates its full length in one second. At this velocity, one inch of tape is equivalent to 10 milliseconds of time in the recording. For example, if the spacing between two of the movable heads is 3.3 inches, then 33 milliseconds of the original word will be skipped in the switching process. Since the track upon which the movable heads are mounted is 20 inches long, up to a cumulative total of 200 milliseconds may be removed from an utterance in from one to six deletions.

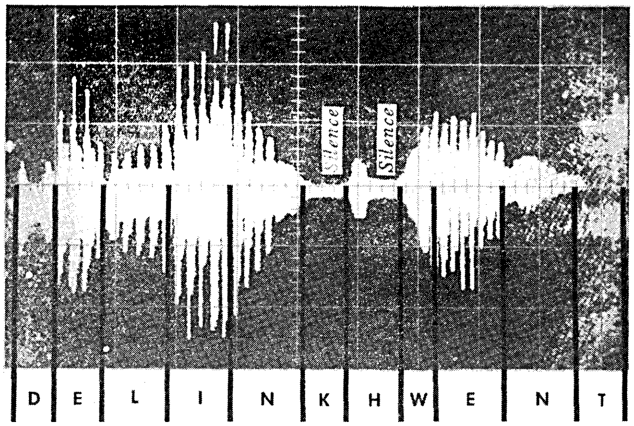


Figure 2
Before Deletion Operation Begins.

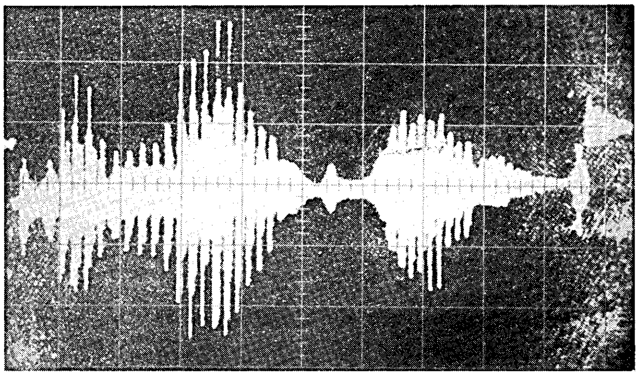


Figure 3
After Deletion of 15 msec from the K stop-consonant.

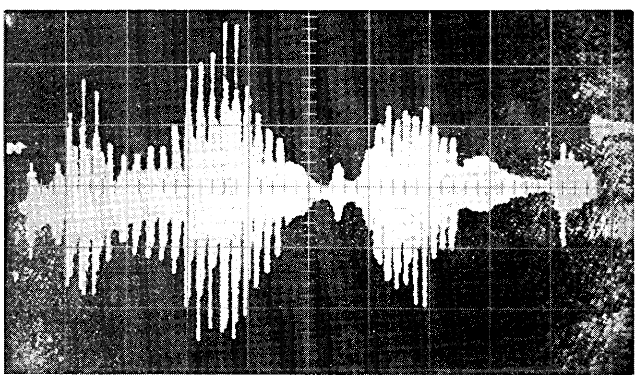


Figure 4
After Deletion of 10 msec from the H sound.

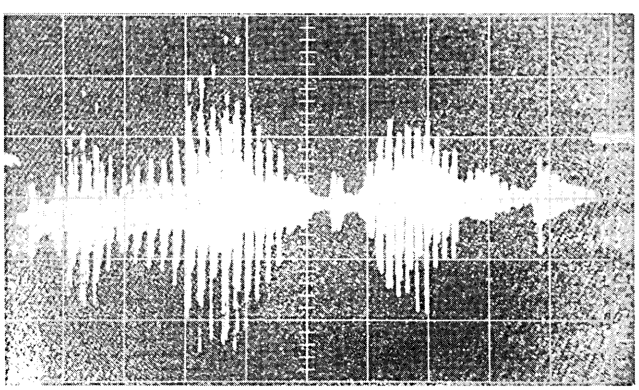


Figure 5
DELINQUENT in Final Form after removal of 10 ms before the burst of the T stop-consonant.

Where and How To Compress a Word

By observing the waveform of a word on the oscilloscope and by listening to it over a loud speaker, the operator can determine how much compression is required and the locations in the word where compression is possible. He can then adjust the distance between the heads to skip portions of the word at the appropriate spots.

Figures 2-5 show a sequence of photographs of the oscilloscope made during the compression of the word DELINQUENT. (If the word is spelled in a pseudo-phonetic fashion as DELINKHWENT-H, the deletion environments are perhaps more readily observable. The two H's in this spelling represent the two momentary aspirations after the K and the final T.) Three deletions were made, one after the other, to remove a total of 35 milliseconds from the word.

Before storing the word as in Figure 2, the operator has adjusted the oscilloscope sweep rate to a total length of one second in order to inspect the word in a half-second window in the center of the screen. He has seen that the word exceeds the limit of the half-second window to the extent that the T is completely outside. Thus, in Figure 2, it is not on the screen at all.

Figure 2 shows the word as the operator sees it prior to the first deletion. The vertical lines mark roughly the limits in time along the waveform during which each sound in the word is being uttered. Two spelling peculiarities should be noted here. Because of the presence of the Q sound, the syllable preceding it, while spelled IN, actually has the sound of ING. Secondly, because Q is always followed by U in English, the two letters have the sound of a K followed by a W. Furthermore, the Q here in the context of the word includes two moments of silence, one before and one after the voicing of the letter, as indicated.

For the first deletion, the operator elects to remove a time segment from the moment of silence of the K stop-consonant. He adjusts the heads to remove 15 msec, and the word appears as in Figure 3. The moment of silence before the plosive has been appreciably shortened.

The next step deletes 10 msec from the first aspiration, or H-sound, and the word appears as in Figure 4. Figure 4 shows that the T is beginning to appear on the oscilloscope at the right. The final deletion will occur in a segment of silence before the burst of the T stop-consonant.

Figure 5 shows the word in its final form. The three deletions have shortened the word sufficiently that the T is now within the 500-msec limit.

Intelligibility of the Compressed Word

All words processed by the SPACELOOP are tested for intelligibility. For such testing, the audio response unit is attached to a computer, and the words are transmitted over regular telephone facilities to the listeners, each of whom uses a standard telephone handset. In the test, the modified words are presented in typical message contexts. If a word passes the test, it becomes part of a permanent library of words from which vocabularies for individual computer applications can be drawn.

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[1]W. D. Chapman, "Speech Compression by Tape Loop and by Computer," *Proceedings of the Louisville Conference of Time-Compressed Speech,* University of Louisville, Louisville, Kentucky, May 1967.

[2]David H. Beetle, Jr., and W. D. Chapman, "Flexible Analog Time-Compression of Short Utterances," *IEEE Transactions on Audio and Electroacoustics,* Vol. AU-16, No. 1, March 1968, pp. 12-20. ■

MICROFILM COMBINED WITH COMPUTER FOR INFORMATION HANDLING

George H. Harmon
Manager, Information Systems
Information International Inc.
545 Technology Square
Cambridge, Mass. 02139

"The effect of combining microfilm and the computer in a system for information handling may turn out to be more dramatic than the effect of either alone."

Microfilm has been utilized for 40 years. The computer has been used for nearly 25 years. The combining of the two in a system for information handling is much more recent, and its effect may turn out to be more dramatic than the effect of either alone.

Microfilm is defined as a fine-grain, high-resolution film containing an image which is greatly reduced in size from the original image. The original is normally inferred to be data, text, or graphics. Microfilm comes in varied forms — rolls, sheets (sometimes with multiple images), or chips (sometimes mounted in an aperture cut in a punch card). There are various sizes. Rolls and chips are usually 16 mm, 35 mm, 70 mm or 105 mm. Sheets are standardized up to 3.25 inches by 7.375 inches.

Passive and Active Handling of Information

Microfilm is a passive tool for handling information. It can store large quantities of information in a small amount of space. It can then be transferred to nearly any remote location. There the images can be enlarged to make the information usable. The enlargement can be on the screen of a viewing device or may be a paper reproduction.

The computer differs from microfilm in that it is an active tool for handling information. It can convert, reconstruct and even generate information. Data can be coded in a computer language and stored in a memory unit. The data can then be interrelated such that new data is created. This converting, compiling, reconstructing, and problem solving is accomplished at high speed. The resulting new information can be reconverted from its coded form to a more usable form for human beings. The output can be printed characters or a cathode ray tube image. It can also be electrical impulses for magnetic recording or for remote transmission using communication facilities.

Microfilm has certain advantages for handling information. Equipment for generating microfilm is relatively inexpensive, and is easily operated by inexperienced personnel. Exceedingly high density storage is realizable at a low cost. The information can be cheaply transported to nearly any remote location. Small inexpensive equipment can convert the information to a usable form.

Advantages of the computer are different. It can handle information at very high speed. It can interrelate data, and thus generate information. It can sort information and transform it for exceedingly fast transmission to a remote location.

Microfilming Computer Output

The problem we have been studying is how to combine these two systems into the best method for handling information. When one considers combining more than one function or procedure, it is normal to simply follow one function by the other. This is what first took place when seeking to obtain the advantages of both the computer and microfilm.

A common output of the computer is printing on paper, and large amounts of printed paper can be created in a very short time. Much of this output is used only as reference information, and in many instances the quantity of printed paper resulted in severe problems of storage and retrieval. This paper output was microfilmed. Space requirements were reduced and information retrieval time was decreased.

Engineering Lists

One large company put this technique to full advantage. Many of the engineering drawings used by the company were list-type drawings (parts lists, wiring lists, etc.), and required extensive drafting department effort to create and update. The information was placed in a computer and the print-out was then pasted on a format sheet. This equivalent drawing was then microfilmed.

To increase the effectiveness of combining the computer with microfilm, automatic machines have been designed to receive unburst computer print-out and simultaneously microfilm the information. Since an image could be placed on a cathode ray tube for display, the image could be photographed directly and thus avoid the print-out operation and save the paper supplies. Automatic control of the filming resulted in much higher speed production than normal print-out; this showed that the film recorder was a most effective computer output device.

Computer-Generated Graphics

The ability to generate an image on a cathode ray tube and then photograph it to make a microfilm encouraged development effort in computer-generated graphics. Since a computer can be programmed to generate the lines, arcs, and characters required on engineering or architectural drawings, programs were created, and line generators, vector generators and character generators were designed. This resulted in extremely high speed production of graphics.

Complex Formats

Along with the creation of characters and line work came the creation of complex formats. Simple formats such as lines and column headings for tabular listed data have been used to make a more usable print-out from computers. With the microfilming of graphic presentations on the cathode ray tube, complete replacement of existing forms was possible. This allowed the same degree of control as was possible with manual transcribing on forms. The format can easily be changed by inserting a new program. Once a general form is created, it is a relatively simple job for a programmer to alter a part of that form. This should be contrasted with the usual procedures for changing a form: redrawing the form; having it reproduced and checked; and then printing the form in large quantities. This means obvious savings in having the computer generate the form.

Programmable Film Readers

Film and the computer can interface in another manner. The information that is on film can be scanned and digitized for computer handling; then the computer can interpret the information via a program. Recognition by the computer program of the patterns and characters can compress the amount of information and permit faster transmission to remote locations.

Combining the reading of film and interpreting with a remote recorder can even act as remote reproduction. Two approaches have been made to reading the film. The flying-spot scanner reads every point on the film and determines which points include the information. A programmable film reader will locate and read only the information. This means that less time is taken and less storage required for a given document. Programmable film readers can read any microfilm made according to Dept. of Defense specifications for engineering drawings that are made in keeping with the latest recommended drafting standards.

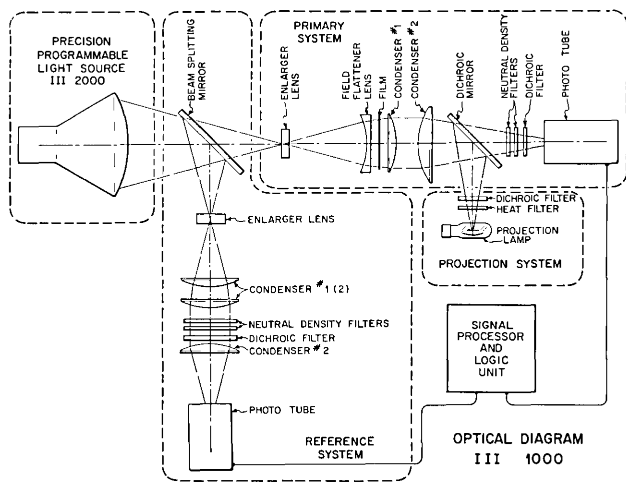


Figure 1

A block diagram of a Programmable Film Reader.

A block diagram of a Programmable Film Reader is shown in Figure 1. The following is the process for film reading:

1. A source of light is produced at a programmed x-y location on the face of the cathode ray tube.
2. Light from this spot is divided into two beams.
3. One beam passes through a lens, and is focused on the film to be read, on a corresponding specified location.
4. Light transmitted through the film at this location goes through a collector lens, is defocused, and is sensed on the cathode of a photomultiplier tube.
5. The other beam, for comparison purposes, passes through a second lens along a different path, which does not include the film being read, but instead is sensed on the cathode of a second photomultiplier.
6. The two signals are passed through a difference amplifier and a density comparison or density measurement is made.
7. The results are evaluated by the film reading program and the x-y location of the next light point is determined accordingly.

Enhancement of Engineering Drawings

The ability to read microfilm information and store it in a computer, combined with the ability to modify information by computer programming, has made it possible to enhance engineering drawings. A drawing which is damaged or worn and no longer able to produce good microfilm can be improved enough by these computer methods to create a satisfactory microfilm. Recording on the microfilm is made with high contrast between line work and background. This allows very good reproductions from the microfilm.

Substantial Savings

Microfilm has combined with the computer in several ways. It has copied the paper print-out; it has recorded directly the output; and it has been used as the input to the computer. Developments are underway to utilize it as a memory. Each combination has produced substantial savings; and it is reasonable to expect that future combinations will produce additional marked savings. ■

C:A WORLDWIDE

REPORT FROM GREAT BRITAIN

General Electric/English Electric Merger in the Wind

It is always dangerous to prophesy when merger battles are raging. However, at the risk of having to retract next month, it does seem likely at the moment that the moves to combine Britain's General Electric and English Electric companies into a giant among European industrial concerns will succeed, as both Government and the Industrial Reorganisation Corporation wish them to.

Should this indeed be the case, despite the bitter opposition of the components-to-agricultural hydraulics group, Plessey, (who started all this buzz two weeks back by a surprise bid for English Electric) there would be formed among other things an exceedingly experienced group in industrial and military real-time control systems. Some assessments put them well ahead of General Electric (USA) with an estimated total of over 450 installations, which would be 125 more than the latter. This would include a good number of machines for unspecified defence applications, however, believed to involve quite small computers with rather limited programs.

The GEC/EE automation empire would embrace the former activities of English Electric, Elliott-Automation, Associated Electrical Industries, Marconi and General Electric. It would, whatever rationalisation moves were made, still demand the maintenance of a whole gamut of equipment including TRW designs, SDS machines, the 4000 Con Pac range from AEI which are GE(USA) licenced, Marconi Myriads, a series of seven or eight different models from the English Electric stables and the multitude of machines from Elliott designed either for military or for industrial work.

Nor can this maintenance effort be simplified for some time since the merged companies would have something like 500 to 600 machines on their order books — many small military units — but still representing five totally different developments with complex software requirements. The protagonists of the merger have been talking with tears in their voices about the great "breadth of experience" the automation section would have.

It is to be hoped the experience will teach it to do just what American management would be most likely to push through if it inherited a "rag-bag" of these dimensions — go for a single range and offer users of antique models replacements from this range as soon as decency permitted. Unfortunately it is a devastating British characteristic to "make do" for as long as possible — indeed I was once told with great pride by a senior executive of Associated Electrical Industries that his apprentices had just hand-made a spare part for an electric motor the company had exported to India some twenty years or more earlier. It would just not have been possible in a U.S. plant even to find a blueprint that old!

Post Office Orders Machines Designed 6 Years Ago

Be that as it may, the same hanging on to outmoded equipment is not doing the new single business and scientific computer group, International Computers, much good. It has several orders for very large 4th generation machines using emitter-coupled logic circuits to achieve fantastic speeds. But there are at least six and more probably twelve installations in the $10m class which could be junked here and now and improve U.K. computing beyond all recognition. At the same time, and this is almost unbelievable, the Post Office has ordered two Leo 326 machines (probably designed all of 6 years ago) one for delivery in November 1969 and one for Spring 1970. They ultimately will take over all 22 million Post Office Savings Bank accounts — but heavens!, must they specify such an old machine?

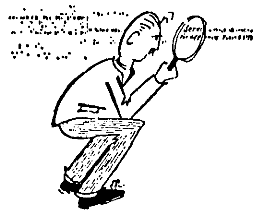
Challenge to ICL

The writing is on the wall for the Government to see. Service in Informatics and Analysis (SIA) of the international Metra group has just staged the official opening of its London centre based on a CDC 6600. University Computing Company (Great Britain), wholly-owned subsidiary of America's UCC, is adding a Univac 1108 to the 1107 which has been carrying out contract computing for four years. What is more, this very large 1108 configuration will, by the end of the year, have among other remote terminals in Britain and Europe such machines as Honeywell 200's, GE-400's and IBM 1130's. No British bureaus can offer machines of the work-crunching capacities of the 6600 or the 1108, except the former CEIR organisation now known as Scientific Computing Systems, which is also an 1108 user.

It is urgent and imperative that the Government and ICL meet this challenge because it can inhibit large companies from spending what they should on really big systems and it can inhibit smaller organisations from enhancing or replacing computers which are being overwhelmed by work — the solution being to run a line to the nearest computer utility. ■

Ted Schoeters
Stanmore, Middlesex
England

C.a



JOBS AND CAREERS IN DATA PROCESSING

Computer Training for the Disadvantaged

Sharry Langdale
Associate Editor

Two concurrent events in Los Angeles in late September drew attention to the potentially powerful role the computer industry can play in helping our underprivileged citizens.

At the dedication of RCA's new Information Systems Center in Los Angeles, the president and chief executive officer of RCA, Robert W. Sarnoff, declared:

> The computer industry holds greater promise than any other for helping to upgrade the skills and earning power of those who now lack both. Those seeking employment in the computer industry will find no preconceptions or insurmountable barriers to be overcome. Computer skills are now being taught not only to high school and college students, but also to youngsters in reform school, adults in prison, and underprivileged residents of the urban ghetto. It is truly a field of equal employment opportunity.

At the same time, in another part of the city, Mr. Sarnoff's comments were being enacted. The Greater Los Angeles Urban League, the Bank of America Foundation, and International Business Machines Corporation had joined together to establish a training center to provide data processing instruction for disadvantaged residents of Los Angeles. The Data Processing Training Center is located in a former Bank of America data processing facility which was renovated for the project at 7226 Figueroa St.

Dr. Frank L. Stanley, Jr., executive director of the Greater Los Angeles Urban League, describes the Center as follows:

> The fundamental reason for the Center and its training programs is to qualify disadvantaged residents for employment in a rapidly growing area of opportunity. Only the most needy, who otherwise could not afford such training, will be eligible for the program.

During its first six months of operation, the Center expects to train 50 people and help place them in jobs. When the project is fully developed, plans are to train a minimum of 250 people a year.

The Center's first class had 12 students enrolled to learn to use keypunch machines. In this three-week course, students learned how to operate the keypunch as well as the verifier, to check the punch cards for computers and other data processing equipment.

The Center will also conduct operator and programming classes. The six-week computer operator course will be offered to 12 students at a time; the 12-week programming classes will be offered to 16 students at a time.

All classes will be taught on the basis that the students will have had no previous knowledge of the subject, with the exception of the keypunch course which requires basic typing skills. Class schedules will closely match the hours of a regular, full-time job. Except for reviewing course material outside of normal class hours, little homework will be required.

The responsibilities of the Urban League include: (1) selection of candidates for training; (2) counseling and administrative services; and (3) job placement for Center graduates. The Bank of America Foundation has provided the facilities for the Center and underwritten the expenses of maintaining the building. IBM has supplied the Center's data processing equipment and course materials, and will also provide four instructors.

Equipment includes an IBM computer system with a card read punch, a printer, tape and disk drives, and control units. Sixteen other machines used in data processing operations — 13 keypunches, a verifier, a sorter and a collator — will also be available to the students.

The three participating organizations hope eventually to make the Center self-sustaining. The Urban League plans to assume the primary instruction requirements, using some of the Center's own graduates, by the end of the project's first year.

From another corner of the computer world we are reminded of the significance of these events. Stephen F. Keating, President of Honeywell, Inc., Minneapolis, Minn. (in this column in our April 1968 issue) summed up the problem this way:

> The electronics industry has consistently outrun its forecasts. Its continued expansion, and that of the rest of business, will require an expanded work force. In fact, the supply of capable, trained people may be the limiting factor in our industrial growth rate. And here it is important to understand that the profit motive of our free enterprise system and the social objectives of government are parallel.
>
> With jobs available, it appears that our social efforts should be directed not toward making work, but toward making *workers* who can take advantage of productive job openings. Government and social agencies can be instrumental in accomplishing this task. But industry, too, should seek the opportunity to become a partner in the search for answers to our urban problems. Businessmen must recognize the job as part of their responsibility — to their companies and to their society. ■

c.a

COMPUTER MARKET REPORT

In the Background . . . Government Procurement Policies, a Computerized Stock Exchange, Continued Sales, and Research for the "Fifth" Generation

Ted Schoeters
Stanmore
Middlesex, England

Although the tussle over the famous Air Force Phase II program (in which Honeywell bitterly protested against the award of the contract to IBM for well over $100m, whereupon the Burroughs bid for far less was accepted) is history, the echoes it aroused still rumble around Congress. A Senate sub-committee has promised further hearings next year when the 91st Congress convenes in January, which may well probe some tender meat.

Probe into Government Procurement Practices Continues

The group has been taking a general look at the whole problem of competition in Government procurement, and it contains some forthright critics of Pentagon procurement methods. It is the Subcommittee on Antitrust and Monopoly Legislation under the chairmanship of Senator Philip A. Hart (D. Mich.).

When it meets again, it is likely to take a look at separate pricing for hardware and software in such major bids. It could also study the proposal put forward by the pressure group of the peripherals industry that standard interfaces for such defense equipment should be developed so that peripheral makers would not be automatically excluded. It is not out of the realm of possibility that at some time in the future an organization with particular expertise in the establishment of big data networks could bid successfully on a large order of the Phase II type using its systems ability as a trump card and employing even the largest hardware manufacturers simply as sub-contractors. Many contracts for complex military systems are already being managed by groups which were originally not computer manufacturers or, at least, have not produced computers other than tailor-made, special purpose equipment. The Hughes involvement in the vast NADGE defense complex of radar, communication, message switching, and computer-controlled evaluation and display for the North Atlantic Treaty Organization is a case in point.

It is true that the computing side here is relatively small, but as computer hardware grows toward a common standard and more and more work is done by central shared systems, the likelihood that the big common carriers, aviation companies and the like will become more involved in an area previously considered the preserve of the largest computer hardware companies must also grow.

The thought behind the Senate Sub-Committee's actions is clear, but even more obvious is the merit of a related move affecting every Defense Department contractor: the passing by the Senate of an amendment to the Truth in Negotiations Act which would give authority to DOD auditors to examine the financial books, records and documents of contractors and sub-contractors, even up to three years after final payment on a contract has been made.

Overpricing May Have Cost Taxpayers $130m

Senator Stephen M. Young (D-Ohio) made the understatement of the year during the hearings when he observed that "Failure in the past to enforce this act caused overpricing of defense contracts and resulted in taxpayers being overcharged millions of dollars. The exact amount has not and *probably cannot* be measured". He qualified this by the statement that, nevertheless, the Comptroller General, after "minimal spot checking", reported that there had been overpricing . . . presumably on military work . . . of more than $130m over a ten-year period.

Cases publicized in Britain during the last ten years amount to, say, $30m and those not or not yet publicized to perhaps $100m, depending on whether one blames politicians for not doing their homework, military strategists for being ten years behind the times, or manufacturers for making hay while the sun shines. These figures would add up to quite a sizeable sum for the U.K., which suggests that had the Comptroller General in the U.S. looked just a little closer, his estimate might have been ten times larger.

Computerized Stock Exchange

Before the end of this year, the New York Stock Exchange expects to have fully operational a computerized system which will greatly simplify the accounting tasks of the brokers both as regards transactions on the floor of the Exchange and over-the-counter trading. The system involves comparison by computer of reports of sales and purchases by member firms to confirm the transactions in detail. The Exchange is progressively working through the alphabetical list of the many corporate bonds traded there. The system will thus gradually take over from manual operations at individual brokers' premises.

Also aimed at a considerable cut in the paperwork, which passes through brokers' hands far too slowly for modern methods of stock dealings, is the "fail clearance" operation which has been tried and tested and will in the future be run three or four times a year. This will keep down the backlog of transactions which are overdue for settlement. Under the system, information on the deals which member firms have failed to complete in the specified settlement period will be fed into the Stock Clearing Corporation on the Exchange.

The computers are programmed in this instance to cut out intermediate transactions and the corresponding deliveries. Any money differences resulting from transactions will be settled through SCC.

Univac's Continued Success

Univac's 1108 design has been doing particularly well in recent months, both in and outside the United States. Already a favored design in France, where the State railways and a number of other official organizations are 1108 partisans, a further prize has been secured — a $7m one — from the Department of Defense which will set up large configurations at the Fort de Montrouge military scientific and computing center in Auteuil, Paris. UCC (Great Britain) will be ceremonially opening its own 1108 center in London during November, while Scientific Computing Systems is running in another major system based on this processor, also chosen by two major petroleum groups in Britain.

Parallel to this activity, in the United States, Univac is equipping the computer utilities of UCC and Computer Sciences Corporation, which by the end of 1970 may have altogether as many as forty of these well-proven machines worth a total of $100m.

RCA Looks To "Fifth" Generation

While third generation computing is about getting into its stride, Radio Corporation of America has twitched aside the curtain over what the future has in store — possibly — for fifth generation computers. Advanced work in the Data Processing Research sector of its Princeton Laboratories has been concentrated on ultra-fast switching by laser devices. So far it has been found quite feasible to operate a semiconductor laser inverter at speeds suggesting that it could lead to the development of transmission equipment able to transfer data at a rate of a million million binary digits a second.

Before the development can progress from the state of little more than a laboratory curiosity, however, the solid state physics experts will have to improve semiconductor fabrication techniques quite considerably. But the prize offered by success in the design of a computer operating on laser pulses rather than electronic pulses is the important one that switching is very much faster and that light signals are not subject to the inductance and capacitance effects experienced with electronic circuitry.

The research work at RCA on laser logic is in the hands of Dr. Walter F. Kosoncky and Roy H. Cornely. The project has attracted support from the Rome Air Development Center of the U.S. Air Force Systems Command. ■

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c.a PROOF GOOFS

Neil Macdonald
Assistant Editor

We print here actual proofreading errors in context as found in actual books; we print them concealed, as puzzles or problems. The correction that we think should have been made will be published in our next issue.

If you wish, send us a postcard stating what you think the correction should be.

We invite our readers to send in actual proofreading errors they find in books (not newspapers or magazines). Please send us: (1) the context for at least twenty lines before the error, then the error itself, then the context for at least twenty lines after the error; (2) the full citation of the book including edition and page of the error (for verification); and (3) on a separate sheet the correction that you propose.

We also invite discussion from our readers of how catching of proofreading errors could be practically programmed on a computer.

For more comment on this subject, see the editorial in the September 1968 issue of *Computers and Automation.*

Proof Goof 6811

Find one proofreading error:

NOD
by Walter De La Mare

Softly along the road of evening,
  In a twilight dim with rose,
Wrinkled with age, and drenched with dew
  Old Nod, the shepherd, goes.

His drowsy flock streams on before him,
  Their fleeces charged with gold,
To where the sun's last beam leans low
  On Nod the shepherd's fold.

The hedge is quick and green with briar,
  From their sand the conies creep;
And all the birds that fly in heaven
  Flock singing home to sleep.

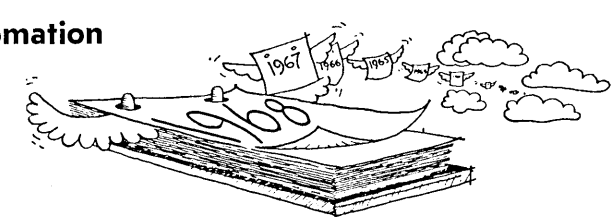
His lamps outnumber a noon's roses,
  Yet, when night's shadows fall,
His blind old sheep-dog, Slumber-soon,
  Misses not one of all.

His are the quiet steeps of dreamland,
  The waters of no-more-pain;
His ram's bell rings 'neath an arch of stars
  "Rest, rest, and rest again."

— From *Poems for Every Mood,* edited by Harriet E. Monroe, Whitman Publishing Co., Racine, Wisconsin, 1931, 144 pp.

Solution to Proof Goof 6810:

Paragraph 4, line 11: Replace "consumed" with "consume".
Paragraph 7, line 3: Replace "reservations" with "observations".
Paragraph 8, line 2: Replace "in" with "is". ■



How A Central Computing Laboratory Can Help Industry

Reprinted from Vol. 2, No. 9 — December, 1953

Dr. Richard F. Clippinger, Head of Computing Services
Raytheon Manufacturing Co.
Waltham, Mass.

Automatic digital computers are now available commercially at prices ranging from $50,000 to about $1,000,000. These computers range in speed from about 10 operations per second to about 20,000 operations per second, in memory capacity from 100 numbers to 1,000,000 numbers, in number size from 5 decimal digits to 15 decimal digits, in input speed from 5 digits per second to 180 digits per second, and with 10,000 digits per second just around the corner.

Confronted by this array of possibilities, a person having one or more mathematical problems to solve may ask whether or not he should use such computers? If so, should he purchase a computer, rent time on an available computer, or turn his problem over to some group which specializes in programming and operating services? If he is considering buying a computer, what kind? How many people does he need to staff it, and where will he get them? What about training? How about maintenance, floor space, etc.? What kind of equipment will he need to go along with the computer? Will he need supplementary desk computation facilities? Data-reduction facilities? How shall he formulate his problem for computer solution? Should he use the same statement of the problem for computer solution as he did previously, or should he restate his problem in more general form? Does he have to prepare his problem differently depending on whether he wants to run it many times over a period of years, or whether he wants just a few answers? Should he carry out the program preparation himself? What numerical techniques should be used? How accurate will his answers be? How does he assure himself that his answers are right? What does he do if they are not? How much money will a computer save him?

These and many other questions which will confront him suggest the need and desirability of central commercial computing centers. Let us discuss some of the services which can be rendered by such a center.

Reduction of Costs

The principal function of a computing center is to reduce costs.

In the first place, a central laboratory reduces customer costs by using the same code for many customers. The disillusionment when a potential computer user discovers that machines do not think like human beings is severe, but never complete. Even the most experienced user of automatic digital computers sometimes underestimates the amount of work involved in preparing a large and complicated problem for solution on a computer. Examples can be cited where experienced people have required 5 to 10 man-years of effort to complete the preparation of such a problem for a digital computer. We cannot conclude from this that the problem should not have been done, for the information that was obtained in four hours on the computer when the code was complete might have required 1,000 man-years and expensive equipment to obtain experimentally.

There are several reasons for the large amounts of effort required to analyze, program, and code large complicated problems.

One reason is the "Scaling Problem", the problem of scaling numbers to stay within the range acceptable to the machine. Millions of steps of computation must be performed without exceeding capacity or losing too many significant digits. In a case where a machine requires all numbers to be between 0 and 1, the first event may result from any addition or division (examples, .6+.5, .6/.5) and the second event may result from many multiplications involving small numbers.

Another reason is the "Convergence Problem". Most design problems are based on some mathematical process of converging to a limit. Frequently several different methods may have to be completely prepared and tried before one is found that works well.

A third reason is the need for tests. If the problem will run more than an hour and the machine is not self-checked electronically, it becomes imperative to program and code tests to determine the correctness of answers, and also to program and code procedures for rescuing the problem when an error is made. This is a large subject in itself.

I do not wish to give the impression that all problems are extremely difficult to prepare for computers, but rather to indicate that problem preparation is an item which may cost from $10,000 to $100,000 for problems about which a pure mathematician might comment casually "Oh, that problem is completely understood". In my experience, a typical problem preparation cost is closer to $10,000 than to $1,000.

In many cases a code once prepared can be used by many customers; by spreading these costs over many customers, central computing laboratories bring high-speed computation within reach of the smaller customer and reduce costs for the large customer. The central computing laboratory gradually builds up a larger and larger library of prepared problems which represent an investment in computing know-how. It is hard for the small computer owner to duplicate this, but it becomes available to him when he goes to the central computing laboratory for help.

Efficient Methods for Solving Problems

The second and most important way in which a skilled and experienced staff reduces costs is by using efficient methods. It is indeed true that some current computers are very fast. It is even true that there are problems where it is cheaper to use an inefficient method because the computing costs will be negligible in all events, and the coding cost will be lower for the inefficient method. In such cases the inefficient method should be used. However, it is by no means true that modern computers are so fast that inefficient methods can always be used. Many design problems depend on so many parameters that a thoughtless evaluation of some function of all these parameters would be out of the question. For example, if there are 60 design parameters and if it is desired to evaluate the function for only two values of each parameter, and if the computer operates at 100,000 operations per second and there are 10 operations involved in evaluating the function once, then to complete the evaluations it will take the computer working 24 hours a day about three million years.

Partial differential equations are at the root of many problems in industrial research. We have seen methods demonstrated for solving a certain special set of non-linear partial differential equations in two independent variables, which were ten times as efficient as the most common method; that is, the results by the more efficient method were obtained to a given accuracy in 1/10 the time or at 1/10 the cost of the less efficient method. It is our expectation that similar techniques for similar partial differential equations in 3 independent variables would be about 30 times as efficient as the common method. These examples are typical of many others.

Efficiency is acquired by a central computing laboratory by paying good salaries, and by carefully selecting the most experienced and accomplished people in the field. If the prospective computer user has such people on his staff, he is fortunate. If not, he may profit by discussing his problem with a central computing laboratory.

Full Operation with Appropriate Computers

A third way a central computing laboratory keeps down costs is by keeping its computers occupied full time or nearly so. Clearly the cost per hour of useful computing is the total cost of operating the computer for a year divided by the number of hours of useful computing performed during the year. When a computer customer buys a computer, and then is only able to occupy a small fraction of its time because of lack of problems, or for any other reason, his costs per hour of useful computation will be high. In such cases he is likely to be better off to use the services of a central computing laboratory when possible.

A fourth way in which a central computing laboratory keeps down costs is by using the most suitable computer for a given problem. A properly organized central computing laboratory not only has its own machines but also arrangements with other laboratories for the use of their machines.

For example, some problems have a large amount of computing per unit input and output. Cost may be lower when such a problem is solved on a fast machine with slow input (cheaper rent). Others require very little computation; a slow machine with relatively fast input-output may minimize the cost. When a customer buys a single computer, he may lack this flexibility; at some time he may pay heavily for this lack unless he supplements his own computer by turning some of his problems over to a central computing laboratory.

Service to Industry

Bearing this cost discussion in mind, we discover that a central computing laboratory can serve industry in a number of ways.

If an organization has too little work to justify buying a computer, it can nevertheless enjoy the benefits of modern computing by turning its applied mathematical problems over to a central computing laboratory when this is economically feasible.

If an organization has enough work to justify the purchase of a computer, it may nevertheless gain efficiency by using the services of a central computing laboratory. First, a central computing laboratory can give the organization more time to determine the computer to be bought by solving its most urgent problems during the investigation period. This will at the same time bring it into direct practical contact with automatic computation and help it make a better choice.

Furthermore, the central laboratory can supply reserve computing power after the computer is bought. Thus the organization may be able to purchase or rent a cheaper computer, keeping it fully occupied (thus reducing its costs), instead of a more expensive computer fast enough to handle its maximum load, yet idle at some times of minimum load.

If an organization has bought its own computer but cannot afford a large and experienced staff, the central computing laboratory can help it prepare problems for its own machine. This may be particularly important in the early stages; but even later when a new problem arises, it may be advantageous for the customer to draw on the more extensive background of a central computing laboratory.

Finally, as mentioned before, the central computing laboratory is continually compiling a growing library of prepared problems. Therefore, there is an increasing chance that the customer can avoid a large part of problem preparation costs by discussing his problem with the central laboratory. . . . ■

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(Act of October 23, 1962: Section 4369, Title 39, United States Code)

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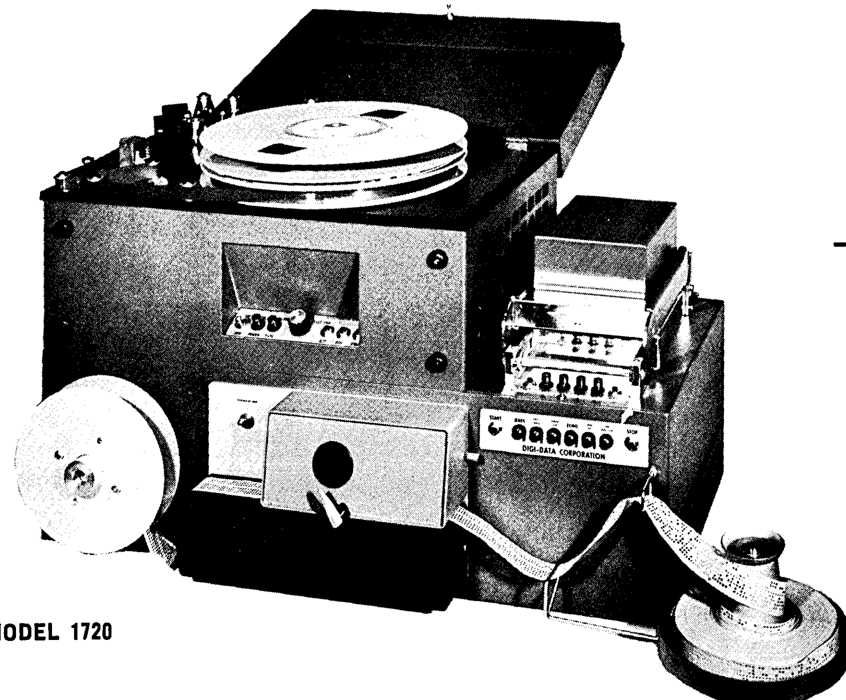

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ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

POWER OF SIX COMPUTERS PROBES THE SEA FOR OIL

The power of six IBM computers is helping researchers probe the bottom of the sea in a world-wide search for oil. The computers — System/360 Model 44s — are being used by Western Geophysical Company to produce cross sections of the earth's layers to help experts locate underwater oil deposits. The Model 44 enables the firm to produce very detailed cross-sections of the earth's crust. These sections point out the most likely places for underwater oil deposits.

Data used to produce these seismic sections are gathered by nearly a score of marine crews in Western's fleet. At sea, a complex mechanical device — called AQUA-PULSE — is lowered into the water. The device produces underwater sound waves which penetrate deeply into the ocean floor, bounce back and are picked up by a cable containing microphone-like devices. The reflected sounds are recorded on magnetic tape as a series of numbers and are later analyzed by the computers to determine the kind of earth layers below the sea. The cross sections are given to oil company geologists who decide where to drill.

Western Geophysical, a division of Litton Industries, provides a complete oil-exploration service to the international petroleum industry from offices in Shreveport (La.), Los Angeles (Calif.), Houston (Texas), London (England) and Milan (Italy).

SCIENTISTS, USING COMPUTER, SEEK SOLUTION TO GROWING REFUSE PROBLEM

Man, overwhelmed by growing mountains of garbage of his own making is turning toward the sea as a way out of his disposal dilemma. A plan to load refuse on specially equipped incinerator ships, used for burning and dumping garbage far off shore, now is under study at the University of Rhode Island (Kingston). Scientists hope to answer such questions as: What effect the incinerated residue would have on the ocean and the millions of life forms that swarm in it. Can the ocean become polluted? Where would the best dumping grounds be?

To answer these and hundreds of other vital questions, scientists are scrutinizing a sea of their own — one that exists entirely within an IBM computer. A mathematical model of a chunk of ocean 50 feet deep is being developed in an IBM System/360 Model 50 at the university. Necessary data for the computer is gathered from a floating research station. Simulating conditions of the real sea, the model reacts to various situations as nature would — and allows parts of the revolutionary dumping proposal to be pre-tested without disturbing a single clam or bait fish.

It has been found that incinerated waste produces only a low-grade toxicity on marine life in the dump area. Additionally, hard-shell clams and lobsters seem to be very resistant to such waste. Even in sensitive species such as sea scallops and shrimp, it generally takes a concentration of three per cent by weight to cause mortality. It is the aim of this project to minimize toxicity by making sure the incinerated waste is contained within the dump site.

The study is being carried out under a grant from The National Center for Urban and Industrial Affairs.

COMPLETE PAGES PRODUCED IN TEN SECONDS OR LESS — AT R. R. DONNELLEY & SONS

R. R. Donnelley & Sons Company, leading national printers headquartered in Chicago (Ill.), has put into operation one of the most advanced computer-operated typesetting systems in commercial use — complete pages can be produced in ten seconds or less. The new character generating system, of the Company's Electronic Graphics Division, centers around an RCA Videocomp 832 electronic composing machine which sets type on film ready for plate making at 1,000 or more characters per second. The term 'Electronic Graphics' was coined to describe the merger of computer technology and typographical skills.

The Electronic Graphics Division's character generating system is particularly suited to high volume typesetting requirements where the basic information is now contained in computer readable files. Existing data can be converted for printing purposes by developing and incorporating graphic arts instructions without limiting further usefulness of existing data.

The Videocomp high-speed character generator operates by magnetic tape from a computer. Input tape is combined with coded graphic arts instructions which determine the form and arrangement of the page, size and style of type, spacing and other aesthetic requirements. A selection of type sizes and styles is available. Different sizes and styles may be intermixed electronically — on the same line if desired. Type is generated in column form or as complete pages including running heads, folios, foot notes, footlines, etc. More than 1,000 characters a second are produced at reproduction quality levels. Speeds up to 4,000 characters a second can be generated at quality levels adequate for proofreading purposes.

The picture shows an operator setting controls of a special purpose computer that is built into the Donnelley Videocomp 832. Pages on paper are processed in the Videocomp and delivered through the opening in the foreground. Pages on film are removed from the Videocomp and are processed in an automatic film processor.

The key to the Donnelley Electronic Graphics system is the merger of the art of typography with the science of computer technology. Fine quality typesetting at computer speeds requires a joint effort involving both electronic computer experts and experienced typographers, according to the company.

RADIATION THERAPY ANALYSIS SPEEDED BY COMPUTER

An IBM System/360 Model 30 computer at St. Francis Hospital, Wichita, Kansas, is cutting radiation therapy analysis times from one month to a few seconds. Hospital radiological physicist, E. L. Darter, said the computer performs 600 calculations per patient in 10 to 15 seconds. "These same calculations would require a month's time if performed manually by a radiological physicist," he added.

The computer-based analysis involves: (1) measuring a patient by a contour (a protractor-type mechanism designed by Dr. Darter and built to specification by St. Francis Hospital personnel). The device measures the distance of the tumor from the skin's surface, at 15-degree intervals, around the circumference of the patient. Next, these measurements are read into the computer along with information on each possible technique of treatment. The computer, following its preprogrammed instructions, then determines how much radiation is likely to be delivered by each technique — in terms both of exposure of the tumor and other tissues in the cross-section.

"The goal of any radiation therapy," Dr. Darter said, "is to irradiate tumors or cancerous tissue to the desired radiation level needed for therapeutic response and to minimize radiation to other body tissues. Using the computer to determine the best technique for a given case not only saves time, it also gives tremendously more complete information about details of therapy."

TV, RADIO PRODUCTION, AND BROADCASTING CONTROLLED BY COMPUTER IN NEW TOKYO SYSTEM

The most advanced information and control system in the broadcasting industry, and one of the most advanced such systems in the world, has been inaugurated by the Japan Broadcasting Corporation (NHK), Tokyo, Japan. The system, called TOPICS (for Total On-Line Program and Information Control System), will coordinate all production and broadcasting activities of NHK's two television and three radio networks — a complex rougly equivalent to a commercial network like CBS, an educational network like NET, plus an FM and two AM radio networks.

TOPICS, developed by NHK with the collaboration of IBM, will help administer the simultaneous production of some 1800 programs by 1000 directors and 2700 technicians at work in 26 TV and 33 radio studios and on location. It will do so without the memorandums, letters and phone calls that characterize other, similar environments. The system also will provide management reports and perform general accounting tasks.

The heart of TOPICS is two IBM System/360 Model 50 computers (one being on-line; the other standing by) and dual IBM 1800 Data Acquisition and Control Systems. The computers are guided by highly complex computer programs. Together, computers and programs perform the functions of several different kinds of systems: as a communications system; as an information retrieval system; as a simulator; and as a master switching

control. The performance of one or another such function by computing systems has become commonplace in the past few years. TOPICS is unique in that it performs all of them simultaneously.

The center of TOPICS and of NHK's broadcasting activities is Broadcast Control Center (BCC), shown above. Fewer than two dozen personnel plan and supervise the production of 640 TV shows and 1200 radio programs and monitor the five that are on the air at any given time. The IBM 2250 Graphic Display Unit (center in photo) gives managers access to all information concerning the some 1800 programs that are constantly in production. They assign personnel, establish budgets, resolve conflicts for resources by simulating solutions on 2250s. They enter their solutions into the system by means of the same device. Other personnel learn of their assignments by calling up displays on any of 184 IBM 2260 Visual Display terminals (right in photo) distributed throughout the corporation's studios. A line of television screens (back) monitor programs being broadcast by the two television networks and those of five competing channels.

NHK President Yoshinori Maeda, under whom the new system was developed, observed that with TOPICS the computer reaches into a new era. NHK, he said, is not using the computer simply in individual applications, but for all applications, simultaneously and in a completely integrated way. The new system, he said, fulfills his ambition to reorganize his corporation in such a way that "the mechanics of running the organization would be looked after by machines so that our people could do human work."

ENVIRONMENTAL CONTROL OF BUILDINGS THROUGH USE OF COMPUTERS

A patent covering use of computers for environmental control in buildings has been issued to Robertshaw Controls Co., Richmond, Va. The company believes the patent is significant because it appears to cover most systems in larger buildings using computers to control temperature and other environmental conditions. Robertshaw has installed what is believed to be the first such computer-controlled system, in the new headquarters building of the International Monetary Fund in Washington, D.C.

The computer in the Washington building determines air-conditioning needs and operates equipment to provide the correct amount of cooling; starts and stops ventilating fans; turns lights on and off; and monitors operation of the heating plant. It also keeps track of and analyzes such data as power and fuel consumption and prints out concise daily summaries of facts and figures important to the building's operation.

The system has been in operation for more than a year. Washington consulting engineer Nash M. Love estimated that savings resulting from more efficient building operation would pay for the computer installation in a maximum of 27 months. He now believes that savings will be greater than at first projected.

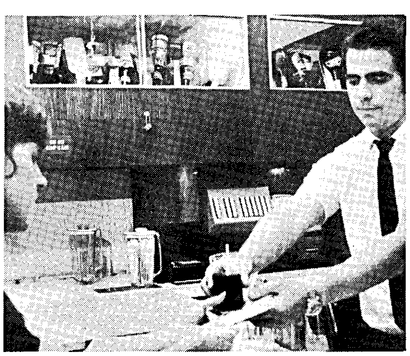
The inventor of the computer-controlled system is Paul A. Schumann, an engineer for Robertshaw's

Control Systems Division. Westinghouse supplied the computer, a Prodac 50. It is designed for flexibility of application and is built of standard modules which can be assembled in a variety of ways. The IMF computer has 12,000 words of core memory with capability for expansion to 16,000 words. Mr. Love says the installation is the forerunner of a new era in building control which should be widely used in five to ten years.

CLEVELAND JAZZ SPOT USING COMPUTERIZED BARTENDER

The Cat's Meow, one of Cleveland's (Ohio) jazz spots, is now setting a new tempo with a computerized automatic bartender that can dispense any one of a thousand drinks in four seconds. This new device, named the "Comp-U-Bar 801", provides faster service, better drinks, and billing control, and leaves the bartender to properly attend his customers at the bar. Comp-U-Bar 801, designed and developed by Stephen R. Krause, President of K & M Electronics Co., Inc. (Baltimore, Md.), is intended primarily for restaurants, nightclubs, hotels and resorts — the service bar business where there is a heavy volume of drinks served to tables by waiters and waitresses.

As many as 36 quarts with 10 different mixes, such as soda, water, ginger ale, collins and sour mixes, can be stored by the Comp-U-Bar. The device automatically mixes and dispenses drinks — always perfectly because all measurements are accurate to a 64th of an ounce. An important feature of the Comp-U-Bar is a bank of locked visual counters which register each alcohol ingredient dispensed in 16ths of an ounce. This eliminates the possibility of pilferage and assures bookkeeping accuracy.



— Comp-U-Bar 801 (rear) and Michael R. Joyce owner-operator of the Cat's Meow

Michael R. Joyce, owner-operator of the Cat's Meow, says his Comp-U-Bar has cut inventory-taking from one hour to 10 minutes. To avoid the hazards of trying to decipher waiter and bartender handwriting on chits, the Comp-U-Bar has an optional automatic bar check printer which tells who served the drink, how much it was worth — and gives tallies for the day's gross.

Mr. Joyce said, "At first we were anxious that the machine would offend bar customers who like a chat with each chit. But the Comp-U-Bar is a great conversation-maker. It allows the bartender to spend more time with customers instead of rushing breathlessly during peak periods. And who would start an argument when he gets a perfect drink every time?"

REGATTA WINNERS CHOSEN BY COMPUTER

All yachts are not created equal, so a Honeywell Series 200 computer figured handicaps and posted winners during the annual Cowes Week (Cowes, England) yachting regatta last August. Winners were determined by comparing the actual time it took each vessel to complete a race against its handicap — a formula that took into account such factors as size, sail and basic speed of each yacht. The computer also considered varying wind and tidal conditions for each race as well as each yacht's handicap.

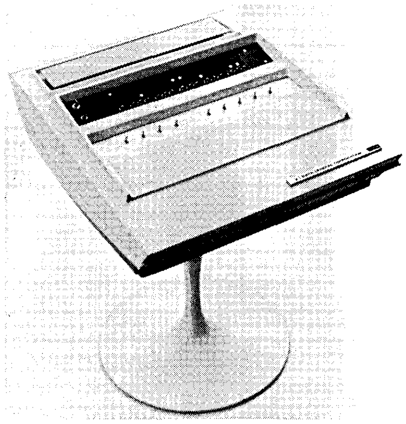
During the week's racing, there were 36 such handicap events. With the handicap, a yacht did not have to finish first to win a race. Honeywell Controls Limited gave its own award to the vessel with the best four showings during the week.

NEW PRODUCTS

Digital

NOVA: SMALL-SCALE GENERAL PURPOSE COMPUTER HAS MULTI-ACCUMULATOR ORGANIZATION

NOVA, developed and manufactured by Data General Corporation, Hudson, Mass., is a small-scale general-purpose computer with multi-accumulator organization. (This is the machine organization used in such large-scale computers as the IBM 360 Series.) NOVA has four accumulators, two of which may be used as index registers. These accumulators perform arithmetic and logical operations within the arithmetic unit of the computer without accessing memory.



— NOVA

The NOVA is one of the most compact computers in its class. It has within its basic configuration more room for expansion than other comparable computers. The $5\frac{1}{4}$" tall NOVA can accommodate 16,000 16-bit words of memory, either core or read-only. (Expanded versions can contain up to 32,000 16-bit words or 64,000 8-bit bytes.) Memory is available in 4906 16-bit word modules; smaller 1000 word modules also are available.

The central processor is contained on two 15"x15" boards. A 4096 16-bit word memory is contained on one 15"x15" circuit. A 15"x15" input-output board can handle up to eight devices. There is room for seven 15"x15" boards in the $5\frac{1}{4}$" tall package. Vacant slots may be used for special I/O interfaces or additional memory.

The NOVA will have a complete set of software and will be available with a full line of options and peripheral equipment.
(For more information, designate #41 on the Reader Service Card.)

IRIS 50 — FIRST OF SERIES OF NEW FRENCH COMPUTERS

IRIS 50, the first of a series of new French computers, has been announced by La Compagnie Internationale pour l'Informatique, Louveciennes, France. IRIS 50 is a medium scale computer and has all of the characteristics of a true third generation system: integrated circuits throughout, modularity at all levels, high processing and input/output speeds.

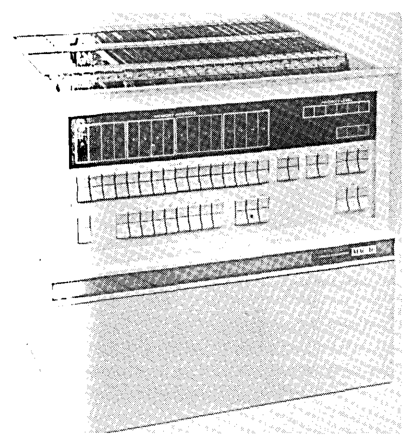
The central processor functions are shared by three autonomous modules. The command and control module includes a large set of instructions designed for business, scientific and real time applications.

Floating point and decimal arithmetic instructions are optional. The modularly constructed main core memory stores from 16,384 to 262,144 bytes, in four banks accessible independently and simultaneously. Cycle time is 950 nanoseconds for a 2 byte word. The data exchange modules (from one to four) allow an input/output rate of up to 1.5 million types per second through standard peripherals and communications oriented devices.

FORTRAN IV, COBOL and a Report Program Generator are provided with a complete package of utility routines for business and scientific applications in multiprogramming mode. The software also includes a modular operating system, SIRIS 2. (For more information, designate #43 on the Reader Service Card.)

MULTIPLE APPLICATION COMPUTER FROM LOCKHEED ELECTRONICS

MAC 16, a one microsecond Multi-Application Computer, is the first of a new family of computers from the Los Angeles based (Calif.) Data Products Division of Lockheed Electronics Company. The MAC 16, for the OEM systems market, offers large scale capability and versatility in a low cost, smaller scale computer.



— Lockheed's MAC 16

MAC 16 is a 16-bit parallel word computer with a 2 microsecond add time and a 4096 word core memory, expandable to 65K words. The basic system includes a Programmed Data Channel servicing up to 255 devices with four true nested priority interrupt levels. This priority system automatically stores the machine state upon interrupt and can be expanded to a total of 64 levels. The standard MAC 16 repertoire includes 86 instructions with multiply and divide available as options.

The standard software available for the MAC 16 includes the LEAP symbolic assembler, program loader, debug and editor programs, math library, I/O driver and hardware diagnostics. An ASA standard FORTRAN IV compiler will be available for an 8K word MAC 16 using paper tape or card peripherals.

The first showing of the MAC 16 computer will be at the Fall Joint Computer Conference. Initial deliveries of the new computer are scheduled for March 1969.
(For more information, designate #42 on the Reader Service Card.)

SCC 4700 — NEW ENTRY IN 16-BIT COMPUTER MARKET

Scientific Control Corp., Dallas, Texas, is entering the 16-bit computer market with their new SCC 4700. SCC 4700 is a 16-bit, 920 nanosecond, digital computer.

Some of the features available in the new SCC 4700 are: (1) microprogrammed to implement use of optional instructions; (2) up to two multiplexor channels available that will handle 64 devices per channel operating simultaneously in a block transfer mode; (3) up to three high speed selector channels that will handle 64 devices per channel; (4) double precision and floating point arithmetic packages; (5) hardware multiply/divide; (6) memory expandable to 65K words; and (7) Real Time Monitor and FORTRAN IV Software in addition to standard software package.

Deliveries on the machine will start next month.
(For more information, designate #44 on the Reader Service Card.)

NEW CORE STACKS DOUBLE MEMORY SIZE IN HEWLETT-PACKARD'S 2116 SERIES COMPUTERS

New core stacks double the memory size in Hewlett-Packard's 2116 series computers, greatly increasing computational power while reducing price. A 16K memory can now be contained entirely within the main frame of the new Model 2116B, making possible a price significantly below that of the earlier Model 2116A with 16K memory (the 2116A required an extender to use 16K memory).

For $34,000, a customer now can have a small, general-purpose computer with the computational power of 16-bit words and a 16K memory, and with the flexibility provided by 16 pre-wired circuit card slots for interface hardware (a feature unique to HP computers). The new computer can be easily upgraded at nominal cost by insertion of the appropriate circuit cards <u>at any time</u>. A multi-level priority interrupt system is built-in for the 16 pre-wired slots and for the additional 32 slots available in an optional extender.

Developed by Hewlett-Packard, Palo Alto, Calif., the Model 2116B, like its predecessor, has a cycle time of 1.6 usec and a 3.2 usec add time. The Model 2116B uses all of the software developed for the Model 2116A. The power of the new Model 2116B is such that it supports the Hewlett-Packard 2000A Time-Shared BASIC system, which accommodates 16 remote terminals simultaneously.
(For more information, designate #45 on the Reader Service Card.)

MULTI-LANGUAGE, TIME-SHARING COMPUTER SYSTEMS FROM DIGITAL EQUIPMENT CORP.

A family of multi-language, general purpose, time sharing computer systems, capable of handling from 8 to 32 terminals simultaneously, has been introduced by Digital Equipment Corporation of Maynard, Mass. Constructed around the company's popular PDP-8/I computer, the systems, called TIME SHARE-8, all offer users "hands-on" contact with the computer and the ability to utilize a wide variety of software.

In their basic configuration, TIME SHARE-8 computers are equipped with 8,000 words of core memory and a 250,000-word memory disk. Four thousand words of core memory are devoted to executive software, with the remaining 4,000 available to users. The TIME SHARE-8 storage system provides several levels of file protection and permission. The disk memory is available to all users for storing binary or source language files. All peripheral input and output devices, such as tape transports and line printers, can be assigned to individual users under operator control. This permits hardware resource sharing, as well as time sharing.
(For more information, designate #46 on the Reader Service Card.)

Analog

ANALOG COMPUTER ENHANCES RESOLUTION OF CONTINUOUS CURVES PRODUCED BY INSTRUMENTS

A new specialized analog computer, which automatically scans and then multiplies the resolution of curves and continuous spectra by deconvolution, is available from Micro-Tol Engineering Corporation, State College, Pa. In the deconvolution mode, this portable self-contained instrument serves as an adjunct to increase resolution 5 to 10 times beyond the performance of basic analytical instruments applied to quantitative analysis of major constituents.

Called the RM-6 Resolution Multiplier, one unusual feature is that no assumptions or computations need be made regarding solutions being sought and results are not subject to operator interpretation. Applications for the RM-6 Resolution Multiplier include mass spectroscopy, gas chromatography, nuclear magnetic resonance, infrared spectroscopy and other continuous spectra producing instrumentation.
(For more information, designate #47 on the Reader Service Card.)

Digital-Analog

TWO INTERCONNECTED COMPUTERS ANALYZE VIBRATION SOURCES

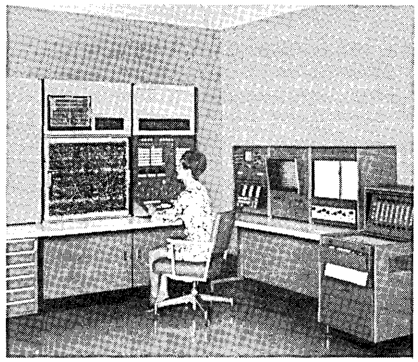
A completely computerized signal analyzing system has been developed by S. Sterling Company, Southfield, Mich. The system was developed for the National Aeronautics and Space Administration, which will use it to pinpoint the source of vibrations in spaceships. According to Sy Sterling, the firm's president and chief executive officer, it will have many significant applications in industry and science.

The system consists of two interconnected computers, the Time Data 100, a digital computer, and the Varian Data Machines 620i, a general purpose stored program digital computer. With this combination, analog or digital information can be processed from such sources as strain gauges, flow meters, and accelerometers; and a visual display of their output can be shown on a monitor. The system can receive information continuously for analysis and it can tape record the processed information for storage.

Some of the specific applications of this "production line" signal analysis system include: use in medical research to obtain and analyze electrocardiograms and electroencephalograms; and for vibration and subjective testing analysis of all types of engines. The S. Sterling Company will engineer and assemble the entire system, customizing it to the individual needs of any potential user.
(For more information, designate #48 on the Reader Service Card.)

100-V ANALOG/HYBRID COMPUTING SYSTEM FROM EAI

Electronic Associates, Inc., West Long Branch, N.J., has announced a new 100-V machine, the EAI 7800. The computer offers a new degree of performance, flexibility and versatility combined with low initial cost and economical throughput. The EAI 7800 is designed to go hybrid or to be used in any number of on-line or real-time applications.



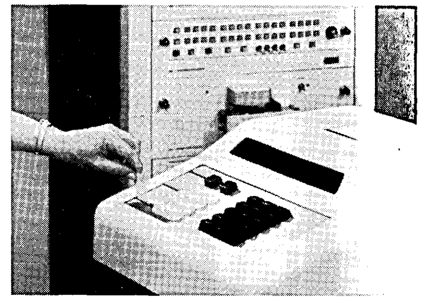
Users may select an analog/hybrid configuration from 30 to 294 amplifiers...as well as a wide range of control and programming features. The basic console, wired for a minimum analog/hybrid configuration, can be expanded by adding functional modules, easily installed in the field or in the factory. The 7800 adds to a product line designed to meet every analog/hybrid need of the engineering and scientific community.
(For more information, designate #49 on the Reader Service Card.)

Special Purpose Systems

CREDIT AND INVENTORY CONTROL SYSTEM FOR RETAIL STORE MANAGEMENT

A credit and inventory control system has been developed by Ricca Data System, Inc., Santa Ana, Calif. The new system automatically checks customer credit and furnishes retail store management with real-time sales and inventory data. The credit and inventory control system can be installed either on a stand alone basis or as a supplement to existing data processing systems.

A Data Terminal at each sales counter station is the key element in the new system. The device provides all cash register functions as well as the credit and inventory control functions. In conjunction with a central computer and data storage bank, the terminal (shown below) accepts customer's charge or credit card and merchandise tags,



and automatically displays price, checks customer credit and records accounts receivable data by customer and inventory data by item, by clerk, and by store.

The fact that each and every purchase is checked immediately, in real-time, eliminates the need for floor limits. A person attempting to make several purchases in different departments would be stopped during the purchase at which the credit limit was being exceeded. The terminal automatically retains the credit charge card if the customer is delinquent, beyond credit limit, or if the card is stolen or counterfeit.

System design is modular and allows maximum flexibility in providing each retailer with his own custom-designed system.
(For more information, designate #50 on the Reader Service Card.)

MANAGEMENT SYSTEMS FOR MEDICAL DATA FROM SANDERS

An automated electronic medical data management system, developed by Sanders Associates, Inc., Nashua, N.Y., permits up-to-the-minute patient information to be maintained from admission through discharge by providing high-speed, access to computerized records, forms and other information.

The automated system, designated the CLINI-CALL® System, includes computers, noise-suppressed printout machines, and electronic display terminals that can be located throughout a hospital or clinic. The CRT terminals provide immediate access to the central computer where lab results, patient data, admission and billing records, drug order forms and doctor's orders are stored. All operations can be interlocked so that a doctor's identification card is required in those cases when orders or information should not be accessible or released without his approval or verification.

Doctors, nurses and others requiring information from the CLINI-

CALL system insert their identification card into a card reader unit on the CRT terminals. An index of formats containing general categories of all data stored in the system then appears on the display screen. The operator then touches a PHOTOPEN® unit to the display screen to indicate and select the specific form desired. The form appears when the "execute" command section is touched with the PHOTOPEN. The form can be updated, modified or erased via the keyboard, and the new data can be proofread before returning for storage in the computer.

Personnel communicate with the computer in English language text using direct or branching access to specific data. Only minimum keyboard operations are involved. Virtually no special training is needed.
(For more information, designate #51 on the Reader Service Card.)

ACQUISITION SYSTEM GATHERS ANALOG/DIGITAL DATA IN THE FIELD OR ON THE BENCH

The Incre-Data Mark II data acquisition system, developed and manufactured by Incre-Data Corporation, Albuquerque, N.M., utilizes IBM-compatible magnetic tape cartridges to completely eliminate digital playback conversion. It can be cartridge-loaded and programmed in the field. The solid state system has five basic components: programmable data formater/controller, analog and digital multiplexer, analog to digital converter, digital clock, and magnetic tape recorder.

Data format handles up to 144 individual digital characters. The high-speed analog multiplexer sequentially samples 20 differential or 40 single-ended inputs, with single scan, continual scan or start/stop scan rates. The digital clock correlates all input data; it can be used to drive external controls or remote displays. The incremental magnetic tape recorder is 7-track and compatible with IBM NRZI at densities of 200 and 556 BPI; it records at speeds up to 2,000 characters per second synchronous speeds and up to 1,000 characters per second asynchronous. All recorder controls can be mounted remotely.

The Mark II, a completely portable system, measures 6 1/2" high, 7 3/4" wide and 13 5/8" long, and weighs approximately 29 pounds.
(For more information, designate #62 on the Reader Service Card.)

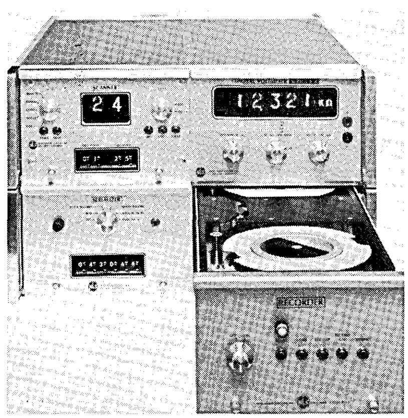
NEW FAMILY OF DATA ACQUISITION SYSTEMS FROM REDCOR CORP.

A family of three computer-based data acquisition systems, designated the Series 685 Systems, has been developed by Redcor Corporation, Canoga Park, Calif. Their function is to acquire and digitize analog data, and record the data on magnetic tape in computer-compatible format. The stored program flexibility of the systems permits processing of raw data in the form of limit checking, linearizing, conversion to engineering units, etc., for logging or display. The system also has on-line control of experiments.

Each of the three basic systems consists of a high-level or low-level multiplexer/A-D converter, a stored program processor, a digital magnetic tape read/write unit, and a teletypewriter with a paper tape input/output. Complete, easy-to-use programs are provided with each Series 685 System. Several standard options are also available.
(For more information, designate #60 on the Reader Service Card.)

PORTABLE DATA ACQUISITION SYSTEM FROM NON-LINEAR SYSTEMS, INC.

The S-2 Data Acquisition Systems, manufactured by Non-Linear Systems, Inc., Del Mar, Calif., are designed on a modular "building-block" concept. The basic system, mounted in a $10\frac{1}{2}$" high console, consists of a four digit, 0.01% accuracy digital voltmeter; a 25-channel, programmable reed relay input scanner; a parallel-to-serial converter; and a half-rack incremental magnetic tape recorder.



— S-2 Data Acquisiton System

Portability is a prime feature of the S-2; one man can easily carry the entire system, even in cramped quarters such as aboard ship. Applications of the S-2 include aerospace testing, air and water pollution studies, oceanographic data gathering, biomedical instrumentation petro-chemical processing research and many others.
(For more information, designate #59 on the Reader Service Card.)

Memories

ISI INTRODUCES LOW-COST MEDIUM-CAPACITY MEMORY SYSTEMS

The 7000 series disc storage system, designed and manufactured by ISI (Information Storage, Inc.), Detroit, Mich., is available in five models ranging in capacity from 0.15 million to 1.2 million bits — at a cost of less than 0.3 cents per bit. Fixed, non-positioning, flying heads, in a head-per-track configuration, allow the computer system designer considerable freedom in selecting data formats. Average access time of 7000 series memory systems is 16.5 milliseconds.

Each memory system includes head address, decode and selection systems, bit and sector clocking, and complete "functionally packaged" integrated circuit boards; one for the entire read function, another for the write.

The 7000 series disc memory systems, designed for easy interfacing with any digital processing system, may be used to extend the core storage on small and medium size general purpose computers, for buffer memory applications, as the main storage for special purpose computer systems, as a refresh memory for display systems, or as extender memories on electronic accounting machines (EAM), calculators, or small business machines.
(For more information, designate #56 on the Reader Service Card.)

ONE MICROSECOND CORE MEMORY BY LOCKHEED ELECTRONICS

A compact, rugged, one microsecond core memory has been developed by Lockheed Electronics Company's Data Products Division in Los Angeles, Calif. The new memory, designated as model CR-95, is available in capacities of 4096 and 8192 words with word lengths variable in 4 bit increments from 8 to 36 bits. Full cycle time is one microsecond with access time less than 500 nanoseconds.

The CR-95 is modular in design. It employs field proven circuits used in the CE-100 memory family

repackaged onto smaller ruggedized boards. All circuits have been subjected to verifiable worst-case design analysis. The new memory is designed for application as a memory or buffer in small computers or data systems and meets the applicable requirements of MIL-E-16400 and similar specifications for mobile and shipboard equipment.
(For more information, designate #53 on the Reader Service Card.)

MODULAR 3RD GENERATION DISC-STORAGE SYSTEM FROM COMPUTER PERIPHERALS CORP.

Computer Peripherals Corp., San Diego, Calif., has introduced a new concept in fast-access disc memories ... a modular 3rd generation design specifically intended for program swapping, time sharing, message switching and all real time applications.

The DSU-8100 has standard 25 and 50 million bit head-per-track and moving head Disc Storage Modules which can be randomly combined to provide memories from 25 million to multi-billion bit capacities. One disc drive serves up to 4 disc storage modules. Thus, a 40-inch high chassis, slide-mounted to fit a standard 19-inch rack, contains from 25 to 200 million bits of memory. Multiple drives are used where larger memories are needed.

— DSU-8100

Fast access modules with individual heads for each track locate data in 16.7 msec average. Economy modules, where each head services 4 data tracks, have a positioning time of only 25 msec. Either module or a combination of modules on a single drive may be chosen. Data transfer rate is 3 MHz bit serial. The DSU-8100 can accommodate up to three computers in a single operational system.
(For more information, designate #54 on the Reader Service Card.)

Software

AUTO-LEX / Computer Resources Corporation, McLean, Va. / Performs all standard computer functions required to establish and maintain a thesaurus based on guidelines of COSATI (Committee on Scientific and Technical Information). Auto-Lex will add new terms, delete old terms, alter term relationships, and maintain generic structures. The package is available for the IBM System/360 and RCA Spectra/70 computers.
(For more information, designate #63 on the Reader Service Card.)

CMAP (Charge Materials Allocation Processor) / IBM Corporation, White Plains, N.Y. / Calculates the most economic mix of raw materials for foundry melting operations. CMAP, designed to calculate the least cost initial charge, takes into account raw material inventory, chemical data and price to arrive at the optimum melt. The program operates under the IBM 1130 Disk Monitor System, Version 2. It is scheduled to be available in the fourth quarter, 1969.
(For more information, designate #64 on the Reader Service Card.)

DOCUMATIC / Data Usage Corp., Fort Lee, N.J. / A Report Program Generator documentation system is now available for all IBM System/360 operating environments on a service basis. The original system, which was announced last June for the 360/20, has been upgraded to accept programs written in RPG for all System/360 versions. DOCUMATIC produces English language descriptions of programs written in System/360 RPG. Large system's users who have Model 20's can purchase the system outright. Other users may have the documentation generated on a service basis.
(For more information, designate #65 on the Reader Service Card.)

EXTENDED BASIC / Digital Equipment Corp., Maynard, Mass. / BASIC®, an easy-to-learn, conversational, problem-solving language for scientific, business and educational applications, was developed by Dartmouth College. As implemented on the PDP-10, Extended BASIC requires 5K of core memory and can automatically expand to the maximum capacity of the system to meet growing user needs. The DEC version includes facilities which allow the user to store his program on mass storage devices such as disk, magnetic tape or DECtape.
(For more information, designate #66 on the Reader Service Card.)

FLOWGEN/F-1 / California Computer products, Inc., Anaheim, Calif. / Produces automatic ink-on-paper flowchart documentation of FORTRAN source programs for users of the IBM 1130 and comparable 16K memory computers. FLOWGEN/F-1 permits the plotting of completely annotated flowcharts, directly from program source cards. The flowchart program is formatted to fit 8½ x 11-inch pages, readily storable in a three-ring binder for permanent reference. The program is available to IBM 1130 and comparable computer users for a one-time lease charge of $2000.
(For more information, designate #67 on the Reader Service Card.)

PMI (Personnel Management Information System) / Computer Sciences Corporation, Los Angeles, Calif. / A broadly-based generalized computer system for maintenance of personnel records, PMI can generate any of 26 pre-determined types of reports in the formats and sequences desired by personnel officers. An English-language shorthand which can be mastered in an hour enables personnel managers with no knowledge of programming to communicate directly with the computer. The PMI system is written in COBOL and operates on IBM System/360 computers from Model 30 upward. PMI is priced at $25,000.
(For more information, designate #68 on the Reader Service Card.)

SHORT-CIRCUIT STUDY COMPUTER PROGRAM / Westinghouse Electric Corp., Pittsburg, Pa. / Provides a means of performing rapid, accurate, and economical short-circuit studies of industrial electric power systems. The program uses mesh analysis to calculate symmetrical values of line current and bus voltage for three-phase and single line-to-ground faults. Printed output from the program includes positive-sequence symmetrical values of fault current and voltage for three-phase faults and zero sequence symmetrical values of fault current and voltage for single line-to-ground faults.
(For more information, designate #69 on the Reader Service Card.)

SIGMA FMPS (Functional Mathematical Programming System) / Scientific Data Systems, Santa Monica, Cal. / An advanced linear programming (LP) package is being jointly developed by SDS and Bonner & Moore Associates, Houston, Texas, for use with the SDS Sigma 5 and Sigma 7 computers. Major uses of the new software package include production scheduling, inventory control, product blending, process optimization, transportation and distribution optimization, and management decision making. Sigma FMPS will operate under

the Batch Processing Monitor in a 32K-word memory system. The LP package, available in the second quarter of 1969, will sell at prices ranging from $12,500 to $22,500, depending upon options selected. Price includes initial training for customer personnel, start-up service, and software maintenance.
(For more information, designate #70 on the Reader Service Card.)

SYSTEM 010 / Share Research Corporation, Santa Barbara, Calif. / Is designed to generate bibliographic, author, and Keyword-Out-of-Context (KWOC) indexes from machine-readable report, journal, etc., data. The KWOC index is a quickly assembled alphabetic listing of significant words from titles. The package, written in COBOL (F), will operate in 20K. Although written primarily for IBM System/360's, the program can be adapted to other computers which have a COBOL compiler and a SORT package.
(For more information, designate #71 on the Reader Service Card.)

UNICRIM (Uniform Crime Reporting System) / The Dikewood Corporation, Albuquerque, N.M. / Police may now process, by computer, all reportable offenses under various crime calssifications, as well as arrest and judiciary activity related to those offenses. The UNICRIM system provides all monthly and annual crime reports requested by the FBI from cities of 100,000 or more in population. UNICRIM operates on any computer for which a COBOL compiler is available, incorporates device independence and stand-alone features, and allows for adjustment without reprocessing monthly activity reports. The entire program may be processed in less than 30 minutes.
(For more information, designate #72 on the Reader Service Card.)

Peripheral Equipment

INTEGRATED CIRCUIT KEYBOARD FROM HONEYWELL

A significant advance in solid state keyboard technology, developed by Micro Switch, a division of Honeywell Inc., Freeport, Ill., is expected to bring the price of electronic keyboards within the reach of nearly every plant, office or home. The heart of the keyboard is a "magnet-actuated integrated circuit." Each key contains an IC chip only 40 thousandths of an inch square. The circuit is controlled in each key by pressing a magnet around the chip.

The integrated circuitry housed in the chip was developed by two Honeywell engineers: Everett Vorthmann of Micro Switch and Joseph Maupin of Honeywell's Solid State Electronics Center in Minneapolis. The chip makes use of the Hall Effect (named for Professor Edward H. Hall who discovered the effect at Johns Hopkins University in 1879), to produce minute voltage along the edges of a tiny bit of silicon. The voltage is then controlled through a special trigger and later amplified to 3.5 volts becoming, in effect, an electronic switch. The switch is said to have the reliability inherent in solid state electronics and the low cost inherent in integrated circuits. Electrical bounce reportedly is no longer a problem, and the Micro Switch keyboard is said to be compatible with all computer logic circuits.

Through the use of such solid state keyboards (shown below), a housewife in the 70's will be able to "talk" directly to computers to do her shopping, her banking, balance her check book, order theater and travel tickets, etc. The Micro

Switch keyboard is linked to the computer through the printed circuit encoding board shown on the left, which translates man symbols into electronic language.

By utilizing magnet-actuated circuitry, Micro Switch is able to offer a keyboard costing about $100, according to James S. Locke, vice president and general manager of the Honeywell division. Limited production of the electronic keyboard has begun.
(For more information, designate #74 on the Reader Service Card.)

DATA SETS FROM LYNCH ARE FULLY "COMPATIBLE" WITH WESTERN ELECTRIC COUNTERPARTS

Lynch Solid State Data Sets, L2103A and L2103F, provide "narrow band", full duplex transmission of data at speeds up to 300 bits per second. These Data Sets, from Lynch Communication Systems, San Francisco, Calif., will be fully "compatible" with the Western Electric "103A" and "103F", respectively, even to the extent that they will offer "plug" interchangeability with their W. E. counterparts.

Donald E. Campbell, Lynch president, stated that these two Data Sets are the forerunners of a complete line of Data Sets, fully "compatible" with equivalent Western Electric type Data Sets, planned to provide the Independent Telephone Industry with the required equipment for connecting to the switched network, or for private lines, for all data applications using physical pairs, cable carrier, or multiplex. These two Data Sets are scheduled for introduction at the United States Independent Telephone Convention in Miami next December, with off-the-shelf delivery beginning January of next year.
(For more information, designate #75 on the Reader Service Card.)

COMPUTER-CONTROLLED KEYBOARD INPUT FROM COMPUTER MACHINERY CORP.

Computer Machinery Corporation, headed by former sales and engineering executives of Scientific Data Systems, has been formed in Los Angeles to introduce "the first computer-controlled keyboard input system designed to substitute a combination disk/tape operation for present keypunch and keyboard-to-tape methods." The new "KeyProcessing System" was announced by James K. Sweeney, president.

The CMC KeyProcessor System is composed of four principal hardware sub-systems: (1) input — typewriter-like keyboards, a display and operator console housed in a simple work table; (2) control — a new, high-speed, digital computer functioning basically as a multiplexor for data input-output under stored program control; (3) storage — a magnetic disk unit which holds 7.25 million characters of data (sections are assigned to input keyboards and all data is held on disk through completion and prior to transfer to output); (4) output — a magnetic tape device which writes data in a format allowing the tape to be used as input to a separate general purpose computer system.

KeyProcessing produces magnetic tape output for use as input to any data processing system. One system can have up to 32 individual keystations, all independently entering or verifying data simultaneously, on 32 different jobs. Keystations are controlled by the new computer containing proprietary programs provided by CMC as part of the system.
(For more information, designate #76 on the Reader Service Card.)

GRAPHIC DISPLAY SUBSYSTEM PROVIDES DIGITAL DEFLECTION TECHNIQUE

Utilizing the first announced digital deflection technique to be offered in commercial graphic displays, the new UNIVAC 1557/1558 Graphic Display Subsystem, introduced by Sperry Rand Corporation's UNIVAC Division, Philadelphia, Pa., produces displays of superior characteristics in terms of speed, resolution and accuracy. The system is designed for direct inter-connection with a large-scale computer system or for remote operation with connections to a central processor via voice grade or wideband communication facilities.

The all digital techniques in the 1557/1558 System enable speed and accuracies, in excess of what has been available to date, to be achieved. This capability is high enough to design integrated circuits and detailed drawings of complex mechanical parts. Other suitable applications would be automotive design, architectural drawings, mathematical models and drawings of animated cartoons on-line.
(For more information, designate #77 on the Reader Service Card.)

A-D CONVERTER FROM EECO PROVIDES 250,000 CONVERSIONS/SECOND

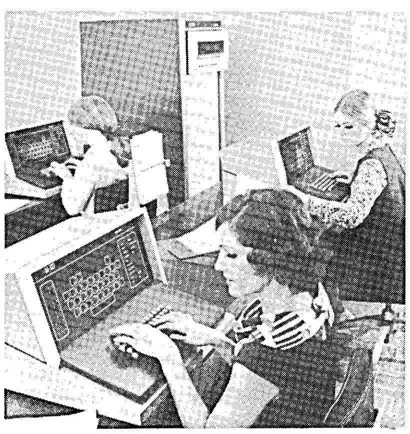
EECO Model 1200, a new high-speed Analog-to-Digital Converter from the Electronic Engineering Company of California (Santa Ana), is capable of 250,000 complete conversions per second with a resolution of 15 binary bits. The new ADC may be used as a direct input to a computer for "on-time" data processing, or for analysis of rapidly varying analog information. Other applications include transient analysis by loading a memory at a 250,000/second word rate and reading out at slower speeds.

Available as a modular unit for mounting in a chassis along with other circuits, the new ADC is isolated from other circuits to minimize noise pickup and insure stability. Data outputs and control pulses are transformer coupled to eliminate ground loops. Analog input range of ±10 V is standard, with optional ranges from ±5 V to ±100 V. Input impedance is 1000 ohms/volt. DC operating power is supplied by integral power supplies. Continuous overvoltage protection is standard on all analog input circuits. Accuracy is ±.01% of full range ±1/2 LSB. EECO Model 1200 can be supplied for either parallel or serial output. The serial output has a 10 MHz bit rate.
(For more information, designate #80 on the Reader Service Card.)

NEW DATA ENTRY SYSTEM SPEEDS UP INPUT AND REDUCES COST

Logic Corporation, Haddonfield, N.J., has developed the LC-720 Data Entry System, a computer time-shared approach to data preparation. The system accepts simultaneously the data from as many as 120 keyboard operators and records it on either two IBM/360-compatible magnetic tape recorders or an IBM magnetic disc pack recorder. Savings of as much as 50% can be achieved over conventional data input systems that use one-keyboard/one-magnetic tape recorder per operator.

The operator's input station for the LC-720 Data Entry System uses a standard 64-character keypunch layout requiring no special operator training. An alpha-numeric display panel shows the operator in English the program being used and the last information entered. Double entry, one of a wide range of operating modes, for the first time, permits the simultaneous entry and verification of data by two different operators.



As many as 30 different programs may be stored in the LC-720 system simultaneously and each program is immediately available to any of the operators. Record size is infinitely variable by each operator from 1 to 240 characters long and an automatic incremental record counter is included. The LC-720 user can field-expand the number of keyboard stations in his system at any time. First deliveries of the LC-720 Data Entry System are currently scheduled to begin in January, 1969.
(For more information, designate #73 on the Reader Service Card.)

CRT DISPLAY TERMINAL WITH ALPHANUMERIC AND GRAPHIC CAPABILITIES

Series 400 family of stand-alone display terminals will be introduced by Computek, Inc., Cambridge, Mass., at the Fall Joint Computer Conference. The Series 400 has a curve generator for graphics, which enables curves to be drawn directly rather than approximated by straight-line segments.

The low cost Model 20 includes a storage-type CRT, an alphanumeric input keyboard, curve and vector generators for graphics, a character generator for alphanumerics, and interfacing for standard data sets. Various options also are available including additional character sets; special symbols; templates; program function keyboards and overlays; and interfaces for direct coupling with computers.
(For more information, designate #81 on the Reader Service Card.)

"BOOK SIZE" OSCILLOSCOPE BY MEASUREMENT CONTROL DEVICES, INC.

A new DC to 10 MHz oscilloscope with measurements of just 1 3/4" x 7 1/2" x 14" — the Model 100 Transi-Scope — is available from Measurement Control Devices, Inc., Philadelphia, Pa. The oscilloscope was designed as a completely solid-state device with extensive use of integrated circuits to achieve both reliability and lightweight compactness. Small enough to be slipped into a briefcase on field trips, or incorporated into a system where space must be conserved, this new "mini" scope finds typical users in: laboratory, research, and production engineers; custom equipment designers; medical researchers; and field service technicians.
(For more information, designate #82 on the Reader Service Card.)

Components

NUMERIC READOUTS, FROM DIALIGHT, ARE MOUNTED ON PRINTED CIRCUIT BOARDS

A seven-segment readout display, announced by Dialight Corp., Brooklyn, N.Y., has one inch characters mounted directly on a printed circuit board, together with selected neon lamps and the required series and shunt resistors. Displays are available in groupings of from 2 to 8 modules, which can include plus-minus, decimal, colon or special caption module. Installation is achieved with the boards plugging directly into standard printed circuit board connectors, with a terminal spacing of .156 inch. Displays are available for operation at 150-160V DC or 110-125V AC.
(For more information, designate #84 on the Reader Service Card.)

PLUGGABLE X-Y MATRIX BOARD FOR MEDICAL RESEARCH APPLICATIONS

The Programming Devices Division of Sealectro Corporation, Mamaroneck, N.Y., has developed a new 30 x 50 pluggable Sealectroboard which is supplied mounted in a custom slide-out drawer assembly for standard 19" rack mounting. The new X-Y matrix programmer was designed to channel brain signals to selective recorders in medical research applications. The compact unit is available in a wide range of custom configurations.
(For more information, designate #83 on the Reader Service Card.)

Data Processing Accessories

COMPUTER-PAK, FOR COMPUTER-PRINTER ENVELOPE ADDRESSING

Computer-Pak, developed especially for computer systems applications by Continuous Envelope Sales Division of Pak-Well Paper Industries, Inc., Phoenix, Ariz., is a continuous web of envelopes, in roll form, that can be fed through computer-printers at high speed. The envelopes are shingled at the outside margins, with pin hole strips on both sides. The overlapping feature reduces printer skip-time to a minimum. The finished appearance of a Computer-Pak envelope is that of a conventional envelope. There is no evidence of a perforation line. Computer-Pak envelopes are available in all commercial sizes, including booklet and announcement envelopes.
(For more information, designate #89 on the Reader Service Card.)

PACK-SCAN I — DISC PACK TESTER AND CERTIFIER

Peripherals Inc., Phoenix, Ariz., has announced PACK-SCAN I, an IBM 2311 compatible, high speed disc pack tester and certifier. Four operational modes — two for unskilled production test personnel and two for skilled operators — employ three separate analog tests to measure magnetic coating irregularities. The track width tester permits use with most current disc drives.

PACK-SCAN I stands about 40" high, is 25" deep and 36" long. It includes all logic, storage and control functions, so no external processing unit is needed. PACK-SCAN I contains a strip-printer for a hard copy of error information and takes about five minutes to detect, interpret and record all errors on a total pack, noting track position and number. The company, a subsidiary of Wabash Magnetics, Inc., says deliveries of the completely self-contained device will begin in December.
(For more information, designate #88 on the Reader Service Card.)

PORTABLE AIR SPRAY FOR DELICATE DUSTING

"Extend-Air," a new aerosol type source of pressurized air, by Miller-Stephenson Chemical Co., Danbury, Conn., is intended for removing dust from delicate or hard-to-reach places and is an improvement over conventional aerosol powered air sources. In the "Extend-Air," the valve and extension nozzle are located on a fountain-pen size probe connected to a control cap on the top of the can by a length of plastic tubing. When the control cap is turned to "ON," the aerosol propellant forces air to the valve at the end of the probe. The operator can now work the nozzle into confined spaces, such as electronic assemblies, typewriters, etc. to blow dust away by fingertip pressure on the valve.

One "Extend-Air" provides up to 30 minutes of continuous air spray, which is the equivalent of several hundred normal applications.
(For more information, designate #90 on the Reader Service Card.)

COMPUTER RELATED SERVICES

SHARE RESEARCH CORP. OFFERS SCIENTIFIC LITERATURE SERVICE

A computerized weekly literature search service reviews 200,000 technical and commercial articles per year. The programmed system is run on an IBM 360/65. Input consists of bibliographic citations and abstracts. The service is offered by Share Research Corp., Santa Barbara, Calif., on a corporate contract basis.

Individual interest profiles are constructed using an open vocabulary. Probable articles of interest are distributed via a computer-printed three-part card. Each profile term is weighted and readjusted through direct user interaction (Port-A-Punch, response cards). Quarterly personal bibliographies are generated automatically of all articles which were "of interest" during that period of time. Each bibliography consists of a chronological listing of selected citation data, an author index, and a "Keyword-out-of-Context" (KWOC) index.
(For more information, designate #91 on the Reader Service Card.)

WESTERN UNION SERVICE FOR SECURITIES INDUSTRY

A computer-controlled system designed for shared use by many firms in the securities industry — providing cross-country communication of buy and sell orders in seconds — is now being operated by Western Union for its first Wall Street customer, Shields & Company.

Called SICOM (Securities Industry Communications) Western Union's new system serves the specialized needs of brokerage firms. The system interconnects a subscribing brokerage firm's headquarters wire and order rooms, its branches and correspondents, the trading floors, of the New York and American Stock Exchanges, and other special points desired by the subscriber. It provides for the fast transmission of buy-sell orders, execution reports, market news reports, administrative messages and other record information.

Western Union engineered the entire system and provides all components, including computers, circuits, teleprinters, outstation equipment, programming and maintenance. The only equipment located on the premises of a SICOM subscriber is an automatic teleprinter supplied by Western Union.

TIME-SHARING SERVICES

DENMARK'S FIRST TIME-SHARING SERVICE

Denmark's first commercially available computer time-sharing service has been announced — expanding to nine the number of countries outside the United States utilizing GE-265 computer systems. The service employs time-sharing equipment, techniques and programs supplied by Bull-General Electric, Denmark, and General Electric, U.S.A. It is operated by ØK DATA, a subsidiary of the East Asiatic Company, Ltd. (Østasiatiske Kompagnie) — an industrial shipping and trading company and one of Scandanavia's leading firms.

WESTINGHOUSE TO OFFER COMPUTER SERVICES TO OUTSIDE USERS

Westinghouse Electric Corporation has announced it will offer the powerful computing capacity of its Tele-Computer Center to outside users through its Westinghouse Information Systems Laboratory (WISL). The Westinghouse Tele-Computer Center (Pittsburg, Pa.), one of the largest of its kind in the world, until now was operated exclusively for Westinghouse corporate, divisional and select customer support programs.

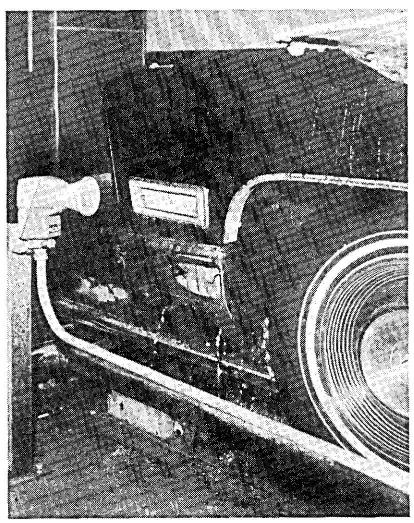
More than 500 tele-processing terminals installed at Westinghouse locations across the country are linked to computers in Pittsburg over leased telephone lines for remote computing and administrative message transmissions. The network of computers in the center, including two major new IBM systems recently installed at an estimated cost of $4.5 million, has a combined on-line or direct-access capacity of storing and retrieving almost 2 billion characters of information.

AUTOMATION

PHOTOELECTRIC SENSING HEAD AUTOMATES WAXING OF CARS

Wayne Quick Wash, Inc. has installed a General Electric weather resistant photoelectric sensing head to automate the application of wax to the cars going through its quick wash. The operation was formerly handled manually.

Operators turn the car's head lights on for those getting a liquid wax treatment. When the head light beam strikes the sensing head



the photoelectric equipment automatically turns on a set of high velocity wax jets. A time delay feature keeps the wax turned on while the car is passing through the spray of wax. The automatic operation assures a uniform coat of wax.

Wayne Quick Wash, Inc., a chain operation, has another installation using the same photoelectric setup in Harrisonburg, Va., and has plans for continued installations elsewhere.

The photoelectric equipment is manufactured by General Electric's Specialty Control Department, Waynesboro, Va.

NEW LITERATURE

VISUAL INFORMATION DISPLAY SYSTEMS, FROM U.S. GOVERNMENT

Advances in displaying information from computers are described in a new survey of technology used by the National Aeronautics and Space Administration. Entitled, "Visual Information Display Systems," the survey was undertaken for the NASA Office of Technology Utilization by the Auerbach Corp., Philadelphia, Pa., to facilitate the adaptation of such systems for use in schools, municipalities and industry. It discusses both the hardware and software now available to display information rapidly and efficiently to engineers, designers, operating personnel, students, decision makers and others.

Examples are given of four broad categories of uses for modern visual information display systems: those in which various kinds of operations must be monitored; those involving engineering and design; those requiring storage and retrieval of information; and those used in communications and simulation. "Visual Information Display Systems," is available as NASA SP-5049 for 60 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

GLOSSARY OF TERMS FOR TAPE AND TRANSMISSION FORMATS, FROM TALLY CORP.

The first in a series of Tally "Tech Topics" is now available from Tally Corporation, Seattle, Wash. "Glossary of Terms for Tape and Transmission Formats" is an 8-page glossary which details and defines many of the terms most commonly used in conjunction with magnetic tape data storage technology.
(For more information, designate #92 on the Reader Service Card.)

SPECIFICATION HANDBOOK FOR SUPERVISORY CONTROL SYSTEMS, FROM DRESSER INDUSTRIES

A free brochure, designed to assist supervisory control users in wiring specifications, is now being offered by the Dresser Controls Division of Dresser Systems, Inc., one of the Dresser Industries.

The illustrated 22 page brochure contains detailed information on the numerous points that must be considered in specification writing in the supervisory control and digital telemetry field.

The booklet is designed for writing specifications for any manufacturer's equipment. Numerous check lists are contained in the brochure.
(For more information, designate #93 on the Reader Service Card.)

ORGANIZATION NEWS

ADAPSO'S NEW BY-LAWS GIVE FULL MEMBERSHIP TO SOFTWARE FIRMS

The membership of ADAPSO (Association of Data Processing Service Organizations, Inc.) approved new Association By-Laws which will now enable software firms to take advantage of full membership in the industry's trade association. "This progressive step was taken as a result of the recent analysis of the industry which clearly defined it as encompassing all aspects of the data processing services business," Jerome L. Dreyer, Executive Vice President of ADAPSO said.

Prior to the changes in the Association's By-Laws, full membership was open to those organizations that "maintained physical control of and prime responsibility for its data processing equipment, facilities and methods." This portion of the By-Laws was deleted. It is obvious by looking at our roster of members that we are in the full line data processing services business, which includes software development," Mr. Dreyer stated.

The new By-Laws are the result of ADAPSO's incorporation in New York State this year.

NEWLY-ESTABLISHED POSITION OF FULL-TIME EXECUTIVE DIRECTOR MARKS A KEY-POINT IN AFIPS HISTORY

Paul Armer, President of AFIPS (American Federation of Information Processing Societies), has announced the appointment of Dr. Bruce Gilchrist to the newly-established position of AFIPS Executive Director. Dr. Gilchrist served as president of AFIPS from 1966 to 1968, and has been involved in computing and information processing since 1952. In his new capacity, Dr. Gilchrist will be responsible for developing increased AFIPS services to the AFIPS member societies, governmental bodies and the general public.

Mr. Armer noted that in its decision to appoint an Executive Director, the Board of Governors of AFIPS recognized that this was just the first step in responsibly meeting a number of long-felt needs. The AFIPS Board has already approved a proposal to start an AFIPS Press to handle the publication of proceedings of AFIPS Conferences and to meet Member Society publishing needs. At its December meeting, the Board will be asked to approve a Public Information program.

Dr. Gilchrist will be responsible for developing plans and programs and assisting in the implementation of approved projects. Mr. Armer emphasized the word "assist," saying that the efforts of volunteers are, and will remain, the mainstay of AFIPS activities. All AFIP Headquarters functions will report to Dr. Gilchrist.

KYBE CORPORATION IS NEW NAME FOR CYBETRONICS, INC.

Cybetronics, Inc., Waltham, Mass., a leading manufacturer of magnetic tape cleaning and certifying systems, has changed its name to KYBE Corporation. The change came about due to the confusion caused between the Company's name and that of Cyber-Tronics, Inc., a New York based public corporation dealing in computer leasing.

The new KYBE Corporation is maintaining its logo type (company symbol), while the other company is maintaining its original company identity. The KYBE Corporation plans no changes in company facilities, sales offices, or distribution channels.

AS WE GO TO PRESS

THREE MORE IBM SYSTEM 360 MODELS ARE NOW ON "LIMITED" NEW PRODUCTION, according to information received at press time. Effective October 15, 1968, the production status of IBM models 360/40, 360/50, and 360/75 was changed from "full" new production to "limited" new production.

What this means to IBM customers is that if their order is filled on a "limited" new production basis, they may not receive a new CPU (central processing unit) — and if they don't, their purchase will not be tax qualifying according to Internal Revenue Service regulations. According to IBM sources, existing orders scheduled for delivery on or before September 30, 1969 will be honored with new equipment, but new orders will be filled on a "limited" basis, and therefore may not be tax qualifying.

What this means to the computer industry in the long run remains to be seen. Another model 360, the 360/30, was put on "limited" new production earlier this year. With the addition of models 40, 50 and 75, a total of four of the ten System 360 models are no longer in "full" new production.

TWO FULL-DAY SEMINARS HAVE BEEN ADDED TO THE ASSOCIATION FOR COMPUTING MACHINERY (ACM) PROFESSIONAL DEVELOPMENT PROGRAM FOLLOWING FJCC in San Francisco next month.

"Digital Simulation of Physical Systems" — to be given Thursday, Dec. 12 — is a state-of-the-art survey of the simulation of continuous systems with emphasis on aerospace applications.

"File Structures for On-Line Systems" is an in-depth tutorial for computer programmers, analysts, and managers who are implementing or studying on-line retrieval and query-response information systems.

Both seminars will be held at the San Francisco Hilton Hotel. Enrollment forms for these seminars (and the two other ACM seminars on "Aerospace Software" and "Computer Systems Analysis Techniques" which are also being held following FJCC) are available from the office of ACM Professional Development, 211 E. 43rd St., New York, N.Y. 10017.

ELBIT COMPUTERS LTD. HAS MOVED UP TO THE NUMBER TWO SPOT AMONG SMALL COMPUTER MANUFACTURERS ON THE CONTINENT, with the receipt of their 45th order for an Elbit 100 computer (first released early in 1968).

(Please turn to page 65)

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Computing and Software, Inc., Panorama City, Calif.	U.S. Department of Defense	Continuation of on-site data reduction support at U. S. Army White Sands Missile Range, N.M. (related to Army's missile test flights)	$8.7 million
Librascope Group of General Precision, Glendale, Calif.	U. S. Navy	Production of Fire Control System Mk 113 Mod 8, an antisubmarine warfare weapon control system	$6,743,188
URS Systems Corp., San Mateo, Calif.	Engineer Research and Development Laboratory, U.S. Army Data Field Systems Command, Ft. Belvoir, Va.	Scheduled work during fiscal 1969 on the Army's Combat Service Support System, which is designed to provide automatic data processing capabilities to tactical forces in the field	$5,500,000
RCA, New York, N.Y.	U. S. Army	Two computer-controlled testing systems that can check out complex electronic equipment 10 times faster than conventional techniques; systems are called DIMATE for Depot Installed Maintenance Automatic Test Equipment	$4.6 million
Sylvania Electric Products Inc. (GT&E Subsidiary), Sylvania Electronic Systems, Needham, Mass.	IBM Corporation (prime contractor for the Army project)	Providing power and communications equipment, mounting data processing units in specially-designed vans and shelters — for a mobile data processing and data communications system	$4 million
EMR-Computer, Minneapolis, Minn.	Environmental Science Services Administration (ESSA)	A multi-computer digital data handling system (DDH); includes two ADVANCE 6130 Computer Systems, two ADVANCE 6050 Computer Systems, an ADVANCE 6050/CDC 6600 intercomputer link and 2700 Series ground telemetry equipment	over $1.6 million
Link Group of General Precision Systems Inc., Binghamton, N.Y.	Pakistan International Airlines (PIA)	A 707-340C flight simulator which will be installed at PIA's training center located in Karachi, in late 1969	over $1.5 million
Link Group, General Precision Systems Inc., Sunnyvale, Calif.	Babcock and Wilcox Co., Lynchburg, Va.	Construction of a large-scale pressurized water Nuclear Power Plant Training Simulator; training in all aspects of operation of a nuclear reactor power plant will be provided by use of the simulator	over $1 million
Planning Research Corp., Los Angeles, Calif.	Data Systems Division of Litton Industries	A sub-contract to assist in the design and development of computer programs for the U. S. Army's Tacfire (Tactical Fire Direction) system	over $900,000
Core Memories, Inc., a subsidiary of Data Products Corp., Mountain View, Calif.	EMR-Computer Division, Minneapolis, Minn.	MicroPACER memory systems which will be used in conjunction with EMR's 6100 series computers	over $850,000
Bunker-Ramo Corp., Stamford, Conn.	California Federal Savings & Loan Association	Electronic teller machines for all 18 of Cal Fed S & L offices	$800,000
Systems Engineering Laboratories, Ft. Lauderdale, Fla.	Natural Gas Pipeline of America, Chicago, Ill.	Eleven compressor control systems; each system will be controlled by SEL 810A computers	$731,000
Dynamics Research Corp., Stoneham, Mass.	Perkin-Elmer Corp.	Continuation of the development and fabrication of optical digital encoders	$701,276
Systems Engineering Laboratories, Ft. Lauderdale, Fla.	Hill AFB, Ogden, Utah	An SEL 840MP Computer System	$570,000
Clary Corp., San Gabriel, Calif.	American Totalisator Co., Towson, Md.	Follow-on production of "Point of Sale Devices" for the "Unitote System" used by retail chain outlets	$498,000
System Development Corp., Santa Monica, Calif.	National Science Foundation	Further development of an author language called PLANIT (Programming LANguage for Interactive Teaching) which will allow simultaneous use by 50 or more students	$433,000
Ampex Corporation, Redwood City, Calif.	Burroughs Corporation	Additional Model ATM-13 digital tape transports to be used in the CENPAC system, being developed by Burroughs for the U.S. Air Force	$400,000
Redcor Corp., Canoga Park, Calif.	Bunker-Ramo Corp., Canoga Park, Calif.	Circuit modules for construction of photogrammetry and mapping systems used by the U.S. Army	about $300,000
Avco Space Systems Division, Lowell, Mass.	Materials Laboratory, Wright Patterson AFB, Ohio	Lightweight, optically transparent armor, applicable to protective systems where weight is a critical performance factor	about $260,000
Ampex Corporation, Redwood City, Calif.	Litton Data Systems, Inc., Van Nuys, Calif.	Magnetic core memory stacks to be used in the TACFIRE system	$200,000
Bailey Meter Co., Wickliffe, Ohio	Georgia Power Co.	A Bailey MINI-LINE 500 Pneumatic Analog Control System for application to a pulverized coal and gas fired Foster Wheeler 3,620,000 PPH boiler	about $200,000
Auerbach Corp., Philadelphia, Pa.	U. S. Army Research Office-Durham	System engineering consulting support in connection with the procurement and installation of the Tactical Automatic Digital Switching System (TADSS)	$190,000
New York City	National Highway Safety Bureau of the U. S. Department of Transportation	Improvement of its emergency ambulance service by using computers; developing a prototype system that can be adopted in other urban areas of the country	$130,000

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B300 system	Bankers Data Processing, Inc., Boston, Mass.	Use primarily in on-line savings operations providing computer services to 94 New England financial institutions (System valued at over $400,000)
Control Data 1700 system	Univ. of California, Lawrence Radiation Laboratory, Livermore, Calif.	Monitoring data from long-term environmental and material-testing experiments
	Free Reformed University, Amsterdam, The Netherlands	On-line registration of nuclear physical experiments with the University's cyclotron
Control Data 6600 system	CDC Data Center, Waltham, Mass.	Providing business and industry throughout the Northeast and Eastern Seaboard with computer power and service
GE-415 system	U.S. Steel, Gary Tube Works, Gary, Ind.	Inventory control, production scheduling, and other manufacturing applications
GE-635 system	General Electric Co.'s Heavy Military Electronics Dept., Syracuse, N.Y.	Reducing data processing costs and providing hundreds of Company business and scientific computer users with vastly increased computational capabilities
Honeywell Model 120 system	Management Information Services Inc., Columbus, Ohio	Handling general accounting for several automobile clubs, savings and loan associations and a central Ohio publishing house
Honeywell Model 1250 system	Littlewoods, Liverpool, England	Handling order processing, accounting and market analysis (System valued at $3.1 million)
IBM System/360 Model 30	Omaha Metropolitan Utilities District, Omaha, Neb.	Handling customer inquiries, payroll accounting, inventory and general ledger reporting, and engineering problem solving
NCR Century-100 system	General Host Corp., Bond Baking Company Division, Bronx, N.Y.	Route accounting and accounts receivable; also a complete fleet analysis program
	Hanna Paint Mfg. Co., Columbus, Ohio	Inventory control of both raw materials and finished products; also payroll and billing
NCR 315-RMC system	Exerpta Medica Foundation, Amsterdam, The Netherlands	Assisting in automation program to obtain permanent indexing of the world's biomedical literature for immediately available reference
SDS Sigma 5 system	Federal Aviation Administration, National Aviation Facilities Experimental Center	Assist in development, testing, and evaluation of improved air traffic control techniques, flight control instrumentation, and pilot/navigation aids
SDS Sigma 7 system	University of Toronto, Canada	Library needs only: assisting in circulation control, administrative tasks, in part as an automated library catalog, and developing bibliographic retrieval techniques
	Sylvania Electronic Systems, Applied Research Laboratory, Waltham, Mass.	Studying advanced communications concepts and devices; developing character recognition and underwater communications equipment; design and develop compact laser systems; and concurrently process general business data and prepare reports
UNIVAC 1108 system	Shell International Petroleum Co. Ltd. (SIPC), London, England	Use as hub of a communications network serving Shell refineries, a chemical plant, and research facilities in England; also connected to offices of the Royal Dutch/Shell Group on the European continent (System valued at $4 million)
	University of Wisconsin, Madison, Wis.	Providing extended services to students and faculty in various departments in Madison and distant U.W. campuses throughout the State
UNIVAC 9200 system	Colorado Kenworth G.M.C. Inc., Denver, Col.	Processing accounts receivable, invoicing, and inventory control
	Gordon Johnson Co. Kansas City, Mo.	Replacing punched card machines; will be used in as many applications as practical
	Kettler Bros. Inc., Washington, D.C.	Scheduling of construction programs, payroll processing and various accounting applications
	Key Drug Co., Pierceton, Ind.	Drugstore management, item order, purchase orders and recording, accounts payable and receivable and payroll processing
	Helsingfors Sparbank, Helsinki, Finland	Accounting tasks formerly run on punched card machine; other programs now being handled on service bureau basis will be added later
	Hensel & Sons Inc., Harrisburg, Pa.	Inventory control, billing, accounts receivable and payable, and statistical preparations
	Utah State University, Logan, Utah	Use by students in the Engineering Department
	Whitley Products Inc., Pierceton, Ind.	Production control, cost accounting, payroll, labor allocation, and inventory control on raw material
UNIVAC 9300 system	Advanced Computer Service Inc., Fort Wayne, Inc.	Supplementing present computing and tabulating equipment
	Texas State Teachers Assoc., Austin, Texas	Preparation of numerous statistical reports re educational matters, renewal notices for membership fees and addressing labels for their monthly magazine
	Data-Pack Inc., Waterbury, Conn.	Developing and using package application programs for small manufacturers in financial and control areas
UNIVAC 9400 system	Associated Grocers, Phoenix, Ariz.	Handling billings on over 17,000 warehouse items, for buyers' reports, payroll, and accounts payable and receivable
	Hasbro Industries, Inc., Pawtucket, R.I.	TV market analysis, inventory control, cost accounting, factory scheduling, controls, purchasing, budgeting, mailing lists, payroll and accounting tasks

MONTHLY COMPUTER CENSUS

The following is a summary made by Computers and Automation of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide.

Our census has begun to include computers manufactured by organizations outside the United States. We invite all manufacturers located anywhere to submit information for this census. We also invite our readers to submit information that would help make these figures as accurate and complete as possible.

The following abbreviations apply:

- (R) - figures derived all or in part from information released directly or indirectly by the manufacturer, or from reports by other sources likely to be informed
- (N) - manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
- (S) - sale only
- X - no longer in production
- C - figure is combined in a total (see column to the right)
- E - figure estimated by Computers and Automation
- ? - information not received at press time

AS OF OCTOBER 15, 1968

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	MFR'S TOTAL INSTALLATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL UNFILLED ORDERS
I. United States Manufacturers							
Autonetics (R)	RECOMP II	$2495	11/58	30		X	
Anaheim, Calif.	RECOMP III	$1495	6/61	6	36	X	0
Bailey Meter Co.	Bailey 756	$60,000-$400,000 (S)	2/65	17		3	
Wickliffe, Ohio	Bailey 855	$100,000 (S)	4/68	0	17	15	18
Bunker-Ramo Corp. (R)	BR-130	$2000	10/61	160		X	
Canoga Park, Calif.	BR-133	$2400	5/64	62		X	
	BR-230	$2680	8/63	15		X	
	BR-300	$3000	3/59	18		X	
	BR-330	$4000	12/60	23		X	
	BR-340	$7000	12/63	19	297	X	0
Burroughs (R)	205	$4600	1/54	38		X	
Detroit, Mich.	220	$14,000	10/58	31		X	
	B200 Series, B100	$5400	11/61	800		31	
	B300 Series	$9000	7/65	370		150	
	B500	$3800	10/68	0		70	
	B2500	$5000	2/67	57		117	
	B3500	$14,000	5/67	44		190	
	B5500	$22,000	3/63	74		8	
	B6500	$33,000	2/68	4		31	
	B7500	$44,000	4/69	0		13	
	B8500	$200,000	8/67	1	1430 E	5	550 E
Control Data Corp. (R)	G-15	$1600	7/55	295		X	
Minneapolis, Minn.	G-20	$15,500	4/61	20		X	
	LGP-21	$725	12/62	165		X	
	LGP-30	$1300	9/56	322		X	
	RPC-4000	$1875	1/61	75		X	
	636/136/046 Series	?	-	29		C	
	160*/8090 Series	$2100-$12,000	5/60	610		X	
	924/924A	$11,000	8/61	29		X	
	1604/A/B	$45,000	1/60	59		X	
	1700	$3500	5/66	100		C	
	3100/3200/3300	$10,000-$16,250	5/64	311		C	
	3400/3600/3800	$18,000-$48,750	6/63	79		C	
	6400/6500/6600	$52,000-$117,000	8/64	77		C	
	6800	$130,000	6/67	0		C	
	7600	$150,000	12/68	0	1900 E	C	300 E
Data General Corp.	NOVA	$7950 (S)	1/68	0	0	0	0
Hudson, Mass.							
Digital Electronics Inc. (R)	DIGIAC 3080	$19,500 (S)	12/64	11		1	
Plainview, N.Y.	DIGIAC 3080C	$25,000 (S)	10/67	1	12	1	2
Digital Equipment Corp. (R)	PDP-1	$3400	11/60	48		X	
Maynard, Mass.	PDP-4	$1700	8/62	32		X	
	PDP-5	$900	9/63	100		X	
	PDP-6	$10,000	10/64	21		X	
	PDP-7	$1300	11/64	99		X	
	PDP-8	$525	4/65	1352		C	
	PDP-8/S	$300	9/66	863		C	
	PDP-8/I	$425	3/68	398		C	
	PDP-8/L	?	11/68	0		C	
	PDP-9	$1000	12/66	271		C	
	PDP-9/L	?	-	0		C	
	PDP-10	$7500	12/67	27		C	
	LINC-8	?	9/66	132	3343	C	450 E
Electronic Assoc., Inc. (R)	640	$1200	4/67	42		18	
Long Branch, N.J.	8400	$12,000	7/65	21	63	4	22
EMR Computer Div. (R)	ASI 210	$3850	4/62	C		X	
Minneapolis, Minn.	ASI 2100	$4200	12/63	C		X	
	ADVANCE 6020	$4400	4/65	C		C	
	ADVANCE 6040	$5600	7/65	C		C	
	ADVANCE 6050	$9000	2/66	C		C	
	ADVANCE 6070	$15,000	10/66	C		C	
	ADVANCE 6130	$1550	8/67	23	89	C	37
General Electric (N)	115	$1370-$5000	4/66	720 E		600 E	
Phoenix, Arix.	130	$4350-$15,000	-	0		C	
	205	$2500-$10,000	6/64	C		X	
	210	$16,000-$22,000	7/60	C		X	
	215	$2500-$10,000	9/63	C		X	
	225	$2500-$16,000	4/61	200 E		X	
	235	$6000-$18,000	4/64	130 E		C	
	255 T/S	$15,000-$19,000	10/67	C		C	
	265 T/S	$17,000-$20,000	10/65	C		C	
	405	$5120-$10,000	2/68	C		C	
	415	$4800-$13,500	5/64	380 E		70 E	
	420 T/S	$17,000-$20,000	6/67	C		C	
	425	$6000-$20,000	6/64	130 E		C	
	430 T/S	$15,500-$19,000	-	0		C	
	435	$8000-$25,000	9/65	C		C	

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General Electric (cont'd)	440 T/S	$22,200-$27,000	-	0		C	
	625 T/S	$31,000-$125,000	4/65	C		C	
	635 T/S	$35,000-$167,000	5/65	C		C	
	645	$40,000-$250,000	7/66	C	1900 E	C	900 E
Hewlett-Packard (R)	2116A	$600	11/66	106		C	
Palo Alto, Calif.	2115A	$412	11/67	140		C	
	2116B	$650	5/68	34		C	
	2114A	$250	5/68	55	335	C	50 E
Honeywell (R)	DDP-24	$2500	5/63	93		X	
Computer Control Div.	DDP-116	$900	4/65	200		30	
Framingham, Mass.	DDP-124	$2050	3/66	64		30	
	DDP-224	$3300	3/65	52		8	
	DDP-516	$700	9/66	155		150	
	H632	$2700	-	0	564	?	218
Honeywell (R)	H-110	$2500	8/68	0		90	
EDP Division	H-120	$4000	1/66	650		240	
Wellesley Hills, Mass.	H-125	$5000	12/67	22		75	
	H-200	$8500	3/64	800		87	
	H-400	$11,000	12/61	52		X	
	H-800	$28,000	12/60	59		X	
	H-1200	$9500	2/66	175		130	
	H-1250	$12,000	7/68	0		20	
	H-1400	$14,000	1/64	7		X	
	H-1800	$50,000	1/64	16		X	
	H-2200	$26,000	1/66	88		71	
	H-4200	$26,000	8/68	0		20	
	H-8200	$50,000	12/68	0	1869 E	5	700 E
IBM (N)	305	$3600	12/57	C		X	
White Plains, N.Y.	360/20	$3000	12/65	7700 E		4200 E	
	360/25	$5330	1/68	C		1800 E	
	360/30	$9340	5/65	7400 E		2300 E	
	360/40	$19,550	4/65	3500 E		1100 E	
	360/44	$15,000	7/66	C		C	
	360/50	$32,960	8/65	C		C	
	360/65	$69,850	11/65	C		C	
	360/67	$138,000	10/66	C		C	
	360/75	$81,400	2/66	C		C	
	360/85	$115,095	-	0		C	
	360/90 Series	-	10/67	C		C	
	650	$4800	11/54	C		X	
	1130	$1545	2/66	4000 E		4300 E	
	1401	$6480	9/60	6300 E		X	
	1401-G	$2300	5/64	1460 E		X	
	1401-H	$1300	6/67	C		C	
	1410	$17,000	11/61	C		C	
	1440	$4300	4/63	3360 E		C	
	1460	$10,925	10/63	1140 E		X	
	1620 I, II	$4000	9/60	1500 E		C	
	1800	$4800	1/66	C		C	
	701	$5000	4/53	C		X	
	7010	$26,000	10/63	C		C	
	702	$6900	2/55	C		X	
	7030	$160,000	5/61	C		X	
	704	$32,000	12/55	C		X	
	7040	$25,000	6/63	C		C	
	7044	$36,500	6/63	C		C	
	705	$38,000	11/55	C		X	
	7070, 2, 4	$27,000	3/60	C		X	
	7080	$60,000	8/61	C		X	
	709	$40,000	8/58	C		X	
	7090	$63,500	11/59	C		X	
	7094	$75,500	9/62	C		X	
	7094 II	$82,500	4/64	C	42,100 E	C	16,000 E
Interdata (R)	Model 2	$200-$300	7/68	3		1	
Oceanport, N.J.	Model 3	$300-$500	3/67	105		35	
	Model 4	$400-$800	8/68	6	114	22	58
National Cash Register Co. (R)	NCR-304	$14,000	1/60	24		X	
Dayton, Ohio	NCR-310	$2500	5/61	10		X	
	NCR-315	$8500	5/62	700		150	
	NCR-315-RMC	$12,000	9/65	105		50	
	NCR-390	$1850	5/61	1200		6	
	NCR-500	$1500	10/65	2000		580	
	NCR-Century-100	$2645	-	-		C	
	NCR-Century-200	$7500	-	-	4039	C	1050 E
Pacific Data Systems Inc. (R) Santa Ana, Calif.	PDS 1020	$550-$900	2/64	145	145	10	10
Philco (R)	1000	$7010	6/63	16		X	
Willow Grove, Pa.	2000-210, 211	$40,000	10/58	16		X	
	2000-212	$52,000	1/63	12	44	X	0
Potter Instrument Co., Inc. Plainview, N.Y.	PC-9600	$12,000 (S)	-	-	-	-	-
Radio Corp. of America (R)	RCA 301	$7000	2/61	635		C	
Cherry Hill, N.J.	RCA 3301	$17,000	7/64	75		C	
	RCA 501	$14,000	6/59	96		X	
	RCA 601	$35,000	11/62	3		X	
	Spectra 70/15	$4500	9/65	190		120	
	Spectra 70/25	$6500	9/65	102		57	
	Spectra 70/35	$10,400	1/67	60		135	
	Spectra 70/45	$22,000	11/65	110		85	
	Spectra 70/46	$34,400	-	0		C	
	Spectra 70/55	$34,300	11/66	7	1270 E	14	420 E
Raytheon (R)	250	$1200	12/60	175		X	
Santa Ana, Calif.	440	$3500	3/64	20		X	
	520	$3200	10/65	27		0	
	703	(S)	10/67	70	292	20	20
Scientific Control Corp. (R)	650	$500	5/66	23		0	
Dallas, Tex.	655	$1800	10/66	63		15	

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Scientific Control Corp.	660	$2000	10/65	9		6	
(cont'd)	670	$2600	5/66	1		0	
	6700	$30,000	10/67	0		1	
	4700	$700	2/69	0		2	
	6700	$30,000	10/67	0	96	2	24
Scientific Data Syst., Inc. (N)	SDS-92	$1500	4/65	120 E		10 E	
Santa Monica, Calif.	SDS-910	$2000	8/62	225 E		25 E	
	SDS-920	$2900	9/62	200 E		20	
	SDS-925	$3000	12/64	C		C	
	SDS-930	$3400	6/64	235 E		30	
	SDS-940	$10,000	4/66	C		C	
	SDS-9300	$7000	11/64	C		C	
	Sigma 2	$1000	12/66	95 E		160	
	Sigma 5	$6000	8/67	C		50	
	Sigma 7	$12,000	12/66	C	1045 E	C	320 E
Standard Computer Corp. (N)	IC 4000	$9000	7/68	0		2 E	
Los Angeles, Calif.	IC 6000	$10,000-$22,000	5/67	7	7	12 E	14 E
Systems Engineering Labs (R)	SEL 810	$1000	9/65	24		X	
Ft. Lauderdale, Fla.	SEL 810A	$900	8/66	74		48	
	SEL 810B	?	-	2		13	
	SEL 840	$1400	11/65	4		X	
	SEL 840A	$1400	8/66	37		24	
	SEL 840 MP	?	1/68	7	148	22	107
UNIVAC, Div. of Sperry Rand (R)	I & II	$25,000	3/51 & 11/57	23		X	
New York, N.Y.	III	$20,000	8/62	77		X	
	File Computers	$15,000	8/56	13		X	
	Solid-State 80 I, II, 90, I, II & Step	$8000	8/58	210		X	
	418	$11,000	6/63	135		20	
	490 Series	$35,000	12/61	200		35	
	1004	$1900	2/63	3000 E		20	
	1005	$2400	4/66	1150		90	
	1050	$8000	9/63	280		10	
	1100 Series (except 1107 & 1108)	$35,000	12/50	9		X	
	1107	$55,000	10/62	33		X	
	1108	$65,000	9/65	105		75	
	9200	$1500	6/67	230		850	
	9300	$3400	7/67	125		550	
	9400	$7000	5/69	0		60	
	LARC	$135,000	5/60	2	5592 E	X	1670 E
Varian Data Machines (R)	620	$900	11/65	75		0	
Newport Beach, Calif.	620i	$500	6/67	238		430	
	520i	-	10/68	2	315	-	430
		I. U.S. Manufacturers, TOTAL		—	67,100 E		23,400 E
II. Non-United States Manufacturers							
A/S Norsk Data-Elektronikk Oslo, Norway	NORD 1	$1000	8/68	5	5	2 E	2 E
A/S Regnecentralen (R)	GIER	$2300-$7500	12/60	37		1	
Copenhagen, Denmark	RC 4000	$3000-$20,000	6/67	1	38	1	2
Elbit Computers Ltd. (R) Haifa, Israel	Elbit-100	$4900 (S)	10/67	35	35	15	15
English Electric Computers	LEO I	-	-/53	3		X	
Ltd. (R)	LEO II	-	6/57	11		X	
London, England	LEO III	$9600-$24,000	4/62	39		X	
	LEO 360	$9600-$28,800	2/65	8		X	
	LEO 326	$14,400-$36,000	5/65	11		X	
	DEUCE	-	4/55	32		X	
	KDF 6	-	12/63	17		X	
	KDF 8-10	-	9/61	12		X	
	KDF 9	$9600-$36,000	4/63	28		X	
	KDN 2	-	4/63	8		X	
	KDF 7	$1920-$12,000	5/66	8		X	
	SYSTEM 4-30	$3600-$14,400	10/67	3		C	
	SYSTEM 4-40	$7200-$24,000	5/69	-		C	
	SYSTEM 4-50	$8400-$28,800	5/67	9		C	
	SYSTEM 4-70	$9600-$36,000	1/68	2		C	
	SYSTEM 4-75	$9600-$40,800	9/68	-		C	
	ELLIOTT 903	$640-$1570	1/66	52		C	
	ELLIOTT 4120	$1600-$4400	10/65	82		C	
	ELLIOTT 4130	$2200-$9000	6/66	23	348	C	110
GEC-AEI Automation Ltd. (R)	Series 90-2/10/20/25/30/40/300	-	3/63-1/68	12		C	
New Parks, Leicester, England	S-2	-	1/68	1		0	
	S-5	-		0		C	
	S-7	-		0		C	
	GEC-TRW130	-	12/64	2		X	
	GEC-TRW330	-	3/63	9		X	
	CON/PAK 4000 Range	-	10/65	321	346	?	8 E
International Computers	1200/1/2	$900	-/55	62		X	
Limited (R)	1300	$3000	-/63	79		X	
London, England	1301	$5000	-/61	127		X	
	1500	$6000	-/62	125		X	
	1100	$5000	-/60	23		X	
	2400	$23,000	-/61	4		X	
	Atlas 1 & 2	$65,000		6		X	
	Orion 1 & 2	$20,000	-/63	17		X	
	Sirius	-	-/61	22		X	
	Mercury	-		19		X	
	Pegasus 1 & 2	-	-/56	33		X	
	1901	$4000	9/66	328		112	
	1902	$4800	7/65	189		24	
	1903	$6500	7/65	99		20	
	1904	$12,200	5/65	58		5	
	1905	$13,000	12/64	31		3	

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International Computers Limited (cont'd)	1909	$5500	8/65	17		1	
	1906	$28,000	12/66	4		1	
	1907	$29,000	12/66	9		0	
	1904E	$16,000	1/68	8		34	
	1905E	$16,500	1/68	4		15	
	1904F	$17,000				9	
	1905F	$17,500				12	
	1906E	$29,300				2	
	1907E	$30,300	3/68	1		1	
	1906F	$31,200				2	
	1907F	$32,500				2	
	1901A	$3700	3/68	1		102	
	1902A	$3600				72	
	1903A	$10,600	9/67	2		7	
	1904A	$18,600				1	
	1906A	$54,000			1268	1	426
Japanese mfrs.	Various models	-	-	C	2074 E	C	500 E
The Marconi Co., Ltd. Chelmsford, Essex, England	Myriad I	£36,000-£66,000	3/66	26		19	
	Myriad II	£22,000-£42,500	10/67	8	34	10	29
N.V. Philips' Computer Industrie Apeldoorn, Netherlands	P1000	?	6/68	0	0	5 E	5 E
Saab Aktiebolag (R) Linkoping, Sweden	DATASAAB D21	$5000-$14,000	12/62	32		2	
	DATASAAB D22	$8000-$60,000	5/68	1	33	11	13
Siemens Aktiengesellschaft Munich, Germany	2002	54,000 (Deutsche	6/59	42		-	
	3003	52,000 Marks)	12/63	34		2	
	4004/15/16	19,000 "	10/65	67		18	
	4004/25/26	32,000 "	1/66	30		9	
	4004/35	46,000 "	2/67	59		63	
	4004/45	75,000 "	7/66	53		42	
	4004/55	103,000 "	12/66	3		3	
	301	2000 "	-	-		8	
	302	4000 "	9/67	10		8	
	303	10,000 "	4/65	65		8	
	304	12,000 "	-	7		22	
	305	14,000 "	11/67	17	387	27	210
Union of Soviet Socialist Republics	BESM 4	-	-	C		C	
	BESM 6	-	-	C		C	
	MINSK 2	-	-	C		C	
	MINSK 22	-	-	C		C	
	MIR	-	-	C		C	
	NAIRI	-	-	C		C	
	ONEGA 1	-	-	C		C	
	ONEGA 2	-	-	C		C	
	URAL 11/14/16	-	-	C		C	
	and others				2500 E		700 E
		II. Non-U.S. Manufacturers, TOTAL —			7100 E		2000 E
		Combined, TOTAL —			74,200 E		25,400 E

BOOK REVIEWS

Neil Macdonald
Assistant Editor
Computers and Automation

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, hardbound or softbound, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning *Computers and Automation.*

Orr, William D., et al. / Conversational Computers / John Wiley and Sons, Inc., 605 Third Ave., New York, N.Y. 10016 / 1968, hardbound, 227 pp., $?

"This volume is intended for the intelligent, curious nonspecialist who, in one way or another, has come to suspect that something is up in the world of computing and would like to know what. The way chosen to 'explain' Conversational Computers is to bring together in one volume some of the writings that have had pivotal effects on the field." The 22 chapters are included in Part I, The Vision; Part II, Problem-Solving Modes; Part III, Instructional Modes; Part IV, Retrieval and Query Modes; Part V, Graphical Conversation Modes; Part VI, Toward the Computer Utility; Part VII, Psychological and Social Implications. There is an index.

Gerard, Ralph W., Editor, and over 40 participants / Computers and Education / McGraw Hill Book Co., 330 W. 42 St., New York, N.Y. 10036 / 1967, hardbound, 307 pp., $7.95

This book is apparently a verbatim report of a conference held at the University of California discussing the future uses of computers with respect to education. It explores the uses of computers as teaching devices, as a vehicle for storing information and written material, and as a worksaver in administration. Session titles: (1) "CAI — Learning Aspects"; (2) "CAI (Library) — Stored Information"; (3) "Administration — Integrated Records and Procedures"; (4) "Regional and National Networks"; (5) "Administration-Integrated Records and Procedures"; (6) "Administration — Top-Level Information Flow"; and (7) "Regional and National Networks".

Foster, J. M. / List Processing / MacDonald & Co., Ltd., Gulf House, 2 Portman St., London, W.1, England / 1967, hardbound, 54 pp., $2.50?

The purpose of this book is to "describe the techniques of list processing to those readers (really 'post-graduate students) with an elementary (really non-elementary) knowledge of computer programming". It describes these techniques as they appear to the computer programmer and as they are implemented inside the computer. The chapters include an "Introduction"; "An Example of List Processing"; "The Representation of Lists"; "Some Typical List Languages" and "The Future of List Processing".

Yourdon, Edward, Editor, and 7 authors / Real-Time Systems Design / Information & Systems Institute Inc., 14 Concord Lane, Cambridge, Mass. 02138 / 1967, hardbound, 205 pp., $10.50

This book seeks to show that "All practical, well-designed real-time systems are characterized by certain common features and universal components. The degree or extent of each component may vary, but the structure is substantially constant." A framework for the development of real-time computer systems is established.

The 12 chapters are in four main divisions, which are: "Real-Time Systems in Perspective"; "Building Real-Time Systems"; "Testing Real-Time Systems"; and "Managing Real-Time Systems Development".

About 2/3 of the chapters are reprints of articles from technical magazines. The remainder consists of chapters especially written for this book. The subject of course is important. Bibliographies are at the end of most chapters. There is an index.

Pear, C. B., Jr., and 9 more authors / Magnetic Recording in Science and Industry / Reinhold Publishing Corp., 430 Park Ave., New York, N.Y. 10022 / 1967, hardbound, 453 pp., $19.50

This is a complete, detailed handbook on magnetic recording technology. The book is intended to provide current and potential users of magnetic recording for technical purposes with a reliable source of detailed information defining its capabilities and limitations.

The twelve chapters include: "Recording principles"; "Magnetic recording media"; "Analog recording methods"; "Digital recording methods"; "Analog tape recording systems"; "Digital tape recording systems"; "Digital data recording applications"; "Analog recording applications"; "Control applications"; "Accessories and auxiliary equipment". References are included at the end of each chapter. There is an index, and two appendices: "Excerpt from interim Federal specification reel, precision, aluminum and magnesium, 3-inch center hole", and "IRIG Document 106-66: telemetry standards".

Schultz, Claire K. (editor), Luhn, H. P., and other authors / H. P. Luhn: Pioneer of Information Science / Spartan Books, 866 Third Ave., New York, N.Y. 10022 / 1968, hardbound, 320 pp., $18.75

This book presents selected writings of Hans Peter Luhn, an inventor and prolific idea producer in computers and data processing including works both in and out of print.

A feature of the book is biographical sketches by four of his colleagues covering his career and personal life, emphasizing his work as an information scientist from 1948 to 1964.

The book includes four biographical notes, 30 publications of H. P. Luhn, a list of his patents, and a bibliography and index to all his publications. The volume is a labor of love by those who knew him and were much shocked by his sudden death in April 1964 at the age of 68.

This book is full of useful information for those persons who are interested in the ideas of a main contributor to the field of computers and information sciences.

Schmidt, Richard N., and William E. Meyers / Introduction to Computer Science and Data Processing / Holt, Rinehart & Winston, Inc., 383 Madison Ave., New York, N.Y. 10017 / 1965, hardbound, 380 pp., $?

The purpose of this book is to introduce students to computer science and data processing in a general course to serve as a first introduction to computers for people early in their academic life.

The 17 chapters are grouped into seven parts: Introduction; Number systems; Boolean Logic; Concept of the Computer; Flowcharting; Programming; Systems. Among the chapters are "Career Opportunities", "Binary Arithmetic", "Boolean Algebra", "Fortran", and "Cobol". Short bibliography. Index.

(As We Go To Press)

(Continued from page 58)

In keeping with the "we try harder" number 2 position, the company (based in Haifa, Israel) announced a new Model "U" Elbit 100, with a completely new instruction list. This instruction list, which is achieved by changing the microprogrammable Read Only Memory portion of the computer, is a result of an extensive market survey to determine just what instructions the small computer user wants. Both Elbit 100 models feature up to 75 different conditional jump operations, logical operations, and real-time interrupt.

VARIAN DATA COMPUTER SYSTEM WHICH WILL SPAN DOWNTOWN SAN FRANCISCO will be one of many displays set up for the Fall Joint Computer Conference (FJCC) next month.

Varian Data Machines is planning a telephone-line link between their reception center at a Nob Hill hotel and their FJCC booth at the San Francisco Civic Center to demonstrate the batch-terminal capabilities of the Varian Data 620i and the new, smaller Varian 520i computers.

The 620i will serve as a Central Batch Terminal at the company's reception center. Its function will be to receive batches of data from remote data sources, temporarily store the information in a bulk memory device, and feed the data to a large computer.

The 520i will act as a Remote Batch Terminal, collecting information from, or transmitting data to such peripheral devices as card readers, line printers, teletype machines, magnetic tape, and high speed paper tape units. The computer will funnel the information onto the telephone line that links the Remote Batch Terminal with the Central Batch Terminal. The system is designed for standard voice-grade duplex telephone links, one per Remote Batch Terminal. The 620i Central Batch Terminal can handle up to eight remote lines simultaneously.

More than 230 620i's have been put into service since its first installation in June of 1967. Two deliveries have been made on the new 520i since it was announced earlier this fall, with a reported substantial backlog.

NEW PATENTS

Raymond R. Skolnick
Patent Manager
Ford Instrument Co.
Div. of Sperry Rand Corp.
Long Island City, N.Y. 11101

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

September 3, 1968

3,400,370 / Masahiko Fukamachi, Shiba Mita, Minatoku, Tokyo, Japan / Nippon Electric Company Limited, Shiba Mita, Minatoku, Tokyo, Japan, a corporation of Japan / Probability comparator.

3,400,371 / Gene M. Amdahl and Gerrit A. Blaauw, Poughkeepsie, Elaine M. Boehm, Wappingers Falls, Peter Calingaert, Poughkeepsie, Richard J. Carnevale, Union, Richard Paul Case, Lagrangeville, Arthur F. Collins and Jack E. Greene, Vestal, William P. Hanf, Endicott, Jacob R. Johnson, Poughkeepsie, Albert A. Magdall, Vestal, Charles B. Perkins, Jr., Endicott, John W. Rood, Vestal, Bruce M. Updike, Union, and Anthony E. Villante, Binghamton, N. Y., and Helmut Weber, Sunnyvale, Calif. / International Business Machines Corp., New York, N. Y., a corporation of New York / Data processing system.

3,400,372 / William F. Beausoleil and William C. Hoskinson, Poughkeepsie, Lewis E. King, Highland, and Herbert G. Weber III, Poughkeepsie, N. Y. / International Business Machines Corp., Armonk, N. Y., a corporation of New York / Terminal for a multi-data processing system.

3,400,376 / Eugene E. McDonnell, Yorktown Heights, N. Y. / International Business Machines Corp., Armonk, N. Y., a corporation of New York / Information transfer control system.

3,400,379 / Michael Godfrey Harman, London, England / The National Cash Register Company, Dayton, Ohio, a corporation of Maryland / Generalized logic circuitry.

3,400,383 / Robert A. Meadows and Lawrence J. Housey, Jr., Dallas, Texas / Texas Instruments Inc., Dallas, Texas, a corporation of Delaware / Trainable decision system and adaptive memory element.

September 10, 1968

3,401,266 / Edmund H. Cooke-Yarborough, Murray Hill, N. J. / Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York / Logic arrangement employing light generating diodes, photosensitive diodes and reflecting grating means.

3,401,380 / Hamish Vernon Bell, Orran Terence Pate, and David Hartley, Liverpool, England / Automatic Telephone & Electric Company Limited / Electrical systems for the reception, storage, processing and re-transmission of data.

3,401,382 / Andrew H. Bobeck, Chatham, N. J. / Bell Telephone Laboratories, Inc., New York, N.Y., a corporation of New York / Magnetic waffle iron memory structure.

September 17, 1968

3,402,392 / Eugene N. Schroeder, Bethesda, Md. / United States of America as represented by the Secretary of the Air Force / Time division multiplex matrix data transfer system having transistor cross points.

3,402,394 / Ralph J. Koerner, Canoga Park, and Alfred D. Scarbrough, Northridge, Calif. / The Bunker-Ramo Corporation, Canoga Park, Calif., a corporation of Delaware / Content addressable memory.

3,402,395 / Glen J. Culler, Santa Barbara, and Roland F. Bryan, Chatsworth, Calif. / The Bunker-Ramo Corporation, Stamford, Conn., a corporation of Delaware / Data compression and display system.

3,402,396 / William J. McBride, Wayland, Mass. / Honeywell Inc., Minneapolis, Minn., a corporation of Delaware / Data processing apparatus.

3,402,397 / James F. McDonald, Lexington, Ky. / International Business Machines Corp., Armonk, N. Y., a corporation of New York / Communications terminal with internal circulation of data.

3,402,398 / Ralph J. Koerner, Canoga Park, and Alfred D. Scarbrough, Northridge, Calif. / The Bunker-Ramo Corporation, Canoga Park, Calif., a corporation of Delaware / Plural content addressed memories with a common sensing circuit.

September 24, 1968

3,403,267 / Robert O. Winder, Trenton, N. J. / Radio Corporation of America, a corporation of Delaware / Flip-flop employing three interconnected majority-minority logic gates.

3,403,385 / Gerhard Dirks, 12120 Edgecliff Place, Los Altos Hills, Calif. 94022 / —— / Magnetic storage device.

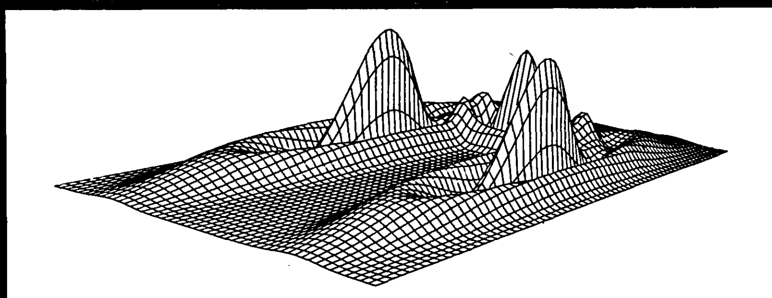
3,403,389 / Allan Henry Ellson, Whyteleaf, and Alexander Donald Main, Sutton, England / North American Philips Company, Inc., New York, N. Y., a corporation of Delaware / Magnetic information storage matrix employing permanently magnetized inhibiting plate.

3,403,390 / Peter Frederic Thomas Cryer Stillwell, Aldershot, England / Rank-Bush Murphy Limited, London, England, a British company / Message storage.

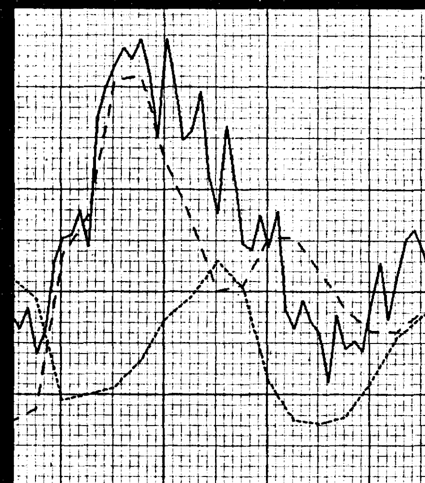
ADVERTISING INDEX

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.

Do you know what it takes to make <u>your</u> computer draw like this?

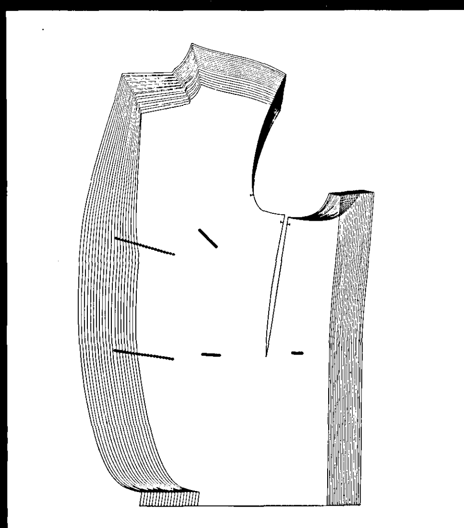


PERSPECTIVE DRAWINGS

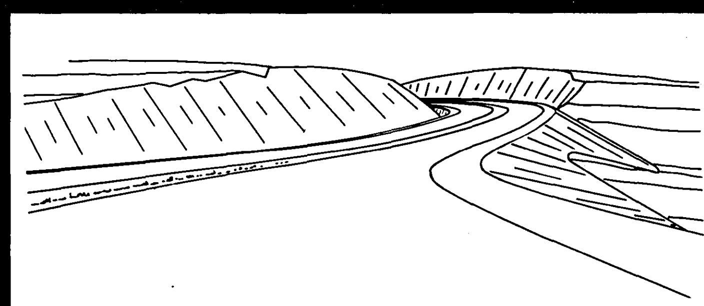


FINANCIAL TREND CHARTS

EVEN FINE ART!



AUTOMATIC APPAREL PATTERN GRADING



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