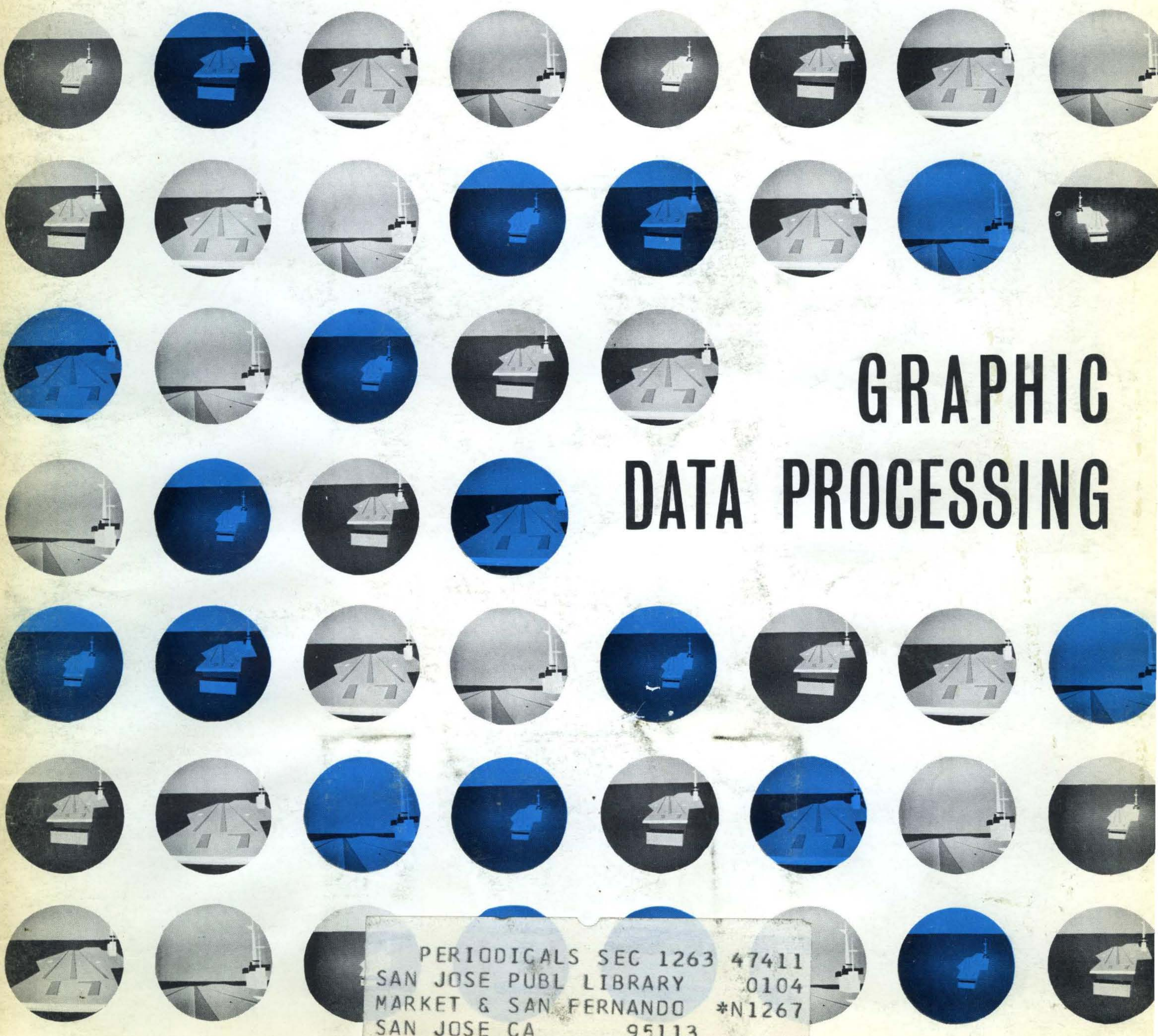
November, 1967

computers and automation



GRAPHIC DATA PROCESSING

WE JUST OBSOLETED EVERYBODY ELSE'S COMPUTER GRAPHICS.

Our new CRT computer terminal makes all other graphics systems suddenly look like Theda Bara vamping Rudolph Valentino. Nostalgic, maybe, but very, very obsolete. □ The difference is that the Adage Graphics Terminal is a fully-integrated general-purpose system. It has its own internal computer and is delivered complete with operating software for communicating with the remote central computer and for local image control and console I/O. □ Hybrid processing techniques exclusive with Adage (our Ambilog 200 hybrid computer is standard in every terminal) produce dynamic displays of 3-dimensional objects which really move continuously. Pictures are bright and clear. Even complex images don't flicker. □ You can start with the Model 10 Graphics Terminal at $75,000, and get 4K of 30-bit core memory, CRT console, and Dataphone interface to the central computer. □ For around $250,000 the top-of-the-line Model 50 buys you 16K of core, extended arithmetic capability, and disk memory for local storage of image and program libraries. The console has a full complement of operator's controls for image translation, rotation, and scaling. Options include a hard copy display recorder and an analog input tablet. □ Would you like a demonstration? In your office? Write David Sudkin, Manager of Marketing Services, at Adage, Inc., 1079 Commonwealth Avenue, Boston, Mass. 02215, on your company letterhead. We will send you a 16mm demonstration film showing the system in action. □ The movie is on us. You bring the popcorn.

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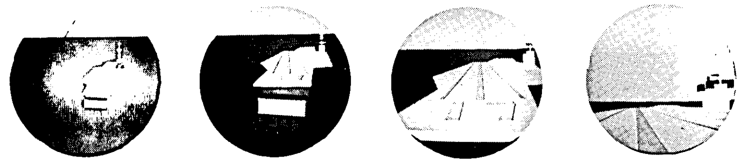

The front cover consists of four miniatures (repeated) showing how an aircraft carrier is seen by a computer as if it were a plane approaching for landing. The programmed computer was designed and built by GE Electronics Laboratory, Syracuse, N.Y., for the Manned Spacecraft Center of NASA, Houston, Tex. For more information, please see pages 53 and 71.

computers and automation

NOVEMBER, 1967 Vol. 16, No. 11

Special Feature:
Graphic Data Processing

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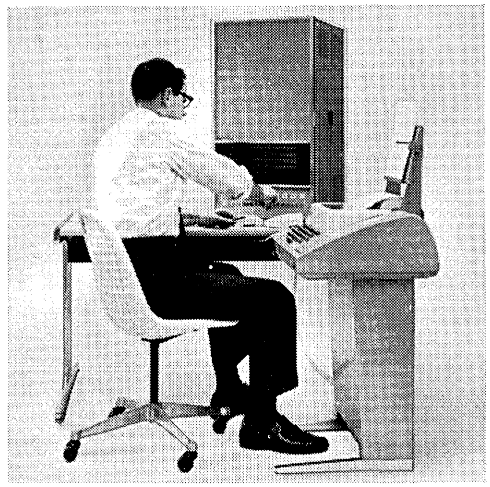

To the computer specialist who figures he'd show 'em how, if he ever got the chance:

You've got the chance.

Now Hewlett-Packard's in the computer business... with a series of versatile, small, high-speed digital computers, so flexible, so well packaged that they're begging to go to work on the applications that only you can find... and sell. We've got the products. We invite you to apply your computer engineering expertise either to advancing our line of computers and software or to marketing them. The choice is yours.

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Learning to Read Using a Responsive Environment

In this issue is one of the most interesting and exciting reports which we have noticed in a long time. This report, "The Talking Typewriter, and the Learning of Reading in a Disadvantaged Community," describes an experimental project in Brooklyn, N.Y., undertaken by Thomas A. Edison Laboratory of West Orange, N.J. and the New York Public School System. The "talking typewriter" was originally conceived and worked out by Dr. Omar Khayyam Moore, then at Yale University. The present report was given by Dr. Richard Kobler of the Edison Laboratory at the Annual Conference of the National Reading Reform Foundation, in New York, August 1967. The facts reported indicate enormously important directions for progress in teaching, education, the usefulness of computers, and the usefulness of human beings.

Reading is probably the most fundamental skill required from all persons in an advanced society.

What is reading? In simple words, reading is looking at written letters and knowing what they say.

Why is reading important? Why should anyone want to read? Won't television, color movies, radio, the computer, the telephone, the phonograph, and other marvels of communication make reading less and less necessary?

The answer is no. The knowledge written down and printed in books is still the foundation of all present-day civilization, and will be so for a long time. This is true for many reasons. First, quantity: The amount of information recorded in print is enormously greater than all the information expressed in all other ways put together. Any story, epic, adventure, idea, principle, philosophy, science, art, technique, discovery, once written down and printed, can be read, studied, and learned from books. Second, accessibility: It is quite easy and inexpensive to get or borrow a copy of almost any book on almost any subject, whenever you want to read it — far easier and cheaper than to obtain a copy of a color movie or a television program, for example. Third, convenience: You can take what the book says into your own mind at your own time at your own speed; and in a book you can communicate with another mind not at his speed or convenience but at your own. Fourth, quality: The greatest men who have ever lived, the best experts, the most informed authorities, can offer you answers for your questions, instruction in the subjects you are most concerned with, guidance in problems that perplex you, — and far more. Fifth, vicarious experience: You and I will probably never climb Mt. Everest, or survive the sinking of an ocean liner — and we shall never sail with Magellan around Cape Horn. Yet reading a book at our leisure we can feel and imagine ourselves having such experiences. The treasure of the wisdom and knowledge of the world is in books. And the gateway is open to anyone who can read.

Dr. Kobler remarks:

> Any human being who has acquired during the small timespan of the first 1000 days of his life the extremely difficult skill of *talking,* including the correct use of such incredibly abstract expressions as "I am," "Where are you?", "What's going to happen?" has demonstrated genius. He therefore should be able, with relative ease and joy, to learn the easier task of superimposing a visual matrix over the already existing auditory matrix — the task called reading.

Coupling the responsive environment of the talking typewriter to the child learning to read has produced vast and visible progress in learning to read, as reported in Dr. Kobler's article. Here lies a way of profound value for helping great numbers of children to read.

Dr. Kobler also states (in substance):

> Each child is born with his own unique learning methodology, involving not only different accentuations of his senses but also different preferences for types of redundancies, types of "skip and jump" modes, etc. — and so a learning machine must not only be a multisensory instrument but also permit frequent switching from discipline to freedom, from dictation to self-learning. . . . .

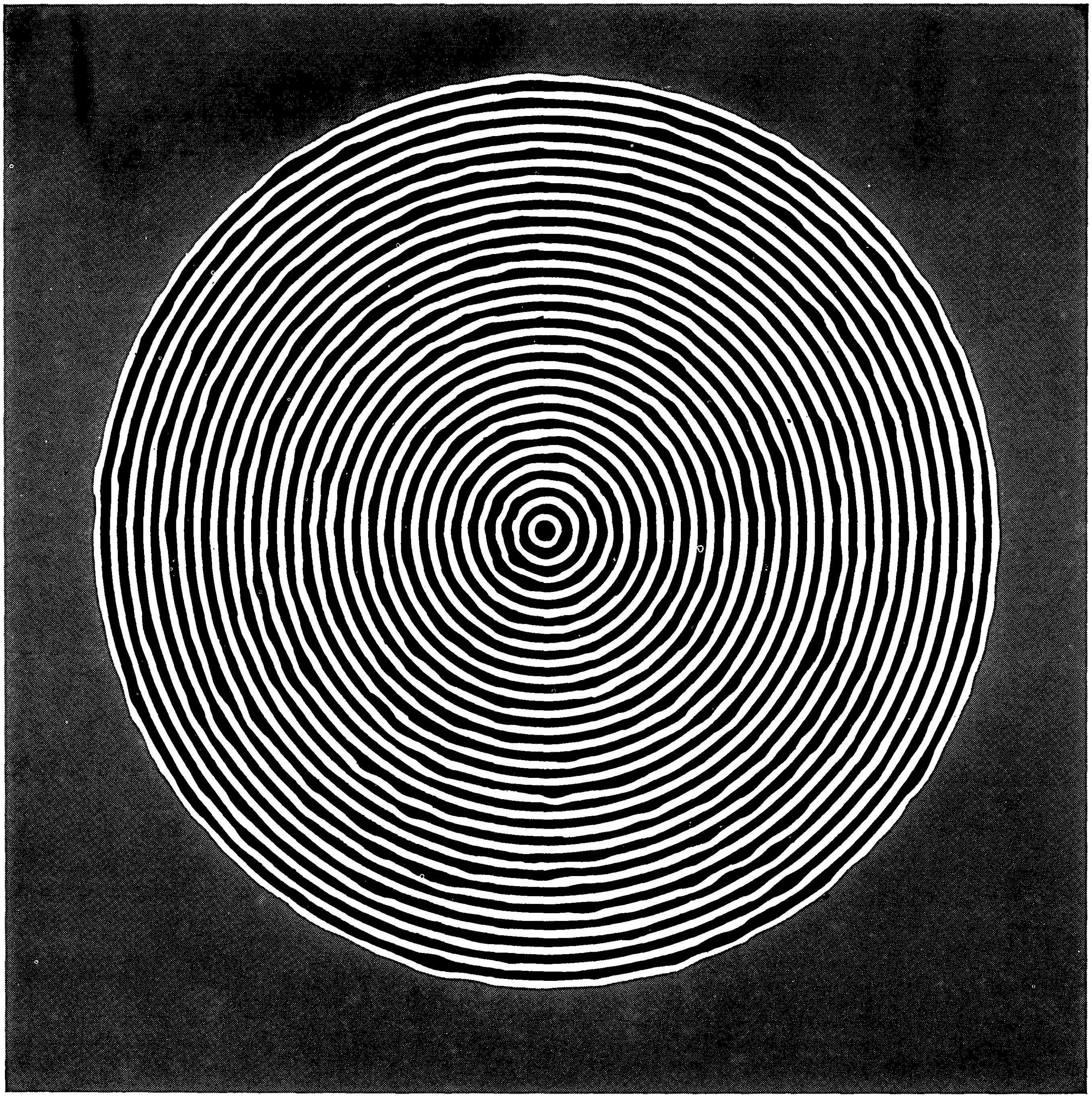
This also makes a great deal of sense. Different people do have different ways of learning; and if a machine can find out the ways that are good for John and bad for Bill, and ways that are bad for John and good for Bill, and use the appropriate ways for the individual person — then an enormous advance in teaching lies at hand to be grasped.

This of course is just what a computer can be adapted to do. A computer in one form or another is the "brain" inside the talking typewriter. A computer makes into operating reality the pattern of programmed interactive responses consisting of appropriate hardware combined with appropriate software.

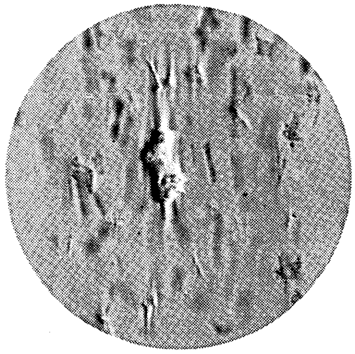
Thus we can teach EVERY child, EVERY young human genius, who has mastered speech, how to read, and teach the child in the way that he likes most and is best for him.

Edmund C. Berkeley

Editor



Just a few micro-inches can rough-up a magnetic tape.



THE OTHER POLYESTER FILM.
SURFACE MAGNIFIED 400X. (UNRETOUCHED PHOTO-MICROGRAPH.)

The smoother the film base, the smoother a computer tape can be made. And the smoother the tape, the better its performance in new generation high-speed computers.

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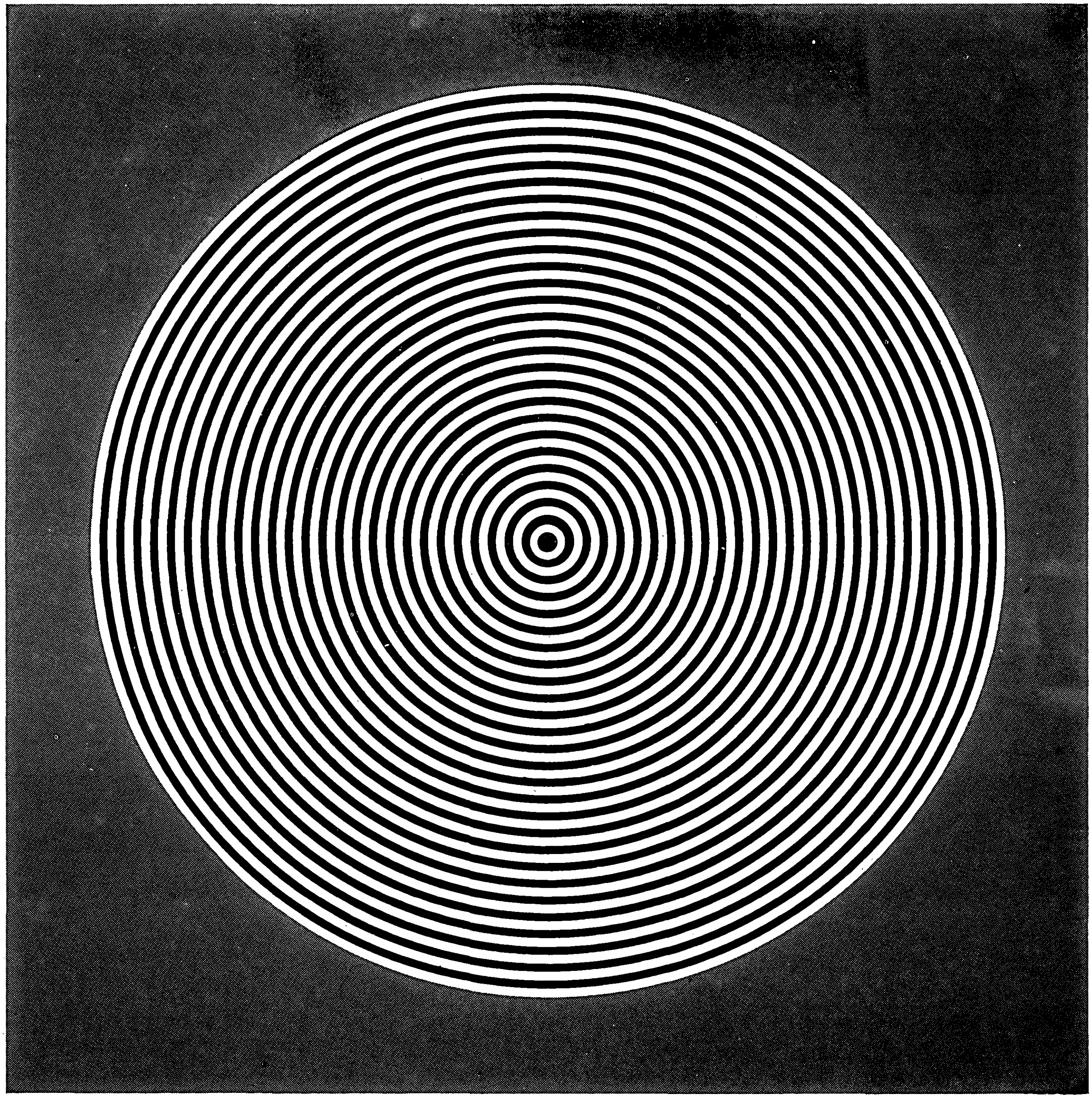
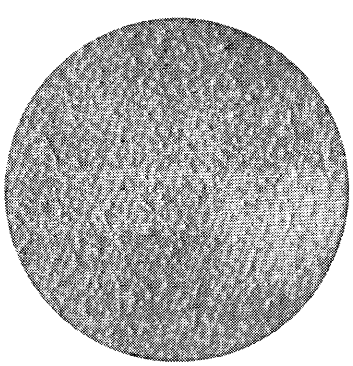
The smoother profile of Celanar L. P. film permits production of reliable, dropout-free tape, thinner coatings, extreme resistance to backing debris or "snow," greater data packing density. Celanar L. P. film has



So we smoothed them out with new Celanar Low Profile Polyester Film.



CELANAR LOW PROFILE FILM. NOTICE THE FAR GREATER SMOOTHNESS, ABSENCE OF SURFACE IRREGULARITIES. (UNRETOUCHED 400X PHOTO-MICROGRAPH.)

unusual flexibility. Durability. Tensile strength. And scratch resistance. Just about everything you could want in a tape material.

Magnetic tape based on new Celanar Low Profile film is already available from at least one major tape manufacturer. And from others very soon. For details on what Celanar L. P. film can do for your computer—and you—please write to: Celanese Plastics Company, Dept. 112 K, P. O. Box 629, Linden, N. J. 07036.

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c.a

MULTI-ACCESS FORUM

COMPUTERS AND SOME MORAL QUESTIONS - ROUNDUP 3

STAND BEHIND YOUR CONVICTIONS; REALIZE YOUR INFORMATION RESOURCES ARE LIMITED; WE ARE FORCED TO TRUST THOSE IN POWER

I. From Vernon M. Danielsen

Data Processing Manager
Augusta, Ga. 30905

Since I am a recent subscriber, I read your survey on moral questions and the results of the balloting at the same time. I feel, however, that I can still make some objective comments.

Basically I feel that if an individual cannot stand behind his convictions he is in trouble as a person; he becomes a dish-rag, a straw-in-the-wind so to speak. My answers to the survey would be:

1. *Should* examine the conflict and try to do something.
2. No answer — strategic considerations may have an effect not definable here.
3. *Should not* participate in allowing information to be believed.
4. *Should* be discussed.

All of these answers are based on the parameters given. However, there are other considerations. We cannot be so naive as to believe that the press and other news media have all the information available to our Heads of State. There is inevitably information, the publication of which would be detrimental to the interests of our nation.

In a society such as ours we are forced to trust those in power to use the strategic information not available to us, to arrive at the right decision. We hope that the checks and balances inherent in our government will preclude wanton disregard of our best interests.

We, therefore, must realize that our opinions are based on less information than those of our government. In some cases blind faith must be resorted to, if for no other reason than to retain one's privilege of claiming the title of U.S. Citizen. If the disagreement is so profound or of so great a magnitude that, regardless of extenuating circumstances, an individual must rebel, he has no choice but to do so. He must remember, however, what the results of such violent disagreement might be; and, indeed, might consider that the disagreement could be better resolved if he chose a country with ideas more closely related to his own in which to establish citizenship.

In my opinion it all boils down to this: Stand behind your convictions; use whatever means at your disposal to assist in the solution of a problem or to shed new light upon it; and, above all, realize that your own resources are limited, and consequently that you must rely to a degree on those whose resources are greater than your own.

II. From the Editor

There is a confusion here, it seems, between loyalty to one's present government and loyalty to one's country. A government happens for a while to be in charge of a country. For example, the Hitler government was in charge of Germany from 1934 to 1945, and did very many evil things including murdering eleven million civilians (French, Jews, Germans, Poles, Russians, etc.) and so it forfeited its claims to loyalty from Germans. Many German anti-Nazis paid with their lives trying to weaken, disobey, or strike down that government. For example, today we respect the memory of the German General Dietrich von Choltitz in charge of Paris in August 1945, who was repeatedly ordered by Hitler to "burn Paris," yet deliberately managed not to do it.

There is another confusion here, it seems, between "truths" as declared by a government and truths as stated by relatively impartial observers, reporters, critics, and historians. And there may be great differences. For example, take the Vietnam situation. One of the "truths" declared by the present Administration of the United States as a reason for half a million American troops fighting, bombing, defoliating, and napalming in Vietnam, is that they are there to fulfill a "commitment" made to a succession of 10 governments in Saigon. Yet there is no doubt that the Vietnamese under Ho Chih Minh fought the Japanese occupying armies 1942 to 1945, and won their independence. There is no doubt that the Vietnamese under Ho Chih Minh again fought the French 1946 to 1954, and again won, at the Battle of Dien Bien Phu.

There is no doubt that the Geneva agreement of 1954 provided for only a "temporary" division between South Vietnam and North Vietnam until a "free" election could be held within two years. There is no doubt that the great majority of Vietnamese people look on Vietnam as a single country, temporarily divided. There is no doubt that General Eisenhower wrote in his memoirs:

> I have never talked or corresponded with a person knowledgeable in Indochinese affairs who did not agree that had elections been held at the time of the fighting, possibly 80 percent would have voted for the Communist Ho Chih Minh as their leader rather than Chief of State Bao Dai.

And there is no doubt that on September 27, 1967, Senator Thruston B. Morton, Republican, of Kentucky, said:

> The basic mistake of the Administration has been its failure to give proper emphasis to the political nature of the war in Vietnam. And the basic but overwhelming reality in Vietnam today is that a political victory may well be out of reach.

Even if there is an area of knowledge where governments and intelligence agencies have crucially important information not available to the generally informed public, nevertheless this fact does not alter truths which are well established by sound proof. Therefore part of the necessary philosophy of socially responsible people — computer people included — is to continue to assume responsibility for knowing great quantities of the truth and acting accordingly. And computers are being used in Vietnam to pursue the aims of governments.

THE VALUE OF MORE CAREFUL INQUIRY AND GREATER ACCURACY

Ronald D. Jones
Assoc. Prof. of Administration
University of Missouri
Kansas City, Mo. 64110

After reading "Computers and Some Moral Questions — Roundup 1" in your July issue, I would agree with Dick Brandon in his conclusion that, "As *human beings,* we have a definite responsibility to speak out against wrongs, to defend our views, to work and vote for what we think right."

My point in writing, however, is to suggest the value of a careful inquiry, whatever the point of view. For example, one of your readers wrote in the July issue that Eugene Burdick's book *The 480* described an example of successful, effective use of computers in the political realm, and further, that such application was utilized in the 1960 presidential campaign.

A better source of information re this subject is *Candidates, Issues and Strategies: A Computer Simulation of the 1960 and 1964 Presidential Elections,* by Pool, Abelson and Popkin. These authors actually participated in the work under discussion, and they have termed the sensationalized accounts of that work as "lurid fantasies." It would appear that several reports based on computer simulation were delivered to a dozen or so key decision-makers during the campaign. However, it is maintained that none of the computer research was utilized in the planning of the 1960 campaign.

Computer persons may or may not have some special social responsibility beyond other persons, but they might be expected to maintain high standards of accuracy in a discussion of computing matters.

COMPUTER PEOPLE SHOULD CONSIDER SOME OF THE SMALLER AND MORE IMMEDIATE MORAL AND ETHICAL PROBLEMS WHICH THEY ENCOUNTER IN THEIR DAILY WORK

I. From Michael Weisbard
Chicago, Ill.

I have come to the opinion, by upbringing, thought, and a little association with some intelligent radicals, that *computer people have a social responsibility the same as all intelligent people.* That responsibility towards society is to think seriously about political and social problems, to attempt to derive rational solutions, and to speak forth upon these problems. As to your four questions, we also have a responsibility to distinguish between what we feel, and what we now think because we have considered the problems (and the consequences of their answers) carefully. Your questions are interesting and important, and, though biased, deserve commendation for their raising.

May I suggest that we also consider smaller and more immediate moral and ethical problems that some of us encounter in our daily work? I would like to pose a hypothetical problem stemming from my past work experience as a Junior Systems Analyst at a large EDP installation:

As an analyst, you are responsible for designing a file and its associated processing and programming for maintaining achievement and performance records of your employer's sales force. Compensation, and extra awards, are based upon the data in this file. You design a file that cannot be altered except by regular and authorized inputs; you assign security procedures for the tape between processing runs.

After turning over the project (and being assigned elsewhere), you learn that a programming manager has directed that the programs be altered to allow "special updating and corrections" by control codes that he will keep. You also know that some sales executives might some day wish to secure extra and unearned rewards for some members of the sales force — and that the rewards are based upon the now-alterable data in the file you designed.

What do you do? Do you question the program modification to a company officer, or do you stay out of involvement because it is no longer your project?

I am sure that other readers have faced questions or situations of a similar moral or ethical nature above and beyond their analytical or programming content. In fact, it might be useful for "Computers and Automation" to ask readers to submit problems they have encountered or become aware of, that involve moral and ethical judgments.

II. From the Editor

In answer to your question, I know what I would do. I would promptly report to top management the unethical programming alterations of which I had learned, although I would have to be certain of the proof. Probably I would be discharged as an indirect result — or discriminated against permanently in promotions, etc. — and would have to find another job. But I would have the personal satisfaction of not being an accessory to stealing and criminal behavior.

We invite our readers to send us comments.

COMPUTER PEOPLE ARE NOT TOOLS OF THEIR MACHINES

Edward Webster
Roxbury, Mass.

When I wrote my last letter (see page 10 of the September, 1967 issue of *Computers and Automation*), I had not finished reading "Computers and Some Moral Questions — Roundup 1" in your July issue. Now I need to make two additional comments.

To Dick Brandon, I can only say that I am surprised that someone of his stature in EDP can be guilty of such opaque double-think. No, none of us is two people: (a) human being; and (b) technologist. And no matter how hard we try to will a separation of values, we continue to remain just one person.

To James Donnellan, I can say I agree. Yes, the computer is no different morally than a typewriter. In Nazi Germany, Eichmann's secretary typed freight bills for X number of Jews, and she was just as guilty as her boss. The typewriter was not guilty; the person using it for that purpose was.

For reasons of efficiency, we may often seek ways that man can function as an extension of a machine. But if man judges himself no more than such an extension, the human race becomes extinct. Computer people who consider themselves tools of their computers are no longer human beings.

BATTLES BY COMPUTER

(Based on a story in The London Times, London, England, September 13, 1967.)

A unique boxing match took place recently in Miami, Florida. Someone had the bright idea of finding out who was the greatest master of the ring that ever lived. Over a hundred American boxing experts fed a computer every scrap of information they could recall or discover about leading boxers, past and present. Intelligence, punching power, stamina, ring technique — everything was recorded. Matches were then arranged, and Jack Dempsey became the champion when he knocked out Gentleman Jim Corbett in the seventh round.

Skeptics who say it must have been a tame affair, more shadowy than shadow-boxing, must think again. The crowd present for the "performance" screamed with delight as the computer buzzed, flickered, and produced the results of the hidden fight, round by round.

What are the implications of this experiment? The most promising ones are not the most obvious. It would be self-defeating, for example, to get a computer to identify the Derby winner or the Major League champions weeks beforehand. All the fun of speculation would be gone, and the computer would become the biggest spoilsport ever known.

But clearly the boxing experiment could be extended to the general benefit of mankind. It could begin by adding to our knowledge of history. If the computer can refight boxing matches, it can refight battles. Suitably furnished with data, it could tell us, for example, whether Wellington really deserved to win "the nearest run thing you ever saw in your life"; whether Napoleon was defeated in Russia by the weather or by the Russians; whether Rommel was as formidable as we once fancied. And more.

And from these elementary exercises there spring much bolder thoughts. Why not install a computer as part of the United Nations peace-making machinery? Two countries, say, are working themselves up to the point of war over a disputed strip of land. Reasoned argument and offers of arbitration are refused. Before mobilization begins, let everything known about the two countries — manpower, intelligence of the generals, armaments, industrial output and potential, popular morale, etc. — be fed into the computer. Let it declare the winner, and, to drive home the point, let it announce the death toll on each side if the war had been fought. Skeptics who say that it is the unexpected that counts in war should be silenced by the weight of evidence. Then let the settlement be pronounced.

The whole procedure could easily come under the Charter's Article 33 on the peaceful settlement of disputes, or under Article 41 on Security Council measures "not involving the use of armed force."

The boxing battle by computer in Miami could, in a saner world, be the beginning of many bigger and better fights — by computer. Why not?

COMPUTER ART: "BOXES" — SOME COMMENTS

I. From James H. Jacobs
Systems Analyst
The Pollak Steel Co.
Cincinnati, Ohio 45215

I have several questions concerning the drawing entitled "Boxes" (by Darel Eschbach) which appeared on page 11 in the August, 1967 issue of *Computers and Automation* (the Computer Art Contest issue). First, I would like to know how I might obtain a copy of this drawing to frame and hang in my home.

Second, it appears that there are several errors in the description of the drawing and/or in its positioning on the page.

1. The drawing is either upside down or all of the numbers used in generating the drawing were negative, because the 0,0 point of the Cartesian coordinates would have to be in the upper righthand corner of the drawing in order for the description to be correct.
2. The factor used to multiply the coordinates in order to obtain the dimensions appears to be in error. If a factor of 1.09 were used, the dimensions would be larger than the displacement of the corner of each rectangle from the origin of the coordinates. This is obviously not the case. It appears from rough measurements that the factor should be either 0.109 or 0.09.

II. From Darel D. Eschbach, Jr.
Computer Programmer and Operations Manager
The University of Toledo
Toledo, Ohio 43606

In answer to question number one, yes, the drawing as printed in *Computers and Automation* is upside down from the point of view of the 0,0 point being in the upper right corner. This is a rotation of 90 degrees from the way the plots come off our plotter. The drawing has better balance if viewed in this position.

As to the scale of the drawing, it is approximately nine inches square, full size. The range of X or Y values over the nine inches is from zero to ten. This scaling may have confused the issue somewhat.

Since these drawings are made by use of random numbers, an exact copy of the published drawing would not be possible, but I would be glad to send you a typical cardboard-mounted drawing for $15.00 if you are interested. This charge is necessary to cover the cost of material, computer time, etc.

COMPUTER SOFTWARE DEVELOPED FOR NASA AVAILABLE AT NOMINAL COST

Harry B. Rowell, Jr., Director
COSMIC, Computer Center
University of Georgia
Athens, Georgia 30601

Computer software developed in activities of the National Aeronautics and Space Administration (NASA) is now available to the U.S. public. Tapes, card decks, run instructions, program logic — complete software packages, ranging in cost of production from $50 to $5,000,000 — can be obtained for the cost of handling, reproduction and distribution.

This is the result of a joint effort by NASA and the University of Georgia. The University has been awarded a contract by NASA to operate the Computer Software Management and Information Center (COSMIC). The Center disseminates computer programs and information emanating from the programs of NASA (and in some cases from other sources) to business, industry, education, medicine, and other sectors of the economy. COSMIC is part of the NASA Technology Utilization Program, which seeks to enlarge the return on the public investment in aeronautical and space activities by encouraging secondary uses for the results of such work.

A complete directory of abstracts for all available computer programs is available from COSMIC at the above address.

SEPTEMBER COVER PHOTO REVERSED IN ERROR

I. From Aaron Rothman
Supervisor of Programmers
Canadian Lady Corset Co., Ltd.
P. O. Box 600, Youville Station
Montreal 11, Canada

Is the cover picture of the September, 1967 issue of *Computers and Automation* reversed? or is there a new kind of tape drive on which the numbers are reversed? Also, if the picture is not reversed, the men in the picture surely have the latest style in men's suits, with the lapel pocket on the righthand side of the jacket!

II. From the Editor

The September cover is reversed. On page 5 of that issue you will see a picture of the cover the way it should have been.

This was a printer's error, and we had no way of stopping it. But the procedure is being improved and it should not happen again.

COMPUTER DIRECTORY AND BUYERS' GUIDE — COMMENTS

I. From Wendelin Rasenberger
1226 Lakeland Ave.
Cleveland, Ohio 44107

I have glanced through your nice 13th Annual Directory and Buyers' Guide (the June issue of *Computers and Automation*), and have found it quite interesting. Yet it seems to me that there are some things missing.

1. I would like to see a directory about computer magazines.
2. Some of the rosters which you do have should show a clearer breakdown for U.S. listings and listings for other countries.
3. The rosters for courses should include all the schools specializing in EDP instruction. I know of some Cleveland schools you did not list.
4. The listing for Germany is not sufficient either, and I believe on pages 65 and 70 you have mispelled an address. The correct address should be: Mathematischer Beratungs- und Programmierungsdienst, Rechenzentrum Rhein-Ruhr, Kleppingstrasse 26, 4600 Dortmund, W. Germany.
5. Since you invite additions to your listing of general purpose computers, I would like to tell you that there are two Siemens computers on the market.

II. From the Editor

We appreciate your comments and corrections. We hope that the next Computer Directory, June 1968, issue will include even more information.

COMPETITION TO DEVISE MANAGEMENT GAME, ANNOUNCED BY NETHERLANDS JOURNAL

Secretariat M.A.B.
c/o Dr. D. G. van Til
Anna van Burenlaan 14
Santpoort-Zuid
The Netherlands

The editors of the *Maandblad voor Accountancy en Bedrijfshuishoundkunde* (M.A.B.) (Journal of Accountancy and Business Economics), published monthly in the Netherlands, announce a competition open to anyone interested. The competitors are required to devise:

- a management game based on the economic problems of a business firm, and particularly suited to both university and non-university higher management training programs.

The successful entry will be awarded a prize of 10,000 guilders (Dutch currency), which is roughly equivalent to £900 or $2,750. Deadline for entries is September 1, 1968. Entry forms and additional information can be obtained from the above address.

DESIGN AUTOMATION: SHARE-ACM-IEEE FIFTH ANNUAL WORKSHOP — CALL FOR PAPERS

H. Freitag
IBM Watson Research Center
P. O. Box 218
Yorktown Heights, N.Y. 10598

The SHARE-ACM-IEEE Fifth Annual Design Automation Workshop will be held in Washington, D.C., on July 8-11, 1968. Papers in the general area of design automation are invited. Suggested topics include:

- Electronic Design: wiring, circuit analysis, partitioning, design language, testing algorithms.
- Computer Aids for Design: employing graphic displays, plotting, mask making.
- Man-Machine Techniques for Design
- Process Automation: interfacing of design with fabrication and test facilities.
- Design Automation for Management: information and control.

Summaries or drafts of papers should be submitted to me at the above address on or before December 15, 1967.

JOINT NATIONAL ORSA/AMERICAN TIMS MEETING — CALL FOR PAPERS

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SYSTEM CONSIDERATIONS FOR GRAPHIC DATA PROCESSING

E. M. Thomas
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"The fact that there is a man on-line in a computer graphic system causes many things to change. The man, not the computer, now controls the flow of the program."

Computer graphics has been attracting considerable interest for the past two years. During that time, more and more people have begun to realize the potential of graphic devices for improving man-machine communications. Its fast output, plotting capability, and new forms of input certainly make it very interesting.

Techniques for operating with a graphic form of input and output, and their applications are only a part of the problem of providing a useful graphic system. Very important, also, is the control program capable of supporting a device such as an on-line graphic console. This paper describes the over-all system environment of graphic systems, the general on-line requirements, and some of the considerations related to both locally-attached and remotely-attached graphic consoles. Also included is a brief description of how we may grow from today's environment into a full graphic capability.

The Environment

There are two elements, at least one of which is common to practically all applications involving computer graphics: (1) a large, on-line data base, and (2) an iterative-design process involving many interchanges of information between man and the machine. Some applications may involve both of these.

With large, on-line data bases, the graphic console becomes very useful because its high rate of output allows the scanning or processing of large quantities of information. The plotting capability allows us to have graphic as well as alphanumeric information stored in the data base. In the iterative design environment, the graphic console allows the designer and the computer to communicate graphic information — a form much more desirable and natural for a designer than reams of tabular data.

The fact that there is now a man on-line causes many things to change, particularly in the area of program control. The man, not the computer, now controls the flow of the program. One interesting aspect of the man in the loop is that he may be used to advantage when unusual conditions arise. When these happen, the conditions can be presented to the man for a decision. The program no longer needs to provide for every situation which can arise and have a routine to handle it. Therefore the man on-line with a graphic console creates some interesting operational characteristics.

The high output rate of the graphic console allows the computer to present much more information to the user than was practical with a typewriter-like device. The computer can now present prompting messages and error messages to the user as he proceeds through his console problem. These messages are very nice to have, but they do require a rather large program if many console procedures are provided. In fact, the total program is usually too large to fit into the area available, and the appropriate routine must be called in when the user indicates what procedure he is going to operate with next. Remember, we no longer can preplan the flow of the program. The user at the console is now controlling the flow; and there are at least some points in his over-all operation where he can take any one of a number of paths.

New Additions to the Data Base

When the user begins to operate on graphic forms of information he adds new dimensions to the kinds of things that must be represented by the data base. The data no longer consists of pure alphanumeric information but drawing information as well. This data, in addition to representing graphic elements, contains relation, grouping, connection, and value

E. M. Thomas joined IBM as an engineer at the Poughkeepsie Product Development Laboratories in 1957, after receiving his B.S. in Electrical Engineering at Tulane University. In 1964 he began work in graphic programming at IBM in Kingston, N.Y., and later studied Computer Science at Carnegie Tech for one year. He is presently the Graphic Programming Manager, Advanced Technology, at the IBM Systems Development Division in Kingston.

information which can become very complex. A full-fledged graphic structure involves quite elaborate associative mechanisms and complex storage management schemes. These data bases are usually very large and may create many involved data management requirements.

Types of Responses

Each time the user performs some operation at the console he also expects some form of reply. The time between his action and the computer's reply is called the response time.

Responses associated with graphic operations can be classified into three types. The first is when the user expects an immediate response. Examples are menu selection, element selection, data entry, etc. The second type of response is that for which he has learned to wait a few seconds (say 10). These operations include such things as the fetching of a new program or the rescaling of a drawing. The third response type is when the user will tolerate a rather long delay. The processing of an application on data just created or modified usually falls into this type. The length of this response depends on both the application and the machine. Of these three types the fast response usually requires a fairly trivial computing operation.. The other types require more computing power.

Many graphic applications involve the use of a large computer to handle the large data base, the large program, a long computation per response, or any combination of these. The large computer is used only when the user at the console performs some operation. With a dedicated computer, the time between actions is wasted and, on a large computer, is rather costly. This leads to a system requirement to share the system between multiple consoles, or between consoles and a background (batch) job. (See Figure 1.)

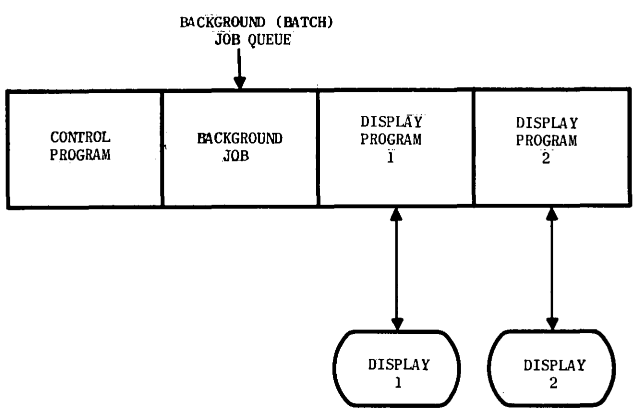

Figure 1. Shared Use of Main Computer

General Requirements for Graphic Consoles

Graphic consoles require that the many operations connected with driving the display and user interaction be handled by the user program or the associated control program. Areas of concern which must be considered are: interactive functions; response requirements; and, recovery from an error and reliability.

Interactive Functions

The control program functions which are required by the interactions of graphic consoles are related to job initiation, asynchronous functions, and resource allocation. In the graphic processing environment, the users' access to the system is via the graphic console and not the traditional batch job queue. The graphic console becomes the device which is used for both control and interfacing with the problem program.

Job initiation should be conversational in nature. The user of the console should have to enter only those things related to his identification and the names of his program and data. He does not want to be concerned with the many details of a job control language. The various functions provided by what has previously been a predefined job control language can now take place throughout the running of the problem — and then only if these functions are needed. When a job is initiated, there is a requirement for immediate scheduling because the user is sitting at the graphic console waiting to begin his operation.

Once the problem program has been started, the graphic console is used to communicate between the user and the problem program. As already mentioned, there may be certain system-level functions which he wishes to use during the running of his program. These are called asynchronous functions because he calls them at some undetermined point in the processing of his problem. A mechanism is required to get from the problem program level back to the control program level. There should be save and restore program functions to allow the user to call in, say a desk calculator, in the middle of a design process. The system should be able to stop and modify an existing data set or to create a new one. Lastly, there must be a method — particularly in program debugging — for regaining control when something goes wrong. For example, the user might want to restore the program to a previously known good condition.

When a large computer is shared between several consoles, the control program must handle the allocation of system resources such as CPU time, storage space, and file space. CPU-time allocation is necessary in order to keep one console from locking out all the others during a long calculation. Storage allocation is necessary to be sure that users who have been allowed to initiate a job have space to run it. File-space allocation is necessary in order that data being created during the run can have storage space. Users also must be able to share the same data.

Response Requirements

The second area of concern for graphic consoles is that of response requirements. The locally attached device requires that the main computer handle all three types of responses described above. Response requirements include a capability of the control program to (1) schedule a routine to process the signal from the user; (2) efficiently call in various parts of the program, as the entire conversational program is usually much larger than the space available; and (3) access parts of a very large data base within the required response time. Also involved in response time is the transfer of data to and from the display. For locally attached devices, this time is usually very small and is not a prime consideration.

When the graphic console is remote from the main computer, there are certain trade-offs which may occur. These have to do with function and data rate for the remote location. If a certain amount of function is provided at the remote location, then the fast responses (immediate) can be handled remotely, and the main system used only for those responses requiring more function than is available at the remote site.

Recovery and Reliability

The third area of concern is recovery and reliability. With interactive consoles, the user becomes much more aware of the reliability of the system. In the batch environment, he is probably not fully aware of whether the system is operating or not. When he is conversing with the system, he is constantly aware of its status because it now affects him directly. Reliability becomes even more important, since gaining user confidence is a very important part of making a system useful.

Associated with the area of reliability is the question of recovery. Recovery relates to both programs and data. One user should not affect any other user. If one program terminates abnormally, it should not cause other users to stop, but simply cause rescheduling of another job in this area. This applies whether the abnormal termination was caused by the program or some associated hardware. A graphic console session may be quite long, so there should be methods to prevent the user from having to recreate the whole session if something happens toward the end of it. The program and/or data save and restore functions certainly provide some backup. Restoration of data is also a real requirement of any system having a large dynamic on-line data base.

Many of the functions listed above are required with any interactive terminal; however, the graphic console is the first to be used in conjunction with many general-purpose design problems.

Graphics on a Small System

Small computers also have been used quite successfully for a large number of design problems. As with larger systems, the graphic console provides a much more convenient method of communicating between the designer and the computer. As long as the application does not require a very large data base or extensive computations, the small computer will operate quite nicely by itself. The cost of the small system is low enough that it can be used in a dedicated environment.

The small system becomes even more useful if we provide a method for attaching it to a larger computer in order to gain access to a larger data base, higher computing power, or both. With the small system, the consoles can be located remotely from the central complex because regeneration and lesser computing requirements can now be handled by the small computer. The use of a terminal which has program capability creates some very interesting system considerations.

Load Sharing

Load sharing is one of the most difficult system problems to solve when working with subsystems. Obviously, the subsystem has eliminated extensive interaction with the main system. This, however, is a very small part of the total task of dividing a job between the main system and the subsystem. Job division depends on a number of considerations, including:

- Size of the subsystem,
- Data rates available between the main system and the remote subsystem,
- Size of the data base being used,
- Computing power needed for various responses,
- User activity.

The capability of the control programs to handle various levels of response, to call up programs, and to access data also plays an important role in determining how a job should be divided.

With a satellite computer, the transfer of information between the large computer and the graphic device takes on some new dimensions. In the past, all operations have been controlled by the main system, and data was the only thing passed between the graphic device and the computer. Since a subsystem has more capability than graphic devices alone, it is desirable to have the subsystem do some of the work. Consequently, not only data, but instructions, must be transferred. This program-to-program communication is something different from system-to-system data transmission. Instructions generally prepare the system to perform some kind of data transmission; they are transferred asynchronously. The control program needs mechanisms to allow this asynchronous program-to-program transmission to occur.

Programming a Small System

A small graphic system, or subsystem, can be programmed in at least three different ways. The first and more restrictive is to simulate the local control unit. This has some compatibility advantages but does not really take advantage of the power of the subsystem. It also creates some very undesirable response characteristics when the subsystem is located remotely from the main system.

The second way is to program the subsystem as a "closed subsystem." (See Figure 2.) In this case, a set of predefined functions are implemented in the subsystem. The main computer can then direct the subsystem to perform one or a sequence of these predefined functions. Compatibility can be obtained by implementing these functions for locally-attached devices as well.

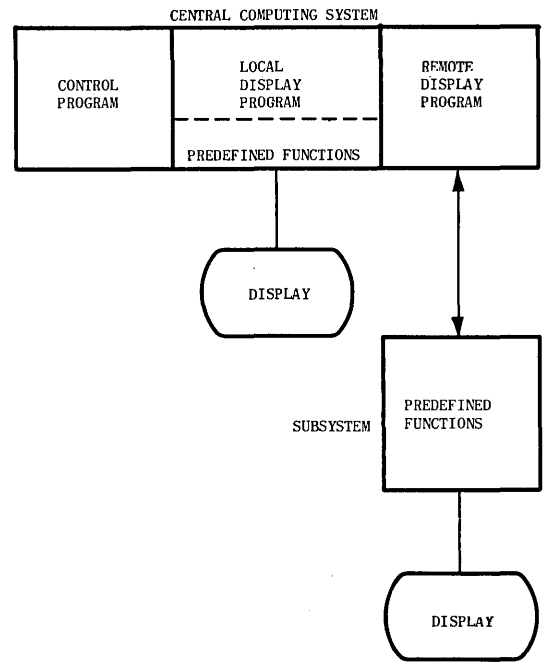

Figure 2. Closed Subsystem

The third way to treat a subsystem is as an "open subsystem." (See Figure 3.) Here, the user writes his program in two parts. One part is run in the main computer and the other part is run in the subsystem. It is up to the user to perform the control and communication between the two halves of his program. This approach, though more complicated to program, allows much more flexibility in the functions to be performed in the subsystem.

Job Control

Job control becomes somewhat more involved when using graphic subsystems. In the "simulated control unit" and the "closed subsystem" approaches, the subsystem becomes a slave to the main system and jobs are largely controlled by the main system, plus some mechanism for keeping the slave program operating in the subsystem. The subsystem program can be loaded remotely, or can be sent from the main computer. The most complicated job control occurs with an "open subsystem", where the user has half of his job in the main system and half in the subsystem. Job initiation for the remote-console user should look as much like job initiation for the local user as possible. The open subsystem is much more independent because it is capable of performing many

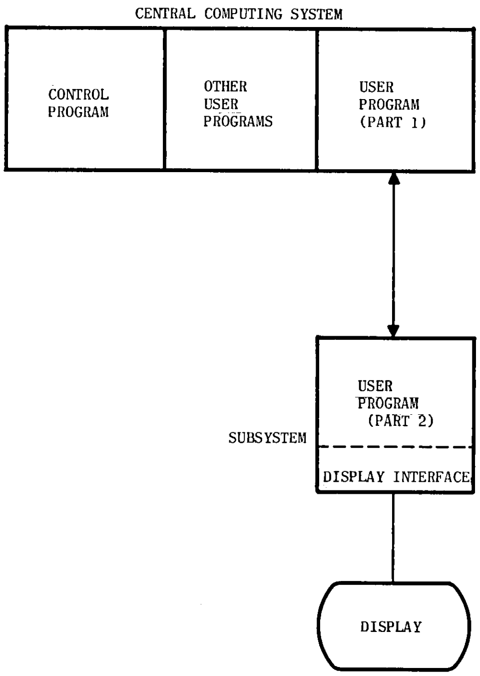

Figure 3. Open Subsystem

kinds of operations on its own and calls on the main system only when it needs assistance.

Device allocation in the subsystem environment can be treated in several ways. The first and simplest is to treat the subsystem as a single device which is used for only one job. Here, the program which operates with a subsystem communicates with all devices attached to that subsystem. In this mode, the control program treats the subsystem as a single device. A second, and far more complicated, type of device allocation is to treat each of the devices on the subsystem as a separate device, and to let these be individually allocated. This implies that the control programs have some higher-level allocation mechanism (for devices attached through subsystems) than is available today.

Unlike systems can cause many problems. The systems can be "unlike" because they have different control programs with different levels of sophistication. They can also be "unlike" because they have completely different data representations. The first case requires that a basic set of communication routines be available which operate with both sophisticated and unsophisticated control programs. The second case requires that data conversion be provided when necessary.

Growing Into A Full Graphic System

The system functions necessary to support a sophisticated graphics environment have been described. It is rather obvious that the transition from batch processing to a sophisticated graphics environment cannot be made in one step. The problem, then, is to decide how to make the transition.

The first requirement for the use of graphic devices is to have program support capable of utilizing the input and output functions available. This involves handling data to be plotted and servicing signals from such input devices as the light pen or function keyboard.

The next step is to have a control program which can operate a graphic program and also continue to run batch jobs. This allows us to process normal jobs while graphic applications are being developed. Early graphic applications can simply modify the input and output routines of an existing batch job to provide communication with the graphic console instead of with a card reader and a printer.

The early graphic applications will use simple forms of inputs such as menu selection or parameter entry. As these applications become more sophisticated, the input will allow the "sketching" of graphic information. With this form of input, a more involved data structure is required than with batch-oriented programs. This data structure can grow from simple arrays of information to lists (which can be created within array areas), to full-fledged associative structures utilizing complicated plex or hash structures, and taking advantage of the dynamic space allocation mechanisms provided in sophisticated control programs.

As the application facilities are being expanded, so too can the control program functions be expanded. Job initiation capability can be extended to include the graphic devices, as well as normal system input devices. Control functions, signaled from the graphic device, can be added to permit the saving and restoring of programs and the modification of data. The capability of the main system to communicate with the subsystem can also be added.

By gradually adding functions to both the application data structure and the control program, it is possible to logically grow from present batch-oriented jobs to a full graphic system.

Summary

The operation of a computer graphic system, then, involves a lot more than looking at drawings on the graphic console. There are many control-program facilities needed to support good man-machine interaction. There are elaborate data bases required to support console manipulation of drawings. There are many trade-offs to be considered when using devices on a large computer, on a small computer, or on a combination of these. The development of a successful system to support computer graphics will depend greatly on just how these trade-offs are made.

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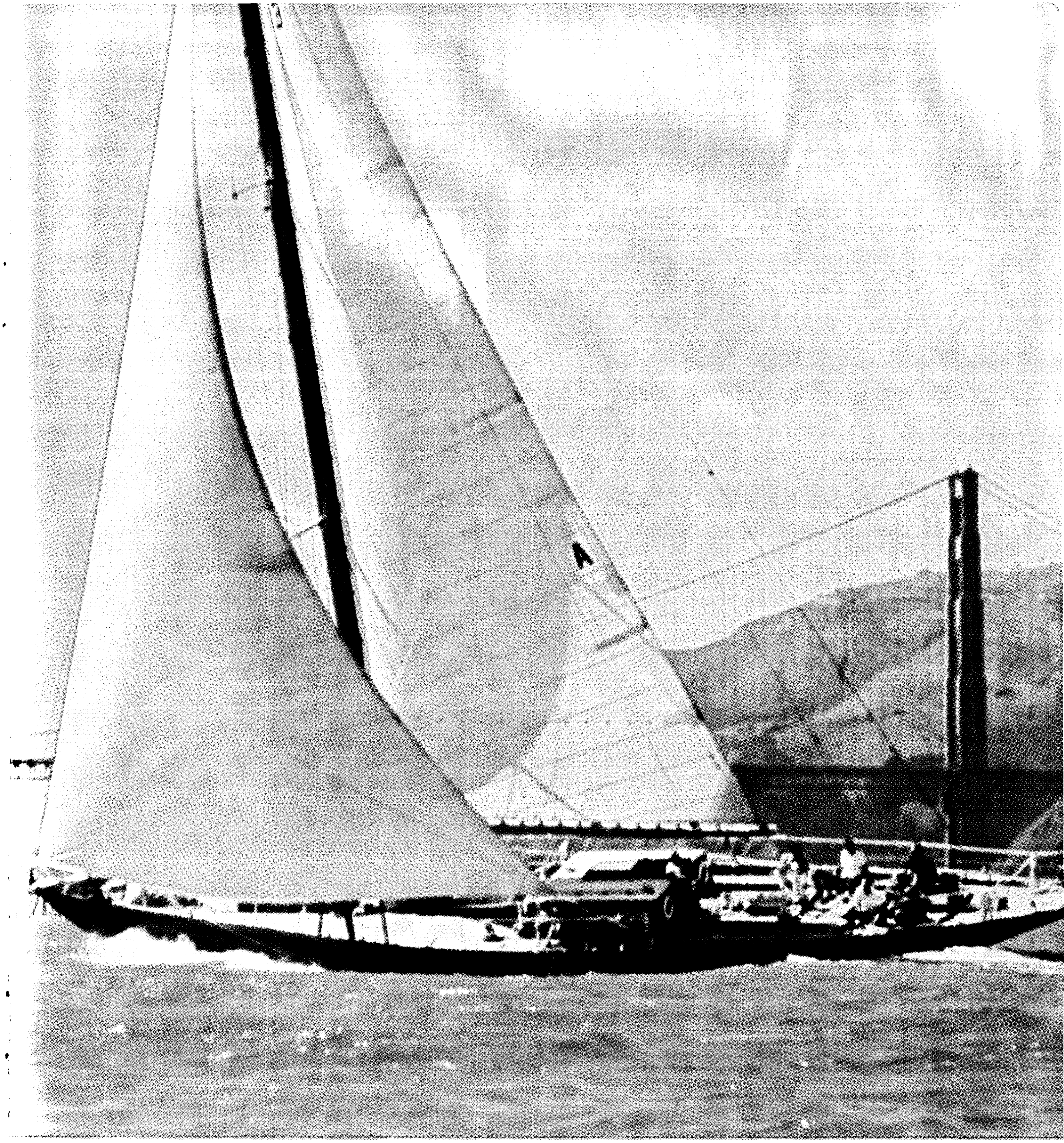

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ON-LINE SYSTEMS AND MAN-COMPUTER GRAPHICS

S. H. Chasen
Lockheed-Georgia Co.
Marietta, Ga.

R. N. Seitz
NASA Marshall Space Flight Center
Huntsville, Ala.

"Engineers have gained new tools for design and analysis through time sharing and visual communications; but effective implementation will be no easy task."

In the past few years, ways and means to facilitate on-line computation have mushroomed. Many systems are evolving which satisfy on-line requirements for both special and general classes of problems. Time-sharing systems, such as those at MIT under Project MAC and at Dartmouth, have received considerable attention. These are designed to provide individual computational service from many remote terminals to a large central processor. And, with the advent of such systems, engineers are beginning to solve their own computational problems.

The Development of Conversational Mode Languages

In recognition of this, several groups around the country have been developing special man-computer interactive (conversational mode) languages for use at these relatively new terminal facilities. The intent is to provide programming or problem-solving capability directly to the users in languages which are familiar to them.

Among the first of these systems to be developed was the well-designed RAND Corp. JOSS system. JOSS is basically a streamlined programming and computation system designed primarily for teletypes or special typewriters. Its constructive error responses, and the similarity of its language to ordinary English sentences, have made it a particularly useful tool for users with little programming experience. Commercial versions of JOSS are being furnished by many companies, including Scientific Data Systems and Burroughs Corporation.

Two programming systems which utilize a special typewriter to simulate natural mathematical formatting of the computer's input and output are the MADCAP and Klerer-May systems. The developers of these systems have done considerable work on free or variable format of inputs.

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The Culler-Fried System

Another pioneering effort which has influenced many researchers is the Culler-Fried system, which utilizes special terminals with "operator" and "operand" keyboards and storage oscilloscopes for graphic display. It provides "bootstrap" programming capabilities which permit the user to construct his own mathematical operators and then to use these as building blocks to construct higher-level operators. It also affords array arithmetic which permits the user to treat arrays of numbers as functional entities without having to write DO loops or FOR statements to add two "functions" together.

For example, with automatic array arithmetic, the user can enter $Y = 2 + X$, where 2 is a single number and X is an array of numbers representing a function. The computer will automatically add 2 to every element of the X array and will store the results in Y. The Culler-Fried system is commercially available through Bolt, Beranek and Newman.

S. H. Chasen heads the Man-Computer research program at the Lockheed-Georgia Research Laboratory, one of the pioneering efforts in the computer graphics field. He received his Bachelor's degree in Chemical Engineering from Georgia Tech in 1947, and his M.S. in mathematics from Emory Univ. in 1951. His work has centered on applied mathematics, statistics, operations research, and computers.

Robert N. Seitz recently joined the Marshall Space Flight Center's Computation Laboratory, after having been associated with the Center's Research Projects Lab since 1958. He holds a Ph.D. in physics from the Case Institute of Technology, and is a co-winner of the IRE's M. Barry Carlton Award, as well as the recipient of two government awards for exceptional work.

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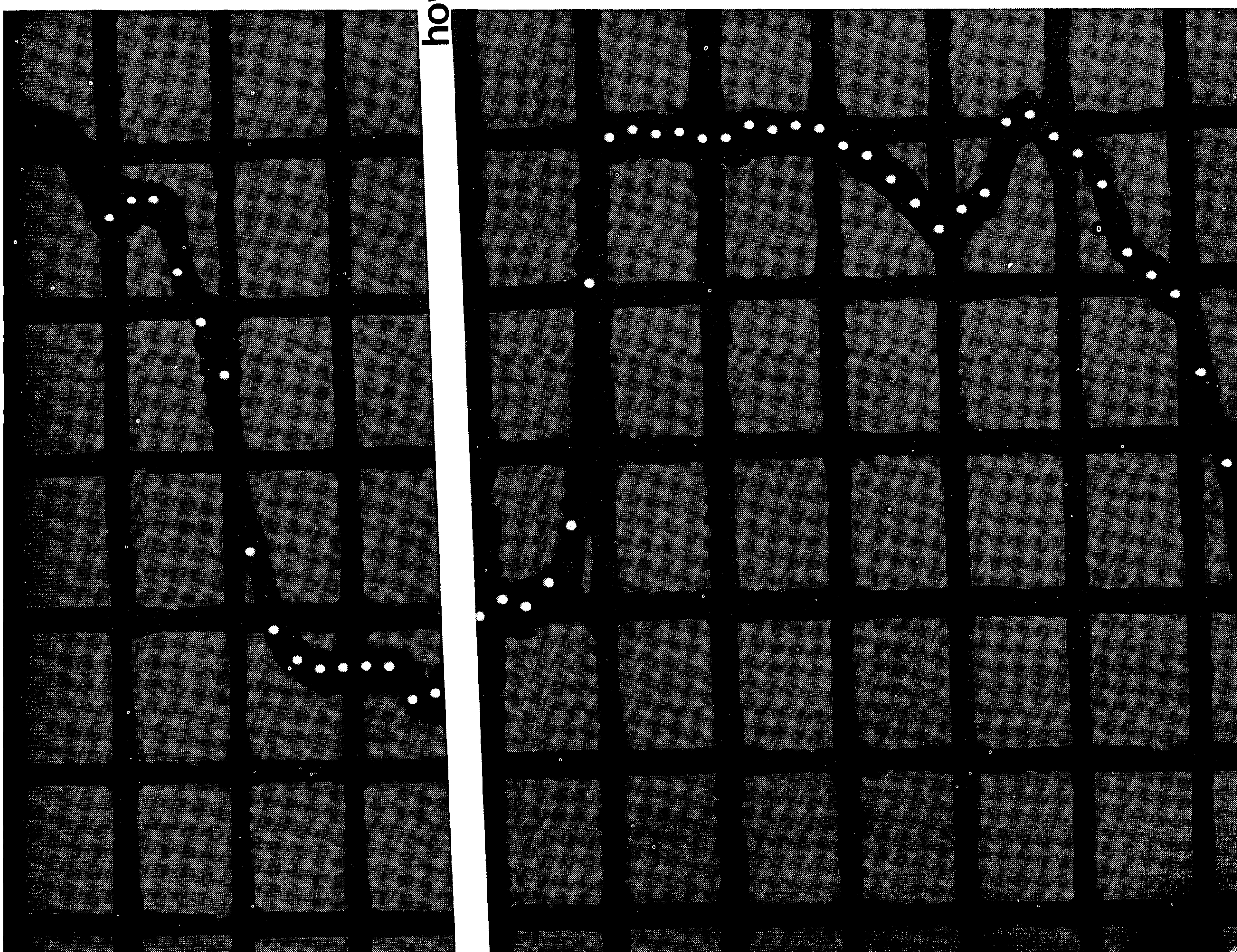


More recently, a number of new systems have been added to the growing list of conversational mode systems. Among them are IBM's QUIKTRAN (conversational FORTRAN) system and the Dartmouth BASIC system (a streamlined FORTRAN language commercially available through GE).

"Problem-Oriented" Systems

Several "problem-oriented" programming systems have been developed, including the MAP, RECKONER, COGO, Iverson, and AMTRAN systems. All provide automatic array arithmetic to facilitate the handling of functions in a mathematically natural way, as well as performing much of the computer's bookkeeping automatically.

The MAP system, developed by MIT's Department of Metallurgy, probably comes as close to satisfying the dream of a "talking" computer as any of the systems described here. The MAP program carries on an interactive dialogue with the user and provides such capabilities as numerical integration, least squares fit, the Fourier transform, and elaborate scope plotting. This system is presently restricted to teletype terminals, except for a centralized graphical display output.

The AMTRAN system, developed at NASA's Marshall Space Flight Center, is similar to the MAP system in its provision of conversational mathematical subroutines, but the emphasis is on greater programming capabilities. A primary objective is the rapid and easy construction of "problem-oriented" computer languages such as MAP or COGO. The AMTRAN system provides natural mathematical formatting and can be used from teletypes only or from graphic display consoles.

The COGO language, developed by MIT's Civil Engineering Dept., is a problem-oriented language used for the solution of geometric civil engineering problems. It is part of a system called ICES (Integrated Civil Engineering System) written in a language called ICETRAN which is similar to the AMTRAN programming language.

The Lincoln Laboratory's RECKONER was initially developed for statistical analyses and for matrix operations. Its capabilities are now being extended to accommodate other problems in applied mathematics.

The Iverson system, implemented at IBM, utilizes a Selectric typewriter terminal with a special character set in conjunction with a terse and symbolic interactive language which has great mathematical power. For example, calculating the product of two matrices requires only a few typewriter strokes in the Iverson language, whereas a moderate-sized program is required to accomplish the same computation in FORTRAN.

Predicting the Orientation of a Tumbling Satellite as a Function of Time

To illustrate how these systems may be used to aid the engineer, consider the problem of predicting the orientation of a tumbling satellite as a function of time. Knowledge of the exact orientation of a satellite is vital to the interpretation of radiation data. Determining the orientation requires the solution of several simultaneous differential equations.

The conventional method of handling such a problem today would consist of assigning a programmer to the engineer who then tries to communicate his problem to the programmer (not always a trivial task). The program will, in general, go through many cycles between programmer and computer before it is "checked out." Each cycle in conventional batch processing represents many hours of elapsed time. When results are finally achieved, pages of numbers are returned to the engineer. His evaluation of the results is hampered by lack of sustained contact with the pertinent parameters which characterize the problem.

On the other hand, with one of the new conversational systems, the engineer can enter his satellite problem and obtain his results in minutes. He can also guide or monitor the computer in the solution of the problem. The computer behaves as though it were his direct personal instrument, like an automobile or a telephone. Furthermore, if graphical display capabilities are present, output can take the form of scaled and labeled curves or a pictographic display of the orientation of the satellite as a function of time. Such systems are of maximum value for the solution of problems in which human judgment plays an important role. Such problems as those involving heat transfer in engines, optimum trajectory profiles, and the behavior of nonlinear control systems, lend themselves well to the conversational mode of computer solution.

All of these systems are designed to permit the engineer to walk up to the computer terminal, enter a mathematical problem and, within limits, receive an immediate solution, getting his instructions from the computer rather than from an instruction manual. The user should be aware that all of the usual caveats apply regarding truncation error, integration stability, "pathological" points, etc. It is the user's responsibility to monitor these sources of error. However, these systems can undoubtedly be of great value if the user is aware of their limitations. Also, many of the systems are still in a developmental stage and are not yet commercially available. They will undoubtedly receive a warm reception, however, if and when the computer companies see fit to distribute them commercially.

Man-Computer Graphics

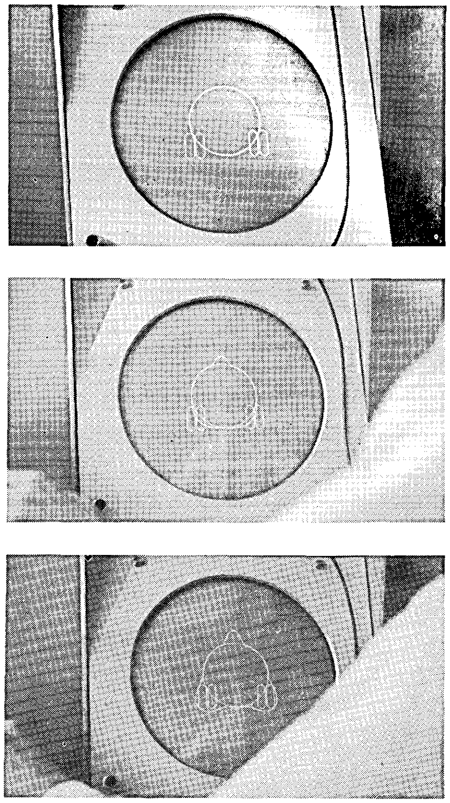
Concurrent with the development of on-line systems has been the growth of visual communications with computers. The automatic drafting machine, plotters, microfilm recorders, CRT displays, and other devices have become increasingly sophisticated, and are being used more and more to enhance the recording of data, to expedite technical analysis, and to strengthen educational processes.

The powerful synthesis of input with visual output in on-line systems has created a new dimension in computer technology — man-computer graphics (or MCG). This concept, which has emerged and flourished within the past three years, permits the individual to interact with the computer in *two ways* through the medium of visual display. This geometric computer communication facility is comparable to the relationship between geometry and mathematics. We can conceive of many examples in mathematics where a geometric solution is the only feasible type of solution. And so it is with computers.

Think, if you will, of the classic "traveling salesman" problem which requires the determination of the shortest route going through each of N points once and returning to the starting point. Attempts to convert this geometric problem into an algebraic problem for solution by conventional programming techniques become extremely inefficient when the number of points is large. With graphical interaction, an operator could exploit both the algebraic and geometric aspects of the problem in his search for a solution. And a mathematician, looking over the operator's shoulder, might acquire powerful insight into creating better algebraic algorithms.

Another example might be the aircraft designer who would like to change the shape of his fuselage, but couldn't care less about its mathematical definition. This last example illustrates perhaps the greatest potential of the graphical man-computer colloquy. The responsibility for computer programming will lie with a special staff of well-qualified systems programmers who will create the operating and applications programs. The designer, the structural analyst, the planner, the parts programmer, the manager, and many across-the-board disciplines will be able to exercise their specialties to their fullest extent unencumbered by routine computation.

All pictures courtesy of Lockheed-Georgia Research Lab



Cross-section shaping.
Operator starts with some initial geometry and then changes shape to create envelope to meet a requirement, such as housing the wheels.

A History of MCG

As we have noted, the MCG concept is relatively new. It first began to achieve significance when I. E. Sutherland presented his "Sketchpad" work at Lincoln Labs to the Fall Joint Computer Conference in 1963. Lockheed-Georgia began its work in MCG early in 1964 without knowledge of any other industrial activity in MCG. In the fall of 1964, Lockheed-Georgia ordered a Univac 418 and a Digital Equipment Corporation 340 scope. At that time, no computer manufacturer had announced an MCG system. Shortly thereafter, IBM announced its Alpine MCG system, while Control Data Corp. announced its Digigraphic system in 1965, and the General Motors DAC-1 (Design Augmented by Computers) was unveiled at the Fall Joint Computer Conference in 1964. (The GM work had begun about 1959, but had been undisclosed until this conference.)

From the last half of 1965 to date the number of MCG systems — most dedicated to research — has steadily increased. The aerospace industry has shown the greatest interest in MCG systems, but many industries are becoming aware of its potential. As of this writing, however, only a few companies in industry have multiple-console, time-shared MCG systems. A few other such systems exist at non-industrial facilities.

Applications

While it would be difficult to select a specific application that characterizes MCG, any practical technology must obviously begin with limited and relatively simple goals before it can expand to its full potential.

One of the first applications envisioned for MCG was the numerical control parts programming function. Conventionally, the parts programmer starts with a blueprint of a drawing and redraws it according to his own needs. He then gives a coded name to each point, line, and arc, and writes a computer program in some stylized language such as APT (Automatic Programmed Tooling) to describe the path a cutting tool must take to cut out the part on a milling machine. This requires conventional batch processing and the usual wait is required to get a plotted output from which the program may be verified. Mistakes require corrections to the program and additional waits for "batch" output.

With MCG, the drawing is put onto the display scope by input from cards, light pen, tape, or combinations thereof. The cutter path is depicted on the scope as the operator maneuvers it with the light pen. Any mistakes in path definition are instantly apparent and may be immediately corrected. As the operator describes the cutter path on the scope, a tape is automatically defined. This tape, when post-processed to adjust to the format for a particular milling machine, is then used to cut out the depicted part as often as is required.

Optimum cutter paths cannot, in general, be computed. Therefore, the display, which affords immediate feedback to the console operator, is conducive to more efficient path definition. This, in turn, reflects itself in less time on the expensive milling machine. The first part produced through the MCG process was manufactured in November 1965 at Lockheed-Georgia.

Electronic Design

The electronics area is also receiving considerable attention. Studies are presently underway at the Norden Div. of United Aircraft, MIT, IBM, and Lockheed Missiles and Space Co. to apply MCG to electronic design. The studies include MCG applications in integrated-circuit development, printed-circuit design, and linear and nonlinear electronic-circuit analysis.

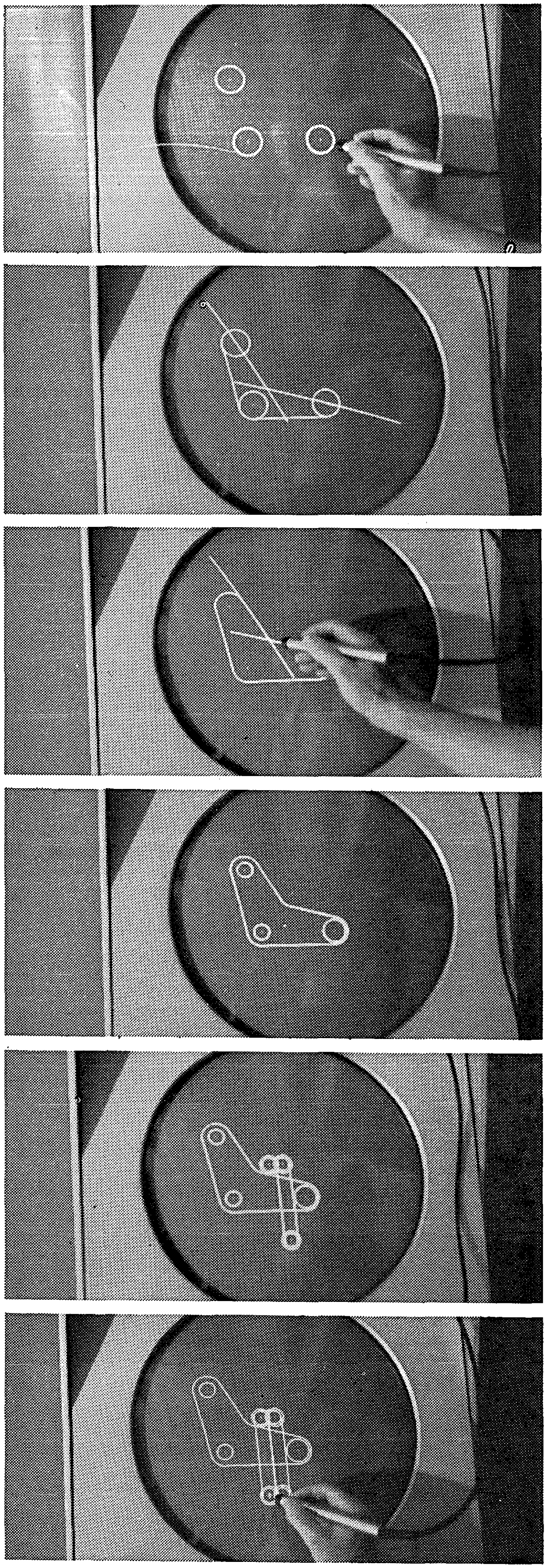
Efforts have been underway for some time to apply non-graphic electronic-circuit-analysis computer programs to electronic design. The most notable of these programs are NET-1, developed at the Los Alamos Scientific Laboratory, and ECAP, developed through a joint effort of IBM and Norden Div. The marriage of such analytical programs with on-line, time-shared graphical techniques promises to significantly enhance the engineer's electronic design capability.

This union would in effect provide the designer with a "computerized breadboard" with which he could specify circuit topology, change components or component values, call for various circuit analyses, and modify or extend his circuit design, depending on the outcome of the analyses. The advantages such a system would offer would include simplified input-output by means of graphical input, and improved design efficiency through the use of a real-time, iterative process made possible by time-sharing and graphics.

Added impetus for the development of circuit-analysis graphics stems from the well-known fact that network theory provides a method for solving a very large class of problems not necessarily related to electronic design. Being able to create various electronic circuits and instantaneously alter circuit values would permit analog-computer techniques to be applied directly to the digital computer. Thus, a generalized circuit analysis/synthesis program would prove useful not only to the electrical engineer but to a large group of engineers who would need only to express their physical devices as electrical analogs.

Dynamic Analysis

An example of another application for MCG is in dynamic analysis. Here, a wing or any type of beam can be idealized by up to N sections, each with its own stiffness and mass. The console operator, or analyst, may vary the stiffness

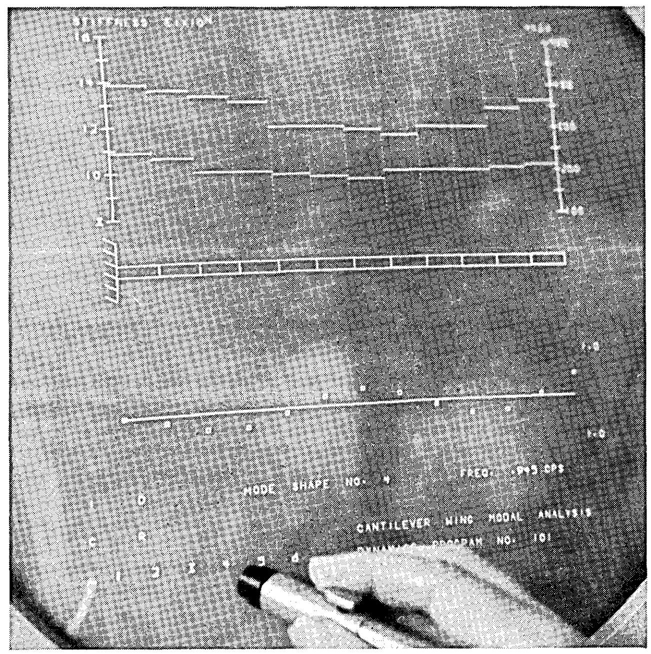


Angle-bracket construction and cutter-path definition using light pen and MCG techniques.

and mass to meet any desired set of standards. These variations may be accomplished by moving the light pen to appropriate positions on the display or by keyboard input. A variety of input media is characteristic of the general MCG system. At the operator's discretion, any desired mode shape may be picked for display.

For example, if mode shape 4 were specified, the points on the scope representing the curve which crosses the axis four times would actually vibrate. By studying the vibrations of various mode shapes, the dynamicist could make judgments on whether the vibration would achieve a flutter condition. In this way, unacceptable designs can be detected early in the design process. It is important to realize that with such a program, the dynamicist need not program anything nor carry out complex mathematical calculations in order to derive the various mode shapes.

When a cross section is created on the scope with the light pen or other input devices, parameters are automatically computed upon request. Again the designer is freed from both programming and manual computation.



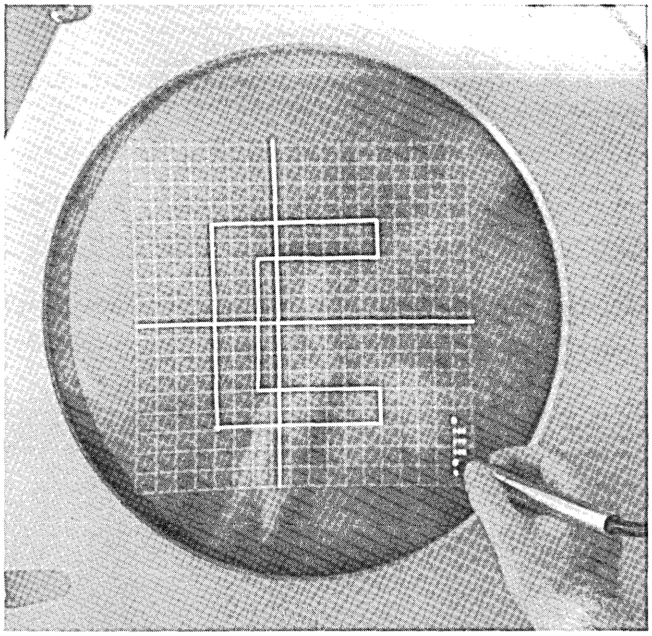
Dynamic analysis, using MCG. Wing or any type of beam can be idealized by up to N sections, each with its own stiffness and mass.

Structural Analysis

Considerable work has been done in the area of structural analysis. At Lockheed-Georgia it is possible to sketch a complex structural network on the cathode-ray tube, have the computer examine the topology of the network, formulate and solve the equations, and output loads, shear, moments, and displacements directly on the scope and/or the printer.

A typical complex frame is shown below. The double lines are the schematic representations for beam elements; the single lines, axial (tension or compression) elements. A variety of restraint conditions can be imposed on the model simply by pointing the light pen at one of several symbols and then at the appropriate node point on the structure. Restraints include pins, rollers, and walls. The structural model can easily be modified by deleting or rearranging structural elements with the light pen. At present, the applied loads and element section properties are read from cards.

Several modes of display output are being contemplated. It will soon be possible for an engineer to make perturbations with respect to section properties, loads, and geometry and immediately observe the results on the graphic display. This ability to interact with the computer has no counterpart in strictly alphanumeric communications.



Section property determination. When cross section is created on scope with light pen, parameters are automatically computed on request.

How the Design Process Might Proceed in the MCG Environment

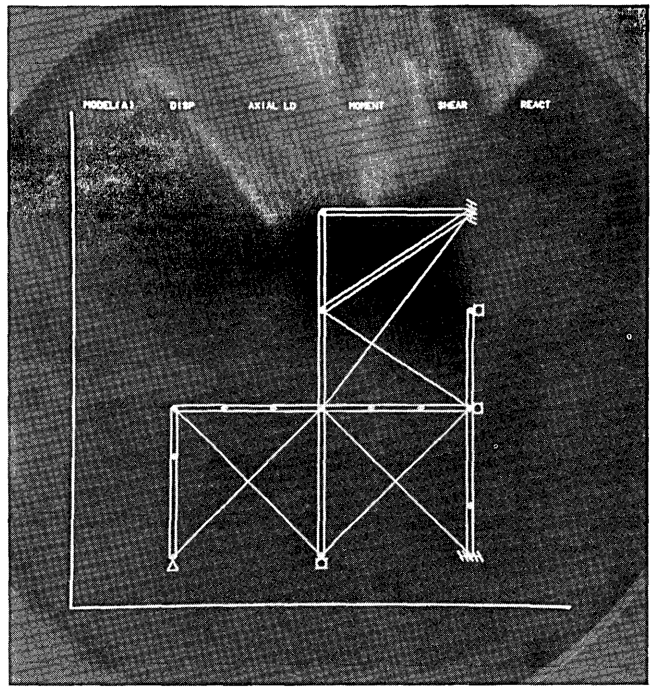
With the foregoing examples, one can begin to see how large elements of the design process might proceed in the MCG environment. First of all, a surface envelope is created. Then an internal structure is conceived, and is analyzed with respect to section properties and stress. Iterations may occur. Then the structure is analyzed from a dynamic point of view to ascertain vibrational characteristics. At any time, a re-design may be required at any specialty area.

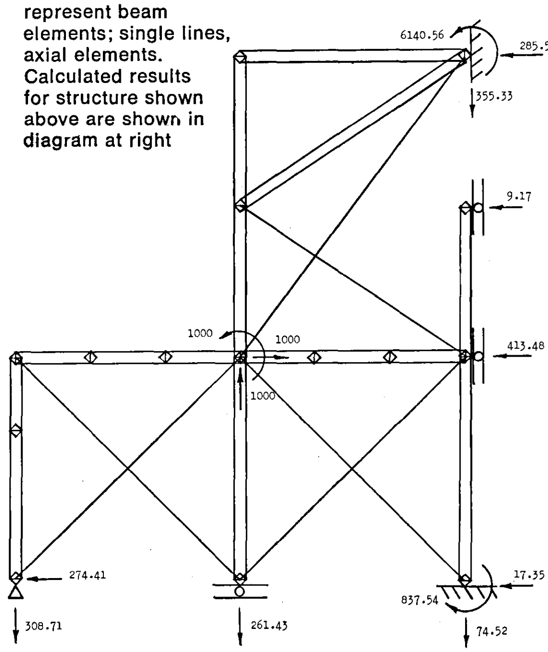
With teams of specialists or with graphic consoles in each specialty area, it is not difficult to comprehend how the entire design process will be speeded up.

Although only engineering examples have been cited, the usefulness of MCG is by no means restricted to engineering. An example of a non-engineering application is fabricated parts planning. The operation work sheet is displayed on the scope and allows up to *N* operations to be displayed at a time. The planner calls up a set of operations or a combination of operations and has them displayed on the working portion of the scope. He then selects the exact operation that is to be performed by pointing to it with the light pen.

When sufficient information is supplied to the program, such as dimensions and material description, time standards are automatically computed and displayed on request. Should the computation of standard hours be requested when insufficient information has been supplied, the planner will be notified on the scope and told what additional information is required. In this way the system assists the planner in the learning process. The entire operation sheet is constructed in this manner. One of the many advantages of this system is that it is easy to update the sheets — and updating is a very frequent requirement.

Another application area with possible high payoff is computer programming itself. Systems for interactive flow-chart definition and manipulation may eventually provide significant gains in programmer productivity.





Typical complex frame. Double lines represent beam elements; single lines, axial elements. Calculated results for structure shown above are shown in diagram at right

Major Problems

The foregoing examples and a great many others indicate the reason for enthusiasm about the potentials of MCG. However, most of the examples cited are still in an elementary stage of development. For MCG to achieve its full potential, it must ultimately be employed in a time-shared environment, and with time-shared graphics come many complex problems. These can be grouped into four categories: Software, personnel, economics of hardware, and implementation.

Software

Software becomes increasingly complex with the growing number of devices in the system, and the constant interaction between them. Programs will be mostly hardware- and application-dependent for a while. Efficient, general systems are impracticable until early experiences are assimilated.

This fact gives the manufacturer, who will have more experience than any single user, the opportunity to take the initiative in systems planning for time-sharing and MCG systems. It also places responsibility on customers to form active user groups to work closely with manufacturers to insure timely and appropriate system implementation.

Personnel

Building good time-sharing or MCG systems requires a large supply of a very rare breed: Applications-oriented systems programmers. There is a strong need for mechanisms to increase their number and their efficiency.

Also, on-line systems will create new demands for efficiency of computational programs. The on-line analyst will be much more concerned about cutting the computing time on a ten-minute guidance systems analysis than he was in a batch-processing shop with a half-day turnaround time.

Economics of Hardware

Providing numerous on-line interactive terminals, and the computing capability to back them up, is expensive. This is especially true for graphics terminals, which currently cost about the equivalent of three men (including pro-rated computer backup). And experience indicates that cost reductions will be slow at best. Some cost relief may be obtained by running background batch processing when functions at the display are inactive, but the additional software to accommodate this mode of operation puts a further drain on system capacity and on scarce manpower.

The primary advantages of on-line interactive systems — man-hour reduction, improved quality of analysis or product, and short span time for task completion — are often elusive and difficult attributes to quantify in terms of value to the company or project. They thus create a tough management problem in deciding which new system to buy. Gone are the good old days, when one could just pick the machines which gave the most computer cycles per dollar. Number-crunching and problem-solving are no longer even approximately synonymous.

Implementation

There is one last problem. Human beings are creatures of habit. Because of this, there is a good deal of momentum in any existing methodology. Therefore, there is a great resistance to change in a methodology regardless of whether it is right or wrong. Most of us prefer to solve problems as they have been solved in the past. When people are busy and concerned with deadlines, they prefer remaining under a known pressure to risking the loss of time to consider an unknown (to them) alternative approach.

It is for these reasons that a shift to the more sophisticated and more productive systems like MCG will be more gradual than we might prefer.

While this discussion of MCG problem areas may be somewhat discouraging, when the problems are weighed against the potential value of MCG systems, the opinion of those who have had experience in this new technology is that it will be well worth the time, cost, and patience necessary to bring about its full implementation.

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ON-LINE PROGRAM DEBUGGING—A GRAPHIC APPROACH

Luther L. Zimmerman
IBM Corp.
Systems Development Division
Kingston, N.Y.

"The graphic display's speed, its ability to present large amounts of data with each response, and its superior two-way conversational ability provided by its CRT and light pen, all help to accelerate the debugging process — and increase the programmer's debugging efficiency."

A great deal of attention has recently been devoted to the burgeoning field of graphic data processing. Computer displays with graphic powers represent a new dimension in data processing and a real breakthrough in man-computer communications.

Scores of articles, books and papers have been written on the subject. Most of these, however, concentrate on the enormous *potential* contributions of graphics processing, while many important, although less dramatic, jobs — that can be done almost immediately — are being to some extent overlooked.

On-line program debugging is one of these. Although perhaps not a glamorous application for computerized graphic display, it could be one of the most immediately productive.

Gaining Control of the Computer

In any form, on-line debugging requires that the programmer have actual or apparent control of the computer as it executes his program. Such control allows him to observe intermediate results and make changes at any time during the run.

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One way to gain control is to take charge of the computer console. The buttons and lights permit the user to monitor and alter his program's activity. This procedure is common only on smaller systems, since it ties up the computer throughout the debugging session.

A more efficient technique is to prepare a special debugging program which provides the necessary control over the problem program independently of computer control. Once this is done, the user need not monopolize the computer. The programmer, at an input-output terminal, can communicate with the special debugging program to exercise a variety of debugging actions. The only limiting factors would be the complexity of the debugging program and the flexibility characteristics of the terminal itself.

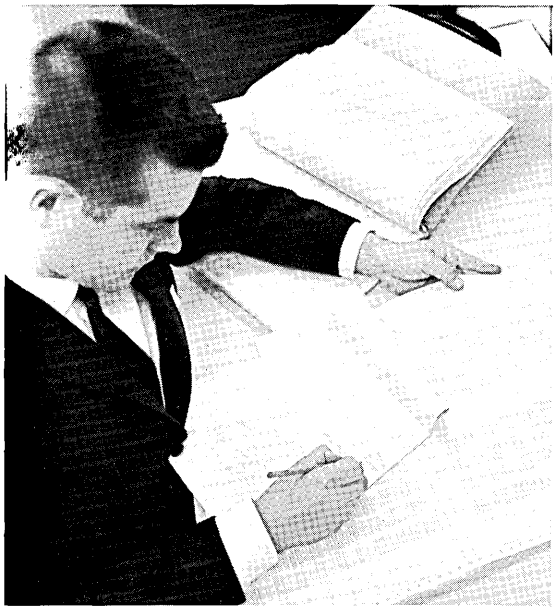
The Burden on the Terminal

Characteristically in debugging operations, little or no overt activity will take place during periods of meditation. When insight occurs, however, the user's thought processes accelerate to lightning speed. He wants answers at a rate which would tax any computer, much less an I/O terminal.

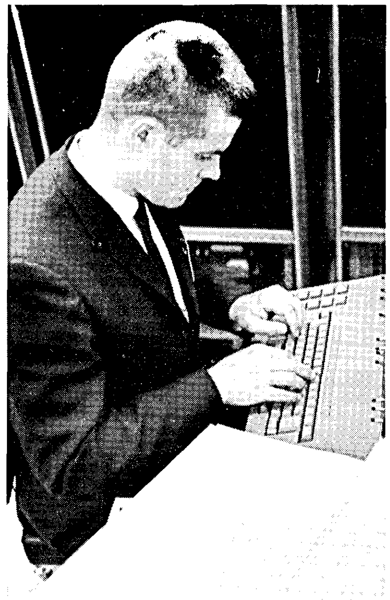
The burden falls largely upon the terminal, and the criteria can be readily identified. The programmer's needs must be met with a minimum of distraction and delay. Methods of making inquiries must be simple and unambiguous. Movements and actions should be kept to a minimum. Built-in safeguards should virtually eliminate the possibility of unintentional keying mistakes. Above all, rapid, concise responses to all inquiries are imperative.

Top efficiency requires that the debugging program itself be able to supply large amounts of information upon request. A data table, for example, is generally most useful if it can be observed as a unit. Even more important, a complete,

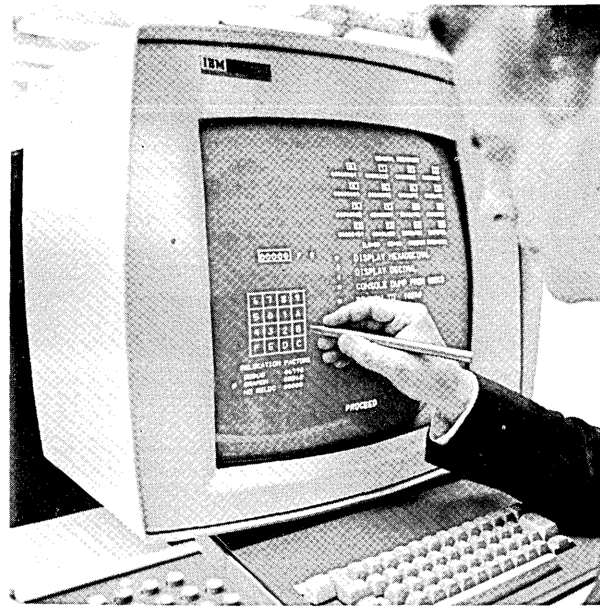
Three Types of Debugging



Off-Line Debugging



On-Line Debugging With a Typewritei Terminal Device



On-Line Debugging With Graphics

up-to-date picture of the problem program's status must be maintained and almost continually displayed.

A graphic display, with its inherent speed, its light pen and other accessories, obviously offers a highly suitable terminal capability to serve this application. At IBM's development laboratory in Kingston, N. Y., an on-line debugging program, designed for display use, was developed. GBUG, as it is called, is a relatively simple program which capitalizes on a graphic display's ability to provide superior on-line, two-way communications.

Efficiency of Graphic Debugging

One quantitative measure of the graphic display's superiority over conventional terminals is speed. Using the light pen for input and the display CRT for output, GBUG proved itself as a debugging time-saver. The contents of a single memory word can be called out for display in about 5 seconds, compared with approximately 15 to 20 seconds at a typewriter or teletypewriter station.

Similar time savings have been shown for other debugging tasks, such as the changing of a memory word, or the display or alteration of a register's contents. These advantages add up quickly, especially during rapid bursts of activity when the programmer is most anxious to see results.

The output of larger amounts of data, often prohibitively time-consuming on a typewriter terminal, presents no special problem when a display is used. The programmer may call for tabular displays, at will, including core dumps, without experiencing excessive waiting periods. For a typical dump — a one- to two-minute job for most conventional terminals — the GBUG user may specify the dump origin address and then see the result instantly.

To provide an effective interface between programmer and computer, GBUG maintains a special display on the CRT. Many items shown have been programmed so that they can be sensed by the light pen. The user executes a debugging step by pointing at an associated displayed item with the pen and closing a switch. The debugging program performs the requested task, updates the display, and waits for the next inquiry. Whenever any debugging display panel is being shown, GBUG is active and the problem program remains in a "holding" condition.

Conversation with the Programmer

Written especially for the assembly-language programmer, GBUG carries on conversation with the programmer in hexadecimal — a language in which he is already fluent from past manual debugging experience. Most debugging operations require him to specify a hexadecimal memory address — the reason for many of the numeric fields shown on the debugging panel. (See Figure 1.) Instead of typing this address, the programmer uses the light pen to select, one-by-one from the matrix displayed, the digits which make up the desired address, (either in absolute terms or relative to the beginning of his program).

To display the contents of a memory location, for example, the operator would first use the digit matrix to spell out the address of interest and then would select with the light pen the desired display mode (hexadecimal, or 2- or 4-byte decimal) from the options listed. GBUG would then produce the correct display. (In Figure 1, the contents of location 7074 can be seen just above the digit matrix.)

Changing Memory Contents

Changing memory contents may be accomplished just as readily as displaying them. The programmer need only select the portion to be altered with the light pen and then

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What do we mean by balance? Read on.

It's a dirty shame what some "clean" tapes do to your heads.

To begin with, we know what happens when balance is lacking. There is, for example, one computer tape on the market that is excellent in its freedom from dropouts. It makes a remarkable "first-pass" impression. Yet, an imbalance in key properties makes this tape more than 40 times more abrasive than Audev K-68.

One of those key properties is friction, both static and dynamic. And one way to reduce friction is by lubricating the surface of the tape. But this "trick" solution is short-lived and tends to distort start/stop performance.

In Audev K-68, we attacked the problem differently. Carefully combining binder ingredients, processing and surface treatment for proper static and dynamic frictional balance, we've produced a wear-resistant surface that will not break down on high-speed transports.

But, you might ask, couldn't a really hard binder accomplish pretty much the same result? We say...

Don't get stuck by the "sticky tape" test.

Take one of those tough tapes and torture it. No amount of pulling, scratching or stripping off with pressure-sensitive tape will cause the surface to flake or shed oxide.

But this, too, may be an imbalance. What you may not see is a stiffness and brittleness which could make the edges particularly vulnerable to damage.

Audev K-68's balanced cohesive properties prevent coating failure. The binder is hard enough to prevent self-generated dirt caused by abrasion, yet tough enough to keep the edges from deteriorating.

At the same time, K-68's smooth, non-sticky coating provides few anchoring possibilities for ambient dirt or oxide redeposit. And its low resistivity virtually eliminates electrostatic pull on floating dust.

Balance also affects a tape's electrical characteristics.

We do our bit for today's high densities.

The higher bit densities of today's computer systems make demands that previously acceptable tapes can no longer meet. Use of a marginal tape in such circumstances often results in a gradual deterioration of quality. Dropouts increase; costly computer time is lost.

Audev K-68 takes these new, stringent conditions into consideration. Its magnetic properties, coating thickness and surface smoothness are balanced for total compatibility with all computer systems and for equal performance at densities from 556 bpi to 3200 fci and beyond.

How? A balanced interplay between low loss magnetics, precise

SEE IT AT THE FALL JOINT COMPUTER CONFERENCE, BOOTH #209

coating thickness and surface smoothness reduces pulse crowding, peak shift and dropout sensitivity without changing output or write current requirements.

K-68's balance also contributes to its environmental stability.

Keep cool. K-68 can take the heat.

Some tapes are as perishable as ripe tomatoes. They react poorly to temperature extremes in storage or transit; they "bruise" easily when moved from transport to transport.

Not Audev K-68. Base and coating properties have been balanced to provide uniform dimensional behavior. Cupping, curling and edge ripples caused by differential expansion or contraction of coating and base have been virtually eliminated.

Nor is Audev K-68 prone to skew-produced, time-displacement errors. Precision slitting, together with the scientifically designed Audev reel—and the low moment-of-inertia of the tape/reel combination—provide smooth tape motion on any transport.

Test a sample reel on your transport. For a change, try a balance, not a compromise.

Audio Devices, Inc.
235 E.42 St., NYC 10017

Designate No. 20 on Reader Service Card

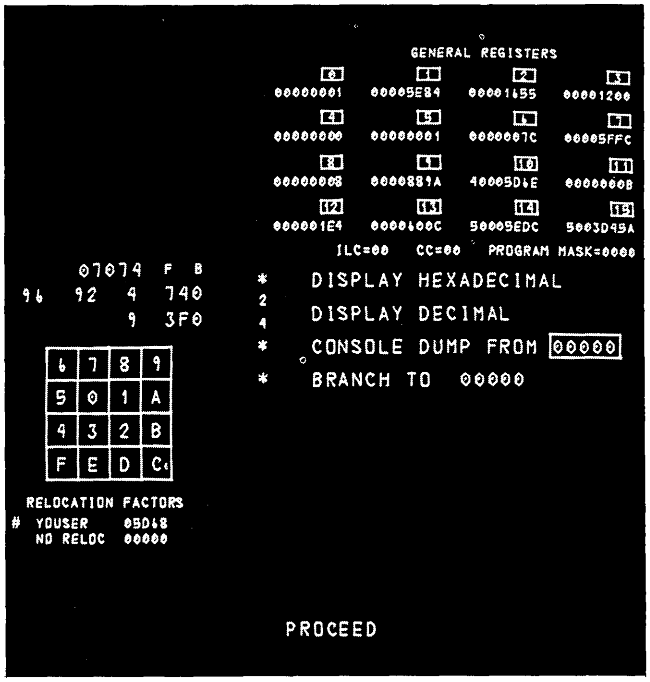


Figure 1. A Debugging Panel

choose corrective digits from the matrix. The corresponding memory location is automatically updated as this occurs.

An inherent value of a programmable CRT display is that portions of the display panel can be masked out during periods in which they are not needed without adversely affecting the remainder of the display. GBUG takes advantage of this characteristic. Many explicit messages to the operator were eliminated. The mere presence or absence of certain maskable items often conveys a subtle but positive message. Moreover, the operator is often led through the proper sequence of conversational steps by blocking as many bad decisions as possible, thereby minimizing mistakes, distractions and ambiguities.

Benefits of the Light Pen

The light pen itself provides a number of unique benefits to the user. Pointing is one of the most natural and least ambiguous ways to express one's intentions. The ability to get action just by pointing at a displayed item furnishes a means of making inquiries with maximum convenience to the operator.

Since all debugging operations in GBUG use only the light pen, the programmer always has one hand free to make notes or flip through his program listing. It also provides a significant speed advantage, especially for non-typists.

The programmer's requirement for printed memory dumps is virtually eliminated since most of his questions may be answered by the more efficient on-line conversation. Dumps still come in handy though, even on-line, especially when a quick look at a table of data would be beneficial. GBUG provides a number of dumping features, the most convenient of which places the output right on the CRT.

Dumping Features

For a generous memory dump, the programmer simply tells the debugging program where to start. The debugging panel is automatically replaced by a dump panel which displays 256 contiguous memory locations (Figure 2). Using the pen, the operator can then look forward or backward to view adjacent blocks of memory as desired with the convenience of leafing through a book. If he sees a location that requires a change, he may simply point at it, causing a return to the main debugging panel where he will find the selected item isolated on the display and ready for alteration.

The speed of a graphic display, such as the IBM 2250, allows GBUG to maintain, via the main debugging panel, a current total picture of the problem program's status. This feature is essential because many items are subject to change each time GBUG is called by the problem program.

Some other debugging features include:

- Address stops or breakpoints (the ability to pre-specify problem program locations at which GBUG will automatically recapture control);
- Automatic program-error interception;
- The initiation of printed dumps for off-line desk-checking.

All the above use the same unique features of the display terminal to provide advantages otherwise unattainable.

Almost any debugging operation can be done faster and more conveniently at a graphic terminal. Unproductive busy-work is thus minimized, allowing the programmer to concentrate more fully on his own problem. The graphic display's speed, its ability to present large amounts of data with each response, and its superior two-way conversational ability provided by its CRT and light pen, all contribute to accelerating the debugging process and to increasing the programmer's debugging efficiency.

On-line debugging is only one of a variety of relatively small-scale problems whose solutions can make good use of the graphic display. It is therefore unwise to overlook the small job as a potential computer graphics application — certainly for jobs of all sizes the graphic display demands careful consideration in the choice of a man-machine conversation device.

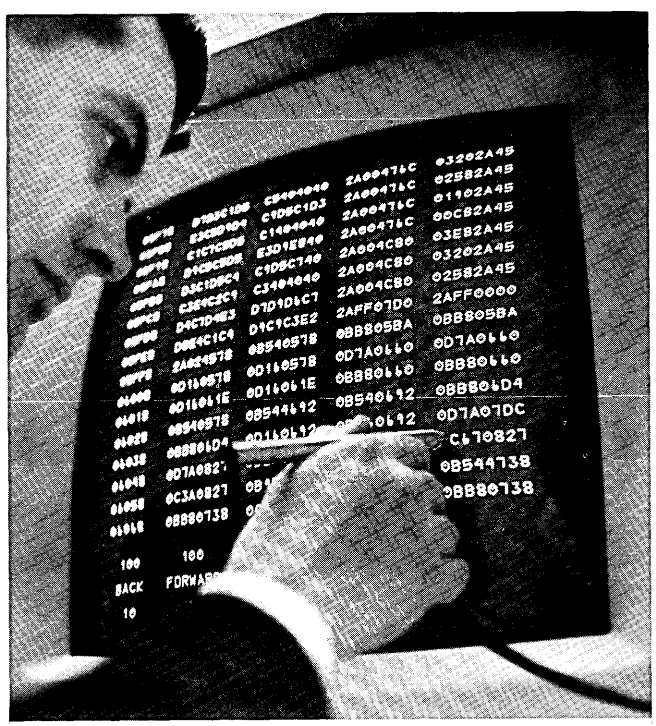


Figure 2. A Graphic Memory Dumpl

THE FORD COMPUTER GRAPHICS PROJECT

Walter L. Johnson
Project Manager
Ford Motor Company
Dearborn, Mich. 48121

"By tapping into a powerful time-sharing system, 'geometric conversation' with powerful programs can provide one of the most dramatic problem-solving tools available today; this mode of use promises to have a major impact on every technically based industry."

Most experimental developments in the field of on-line graphic displays involve the direct connection of the display electronics with the memory of a large-scale computer. While this approach is direct and has proved quite flexible for research and development purposes, it has proved expensive and restrictive in terms of the communications bandwidth required to distribute such services over standard communications lines. Thus advanced large-scale time-sharing systems have rendered this approach obsolete.

It is possible to lower the cost of servicing the display and also to permit its operation over standard voice-grade communication lines. This can be done in the following manner:

1. By functionally separating enough control electronics and memory, and dedicating them to the display system itself;
2. By relying on this dedicated hardware for the high-frequency routine functions to be performed locally; and
3. By calling on the large-scale mainframe power in bursts only when it is required (through an advanced time-sharing system).

Although this systems approach has been extremely controversial in the past, advances in the communications art, as well as ingenuity in exploiting programming techniques to improve the efficiency of two processors communicating over a phone line, appear to justify this approach.

A large number of routine data editing functions can be done as a "free-standing" system. These functions include previewing computer output prior to drafting-machine operations and editing tutorially oriented input preparation programs prior to large-scale simulation-type applications. By tapping into a powerful time-sharing system, the "geometric conversation" with more powerful programs can provide one of the most dramatic problem-solving tools available today, and this mode of use promises to have a major impact on every technically based industry.

Equipment

The equipment selected for the Ford graphics activity is the Control Data Corporation 274 display. Featuring a screen of over 300 square inches and a 4000 x 4000 resolution matrix, it can approach 20,000 vector inches of information on a flat distortion-free tube face. Its hardware characteristics proved to be substantially superior, and it was also oriented to a satellite computer concept. A Control Data Corporation 1700 which offers an extremely efficient bit manipulation FORTRAN as well as a mass storage operating system for local disc pack use is also used.

Project Organization

The computer facilities are administered by the Engineering Staff of the Company and the software system is being developed by system programmers from the Technical Computer Center. The applications are being developed by teams assigned to the project from the Design Center (Styling), Body Engineering, Metal Stamping Division, Manufacturing Engineering Office, Automotive Assembly Division, Engine and Foundry Division, and some of the other manufacturing activities. The applications development teams are in residence at the Center while the software development is in progress to assure that:

a) each using activity is developing a cadre of in-depth professionals; and
b) that the software being developed in support of the applications is responsive to the real needs.

Applications

Initial applications were centered on relatively routine tasks which can be done in an off-line mode, such as data editing and modification, analyzing the output from more complex computer programs, and developing the data input to programs which are error sensitive.

In extremely complex computer programs which deal with data which are difficult to correct in symbolic form (such as coordinate information which comes from scanning equipment or coordinatographs), conventional practices require repetitive computer runs before satisfactory results are obtained. By providing facilities which can identify and correct errors through geometric (rather than symbolic) communications with the engineer, it is possible to reduce substantially the computer costs. In fact, such applications appear to more than pay for the entire graphics activity. This, of course, is simply one of a large number of potential applications.

Analysis Programs

There exists, within the engineering computer-aided design library, a large number of extremely complex analysis programs which can benefit by geometric interaction with the engineer. An example of this is kinematic linkage analysis. Being able to review the computer output to check interferences, torque and acceleration studies, etc., can substantially assist evolving a design which is both smooth and efficient in its operation and also one in which the tolerances are optimized for manufacturing feasibility.

Large system simulations can also be aided by reviewing geometric trade-offs such as are encountered in optimizing vehicle packaging, drive-line analysis, etc: (See series of photos).

Numerical Control of Machine Tools

One of the most exciting areas for applying on-line graphic displays is, of course, numerical control of machine tools. The integration of the design analysis programs with the formulation of instructions to the machine tools themselves can be substantially aided by establishing a geometric conversation between the machine (with its problem-solving power and self-organizing file capabilities), and the engineer (with his design resolution decisions), in a face-to-face, iterative, dialogue.

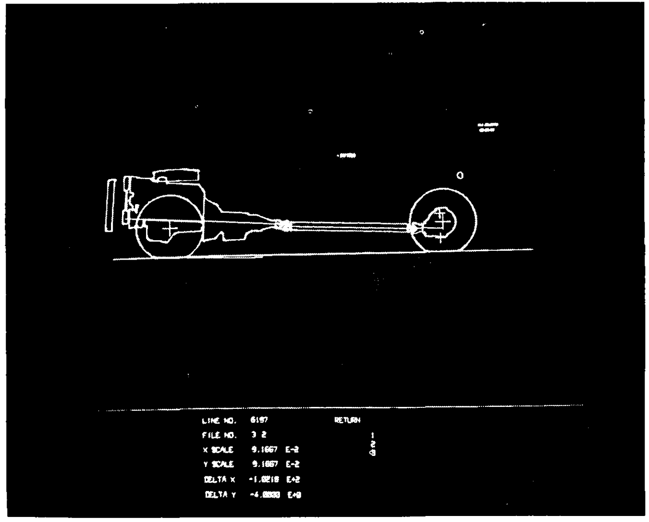
The analytical description of surface geometries is, of course, a principal avenue of essential development, and the first known implementation of the Coons surface technique was made at Ford some years ago.

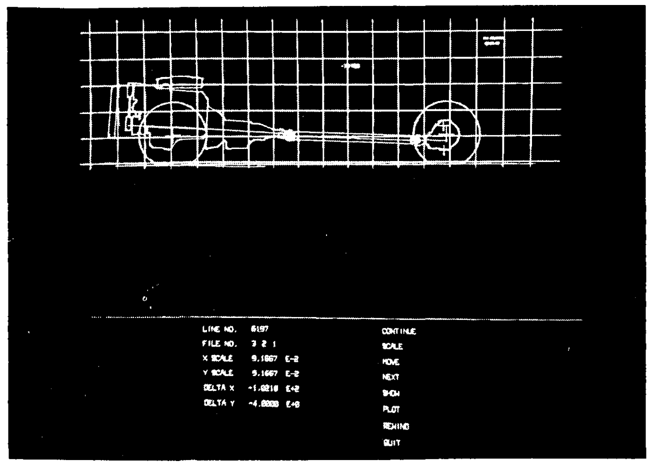
Technical Computer Center

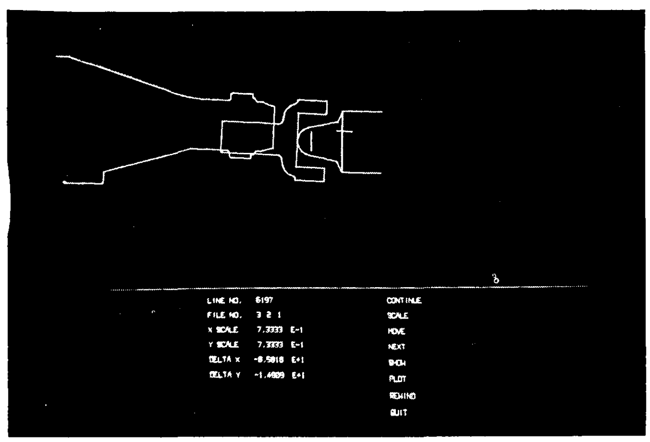
The remote graphics facilities are supported by the central Technical Computer Center, which is an integrated complex of 22 major systems built by 10 different manufacturers and serves the Ford Motor Company operations in the United States and overseas by means of standard communication lines. The users of the Center include the Ford Motor Company technical activities (including Engineering, Operations Research, Numerical Control) as well as related activities of Ford Motor Company subsidiaries and, in some cases, its principal vendors. There are over 150 terminals and remote computers linked to the Center which can deal with the Center by means of a selection of over 30 different compilers, problem-oriented languages, assemblers, and operating systems.

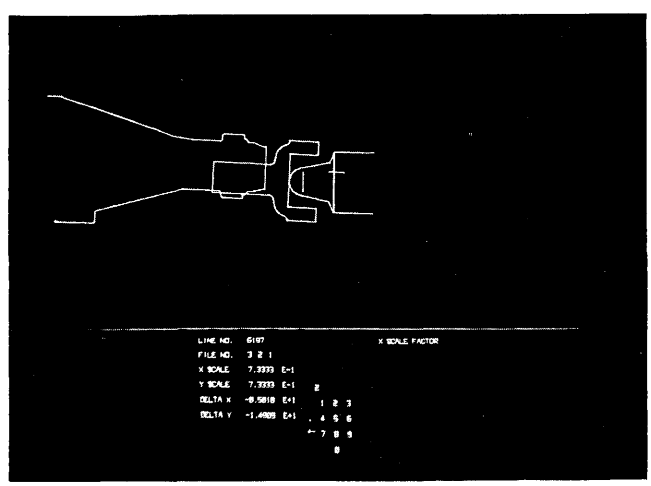
Advanced System Plans

The heart of the facilities at Ford is essentially military command and control equipment built by the Philco Corporation. This includes a pair of Philco 212 large-scale scientific processors and the Philco 102 advanced communications processor. This type of equipment is generally found in military command and control applications and proves to be ideally suited for large-scale time-sharing utility applications. Presently under way at Ford is an extremely advanced time-sharing system which features dynamic data structures, completely general file systems, and complete machine independence for the users. In addition to an unusually advanced time-sharing Executive System, a number of special language developments are also under way. One of the most unusual of these is a combination of an advanced version of MAD, the military command and control language JOVIAL, PL/1, and features borrowed from some of the major list processing advances. (Perhaps we should call it PL/2?)









The Talking Typewriter—and the Learning of Reading in a Disadvantaged Community

Dr. Richard Kobler
Thomas A. Edison Laboratories
West Orange, N.J. 07051

"We have become incontrovertible believers in the genius of each and every small child, whether socio-economically deprived or advantaged. The free discipline of the Talking Typewriter — the individualization of certain programming sections, coupled with an appropriate mixture of monastic and social learning environments — brings these young geniuses the greatest joy of all . . . the love of learning."

This is a report, in capsule form, of some rather startling, preliminary results in reading achievement — and of some tentative insights as to why they were obtained.

In August 1966 the Board of Education of the City of New York authorized the Superintendent of Schools, Dr. Donovan, to proceed with the establishment of the "Responsive Environments Project," with funds made available by the Office of Economic Opportunity. The purpose was to test on a large scale the efficacy in learning reading of the "Edison Responsive Environments Learning System," otherwise known as the "Talking Typewriter." This is a highly sophisticated example of educational technology.

The research, development, and testing of the Talking Typewriter on hundreds of subjects was initiated by my company in 1960 and essentially completed six years later after an investment of 1½ million dollars of our corporate funds.

The Project Gets Underway

In August, 1966, the following steps were taken by Dr. Donovan and the Board of Education:

1. Dr. Edward Welling was hired as Project Director.
2. A small staff was hired and turned over to us and our marketing affiliate, the Responsive Environment Corporation, for training.
3. 10,000 square feet were rented on the second floor of a wholesale carpethouse on Linden Boulevard and Euclid Avenue, in the center of a socio-economically deprived section of Brooklyn, the Brownsville-East-New-York Section.
4. In three months, the so-called "laboratory-area" for Talking Typewriters, three related classrooms, administrative, and visitors' areas had been designed, and had been erected by the excellent engineers and workmen of the New York School System.
5. Twenty Talking Typewriters were installed in twenty soundproof booths.
6. In the middle of January, 1967, Dr. Donovan, Mayor Lindsay and representatives from the Office of Economic Opportunity (OEO) officially opened the installation and designated it as an Annex to a local Public School.
7. Promptly, some 350 children from surrounding schools, including two complete kindergarten classes and two first-grade classes, as well as some junior-high and high-school students, spent *one hour* daily in the project.
8. Approximately one third of this time, or a maximum of 20 minutes, each child spent *alone* in a booth with a Talking Typewriter.

(By the way, my remarks so far demonstrate that even an enormous bureaucracy *can* move fast.)

Results After One Semester

Four and one half months later — please note: only one single semester later — these culturally deprived children in the Project and the Control Groups were retested for word knowledge and word discrimination. The tests used were the Metropolitan Achievement Test, Primary Battery.

On July 19, 1967, Dr. Donovan stated to the National Seminar on Innovation, the following results regarding the

(Based on a talk given at the Annual Conference of the National Reading Reform Foundation, New York, N.Y., August 3, 1967.)

Although computers aren't new to the industry, only now has it been demonstrated how completely computer technology can serve every phase of an airline's organization.

This happened when United Air Lines commissioned UNIVAC to design and build an on-line computerized information system.

It represents the largest such investment the business world has seen thus far. The first to utilize cathode ray tube sets (input/output devices resembling TV monitors) on a nationwide basis.

Over 2800 of these UNISCOPE™ visual communication terminals will link 116 United cities to a centralized complex using three UNIVAC® 1108-II computers.

To the United customer this will mean better service.

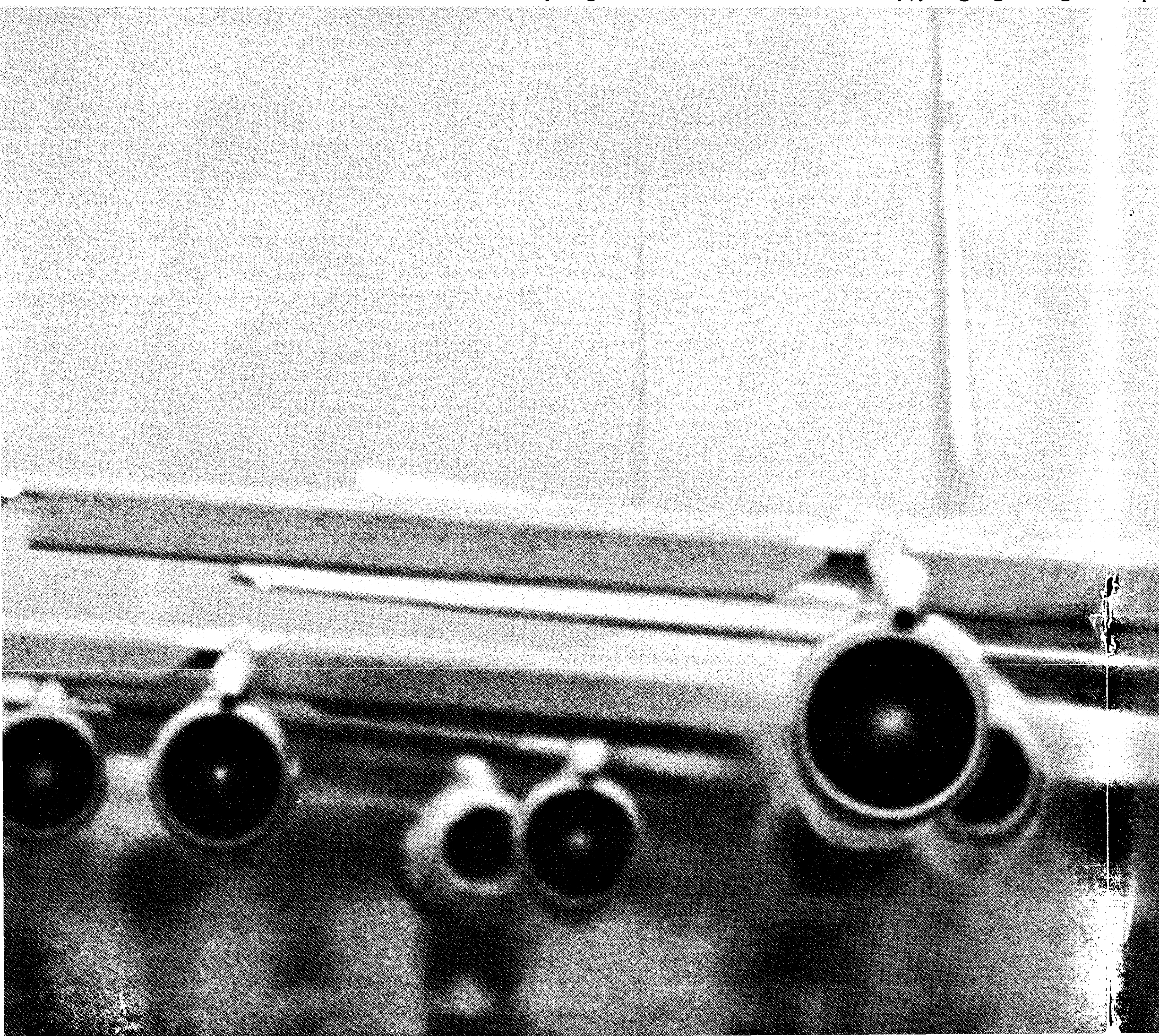
When a United agent queries his set on seat availability he'll get a response in one second.

And in that time he'll also get a complete readout on his screen with availabilities for five flights in addition to the one he requested.

Agents at ticket counters and in air freight terminals will have the unique advantage of automatic ticket or airbill printing provided by any one of 700 printer units that are integral to this

Univac

When you grow as fast as the airline industry, you get growing



UNIVAC real-time system.

The information this system processes will cover seventeen basic categories ranging from passenger reservations, meal planning, crew and aircraft scheduling to flight planning and cargo loading.

It will provide United management with the basic data vital to operating a jet fleet of 400 aircraft and a passenger volume which is expected to double in the next five years.

For such potential to become operational by 1968 requires years of work. Three years of United planning. Three hundred man years of systems analysis and programming.

But United isn't the only airline taking advantage of UNIVAC real-time capability. Others are Air France, Allegheny, British European Airways, Eastern, Lake Central, Mohawk, North Central, Northwest, Ozark, Scandanavian Airlines System and Trans World Airlines.

And UNIVAC systems are performing important tasks for many other industries. For science, education, and government—in all parts of the world.

UNIVAC

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

SPERRY RAND

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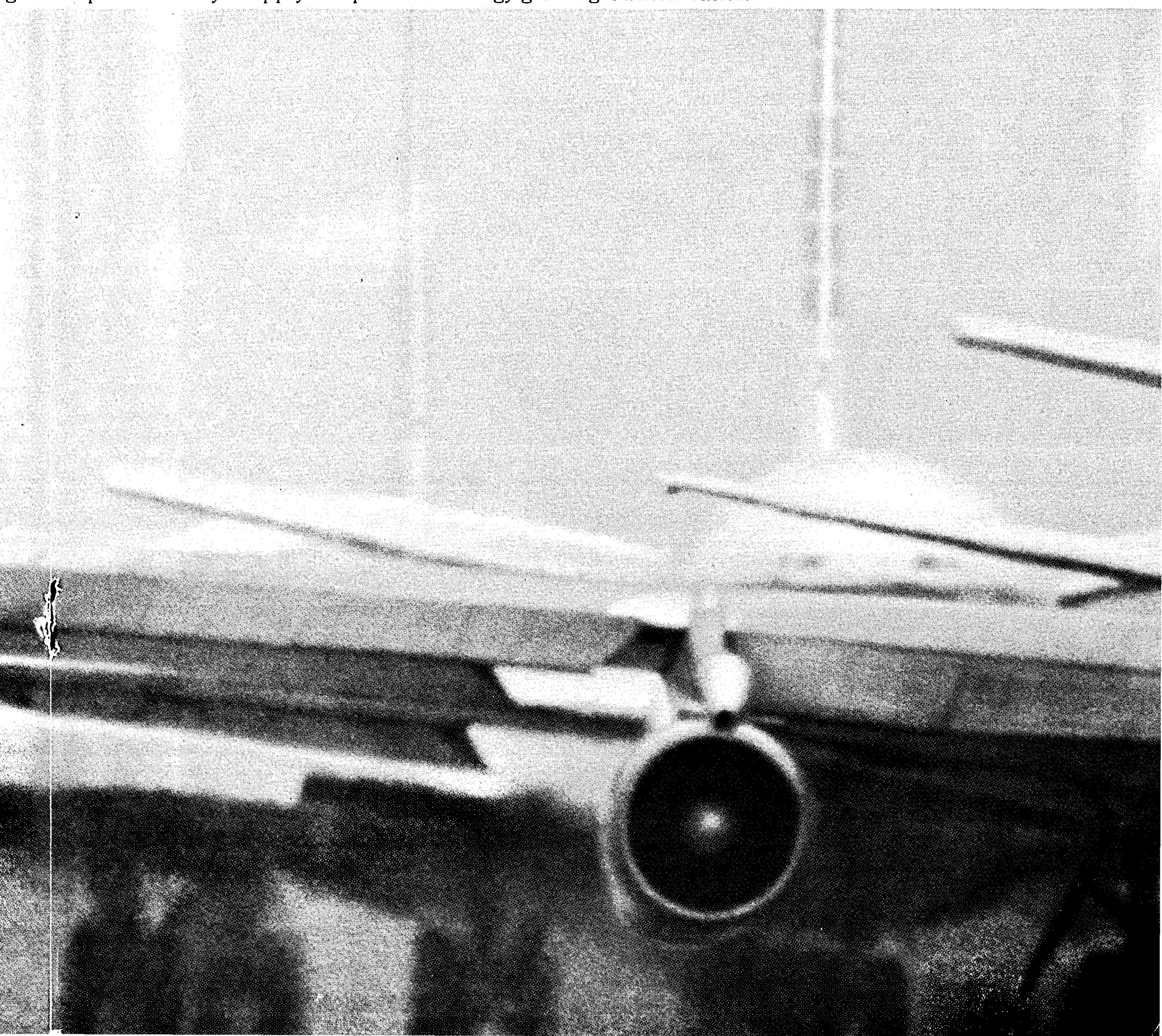
Airlines.

pains. When you apply computer technology growing is a little easier.



kindergarteners and first graders:

1. On word knowledge, our kindergarteners tested at an average of 1.5; the Control Groups at 1.0; a clear gain of five months within four and a half months. They were more than one half way through first grade. Another Control Group who *finished* first grade also averaged 1.5; so that our kindergarteners, after four and one half months in the project, at the end of their kindergarten year, tested as equals of those who completed their standard first grade year under usual conditions.
2. On word discrimination our kindergarteners averaged 1.5; the Control Group 1.2; a clear gain of three months within four and one half months. The other Control Group who *finished* first grade tested at 1.3, or two months *less* than our kindergarteners. In other words, during one full first-grade year the Control children advanced from 1.2 to 1.3. This exemplifies the frightening intellectual attenuation process which characterizes the first encounter of the culturally deprived child with a formal school system. At the same time our kindergarteners are *entering* first grade with an *advantage* of 1.5, or more than one half way through first grade.
3. On word knowledge, our first graders averaged 1.8 after four and one half months in our project; the Control Group 1.5; a clear gain of three months, with practically all handicaps for entry into second grade wiped out.
4. On word discrimination, our first graders averaged 2.0; the Control Group 1.3; a gain of *seven* months in a four and a half month period, wiping out *all* handicaps for entry into second grade.

Unmeasured Gains

Now, here are some unmeasured important byproducts:

1. Our children know how to *typewrite;* they know uppercase and lowercase (popularly known as "shift-keys"); they know ". ? !, carriage return, space, backspace, numbers from 1 to 10, +, —, x, " — yes, even the "dollar sign."
2. They can take *dictation.* This means that upon oral commands *only* by the Talking Typewriter, they can type the words which they have learned — a process more difficult than reading.
3. *Not a single act of vandalism* occurred on more than ¾ million dollars worth of equipment or on a single windowpane.
4. *Not a single act of theft occurred;* remember, many culturally deprived teenagers went through the Center daily.
5. Grooming and dressing improved so markedly that the laboratory toward June started to resemble a middle-class school.
6. Kindergarteners, who, at the start of the first grade, are more than half way through first grade, have acquired the additional skills of typing and typed dictation. They have also acquired some relatively esoteric symbol-knowledge, and are approaching the accomplishments of some of their highest socio-economic peer-groups. This is real "Headstart." Here, at least among children, it is possible to create an *"intellectually classless society."* This feeling of *real, visible* progress in their children's learning apparently convinced many of their parents that, in spite of their unremitting poverty, a little bit better dress, a little bit better grooming, would do its part to help their children along on their way.
7. Finally, we, and the Project staff, know how to duplicate these phenomena *anywhere,* and at a *profit* to the taxpayer. For the $250 spent per child are almost immediately wiped out by cancellations of remedial reading sessions, not to mention the prospective losses to society amounting to a minimum of $250,000 over the lifetime of a single dropout, considering welfare payments and loss of productive income.

Why Did the Children Learn So Quickly?

Now a few points regarding some of the underlying principles which produced these extraordinary results.

First, for many reasons, including pragmatic ones, we have become incontrovertible believers in the genius of each and every small child, whether socio-economically deprived or advantaged. In other words, any human being who has acquired during the small timespan of less than the first 1000 days of his life, the extremely difficult skill of *talking,* including the correct use of such incredibly abstract expressions as "I am," "Where are you?", "What's going to happen," etc., has demonstrated genius. He therefore should be able, with relative *ease* and *joy,* to learn the easier task of superimposing a visual matrix over an already existing auditory matrix — the task commonly called reading.

Second, each child is born with his own *unique* learning methodology, involving not only different accentuations of his "sensory tentacles" — seeing, listening, talking, touching, etc., — but even more he is born with his own *individual preferences for redundancies* for each new expression (letters, words, sentences). Just as importantly, he is born with his individual "skip and jump" modes, constructing words and sentences not only from left to right but frequently backwards and even from the center outwards. Even adults read many times "ahead" and "later come back."

Third, consequently, a learning machine must not only be a multisensory precision instrument, but must also permit frequent switching, back and forth, from programmed materials to free exploration — from dictation or from "discipline" to the "freedom of self-learning."

In addition, programs, particularly in the beginning, must be *individualized.* In fact they are frequently drawn from stories the children themselves tell us.

The whole system must be voluntary. Each day each child is at complete liberty not to go into the booth with the Talking Typewriter or to leave it at any time. However, he cannot stay longer than about 20 minutes per day.

Most importantly, for those few minutes per day the child is *alone* — and I mean *alone* — in a monastic environment, confronted only by the Talking Typewriter. In fact, a child, particularly during some creative moments of discovery, must be left alone. Children like to wrestle with a task — how often have you heard them almost desperately cry out: "Let me do it myself!" This is the type of learning which puts spine into the back, which makes them intellectually into *men* instead of remaining intellectually children.

We do not neglect the "social" learning process. Our classrooms with their normal class teachers serve precisely to underpin and expand the children's knowledge in dialogue with colleagues and teacher.

Thus, *far from drilling and far from anarchic freedom,* the *"free discipline"* of the Talking Typewriter, the individualization of certain programming sections, coupled with an appropriate mixture of *monastic* and *social* learning-environments, — all result in what we may call "Humanistic Technology." This serves the greatest joy of them all, the "love of learning."

EMBEZZLING PRIMER

Sheldon J. Dansiger
President
EDP Associates Inc.
New York, N.Y. 10017

"Before computers became part of the American way of life, there were countless occurrences of embezzlements and frauds done by hand. With the computer mystique now present, there is a strong indication that a day will come in the not-too-distant future when a new, sophisticated style of stealing will begin coming to light. What can we do about it?"

Magnetically Imprinted Numbers

One story making the rounds in Data Processing circles is well on its way to becoming a classic. It concerns itself with the time when many banks around the country first mailed their depositors deposit slips with magnetically imprinted account numbers on the bottom.

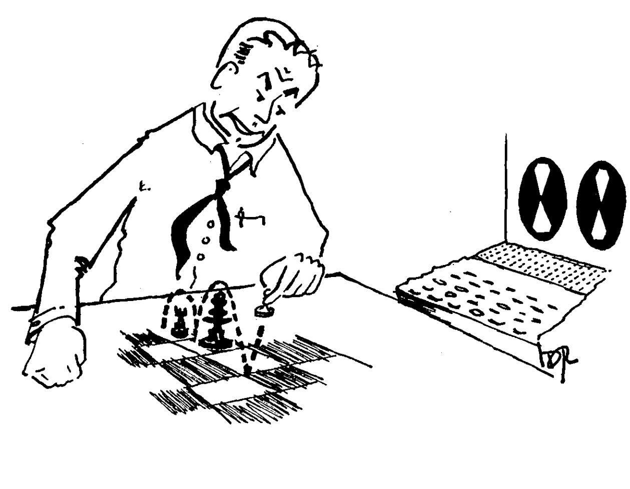
One enterprising young man, upon the receipt of such a set of imprinted deposit slips, promptly went to his bank and carefully dispersed his full compliment of imprinted slips among the neat stocks of regular un-imprinted slips. As one would expect, these slips were used by numerous uninitiated depositors, who unsuspectingly wrote their own numbers above the imprinted ones.

The bank's processing procedure was such that imprinted slips were selected from the mass of regular checks and automatically credited to the imprinted account number. Thus it is not surprising that this same gentleman's balance totaled $67,000 the following morning. Nor should it surprise one to learn that he promptly closed out his account and proceeded on his way.

Mutual Fund Processing

In the same vein was an experience I had while writing an IBM 7074 program for a commercial bank which processed many mutual funds. On one occasion I indicated to the processing manager, that, given five minutes alone with his mutual fund program for the ABC Mutual Fund Co. (a pseudonym), I could steal at least $10,000 from the month's run and still leave the grand totals balanced. He laughed and said he didn't believe I could do it. I created and punched the appropriate patch, which I then inserted into the program deck. We ran the mutual fund once again, and again it balanced out. He compared a number of individual accounts and they were the same; he, of course, maintained that I had failed in my attempt. At this point I told him to check account number 123456789, and as his smile faded, I knew he was convinced. The old slip had credited the account with a $70 contribution, while the new slip had given credit for a $12,545 contribution. I then took the patch out of the deck, tore it up and announced that I would explain it to the first person who bought me a good, repeat, good lunch.

The explanation was simple enough. When the number of shares purchased for a person is calculated, it goes to four decimals and is then rounded. I merely truncated and added the excess to a counter; I compared each account number to one I had built in my patch, and when I had a match I added the counter to the account and proceeded on. The account was my father's, and I am sure he would have been happy to know of his sudden good fortune, no matter how temporary it might have been.



Chess Move

Finally, we have the story of the night-shift computer operator, who, having lost his fourteenth straight chess game to the computer chess program, angrily took the machine's queen with his pawn by a grossly illegal move. When, to his amazement, the machine accepted his move (it did not check the legality of an opponent's moves), the operator smiled a tight little smile. He never lost again.

Dansiger's Law of Counter Measures

These three examples of various degrees of larceny are meant to illustrate what I have modestly entitled Dansiger's law of Counter Measures. It states:

> Whenever something is invented, someone, somewhere, immediately begins trying to figure out a method to beat the invention.

Before computers became part of the fabric of the American way of life, there were countless occurrences of embezzlements and frauds done by hand. Now, with the computer mystique ever present, the tendency is to stay away from delving too closely into the workings of the system in a company. This, I feel, lends itself strongly to a day in the not-too-distant future when a new, sophisticated style of stealing will begin coming to light. The reason for this, quite simply, is the failure of large companies to modernize their control techniques to keep up with their modern equipment.

Poor Control in Brokerage Houses

Perhaps the best example of this at the current moment is the poor controls used by many brokerage houses. In general they use what I have termed a double funnel operation, in which all the purchase and sales slips are funneled into one man, the head of the EDP operation, who then is responsible for funneling the different items out to the EDP department. A portfolio program of any sophistication could ascertain which accounts have large balances continually on hand at the brokerage house, and collusion between any one of the broker's men and the EDP man (or the operator working in the EDP department on the man's accounts) could work out many variations of the old embezzlement methods. The reason it would be more effective is simply because people have a tendency not to question a nice, neat report from a computer.

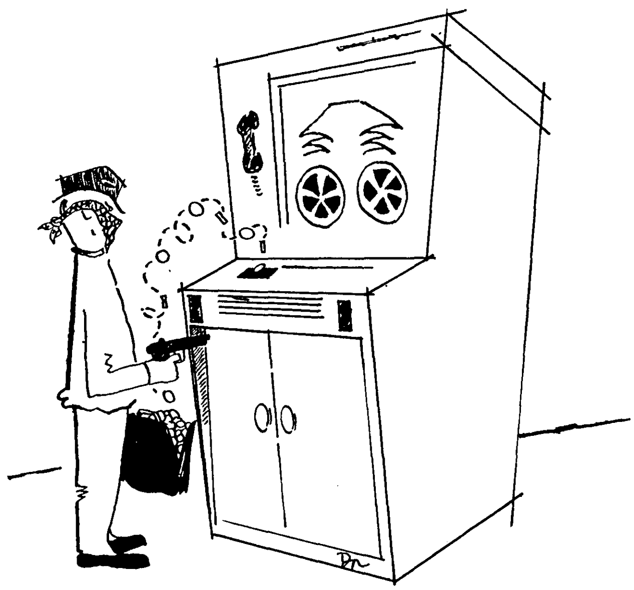
Changing the Tolerance Percentage

Another example would be any company which carries large inventories of a diverse number of items. Traditionally, there is a difference between what appears on an inventory program calculation and what truly exists in the warehouse. Most companies establish a tolerance percentage which is meant to cover pilferage, spoilage and all other items that cause a depletion in actual amounts. A basic embezzling technique might simply require the changing of this tolerance in an upward direction, which thus would allow for a systematic stealing from the several inventories of an amount equal to the increase in tolerance.

Payroll Programs

The area of payroll is also a highly vulnerable one. There is an old story about a bar that did good business but was losing money. When a check was run, they noticed the bartenders rang up each sale on one of four registers. Of course, when it was discovered the owner had only three registers, the problem was solved.

In the same manner, computer payroll programs creating checks for employees that do not exist, or overtime for hours not worked, represent perhaps the simplest most basic examples of effective computer embezzlement techniques. These can be especially effective in companies that do primarily piece work, and which depend on a large staff of temporary personnel with high turnover rates. A fine example is, of course, EDP controls in an insurance company. The very small personal contact between customers and insurance companies serves as an additional aid to larcenous types. Collision cases which involve only the client and the insurance company he is insured with, are prime material for this type of operation. Since there will be no contact with a second insurance company (as in cases involving a car crash with another person), the number of people needed for collusion is reduced.



Hard and Unpleasant Facts

This article is not really meant to serve as an embezzlement primer. However, as previously stated, the control gap is large, and specific examples of dangerous situations that exist are probably the most effective method of getting my message across.

Furthermore, although embezzlement is not a nice word, the hard fact is that it exists in all fields of endeavor, and that the more liquid the cash in a company, the greater the dangers. It should be noted that all the quoted examples are based on only a cursory inspection of various industries. Anyone with a knowledge of the intimate workings of a particular organization could develop a number of techniques that would wreak havoc in the organization.

The question of course arises, what can be done to help prevent these situations from occurring? It is impossible to prevent stealing in its entirety, and what I offer now is not a panacea, but perhaps it can be of some help.

One Solution — Intelligent Auditing

The classical enemy of all embezzlers is the auditor who is sent in to look over a company's books to make sure that proper accounting systems and procedures have been followed. In any given day a listing of all programs run should be obtained, and these listings should be looked over by an outside party whose job is to determine if the programs are doing what they are supposed to be doing. The audit should be done on a spot check basis, and the accent should be on programs that deal with cash or near cash items.

Furthermore, the embezzler works best in an area where the staff is disinterested and uninformed. One of the best defenses against stealing is an alert and informed staff. The clerks who are working on items being prepared for computer runs are really in more responsible positions than the clerks working in a manual operation. To get clerical personnel of a higher degree of intelligence and interest, you simply have to pay more money.

Both the auditor and the superior clerking personnel are items that cost money on your operation, but this expenditure should be considered an insurance expense, similar to the insurance expenses incurred regarding fire and physical theft. As a simple instance, an audit in a stock firm could take a listing of portfolios and check with the banks involved to see if the dollar holdings indicated are truly those which are being held at the bank. In the insurance company instance given previously, a good technique would be to take a given day's run on collision items and contact the customers involved to see if they really exist (or better yet, check a central credit bureau to see if they are members in good standing in the community).

To cope with the mutual fund example I provided, and with others similar to it, at irregular intervals one should take an entire mutual fund run and go thru it item by item.

Overcoming the Computer Mystique

Next, the computer mystique must be overcome. The following point must be driven home to the accounting department (and all other departments that may be involved): The commercial computer is not a big, black mysterious box with flashing lights. It is a tool to aid in quicker and more accurate compilation of information whose preparation is vital to a company's progress.

The basic problem here is that many executives in a firm are well versed in all facets of their business and feel comfortable in the discussion of anything relating to their business. However, they are afraid that since they do not understand the workings of the computer, they will appear foolish if they ask too many questions. Probably not one man in twenty knows how his automobile works, but he knows how to deal with it, what it can do, and what he can expect from it. In a similar manner, such executives should learn how to deal with a computer, what it can do, and what they can expect from it.

Distributing Control

The final and perhaps most important counter measure is to set up your system so that not all parts of a given system are under the control of one man. Even so simple an item as having the balance control totals prepared by a man other than the person in charge of the system would be a major safeguard.

In summation I would like to relate one final story.

In one company, a young man with embezzlement in his heart but crudeness in his techniques merely punched up cards which contained the totals he wanted to print on a summary report. He then proceeded to alter his program so that it did not process the original data, but merely printed out his totals as it read them. If the gentleman in question had not broken his leg in a skiing accident, he might still be doing it.

I rest my case.

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JOBS AND CAREERS IN DATA PROCESSING

A Personalized Recruitment Program

Paul F. Chambers
Manager of Plant Personnel
Digital Equipment Corporation
Maynard, Mass. 01754

Wading through a long series of interviews with technical companies set up by a placement office can be a perplexing experience for students who are about to graduate from college or school and enter the data processing field.

Essentially, each company seems to be saying the same thing, . . . talking about competitive salaries, sophisticated technical tasks, training opportunities, advancement . . . and a list of involved benefits that would perplex many actuarial experts.

There is little for the graduate to personally associate with, no tangible evidence to show how well he might do with a potential employer. Digital Equipment Corporation has developed and is refining a personalized recruiting program to assure that the individual graduate does not feel he is only a small objective in a nationwide mass recruiting effort.

School Area and Home Area

After January and June graduates report for work in a department, or start the Company's seven-week course in computers, they are classified into home town geographical areas and the areas in which they went to school. By consulting *Ayer's Directory of Newspapers,* they are divided into geographical groups of three or four, and they are then photographed working with one of the firm's newest computers.

Photos with captions explain their free training or their interesting new assignments, and are sent out, written in various ways. Home town paper releases say: "Newark Man Working on New Computer System." School placement office releases say "UMASS Graduate Working on New . . ."

The remainder of the story or caption is the same for all media. Home town papers and those in the school area usually print the material; they are always looking for news tailored to their local needs. Placement offices put the material on bulletin boards; they're proud of having helped get a significant job for a Senior. School newspapers and alumni publications also readily use the information.

Not only does this gain much favorable publicity, but it provides a personal association for the job-seeking senior. Here is a student in his physics class last semester, who is already helping design computers, or receiving valuable training. So the senior says to himself, "Maybe I'll be in the picture next year." Obviously, extensive use of this technique also helps reinforce and strengthen the ego in most graduates who are about to go out and challenge the world outside school.

The Personalized Recruitment Brochure

Four-color, super-glossy paper, with artistic layouts, engraved lettering — many companies have gone the limit to produce expensive recruitment brochures which paint the best possible picture of the company. But the expectant graduate is treated like a number. He gets a beautiful brochure, . . . but it's just like many thousand others given to graduates all across the country. Some companies publish several brochures about various vocational areas, but always the same for everyone, not tailored to particular students or groups of students.

Our company tried an interesting experiment this past Spring: the publishing of a booklet aimed at one particular school, Wentworth Institute in Boston. The booklet carried several of the same pictures described earlier, along with biographical reports about the success of recent Wentworth graduates at the company. To an extent, wording of the job specifications was tailored to Wentworth's curriculum. In this way students could consider their possible future job in terms of specific things already learned. It appeared to be a very personal approach, yet much of the booklet wasn't, because that part contained standard information (about products, benefits, plant location, organization, etc.). The Wentworth book was certainly successful. Fifty, yes *fifty,* seniors accepted jobs (that was one third of the graduating class).

This gave us an idea for next year. Why not make personalized books for numerous schools across the country?

It can be easily done. A publisher will tell you that booklets are printed in a strange way. For instance, in an eight-page booklet, pages 1, 2, 7, and 8 are printed on both sides of one sheet of paper. Pages 3, 4, 5, and 6 are printed on both sides of another sheet. The sheets are then both folded, and one is placed inside the other to make up the booklet.

If pages 3, 4, 5, and 6 are used for standard information on products, benefits, location, etc., then thousands of these sheets can be printed because these pages could be used in all the booklets. Pages 1, 2, 7, and 8 can be used for the personalized material (much of which can be copying personal pictures and releases mentioned earlier). These pages would be printed in smaller numbers, depending on school size. The result is personalized booklets for many schools at an economical price.

Rest of the Personalizing Process

With personal news releases and booklets to use as tools, it is easier to convey to a possible recruit a feeling of individuality, during the rest of the interview and visiting the plant. A magnetic tape unit is used to send a personal-appearing letter to each student prior to an interview (the machine has names and addresses in its memory, — adds them to the top, and repeats them somewhere in the body, of one basic letter).

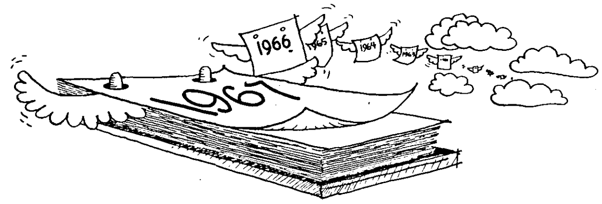
Also, recent graduates of a school can accompany the interviewer. This technique goes right along with the "success-story" approach in the publicity materials. Even during plant visits, every effort is made to pair up the applicant with a recent graduate from his own school. School spirit has a long time to develop during the student's education; we do everything we can to take advantage of it.

With particularly good prospects, we'll even take pictures of them visiting the plant, and send them to the student's home town newspapers. Then we'll obtain an actual newspaper clipping of the picture and its caption (from a clipping service), mount it on a piece of art board, and send it in to his school for the placement office bulletin board. This even lends significance to a particular senior's quest for a job. Why accept somebody else's job when your friends keep talking about the picture in the paper showing your visit to Digital?

Side Effects

Using this personalized system of recruiting not only helps to bring new seniors into the Company, but has a beneficial effect on older employees. When you hold up an employee as an example to former classmates and home town friends, you are at the same time telling him that he is doing a significant job and a good one. Development of this type of pride reaps valuable return in terms of staff morale, low turnover, and maximum productivity.

15 YEARS AGO IN computers and automation



Edmund C. Berkeley
Editor, *Computers and Automation*

The development of the field of computing machinery in the middle twentieth century is becoming increasingly important, and in fact has the earmarks of a revolution as great as the Industrial Revolution.

Whatever part of the field we happen to be working in — research, design, construction, applications, or just the pure science — we are all of us in process of becoming experts in the handling of information: "information engineers". One of the major problems that we face, as the number of information engineers mounts into thousands, is that of organizing really well the flow of information between ourselves. Of all people, information engineers surely are the last to be justified in using poor ways of communication among themselves.

Fortunately, the harmful effects of military security upon the free flow of information touches our field only in a minor way. We are largely free to communicate in full accord with the fine purpose put down in the constitution of the Association for Computing Machinery: "to advance the science, design, development, construction, and application of modern machinery for performing operations in mathematics, logic, statistics, and kindred fields, and to promote the free interchange of information about such machinery in the best scientific tradition".

Fortunately, the meetings of the Association for Computing Machinery over the years since 1947 when it was formed have not yet reached the point where most of the papers are incomprehensible to most of the audience — and there are people on the Council of the Association who are determined not to let that happen. The language for communication in our field is still working in most respects rather well.

But there are serious problems of communication among ourselves, even with a fair degree of freedom to discuss and a fairly comprehensible language (for the most part) to discuss in. Some of them are:

1. A Problem of Discussion: How do we find and talk with people nearby who are interested in discussing the same subdivision of the field we are interested in.
2. A Problem of Learning: How to read, understand, and remember the mass of information produced by many different organizations.
3. A Problem of a Program Committee: How to arrange that the giver of a paper says something worthwhile and says it so that other people can understand what he says and enjoy listening to him.
4. A Problem of Personnel: How to find out and attract good people into your organization.

The design of working communication systems that solve such problems as these has many points of resemblance to the design of computing systems that solve the problems of communication between their different parts. Both need to be the concern of information engineers.

WORLD REPORT – GREAT BRITAIN

English Electric's System-4 Still in Trouble

Manufacturers are always reticent about the why and wherefore of troubles with new machines; English Electric has been very clam-like concerning difficulties with the two smaller machines in its System-4 range.

Already at the beginning of the year rumour had it that the smallest machine of the range (the 4/10 — in basic form worth $140,000) was a non-starter, that several had been built but junked, and that the whole job would have to be started again from scratch.

Each time I questioned the company, the basic facts were denied, though time began to make it painfully obvious that neither the 4/10 or the 4/30 were making any headway with the consumer.

Now English Electric has held a press conference to tell everyone that its machines are going to be three months late, due — mark you — to trouble with new designs of peripherals. As a make-weight at the end of the conference, a senior salesman admitted that the 4/10 had been quietly erased and that a slower version of the 4/30 would take care of the handful of orders booked for these two ill-fated machines, which were originally to be microcircuit versions of RCA's smaller Spectras.

What seems a bit tragic to me is that one of the arguments put forward in favour of System-4 has been that it is a good alternative to System-360. This is certainly not the way to go about displacing IBM.

Shortly after the English Electric admission of trouble, it issued a joint statement with Elliott-Automation (its companion in a recent merger), that used many words to say nothing. There were some pious hopes of compatibility between the two ranges (English has an 8-bit byte design and Elliott has a 24-bit word machine), and a declaration that the ideas of both sides on the number cruncher super-giant were being put together in one great and unholy brew — too late to influence the government one would think.

More Leasing Finance for ICT

While this particular pot was bubbling, the biggest UK computer group, International Computers and Tabulators Ltd. (ICT), was tying up fresh finance in the City for its leasing operations. This is always a long and painful process in Britain, but now with Computer Leasings (ICT associate) assured of a further $72m over the next four years, the company has a rolling credit of $140m to take care of sales which it sees doubling to $336m annually by 1972. The machines will still be the basic 1900-word oriented design, but will be converted to micrologic on Texas circuits. The first of these new generation machines will be at the top of the range and, as a gesture, it will have a companion machine able to work on an eight-bit byte basis.

Maybe this is just a gesture to the Ministry of Technology; ICT claims that those manufacturers in the U.S. (and Britain) who have "tried to ride into heaven on IBM's coat tails have ended up in the other place." They maintain, with some justification, that if they have a good design with good software that really works, why should they make a radical change? Some critics of the ICT design, especially in English Electric, say it is outmoded and slow. They also call the IBM 360/67 "slow." But better a slow machine than no machine at all. Univac's decision to stick to slower, conservative circuits for the 1107 and 1108 has paid off handsomely.

Exports Behind the Iron Curtain

Now to a painful subject: that of exports behind the Iron Curtain. If British manufacturers had thought that the strategic embargo committee of the NATO organization, known by the curious acronym of COCOM, was a dead duck, events behind the scenes in the past few months have proved that the duck was still capable of sounding an anti-red alarm note. ICT's big $2½m computer for East Germany has been cut down in size to a 1904 — comparable to a small configuration of 360/40. At the same time, English Electric is having a hard time in getting a licence to export a $800,000 machine to Moscow.

Yet, British manufacturers point out, what is there to stop Bull-General Electric and IBM-France from working flat out for the Iron Curtain group, since France is no longer in NATO and certainly would hate to lose a chance of lucrative trade?

The last move reported on this front was from Prague. The Czechs have put forward definite proposals for the manufacture under licence of ICT's smallest machine, the successful 1901, of which some 400 have been sold in two years. Small as it is, this is a powerful unit, taking discs in its largest configurations at a total cost of about $300,000.

Nothing the State Department might do could prevent this move since ICT is making its own small discs and since almost every component of the 1901 is British-made. The proposal has gone up to the Minister of Technology who now has to convince the Cabinet that strategic embargoes are worth breaking in this case.

UK Exhibitions Highlight U.S. Equipment

Here in Britain we have just got over Datafair, organised by the British Computer Society and highly flavoured this year with time-sharing consoles etc. It has now given way to the Business Efficiency Exhibition which forms, with France's SICOB, the main shop window in Europe for all business equipments, from a third-generation computer to an office chair.

U.S. affiliates are there in force, and a feature this year is the large number of accounting machines which have been given the sophistication of a stored internal program and, by the same token, are accepted as computers by the tax authorities here for investment grants. To six American machines on display, there are only two British units and one French unit.

How Philips of Eindhoven will ever get the computer fraternity to call its forthcoming general-purpose range anything but the "Cliffhanger Series" I do not know. However, it has taken over the Logaba group which will market the new equipment in Europe when it finally appears, some say this side of Christmas. Joking apart though, the well-known attention to fine detail by Philips must be giving other builders in Europe (especially Germany) furiously to think. Many would welcome competition for IBM, particularly from a company as proud of its reputation as the Eindhoven giant.

National Data Processing Service to Select Computers for London Airport Freight Control

A massive central on-line computer-centred system is to be installed at London Airport to handle inward and outward freight. Airlines, customs, and shippers are co-operating; the mammoth task of developing the system — and presumably selecting the computers — is being given to the Post Office's National Data Processing Service. This proposed organisation has already aroused bitter controversy at the Committee stage in Parliament, since Conservatives see it as crushing the independent computer bureaux and liable willy nilly to exert intolerable pressure on users of other data networks — which must perforce be set up over Post Office lines, and modems.

The Post Office network will have at least 20 computers in the \$1½m class, linked by wideband data highways between centres and to each national data bank as it is constituted. And the Post Office intends to require any would-be user to worry about his interface problems all by himself.

Ted Schoeters

Ted Schoeters
Stanmore
Middlesex
England

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

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POD Form 3526, Jan. 1965

WORLD REPORT — AUSTRALIA

Government Criticized for Failing to Meet Problems of Automation

The Australian Government has come under concerted criticism for its alleged failure to provide leadership in meeting the mounting problems posed by automation.

The criticism was voiced by a succession of speakers at Australia's first wide-ranging public symposium on automation, held in Sydney early in September.

The outcome of the two-day conference, which was addressed by speakers representing various academic disciplines, labour unions, and business management, was a demand by the New South Wales branch of the Australian and New Zealand Association for the Advancement of Science (ANZAAS) for an urgent inquiry by the government into the economic, educational, and sociological implications of automation.

As organizers of the symposium, the branch performed a long overdue service for all sections of the community who are directly affected by automation.

Public discussion of the subject in the past few years has been sporadic and unorganised, marked on one hand by the expression of fear and distrust among the unions, and on the other by vague reassurances from individual employers and employer organisations.

The Federal Government, a coalition of the two major conservative parties, has tended to avoid participation in the controversy and to take the view that any problems which arise will be solved in the natural working of the free enterprise system without the need for government guidance or intervention.

Computer-guided automation, however, is now advancing at a rapid pace. In per capita terms, Australia ranks with several leading industrialised nations of Western Europe in computer installations and the growth rate of installations. Well over 500 digital machines are installed at the present time, with about 200 more on order.

The Government View

At the symposium, the government view presented by L. Bury, the Federal Minister for Labour and National Service, was that workers displaced by automation would be reabsorbed into other industries and that no grave adjustment problems would arise. This was strongly challenged by several speakers.

Warnings were given that unless major changes took place in Australia's educational, industrial, and political thinking, continual industrial upheavals could result from uncontrolled introduction of automation.

The union movement in this country has a militant tradition, and union leaders have been calling for some time for the establishment of a tripartite body representing government, employers, and labour to deal with automation problems.

The symposium also was warned of racial conflict between the less-educated native Australians and the southern European migrants over competition for scarce jobs, and of the possible breakdown of the democratic system with the creation of an elitist society and mass unemployment.

Potential Unemployment Problem

Professor J. Nalson, professor of sociology of the University of New England, presented a sobering indication of the potential problem in employment. He estimated that in New South Wales alone half the work force of about 880,000 is now in industries likely to be affected by automation within the next ten years.

He said sociological and economic data were urgently needed on the effects of the present automative trends, together with analyses of the possible outcomes of adopting different rates and types of automated systems in our society.

Criticising the government for its "absence of concern with research into automation and long-range planning for it," he called on the ANZAAS to consider a joint venture in this field with universities, federations of business organisations, labour unions, and educational research organisations.

As a model for a planning and research organization, Professor Nalson cited the National Planning Association of the United States.

Changes in Education Needed

He warned that if the present education system continued to operate in a society where pressure from business resulted in a large degree of automation, Australia would be producing specialist-trained professional and technological workers for occupations which no longer existed, and a minimally-educated mass with no vocational skills for the jobs available.

Two alternatives were open:

1. Raising the intellectual capacities of all, with the majority sharing in the work needs of society; or
2. Educating an elite to manage and develop automated systems of production, exchange, communications, and control, with the majority adjusting to a system which required no work from them.

The present system, he thought, was more likely to evolve along the lines of the second alternative.

Predictions for the Next Decade

One of Australia's foremost computer scientists, Professor John M. Bennett, professor of physics (electronic computing) at the University of Sydney, gave several dramatic examples of computer-guided automation resulting from the present pace of progress.

Among his predictions on computer usage in Australia over the next decade were:

1. The abolition of money and cheques for most purposes. Credit cards would be placed in reading devices connected to centralised bank accounts which were automatically adjusted for all transactions at the time made.
2. A display unit, like an additional television channel, on which any page of any book desired could be displayed on request in homes.
3. A design facility whereby sketches made on the face of a cathode ray tube would be transformed into the displayed equivalents of finished drawings, and ultimately to computer-controlled machine tools which could produce finished items individually or in quantity.
4. Diagnostic aids in medical centres which would guide a patient through a series of tests and questions, each one being selected by a computer.
5. A nationwide data bank in which all personal information which has ever come to the notice of a public body will be held in a central automatic filing system.
6. Computer-controlled teaching machines, enabling instructional techniques to be groomed to the individual pupil.

Quoting a U.S. government contention that automation was currently wiping out two million jobs a year, Professor Bennett warned that "Australia will follow not far behind."

The Union View

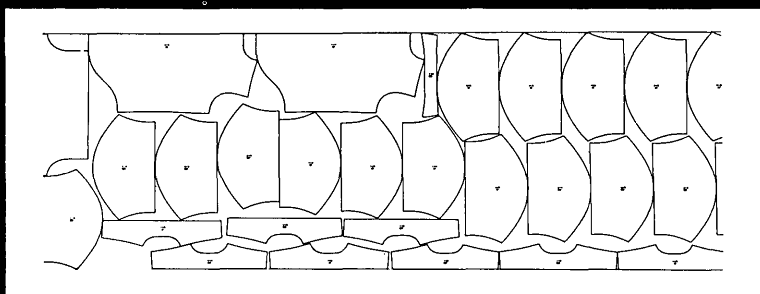
The point of view of the militant Australian union was put by Mr. J. D. Garland, secretary of the Amalgamated Engineering Union, who said people were not wrong when they feared economic collapse, unemployment, and social insecurity from the application of automation.

He called for the establishment of Commonwealth and State co-ordinating committees from government, management, and unions to control the scope and direction of automation "channelling it where it is most needed and where traffic can best bear the strain."

W. R. Cooper

W. R. Cooper
Wahroonga, N.S.W.
Australia

Do you know what it takes to make your computer draw like this?



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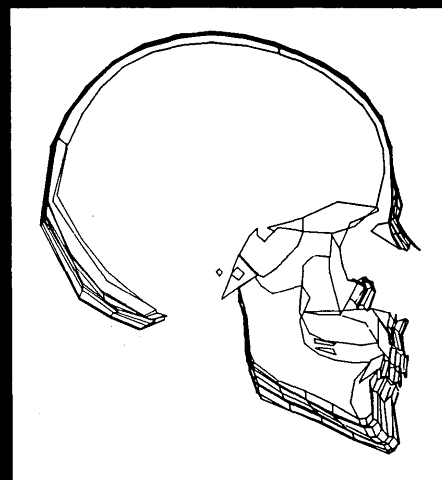

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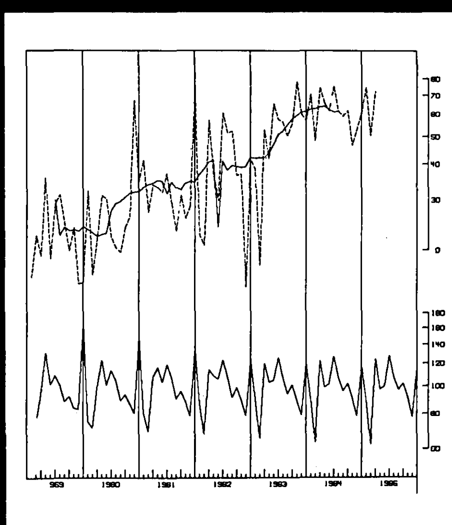
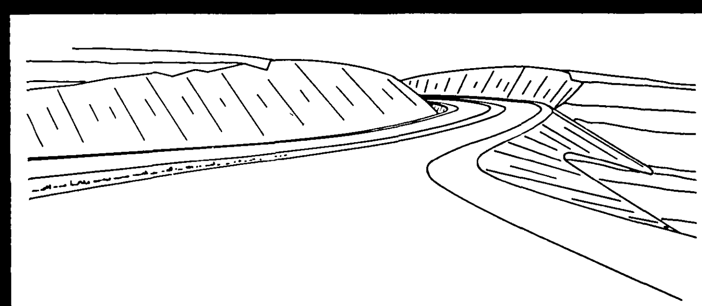


instant trend charts



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ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

Table of Contents

APPLICATIONS

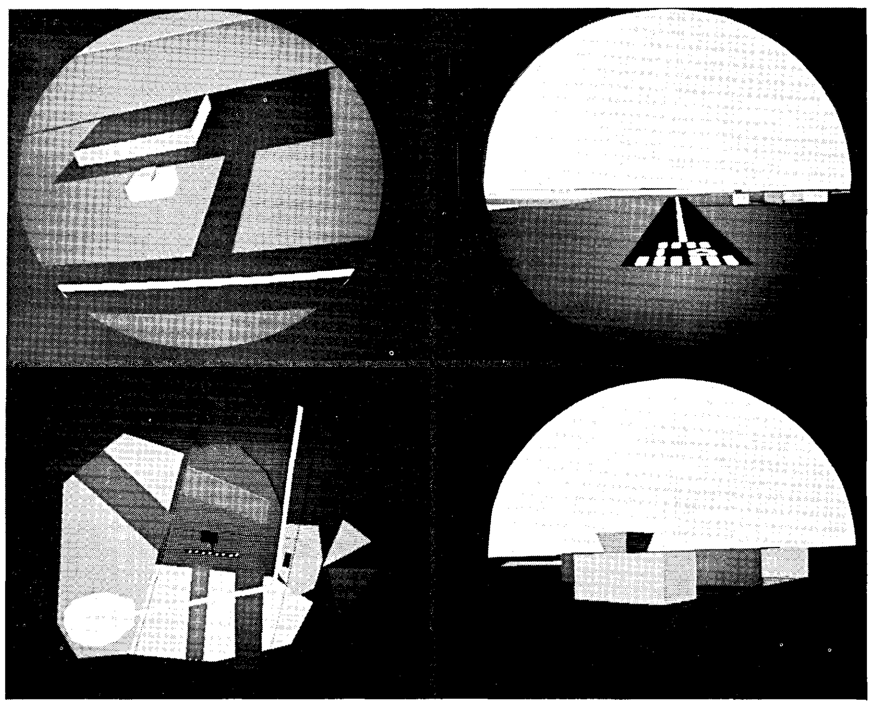
COMPUTED VISUAL SIMULATION DEVELOPED BY GE

A computer that makes television pictures out of numbers has been developed by General Electric's Electronics Laboratory, Syracuse, N.Y. This computer, designed for NASA's Manned Spacecraft Center in Houston, Texas, will be a part of NASA's simulation facility.

The purpose of the computer is to generate life-like TV pictures of objects such as NASA's Lunar Module, Command & Service Modules and the lunar surface. The computer creates pictures of these objects from numbers stored in its memory — numbers that mathematically describe the shapes and colors of the objects. There are no TV cameras, no films or slides, and no models or drawings in the system.

The numbers that describe a particular scene are on tapes which are read into the computer's memory initially and remain there until deliberately erased or until a new tape is read in. Since the "models" are only computer tapes, it is possible to change from one simulation task to another in a matter of seconds.

The operator can see the computer's visualization from any vantage point. In effect, he enters the computer's world by manipulating an aircraft-type control stick. The computer senses his location through the movements of the control stick, then computes and presents a TV picture of the scene as it would appear for an instant in time. This process is repeated



up to thirty times per second, giving the operator the same visual sensations he experiences in a "real-world" situation.

In addition to space objects and scenes, the computer has been programmed to create pictures of an aircraft carrier, an aircraft, an airport, and a street scene. This picture shows how a computer visualizes an airport. The computer is given a series of numbers that tell it the shape and colors of the airport. From the numbers fed to its memory, the computer draws the airport on a TV screen. As the viewer manipulates the aircraft-type control stick to inform the computer where he would like to be in relation to the airport, the computer re-computes the exact perspective and size of the scene for the viewer's location.

NASA will use the computer to conduct engineering tests and evaluations of spacecraft control systems. For example, the characteristics of a proposed control system can be simulated on a computer. This information is then fed to the computed visual simulator, which generates a TV picture. Thus, an engineer can actually see whether a control system has the ability to perform the maneuvers required for rendezvous and docking with another spacecraft, or for making a soft landing on the moon.

AIR POLLUTION STUDY USING COMPUTER TO MONITOR BREATHING TESTS

Hazleton Laboratories, Inc., Reston, Va., has begun a long-range experimental study of the effects of air pollution, using a computer to analyze data that will be taken on a split-second basis over a five and a half year period. The $2.25 million study is designed to gauge some of the biological effects of air pollutants given off by large, coal or oil fired electrical power plants. The study is being conducted under the sponsorship of the Electric Research Council, with financial support from Edison Electric Institute, the city of Los Angeles Department of Water and Power, the Bituminous Coal Research, Inc. and the TVA.

Four laboratories, used in the study, are linked directly to an IBM 1800 data acquisition and control system computer. Two other laboratories are scheduled to be used, with the computer ultimately monitoring tests in six laboratories simultaneously.

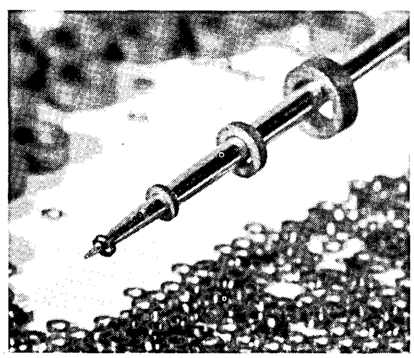
In the first phase of what — in its entirety — is a three-phase study, some 99 monkeys and 120 guinea pigs are being exposed over the next 18 months to contaminants produced by coal-burning power plants — sulfurous byproducts and fly ash. In the later phases of the study, combinations of the contaminants will be tried where concentration and particle sizes will be varied. Throughout each of the three 18-month phases the animals will be checked by the computer to see whether parameters of their respiration have been affected.

To give the computer a means of analyzing an animal's breathing, a laboratory monkey, for example, will breathe through a pneumotachograph — which measures air flow in and out of the lungs. The computer, sampling these electrical signals 100 times a second, will record and analyze some 3000 readings to provide an analysis of 10 breaths taken by the monkey. If this analysis is out of line anywhere the computer relays the anomaly back to the laboratory through a typewriter-like terminal and the test is repeated. Once it is satisfied that it has a good test, the computer stores the data on punch cards or magnetic disk memory and goes on to analyze it in more detail at night.

From this exhaustive, long-term analysis, which will be concluded in 1971, in addition to basic findings, it is hoped that the study may also help to uncover practical information on air quality standards and on synergism between different air pollutants.

IBM PROCESS CONTROL COMPUTER TO AID MANUFACTURE OF COMPUTER MEMORIES

These tiny ceramic rings shown resting on a sewing needle are ferrite cores manufactured by International Business Machines Corporation. They contain electro-magnetic properties and, when wired together, form the most widely used computer memories. The largest



ring is 80 mils (thousandths of an inch) in outside diameter. The one at the needle's tip is 20 mils, and its weight is measured in millionths of a gram. Although cores are manufactured in great volume, each is individually tested.

To provide increased control over this manufacturing process, the company will install an IBM 1800 process control computer at its Poughkeepsie, N.Y., manufacturing plant next year. The computer will report on production quantities, process yields, product inventory, equipment utilization, and even equipment parts inventory.

Through display terminals connected to the computer, operators at each work station will receive current information about the particular batch of cores they are manufacturing. If the system detects discrepancies in the cores' electrical characteristics while they are in test, it will shut down the tester until the discrepancy is corrected.

The manufacturing process involves pressing the core from a metal oxide "batter" and then hardening it by heat treating in a kiln. The first cores were made on drug industry "pill-pressing" machines, modified for the stricter core tolerances. Now, IBM-designed rotary presses can press about 70 cores per second. Rates of several thousand cores per second are predicted.

SIMULATING LIFE IN THE SEA

In the quiet coastal town of Kingston, R.I., an entire colony of lobsters is living, breeding, dying and getting caught for the dinner table — all within the confines of an electronic computer. The birth-to-death cycle of Homarus americanus — the New England lobster — has been simulated with an IBM System/360 at the University of Rhode Island. This simulation tests the effects of man's and nature's laws on a typical lobster population, and helps turn up clues about the crustaceans' habits, instincts and behavior patterns.

The computer-based lobster study has been going on for two years under the direction of Saul B. Saila, director of the Marine Experiment Station at the university's Graduate School of Oceanography. In building a mathematical model of a lobster population, Dr. Saila and his assistant, mathematician John M. Flowers, fed the computer such information as a lobster's growth rate, age of maturity, average fertility, frequency of shedding the shell and chances of getting caught by a New England lobsterman.

One surprising conclusion arrived at as a result of the computer study is that laws protecting large lobsters (Maine has such a law on the books) actually reduce the total catch without effectively increasing the lobster population. It was found that large males cannot mate with smaller females, yet they drive the smaller males that can away. "However, our simulation showed us that only about 4% of the female lobsters would survive to be the proper size for these males", Prof. Saila said.

Other studies performed with the System/360 reveal that lobsters are not wanderers — they like to stay where they are and will try to return home if you move them. Egg-bearing females, however, can be moved to other areas to try and start lobster colonies — they will not leave an area to which they have been moved until they shed their eggs. This could be significant for areas with few or no lobsters.

CREATING DISEASE WITHIN A COMPUTER

Dr. Johannes Ipsen, professor of epidemiology and medical statistics at the University of Pennsylvania School of Medicine (Philadelphia) creates epidemics by simulating them within an IBM computer. His object: to study the finicky ways that communicable diseases can sweep through towns and cities.

"The known factors involved in an epidemic are represented in a mathematical model which allows us to arrive at the results of different actions and conditions without their ever happening," he explains. "Within the computer I can build up — almost case by case — an epidemic such as measles or chickenpox and find out just what makes an epidemic come and go."

Dr. Ipsen does this work on an IBM 7044 computer without having to leave his office. Installed next to his desk is a typewriter-like communications terminal linked to an IBM QUIKTRAN computer housed at a time-sharing center in downtown Philadelphia. When he wants to analyze the growth rate of a measles epidemic, for example, he calls up the computer on the telephone. He then feeds the computer information about a hypothetical epidemic. In a matter of seconds, the computer-linked terminal prints out the number of people who will probably develope the disease, how quickly the disease is spreading and how long the epidemic will last.

The computer not only serves as a breeding place for Dr. Ipsen's epidemics, but also is used to diagnose other afflictions — such as diabetes, heart attacks and strokes - and determines a patient's chances of surviving them. Also, by experimenting with the patient's symptoms, he is able to evaluate the effectiveness of a given treatment. Further, by studying the medical history of a person being treated as a potential diabetic, for example, Dr. Ipsen can determine the likelihood of the patient's developing diabetes, and approximately when the ailment will strike.

He is able to do this by storing in the computer's electronic files information about 15,000 persons — 500 of whom were at one time afflicted with diabetes and about 320 of whom were heart patients. "As more medical diagnoses of previous heart attack and stroke victims are stored in the computer, our ability to predict the probability of other patients suffering these attacks will increase," he said. Dr. Ipsen hopes that the diagnostic and prognostic experiments he is presently conducting will develop into a bedside service.

FLIGHT SIMULATOR FOR BOEING 747 USES SDS SIGMA 2 COMPUTER

When the first Boeing 747 jet supertransports begin commercial flights for British Overseas Airlines Corp. (BOAC) in 1970, its flight crews will have logged hundreds of hours flying the giant plane without ever having left the ground. Months before the first flight, BOAC pilots and flight engineers will begin training in a flight simulator built by CAE Industries, Ltd., Montreal, Canada, that uses an SDS Sigma 2 computer as its key element. (The Sigma 2 system is manufactured by Scientific Data Systems, Santa Monica, Cal.)

The CAE simulator is an exact replica of the flight deck of the 747, including all instruments, switches and controls. The sounds of engines running up, circuit breakers tripping, hydraulic fluid rushing, and the other details that simulate actual flight also are duplicated. Even the motion of the plane is indicated by a hydraulic mechanism that vibrates and tilts the cabin in accordance with the pilot's actions.

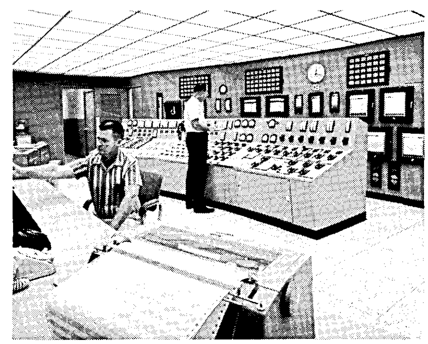
The SDS Sigma 2 computer will receive and interpret the inputs from the controls in the simulator, and, based on previously calculated flight performance characteristics of the aircraft, the computer will activate the simulator and its instruments accordingly.

One of the simulator's major advantages is that it teaches flight crews to respond to the characteristics of the 400 passenger craft without the expense and hazards of performing the training in actual flights. BOAC expects almost all of its pilots training to be performed on the ground. Regular pilot proficiency checks also will be carried out with the simulator.

230,000 KILOWATT GENERATOR WATCHED BY IBM COMPUTER

An IBM 1800 computer is keeping 24-hour watch over one of the electric generators of San Antonio's (Texas) City Public Service Board. This data acquisition and control system monitors the operations of a 230,000 kilowatt generator, part of the 1,053,000 kilowatt electric system which produces electricity for residents and businesses of this city of 719,190 and a service area of 1,555 square miles.

Critical points of the generator are equipped with sensors which are connected by wire to the 1800 system. When a variation in the operation of the generator occurs, the change is detected by one of the 325 sensors, which instantly transmits the data to the computer. The 1800 (situated in the generator's control room) then prints out



on a typewriter-like terminal the nature and location of the problem so that remedial action may be taken by operating personnel. Previously, inspection teams made continual rounds of the generator searching for evidence of potential trouble.

In the event something does go wrong and various units in the generator cease operating in response to the malfunction, the computer provides the control room with the exact sequence of the shutdown immediately so they can pinpoint the cause. The 1800 starts giving them this information less than a second after the problem begins.

The computer also logs the performance of the generator every hour. This data is processed by the 1800, analyzed and used to judge the general state of the equipment and to set its optimum operating range. While the 1800 monitors the generator, it simultaneously is doing a series of complex engineering studies.

Newsletter

ORGANIZATION NEWS

A-M CORPORATION, PHOTON AGREEMENT

Addressograph Multigraph Corporation of Cleveland, Ohio and Photon, Inc., of Wilmington, Mass., have agreed upon a manufacturing and marketing arrangement for an entirely new line of photo typesetting units designed especially for A-M by Photon. The first of a family of electronic phototypesetters, designated the A-M 725 Photo Typesetting Machine, has been designed to meet the requirements of offset-printed newspapers, publishing firms, commercial printers and in-plant industrial and institutional printing departments.

The agreement between Addressograph Multigraph and Photon combines the wide facilities of A-M and the advanced typesetting technology of Photon. The A-M 725 will be distributed through the Vari-Typer Division of A-M and will be sold and serviced through A-M's network of 143 sales offices in the U.S. and 21 subsidiary companies throughout the world. The manufacturing facilities of A-M will be utilized to augment production of the Photon machine as required. Photon will continue the manufacture and direct marketing of its own line of photo typesetting equipment.

DALLAS TABULATING UNITES WITH MSC

Management Systems Corporation has acquired the business of Dallas Tabulating Service, Inc., the oldest independent data processing organization in Dallas. MSC President Farris O'Dell and Vice President Bob Carlson, stated the additional management and operating staff of Dallas Tabulating would make MSC one of the largest data processing service centers of Dallas in addition to its system and programming capabilities.

Dallas Tabulating has served Dallas and the Southwest for over 20 years in processing accounting applications, paper tape accounting, inventory control, sales analysis, billing, payroll and systems analysis. Mr. James Carpenter, President of Dallas Tabulating, plans to be active in MSC as well as to continue to operate his school, Dallas Tabulating Institute. He says the consolidation with MSC, a systems-computer oriented organization, will add computer experience, application capabilities and knowledge for the combined clientele.

NEW PRODUCTS

Digital

CONTROL DATA 449 COMPUTER

Control Data Corporation's (Minneapolis, Minn.) exhibit at the 1967 Air Force Association Aerospace Development Briefings and Displays, included the new Control Data® 449 Computer. The 449, measuring a mere four by four by nine inches, Is the world's smallest operational data processing system.

The tiny 'teacup' computer, itself, occupies only a four-inch cube inside the outer case. Yet it contains all of the elements and computing power of a standard-size, general purpose computer system — including a 4096-word (24-bit) memory. The computer, weighing less than four pounds, consumes just four watts of power.

Remaining space inside the 449's case houses a push-button keyboard for manually entering data, a digital display, an accurate electronic clock, and a special battery pack. The battery pack is capable of powering the computer on a continuous service basis for over 24 hours, thus making the system entirely self-contained. The 449 was specifically designed for aerospace applications.
(For more information, designate #43 on the Readers Service Card.)

B340 FOR BANKING INDUSTRY

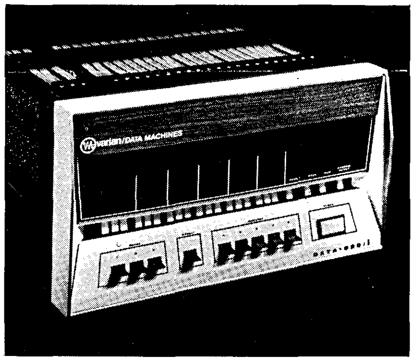
Burroughs Corporation, Detroit, Mich., has announced the B340 electronic data processing system which President Ray W. Macdonald described as "the keystone of a new package of computer power that puts in-house automation within reach of a whole new section of the banking industry". He said the B340 "package" — which includes the computer hardware, complete system software, a full range of bank application programs, operator training, and system expansion without reprogramming — provides all the ingredients necessary for a successful bank automation program.

Components of the B340 system include a central processor with 4800 characters of high speed core memory, a Magnetic Ink Character Recognition sorter-reader with speeds up to 1000 items-per-minute, a 200 card-per-minute punched card reader, a buffered printer with a speed up to 400 lines-per-minute, and a Burroughs magnetic tape "cluster which contains three tape stations in one compact unit". The tapes have a transfer rate of 25 thousand characters-per-second, and a capacity of 556 bits-per-inch.

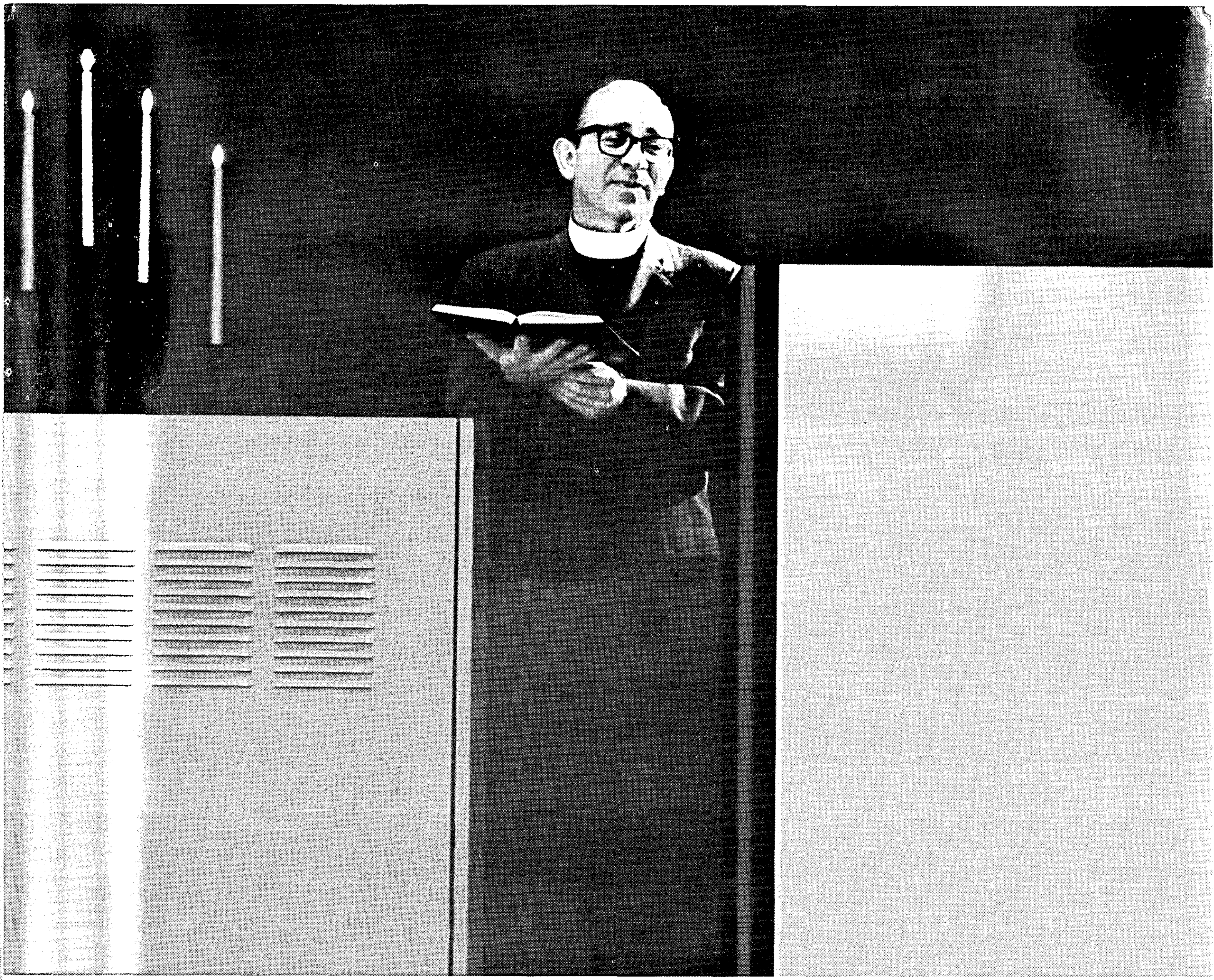
The package is designed for banks with less than $100 million in assets, particularly those in the $10 to $50 million range, and offers a total system entry into in-house data processing. Because the B340 is part of the Burroughs B300 family of systems, customers will find that the initial system is easily expandable as the bank's requirements grow larger — and without the high costs of reprogramming.
(For more information, designate #41 on the Readers Service Card.)

DATA 620i COMPUTER

This new computer, a product of Varian Data Machines, formerly Decision Control, Inc., Newport Beach, Calif., was developed for operation on line to perform automatically a wide range of information and control functions. The 620i is suitable for air and sea duty and offers software field-proven on the former 620 models. Typical applications are in analog data acquisition and digital control systems.



The console contains displays and data entry switches for all operational registers. In addition, there are three sense switches, in-



I, Digital, take thee, Analog...

We'll give it five years.

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We've performed more digital-analog marriages than anybody. So many that we're able to guarantee them.

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We've hybridized all the leading brands of analogs, we've solved the interface problems, we've developed reams of hybrid software, and we make the fastest, most versatile and economical digital computers for hybrid applications.

We support analog computer manufacturers in the design and installation of hybrid systems, and we install SDS digital computers in simulation laboratories which already have analog computers, providing interface equipment, software, and system integration.

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They're also licensed to perform marriages, so if you have a lonesome analog...

SDS

**Scientific Data Systems,
Santa Monica, California**

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struction repeat, single step, run, and power on-off. Other features include interfacing ease, I/O balance with processing power, over 100 commands, and hardware registers for arithmetic and addressing speed. Full cycle time is only 1.8 microseconds. The processor can be supplied with memory modules ranging from 1024 to 37,768 words of 16 or 18 bits.

An important optional feature is MICRO-EXEC, which permits software programs to be hard-wired. MICRO-EXEC eliminates the need for additional stored program memory, allowing in some applications a 500 percent increase in speed over conventional stored program techniques.
(For more information, designate #42 on the Readers Service Card.)

LEEDS & NORTHRUP ANNOUNCES ITS THIRD GENERATION SYSTEM, THE LN5000 DDC

The LN5000 DDC, a new high-speed, third generation computer system for real-time control, has been announced by Leeds & Northrup Company, Philadelphia, Pa. This computer includes input/output assembly, computer mainframe, and peripheral equipment, as well as comprehensive software.

The LN5000 DDC System is designed for easy expansion on the job. The core memory is expandable from 4096 to 65,536 words. Core memory cycle time is less than one microsecond.

The combination of hardware and software gives the LN5000 Computer System multi-programming capability. Real-time process-control programs can operate in the foreground while the computer is concurrently performing general purpose programs. The time required to switch from background to foreground is just a few microseconds.

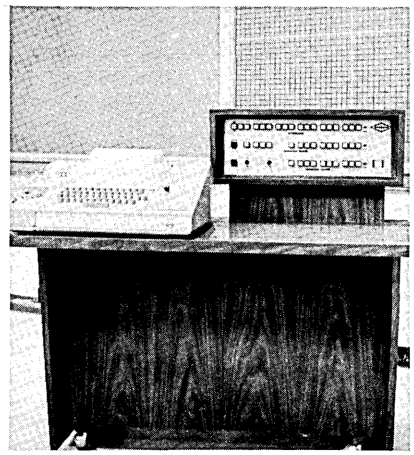
For direct digital control, the human engineered Manual Input Console enables the operator to monitor and control a complete plant. Pertinent process and control system information is displayed on demand, and changes are made through simple keyboard entries.

Three methods of back-up for the LN5000 DDC System are manual back-up on all loops and analog controls to back-up the digital computer, or a fully redundant computer.
(For more information, designate #45 on the Readers Service Card.)

MATH-MASTER ECP-18A CLASSROOM COMPUTER

Educational Computer Products Division of Gamco Industries, Inc., Big Spring, Texas, has designed the Math-Master ECP-18A Computer specifically for classroom use. Business and science classes can use the ECP-18A as well as mathematics classes.

The Math-Master is easy-to-program, easy-to-operate yet sophisticated enough to challenge. It is representative of digital computers used in industry. The elevated, brightly lit display panel is easy to see from the back of the classroom.



The ECP-18A has a repertoire of only sixteen basic instructions making the computer easy to program. A full set of logical operations designed to complement modern mathematics courses are included in the instruction repertoire. If desired, each step in the execution of a program can be displayed on the display panel for ease of explanation. All words in the 1024 word 18 bit memory are directly addressable.

Information may be read into the computer from punched paper tape or typed from the Teletype keyboard. The display panel may also be used for direct entry of data. Output from the computer in octal, decimal or full alphanumeric may be printed on the Teletype page printer and punched on paper tape in addition to the visual display.

A twenty hour teacher training program is provided with the computer. Course outlines, teacher-student manuals, programming and operating manuals, demonstration programs and a symbolic assembly language called "Easy-Code Programming" are a part of a complete software package supplied.
(For more information, designate #47 on the Readers Service Card.)

SYSTEMS ENGINEERING LABS ANNOUNCES SUB-MICROSECOND 16-BIT COMPUTER

Systems Engineering Laboratories, Inc., Fort Lauderdale, Fla., has announced the SEL 810B, a sub-microsecond general purpose 16-bit digital computer. This latest addition to the SEL 800 Series operates at more than twice the speed of the others. Full cycle time of the new computer is 790 nanoseconds.

The SEL 810B is compatible with all software and peripheral devices used with the SEL 810A. It also is compatible with the SEL 80-816A Computer Graphics System.

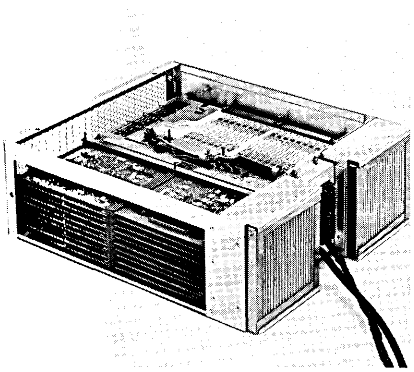
The basic SEL 810B Computer system includes a high-speed arithmetic unit, 4K memory, 2 levels of priority interrupt, I/O typewriter, memory parity, real-time I/O structure, field proven software and a second hardware index register as an optional feature.

The SEL 810B was designed as a companion machine to the SEL 810A for high speed general purpose performance in application areas including manufacturing test control, scientific research, nuclear and industrial process control and automation, simulation, real-time computation and off-line data processing. Systems Engineering Laboratories, Inc. will display the new computer for the first time at the Fall Joint Computer Conference this month.
(For more information, designate #44 on the Readers Service Card.)

Memories

HONEYWELL INTRODUCES FAST COMPACT I/C MEMORY SYSTEM

Honeywell's Computer Control Division, Framingham, Mass., has introduced a family of 500 to 600 nanosecond core memories which it said are the first to have all electronic functions performed with integrated circuits. The new ICM-500 memory system, designed for use as main or auxiliary memory within standard or custom digital systems, has 600-nanosecond full cycle time and access time under 300 nanoseconds in standard production units. Special units are available with full cycle times of 500 nanoseconds. The ICM-500 offers capacities from 4096 to 32,768 words. In an 8192 36-bit word configuration, the ICM-500 occupies a volume of only six-tenths of a cubic foot.



The ICM-500 is the first core memory to use integrated circuits in all electronic functions including sensing and direct drive of selection lines, Benjamin Kessel, division vice president and general manager, said. He said the system is also unique mechanically since it has no wired backboard.

A new integrated circuit in the ICM-500 replaces a number of discrete transformers and transistors. It performs both current switching and logic functions for the system. In a typical 8192-word capacity memory of 24-bit words, 112 flat packs perform the functions formerly requiring over 2000 discrete components.

Two types of memories make up the ICM-500 line. The system may be obtained in a flexible mechanical package designed for use by original equipment manufacturers or in applications having a confining mechanical environment. It also is available as a self-contained rack-mountable memory system with power supply. A 2½D stack organization is used in both versions.
(For more information, designate #49 on the Readers Service Card.)

Software

<u>CFP (CONSOLIDATED FINANCIAL PLANNING) SYSTEM</u> / Bonner & Moore Associates, Inc., Houston, Tex. / This integrated series of computer programs is designed for use in consolidation and production of corporate long range plans or budgets. The CFP System operates in five distinct phases which will be familiar to accountants and financial analysts. These are: (1) define chart of accounts and ledgers; (2) set up posting rules; (3) code data to chart of accounts; (4) post data to ledger accounts; and (5) close the books. The package consists of three basic elements: operating programs, full documentation for system use, and training and consultation. The system is available to meet the requirements of clients in three different classes: corporations with established departments for planning or budgeting; corporations desiring to set up planning or budgeting departments; and companies who wish to use consulting services for preparation of plans or budgets.
(For more information, designate #50 on the Readers Service Card.)

<u>CREDIT CARD ACCOUNTING SYSTEM</u> / Software Resources Corporation, Los Angeles, Calif. / The system, presently operational, is intended for use by banks and other credit card operations. Customer statements may be printed or printed-and-punched on 51-column automatic re-entry cards; statement format can be either country club or detailed. An optional on-line inquiry file can be used for immediate account status inquiry. The system will run on any IBM System/360 with a 32K byte memory and either three disk drives or four tapes.
(For more information, designate #51 on the Readers Service Card.)

<u>MPS/360 REPORT WRITER</u> / The SBC Scientific Computer Center, New York, N.Y. / Mathematical programming System/360 report writer now is available to process the output of MPS. It facilitates transformation of MPS output into management reports with a minimum of effort. MPS/360 Report Writer may be used at any SBC Scientific Computing Center with no additional surcharge, in conjunction with SBC's full range of services.
(For more information, designate #52 on the Readers Service Card.)

<u>OPTIMA</u> / Control Data Corporation, Minneapolis, Minn. / This new mathematical programming system (for use with Control Data 6400, 6500 and 6600 computer systems) is designed to find solutions which will maximize or minimize some numerical quantity — such as profit or cost. Among other things, this flexible program enables users to mix, compare, and combine a large number of solutions. Over 100 major mathematical programming operations may be specified within OPTIMA. This proprietary program will be completed in three versions: the basic OPTIMA 1.0 will be made available during this last quarter of 1967; OPTIMA 2.0, a complete and comprehensive system, will be ready during the first quarter of 1968; and an advanced system, OPTIMA 3.0, will be delivered during the second quarter of 1968.
(For more information, designate #53 on the Readers Service Card.)

<u>PDQ INFORMATION RETRIEVAL SYSTEM</u> / Applied Data Research, Inc., Princeton, N.J. / PDQ (Program for Descriptor Query) has been designed for use with IBM System/360 computers, models 30 and larger and specifically for use by persons with no computer background. It can be applied where information retrieval is needed in industry, research facilities, colleges and universities and govermental agencies. It can operate in an on-line inquiry mode or in a batch mode; it requires a minimum of one disk back and 32K of memory. The new proprietary software product is available on a lease basis.
(For more information, designate #54 on the Readers Service Card.)

<u>QWICK QWERY</u> / C.A.C.I. (Consolidated Analysis Centers, Inc.), Santa Monica, Calif. / Without the help of a programmer, the process makes it possible for an executive to obtain tailor-made reports in a matter of minutes. Qwick Qwery extracts only the specific information requested; it sorts, analyzes, and prints this data each time in the manner desired. The system is effective for almost any type of information in computer-usable form and operates on almost any large digital computer (it is being adapted for smaller computers as well). C.A.C.I. is offering the system to companies or agencies on a lease, purchase, or service bureau basis.
(For more information, designate #55 on the Readers Service Card.)

Newsletter

Data Transmitters and A/D Converters

DIGITAL DATA RECORDING SYSTEM AVAILABLE FROM BECKMAN

A digital data recording system that automatically converts signals from laboratory instruments into computer language is available from Beckman Instruments, Inc., Fullerton, Calif.

The versatile system readily translates output from a variety of atomic absorption, ultraviolet and infrared spectrophotometers into digital form. Output can be visually displayed or recorded punched paper tape, magnetic tape or standard IBM cards. Identification data may be introduced and recorded by the setting of 10 thumbwheel, parameter switches.

The system can be economically expanded as users' needs increase. Eight operating models are available. Up to three encoders may be used simultaneously, permitting wide latitude in the handling and calculating of analytical data.

Capabilities range from the simplest digital recording of ordinate values on manual command, to automatic and simultaneous recording of ordinate and abscissa data while detecting and recording spectral peaks and valleys.
(For more information, designate #56 on the Readers Service Card.)

NEW IBM TERMINAL ANSWERS THE RETAILER'S TELEPHONE

During the NRMA Retail Research Institute's 9th Annual EDP Conference in September, retail executives previewed a new IBM computer terminal, the IBM 1907 batch recording system. The 1907 records business transactions during the day and relays them to a computer at night by phone.

One of the system's main features is a reusable magnetic tape cartridge which stores sales, merchandise and other retail information. The 1000-inch magnetic tape cassette stores up to 7500 characters of business information which is entered through the 1907's keyboard or punched-card reader.

Information remains on the magnetic tape until a remote central

— Karen O'Donnell, IBM, holds 1000 inches of magnetic recording tape snaked in a specially-designed plastic cassette

computer, an IBM System/360, automatically "telephones" after the close of business and requests it. The terminal, unattended, transmits its information via telephone line, readies its cassette to record the next day's business, and shuts itself off.

The central computer can "telephone" hundreds of 1907 terminals at widely-scattered store locations. It automatically processes combined terminal information, to generate daily sales, merchandise, inventory, accounting and management information reports on a store-wide basis.

The IBM 1907, specifically designed for use in distribution industries, is available only on special order.
(For more information, designate #57 on the Readers Service Card.)

Input-Output

CDC 274 DIGIGRAPHICS SYSTEM FOR USE WITH SMALL-SCALE CONTROL DATA 1700

Control Data Corporation, Minneapolis, Minn., is marketing a Digigraphics System designed for use with a small-scale Control Data® 1700 Computer System. Digigraphics refers to a CDC system in which an operator seated at a special console equipped with a large TV-like display screen is able to enter data in graphic form — using a light pen and keyboard — directly into a computer system for processing, storage and retrieval.

The controller used in the 274 Digigraphics System has a 4096 word buffer memory — expandable to 8192 words — for operating a single Digigraphics console. A vector-oriented, 22-inch diameter, flat-face visual display screen on the console is capable of displaying the equivalent of 2000 inches of curves, or up to 1800 characters of variable size or font.

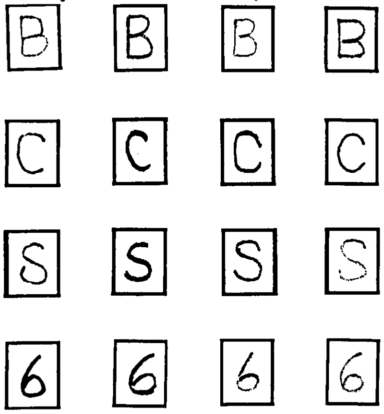
The software package (Function Control Package) provided with the system offers a large number of universal design features. This means that the user, rather than structuring a software system from scratch, need only interface his application program(s) with existing routines to achieve full operational capability. Integration of user oriented programs with the FCP software is accomplished via FORTRAN IV CALLS.

Upgrading any general purpose Control Data 1700 Computer System to Digigraphics capability requires only the addition of the 274 Digigraphics Controller, the 274 Digigraphics Console, and 24,000 words of core and disk pack memory.
(For more information, designate #63 on the Readers Service Card.)

OPTICAL HANDPRINTING READER FROM RECOGNITION EQUIPMENT

Recognition Equipment, Dallas, Texas, has announced a Handprinting Reader Module for its Electronic Retina™ Computing Reader that reads ordinary handprinted letters and numbers with the speed and reliability previously possible only when reading machine-printed information. Herman L. Philipson, Jr., Recognition Equipment president, said that the Handprinting Reader reads handprinted information from ordinary paper documents at speeds up to 1200 documents per minute and imposes very few constraints on the people printing the information.

The Handprinting Reader simply requires that characters be printed within a preprinted box, without voids or extra loops or frills. The printing can be done with an ordinary soft-lead pencil or with a ball-point pen using a black, pigment-based ink if it does not leave voids in the characters. The device can have a vocabulary of up to 40 characters, usually consisting of capital letters, numbers, and 4 special symbols selected by the user, such as $, +, -, and =.



— Pictured are samples of handprinted letters and numbers that can be read by a Handprinting Reader Module

The Handprinting Reader Module is based on a Multilevel Logic technique, for which several patents are being applied. The Multilevel Logic technology begins with the detection of black and white information and the determination of such things as the points where lines intersect and terminate. Information from adjacent photocells in a two-dimensional matrix is combined, and a value is assigned to each photocell in the mosaic. These values indicate the magnitude and characteristic (i. e., concave or convex) of character strokes. This information is compared to a set of stored feature patterns, one for each character in the Handprinting Reader's vocabulary, in order to determine which pattern the handprinted character most nearly resembles.

The Handprinting Reader Module will be available on Recognition Equipment's Electronic Retina Computing Readers equipped with a Document Carrier.
(For more information, designate #58 on the Readers Service Card.)

ELECTRONIC TEACHING SYSTEM SPEEDS TRAINING

An electronic system developed by Sylvania Electric Products Inc., Waltham, Mass., is teaching Morse Code reception to U. S. Army students. (Sylvania is a subsidiary of General Telephone & Electronics Corporation.) The system provides individual audio-visual instruction at each of 24 computer-controlled consoles simultaneously. In addition to the student consoles, the system consists of a control computer and an instructor's monitoring panel.

The computer controls the 24 consoles and triggers both the audio and visual signals. The computer program analyzes the speed and accuracy of each student individually, automatically regulating his progress according to his capabilities. Computer data printouts at the end of every training period summarize student performance for detailed diagnosis of individual learning problems.

Each student console includes earphones, a typewriter keyboard with color-coded keys, and an electronic display of a typewriter keyboard. The student is taught to depress the typewriter key corresponding to the signal heard in code and illuminated on the display board. Speeds are adjusted automatically to the capabilities of the individual. The computer is programmed so that a new set of signals is not presented until the student has responded to the current one. Display lights are gradually delayed so the trainee is responding to the audio signals alone. The lights then inform him only of errors.

The system was designed and produced by the Applied Research Laboratory of Sylvania Electronic Systems, a division of the company. Laboratory director, Dr. James E. Storer, said that with modifications, the Sylvania system can be adapted to teach typing or keypunching.
(For more information, designate #62 on the Readers Service Card.)

DATA CORPORATION ENTERS COMPUTER DATA TERMINAL MARKET

Service industries, government agencies and even the professional businessman with a small office staff now can subscribe more easily and cheaply to computer time sharing as the result of a new entry into the remote data terminal market by Datel Corporation, Palo Alto, Calif., and Riverton, Wyo. Their new development is a Series 30 "Conversational Data Terminal" that doubles as an electric typewriter when not in use providing input/output computer data. This portable device brings the services of time-shared computer facilities right to the desk of anyone within economical telephone calling distance, the company spokesman said.

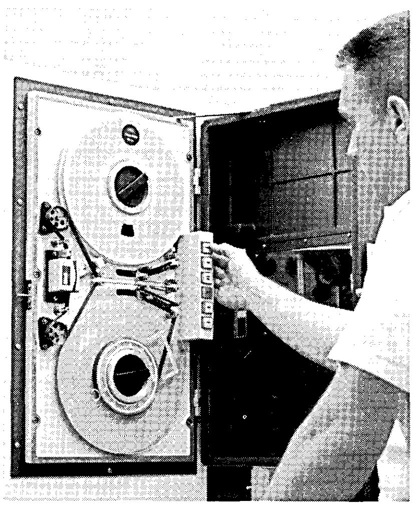
In addition to doubling as a typewriter by simply turning off the telephone coupler, when used as a typewriter exclusively, the user has the option of selecting one of several interchangeable type faces. The only difference to a typist from a standard, 15-inch, electric typewriter are the four additional keys added for specialized computer command functions.

The solid-state devices are designed with circuit chips and the entire integrated circuitry is contained in one package. These portable terminals, weighing approxi-

mately 50 pounds, can "talk" to a computer regardless of make or size, at a rate of 15 characters per second. No special equipment or detailed instruction is required to use the machines. Transmission and reception signals for the basic terminal are coded in a six-bit binary code with one start bit, one check bit, and one stop bit. Seven bit codes, including ASC II are available in other models in the company's Series 30. A special feature provides parity checks to confirm the accuracy of all data transmitted and received.
(For more information, designate #60 on the Readers Service Card.)

AMPEX MODEL GTM-14, COMPACT DIGITAL TAPE TRANSPORT

Ampex Corporation, Redwood City, Calif., has begun delivery of a new, compact digital tape transport which generates computer compatible data and has tape speeds up to 105 inches per second. Eugene E. Prince, general manager, computer products division, said the GTM-14 is designed for land-mobile and shipboard use in such applications as geophysical data gathering, oceanography and reconnaissance.



The GTM-14 produces blocks of recorded data suitable for immediate feed-in to IBM and almost all other computer systems. It is available in seven-track (IBM 729 compatible) and nine-track (ASCII-9 format compatible) versions as either basic transport or full memory system. The new model may be used as an independent recorder or as part of larger data gathering systems.

The GTM-14 comes in three optional dual-speed versions: 26¼-and-52½ ips; 40-and-80 ips; and 52½-and-105 ips. The transport can pack up to 800 characters on one linear inch of magnetic tape in either of two modes: start/stop, or continuous read and/or write (gapless).

The tape transport, which weighs approximately 90 pounds, measures 14 inches long by 25 inches wide by 12 inches high. A window in the cover door permits viewing of the reels. The separate power supply, weighing about 40 pounds is of comparable size.
(For more information, designate #59 on the Readers Service Card.)

IBM ANNOUNCES NEW READER/SORTER FOR BANKS

A new reader/sorter for MICR banking applications has been announced by IBM Corporation, White Plains, N.Y. The device — called the IBM 1259 magnetic character reader — operates on-line with IBM System/360 Models 20, 30 and 40.

The new 1259 reads and sorts checks into 11 pockets at a rate of up to 600 a minute. It also can handle deposit slips and other bank documents that conform to ABA magnetic ink standards.

The 1259 will be manufactured to IBM specifications by Lundy Electronics & Systems, Inc., Glen Head, N.Y. Deliveries to Model 20 customers are scheduled to begin in the third quarter of 1968. Deliveries to Model 30 and 40 customers are scheduled to begin in the first quarter of 1969.
(For more information, designate #64 on the Readers Service Card.)

GRAPH PLOTTERS FOR SIGMA COMPUTERS

Two new graph plotters designed to operate with SDS Sigma computers have been announced by Scientific Data Systems, Santa Monica, Calif. These devices are used in applications where pictorial output in hard-copy form is required rather than alphanumeric output.

The two graph plotters offer users a choice of drum widths. The Model 7530 has a 12-inch wide drum with a maximum plot size of 11 inches by 120 feet and an incremental speed of 300 steps per second. The Model 7531 has a 30-inch wide drum with a maximum plot size of 29.5 inches by 120 feet and an incremental speed of 200 to 300 steps per second.

These plotters operate on the digital incremental principle. Commands from the computer produce incremental steps in either direction along each axis, and combined motions permit plotting an incremental line at any 45-degree angle. Because their operation is completely digital, the graph plotters are drift-free.
(For more information, designate #61 on the Readers Service Card.)

Components

SUBMINIATURE ILLUMINATED PUSHBUTTON SWITCHES

Dialight Corp., Brooklyn, N.Y., has announced a switch series designed to greatly reduce installation time and costs where large numbers of such components are required in original equipment. The Subminiature Illuminated Push Button Switches are for direct connection to printed circuit boards.

The printed circuit terminals, which are now available on the 513 Series Switch, are designed for either single or double-sided copper clad printed circuit boards up to .090 thick. The momentary action switch ratings are: 3 amps, 125V AC; 3 amps, 30V DC (resistive load); operating force: Normally Open - 20 ozs. (approx.), Normally Closed - 10 ozs. (approx.); button travel - 3/32".

The Subminiature Illuminated Push Button Switches accommodate a T-1 3/4 incandescent bulb with midget flanged base in a range of voltages from 1.35 to 28V; lamps are housed in 1/2" or 3/4" round or square friction-fit push button caps, keyed or rotatable, with or without engraved legends.
(For more information, designate #65 on the Readers Service Card.)

NEW ALLOY DEVELOPED FOR COMPUTER MEMORIES

A new alloy for permanent magnets which can undergo large amounts of stress without significantly changing its magnetic properties and whose coercive force can be conveniently adjusted over a wide range, has been developed at Bell

Telephone Laboratories, Murray Hill, N.J. The material, for use in computer memories, is ductile and hence can be made into complex shapes, fine wire, or tape.

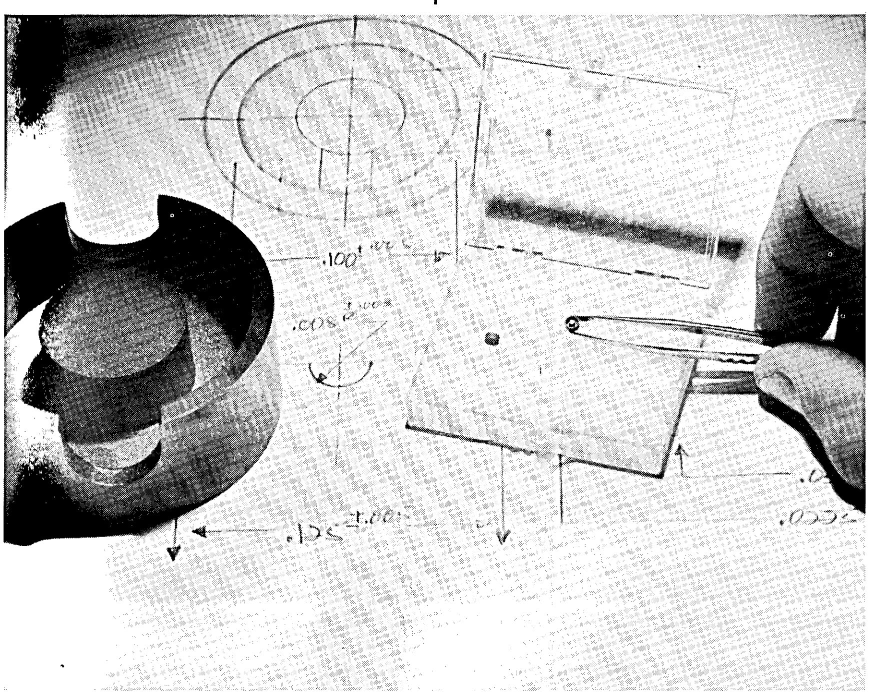
The new alloy consists of Cobalt (82%), Iron (12%) and Gold (6%). This alloy can be used to make a permanent magnet that has a low magnetostrictive value; that is, under high tensile loads its magnetic properties change only slightly.

A magnet made of the new alloy has a magnetic flux density of 18000 gauss, and a square hysteresis loop. The gold enables the magnet's coercive force (a measure of the ease of reversing the direction of magnetization) to be controlled by heat-treatment during production to any desired value within the range of 10 to 20 oersteds.

For Bell System applications in Electronic Switching Systems (ESS) the alloy is rolled to a thickness of half of one-thousandth of an inch for use in a permanent magnet memory device. Details were reported by E. A. Nesbitt, G. Y. Chin, and D. Jaffe at the International Congress on Magnetism.
(For more information, designate #67 on the Readers Service Card.)

WORLD'S SMALLEST CUP CORE

The world's smallest ferrite cup core (shown in tweezers) has been developed for the U.S. Army's Electronics Command, Fort Monmouth, N.J. by Indiana General Corp., Electronics Div., Keasbey, N.J. Its O.D. is 0.125 inches, ground to a 0.035-inch thickness. Tolerances are held to 0.005 inches by a special fabricating process at IGC. It is shown here compared to a 2.500 inch O.C. cup core. Smallest core previously made by IGC was 0.230-inches O.D.



Main application will be in portable and vehicular communications equipment where size reduction is a prime concern. Its small size allows the cup core — for the first time — to be used in integrated circuits of frequency synthesizers and IF sections as radio frequency chokes and transformers.

The core has two advantages over a small ferrite toroid used in the same application: (1) it is a shielded assembly which emits and picks up a bare minimum of stray RF fields; (2) it is far easier to wind than a toroid.

Core material is IGC's Ferramic® Q2 ferrite which was chosen because of its good frequency response in the 10-65 mHz range and its relatively flat temperature coefficient range from -55°C to +125°C. In addition, Q2 has one of the highest Curie temperatures of all IGC ferrite materials.
(For more information, designate #66 on the Readers Service Card.)

Data Processing Accessories

VARIABLE AMOUNT IMPRINTER

A variable amount imprinter, now available from Farrington Manufacturing Co., New York, N.Y., prints the dollar amount of a sale, product code, date or transaction and vendor identification at the point of sale as well as customer identification contained on an embossed card. The important addition of variable amount capability to standard imprinters makes all of the data from a credit card sales transaction completely compatible with optical reading equipment.

An entire sales transaction from the sale to the billing of the customer can be handled automatically. With the dollar amount printed in the sales document at the time of purchase, sales documents can be fed into an optical character reader. This equipment reads the information and automatically converts it into computer tape for completely automatic processing and billing.

The Model 889 imprinter, designed for use with 51- or 80-column size documents, can be used interchangeably with "A" or "F" size cards. The compact money deck of the Model 889 can be fitted with up to seven variable digits which are controlled by easily operated levers on the selector panel. Before imprinting, the money amount is clearly shown through money amount windows.

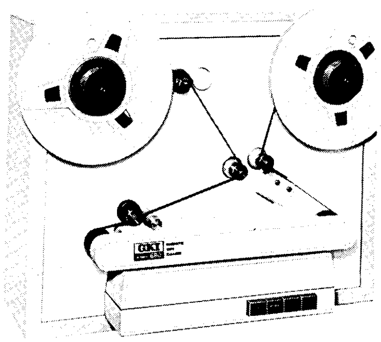
The Model 889 is equipped with a 5-line embossed metal plate to print adjacent to the embossed card. Form guides for both 51- and 80-column size document sets are included. The device is available with or without a six wheel rotary date box.
(For more information, designate #69 on the Readers Service Card.)

MODEL 680 HIGH SPEED MAGNETIC TAPE CLEANER

A new high speed magnetic tape cleaner has been announced by General Kinetics Inc., Arlington, Va. The GKI Model 680 High Speed Magnetic Tape Cleaner is capable of cleaning 1/2", 3/4", and 1" wide magnetic tapes on all standard computer and instrumentation reels up to 14" in diameter. The fully automatic forward and reverse pass cleaning cycle completely cleans a

2400' reel of IBM 1/2" computer tape in 4.8 minutes.

The Model 680 utilizes GKI's proprietary self-sharpening cleaning blade system in which the cleaning blade does not require changing and is guaranteed for the life of the machine. In addition to the cleaning blade action, both the front and back of the tape are continuously wiped by means of special, lint-free rolls of wiping tissue which are automatically advanced to present a continuously renewed cleaning surface while the tape is in motion.



— Model 680 High Speed Magnetic Tape Cleaner

The tape drive uses a printed circuit motor, twin capstan drive system which allows establishing the optimum tension for cleaning and the proper tension for winding, with each tension independently controlled. A high precision winding action resets the guide positions automatically to minimize any possibility of tape damage during unwinding of a roughly wound roll coming from the computer and in rewinding the roll as the cleaning cycle is completed. The Model 680 Cleaner is equipped with fail-safe reel brakes designed to prevent accidental spilling of tape in the event of a power line failure.
(For more information, designate #68 on the Readers Service Card.)

DATA PROCESSING KIT

Tab Products Co. San Francisco, Calif., is making available, at no cost, a complete kit to aid in the planning or reorganization of data processing departments. Kit materials include: (1) a ruled grid scaled ¼" to the foot upon which the user's floor plan is drawn; (2) pressure sensitive templates, appropriately scaled, representing all of Tab's EDP storage and filing equipment; and (3) scaled templates for all of the major data processing machines, identified with the manufacturers' nomenclatures.

A feature of the machine templates is the designation of main line cable locations and areas which must remain free for access or operation. With these points noted it is possible to plot personnel movement and work flow as well as cable routing. The templates are easily removed for repeated relocation.

The kit comes complete with instructions for use and suggestions for departmental planning, noting such considerations as lighting, ventilation, and grouping for simultaneous machine operation.
(For more information, designate #70 on the Readers Service Card.)

MEETING NEWS

IFIP EXHIBITION '68 IS FULLY BOOKED

Over a year before the international IFIP Exhibition 68 is due to open, the whole of Edinburgh's Waverley Market Exhibition Hall has been fully booked by the exhibitors. On display in the 30,000 square feet of space in this hall will be the latest products and applications of the world's computer and ancillary equipment industries.

The exhibition will run concurrently with IFIP Congress 68 from August 5th to 10th. Over 4000 delegates from more than 40 countries are expected to attend the Congress and visit the exhibition.

Sixty-five companies from six countries are taking advantage of this opportunity to reach an international audience. Among the British entrants are Elliott Automation, English-Electric, Ferranti, I.C.T. and Plessey. American firms represented include Bryant Computer Products, California Computer Products Inc., Control Data Corporation, Hewlett-Packard, Memorex Corporation and the Potter Instrument Company.

Represented by their U.K. companies are Burroughs, Fabri-Tek U.K., General Electric Company of U.S.A., IBM, Honeywell Controls, NCR, and the Minnesota Mining and Manufacturing Company. Many prominent computer users in the U.K. will also be exhibiting, including the General Post Office, the Ministry of Technology, the National Computing Centre and the Electricity Council.

Bull-General Electric and Comp. Internationale Pour L'Informatique will come from France, and from further afield Elbit Computers Limited (Israel), Olivetti-General Electric (Italy), and Nippon Electric (Japan).

STANDARDS NEWS

AIR FORCE ADOPTS JOVIAL

Adoption of JOVIAL (J3) as the Standard Programming Language for Air Force command and control applications has been announced by the Air Force's Directorate of Command Control and Communications. JOVIAL, a machine-independent, general purpose programming language, will be used as a standard only for new Air Force command and control systems. Adoption of the language does not mean existing systems must be reprogrammed to meet the JOVIAL standard, an Air Force spokesman pointed out.

JOVIAL, developed by System Development Corporation (SDC), in 1958 for use by the Air Force in the SAGE (Semi-Automatic Ground Environment) air defense system and other large-scale command/control systems, is an acronym standing for Jules Own Version of the International Algebraic Language. The language also is used by other branches of the armed services, and has had numerous civilian applications as well.

In adopting JOVIAL (J3), the Air Force also established standard specifications for the development of compilers, and established a means of updating the language and specifications to incorporate future developments in programming languages that may be used in command and control applications.

Details of the programming language standard were recently published in Air Force Manual 100-24. The manual includes specifications for requirements for design, test, performance and qualification of JOVIAL (J3) compilers.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
IBM Corporation, Information Records Div., Princeton, N.J.	Los Angeles County, Los Angeles, Calif.	Purchase of 33,000 Votomatic punch card vote recorders and 7000 demonstrator units; delivery will be in time for the 1968 California presidential primary	$5.6 million
Radiation Inc., Melbourne, Fla.	NASA's Goddard Space Flight Center, Greenbelt, Md.	An advanced data collection system that will use the Nimbus-D research satellite; the contract funds the second phase of a world-wide weather data gathering network called IRLS (Interrogation, Recording and Location System)	$2,981,000
Potter Instrument Co., Inc., Plainview, N.Y.	UNIVAC, Division of Sperry Rand Corp.	Production of Potter MT-120 magnetic tape transports; the MT-120's will be used with UNIVAC high-performance computers requiring high-transfer rates	$1,741,837
Data Products Corp., Culver City, Calif.	Scientific Data Systems, Santa Monica, Calif.	A follow-on order for additional Model 5045 DISCfILE random access memory systems	over $1 million
ITT Data Services a division of International Telephone and Telegraph Corp., Paramus, N.J.	H & M Publications, Los Angeles, Calif.	Development and implementation of an automatic bowling league score sheet service for use by H & M Publications in U.S. bowling centers	$1 million
Badger Meter Mfg. Co., Milwaukee, Wis.	Minneapolis-Saint Paul Sanitary District, Saint Paul, Minn.	A computer based interceptor sewer control system; system will be used to control the loss of waste from combined sewer overflows during rainstorms	$387,105
System Development Corp., Santa Monica, Calif.	Advanced Research Projects Agency (ARPA), Department of Defense	A study of human behavior in bargaining and negotiation situations; researchers will explore multi-person international relations games using an on-line computer and simulation techniques	$246,000
Bryant Computer Products, Walled Lake, Mich.	AEG-Telefunken, Frankfurt, Germany	Purchase of four positioning head drums (PhD) which will be used as a mass storage media with their GEAMATIC-1009 process control computer system	over $168,000
System Development Corp., Santa Monica, Calif.	U.S. Department of Labor, Office of Manpower, Evaluation and Research (OMPER)	A research program aimed at bringing the capabilities of systems analysis and information science to bear on national manpower problems	$123,620
Planning Research Corp., Los Angeles, Calif.	U.S. Bureau of Public Roads	Additional work toward creating a reliable, thoroughly tested traffic systems simulation package that city traffic engineers can use in solving recurring street traffic problems	$98,000
System Development Corp., Santa Monica, Calif.	National Council on Marine Resources and Engineering Development, Office of Naval Research	First study phase of a national data system for the field of marine science	$75,000
Planning Research Corp., Los Angeles, Calif.	The Boeing Company	Technical assistance in the design and development of an Advanced Saturn Computer Validation System	$72,600
Systems Engineering Laboratories, Fort Lauderdale, Fla.	Ampex Corp., Redwood City, Calif.	SEL 810A computers to be used in the control of the Ampex developed Videofile document filing and retrieval system	$50,000
System Development Corp., Santa Monica, Calif.	U.S. Army Data Support Command	Development of a concept for a system to produce the New Equipment Personnel Requirements Summary (NEPRS), which is currently prepared by the Office of Personnel Operations, using manual procedures	$48,500
Bryant Computer Products, Walled Lake, Mich.	Xerox Corp., Rochester, N.Y.	Purchase of one Auto-Lift memory storage drum including 9000 series electronics for use in a special development program	$40,000
Control Data Corp., Minneapolis, Minn.	United States Air Force Space and Missile Systems Organization (SAMSO)	Eight large-scale Control Data 3800 systems to replace CDC 3600 computer systems now in use by SAMSO. All systems will be installed by March, 1968	—
Recognition Equipment Inc., Dallas, Texas	Humble Oil and Refining Company, Houston, Texas	Lease of optical readers and high-speed sorting equipment (approximate purchase value is $3 million)	—
North American Aviation's Autonetics Division, Anaheim, Calif.	City of Redondo Beach, Calif.	Aiding in streamlining the information procedures of moderate-size police departments with the application of techniques developed in the aerospace industry	—
Lockheed Missiles & Space Co., Sunnyvale, Calif.	State of West Virginia	Assisting in planning and establishing a central facility for the state's electronic data processing needs	—
Information Development Co., Santa Ana, Calif.	Philco-Ford Corp., Communications & Electronic Div., Willow Grove, Pa.	The design and implementation of a USASI COBOL Compiler, including Sort and Report Writer modules for the Philco 102 Computer	—
Planning Research Corp., Los Angeles, Calif.	U.S. Air Force	An intensive analysis of computer program requirements for the Air Force Systems Command, Space Systems Div., Satellite Control Facility	—

OF	AT	FOR
Burroughs B-300 computer system	Amway Corp., Ada, Mich.	Increased efficiency in the area of processing, inventory control and mailing
Burroughs B5500 computer system	Realtime Systems, Inc., New York, N.Y.	A general purpose time-sharing service (system valued at $1.5 million)
Control Data 3300 computer system	Caterpillar Tractor Co., Peoria, Ill.	Many types of research activity such as fluid-flow analysis, stress analysis, gear design, and on-line data reduction in connection with the testing of engines
Honeywell DDP-124 computer	National Aeronautics and Space Administration, Cambridge, Mass.	Testing instruments and various programming techniques for NASA's strapdown guidance system
IBM System/360 Model 20	City of Clearwater, Data Processing Center, Clearwater, Fla.	Calculating and printing invoices for 22,000 users of public utilities and community services; payroll processing; maintaining a running inventory record of all city property and performing budgetary accounting
	Atlas Van-Lines, Inc., Evansville, Ind.	Accounting and customer services
IBM System/360 Model 30	Jerrold Electronics Corp., Philadelphia, Pa.	Making preliminary feasibility studies of proposed community antenna television (CATV) locations, designing electronic circuits for new equipment, as well as conventional tasks. Eventually will make complete engineering surveys and plans for entire CATV systems
	Chicago Forwarding Co., Chicago, Ill.	Computer control of freight routing and freight consolidation
IBM System/360 Model 65	Esso Mathematics & Systems Inc. (EMSI), Florham Park, N.J.	Increased computer capability, greater flexibility and versatility; applications range from design of refineries and petrochemical plants to developing operations research tools for planning Standard Oil Company's (N.J.) diverse operations
NCR 315 computer system	Consultants & Designers, Inc., New York, N.Y.	"Instant inventory" of available skills to staff its programs throughout the United States and Canada; also payroll, accounting statements, and invoicing
	Transport Motor Express, Inc., Fort Wayne, Ind.	Increasing data processing capacity; system will handle freight billing from all of firm's terminals and also the payroll for about 1200 employees
NCR 315 RMC computer system	Computer Research, Pittsburgh, Pa.	Instant access to inventory information and accounts receivable files for wholesale distributors via "on-line" system; also processing work for other types of businesses
NCR Series 500 computer	The Stroud Building Society, London, England	Computerizing entire mortgage and investment ledger accounting operations
	D. Anderson & Son Ltd., Stretford, Manchester, England	Invoice preparation, sales and order analyses and sales ledger posting; stock control and production planning will be computerized in the near future
SDS 940 computer system	Institute for Environmental Research, Environmental Science Services Administration (ESSA), Boulder, Colo.	Scientific computations and administrative data processing for the Department of Commerce Boulder Laboratories of ESSA and the National Bureau of Standards (NBS); future plans include real-time monitoring and control of various scientific experiments
UNIVAC 491 computer system	Kansas City Life Insurance Co., Kansas City, Mo.	Connecting, by direct line, to major branch offices and agencies of Kansas City Life via remote communication terminals (system valued at about $1 million)
UNIVAC 494 computer system	Eastern Airlines, Operational Data Center, Charlotte, N.C. (2 systems)	Replacement of two UNIVAC 490 computer systems in service since 1962; primary functions of new systems are handling of seat reservations and associated data. Other applications include management information, flight planning and summaries, flight watch display, and catering services (systems valued at approximately $2 million)
UNIVAC 1108 computer system	Sandia Corp., Albuquerque, N.M.	Scientific uses (nuclear codes, differential equations, simulations and linear programming, data reduction of rocket firings and nuclear tests), engineering information systems and general business processing (system valued at about $5 million)
	University of Paris, Orsay branch, France	Analysis of spark and bubble chamber data and research in elementary particle, physics, statistical mechanics, crystallography, physical chemistry, and anthropology are among the many applications (system valued at over $2.5 million)
UNIVAC 9200 computer system	Southern Baptist Foreign Mission Board, Richmond, Va.	Personnel record keeping, payroll processing for home office personnel and missionaries, budget accounting, maintaining records on promotion work
UNIVAC 9300 computer system	First Federal Savings & Loan Association, Phoenix, Ariz.	Processing of savings accounts, mortgage loans, property improvement loans, as well as for payroll and general accounting purposes

MONTHLY COMPUTER CENSUS

The number of electronic computer systems installed or on order changes rapidly. The following is a summary made by "Computers and Automation" of reports and estimates of the number of general purpose electronic digital computers manufactured by companies based in the United States. These figures include installations and unfilled orders inside and outside of the United States.

These figures are mailed to the individual computer manufacturers from time to time for their information and review and for any updating or comments they may care to make.

Our readers are also invited 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
- X - no longer in production
- C - figure is combined in a total (see adjacent column)
- E - figure estimated by "Computers and Automation"
- ? - information not received at press time

AS OF OCTOBER 15, 1967

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 ORDERS
Autonetics (R)	RECOMP II	$2495	11/58	30		X	
	RECOMP III	$1495	6/61	6	36	X	0
Bunker-Ramo Corp. (R)	BR-130	$2000	10/61	160		X	
	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	X
Burroughs (R)	205	$4600	1/54	38		X	
	220	$14,000	10/58	31		X	
	B200 Series, B100	$5400	11/61	790		31	
	B300 Series	$9000	7/65	292		150	
	B2500	$5000	2/67	7		45	
	B3500	$14,000	5/67	2		50	
	B5500	$22,000	3/63	71		19	
	B6500	$33,000	2/68	0		6	
	B8500	$200,000	8/67	0	1230 E	3	310 E
Control Data Corp. (R)	G-15	$1600	7/55	285		X	
	G-20	$15,500	4/61	23		X	
	LGP-21	$725	12/62	159		X	
	LGP-30	$1300	9/56	322		X	
	RPC-4000	$1875	1/61	73		X	
	046/136/636	?	-	28		C	
	160*/8090 Series	$2100-$12,000	5/60	594		X	
	924/924A	$11,000	8/61	30		X	
	1604/A/B	$45,000	1/60	59		X	
	1700	$3500	5/66	48		C	
	3100/3150	$10,000	12/64	87		C	
	3200/3300	$16,250	5/64	132		X	
	3400	$18,000	11/64	20		C	
	3600/3800	$48,750	6/63	57		X	
	6400/6500/6600	$52,000-$117,000	8/64	49	(as of	X	
	6800	$130,000	6/67	0	1938 June 30)	C	320 E
Digital Equipment Corp. (R)	PDP-1	$3400	11/60	59		X	
	PDP-4	$1700	8/62	55		X	
	PDP-5	$900	9/63	114		X	
	PDP-6	$10,000	10/64	22		X	
	PDP-7	$1300	11/64	165		C	
	PDP-8	$525	4/65	1010		C	
	PDP-8S	$300	9/66	520		C	
	PDP-9	$1000	12/66	57		C	
	PDP-10	$7500	7/67	0	2002	C	400 E
Electronic Assoc., Inc. (R)	640	?	8/67	5		28	
	8400	$12,000	6/65	21	26	7	35
EMR Computer Div. (R)	ASI 210	$3850	4/62	26		X	
	ASI 2100	$4200	12/63	7		X	
	ADVANCE 6020	$4400	4/65	14		11	
	ADVANCE 6040	$5600	7/65	7		3	
	ADVANCE 6050	$9000	2/66	18		8	
	ADVANCE 6070	$15,000	10/66	7		2	
	ADVANCE 6130	$1000	8/67	5	84	36	60
General Electric (N)	115	$1340-$4800	12/65	400 E		600 E	
	205	$2500-$10,000	6/64	C		X	
	210	$16,000-$22,000	7/59	C		X	
	215	$2500-$10,000	9/63	200 E		X	
	225	$2500-$26,000	4/61	C		X	
	235	$6000-$28,000	4/64	C		C	
	405	$5120-$10,000	11/67	C		C	
	415	$4800-$13,500	5/64	300 E		70 E	
	425	$6000-$20,000	6/64	C		C	
	435	$8000-$25,000	9/65	C		C	
	625	$31,000-$135,000	4/65	C		C	
	635	$35,000-$165,000	5/65	C		C	
	645	$40,000-$250,000	7/66	C	1330 E	C	850 E
Hewlett-Packard (R)	2116A	$600	11/66	56		C	
	2115A	$412	2/68	0	56	C	20 E
Honeywell (R)	DDP-24	$2500	5/63	85		X	
	DDP-116	$900	4/65	172		41	
	DDP-124	$2050	3/66	38		33	
	DDP-224	$3300	3/65	50		8	
	DDP-516	$700	9/66	49		154	
	H-120	$3900	1/66	535		242	
	H-200	$8400	3/64	1115		87	
	H-400	$8500	12/61	120		X	
	H-800	$28,000	12/60	89		X	
	H-1200	$3800	2/66	132		94	
	H-1400	$14,000	1/64	12		X	
	H-1800	$42,000	1/64	21		1	
	H-2200	$12,000	1/66	45		64	
	H-4200	$20,500	6/67	0		15	
	H-8200	$35,000	4/68	0	2460 E	5	740 E

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTAL-LATIONS	MFR'S TOTAL INSTAL-LATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL ORDERS
IBM (N)	305	$3600	12/57	C		X	
	360/20	$2000	12/65	4000 E		6000 E	
	360/30	$7500	5/65	5000 E		4000 E	
	360/40	$15,000	4/65	3000 E		2000 E	
	360/44	$10,000	7/66	C		C	
	360/50	$26,000	8/65	C		C	
	360/65	$50,000	11/65	C		C	
	360/67	$75,000	10/66	C		C	
	360/75	$78,000	2/66	C		C	
	360/90 Series	$140,000	10/67	C		C	
	650	$4800	11/54	C		X	
	1130	$1200	2/66	1900 E		4500 E	
	1401	$6600	9/60	7650 E		X	
	1401-G	$2300	5/64	C		X	
	1401-H	$1300	5/67	C		C	
	1410	$14,200	11/61	C		C	
	1440	$4800	4/63	3600 E		C	
	1460	$11,500	10/63	C		X	
	1620 I, II	$4000	9/60	C		C	
	1800	$7600	1/66	C		C	
	701	$5000	4/53	C		X	
	7010	$22,600	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	$22,000	6/63	C		C	
	7044	$32,000	6/63	C		C	
	705	$38,000	11/55	C		X	
	7070, 2,4	$27,000	3/60	C		X	
	7080	$55,000	8/61	C		X	
	709	$40,000	8/58	C		X	
	7090	$63,500	11/59	C		X	
	7094	$72,500	9/62	C		X	
	7094 II	$78,500	4/64	C	31,500 E	C	19,500 E
National Cash Register Co. (R)	NCR-304	$14,000	1/60	24		X	
	NCR-310	$2500	5/61	14		X	
	NCR-315	$8500	5/62	563		150	
	NCR-315-RMC	$12,000	9/65	52		50	
	NCR-390	$1850	5/61	600		6	
	NCR-500	$1500	10/65	1400	2650 E	580	790 E
Philco (R)	1000	$7010	6/63	16		X	
	2000-210,211	$40,000	10/58	16		X	
	2000-212	$52,000	1/63	12	44	X	X
Radio Corp. of America (R)	RCA 301	$7000	2/61	635		C	
	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	122		125	
	Spectra 70/25	$6500	9/65	72		57	
	Spectra 70/35	$10,400	1/67	34		135	
	Spectra 70/45	$22,000	11/65	68		107	
	Spectra 70/46	$34,400	-	0		C	
	Spectra 70/55	$34,300	11/66	5	1110 E	14	420 E
Raytheon (R)	250	$1200	12/60	175		X	
	440	$3500	3/64	20		X	
	520	$3200	10/65	27		0	
	703	?	10/67	2	224	20	20
Remington-Rand UNIVAC (R)	I & II	$25,000	3/51 & 11/57	23		X	
	III	$20,000	8/62	67		X	
	File Computers	$15,000	8/56	13		X	
	Solid-State 80 I, II, 90, I, II & Step	$8000	8/58	222		X	
	418	$11,000	6/63	118		33	
	490 Series	$35,000	12/61	160		58	
	1004	$1900	2/63	3195		40	
	1005	$2400	4/66	740		200	
	1050	$8000	9/63	285		16	
	1100 Series (except 1107 & 1108)	$35,000	12/50	9		X	
	1107	$55,000	10/62	33		X	
	1108	$65,000	9/65	58		75	
	9200	$1500	6/67	2		1100	
	9300	$3400	7/67	0		650	
	LARC	$135,000	5/60	2	4930 E	X	2170 E
Scientific Control Corp. (R)	650	$500	5/66	20		33	
	655	$1800	10/66	2		12	
	660	$2000	10/65	2		2	
	670	$2600	5/66	1		1	
	6700	$30,000	10/67	0	25	1	49
Scientific Data Syst., Inc. (N)	SDS-92	$1500	4/65	100 E		30	
	SDS-910	$2000	8/62	200 E		30	
	SDS-920	$2900	9/62	200 E		20	
	SDS-925	$3000	12/64	C		C	
	SDS-930	$3400	6/64	200 E		40	
	SDS-940	$10,000	4/66	C		C	
	SDS-9300	$7000	11/64	C		C	
	Sigma 2	$1000	12/66	30		200	
	Sigma 5	$6000	8/67	C		C	
	Sigma 7	$12,000	12/66	C	830 E	C	500 E
Standard Computer Corp. (N)	IC6000	$10,000-$22,000	5/67	6	6	10 E	10 E
Systems Engineering Labs (R)	810	$1000	9/65	24		X	
	810A	$900	8/66	29		23	
	810B	?	-	0		5	
	840	$1400	11/65	4		X	
	840A	$1400	8/66	14		25	
	840 MP	?	-	0	71	5	58
Varian Data Machines (R)	620	$900	11/65	75		0	
	6201	$500	6/67	22	97	80	80
				TOTALS	50,946		26,332

BOOKS AND OTHER PUBLICATIONS

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.*

Reviews

Amosov, N. M., (translated by Leo Fingold) / Modeling of Thinking and the Mind / Spartan Books, New York, N. Y. / 1967, ? , 192 pp., $?

This book deals with the application of "cybernetic theory" to psychology: the author feels that mathematicians and engineers can contribute much to the study of the human mind. The chapters include: "Some General Assumptions of Cybernetics," "The Evolution of Pre-Human Living Systems and Their Programs," "Basic Programs of Human Behavior," "Consciousness, Thinking, Creativity," "Modeling of Mental Functions," "Conclusion." There is an index.

This book was originally published in 1965 in Kiev, and has been translated from the Russian. There appears to be very little reference to actual experiments; instead the book seems to be a large collection of suppositions.

Bowles, E. A., editor, and 21 authors / Computers in Humanistic Research: Readings and Perspectives / Prentice Hall, Inc., Englewood Cliffs, N. J. 07632 / 1967, hardbound, 264 pp., $7.95

This book contains 24 papers from 6 regional conferences on the use of the computer in humanistic research. Sections are "Introduction," "Computers in Anthropology and Archeology," "Computers in History and Political Science," "Computers in Language and Literature," "Computers in Musicological Research," and "Man and the Machine." The 3 final chapters are panel discussions held at Yale, Univ. of California at Los Angeles and Purdue.

Bushnell, D. D., and D. W. Allen, and 22 authors / The Computer in American Education / John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 10016 / 1967, hardbound, 300 pp., $5.95

Nineteen papers, written for a conference on the development of electronic data processing in education, have been expanded and revised in this book. The parts are: "Individual Instruction and Social Goals," "Computers in Instruction and Research," "Teaching the Computer Sciences," and "Information Processing for Education Systems." Contains bibliography and index.

Cuadra, C. A., Editor, and 15 authors / Annual Review of Information Science and Technology, Vol. 1 / Interscience Publishers, Div. of John Wiley and Sons, 605 Third Ave., New York, N. Y. 10016 / 1966, hardbound, 389 pp., $12.50

The literature on information science reviewed in this book for the most part appeared in 1965. Some of the 13 chapters are: "Professional Aspects of Information Science and Technology," "Information Needs and Uses in Science and Technology," "Content Analysis, Specification and Control," "Automated Language Processing," "New Hardware Developments," "Information System Applications," and "National Information Issues and Trends." Each chapter contains an extensive list of references.

This seems to be a thoroughly important book.

Danskin, J. M. / The Theory of Max-Min and its Application to Weapons Allocation Problems / Springer-Verlag New York, Inc., New York, N. Y. / 1967, hardbound, 126 pp., $0.00

This book deals with maximum-minimum problems in relation to military weapons systems and games. Chapters are: "Introduction," "Finite Allocation Games," "The Directional Derivative," "Some Max-Min Examples," "A Basic Weapons Selection Model," "A Model of Allocation of Weapons to Targets," and "On Stability and Max-Min-Max." The book is mathematical and advanced.

Evans, G. W., G. L. Sutherland, and G. F. Wallace / Simulation Using Digital Computers / Prentice-Hall, Inc., Englewood Cliffs, N. J. 07632 / 1967, hardbound, 198 pp., $11.50

A major purpose of this book is "to serve as a practical guide to the construction and use of computer simulation models and routines." Chapters are: "Simulation as a Research Technique," "Computing and Simulation," "A Simulation Study of Medical Evacuation of Casualties," "Computer Simulation of Armed Combat," "Simulation Studies Employing Man-Computer Gaming," "Computer Simulation of Radar Backscatter from Space Vehicles," and "Mathematical and Programming Considerations for Simulation Studies." Appendices are: "A Simulation Routine for the Medical Evacuation of Casualties," and "Statistical Considerations." The authors belong to the Mathematical Sciences Dept. of the Stanford Research Institute.

Gill, Arthur / Linear Sequential Circuits — Analysis, Synthesis, and Applications / McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036 / 1967, hardbound, 215 pp., $14.50

This book for mathematicians and engineers is intended to analyze linear sequential circuits mathematically and show their use in digital operations. Chapters are: "Mathematical Prerequisites," "Linear Sequential Circuits — General Properties," "Autonomous Linear Sequential Circuits," "Quiescent Linear Sequential Circuits," "Internal Circuits," "Applications of Linear Sequential Circuits," and "Some Related Systems." This book is advanced mathematically.

Gray, James A., *et al.* / NC, A Vehicle for Progress / Numerical Control Society, 44 Nassau St., Princeton, N. J. 08540 / 1967, paperbound, 146 pp., $9.95

These are the papers presented at the Numerical Control Society's Annual Meeting in Detroit, 1967. Parts are: "NC: USA and Europe," "NC and the Computer," "Retrofit for NC," "NC Inspection," "NC in the Small Shop," and "NC Training."

Haga, Enoch, and 21 authors / Automated Educational Systems / The Business Press, 299 Park Ave. West, Elmhurst, Ill. 60126 / hardbound, 1967, 343 pp., $15.00

This book presents to educators the potential of automation in both school administration and instruction. It is divided into two parts: Part I, "Concepts and Patterns," discusses the use of the computer in education as well as data centers and information systems. Part II, "Applications and Techniques," contains papers on automated pupil scheduling, pupil accounting, computer-assisted instruction, test scoring, and the use of the computer in personnel and payroll procedures. There are many illustrations and references.

Kelber, Harry, and Carl Schlesinger / Union Printers and Controlled Automation / The Free Press, Division of Macmillan, 866 Third Ave., New York, N. Y. 10022 / 1967, hardbound, 299 pp., $7.95

This book explains the effect of automation in the printing industry, beginning with the first use of the Linotype machine in the 1880's, using the example of the New York Typographical Union No. 6. Chapters include: "Historical Background: Impact of the Linotype Machine," "The Battle for Jurisdiction," "Mastering the New Technology," "The Problem of Productivity," "The 114-Day Newspaper Strike," "Causes for Anxiety," "New Approaches to Automation," "The

World Journal Tribune Merger," and "Guidelines for the Future."

With electronic typesetting close at hand this is an interesting case study of conflict between union printers and New York newspapers from about 1880 to the present: and the story should have many applications and implications.

Kleinmuntz, Benjamin, Editor, and 13 authors / Problem Solving: Research, Method and Theory / John Wiley and Sons, New York, N. Y. / 1967, hardbound, 406 pp., $6.95

The papers which make up this book were presented at a Carnegie Inst. Annual Symposium on cognition held in April 1965. Chapters are: "Introduction: Current Trends in Problem Solving," "Perception and Memory Versus Thought: Some Old Ideas and Recent Findings," "Cognitive Processes in Solving Algebra Word Problems," "Human Problem Solving: Internal and External Events," "Memory, Goals and Problem Solving," "Perception, Language and Conceptualization Rules," "An Operant Analysis of Problem Solving," and "An Integrated Functional Learning Approach to Complex Human Behavior." Also included are discussions of these papers, and an epilogue in which the differing points of view expressed by these psychologists are contrasted.

Klerer, Melvin, and Granino A. Korn, editors and 28 authors / Digital Computer User's Handbook / McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036 / 1967, hardbound, 922 pp., $27.50

This handbook is meant for those who are not programmers but who need to use the computer at times for problem solving. The editors and contributors have sought "clarity of expression and pedagogic illumination, but wthout sacrificing intellectual level." Part I: "Topics in Programming," contains chapters such as "Elements of Programming," "PERT/CPM," and "Structure and Use of ALGOL 60." Part II is "Numerical Techniques"; Part III is "Statistical Methods"; Part IV, "Computer Applications," contains "Symbolic Logic and Practical Applications," "Nonlinear Programming," "Commercial Data Processing" and "Scheduling and Inventory Control" among other chapters. There is an index.

Trigg, Charles W. / Mathematical Quickies / McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036 / 1967, hardbound, 210 pp., $7.95

This book contains 270 mathematical problems and their solutions, some solutions by the author and some by 102 other mathematicians who are listed at the end of the book. The problems are of varying difficulty; the reader is challenged to find elegant solution methods other than the ones presented. It is divided into three sections: "Challenge Problems," "Quickie Solutions," and "Names Mentioned."

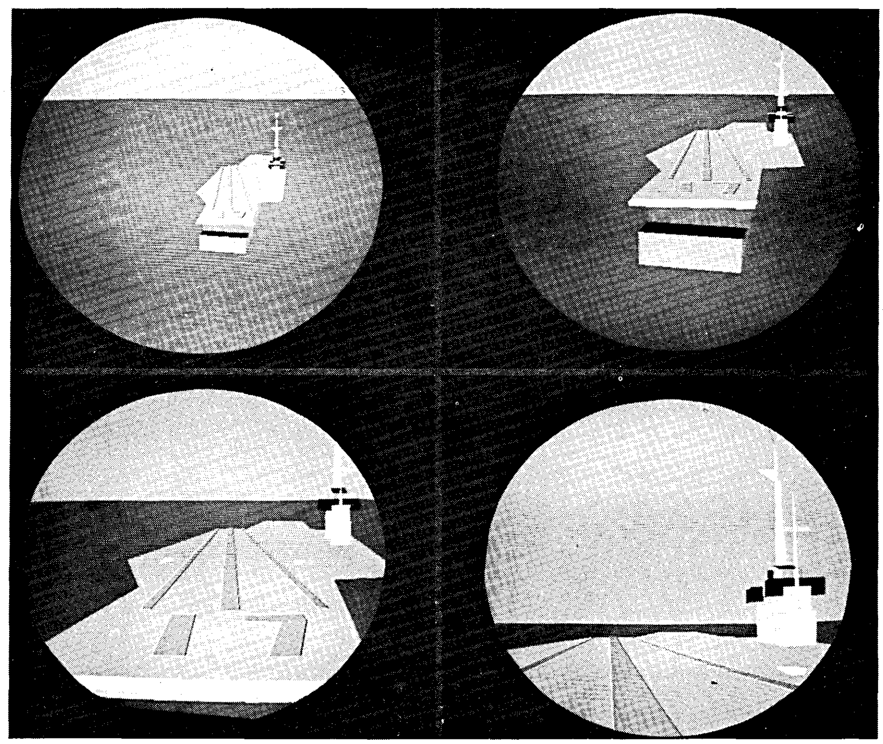
Cover Story:

Computer Visualizes Aircraft Landing

The series of pictures below appears on the cover of this issue. It shows how a computer visualizes an aircraft carrier of the U.S.S. Forrestal class. The computer, designed and built by G.E.'s Electronics Laboratory, Syracuse, N.Y., is given a series of numbers that tell it the shape and colors of the carrier. There are no models, drawings, pictures, films, or TV cameras in the equipment.

From the numbers fed to its memory, the computer draws the carrier on a TV screen. As the viewer manipulates an aircraft-type control stick to inform the computer where he would like to be in relation to the carrier, the computer re-computes the exact perspective and size of the ship for the viewer's location. The procedure is repeated up to thirty times per second, so that a smooth continuous motion is presented on the TV screen.

For more information, see page 53.



Spinrad, B. I., and 25 authors / Use of Computers in Analysis of Experimental Data and the Control of Nuclear Facilities / U. S. Atomic Energy Comm., Div. of Tech. Information, Oak Ridge, Tenn. / 1967, paperbound, 300 pp., $3.00

This book contains the proceedings of a symposium held at Argonne National Laboratory, Argonne, Ill. in 1966 and discusses many new findings in the development and use of the computer. The papers presented are in the following categories: "Data Analysis: Present and Future"; "Data Acquisition, On-Line Analysis, and System Control"; "Pattern Recognition and Graphics"; and "Hardware and Software Problems." Five discussions are included. The book is illustrated; there are references and an index.

Parkhill, D. F. / The Challenge of the Computer Utility / Addison-Wesley Publishing Co., Inc., Reading, Mass. 01867 / 1966, hardbound, 207 pp., $7.95

This book traces the development, technology, and economics of the computer utility and its effects on society. Chapters are: "From Magic to Technology," "Modern Computer Technology," "The Computer Public Utility Concept and its Evolution," "Early Computer Utilities," "The Technology of Sharing," "Economic Considerations," "Legal Factors" and "In Conclusion." A list of references, a glossary and an index are included. The book received an award as one of the five outstanding management books of 1966 by the McKinsey Foundation for Management Research.

CALENDAR OF COMING EVENTS

Nov. 6-8, 1967: Computer Graphics Conference, Univ. of Ill., Urbana, Ill.; contact L. J. Brightbill, Dept. of Architectural Engineering, Univ. of Ill., Urbana, Ill. 61801

Nov. 9-11, 1967: Tenth International SDS Users' Group, Airport-Marina Hotel, Los Angeles, Calif.; contact Ed Noyce, Ext. 370, SDS Users' Group Sec'y., Scientific Data Systems, 1649 Seventeenth St., Santa Monica, Calif. 90404

Nov. 10, 1967: ACM Symposium on the Application of Computers to the Problems of Urban Society, New York Hilton Hotel, New York, N.Y.; contact Dr. E. S. Savas, New York Scientific Center, IBM Corp., 590 Madison Ave., New York, N.Y. 10022

Nov. 14-16, 1967: Fall Joint Computer Conference, Anaheim Convention Center, Anaheim, Calif.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N.Y. 10017

Feb. 22-23, 1968: Management Conference, the Association of Data Processing Service Organizations (ADAPSO), Jung Hotel, New Orleans, La.; contact W. H. Evans, 947 Old York Rd., Abington, Pa. 19001

March 14-16, 1968: Sixth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Shamrock Hilton Hotel, Houston, Texas; contact Office of the Dean, The University of Texas Graduate School of Biomedical Sciences at Houston, Div. of Continuing Education, P. O. Box 20367, Houston, Texas 77025

March 18-21, 1968: IEEE International Convention & Exhibition, Coliseum & New York Hilton Hotel, New York, N.Y.; contact J. M. Kinn, IEEE, 345 E. 47th St., New York, N.Y. 10017

Apr. 30-May 2, 1968: Spring Joint Computer Conference, Atlantic City Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing, 211 East 43rd St., New York, N.Y. 10017

May 1-3, 1968: Joint National ORSA/American TIMS Meeting, St. Francis Hotel, San Francisco, Calif.; contact Miss Joan T. Sullivan, Computer Usage Co., Inc., 3181 Porter Drive, Palo Alto, Calif.

June, 1968: Sixth Annual Conference of The Special Interest Group on Computer Personnel Research of the Association for Computing Machinery; contact A. J. Biamonte, Program Chairman, West Virginia Pulp and Paper Company, 299 Park Ave., New York, N.Y. 10017

June 12-14, 1968: Annual Meeting, The Association of Data Processing Service Organizations (ADAPSO), Waldorf-Astoria, New York, N.Y.; contact W. H. Evans, 947 Old York Rd., Abington, Pa. 19001

June 25-28, 1968: DPMA International Data Processing Conference and Business Exposition, Statler Hilton Hotel, Washington, D.C.; contact Mrs. Margaret Rafferty, DPMA, 505 Busse Hgwy., Park Ridge, Ill. 60068

June 25-27, 1968: Second Annual IEEE Computer Conference, International Hotel, Los Angeles, Calif.; contact John L. Kirkley, 9660 Casaba Ave., Chatsworth, Calif. 91311

July 8-11, 1968: SHARE-ACM-IEEE Fifth Annual Design Automation Workshop; Washington, D.C.; contact H. Freitag, Program Chairman, IBM Thomas J. Watson Research Center, P.O. Box 218, Yorktown Heights, New York, 10598

Aug. 5-10, 1968: IFIP (International Federation for Information Processing) Congress 68, Edinburgh, Scotland; contact John Fowlers & Partners, Ltd., Grand Buildings, Trafalgar Square, London, W.C.2, England

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C.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

Problem 6710: Computing Without a Computer*

"This program was written by a student in my last class who seems to have lost interest in it," Claude Liffey said, pointing to a somewhat crumpled Fortran sheet. "Now I'm trying to figure out what it would compute."

John Lawthorne picked it up and smoothed it out a bit. "Shouldn't be much work to punch up a few cards and run it."

"That's the coward's way out," said Claude. "I'm trying to do this by using what little mathematics I still remember."

John looked up from studying the program. "It's really quite simple," he said.

What does the program compute?

```
      SUM = 0.0
      X = 2.0
3     Y = X * (X - 1.0) + 1.0
      SUM = SUM + 1.0/Y
      IF (10.0 ** 8 - Y) 8, 6, 6
6     X = Y
      GO TO 3
8     PRINT 9, SUM
9     FORMAT (F10.8)
```

*The program which was part of Problem 6710 was unfortunately omitted in our October, 1967 issue. We are repeating the entire problem here.

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

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.

August 8, 1967

3,335,293 / Thomas B. Horgan, Endwell, N. Y. / International Business Machines Corp., N. Y. / Threshold logic circuit with quasilinear current summing.

3,335,408 / Donald S. Oliver, West Acton, Mass. / Itek Corp., a corp. of Delaware / Apparatus for data processing.

3,335,411 / Robert S. Sinn, Philadelphia, Pa. / Ultronic Systems Corp., Pennsauken, N. J. / Stock information storage and request system.

August 15, 1967

3,336,576 / Roger P. Sourgens, Bourg-la-Reine, France / Societe d'Applications Generales d'Electricite et de Mecanique, Paris, France / Data transmitting system.

3,336,579 / Hans Heymann, Wilhelmshaven, Germany / Olympia Werke AG, Wilhelmshaven, Germany / Testing apparatus for information storage devices of data processing systems.

August 22, 1967

3,337,745 / Henry R. Irons, Washington, D. C. / United States of America as represented by the Sec'y. of the Navy / Thin film logic circuits using single turn coils.

3,337,803 / John P. Costas, Fayetteville, and Lawrence C. Widmann, Kirkville, N. Y. / General Electric Co., N. Y. / Data transmission system.

3,337,848 / Terrell N. Lowry, Columbus, Ohio / Bell Telephone Laboratories, Inc., N. Y. / Serial matrix arrangement having selectively switched crosspoints.

3,337,851 / David M. Dahm, Pasadena, Calif. / Burroughs Corp., Detroit, Mich. / Memory organization for reducing access time of program repetitions.

3,337,852 / Franklin Lee, West Acton, and John C. Kent, Lexington, Mass. / Honeywell Inc., Minneapolis, Minn. / Information handling apparatus.

3,337,853 / Yves Marie Charles Rene Harrand, Cachan, France / Societe Europeenne pour le Traitement de l'Information, Montrouge, France / Intermediate storage device.

3,337,854 / Seymour R. Cray and James E. Thornton, Chippewa Falls, Wis. / Control Data Corp., Minneapolis, Minn. / Multi-processor using the principle of time-sharing.

3,337,856 / Geoffrey Bate, Poughkeepsie, John R. Morrison, Wappingers Falls, and Dennie E. Speliotis, Poughkeepsie, N. Y. / International Business Machines Corp., N. Y. / Non-destructive readout magnetic memory.

3,337,858 / John E. Gillis, Burlington, and John Q. Johnson, Dorchester, Mass. / Massachusetts Institute of Technology, Cambridge, Mass. / Storage and retrieval of orthogonally related signals.

3,337,861 / Leonard R. Harper, Poughkeepsie, N. Y. / International Business Machines Corp., New York / Data transfer device.

3,337,864 / Adam Lender, Palo Alto, Calif. / by mesne assignments, to Automatic Electric Laboratories, Inc., Northlake, Ill. / Duobinary conversion, reconversion and error detection.

August 29, 1967

3,339,084 / Gerald W. Kinzelman, Washington, D. C. / United States of America as represented by the Sec'y. of the Army / Magnetic core logic circuit.

3,339,181 / Robert S. Singleton, Orlando, Fla., and Robert C. Brigham, Little Silver, N. J. / Martin-Marietta Corporation, Middle River, Md. / Associative memory system for sequential retrieval of data.

3,339,183 / Robert V. Bock, Sierra Madre, Calif. / Burroughs Corporation, Detroit, Mich. / Copy memory for a digital processor.

3,339,184 / George G. Pick, Lexington, Mass. / Sylvania Electric Products Inc., a corp. of Delaware / Zener diode memory plane biasing circuit.

3,339,189 / Edwin S. Lee III, West Covina, Calif. / Burroughs Corp., Detroit, Mich. / Associative memory employing transfluxors.

3,339,190 / Melvin M. Kaufman, Levittown, N. J. / Radio Corporation of America, a corp. of Delaware / Imbedded loop conductor magnetic memory.

September 5, 1967

3,339,570 / Richard W. Hatch, Jr., Norwell, Mass. / The Foxboro Co., Foxboro, Mass. / Fluid logic time temperature programmer.

3,340,506 / Jean-Jacques G. Mayer, Paris, France / Societe Nouvelle d'Electronique et de la Radio-Industrie, Paris, France / Data-processing system.

3,340,511 / Wyman L. Deeg, Glenview, Ill. / C. P. Clare & Co., Chicago, Ill. / Allotting system using plural winding magnetic flux logic.

3,340,512 / Erwin A. Hauck, Arcadia, and James E. Wollum, Duarte, Calif. / Burroughs Corp., Detroit, Mich. / Storage-pattern indicating and decoding system.

3,340,524 / Massimo Rinaldi, Rome, Italy / Industria Macchine Elettroniche-I.M.E.-S.p.A. / Device for the digital display of data stored in electronic circuits.

September 12, 1967

3,341,717 / Robert Henry McCracken, Glen Cove, Md. / U.S.A. as represented by the Sec'y. of the Army / Binary circuit.

3,341,817 / Jack C. Smeltzer, Woodlands Hills, Calif. / The Bunker-Ramo Corp., Canoga Park, Calif. / Memory transfer apparatus.

3,341,820 / Earl J. Grillmeier, Jr., George C. Beason, William J. Hale, and James D. Turner, Jr., Dayton, Ohio / The National Cash Register Co., Dayton, Ohio / On-line branch for data processing systems.

3,341,827 / Albert E. Slade, Cochituate, Mass. / Arthur D. Little Inc., Cambridge, Mass. / Electrical memory device.

3,341,828 / Michael Godfrey Harman, London, England / The National Cash Register Co., Dayton, Ohio / Associative magnetic memory devices and matrices.

3,341,829 / Donal A. Meier, Inglewood, Calif. / The National Cash Register Co., Dayton, Ohio / Computer memory system.

3,341,830 / Jules R. Conrath, Salisbury Township, Lehigh County, Pa. / Bell Telephone Laboratories, Inc., N. Y. / Magnetic memory drive circuits.

3,341,831 / David R. Bennion and William K. English, Menlo Park, Calif. / AMP Inc., Harrisburg, Pa. / Magnetic core device.

September 19, 1967

3,342,539 / Terence J. Nelson, Ames, Iowa, and Henry E. D. Scovil, New Vernon, N. J. / Bell Telephone Laboratories, Inc., N. Y. / Digitally responsive pattern recognition systems.

3,342,980 / Clarence George Bieber, Ramsey, N. J. / The International Nickel Co., Inc., N. Y. / Precipitation hardenable stainless steel.

3,343,132 / Merlin L. Hanson and Don M. Meyer, Jr., St. Paul, Minn. / Sperry Rand Corp., N. Y. / Data processing system.

3,343,134 / Kenneth D. Foulger, San Jose, Calif., and Arthur G. Silver, Endicott, N. Y. / International Business Machines Corp., N. Y. / Multiple section retrieval system.

3,343,136 / James J. Nyberg, Chesterfield, Mo. / The Bunker-Ramo Corp., Canoga Park, Calif. / Data processing timing apparatus.

3,343,140 / Richard C. Richmond, Orange, and Thomas A. Connolly, Hacienda Heights, Calif. / Hughes Aircraft Co., Culver City., Calif. / Banked memory system.

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.

You get more work out of a Burroughs 500 system because more of the computer gets into the work.

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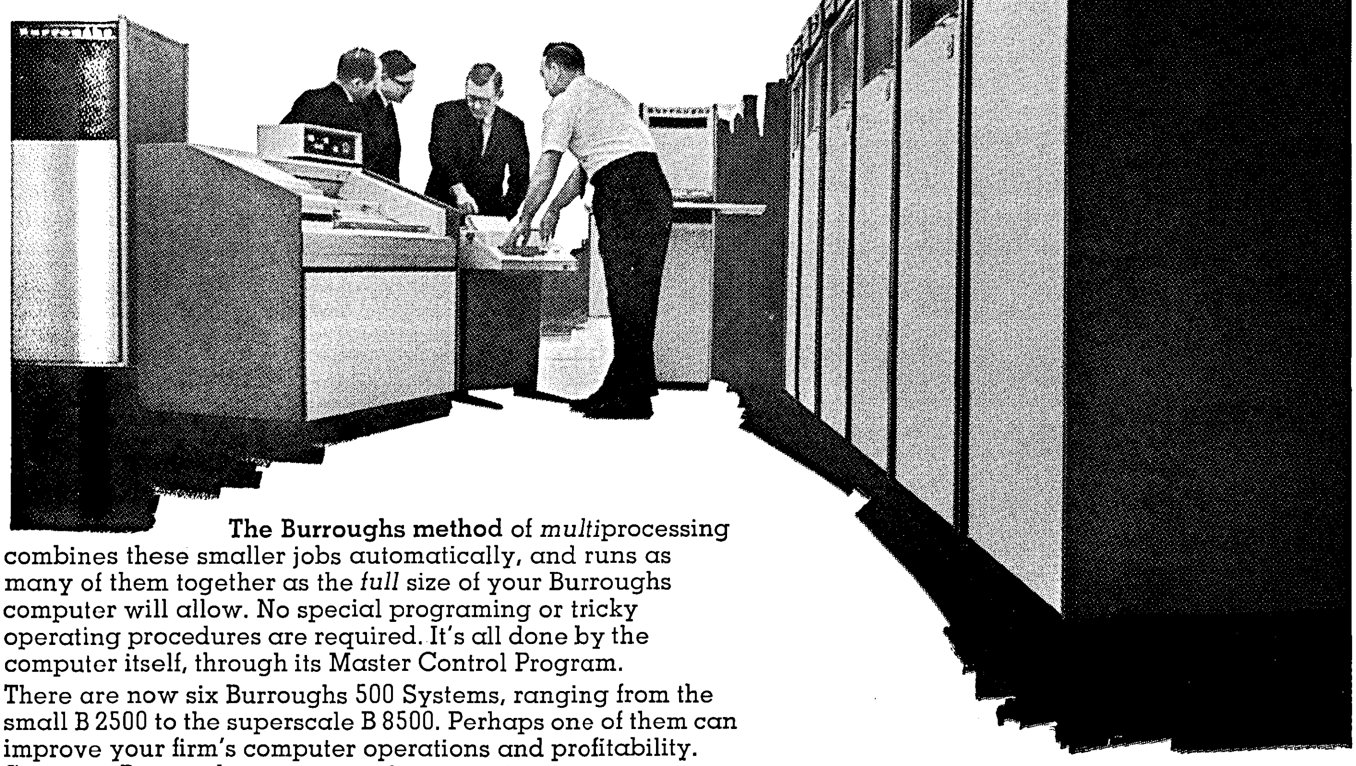

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To find out how easy the 2115A is to use—and its big brother, the 2116A, write to Hewlett-Packard, Palo Alto, California 94304; Europe: 54 Route des Acacias, Geneva.

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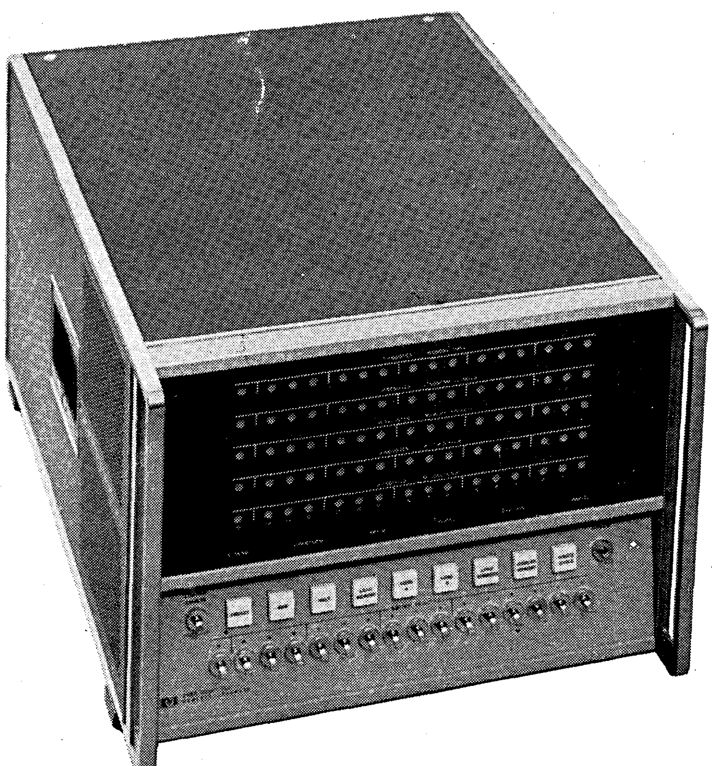

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Fall Joint Computer Conference