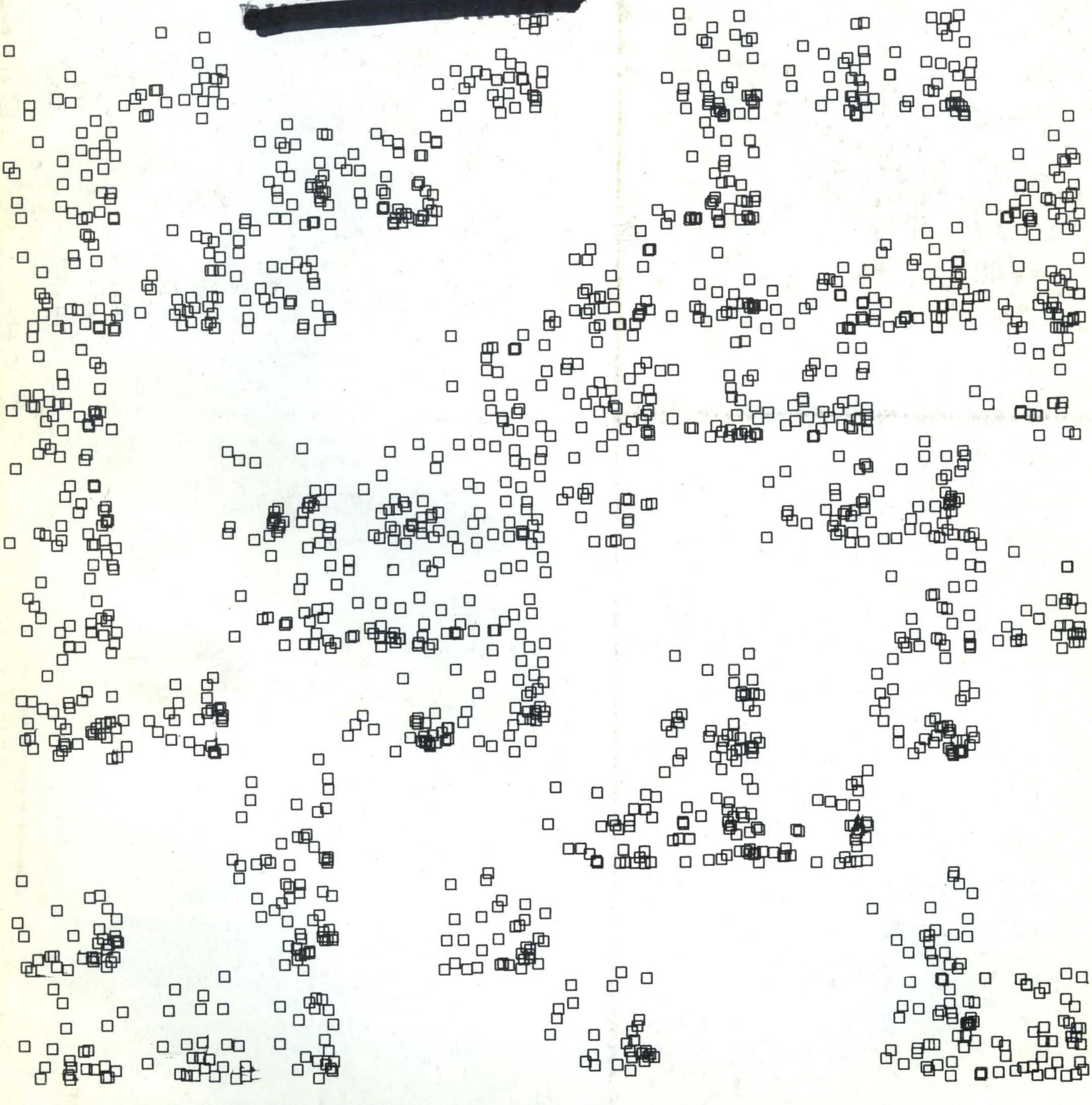
August, 1966

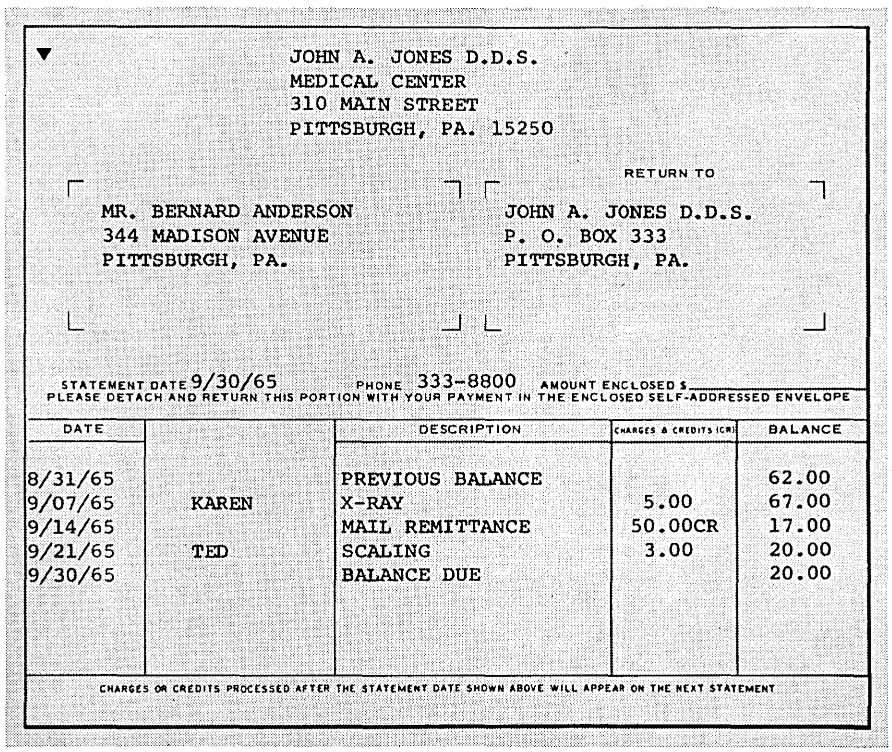
computers and automation



Computer Art Contest First Prize

NAKE/ER56/Z64

Banks can render this type of bill and these types of statements for all types of businesses!



JOHN A. JONES D.D.S.
MEDICAL CENTER
310 MAIN STREET
PITTSBURGH, PA. 15250

RETURN TO

MR. BERNARD ANDERSON
344 MADISON AVENUE
PITTSBURGH, PA.

JOHN A. JONES D.D.S.
P. O. BOX 333
PITTSBURGH, PA.

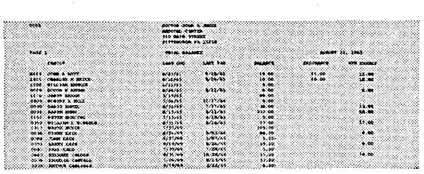
STATEMENT DATE 9/30/65 PHONE 333-8800 AMOUNT ENCLOSED $

PLEASE DETACH AND RETURN THIS PORTION WITH YOUR PAYMENT IN THE ENCLOSED SELF-ADDRESSED ENVELOPE

DATE		DESCRIPTION	CHARGES & CREDITS (CR)	BALANCE
8/31/65		PREVIOUS BALANCE		62.00
9/07/65	KAREN	X-RAY	5.00	67.00
9/14/65		MAIL REMITTANCE	50.00CR	17.00
9/21/65	TED	SCALING	3.00	20.00
9/30/65		BALANCE DUE		20.00

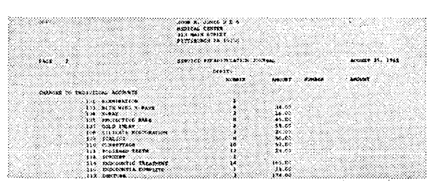
CHARGES OR CREDITS PROCESSED AFTER THE STATEMENT DATE SHOWN ABOVE WILL APPEAR ON THE NEXT STATEMENT

What started out to give doctors relief from bookkeeping chores has turned into a remedy for many another small business in Pittsburgh.



For now the Mellon National Bank & Trust Company of Pittsburgh is doing it for restaurants, auto parts stores, florists, drugstores, country clubs and others, as well as for dentists and doctors.

Prepunched account cards are inserted into a card reader connected to a Data-Phone* data set. And the information is transmitted over regular telephone lines. At the bank, the cards are automatically duplicated

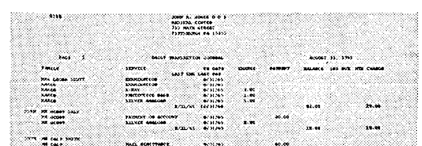


and then processed to provide the bills and forms shown here.

Businesses using the service need no longer be concerned with accounting equipment, maintenance agreements, printed forms, envelopes and stamps.

Overtime and billing-time confusion are eliminated. Remittances come in regularly, because statements are mailed on time regardless of personnel turnover, vacations, peak loads and emergencies.

The bank's data system provides businesses with these daily reports and forms: Transaction Journal; Trial Balance Journal; summary of all daily charges, payments, adjustments, month-to-date and year-to-date receipts; deposit tickets for all money



automatically deposited in the business's account; prepunched cards for new accounts.

Monthly reports include: Statements for all due accounts; Aged Accounts Receivable Report; Service Recapitulation Journal; New Account Report; Closed Account Report.

Now even small businesses get big-business billing service.

Our Communications Consultant can give you more details.

AT&T Bell System
American Telephone & Telegraph and Associated Companies

* Trademark of the Bell System

And Now, the $10,000 Computer

PDP-8/S: A full, general purpose, digital computer for real time analysis. 4K core memory (expandable). usec speeds. 66 plus instructions. Complete, proven software, including FORTRAN. Flexible input/output bus. Teletype included.

Available now, the new PDP-8/S — a direct lineal descendant of the PDP-8, the most flexible, versatile, approachable, on-line, real time, high speed digital computer ever made.

Both use the same basic design concept. Both have the same size memories. Both are expandable. Both use the same instructions, use the same software libraries.

They do not, however, work at the same speeds. And they do not cost the same amount of money.

The PDP-8/S adds in 32 microseconds (compared with 3.0 microseconds for its parent). If you need the speed, the PDP-8 is for you.

The PDP-8/S costs $10,000.

Think of it. Full computer. Proven hardware. Proven software. $10,000.

Any DIGITAL field office can give you the details. Or write.

digital

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Designate No. 2 on Readers Service Card

Heads!

<u>You</u> don't pick precision magnetic tape this way, but we have the feeling that some people do.

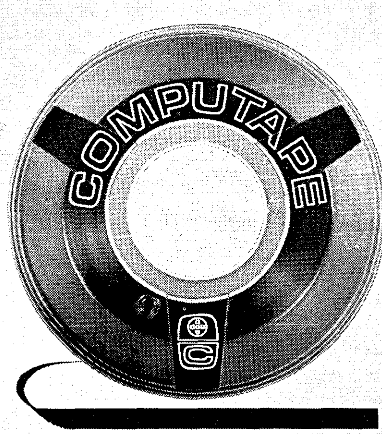
"How can you lose," we've heard it muttered, "one leading brand is as good as another."

Well, like the song says, "it ain't necessarily so."

Take Computape users. They would rather be safe than sorry. And they've found that, for long, reliable, error-free performance, Computape is about the safest tape going.

Has to be. Not a reel of tape leaves the plant that hasn't been checked and re-checked dozens of times for perfect quality and uniformity. And of course, each reel has been meticulously produced to meet the individual specifications of the equipment on which it will be used.

Nothing is completely sure in this life, but when you can come this close with Computape, why tempt fate with some other brand?



A PRODUCT OF COMPUTRON INC.
122 CALVARY ST., WALTHAM, MASS. 02154

VISIT OUR EXHIBIT AT ACM CONFERENCE — BOOTH 39-40

Designate No. 3 on Readers Service Card

The front cover shows some computer art from Stuttgart, Germany, first prize in the 1966 competition. For more information, see page 8.

computers and automation

AUGUST, 1966 Vol. 15, No. 8

In This Issue

Special Feature: The Computer in the Arts

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

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Computer Application Failures

On July 6, the *Wall Street Journal* published an article by staff reporter Lee Berton entitled "Zip, Buzz, Whir, Clonk: Computers Botch up Some of Their Jobs" — A Theater Fires Its Machine; Study Calls Humans Faster; But Who Really Is at Fault?"

The article (reprinted elsewhere in this issue) is well worth reading and thinking about. It lists instances where:

- A computer failed in adequately assigning seats at a theater;
- It was shown that a computer would take longer for billing and filling orders in an office supply house than human beings would;
- Changing to a computer caused 50 complaint telephone calls a day, in a subscription fulfillment operation;
- A computer increased time to 7 days, compared with 4 days using clerks and billing machines, in filling orders for books.

Clonk! Clonk! Do the troubles actually come from the computer?

Of course it is true:

- That it is worse to make errors 1000 times a second than it is to make them once a second;
- That if people have not understood the process which the computer should perform, then the process programmed in the computer MUST produce errors;
- That it is easier to correct human clerks in the visible performance of their work than it is to correct a computer in the completely invisible performance of its work.
- That computers, like matches and guns, are tools and are completely neutral in human affairs;
- That there are many examples of successful installations of computers in assigning seats, assembling orders, performing billing, fulfilling subscriptions, etc.

And we could go on for a long time in pointing out similar truths about computers, and perhaps make a case for no blame to be attached to the computer.

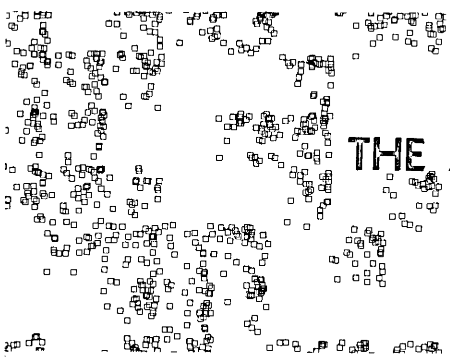
But is this all to it? No.

Computers are sold by human beings in order to receive a sale price. They are bought by human beings in order to get a value out of them. The sellers may be informed or ignorant, but they are most often informed. The buyers may be informed or ignorant, but they are all too often ignorant. The informed seller has a duty to the ignorant buyer. The seller should refuse to sell a computer when with his knowledge it is clear that the buyer is going to waste his money.

For example, in 1950 I visited the central office of a large paper company in New York. This office had to produce weekly and monthly summary reports for some 200 products produced by 29 plants here and there all over the United States and Canada. At one time, they had had a punch card installation with some 8 machines and 6 people for the purpose, and they found they could not get their summaries quickly and correctly. That installation was gone. They now used an ordinary table, some perforated forms, and an arrangement of pins. The forms listed all possible products in the same sequence for every plant; zero would apply if some product was not produced at a plant; and for each reporting period the completed forms giving the production figures were mailed in from all over the country. As soon as the 29th report was in, the forms were aligned by the pins on the table, and a girl would go across each row on the forms, picking up the figures for a particular product, adding them with an adding machine, and entering the total on a 30th form. Then another girl could check the adding machine tape and the entry. Thus the office avoided the entire input, output, sorting, and collating of punch card operations. They handled each figure only twice, once for adding and once for checking. Here is a fine example of a simple, direct, fast, efficient method avoiding both the computer and punch card machines.

In almost every case where a figure is going to be added only once, it makes no sense to put it into some input device, add it inside a computer, and then take it out through some output device. It is better to use some other process. A guide to "When NOT to Use a Computer" would contain such a warning.

(Please turn to page 29)

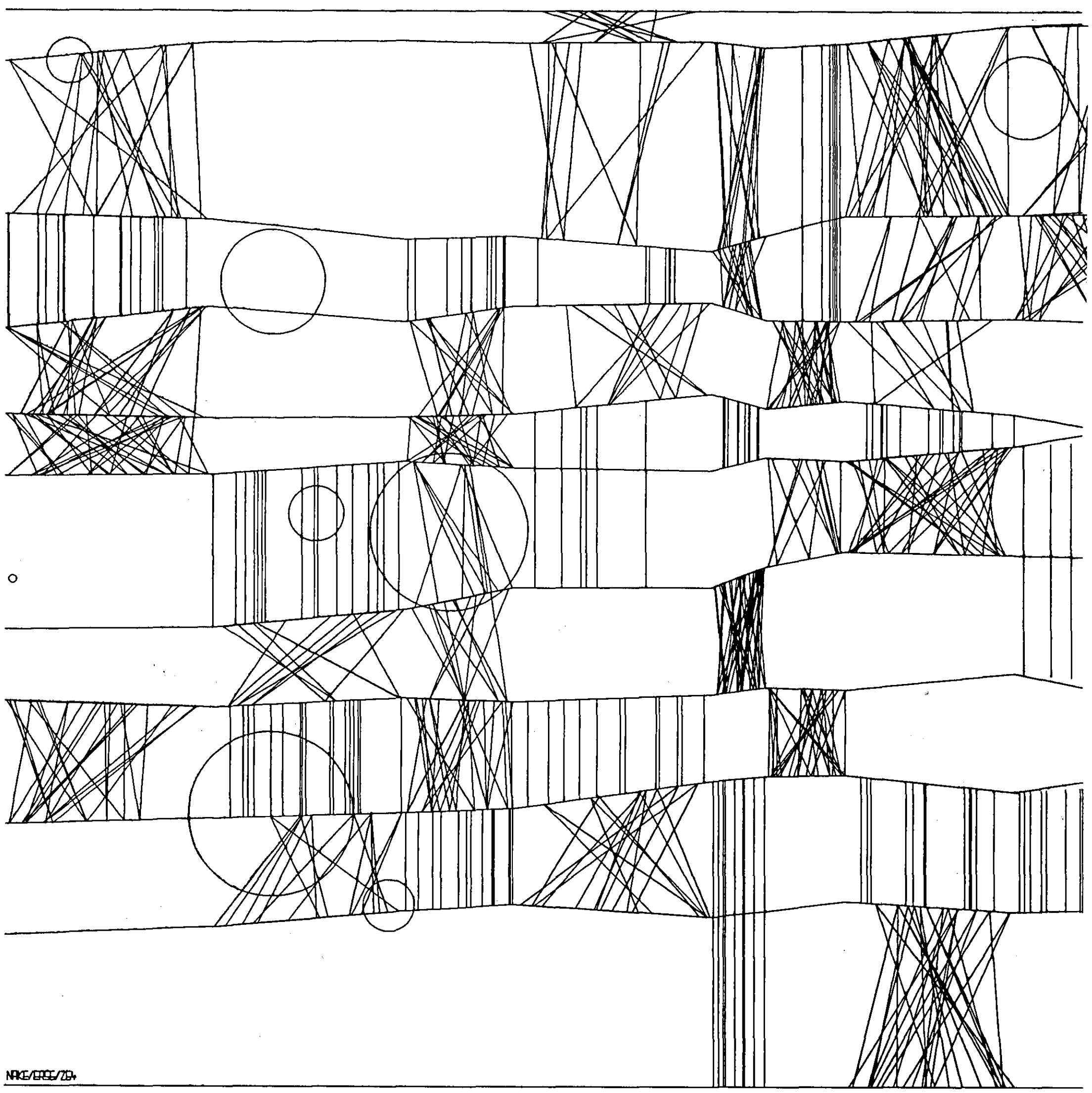


THE ANNUAL COMPUTER ART CONTEST OF "COMPUTERS AND AUTOMATION"

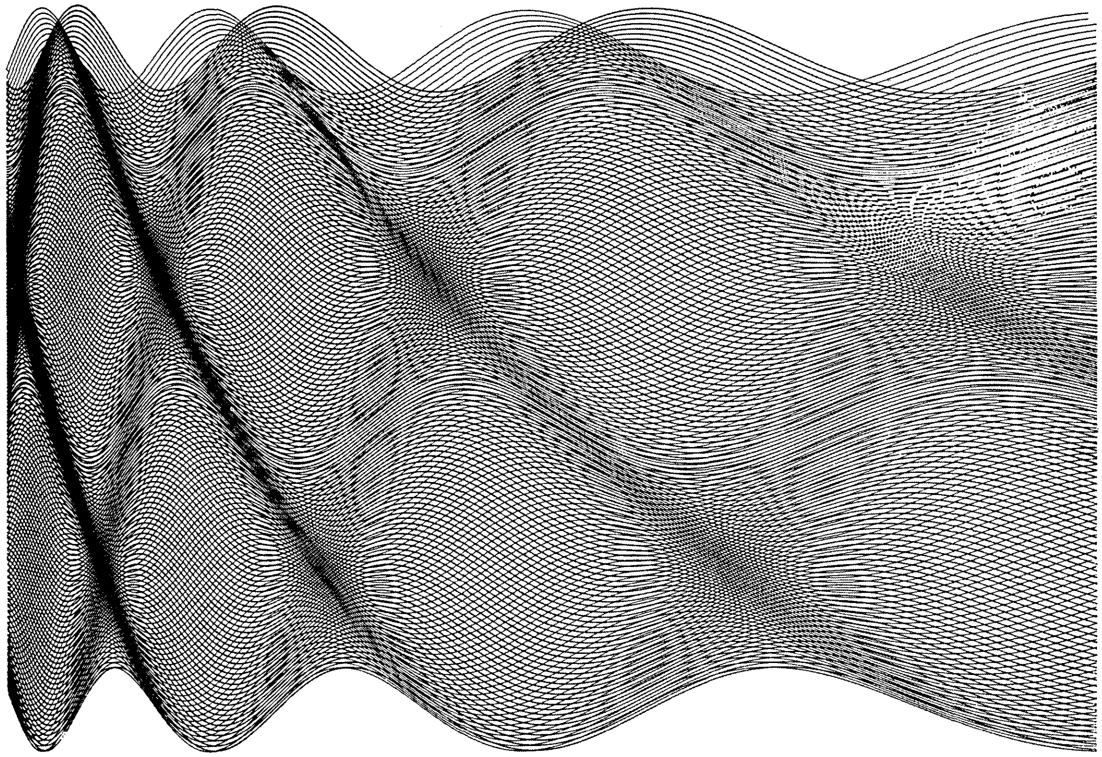
The first prize of our 1966 Computer Art Contest is awarded to Frieder Nake, Stuttgart, Germany. This drawing is the result of producing uniform small squares with a kind of regular irregularity specifically suitable to a computer's patience. It appears on the front cover of this issue, and in miniature above.

All the other computer art drawings published in this issue receive honorable mention. For some of these drawings, the explanation is obvious or can easily be inferred; for others, some explanation is given.

Next year we expect to run this contest again, and we again invite contributions of computer art from our readers.



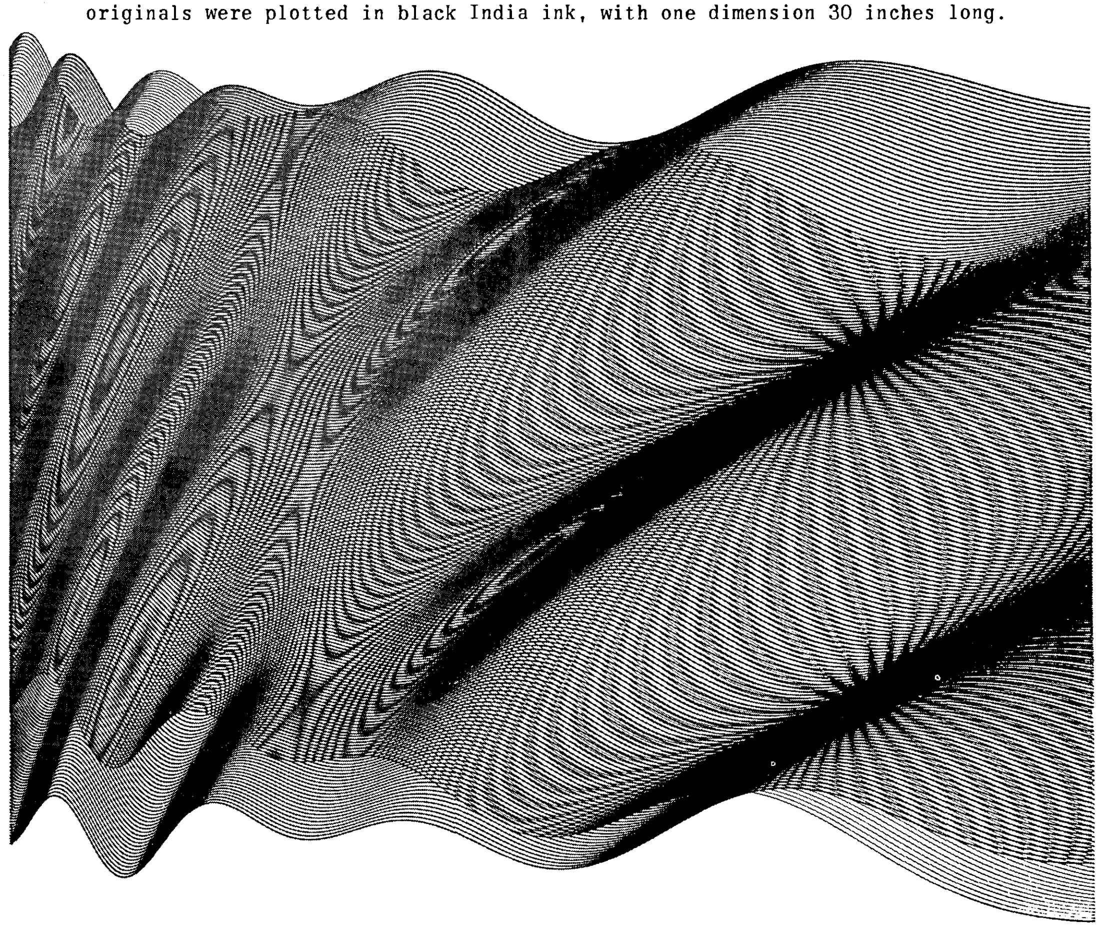
Another drawing entered by Frieder Nake.



SILK PATTERNS

From Maughan S. Mason, Huntsville, Alabama 35802

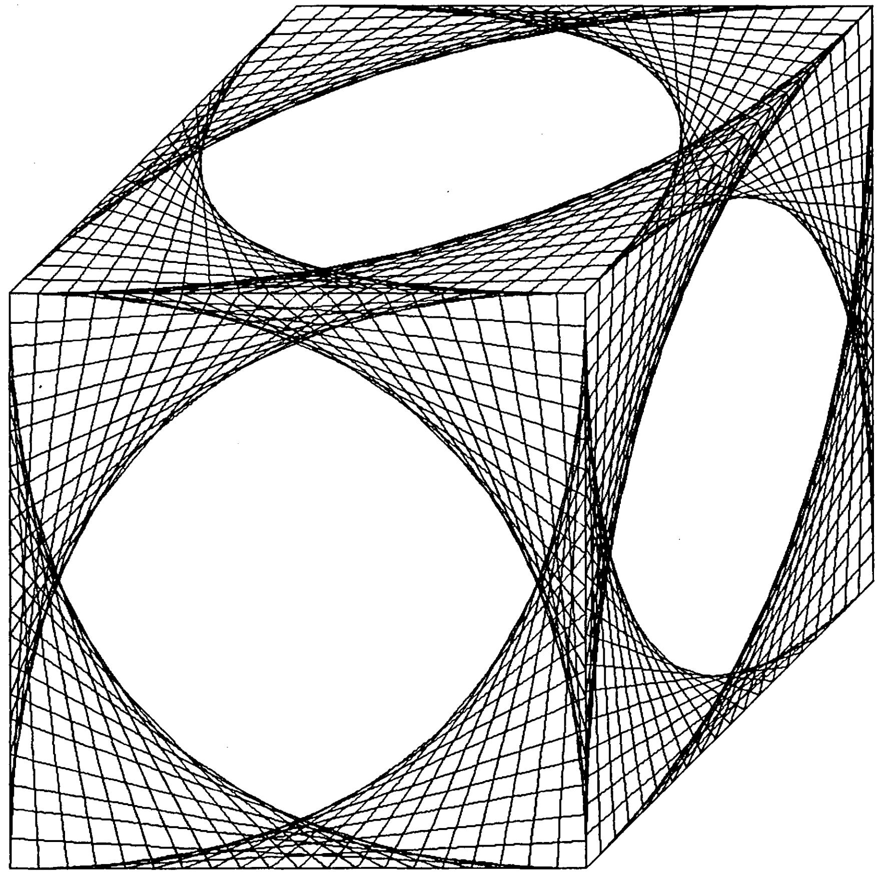
Both these drawings were generated by an analog computer with an X-Y plotter output. The originals were plotted in black India ink, with one dimension 30 inches long.

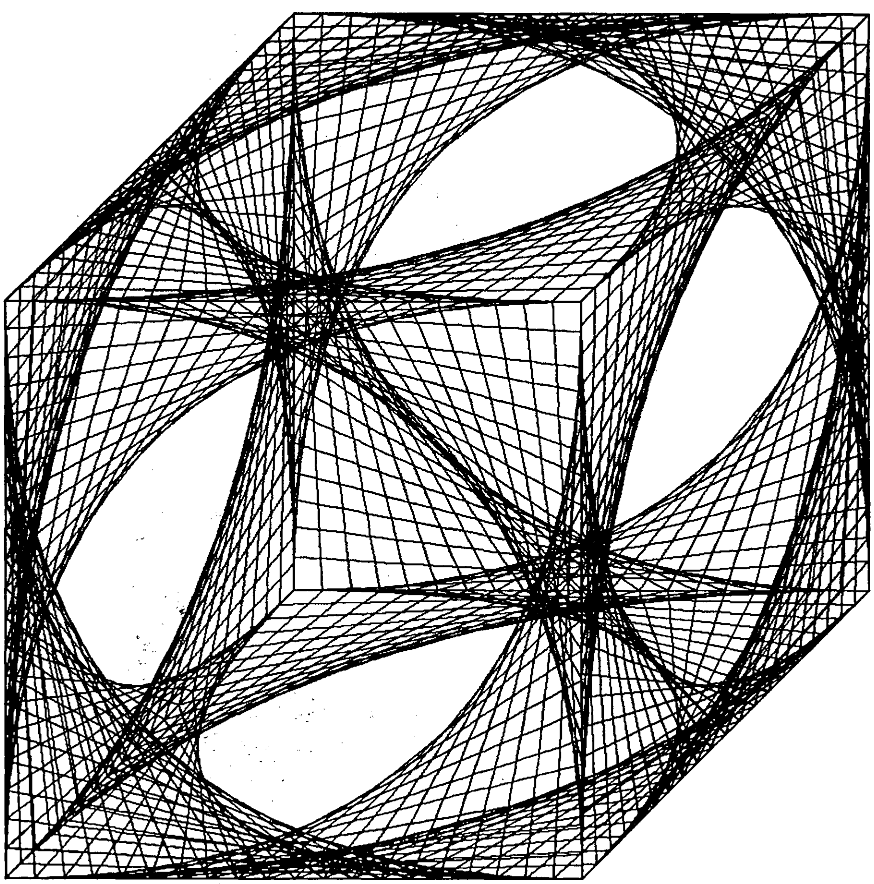


CUBIC FIGURES

Peter Milojedic
McGill University
Montreal, Quebec
Canada

The cubic figures on the right and below were obtained by connecting certain points on the sides of a cube.





The positions of the lines were changed by translation or rotation in order to achieve artistic effects.

The figures were drawn on a Calcomp 565 Plotter made by California Computer Products.

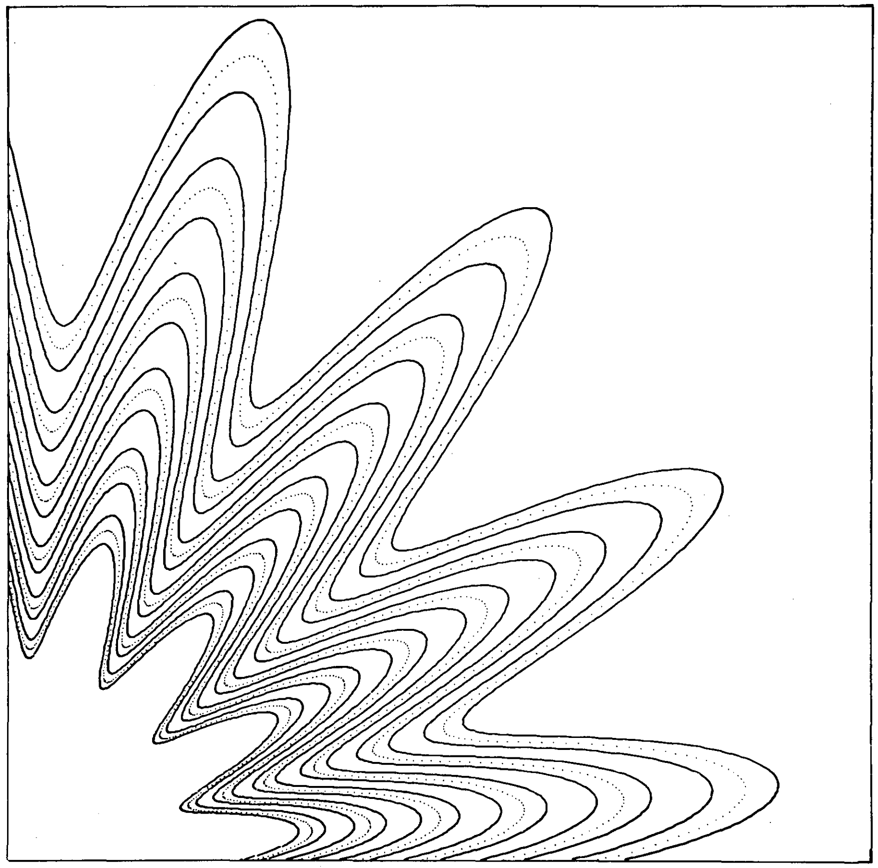
LOGARITHMIC SPIRAL

C. K. Messinger
China Lake, Calif. 93555

The design at the right is the result of plotting:

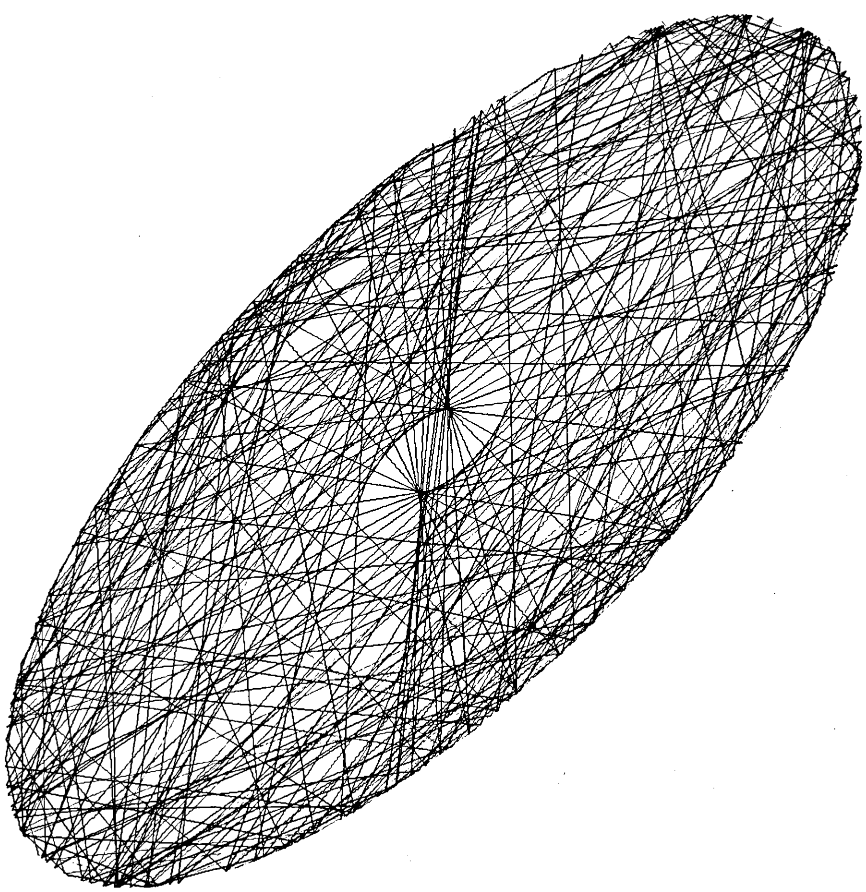
$$\left[2 + \frac{\sin(16\theta)}{2}\right] e^{.1135\theta}$$

This is a modulated logarithmic spiral in the first quadrant.



ELLIPSE BY ERROR

L. W. Barnum
EG&G, Inc.
Las Vegas, Nev. 89101



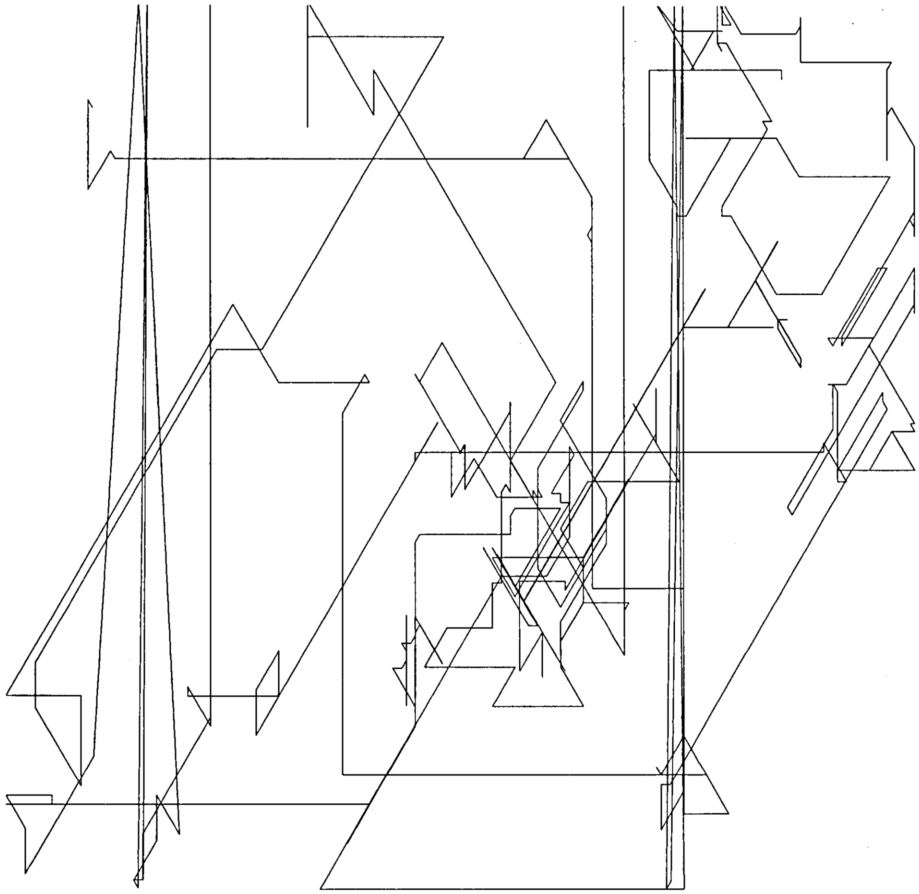
This elliptical figure was accidentally generated during a study of digitally generated Lissajous figures. The figure should have been an ellipse caused by a 45° phase shift, with sample points every 0.1 inch along the boundary of the figure. However, while generating this plot, the angular change from point to point instead of being

$$\theta_i = \theta_{i-1} + \Delta\theta, \quad i = 1,1256$$

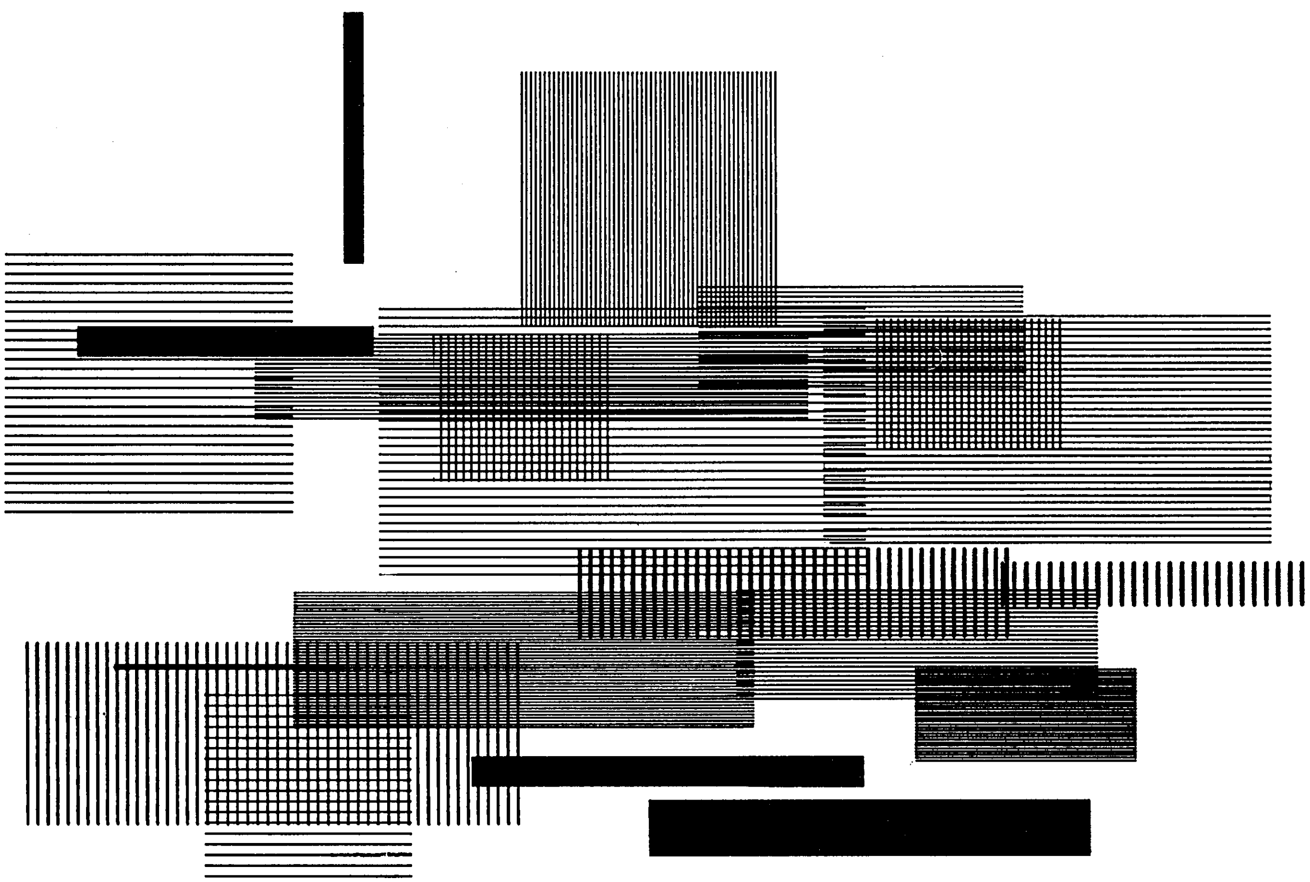
became

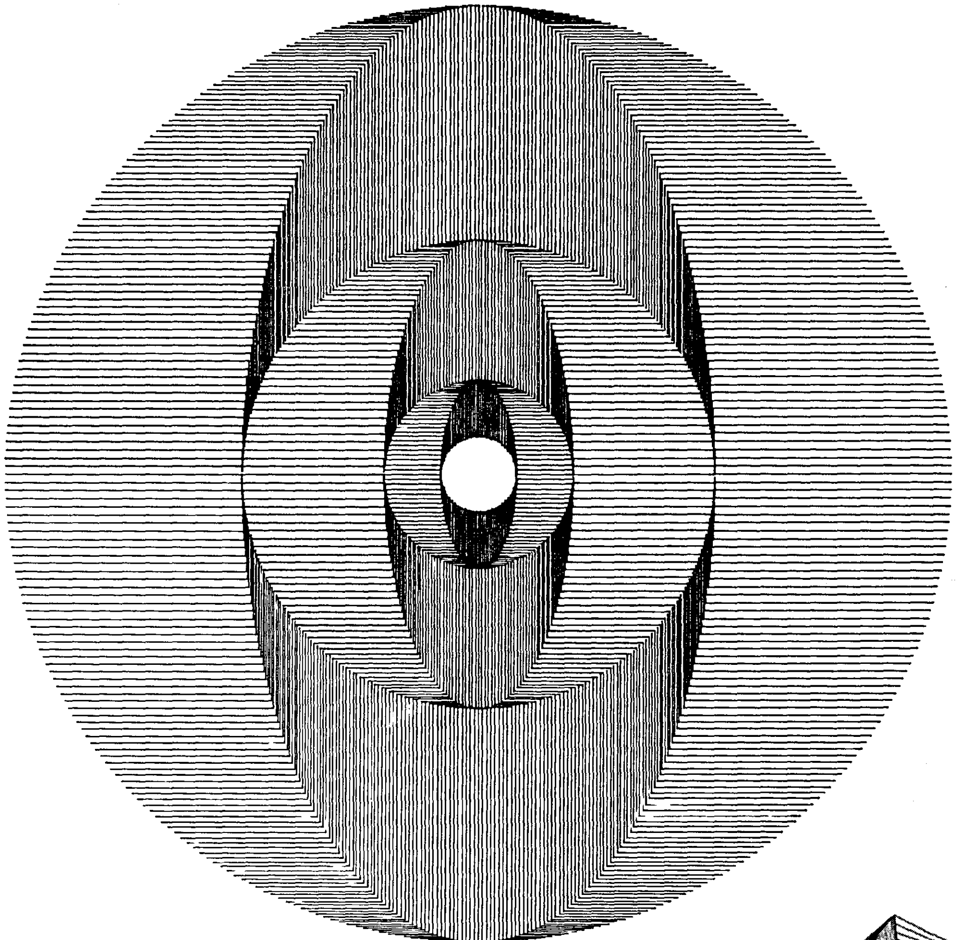
$$\theta_i = \theta_{i-1} + \Delta\theta \times (i-1), \quad i = 1,1256$$

Thus the points revolved about the elliptic envelope, but the routine generating the connecting straight lines created the effect in the figure. A CalComp 565, driven by a CDC 160A, drew the figure.



Here are two more examples of the computer art work of Frieder Nake of Stuttgart, Germany.

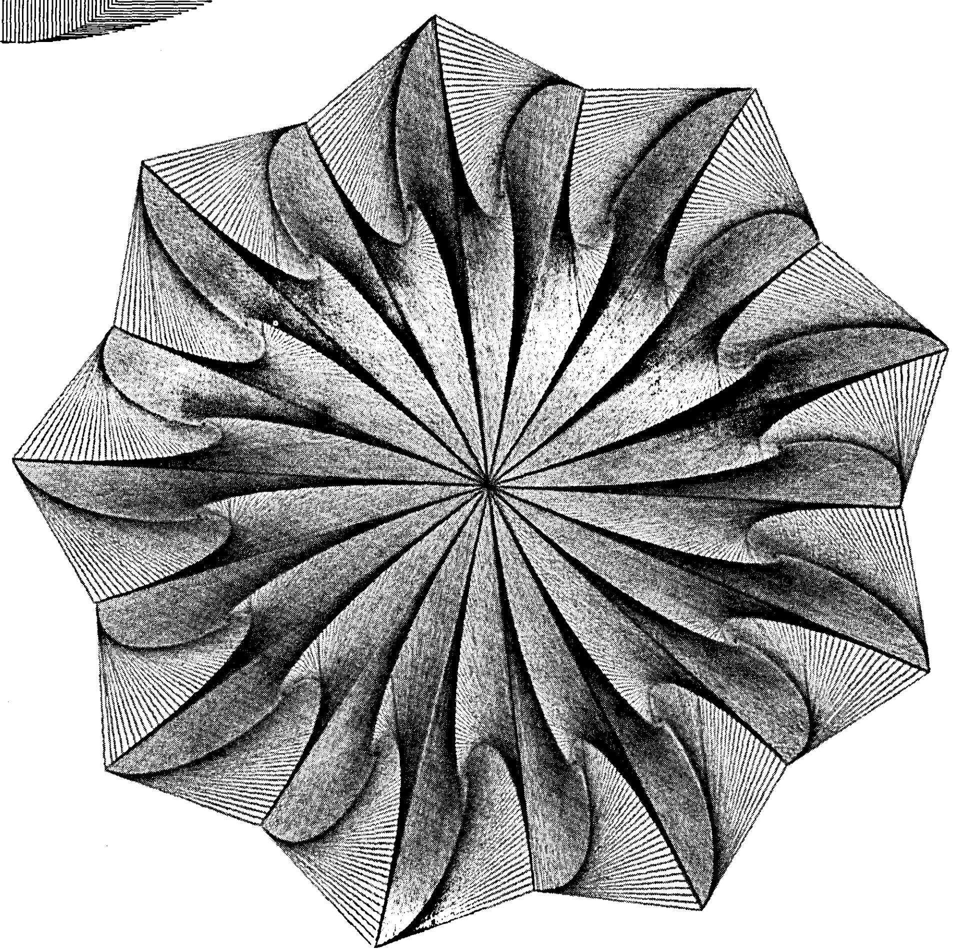




ELLIPSES AND CIRCLES

Peter Milojedic
McGill University
Montreal, Quebec,
Canada

A composition based on circles and ellipses



ROSETTE

D. K. Robbins
Sandia Corp.
Albuquerque, N. M.

The figure at the right represents a modification of a solution to a problem in calculus.

It was drawn on a CalComp plotter made by California Computer Products.

c & a MARKET REPORT

GOOD PROGRAMMING IS A CREATIVE EFFORT. SATISFACTORY COMPLETION OF A CREATIVE EFFORT CANNOT BE ACCURATELY PREDICTED. SATISFACTORY COMPLETION OF A GOOD PROGRAMMING EFFORT CANNOT BE ACCURATELY PREDICTED.

The above syllogism has not, apparently, been given serious consideration by vendors in the computer field. All computer builders make promises to customers and prospects on the delivery date for their system software. Some are rashly willing to include the promise in an equipment contract. One vendor is even advertising in national magazines the software delivery dates he is promising on his new computer system.

But the fact is that nearly all early users of a new computer system have had to face software delivery delays and/or defective delivered software. This is due largely to the inability of the computer manufacturer and the software contractors he employes to predict accurately the date on which they will complete a particular programming job. And since the programming jobs in creating systems software are often interrelated, the delays can be additive ....one delay sets back the time when work can begin on other parts of the project.

The table below provides some appreciation for this phonomenon by listing the software delivery slippages for the leading computer manufacturer, IBM, on its new 360 line (according to a survey recently conducted by our staff). A similar table, with delivery delays in many cases as severe as those shown here, could be constructed for other computer manufacturers. No vendor has been faultless in this regard.

Can delays in delivery of software be overcome? Certainly many programming efforts on routine applications require a minimum of creative effort, and often can be produced to a close timetable. However, so long as computer manufacturers produce new computers that require systems software more complex and more challenging that that already available (which is surely in the interest of technical progress), attempts to rigidly schedule the completion time of advanced programming efforts will continue to meet with limited success.

Comments, letters, and articles from readers on this important problem are invited.

SOFTWARE DELIVERY DELAYS ON IBM'S SYSTEM 360

SOFTWARE	ORIGINAL DATE (Announced 4/64)	REVISED DATE (Announced 1/66)	REVISED SIZE	DELAY (In Months)
Control Program (Basic)	4th Q,1965	3/66	-	3-5
Control Program (Time Sharing)	2nd Q,1966	1/67(Basic)	-	7-9
		7/67(Queued)	-	13-15
Assembler				
Design Level 10K	4th Q,1965	3/66	15K	3-5
44K	4th Q,1965	5/66	-	5-7
200K	2nd Q,1966	None Listed	-	-
FORTRAN				
Design Level 10K	4th Q,1965	3/66	15K	3-5
200K	4th Q,1965	6/66	-	6-8
COBOL				
Design Level 10K	4th Q,1965	3/66	15K	3-5
44K	2nd Q,1966	11/66	-	5-7
PL/I				
Design Level 10K	4th Q,1965	None Listed	-	-
44K	4th Q,1965	4/66	-	4-6
200K	2nd Q,1966	7/67	-	13-15
Report Program Generator(10K)	4th Q,1965	12/66	15K	12-14
Simulators				
IBM 7090/7094 & 7070/7074	1st Q,1966	6/66	-	3-5
IBM 1410/7010 & 7080	2nd Q,1966	10/66	-	4-6
Sort/Merge				
2400 series tapes & 2311	4th Q,1965	3/66	-	3-5
7340	2nd Q,1966	4/67	-	10-12
2301	2nd Q,1966	1/67	-	7-9
Utility Programs(10K)	4th Q,1965	3/66	-	3-5

c&a CAPITAL REPORT

A Special Report from C&A's Washington Correspondent

Sometimes it pays to complain, and if you complain to the right people, it may pay millions of dollars.

This is exactly what happened in the computer industry in recent months, but it goes back to June 1965 when IBM Corporation received the first of two large equipment orders from the National Aeronautics and Space Administration. This was an $18 million computer order for the Goddard Space Flight Center, in Greenbelt, Md. It was followed in October by an $80 million contract to extend the real-time computer complex at the National Aeronautics and Space Administration Manned Spacecraft Center, in Houston, Tex.

The first contract caused little stir in the industry, but when NASA announced the second as a sole-source procurement, thereby sidestepping any competitive procedures, the computer industry began to howl.

Two months after the sole-source procurement, NASA Headquarters called in the upper echelon of computer management. William Rieke, deputy associate administrator for industry affairs, discussed a new committee set up within NASA to review its own computer procurement management with an eye to increasing competition throughout the computer industry. His announcement was met mostly with silence.

Then in April 1966, NASA reorganized its entire procurement office, establishing a new division for policy and review and another for procurement surveys, in addition to the normal contract management division.

Still, as far as industry was concerned, nothing concrete had come out of NASA's meetings and announcements, and many computer manufacturers were openly skeptical about NASA's "competitive" intentions. However, much of this skepticism has finally been dispelled by some of the new contracts awarded by NASA.

In June, one of the long-time IBM strongholds — the Langley Research Center in Hampton, Va. — fell to Control Data. CDC picked up a $20 million contract for three large computers of the 6400/6600 variety. Less than two weeks later, Univac was awarded a contract from the Marshall Space Flight Center, Huntsville, Ala., for five leased 1108 multi-processing systems, valued at $30 million. After the initial weeding-out process, IBM was in strong contention for only the Langley contract.

What does this all mean? For one thing, it means that IBM's piece of the federal government computer pie is shrinking each year. IBM is still doing a hefty government business, and you will hear no official complaints, but with competition increasing so rapidly in such places as NASA — the second largest customer in government — IBM's share of the total government dollar is dropping. In 1963, it supplied 65 per cent of all computers in the government inventory; as of June 30, 1966, it was supplying only 35 per cent.

For another thing, all this means that NASA is moving rapidly into third-generation equipment.

In the procurement of software, NASA seems to have competition in mind also. When it announced the Univac contract for Huntsville, it also announced a $5.5 million contract to Computer Sciences Corporation to provide computer support to Marshall's Computation Laboratory. CSC outbid General Electric, which held the contract for six years.

In a message to the heads of government agencies last month, President L. B. Johnson said the computer is having a greater impact on what the government does and how it does it than any other product of modern technology.

The White House message was released while the government's use of computers was being reviewed in hearings in the House Subcommittee on Census and Statistics.

President Johnson said the computer is enabling us to achieve progress and benefits which a decade ago were beyond our grasp. He asked agency heads to study new ways in which the computer can be used to provide better service to the public, improve agency performance, and reduce costs.

"At the present time," he said, "the federal government uses 2,600 computers, employs 71,000 people in this activity, spends over $2 billion annually to acquire and operate this equipment, including special military type computers. Clearly, we must devote our best efforts to managing this large investment wisely and with the least cost. . .

"In my budget message for 1967," he said, "I told the Congress of my intent to make sure that this huge investment is managed efficiently. The federal government must give priority attention to establishing better and more effective procurement methods; making fuller use of existing facilities through sharing and joint-use arrangements before acquiring additional equipment; re-utilizing excess equipment whenever feasible; and achieving, with industry cooperation, greater compatibility of equipment.

"I expect all agencies to cooperate fully with the Bureau of the Budget, the General Services Administration, and the Department of Commerce in accomplishing these objectives.

"I want the director of the Bureau of the Budget to report to me on December 31, 1966, and every six months thereafter, on the progress that is being made throughout the federal government in improving the management of this very important technology."

(Please turn to page 29)

THE COMPUTER IN MUSICAL COMPOSITION

Prof. Gerald Strang
San Fernando Valley State College
Northridge, Calif.

"The computer is extraordinarily fast and extraordinarily accurate, but it is also exceedingly stupid and therefore it has to be told everything."

There are two main aspects to computer experimentation in musical composition. One is the use of the computer to aid the composer in the production of a score. The other is the use of the computer to generate actual sounds.

The Production of a Musical Score

For the first aspect, the center of principal investigation today is at the University of Illinois. It began with Hiller and Isaacson's work in 1955 and '56, which produced a piece called the Illiac Suite. Hiller and his colleagues have continued their investigation and recently put out another computer work called the Computer Cantata.

Essentially their composing program is a system allowing the computer to make some of the choices which a composer has to make. They have experimented with random processes, probability tables, etc., and have codified the whole procedure into a program which they call (with a typical programmers' acronym) MUSICOMP. The program is essentially a way of simplifying the process by which a composer may specify what choices the computer may make on his behalf.

The Illinois investigations have dealt with producing computer output which could then be transcribed into musical notation and performed by musical instruments. Recently they have developed an experimental computer called the CSX1 which can convert digital output to give sound of a limited variety. But for the most part, they have not investigated this phase of the process.

The Production of Actual Sounds

Many people prefer to do their own composing and make their own choices. However in the generation of the actual sounds chosen, there are a great many detailed tasks for which the computer is a well qualified assistant. The computer can, of course, do repetitive tasks with great ease and with great speed; and the sound of music is essentially repetitive. We deal with cyclic repetitions of sound waves, which may range anywhere from say 20 cycles per second to say 15,000 cycles per second.

The calculation and execution of such repetitive patterns is made to order for the computer. The computer can also do many other types of manipulation with great ease. It can, for instance, elaborate a pattern of accompaniment. Given certain parameters it can then adapt such a pattern to various keys, various harmonies, etc.

The sound-producing program started with the work of Max Mathews at Bell Telephone Laboratories about four years ago. The first public output of this was in the form of a record called *Music from Mathematics.* Here the samples were mainly the work of engineers, and composers naturally are interested in doing rather different things than engineers. The BTL Program is now in its fourth version; there is even a programmer's manual for "Music IV."

Instruments

The composer who wants to use this program invents certain types of computer operations which are called "instruments." For this purpose, Mathews has designed a group of unit generators which are similar to the unit generators of an electronics laboratory. There are filters, envelope generators, shapers, oscillators, etc. These units can be linked together, as in electronic circuit building. In fact, experimentation with simulated electronic circuits undoubtedly affected the development of this system.

An instrumental circuit of almost any degree of complexity can be drawn; it will provide almost any sort of sound manipulation desired. It corresponds to an instrument, in that its subroutine is one through which data is passed and from which it acquires certain characteristics. But this is exactly what a musical instrument does. If I write a series of notes and I say this passage is to be played mezzo forte by the oboe, with certain particular kinds of attacks and certain phrasing patterns and certain expressive devices, I am really saying that certain raw data shall be processed and modified by passing through this instrument, coming out as acoustical sound waves.

Orchestra

Under the BTL Program, once the composer has designed his instruments, he can specify that these shall form an orchestra. This then is compiled by the computer through the use of an elaborate set of instructions which form the compiling program.

At this point a binary deck comes out which can be put into the final operation. Meanwhile the composer writes a score expressing his choices in musical composition with his computer-simulated "orchestra." The score needs to be presented in numerical form. Moreover, the computer is extraordinarily fast and extraordinarily accurate, but it is also exceedingly stupid and therefore it has to be told everything. You cannot assume that it is going to decide what kind of "tonguing" or "bowing" to use, or what interpretive characteristics are to be selected. So the composer specifies different kinds of data. On the other hand, his instruments can be so designed that a single instrument routine can produce a number of different kinds of tone quality and any number of different kinds of attack and decay pattern. These timbres, attack and decay patterns and the like, can also be designed by the composer. They are stored in arrays to which the computer can make reference as demanded by the score.

The composer can write his score in any fashion he wishes. He can also put in conversion functions so that he can specify his data in any form he wishes. If he prefers to specify loudness by the usual musical means, the equivalent of *mezzo forte, mezzo piano, fortissimo,* he can set up a numerical scale and a conversion function which says, "If in this particular position on the card I punch 1, this means pianissimo; if I punch a 6, it means fortissimo." If he prefers to specify loudness in decibels, he uses a different conversion function.

And so on with all the other parameters. One can, for instance, very easily generate a tempered scale. Not necessarily a twelve tone tempered scale, but eleven or nine or thirteen or twenty-one tone tempered scales. One can also allow the computer to make random choices of pitches or loudnesses or envelopes or anything else.

In short, the score can specify in as much detail as you choose, whatever types of parameter you choose. Other parameters can be specified as constants.

The Orchestra and the Score

When the data which form the score have been punched on IBM cards, it is fed in with the already compiled orchestra. You can feed in data for as many instruments as you like simultaneously, and you need not insert the cards in any particular order within sections.

In the execution phase of the program, the computer accepts the data and stores it. It then processes that data according to your instructions and sorts it in such a way that all of the events are now ordered according to the beginnings of the events.

So you now have your score sorted and ordered. At this point, if you wish, you can put in instructions to generate new notes (e.g., to modify, invert, reverse, or permute stored data); to create accelerandos, crescendos or diminuendos; to perform any large scale manipulation of the ordered data.

Sampled Output

The computer now calculates values for the combined output at a fixed sampling rate. The Bell Telephone Labs Program uses a sampling rate of 10,000 samples per second of musical output. That is an enormous output; in fact, since each value may be the result of a large number of cycles required to process several different instruments and several different units within each instrument, this represents a considerable task for the computer. It is a sufficient task so that on the IBM 7090 at Bell Labs in 1963, our time factor was about 10 to 1: it took us 10 seconds of computer time to generate the samples for one second of music.

Digital-to-Analog Conversion

The computer output is in digital form — a string of binary numbers. It has to be processed further in order to get sound out of it. Essentially this is done by passing the digital output through a buffer into a digital-to-analog converter. The digital-to-analog converter takes the numerical output of the computer and converts it into voltage values which correspond in scale to the numerical values on the computer tape. This output has to be filtered. A low-pass filter is used, which usually cuts off at half the sampling rate. At Bell we were using a 5 kilocycle cut-off with a 10 kilocycle sample rate. The result of the low pass filter is to smooth the stepped aspect of the digital output. The resultant smoothly varying voltage is essentially what happens to voices in microphones. A voice is picked up by the microphone, converted into a varying voltage, amplified, and applied to the loud-speaker voice coil. At that point it is re-converted from electrical to acoustical energy. It becomes a series of pressure waves in the atmosphere and is carried to the ears of the audience.

Sound

Once the computer output has been converted into a varying voltage, it is simple to apply it to a tape recorder head, or directly to a speaker, thus producing sound.

Some variations of the BTL program are being worked on at Stanford, at U.C.L.A., at my college, and elsewhere. In addition, various experimentation is going on with other composing programs. The main centers for work with composing programs are Illinois and to some extent Yale.

From the standpoint of the composer, learning to program in this way is formidable, but it is still quite possible for a composer to learn rather rapidly to present his data in this form and even to anticipate what kind of sound is going to come out of the computer.

A Sample Musical Piece

Let's describe a sample of output from the program. In this sample, there are five separate voices, and a mixture of features. One voice consists of noise, filtered in such a way that the bandwidth and center frequency can be shifted continuously between set limits.

One instrument makes use almost exclusively of gliding tones of various sorts. There are two tempered scales, one of nine tones, the other of twenty-one tones. There's another instrument in which the pitches are chosen by the random number generator, whose limits can be set. For the random number generator a center frequency and a bandwidth can be set; then the numbers chosen will be translated into sound frequencies within the specific range. The rate at which random numbers will be generated can be set. If I generate these random numbers at, say, 2,000 per second, I get a kind of brittle noise. If I generate them one or two or five or twenty per second, I get a set of separate pitches.

It is characteristic of electronic music that a tremendous amount of dubbing, patching, snipping, putting pieces of tape together and so on, goes into it. But in this sample, no editing is necessary. The whole thing is put together in the computer. All the drudgery, all the manual manipulation, all the incredibly time-consuming fussing around is avoided, and this eliminates the noise build-up completely. This sample indicates that with this kind of a program you can do almost anything you can do in an ordinary music lab. But you can do it more accurately, more easily, and certainly with far more variety.

There are still limitations, and other difficulties, but they are being overcome. For instance, at present the filtering produces a 5,000 cycle ceiling. The resulting sound is a little bit like a Hammond organ. But that is not a necessary result. We can very easily increase the sample rate and increase the complexity of the sound color to any degree that we wish.

CRITICAL EVALUATION OF SOFTWARE PACKAGES

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"An operational system implies that both hardware and software are in working condition."

The importance of evaluating and testing computer software in a way like that used for hardware has only recently come to be fully understood. Even the less knowledgeable users appreciate that they must subject the proposed hardware to a very thorough scrutiny; they must determine whether it meets their specifications and possesses all the features needed for their intended applications. However, many users still hesitate to accept the fact that a critical evaluation of the software is at least of equal importance, and that this task has a rather extensive scope. Yet, it is quite apparent that testing and maintenance of software packages and machine hardware have many features in common. We have learned enough during the past hardware decade so that we should know what to do about the software.

Possibly the most dramatic lesson learned along these lines is the importance of insisting upon accepting delivery of a machine, *with software,* from a manufacturer. For strange reasons, there is still a great reluctance to make this a *sine qua non* condition for systems acceptance. But the disastrous consequences of systems acceptance without adequate software are too well known, although less documented. Who would ever admit publicly that his computer was not doing its job?

The user accustomed to hardware analysis will find that software analysis reflects every facet of the problem with which he is already familiar. He should keep in mind that any investment he makes in analyzing software packages along the lines proposed here will pay off handsome dividends both during pre-installation and actual operation of the system. In fact, it is clear that by definition an operational system implies that both hardware and software are in working condition.

Design of Software

Only properly designed software packages can be effective. Detailed design specifications should be available for inspection and they should have been reviewed prior to flow-charting and implementation. Naturally, we must distinguish hardware-oriented systems software (e.g., executives, monitors, input/output handlers, etc.) from problem-oriented operational packages (e.g., compilers, sort-merge generators, linear programming, etc.). The first category offers a great variety of very challenging problems, especially for systems with multi-programming or multi-processing capability. Some of these queueing and allocation studies are very intricate and the determination of pertinent program parameters may require fairly sophisticated analytical tools. This is particularly true where input/output and transfers between drums, discs, and main memory are concerned. In fact, it is difficult to conceive how this type of software can be designed without extensive simulations; prospective users should inquire about the extent to which such simulations were used to determine optimum parameter values or to compare different logical approaches. The design of programs in the second category is less hardware-oriented; it is often governed by existing or proposed standards, conventions, or functional specifications. Many program designs, including such well-established compilers as FORTRAN or COBOL, also incorporate special, non-standard features (electives). These enhancements provide an immediate inducement to applications programmers to try their hand at the available, greater sophistication; they also contribute to conversion problems due to general lack of compatibility. Needless to say that this tendency to incorporate "goodies" is encouraged and fostered by competition among hardware manufacturers who wish to give their proposals "that little extra," as an inducement to simplify applications programming. Therefore, the wily or wary user must examine his own long-range plans to determine whether they are properly served by making use of non-standard features of an otherwise standard language; he might also prepare some estimates of the impact that the need for conversion will have if some or all of the special features should remain non-standard.

Quality and Efficiency of the Software

Upon completion of the software design, programs are customarily flow-charted before coding begins. The more effort spent on these preparatory efforts, the better the product will be. Most software is now also subjected to selective field testing before it is released for general use. Regardless, the user has the right to expect a polished product, but unfortunately many customers facing software problems still show a non-realistic attitude which could imperil their planned operations. Admittedly, no major software package is ever *absolutely* free of errors but after passing field tests packages should be *relatively* error-free. As in the case of hardware, a quality measure can be attached to the software which describes its Mean-Time-Between-Failures (MTBF). The sophisticated user should inquire not only about the "bug" process reports but also about the frequency of such reports at the time when he makes his evaluation. It may not be easy to gain access to such records, but a request for a supporting statement along these lines is usually honored by the manufacturer, especially if the sale of a large-scale system hangs in the balance.

The quality of the code of any software package under study is only one of its several aspects with which the user must familiarize himself. It is of equal importance that he determine how efficient a particular piece of software is, say, under operational conditions. Thus, he may wish to obtain figures about compile speeds, or system throughput, to mention only two items of interest. Either aspect can be readily determined from properly (or cleverly) chosen benchmark programs. This approach has gained recognition and wide acceptance during the past few years; it will probably be used even more frequently in the future. Customers have learned how much information this process can supply about quality and efficiency of software packages, at little or no cost to them. Further, if the problem mix used for such a test includes a variety of languages and problems, one can also very quickly determine whether all of the software needs are indeed met and are operational or whether one has to rely on paper tigers.

As a byproduct of such benchmark program comparisons a prospective user can also determine how efficient the compiler-produced object code is. In many job mix environments compile speed is as important as object code efficiency. Thus the benchmark approach provides valuable information at once about many aspects of the software: (i) Existence and efficiency of an operating system, (ii) Existence and speed of certain compilers or special purpose programs, (iii) Efficiency of the produced object code, (iv) Diagnostic capability of the packages tested. The last item should be given careful consideration where frequent assemblies or compilations are made, especially in more advanced systems where short turnaround times are the order of the day. For example, two well-known FORTRAN compilers differ in this respect mainly by producing either "on-line" diagnostics or by listing all diagnostic messages at the end of the program. While the latter approach provides an esthetically pleasing print format, professional programmers prefer the former approach. Little things like these can contribute greatly to the better use of human beings (to apply a well-known remark of Norbert Wiener to programmers).

Quality of Documentation

In the past, availability of good documentation to accompany software packages has often been a problem. More and more, users find what they really need is "legal documentation" which "tells the truth, the whole truth, and nothing but the truth." For example, there is little more aggravating to the professional programmer than to have to resort to trial-and-error methods to determine program parameter limits. Also, the experienced user will certainly look carefully at existing documentation to determine whether or not it meets his needs.

Documentation of software packages can have several parts. First, there should be available detailed, flowcharted, and annotated documentation to describe the program code. An experienced user suspecting a program error in the source code can therewith often quickly track down the cause of his difficulties. Secondly, there may be programmers' reference manuals. As implied by the title, they serve as guides to the professionals, to refresh their memories, so to speak. Finally, there must be documentation intended for operational use. Here we expect a listing of the program parameters, their permissible values, operating instructions, error messages, recovery procedures, running times, etc. However, no matter how much documentation is supplied, large quantities of printed matter are only a poor substitute for quality documentation.

Testing of Software Packages

Testing of software packages and/or systems is, at best, a joint venture between hardware and software producers and their customers; at worst, a venomous battle between their respective legal departments. The magnitude of a thorough software test program is indeed enormous and in some cases it cannot really be completed for years. More recently, several manufacturers have developed quality assurance programs to test software packages. The test methods used are very similar to the earlier mentioned benchmark programs. However, we must remember that considerable manpower is needed to develop such programs and that the machine time needed to make these tests can run into hundreds of thousands of dollars. This hidden cost is often overlooked or ignored, both by the manufacturers and users. However, it should most certainly be incorporated into any plan for proposed or existing computer installations. More specifically, the personnel budget for every installation should provide for sufficient manpower to carry out a well-planned software maintenance program; in the case of "large" machines at least two persons should be doing this kind of work on a full-time basis. The requisite amount of computer machine time to perform this maintenance function should also be planned for in the budget; it could easily amount to several hours per day if the installation has many special requirements.

In the process of evaluating software packages, consideration should also be given to compatibility (of compilers, for example) and non-standard items. Extensive use of non-standard items can prove to be very troublesome in case of subsequent program conversions. Naturally, of even greater importance is the need to have the required software packages available WITH the delivery of the hardware. As a matter of fact, the software should be available at least half a year prior to the installation of the hardware, but this sort of availability is still considered rather radical by many.

The critical time span for software delivery can often be shortened by calling in one of the many excellent software houses. This course of action is especially recommended where special purpose software is concerned; for it is simply not realistic to expect that each and every manufacturer can deliver an unlimited number of comprehensive software packages or systems with every product-line machine. This constraint may also call for a compromise attitude on the part of the user, a willingness to employ efficiently only those packages or their parts which are tested and acceptable at the time of machine delivery. For example, if certain (small) features of a package are found to be inoperative, a user may well decide to "program around" them, while getting his emotional satisfaction from a prolonged legal battle, usually of questionable value.

In view of all our experience with software during the past decade, users are therefore well-advised to give careful thought not only to the selection of the hardware, but even more so to the problem of evaluating the software necessary to run their applications. Since many manufacturers are now offering multi-programming and multi-processing systems, this software evaluation MUST begin with the systems software (Executive Monitors, Time-Sharing System, Communications Processors, etc.); it must then extend to assembly programs, compilers (both batch and conversational), and all needed special purpose packages; and it should continue as part of the regularly scheduled work load, during the entire lifetime of the installation.

The design of such a program is obviously contingent upon a combination of the three ingredients which make for successful operations: Hardware, Software, and Brainware, with emphasis on the last so as to insure success with the first two elements.

INFORMATION: DILEMMA OR DELIVERANCE?

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"The technologist must become a man of the world. He must bring his thoughts and convictions into the broad public domain . . . persuasively, clearly, and broadly, to the extent that his influence can be felt by all men."

The evangelist and the technologist share, I think, the same ultimate goal: to improve the well-being of man.

The difference between the two lies largely in the degree of importance each attaches to an ultimate goal. For the evangelist "deliverance" and "salvation" are favored items; he holds close to himself the ultimate purpose of his life's work. For the technologist, those terms are fashioned most frequently in the abstractions of some distant time and place; he holds close to himself solutions to the seeming immediate "dilemmas" that impede his reach for near-term goals.

The evangelist works with traditional attitudes of the past, emotion, enthusiasm and group assent. The technologist relies on technical research, experiments, reason and individual effort.

Both are advocates: the evangelist promotes salvation through repentance and prayer; but the technologist works his accomplishments through mastery of his physical environment.

Persuasion, oratory, mass meetings, and an appeal to broad audiences are the tools of the evangelist. Logic, hypothesis, application of the scientific method, and appeal to specific audiences are the technologist's means of advancing his discipline.

And both can point to what they believe are positive results. Technology has as proof of its worth a massive number of products, devices, equipment, processes, and designs that have added to the economic, strategic and physical well-being of man. Evangelism has as evidence the conviction and zeal of its many believers.

(Based on a talk given at the Spring Joint Computer Conference, Boston, Mass., April 26, 1966)

The Information Frontier

Information is the last great frontier of man. Diligently gathered and freed from bias, it will fill gaping holes in man's knowledge. Carefully organized, it can serve virtually any human discipline. Readily available, it can be marshalled at the time decisions are to be made, rather than days, weeks or months later. Properly used, it can indeed become a *deliverance* from human ignorance and lack of knowledge. The efforts of those engaged in the new information technology have already pointed the way to the ability to gather, organize, and make information available with efficiency unimagined a short decade ago.

On the other hand, man is the ultimate user of information and information systems. And the *dilemma* that persists is that while the technical community works hard preparing the technology that will allow man to use data, it has disregarded the most critical need of all, the need to help people prepare for the task of adapting to that technology and effectively achieving the vast potential benefits which it opens to us.

The "Semantic Curtain"

In the 11 years that I have been associated with the computer industry, I have come to the conclusion that our technical profession lives behind a Semantic Curtain, a shroud of its own manufacture through which the outside world can seldom penetrate; but even worse, through which the ideals, convictions and values of our inner world emerge fitfully and only in part — if they emerge at all.

Like other curtains in the world — notably the Iron and Bamboo — this Semantic Curtain provides an effective barrier behind which exists a society apart from society. It contributes pressures, fears and anxieties at the same time that it contributes its steady stream of new products, processes and applications.

Behind the Semantic Curtain reside some of the world's best minds. Behind it are some of its most competent planners and thinkers. Behind it, too, are great ideas, ingenious solutions, sound programs. But by and large this society is preoccupied with its own ponderously constructed orthodoxy. It stands aloof. Alone. And limited in shaping its own destiny, for its spokesmen are few, its influence limited. It is a society that operates, as other curtained societies do, without understanding the need for human consent and commitment to its actions. In its own way, it is dictatorial, its people shackled by consuming allegiance to the Scientific Method.

Laissez-faire

A "language barrier" as real as any that exists in the world today separates this technocratic society from the remainder of society. And the tragedy is that little attempt is made to break down that barrier. No initiative is exercised to take a firmer hand in the direction of human affairs. Laissez-faire sums up the attitude of the group. It stands intransigent against demands by society for involvement.

This situation is compounded by other factors, to be sure. For one, technical people have been isolated by a protective cushion set up by the organizations that employ them — industrial, government, research and development groups and others. Also, their backgrounds, training and job demands often contribute more to introspection than extroversion.

Security and Frustration

The main result of the curtain is to produce both a sense of security and a sense of frustration. Security, because there is a basic demand for the technologist's skills that will lead interested bidders to great lengths to acquire them — as is evident, for example, by the vast number of recruiters who appear at every technical conference. Frustration, because he senses the limits of his growth despite the enticements offered for his services. He is a person at the mercy of many variables — a cancelled defense program, the threat of obsolescence of his skills, the vicissitudes of organization charts.

He has little hope of broadening his range of influence. If he chooses to speak, he often finds no one listening. If the right audience is there, his presentation — from lack of perspective and experience — is likely to be ineffective. Thus a stereotype describes many thousands of our technical people today. And thus we arrive at the essence of what I want to assert here:

• **The technical community must broaden its sphere of influence and concern.**

And in doing so, it might well adopt a few of the techniques of the evangelist. Technologists must learn to become persuasive. They must strive to communicate with greater clarity to broader audiences. Most important, they must become as adept at engineering human consent and commitment as they are at engineering new products and processes.

Active Role in Social Affairs

There is a critical need for the technical community of this country to take a more vocal and active role in social affairs. The factors that create that need are intensifying the pressure to fulfill it. Let us examine some of these factors, especially those related to the information sciences field, that will force technologists from their curtained chambers into the world at large:

Technological Change vs. Social Change

• **First, the rate of technological change is outpacing society's ability to react to it.**

It is clearly apparent that the mechanism for producing technological change is far more efficient than the mechanism to produce commensurate social change. We have clear methods and procedures for introducing new technology, but only the crudest mechanisms for cushioning the impact of that technology.

A splendid illustration of that fact can be seen in the newest brochure issued by the American Federation of Information Processing Societies, entitled *The Quiet Revolution: Computers Come of Age.* The opening line of the brochure asks the question: "What were you doing on the second Friday in April, 1946?" One sure answer for all of us in the computer field now, of course, is that we were not operating electronic computers. And therein lies the point, for in 20 short years ours has become one of the most important fields of human activity, with perhaps the greatest implications for society. And it is just one form of new technology.

Computers are superimposed everywhere. They make possible journeys to the stars at the same instant they provide mankind with the most efficient tools for his own destruction. They allow massive increases in the production of automobiles at the same instant they tally record numbers of highway deaths. They open new employment opportunities at the moment they snuff out or change the job content of other positions.

Automation Drop-Outs

Despite these technological facts of life, there is too little evidence of substantive social adjustment to them. In the vacuum created by sluggish social reaction to rapid technical change there has come into being too large a segment of the population bearing a new name — "automation drop-outs."

Our response to these social disruptions has been minimal. Just a few months ago, the National Commission on Technology, Automation and Economic Progress published a report on the subject that by its inconclusiveness — because of many factors — only served to underscore the currency and severity of the problems.

If this country continues to pursue technology headlong without developing a more sophisticated capacity to adapt society to it, we can safely anticipate more of these same problems on a vastly larger scale. This is not a neo-Luddite philosophy of fear. It is a candid view of a real situation.

As society advances, it inevitably causes shifts in values and emphasis. This leads to the **second** factor that will require of us a more vocal and influential role that is:

Participation in Human Affairs

• **Technology's unique stature in society requires greater participation in human affairs.**

The challenge we face in this whole matter is largely one of problem definition. What are the root causes of current social problems? Where do they stem from? What do they encompass? It is axiomatic in our business of information processing that the first need is to describe the problem, establish its parameters, and build the system needed to handle it. The effectiveness of the final system is measured by the quality of the initial problem definition more than by any other single factor.

The skills of problem definition, of breaking down a massive and nearly incomprehensible set of factors into component parts that can be attacked prudently and efficiently are skills we possess. They are not necessarily the skills of the political leader, of the social action proponent, of the labor boss or of the top business executive. They are skills of the systems technologist. These skills, guided by the thoughtful involvement of the nation's leadership, can and should be brought to bear on the problems of defining and implementing social mechanisms for change.

Data Systems for Social Change

Surely it is paradoxical that with all our talents for developing weapons control systems, missile systems, industrial process systems, business information systems, and the myriad other systems of our technologies that we have done so poorly in providing the data collection and analysis systems needed to abet social change. Are we incapable of devising such systems? I choose to think we are not.

The solutions to them must come from concerted action, not just by political and social leaders, but by technologists as well. The talents of this industry must somehow be applied to these problems. This can be done if you, the technologists, do it. Take some of your technology from the space program, from defense systems, from commercial environments, and apply it to the pressing needs of society. Equip yourselves with the organization and motivation required to attack such a monumental task. You have demonstrated continually your capabilities to achieve difficult objectives. Building mechanisms for enhancing social change is one of the most difficult of all. Your participation and viewpoint is needed, but lacking. Accept your role in overcoming these social problems that are partially the result of your talents, for, in fact, you will have no choice in the matter in the future.

The Social Niche of Technologists

It is true that technologists have held a special and separate place in our social system. The essential reason for this has been that, for the past 100 years, technology has been a vital factor in our social progress. It has been the whiplash of economic growth. But it has also become a victim of its own success, in the sense that by its commonness it has ceased to be a subject that inspires awe.

A fine summary of it is given by Dr. J. Douglas Brown, dean of the faculty at Princeton and a renowned economist:

"Over the past century, the United States has passed through four great overlapping swings in the predominance of the major factors which have given impetus to economic progress: (1) **Land,** from the earliest times, was the key to economic success for the individual and society; (2) **Capital,** with the Industrial Revolution which developed in the North in the 1850s and much later in the South, became the major stimulus; (3) First **Invention,** then **Technology** and later **Scientific Discovery** became the critical factors as industry was more highly developed; (4) A fourth swing is already gaining momentum and developing a new focus of interest and concern. This is emphasis on **Human Resources** and their effective organization. These will become critical elements in American development in coming decades."

Expanded Role in the Future

The fact is that technology's role, rather than contracting, will expand in the future. But the insular nature of its practitioners will undergo radical change. Rather than a society within a society, separated by a Semantic Curtain, the technical community will find itself involved in greater numbers of broad-based activities.

We see this happening in selected instances already. Systems, programming, simulation and applications experts are finding their ways into wide-vision management positions in government, industry, education and other fields. Their purely technical outlooks are being forced to adapt to these new responsibilities. This involvement is likely to spread rapidly in coming years into such fields as medicine, law, social sciences and local and state governments as supporting staffs for information systems evolve and mature.

It is essential then, whether this transition is measured in years or decades, that the technical community develop a generalist's viewpoint to complement its necessary technical outlook. Its characteristic "narrow window on the world" will provide inadequate peripheral vision for the years ahead.

You have the option of viewing your growing involvement in one of two ways: First, you can resist it and retain, for as long as progress allows, your present insularity. Or, you can assume a more influential role, and thus become an initiator of change and a contributor to the destiny of man.

If we accept Dr. Brown's thesis that the recent era of invention-technology-scientific discovery has served to pave the way for a new era — the era of developing human resources and organization — then I hope that we also can conclude that the technologist's role is indeed changing.

Gulf between Scientists and Non-Scientists

Several years ago during the centennial year of Mass. Inst. of Technology, the noted English author Sir Charles Percy Snow expressed one view of this matter by saying — in a statement heard round the world — that he feared that technological progress would eventually lead to a situation in which life-or-death decisions would one day be made by a small scientific elite "who do not quite understand what the depth of the argument is. That is," he said, "one of the consequences of the lapse or gulf in communications between scientists and non-scientists."

In the headlines that resulted from his statement, the full context of his remarks were lost. But I will repeat them now because they serve as appropriate emphasis for the **third consideration** which must cause you to re-examine the importance of broadening your roles in the world. And that point is:

- **Technology is already creating an environment for greater human understanding.**

Despite the Doomsday tone of his reported comments, Sir Charles also concluded by saying he was "not in the least pessimistic about our finding our way through these difficulties and dangers." He credited individual human judgment as being the key factor to a viable society, by saying: "There is no substitute for individual human judgment; and the wider it is spread, the healthier and more viable this society is likely to be."

The few years that have elapsed since those statements seem to have borne out Sir Charles' faith. For I think the danger of a scientific elite, if there ever was one, has largely subsided. The irresistible march of time his brought man to a point at which his social relationships are becoming larger and more complex. As human accomplishment moves closer to human aspiration, man is invariably called upon to make greater and more complex adjustments in his thought and action patterns.

Technology to Soften Change

Technology has come along to help in this matter. And rather than serving the few, it will serve all humanity in making these adjustments. It is a catalyst that can soften the harshness of rapid change, because it will allow us to become more thoughtful and to spend more time seeking for the intelligent answers which future progress demands.

Today we see change everywhere. New modes of transportation. Improved products at home, on the job, and during growing leisure-time activities. Expanded means of communication. An outpouring of services. But these represent only the superficial levels of change.

Technology as an Agent of Understanding

Beneath them lie the fundamental levels of changing attitudes, opinions, feelings, ideals and convictions that accompany any social evolution. Never before has the rate of change at either level been so precipitous, and never before has so much technology been mustered to meet it. Because of its diversity and capacity to meet these changes, I believe technology will go down in history more for its role as an agent of understanding in the world of tomorrow than for its impressive productive capacity in the world of today.

Technology in general frees man from his centuries-old preoccupation with working by the sweat of his brow. It subverts manual labor and substitutes more thoughtful activities. Information technology in particular brings new dimensions of useful and timely information. Thus technology opens new opportunities for man to understand and be understood by his fellow man. It will bring new broadness to viewpoints at the same time it destroys the clay idols of prejudice, parochialism and apathy.

As that occurs, every segment of our society will be affected. For the scope of technology has no single master, no tight elite which it will serve to the exclusion of others. It is the servant of all society, and as such will broaden the scope and depth of the "individual human judgment" which Sir Charles considers is so necessary to viable social relationships.

Technology Diminishing Prejudice

This is happening on broad fronts in the world today. While the incidence of political and prejudiced resistance remains substantial in many areas, it is nevertheless diminishing under the inexorable pressures of greater knowledge and understanding.

On religious fronts, for example, there is growing unity among like faiths as well as greater understanding, tolerance and communications among those with fundamentally different beliefs.

The barriers once erected by national origins have been torn down. A man's heritage used to be the controlling factor of his chance for success. Today this notion has been dissipated and we seek the knowledge of all capable individuals, regardless of race, color or creed.

On political fronts, Attila, Alexander, Caesar, Napoleon and more recently Hitler — to name just a few — interpreted power as military expansion and control over new territories, peoples and resources. The notion of co-existence, which has as its implicit hope peaceful solutions to political problems, never occurred to them. But today it exists as a fundamental policy of virtually every world power. Expansion of power is now the province of the cold war rather than the hot war. The battle is waged for man's minds more than for his body.

Technology in its many forms has contributed to each of these evolving world situations. Sophisticated communications, transportation, and weaponry have all played a role. In this context, where will technology eventually lead — except to continued evolution of man's understanding of man.

Technology Becoming Universally Available

Furthermore, technology must be a universally available tool. History has taught us that human invention is never long the exclusive domain of a specific individual or group or nation. This is eminently so of current technology.

While this country may lead in the abundance, quality and sophistication of technical capability, that lead is likely to diminish for several reasons:

First, the very openness of our society helps contribute to the world's fund of knowledge. Second, our economic base is no longer national, but international in dimension; products and processes developed here are shortly put to use around the globe. And third, one of the goals of our specific discipline — information sciences — is to increase the efficiency with which information is interchanged. We all know just how efficient that interchange is likely to become. And in view of the periodic meetings of the International Federation of Information Processing Societies, we have evidence that such information interchange is occurring internationally, at least among the technical communities of the world.

When we stop to consider that 25 per cent of all the people who have ever lived are alive today, the urgency of the need to broaden the world's technological capacity becomes clear. For only by equitable distribution of technology can we provide an equitable basis for mutual understanding.

Information Technologists

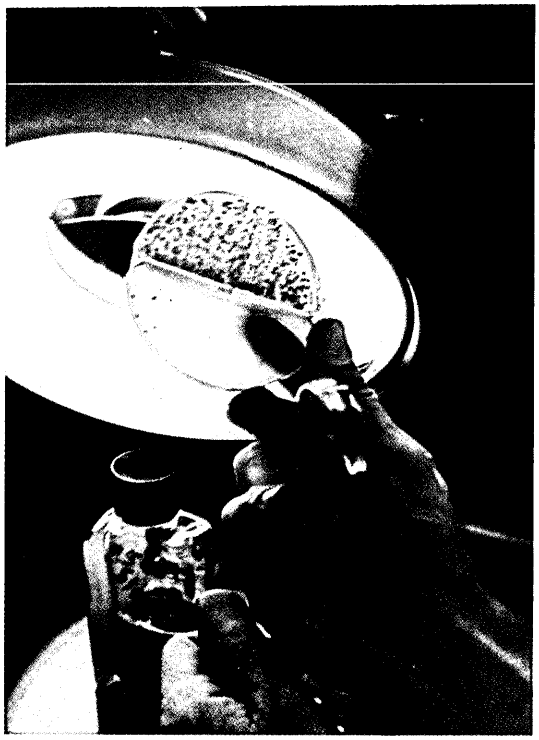
These three points emphasize the need for involving the technical community in the affairs of humanity to a greater extent than ever before. I recognize there are no simple solutions to the extremely complex problems that confront all society today. I recognize that no one group's voice can bring complete deliverance or resolve dilemmas. But it is the recognition of both of these truths which leads me to call upon the information processing profession to exercise a greater role in world affairs.

For there is another truth of equal urgency — and that is that, while no one group can solve all these problems, neither can any one group afford to be absent from the world court that is discussing them. As technologists, you have largely been absent.

Information technology is a part of all technology. It is not excluded from any discipline. It is not divorced from any world problem. It is not hemmed in by any boundary, or environment, or application. It is universal in its importance and effect. Being so, it can be wisely applied to aid in the process of deliverance, which Webster defines — succinctly — as "the act of delivering or state of being delivered . . . as from restraint, captivity or peril."

If ignored or casually applied, information can surely result in a dilemma, which is defined as "a choice or a situation involving choice between two unsatisfactory alternatives."

It seems to me we have no choice. Like the evangelist, the technologist must become a man of the world. He must bring his thoughts and convictions into the broad public domain. He must do this persuasively, clearly, and broadly, to the extent that his influence can be felt by all men, not merely in the manifestations of the products of technology, but in the changing ideas, attitudes and opinions to which he can make so great a contribution.




IBM

At Monmouth Medical Center, SYSTEM/360 checks in–checks out...

George Bartel, Hospital Administrator, has big plans for Monmouth Medical Center, Long Branch, New Jersey. That's why SYSTEM/360 is there.

Just a few weeks after its arrival, SYSTEM/360 took over patient billing, and went on to automate all administrative paperwork.

Nine more days, and SYSTEM/360 converted the process to direct-access disk files. An easy transition with IBM SYSTEM/360 Basic Operating System (BOS/360 for short).

After information is entered, it can be processed in microseconds.

This opens an entirely new realm of operations—a real-time Hospital Information System.

A complete information hookup is planned. Keyboard communications will connect SYSTEM/360 to vital areas—nurses' stations, X-ray, pathology, pharmacy and others.

New information can be entered immediately. Services ordered and validated. Treatments reviewed by instant printout. Drug control data displayed. Resources scheduled and allocated.

The goal—the most efficient use of facilities and time.

Monmouth Medical Center is growing. And SYSTEM/360 is ready to meet this growth, because the System's modular design makes it easy to expand, to solve more problems, to take on more information-handling chores.

Monmouth Medical Center likes its IBM SYSTEM/360.

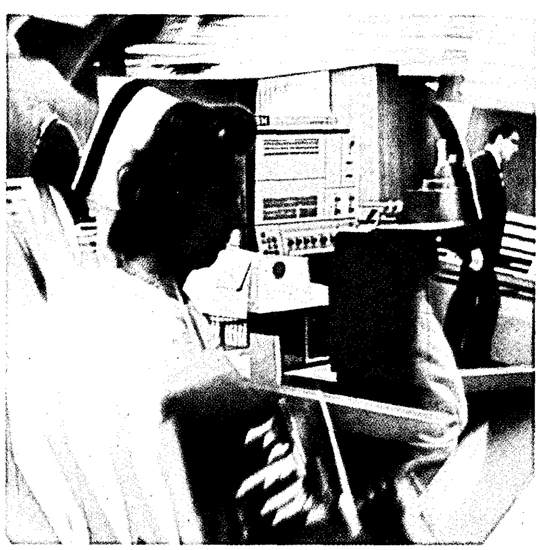
So do hundreds of other companies in all kinds of industries.

They like its performance, speed and versatility.

We think you will, too.

IBM®

and starts a new era.



ZIP, BUZZ, WHIR, CLONK: COMPUTERS BOTCH UP SOME OF THEIR JOBS

Lee Berton
Staff Reporter
The Wall Street Journal
New York, N.Y.

A theater fires its machine; a study calls humans faster; but who really is at fault?

NEW YORK — Blue-eyed Kate Brown is a lot prettier than a computer. There's no doubt about that. And there's some feeling that the 19-year-old blonde is a lot smarter than a computer, too.

At least she efficiently handled a job that a computer kept botching up — tackling seat assignments and subscriptions at Lincoln Center's Repertory Theater here. The leased computer, which was costing the theater $6,500 for a three-month season (Miss Brown earned $900), had so fouled up the assignment of seats for the theater's 39,000 subscribers that it took three months to straighten out the mess.

"We've learned nothing can replace personal contact with our subscribers," says Alan Mandell, the theater's general manager, in explaining why the machine was fired.

Lincoln Center is not alone in its preference for human help. A surprising number of discouraged computer users or would-be users are rediscovering the advantages of programing people rather than machines for many chores. The trend, of course, isn't likely to be the undoing of the phenomenal computer industry, but it does point up that computers aren't necessarily the be-all and end-all of the Twentieth Century.

No Thanks

"A computer just couldn't move fast enough to satisfy temperamental artists wanting their pay," says Robert Stringer, comptroller for the Metropolitan Opera House. He says he just rejected a management suggestion to computerize issuance of 1,000 paychecks weekly. Royal Office Supply Corp. of New York, which has 3,500 customers in the U.S., also has decided against use of a computer for billing because it probably would lengthen order-filling time, claims Samuel Schneider, manager of the order department. It now takes the company only one to two days to fill orders, he says.

When companies do decide to switch to computers from people, problems often abound. A recent letter to a complaining subscriber from U.S. News & World Report concludes "This is not an excuse, or alibi, but by way of explanation we recently converted to magnetic computer tape for our records. Some unfortunate things have happened in this conversion."

Hearst Corp., the publishing company, began converting its subscription service to computers earlier this year, and a clerk says: "Since we began going on computer, everything has really gotten fouled up and we now get up to 50 telephone complaints daily from subscribers."

A Short Hills, N.J., housewife has had an especially frustrating go-round with Hearst's *Good Housekeeping* magazine. Last January she sent a check for a two-year renewal of her magazine subscription, which still had 11 months to run. In February she received two issues, with a note saying her subscription now would expire in February 1968, 11 months before it should.

She sent back both her labels and a note. In March she received two copies. In April she received two copies. In May a toll call to *Good Housekeeping* elicited sympathy, but she received two issues again. She also received a letter from Hearst asking for both address labels again. She sent that, and received a third May issue followed by two June issues.

Says the Hearst clerk: "It was a lot better when we handled subscriptions by hand."

Is It Worth It?

"We have finally mastered how to use the computer and expect to be in the black this year, but we sometimes wonder whether it was worth it," says Michael Michaelson, president of Franklin Square Subscription Agency in Teaneck, N.J. The agency, which distributes 30,000 periodicals to 25,000 customers, installed a computer system to fill subscriptions in March 1964.

He says the system put the agency into the red in 1964 and 1965. "It cost $250,000, or five times our original estimate, to get our computer in working order and it raised our processing costs 10% to 12%," he says. He reports orders were delayed up to 12 weeks beyond normal.

Such delays are not uncommon. A study by the accounting firm of J. K. Lasser & Co. for two publishing trade groups

(Reprinted with permission from *The Wall Street Journal*, July 6, 1966, published by Dow, Jones & Co., Inc., New York, N.Y.)

discovered that publishers processing customers' requests manually or with simple billing machines took an average of four days to fill book orders while those with their own computers took five days and those using computer centers took seven days.

The computer companies, of course, say the delays and woes aren't the machines' fault. They ascribe the problems to errors of humans who operate the machines. In the Lincoln Center debacle, for instance, they note that the theater successfully used a computer system for two years, but when it moved uptown to a 1,089-seat theater from a 1,158-seat house they claim someone forgot to tell the computer.

"The computer in trying to give long-time subscribers the same or similar front-row seats just didn't have enough information to make the changeover," admits Alison Harper, the theater's subscription manager. But, she adds, "It also occasionally hiccoughed and made seat assignments more arbitrarily than a person who would look after pet customers."

Besides, says Miss Harper, "When Mrs. Jones writes in for theater tickets and says she is deaf in her left ear, a helpful clerk will seat her left of center so she can hear from her right ear, but most computer systems couldn't cope with this." And if they could, the "cost would be too prohibitive," she says.

Mr. Michaelson of the subscription agency also admits that human error is responsible for much computer woe, but he accuses computer company engineers of giving his company a lot of technical "gobbledygook" that prevented the agency's management from using sound judgment on which computer to buy in the first place.

Yet Mr. Michaelson is reasonably good-natured about his troubles. "The computer is a complete revolution in the ways of doing business," he says, "and as in any revolution some innocent people always get slaughtered."

CAPITAL REPORT

(Continued from page 15)

During the House hearings on computers, the problem of procuring software seemed uppermost in the minds of government witnesses. Harold Seidman, assistant director for management and organization in the Bureau of the Budget, said a high priority has been placed on the studies in the National Bureau of Standards of software evaluation.

"As these evaluation techniques are developed," he said, "it will be possible for the General Services Administration to determine whether or not the present methods of acquiring equipment software are in the government's best interests. A determination of whether or not new methods for acquisition are desirable must await the outcome of these efforts."

Seidman said GSA will also examine current pricing structures to see if the cost of hardware installation, training, technical service, and programming aids should be separated from the price of rental or purchase.

James Titus

JAMES TITUS

EDITORIAL

(Continued from page 7)

Basically there is always the same flaw in poor or wasteful applications of computers, and in application failures where computers are subsequently thrown out.

This flaw is the failure of a group of human beings to understand:

- What computers are good for, and what they aren't any good for at all;
- The ironclad necessity for correct programming, covering all the possible cases, more than most clerks encounter in 10 years of working at a job;
- The need for sensible trials on a small scale before operating on a large scale;
- The importance of investigating methods improvements that *do not use* computers.

When one man drives a car well for 5 years getting a great deal of useful service out of it, and another man drives exactly the same kind of car for 5 days, and then has an accident which demolishes the car, and sends him to the hospital, do we blame the car or the driver?

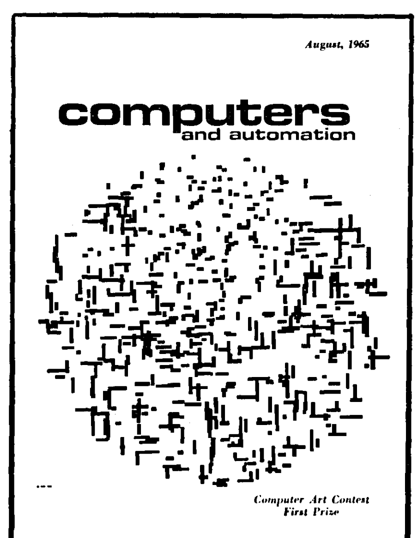
In rare cases it is actually a fault in the car, which the first man never encountered. For example, in certain kinds of freezing slush, in one type of car (now being repaired under manufacturer call-in), it becomes impossible to disengage the automatic drive forward, so that the driver can't stop and must hit something. (See also "Unsafe at Any Speed: The Designed-In Dangers of the American Automobile" by Ralph Nader, published by Grossman Publishers, New York, 1965, 365 pages.)

But in a great many cases it is fitting and proper to blame the driver.

The driver in the case of the wasteful or failing computer installation is the group of human beings in charge of it together with the group of human beings who sold and bought it. Clearly, they should have arrived at a better decision, which in such cases would have been "Don't try to use this computer with this management in this application."

Edmund C. Berkeley

EDITOR



c & a
THROUGHPUT

Reliable Industry Sources, Inc.

We have always felt that it might be important for us to have a subsidiary corporation with the name "Reliable Industry Sources, Inc." This would provide tremendous free publicity, and would really justify a consulting activity. At any time when you read: "According to reliable industry sources . . ." you would immediately think of our subsidiary and credit it with the information given.

We have been held back from this course of action by only one factor: in the data processing industry today there are almost no reliable industry sources (perhaps, a well-placed friend at the largest manufacturer). Thus it would be fairly rare to have a credit in the trade press to "reliable industry sources," or even to "industry cognoscenti" (to be eventually one of our other subsidiaries).

Seriously, however, it is a shame that our industry has not developed more official sources of information than it has. Here is a segment of the U. S. economy representing $10 billion in hardware, and close to $20 billion in personnel and supporting services; yet our industry lacks a central source of official information — usable in marketing, in policy-making, or in the establishment of better services for users.

Perhaps the dominance of one manufacturer is the main reason. At present, industry data and competitive data are closely guarded secrets. Only a limited amount of data can be guessed at or determined by a moderate amount of ordinary market research techniques. Industry associations have not been able to obtain the cooperation of data processing equipment manufacturers in releasing sales information. Also, the confidential nature of the application of many computers makes collecting information on personnel, programming languages, etc., difficult. It may however be possible for a concerted effort by users to overcome a large part of this lack of information.

It would be interesting to compare the views of readers and those of our proposed subsidiary "Reliable Industry Sources, Inc." In the accompanying table we have listed some significant industry statistics, and the estimates made by "R.I.S., Inc." Estimates by industry cognoscenti (not yet our subsidiary), are welcomed. Please send us your estimates or other statistics in comparable style.

Statistics	*"Reliable Industry Sources, Inc." Estimate*	*Your Estimate*
1. Number of digital, general-purpose stored program computers installed in the U.S., 1966	25,500	
2. Number of such computers installed outside U.S., 1966	14,800	
3. Number of such computers on order, U.S., 1966	12,600	
4. Number of such computers on order, outside U.S., 1966	11,400	
5. Number of systems analysts employed in the U.S.	110,400	
6. Number of programmers employed in the U.S.	182,000	
7. Total number of digital systems expected to be installed in U.S. by 1970	52,000	
8. Number of time-sharing consoles in use, 1966	2,700	
9. Number of time-sharing consoles expected to be in use in 1970	11,400	
10. Number of reels of magnetic tape in use in U.S., 1966	10,400,000	
11. Average rental per month paid by U.S. user	$10,400	
12. Average personnel costs for operating and data processing planning personnel per month.	16,700	
13. Analysts expected to be required for 1970 computer systems in U.S.	195,000	
14. Programmers expected to be required for 1970 computers in U.S.	200,000	
15. Most popular programming language, 1966, in U.S.	Autocoder	
16. Most popular programming language, 1966, outside U.S.	ALGOL	
17. Expected most popular language, U.S., 1970	A.P.L.	
18. Expected most popular language, outside U.S., 1970	COBOL	

The list can go on endlessly. Your suggestions are welcomed, and will be considered as if they were supplied by "Reliable Industry Sources."

Dick H. Brandon

Dick H. Brandon
Contributing Editor

"ACROSS THE EDITOR'S DESK"

Computing and Data Processing Newsletter

TABLE OF CONTENTS

APPLICATIONS

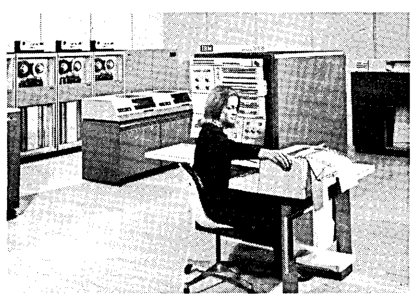
FBI DISCLOSES PLANS FOR NATIONAL COMPUTERIZED ANTICRIME NETWORK

The May issue of the FBI Law Enforcement Bulletin, circulated nationally among police agencies, announced formation of the National Crime Information Center (NCIC) in Washington, D.C., which will be the hub of a nationwide information network to make it harder for criminals to avoid capture. The NCIC will complement existing metropolitan and state systems. Some large cities will buy computers, which can be put to other uses. But small police departments will be able to join the national network with equipment that costs only $150 a month.

The computers or data terminals of the cooperating state and local agencies will be connected to the NCIC via leased telecommunication circuits. Law enforcement agencies throughout the nation will be able to file or obtain information on stolen property identifiable by serial number and also on wanted persons.

License numbers, automobile serial numbers, serial numbers of valuable parts such as engines and transmission for solen cars or cars used in felonies will be stored in the system. Similar files will be maintained on firearms or identifiable valuables such as office machines. Social Security number, fingerprint classification, FBI or police number, date of birth, height, weight, scars or marks of identification and any aliases or significant facts will be entered into wanted persons' files.

By January, 1967, when the NCIC is scheduled to begin operation, the states, local agencies and the FBI expect to have a common computer language for the system. An advisory group established by the International Association of Chiefs of Police is working with the FBI to establish this Uniform Crime Reporting System to integrate information from anticrime computers that are already operational in several states and metropolitan areas.



— Advanced computer system planned for the FBI Center.

"The planners visualize an ultimate information network encompassing the entire United States which will make available to each law enforcement agency, in a matter of seconds, the facilities of an information file national in scope," the FBI article said. "No longer will the mobility of today's criminal element afford a sanctuary, even temporary, as information will be readily available to any participant in the system concerning any criminal or criminal act regardless of geographic boundaries."

The NCIC computer complex will include: two IBM System/360 Model 40s; six IBM 2311 magnetic disk drives; and nine IBM 2400 series high-speed magnetic tape drives.

TRAVELERS' INSTALLS LARGEST REAL-TIME SYSTEM IN INSURANCE FIELD

The Travelers Insurance Company of Hartford, Conn., is turning to a real-time EDP system to cope with the tidal wave of paper work and statistical matter that threatens to engulf the fast-growing automobile insurance business.

Travelers has chosen a Univac 490 and a Univac 492 to serve as the core of what they call the "largest real time computer-communications system in the insurance industry and one of the largest non-governmental systems in the world." The two Univac computers will be replaced by two Univac 494's this summer. Working in conjunction with the Univac computers are 3 FASTRAND storage devices, each consisting of dual magnetic drums upon which information for up to 250,000 personal automobile policies can be stored. Travelers' officials estimate that 15 or 20 more FASTRAND's will be installed in the future.

Travelers' real time computer-communications system is serviced by a communications network supplied by Western Union which will connect some 56 field offices by the end of 1966. Each field office participating in the system (some will not participate immediately due to the type of auto policy forms in use in certain states) is initially equpped with a Friden Flexowriter and an IBM 1050 communications terminal. As the need for these devices in each field office is determined, more units will be added. Travelers' officials hope to eventually provide each broker with his own communications device. At present, many brokers are serviced by one field office, to which inquiries on customers are telephoned.

Utilizing a file of auto policies which is updated daily, Travelers' agents may receive answers to inquiries about the status of a customer's policy within 90 seconds. This same file permits Travelers' management to make statistical analyses with information which very accurately portrays the current state of the business.

While at present, only Personal Automobile Policies are being handled by the real-time system, Travelers envisions life, casualty, and other types of policies becoming a part of the system. Travelers also expects the real-time system, which was first conceived in 1962, to give them the ability to offer faster and more accurate service than other insurance firms, over whom they feel they have a 2-4 year lead time.

BELL TELEPHONE LABORATORIES AIDED BY COMPUTER IN STUDY OF INTERNATIONAL DIRECT DIALING

When a telephone user is able to dial a foreign country directly, will he be able to recognize that country's busy signal or ringing sound? Answers to this and other questions surrounding human reactions to international direct dialing problems are being studied, with the aid of an SDS 930 computer, by psychologists and engineers at Bell Telephone Laboratories, Murray Hill, N.J.

The subjects' reactions are important since telephone administrators of the United States and other countries are planning on customer-dialed international calls. Since the various signals used to indicate ringing, busy, etc. vary widely in various countries, Bell researchers are concerned about the customer's ability to identify these sounds. For example, in England the ring to a caller sounds similar to the busy signal in the United States, while in France the caller hears a series of ascending and descending tones while the call is being placed.

Dr. Michael A. Pilla of the Human Factors Research Group at Bell Laboratories said the SDS computer will be used to control simulation of signals such as busy and ringing, and will correlate the responses of subjects in various psycho-physical experiments. The SDS 930 computer will allow as many as three independent experiments to proceed simultaneously.

To study this problem before the new telephone service is offered, the engineers and psychologists of the Bell Telephone Laboratories Human Factors Research Group will generate signals representative of each country and present them to subjects who will indicate the degree of confusion presented by the signals. In a typical experiment, twenty subjects with regular handset telephones will sit in front of individual keyboards on which they will register their responses on hearing a tone controlled by the SDS computer. Keys for busy, ringing, etc. will be available in addition to keys providing a scale of value for certainty.

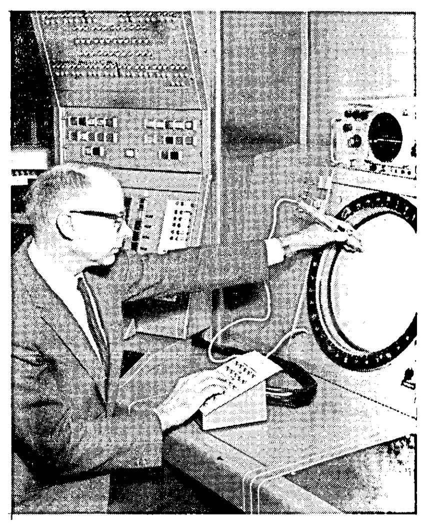
The SDS 930 computer will run the experiment by controlling the various tone generators to supply the proper signals in the correct sequence (program variable) and by automatically recording the subjects' responses. Hopefully, the results can be used to correct any potential trouble spots before the advent of subscriber international dialing.

DIAGRAMS DRAWN ON SCREEN READ BY COMPUTER SYSTEM

Pictorial material "drawn" on its screen is sensed and remembered by MAGIC (Machine for Automatic Graphics Interface to a Computer), a research tool developed at the National Bureau of Standards (U.S. Department of Commerce) in work co-supported by NBS and the National Aeronautics and Space Administration. James A. Cunningham, Don E. Rippy, Donald E. Humphries, and Paul Meissner designed the machine for investigation directed at facilitating man's two-way communication with computers and the operation of remote computer inquiry stations.

MAGIC's operator draws on the screen of the display device in somewhat the manner in which he would sketch a map for a fellow worker, with the assistance of computer operations for erasing, translating, rotating, adding additional information, and editing. The drawings created can be maps, plans, or schematic diagrams, for example. A completed drawing can be placed in the computer's memory and recalled for output or additional processing at a later time. This feature is of value for such applications as drawing routes on maps, charting courses, and mapping weather predictions. Capable of operating as a self-sufficient computer, MAGIC also can be used with other computers as an input-output interface with the operator.

MAGIC consists of a multisection, desk-type console forming a crescent before the operator. Visible to the operator seated at the console are a cathode ray tube (CRT) presenting the primary display, the "light pen" used with it, a secondary (passive) display, a keyboard input, and built-in and accessory control panels. NBS engineer Paul Meissner is shown in the picture below using the light pen to connect an added symbol to a schematic drawing obtained from machine memory. MAGIC circuitry is contained in the console (background).



The basic principle of MAGIC is that a curve can be represented as a series of points along a connected path on the display area. Each point can be described in terms of the values of its Cartesian coordinates and numbers corresponding to its display characteristics. Thus a curve can be described by three parallel lists of numbers giving successive values for two coordinates and the display characteristics.

A presentation can be obtained on MAGIC's primary display in three ways: a previously memorized figure can be obtained from the machine's memory, the operator can draw a straight-line figure by means of the light pen, or a drawing can be assembled from components in the machine's "library" of symbols. In the last method the positioning operations are used to manipulate components and the light pen to connect them.

The operator can not only position material; he can also shrink, expand, and rotate it. When the drawing has been edited to the operator's satisfaction, it can be returned to the machine's memory. The digital information also can be used to produce "hard" copy; this has been done by placing it on magnetic tape to drive an X-Y plotter.

MAGIC has recently been connected as part of a large automatic data processing system. This system consists of a MOBIDIC B twin computer and peripheral devices, including MAGIC. The system is being used in investigating time sharing, interfacing, and man-machine on-line techniques.

COMPUTERIZED REGISTRATION SYSTEM FOR LOS ANGELES PUBLIC LIBRARY

The continuing growth of the Los Angeles Public Library has made it impossible to continue operating with old fashioned techniques. Nearly 14 million books are circulated each year to some 800,000 individuals. While other libraries have been investigating and using computer technology in recent years, it is believed that the Los Angeles Public Library is the first to develop a fully integrated electronic data processing system. The new registration system is the beginning of a five-part program designed to improve the technical services which support the library.

The five-part program includes an automated ordering system to handle the more than one million dollars worth of books purchased each year; the ordering and controlling of more than 33,000 magazines and journals, some of them with as many as 100 subscriptions per title; cataloging of books with more than 17,000 different titles each year; an improved circulation system with a faster and more accurate notification process for persons with overdue library materials and a more vigorous follow-up with delinquents.

Under the new registration system, records of more than 800,000 library users are being maintained by the City's new IBM System/360 model 30. Library users who live in the City of Los Angeles and who remain in good standing will not have to re-register every three years as they have in the past. This will be a permanent lifetime registration. Persons who obtain Library Cards on any other basis will have to qualify every year. The new system will reduce the cost of issuing Library Cards and maintaining registration files, and will provide a new series of controls over library usage.

The system is expected to help reduce the loss of library materials through negligence or willfulness. Installation of the system has revealed that there is probably two million dollars owed to the Los Angeles Public Library by its users as of May 19th, and that more than 134,000 books have been checked out and never returned. Persons who owe substantial debts to the Library will receive a notice asking them to settle their account before they can obtain a new Library Card. This is a closer control than has been possible under past operations.

Each of the five elements of the program can function independently. The new registration system will operate as a separate unit until other systems are installed at which time they will be integrated to produce even greater benefits.

INSTANT CREDIT REPORT MADE POSSIBLE BY COMPUTERS

Computers "talking" to each other will soon be able to request and receive credit information within seconds on a nationwide basis, according to The Hooper-Holmes Bureau, Inc., New York. F. D. King, Vice President of the 67 year-old insurance, consumer and personnel reporting firm said, "The operation of the first computerized continent-spanning credit index will enable granters of consumer credit to reduce their bad debt rates, while speeding their debt rates, while speeding their decisions regarding credit applications."

The H-H Credit Index Division already numbers among its subscribers the major credit card and oil companies and many financial organizations and merchandise companies. "The credit records of these companies are stored in a computer system that is operative in our Morristown headquarters," said J. T. Borman, Vice President of the Credit Index Division, as he explained the amassing of information. "Leading companies in one industry after another added their credit records and shared the credit experience of all the others. It was early realized that a bad credit risk for one industry would be a bad credit risk for another."

Rapid transmission equipment will ultimately be installed in the firm's branch offices that are strategically located in the United States and Canada. Through these offices a subscriber may ask any one of the six regional computerized centers to search its filed credit records for the name of a credit applicant. Or a credit inquiry may be dispatched directly from a subscriber's computer, teletype, telephone or other transmission device. In each such regional center, computers designed to the company's specifications will store up to 15 million individual credit histories of the area that it serves. Each computer will be able to scan its entire bank of histories and make response within seconds after having received a credit applicant's name.

Expansion of industry and commerce information through the imaginative application of computers is highlighted by Mr. Borman's analysis that, "our business is one of the few that were started by the computer and not computerized later. The Credit Index Division, as Hooper-Holmes has established it, would not have been practical until the highly sophisticated computers of today were developed. We're not automating a business: The computer itself is the business."

Newsletter

NEW CONTRACTS

FROM	TO	FOR	AMOUNT
National Aeronautics and Space Administration	Sperry Rand Corp., UNIVAC Data Processing Div., Federal Government Marketing Department	Provision of a new computing system at Marshall Space Flight Center, Huntsville, Ala. — contract calls for lease of five UNIVAC 1108-II Multi-Processing computers with an option to buy	about $30 million
Government of India	Honeywell Inc.	Ten Honeywell 400 systems which will form first stage in establishment of government-wide computer processing network	over $7 million
Independent Exploration Co., Houston, Texas	Scientific Data Systems, Santa Monica, Calif.	Fifteen SDS Data Systems Series 1010 Geophysical Digital Recording Systems and two Series 1011 Trace Compositing Modules	over $1 million
U. S. Army	URS Corp., Burlingame, Calif.	Program in automatic data system design and implementation, concentrating on Army logistic and administrative functions adaptable to automatic data processing systems	over $2 million
Rome Air Development Center, Griffiss Air Force Base, N.Y.	Sylvania Electric Products Inc., Sylvania Electronic Systems, Applied Research Laboratory	Development of a technique which will increase the speed of electronic reading machines by eliminating many decision-making functions	$49,854
Sacramento Medical Foundation Blood Bank, Sacramento, Calif.	Lockheed Missiles & Space Co.,	A computerized blood bank control system to serve 43 hospitals in 12 counties	—
U. S. Army's Frankfurt Arsenal	California Computer Products, Inc., Anaheim, Calif.	Production of FALT computer logic testers and auxiliary equipment to be used for field testing of FADAC automatic artillery fire control system	$914,278
Elliott Automation Computers Ltd., Borehamwood, U.K.	Computers in Business Ltd., London, W.1.	Magnetic tape input/output software, sorting software, integrated job costing and payroll application for the Elliott 903	—
U. S. Army Electronics Command, Fort Monmouth	Philco Corp., Communications and Electronics Div., Philadelphia, Pa.	Additional equipment and services at overseas locations of AUTODIN, the Automatic Digital Network of the U. S. Department of Defense	$5 million
Electrologica, Rijswijk, The Netherlands	Informatics Inc., Sherman Oaks, Calif.	Design and manage implementation of a COBOL compiler for the Electrologica ELX8 computer	over $200,000
NASA's Marshall Space Flight Center, Huntsville, Ala.	Computer Sciences Corp., El Segundo, Calif.	Integration of Marshall Computation Laboratory computing equipment to fulfill the scientific, engineering and business data processing requirements of the center	$5.5 million
Air Force Western Test Range, Vandenberg AFB and Pillar Point Air Force Station	Informatics Inc., Sherman Oaks, Calif.	Computer programming services for implementing the Western Test Range, Radar Data Handling and Target Acquisition functions on Univac 1218 computers	over $50,000
Federal Aviation Agency	Philco Corp., Philadelphia, Pa.	Design, furnish and install visual display equipment known as Computer Update Equipment (CUE) used to update the data base in the FAA's Air Route Traffic Control Center at Jacksonville, Fla. and their experimental facility in Atlantic City, N.J.	about $1 million
United Aircraft Research Laboratories, East Hartford, Conn.	Sperry Rand Corp., UNIVAC Div.	A computer complex to be used in research projects — will include two Univac 1108s, one Univac 418 and seven Univac 1004 peripheral and remote systems	—
NASA, Manned Spacecraft Center	National Cash Register Co., Military Equipment Dept.	Development of printing device for use aboard spacecraft (possibly in Apollo program) — must be capable of printing high-accuracy data continuously for a mission up to 14 days in duration	$145,329
U. S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.	Itek Corp., Lexington, Mass.	Fabrication of a special stereo viewer for use by Army photogrammetrists and photointerpreters	$89,500
New York State Department of Education	System Development Corp., Santa Monica, Calif.	Testing administrative feasibility of a three-semester school calendar plan using a computerized scheduling system, MASTER (Matching Available Student Time to Educational Resources)	—
Telemax Corp., a subsidiary of Maxon Electronics Corp.	ARIES Corporation	Operating management of Telemax's $6 million computerized reservation service, Reservations Center; includes finalization of system design, programming of system and installation of equipment	$878,000

FROM	TO	FOR	AMOUNT
Boeing Company, Commercial Airplane Div. plant, Renton, Wash.	Bendix Corp., Industrial Controls Division	Rebuilding five spar milling machines and equipping them with numerical control systems	$2.3 million
National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.	Control Data Corp., Minneapolis, Minn.	Fixed-price contract to furnish large-scale computer complex; computers and associated equipment are expected to cost about $20 million	—
Control Data Corp., Minneapolis, Minn.	Computer Sciences Corp., El Segundo, Calif.	Designing and implementing a comprehensive COBOL '65 compiler for Control Data's Models 6400 and 6600 computers	—
General Dynamics, Electronics Div., Rochester, N.Y.	Ferroxcube Corp., Saugerties, N.Y.	Mass production of Core Memory Units to be used on the AUTODIN Program — over 2000 such devices will be delivered in an eighteen month period	—
The Paul Revere Life Insurance Co., The Paul Revere Variable Annuity Co. and the Massachusetts Protective Association, Inc., Worcester, Mass.	IBM Corporation	Installation of advanced computer system, System/360 Model 50, capable of examining and updating daily the records of more than 500,000 policyholders	about $1¼ million

NEW INSTALLATIONS

AT	OF	FOR	FROM
Pan American Petroleum Corp., Research Center, Tulsa, Okla.	Control Data 3300 computer system	Processing seismic data	Control Data Corp.
Fisher-Stevens, Inc., Clifton, N.J.	IBM 360/30 computer system	Satellite to firm's IBM 360/40	IBM Corporation
City of Norfolk, Norfolk City Hall, Data Processing Center, Norfolk, Va.	IBM System/360 model 30	Data processing functions of a number of city departments, including management of tax rolls	IBM Corporation
Department of Commerce, Washington, D.C.	IBM System/360 model 30	Provide American companies with business information designed to help expand their foreign trade	IBM Corporation
Consumers Power Co., Jackson, Mich.	IBM System/360	Expanding EDP program for better customer service, tighter operating control and engineering planning	IBM Corporation
Riviera Motors, Inc., Beaverton, Ore.	IBM System/360 model 30	Inventory control of 30,000 spare parts items for 65 Volkswagen dealers in Pacific Northwest and Alaska	IBM Corporation
First National Bank, Mobile, Ala.	IBM System/360 model 30	Internal records keeping and external customer service	IBM Corporation
Iona College, New Rochelle, N.Y.	IBM 1130 computer	Use as "electronic blackboard" in subjects ranging from psychology to mathematics, as well as for faculty research projects	IBM Corporation
Oregon State University, Computer Center, Corvallis, Ore.	Control Data 3300 computer system valued at about $½ million	Providing a substantial increase in facilities to serve the data processing requirements of the University	Control Data Corp.
Firth Sterling, Inc., Pittsburgh, Pa.	IBM System/360 model 30	Use in production control system and other related applications to provide base for management information system	IBM Corporation
U. S. Atomic Energy Commission, Brookhaven National Laboratory, Upton, L.I., N.Y.	Control Data 6600 computer system	Fundamental and applied research in the nuclear sciences and related fields	Control Data Corp.
Spector Freight System, Inc., Chicago, Ill.	IBM System/360 model 40	Computer-based total management information system	IBM Corporation
AROCA, Inc., Portland, Ore.	IBM System/360, model 40	Keeping track of 100,000 U-Haul trailers and trucks (AROCA, Inc. is the accounting clearing house for the U-Haul system)	IBM Corporation
Service Bureau Corp., New York, N.Y.	IBM System/360 model 50 it	Expansion of data processing facilities at Madison Avenue Computer Center	IBM Corporation
Commercial Airplane Div., The Boeing Co., Renton, Wash.	Control Data 6600 computer system	Scientific data processing	Control Data Corp.
Wayne Oakland Bank, Royal Oak, Mich.	NCR 315 system	Demand deposit servicing	National Cash Register Company
Citizen's National Bank, Muskogee, Okla.	NCR 315 system	Demand deposit and installment loan processing	National Cash Register Company
Worcester Polytechnic Institute, Worcester, Mass.	EAI 680 Analog/Hybrid Computing system	Use by undergraduate and graduate students in the Electrical Engineering Dept.	Electronic Associates, Inc.

AT	OF	FOR	FROM
Harvard University, Cambridge, Mass.	EAI 680 Analog/Hybrid Computing system	Use by graduate and undergraduate students in conjunction with courses offered by the division of Engineering and Applied Physics; also will be available on "open shop" university wide basis as a research tool	Electronic Asso-
Lutheran Brotherhood, Minneapolis, Minn.	IBM System/360 model 40	Key element in long range plan for achieving fully automatic insurance data processing system	IBM Corporation
University of California, Santa Barbara, Calif.	IBM System/360 model 50	Implementation of advanced research and instructional system	IBM Corporation
Massachusetts Institute of Technology, Cambridge, Mass.	Control Data 5360 Miniature Integrated Circuit Computer	Use by MIT Instrumentation Laboratory as part of a flight inspection positioning system under development for the Federal Aviation Agency	Control Data Corp.
Eagle Rubber Co., Inc., Ashland, O.	IBM System/360 model 20	Standard accounting and billing applications and management reporting	IBM Corporation
Curtis Industries, Inc., a div. of the Curtis-Noll Corp., Eastlake, O.	IBM System/360 model 20	Control of 9000-item inventory in Eastlake, Richmond (Calif.) and Toronto (Canada) warehouses	IBM Corporation
Centre-File Ltd., Gillet House, London, E.C.2	IBM System/360 model 40	Providing a comprehensive data processing service for stockbrokers	IBM Corporation
Greve and O'Rourke, Inc., Los Angeles, Calif.	IBM 1130 system	Providing architects with fast solutions to engineering problems; also handling all of company's accounting and will soon be used as management control system	IBM Corporation
National Bureau of Standards, Computer Sciences and Technology Center, Gaithersburg, Md.	Control Data 3100 Computer	Provide internal processing capability, as well as contract usage by other Federal agencies	Control Data Corp.

COMPUTING CENTERS

LAW RESEARCH SERVICE, INC. USES WESTERN UNION'S COMPUTER CENTER

Western Union recently announced the first customer use of its national information utility computer system — a real-time, or instant-response, legal citation service offered by Law Research Service Inc. (Law Research Service, Inc., has the business and le legal responsibility for providing the citation service while Western Union provides the national communication and on-line computer retrieval system.)

The new nationwide computerized law research service, serving subscribers coast-to-coast, will use the computer facilities in Western Union's Information Services Computer Center in New York. An LRS subscriber will have access to the central computer by using Western Union's Telex network and a dial-equipped teleprinter. In addition, the subscriber will be able to obtain normal Telex service over the same teleprinter.

The new legal citation service is being offered, initially, to lawyers and others in 10 states and the District of Columbia through the directors of 83 area offices in these states (New York, New Jersey, Connecticut, Massachusetts, Pennsylvania, Maryland, Florida, Georgia, Texas, and California). Services in other states will follow as additional representatives are appointed.

The first service covers Federal law citations relating to patents, copyrights and trademarks. Citations from the body of law of 12 states are being added to the central computer and additional states will follow at the rate of about one state every two weeks. LRS president, Ellias C. Hoppenfeld, said, "When our citation file is completely programmed we expect it will provide more than a half-million coded references on all pertinent federal and state cases."

CENTRALIZED, COMPUTERIZED CREDIT REPORTING CENTER

An unprecedented joint venture of 33 local credit bureaus, with 16 million individual credit records, in Arizona, Southern Nevada and Southern California, will create a major new centralized and computerized credit information center in Los Angeles, according to a recent announcement. The announcement was made by Eugene S. Mikkelson, San Bernardino, who will serve as president of Computer Reporting Systems, Inc., the service company organized by the sponsoring bureaus. The center is expected to become operational by October, 1966, on a modified basis, with full conversion and functioning expected about one year later.

Each of the 33 local credit bureaus will continue its traditional function of complete local service supplemented by this central information source. Inquiries to CRS will be made by customers of any of the 33 bureaus merely by dialing a toll-free local telephone, which will be connected by leased wire to the computer center. There, an operator, working with automatic equipment, will read off the desired credit report flashed instantly on a TV screen in front of her.

Full credit information on almost any resident of the 154,000 square mile area will be provided within 90 seconds at a cost of less than 75 cents. With all 33 credit bureaus being members of the Associated Credit Bureaus of America, they also will continue to have quick nationwide access to credit information from that organization's 4100 other members.

DATA PROCESSING CENTER OF THE FIRST NATIONAL BANK IN FORT COLLINS

The First National Bank in Fort Collins (Colorado), realizing that there was a definite need in the Northern Region of Colorado for a modern data processing facility to accomplish service bureau work, installed an NCR-315 computer system in November 1965. Today the bank has one of the most modern and complete data processing facilities in Colorado, which is doing not only the bank's own processing, but also the processing of many outside firms.

Present applications include: demand deposit accounts; term savings; marketing analysis; municipal billing and statistics (water/sewer and electrical); lumber yard accounting; and bulk sale of computer time to CPA firms. Among the projected applications are data line transmission for banks and for inventory and production control.

The bank's NCR system includes an NCR-315 100, 10K memory; 5 tape drives; a PPT reader; a high speed printer; and a sorter-reader. Prior to the installation, the majority of all data processing was handled in Denver.

UNIVERSITY COMPUTING SETS UP LARGE-SCALE HOUSTON/AUSTIN COMPUTER FACILITY

University Computing Company has established a major computer facility with offices in Houston and Austin, Texas, Sam Wyly, president, announced. The Houston office is equipped with a Univac 1004 computer, while the Austin office will have a new Univac 1108 large-scale computer which will be in operation August 15. As an integral part of the Houston/Austin center there will be data transmission lines between the two offices.

Like the Univac 1107 which UCC purchased last winter and which has been operating in Los Angeles, the new Austin office's 1108 will be able to receive computing problems directly from customers or other UCC computer centers via telephone lines and return the solutions over the same circuits. It also will do work brought into the center by mail or messenger. The 1004 (Houston) will be used primarily to process problems for transmission over telephone lines to the Austin office for computation and return. Before Austin's August 15 opening, the Houston office will transmit problems to UCC's Univac 1107 facilities in Huntsville, Ala.

EDUCATION NEWS

PILOT PROJECT FIVE IN MATHEMATICS

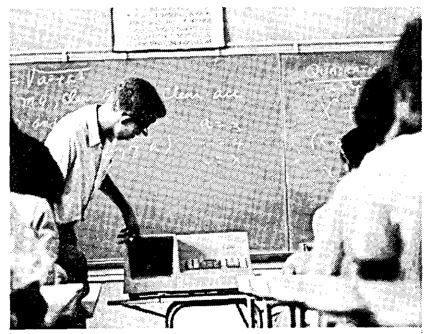
Students in six junior and senior high schools in the Watts area of Los Angeles (Calif.), participating in a major two-month pilot program, have learned to use a desk-top digital computer in their study of mathematics — with results already termed by local educators as "successful and immensely rewarding." The program — called Pilot Project Five in Mathematics — was carried out by the Los Angeles Board of Education under the direction of Dr. Thomas O. Lawson, using funds made available by the federal government under Title I of the Elementary Secondary Education Act (ESEA).

The purpose of the pilot program was three-fold: (1) to heighten the basic skills of studnets in mathematics at various levels of proficiency and achievement; (2) to open the door to new and broadened vocational areas ranging from computer programming to key punch operation; and (3) to inspire some students to seek careers in the field of computing science.

The Wyle Scientific, a desk-top computer designed and manufactured by the Products Division of Wyle Laboratories, El Segundo, Calif., was selected for use in the project. Choice of the Scientific was based on several factors, including the computer's simplicity and ease of operation, and its use both of a screen which shows what is happening step-by-step as the student solves a problem, and of uncomplicated programming cards which can be punched with an ordinary ball-point pen, a stylus, or any other pointed object.

Under the supervision of Seymour Lerner and Joella Gibson, both of the Secondary Mathematics office, division of Secondary Education of the Los Angeles School system, six of the Wyle Scientific computers were leased at the beginning of April. In several of the schools, the computers were incorporated into regular classroom work. In others, the computers were made available to students before classes in the morning, during the lunch hour, and after regular school hours. Weekend workshops in the use of the computer also were held for teachers at the schools and a final seminar was held at Wyle Products Division headquarters.

Mr. Lerner and Miss Gibson reported that student response during the two month project was "one of great enthusiasm and intense interest." They added: Attendance at classes was so high that some schools had standing room only for use of the computer, while others had to schedule the use of the computer carefully to accommodate all of the students who wanted to use it. Beyond that, we have had —



— A student in a high school classroom solves a problem in mathematics using a Wyle Scientific desk-top digital computer.

and are still receiving — phone calls and letters from parents telling us how the program has changed the attitudes of their children not only toward school, but toward learning itself."

Plans now are under discussion to make the "computer experiment" a permanent part of the mathematics curriculum for junior and senior high schools in the Watts area, and subsequently, throughout the Los Angeles District school system.

NEW PRODUCTS

Digital

SIGMA 2 COMPUTER ANNOUNCED BY SDS

Sigma 2, a small, low-cost, real-time computer for scientific, engineering and process control applications, is being announced today (August 2) by Scientific Data Systems, Los Angeles, Calif. Sigma 2, featuring multiprogramming and multiprocessing capabilities, is the second real-time computer in the new SDS family of Sigma machine. Sigma 7, a medium-priced computer, was announced in mid-March.

Sigma 2 features input/output rates of over five million bits per second, internal memory speeds of 900 nanoseconds, re-entrant software for optimized foreground and background data processing, a priority interrupt system identical to Sigma 7, byte organization of memory, and extensive use of monolithic integrated circuits. Sigma 2 may be used as a local or remote satellite processor for Sigma 7 systems; it may operate out of a Sigma 7 memory, or may be used as a stand-alone, general purpose, real-time computer. The Sigma 2 input/output interface is identical to Sigma 7, enabling all Sigma peripherals to be operated on either machine.

The modular memory of Sigma 2 is expandible from 8192 to 131,072 bytes (4096 to 65,536 words), (16-bits plus parity) in blocks of 8192 bytes (4096 words). Sigma 2 is the only small computer in which a 65,536-word memory may be directly addressed. All central processor operations in Sigma 2 are performed in an integral number of half-cycles with a main magnetic core memory speed of 450 nanoseconds for each half-cycle.

Modular programming systems for Sigma 2 include Basic Control Monitor, FORTRAN IV compiler, real-time compiler, real-time monitor, basic and extended assemblers, and a library of mathematical and utility programs. Software will be available when the first Sigma 2 computers are delivered early next year.
(For more information, designate #41 on the Readers Service Card.)

PDP-8S TO BE ANNOUNCED

Digital Equipment Corporation of Maynard, Mass., is planning to announce its new computer, the PDP-8S, this month. Initial sales will be made to system houses for process control and instrumentation systems for resale to end users.

The PDP-8S computer will have an 8 μsec memory cycle. The circuits are DEC Flip-Chips, using regular and hybrid circuitry components. Logic organization of the 8S is a serial set-up, rather than the parallel processing available on the PDP-8. All software available on the PDP-8 will be available for the 8S, including a Fortran compiler and an assembly program. Advanced peripherals for the new computer, such as magnetic tapes, and card equipment will not be ready until next year.

The basic PDP-8S — processor, 4K memory and teletype terminal — will sell for under $10,000. Sales directly to end user will not be made until next year.
(For more information, designate #42 on the Readers Service Card.)

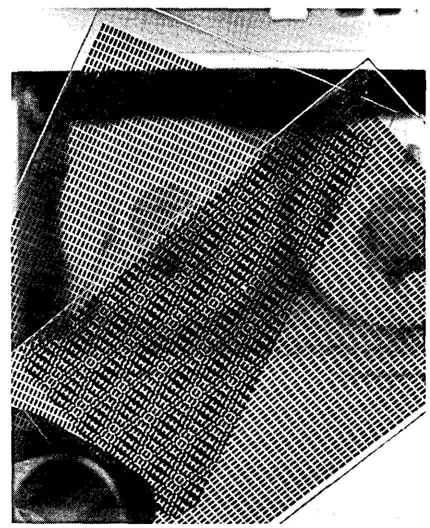
BURROUGHS THIRD GENERATION B6500 COMPUTER

Ray W. Macdonald, Burroughs Corporation president, has announced the new third generation B6500 electronic data processing system. In announcing the B6500 he emphasized, "the software for this system, which has been proven in operational use, is ready <u>right now</u>." The B6500 is equipped for "true multiprocessing, parallel processing, and real-time and time-sharing operations," he said. (Within the Burroughs 500 Systems, the B6500 fits between the medium-sized B5500 and the giant B8500.)

The new system's central processor utilizes monolithic integrated circuits throughout. The ultra-fast thin film main computer emmory, developed and manufactured by Burroughs, has a cycle time of 600 nanoseconds and is expandable from 16,384 words up to 106,496. The word length is 48 information bits plus two special purpose bits.

Hardware elements of the new system work in conjunction with the system's key software element, the Master Control Program, which is a comprehensive automatic operating system used by the computer in controlling its own operations. Macdonald asserted that this working combination of hardware and software elements, as perfected by Burroughs, makes the new B6500 the fastest and most powerful general purpose computer in its price class by a considerable margin.

Peripheral units available with the B6500 include line printers, card readers, card punches, paper tape equipment, magnetic tape units with up to four tapes each. Adjuncts for the new computer include a large capacity, high-speed, "head-per-track" disk file secondary memory system and a wide range of data communications capabilities.



— The planar thin film memory surfaces in the main memory of the new B6500 are only 1/1000th as thick as a human hair. Each contains 3072 storage spots on which information bits are deposited.

The first complete systems will be delivered in the first quarter of 1968. Purchase prices of the new system will begin at about one million dollars with leases beginning at about $22,000 per month.
(For more information, designate #43 on the Readers Service Card.)

GE-115 EXPANDED

Major expansions in the memory and speed of the small-scale GE-115 computer have been announced by General Electric Company, Phoenix, Ariz. The GE-115, Model II, features up to twice the memory capacity of the Model I, and nearly 20 per cent the processing speed.

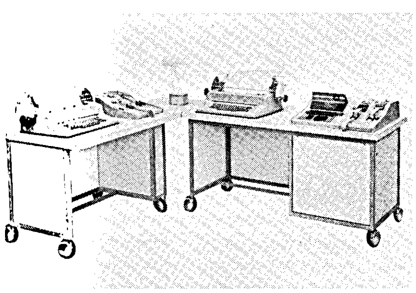
In addition, the General Electric Information Systems Marketing Operation announced that it will offer the GE-115 as a free-standing computer. Previously it had been marketed solely as a remote terminal for larger G-E computer systems.

The GE-115, Model II, is being offered for delivery beginning in April, 1967. The GE-115, Model I, is being offered on an eight-month delivery schedule.
(For more information, designate #44 on the Readers Service Card.)

PDS ACCOUNTANT'S COMPUTER

A compact new computer to perform accounting functions has been announced by Pacific Data Systems (a subsidiary of Electronic Associates, Inc.), Santa Ana, Calif. Designed for accounting firms with 40 or more clients, the machine is a full-scale digital computer that automatically executes all of the normal tasks of preparing monthly or quarterly financial statements.

Charts of accounts, journals, trial balances, general ledgers, balance sheets, statements of income, and payroll compensation reports in addition to W-2 and 941 forms are prepared in less than an hour. No special training is required for the operator.



— PDS Accountant's Computer

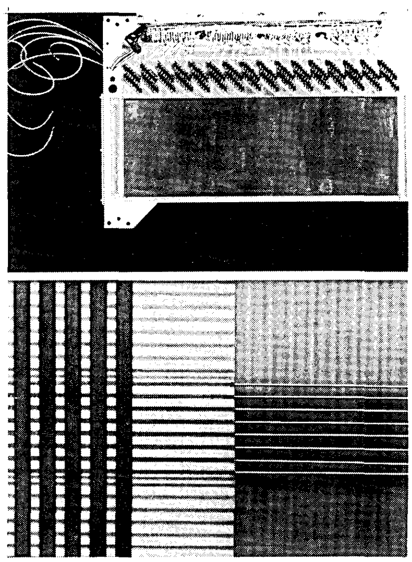
Completed statements are automatically typed out by a high speed, ball-type electric typewriter, on bond paper with the firm's letterhead. The appearance simulates a personally hand-typed statement typed in upper and lower case, with full punctuation.

There is also ample capacity for the computer to take on additional functions such as Accounts Receivable, Accounts Payable, Payroll, Job Costing, and Internal Record Keeping. The PDS Accountant's Computer may be purchased or leased.
(For more information, designate #45 on the Readers Service Card.)

NEW 9000 COMPUTER SERIES ANNOUNCED BY UNIVAC

In its largest multi-product introduction in more than five years, Sperry Rand Corporation's UNIVAC Division has announced the establishment of a new series of integrated computers that will span the small, medium and large-scale data processing market. The first members of the new 9000 computer series are the UNIVAC 9200 and UNIVAC 9300. (Also announced was a modern 80-Column Punched Card line.)

The UNIVAC 9200 and 9300 are the first two systems in the UNIVAC 9000 series of compatible computers featuring a unique plated-wire memory and monolithic integrated circuits. The 9200 is a low-cost system designed for card users moving up from punched card equipment to a computer. The 9300 is a fast and flexible system designed to serve as a high performance punched card, magnetic tape computer or as a satellite to a larger data processing system.



— Plated-wire memory panel, above, has capacity of storing 4096 bytes of information on each side. Lower photo is a closeup of the plated wires each of which is five-thousandths of an inch in diameter.

The basic plated-wire memory in a UNIVAC 9200 provides twice as much storage, 8192 bytes, as most comparable competitive systems selling for approximately the same cost. Its memory cycle time is 1.2 microseconds.

The UNIVAC 9300 card and magnetic tape system has a memory cycle time of 600 billionths of a second. As a high speed tape computer, the 9300 can operate within a wide range of business, institutional and scientific applications.

Complete programming compatibility exists among each of the 9000 series systems including the soon-to-be-announced UNIVAC 9500 medium-scale system.
(For more information, designate #46 on the Readers Service Card.)

Analog

INDIVIDUAL INVESTMENT COMPUTER

An individual, desktop investment computer for under $500 has been introduced by The ISEC Corporation, Princeton, N.J. The computer, the ISEC-250, is the first solid-state analog computer inexpensive enough for the small investor. Designed to program over 1000 stocks, it requires no special knowledge or skill to use, and will program and evaluate any stock in less than one minute.

Individual stock prices and market data are obtained from the investor's daily newspaper and fed

into the ISEC-250. The computer electronically considers a stock's current price in relation to its historical evaluation, its earnings and earnings growth rate, the market trend and the relationship of the stock to the market as a whole.

First year testing, which established a model fund for analysis, resulted in profits of 44 per cent, excluding commissions and reinvestment of profits. President of ISEC, Fredrik J. Ranney, stated, "We consider the first year's testing results and its 44 per cent profit margin remarkable. The small investor now has at his command a sophisticated computer that enables him to re-evaluate his holdings on a daily basis, not at fixed intervals as is usually the case. His findings are based on current figures, using up-to-date data obtained from his own daily newspaper."

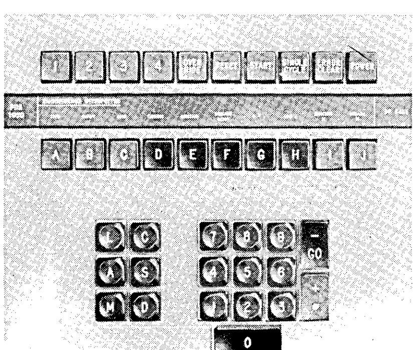
Deliveries of the ISEC-250 will begin in about 60 days. Initial production is scheduled at 35 units each month.
(For more information, designate #47 on the Readers Service Card.)

Software

NEW SOFTWARE PACKAGE FOR PDS 1020 DIGITAL COMPUTER

A new improved software package for their PDS 1020 digital computer has been developed by Pacific Data Systems, Inc., Santa Ana, Calif. Called the PR 5461 Engineering Interpreter, this new package is a recent development and improvement over the original PDS engineering interpreter. It is a program punched on paper tape, and entered through the machine's high speed tape reader. It transforms the PDS general purpose digital computer into a powerful, easy-to-use, engineering and scientific computer.

Once the machine has been programmed, the operator can enter data through the keyboard using everyday mathematical terms. Special functions such as square root,



e^x, sine, $\log_e$, cosine, and arctangent can be performed by simply pushing the appropriate button.

As an additional feature, PR 5461 enables the operator to use the machine's typewriter as an x, y plotter. With this capability, a graphical solution as well as a numerical solution can be obtained for a given problem.
(For more information, designate #48 on the Readers Service Card.)

SYSTEM/360 ALGOL LANGUAGE COMPILER

IBM Corporation has announced a new program to support users of ALGOL (ALGOrithmic Language) when they convert to IBM's System/360. The program — a System/360 ALGOL language compiler — will help translate a user's ALGOL programs into System/360 machine language. The compiler will aid users who exchange a large number of programs with European installations, where ALGOL is employed much more frequently than in the United States.

The System/360 ALGOL compiler, which is scheduled to be available in the third quarter of 1967, will run under Operating System/360 control programs. When completed, it will meet standards of the European Computer Manufacturers Association (ECMA) and the International Federation for Information Processing (IFIP).
(For more information, designate #49 on the Readers Service Card.)

CPM PROGRAM FOR GE-115

The General Electric Information Systems Marketing Operation (Phoenix, Ariz.) has announced a high-performance CPM (Critical Path Method) program now is available for the small-scale GE-115 information processing system. With a minimum configuration — a 4K central processor, printer, card reader, and card punch — the GE-115 CPM program can schedule 350 events. With an 8K central processor, it can handle 1350 events.

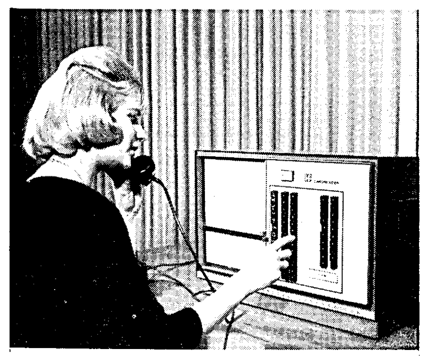
Activities may be arranged in sequence or numbered at random. In sequence, the program requires only two passes of the data cards through the GE-115 system; in random order, three or more passes are required. Either mode requires the setting of only one console switch.

The output produced by the program is a standard CPM schedule of events. Through the use of an auxiliary program and summary decks produced by the CPM program, the system also is capable of producing Gantt charts.
(For more information, designate #50 on the Readers Service Card.)

Information Retrieval

PUSHBUTTON RANDOM ACCESS SYSTEM STORES 67,500 MICROFILMED PAGES

A new development from Houston Fearless Corp., Los Angeles, Calif., called the FilmCARD Reader (patent pending), gives 4-second access to any page in a total file of 67,500 microfilmed pages. The desired record, selected by pushbuttons on the control panel, is located and displayed full size on a screen at the front of the Reader.



This latest model of CARD (Compact Automatic Retrieval Display) system is a desk top, self-contained microfiche reader. The device contains a file of up to 750 filmcards (microfiche), each of which contains 90 microfilmed pages, providing a total of 67,500 pages of information. Any amount of additional file storage can be contained in magazines external to the machine and be quickly interchanged with identical magazines in the Reader.

The FilmCARD Reader is made operational by plugging it into a standard 115-volt, 60-cycle, AC outlet. Overall size is approximately 16" high, 22" wide, and 21" deep.

In addition to the standard model, custom models can be furnished to meet specific applications. Special features available include a printer for hard copy output, COSATI and NMA formats, increased internal capacity, and numerous others.
(For more information, designate #51 on the Readers Service Card.)

Data Transmitters and A/D Converters

DATA COMMUNICATION RECEIVER TERMINAL FROM TALLY

A new business communication receiver, the System 200, has been designed to effect a one-third purchase price reduction over an earlier model without sacrifice of quality, it has been announced by Tally Corporation, Seattle, Wash. "On a two-year monthly rental basis, the cost of this receiver has been cut in half," said Russell C. Dubois, Tally president.

The receiver features simple operation at asynchronous speeds up to 60 characters per second (600 words per minute) and is designed for consistently reliable reception of parallel data over ordinary telephone lines with a Bell System 402-D or equivalent data set, he added.

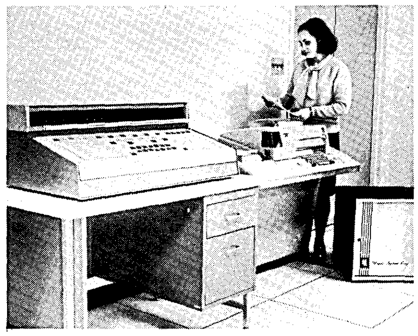
Dubois said that the desk console System 200 is the first of a full Tally line of data communication receivers to benefit from engineering improvements which will increase performance and reduce costs. Tally Systems 220 and 228 will be introduced this summer and will offer automatic unattended operation plus optional error detection and correction equipment. (For more information, designate #52 on the Readers Service Card.)

SIMULCOM^T, TELETYPE COMMUNICATION SYSTEM

The first communications system to allow all stations in a teletype network to operate simultaneously over a single voice grade circuit has been introduced by Ultronic Systems Corp., New York, N.Y. The system, called SIMULCOM®, introduces a new concept in low-cost character multiplexing techniques, operates over voice grade lines and uses standard teletype equipment. By using a specially designed ULTRONIC® Local Control Unit in each station, the system provides direct line accessibility for each station on minimum level voice grade lines.

A single SIMULCOM network leg can tie together, in series, up to twenty 100 wpm stations over a wide geographical area on a single pair of voice grade lines. By using voice grade lines, SIMULCOM can decrease the number of lines in a typical existing network by a ratio of 4:1 while providing the equivalent of a 16-fold increase in transmission capability.

Equipment requirements for the SIMULCOM® simultaneous teletype communication system includes (from left to right in the picture) a central console unit for installation at the central office, a



standard 100-word-per-minute teletype unit for each station and central control monitoring, and an ULTRONIC® Local Control Unit for installation at each station location (the Central Control Unit at the main office is the same in appearance and size). Not shown are the DATA PUMPS® (about the size of a telephone) which would be installed at each station.

The message is generated by the 100 wpm teletype unit. From here it is processed in the Local Control Unit where the data is buffered and inserted into an outgoing message train before being converted into two high-frequency tones by the DATA PUMPS for transmission. The data is then processed through a third generation, real-time switching computer and instantly routed to the proper station. Incoming messages are processed in the same way — the high-frequency tones are demodulated by the DATA PUMP, then processed by the Local Control Unit and printed out on the teletype unit. Alternate SIMULCOM systems are available for non-computerized networks.
(For more information, designate #55 on the Readers Service Card.)

G-E ANNOUNCES LOW-COST DESK-TOP DATA SET

General Electric's Communication Products Department, Lynchburg, Va., has announced it will market a new low-cost desk-top data set that converts pulses of binary serial data from peripheral business machines into FM signals for transmission over leased wires or microwave. The new communications interface equipment, called the GE-TDM 210, is the first of its type offered by General Electric. It serves as an economical modulator-demodulator for data transmitted with FSK modulation techniques at speeds up to 1800 bits per second.

The set plugs into a 117-volt receptacle at the desk location and then interconnects with the data terminal and telephone circuit by wire. It is compatible end-to-end with Bell 202D data sets and meets EIA digital interface standard RS-232B.

The voice channel can be over cable, open wire, carrier telephone or microwave radio. Through conservative use of the channel, TDM-210 can handle data reliably over telephone networks using FCC Tarriff 260 Series 3000 Channels, as well as other voice frequency transmission facilities having comparable specifications.

Designed primarily for one-way or two-way transfer of information between digital computers, TDM-210 also may be used in a wide variety of other data applications, including telemetering and facsimile. (For more information, designate #54 on the Readers Service Card.)

Input-Output

GE DEVICE READS OPTICALLY AS WELL AS MAGNETICALLY

General Electric has announcea that it will provide new optical document reading ability for its computer systems installed in banks and other financial institutions. A new device, capable of being added to already installed General Electric MICR document handlers, enables them to read documents optically as well as magnetically.

A new type font called COC-5 can be printed on continuous forms and documents with a slight addition to standard G-E printers. As a result, documents generated by a G-E computer can be entered directly into the computer system automatically. This eliminates the present procedure of punching cards or tapes in order to re-enter information into a bank's computer system. The new device can be adapted to present General Electric document readers, thus providing current G-E bank installations with added operating economies without an equipment change.

Documents with COC-5 type font printed on them can be processed at the same time as E13B magnetic font on the same document handler, whether on a batch-fed or intermixed basis. The magnetic and COC-5 reading heads operate simultaneously, so that if both type fonts appear on the same document, sorting and recording proceed as though only a single font were being read. The new COC-5 technique operates at more than twice the reading and sorting speed of most optical-type reader/sorter systems.

The new font consists of 10 numerical characters and a special character for formatting and field-separation. It is easily readable by both machine and human. It is printed by standard 1200 lines-per-minute G-E computer printers which can use a fabric ribbon. The COC-5 kit rents for $580 a month and first delivery will begin in January 1967. It is available for most G-E general-purpose computers of the GE-200 and 400 series.
(For more information, designate #56 on the Readers Service Card.)

POTTER SYSTEM, MODEL PS-6020

A new, off-line printer system developed by Potter Instrument Company, Plainview, N.Y., is designed to relieve general purpose computers of the burden of routine printing operations. The low-cost printer system, PS-6020, offers the high print quality characteristics of a chain printer, together with program and format flexibility.

The central computer prepares the magnetic tape in suitable format, e.g., one complete printer line per tape record, with blank filling wherever required. Tape format is IBM compatible, 7 channel, 200, 556, or 800 bpi, or 9 channel, 800 bpi.

The Potter Chain Printer operates up to 600 lpm and provides significant advantages over drum-type printers. These include readily interchangeable type fonts, and greatly increased reliability. Up to 192 different characters can be provided on the print chain for specialized applications.
(For more information, designate #57 on the Readers Service Card.)

ADVANCED LINE OF 80-COLUMN PUNCHED CARD EQUIPMENT FROM UNIVAC

A new and advanced line of 80-column electronic punched card equipment has been announced by Sperry Rand Corporation's UNIVAC Division, New York, N.Y. The new line, composed of a Key Punch, a Verifier, a Sorter and an Interpreter, was designed specifically to provide high-speed automatic production, to furnish a new level of operating convenience and efficiency, and to complement UNIVAC equipment.

Among the features common to both the Key Punch and Verifier are magnetic core storage of data and program, fast error correction and quick-change automatic programming. Additional benefits for the user are a compact, movable 67-character keyboard, providing centralized control, and a lighted column indicator. Both the Key Punch and the Verifier have an ample work surface measuring 44 inches by 16 inches.

The Key Punch can duplicate any card automatically at the rate of 60 cards per minute. Both single card and quantity duplication are possible.

The new UNIVAC 2001 Card Sorter has programmed sorting at the rate of 1000 cards per minute of any combination of 13 in the full 64-character code in a single pass, and 14 output stackers facilitating alphabetical sorting.

UNIVAC's new 80-Column Card Interpreter interprets the 64-character card code. This machine prints each character in a single line directly above the corresponding column at the rate of 40 columns per second, and skips at 140 columns per second.

The new line will be available for delivery in approximately nine months.
(For more information, designate #58 on the Readers Service Card.)

J. H. BUNNELL & CO. ANNOUNCE NEW PRODUCTS

Three new products announced by J. H. Bunnell & Co., Brooklyn, N.Y., include a jumbo motorized unwinder, a puller/winder combination, and a new fully automatic tape winder.

The new jumbo motorized unwinder (Bunnell Model 4-200) fits the need for larger sized unwinders. The device takes a 14" tape that feeds from the center core so that tape always reads in the proper sequence. It feeds up to 1200" of tape per minute of 12,000 characters per minute.

The new Bunnell puller/winder combination can take 11/16", 3/4", 7/16" or 1" tapes on the same reel. Because of its speed (approximately 10¼' per minute) this puller/winder is particularly useful for high speed tickers as well as data processing, teletype, automatic type setting, business machines and automation applications.

The fully automatic tape winder (Bunnell Type 3-15) can be used with 10½" or 12" reels and with tape widths of 11/16", 7/8" or 1". A new feature allows the wound tape to be pulled out for re-examination. The motor (mercury switch controlled) can be stopped or started when tape is either loose or taut without tearing tape.
(For more information, designate #59 on the Readers Service Card.)

MODEL 1311 DISPLAY/RECORDER

The Model 1311 Display/Recorder, developed by the Data Handling Department of Straza Industries, El Cajon, Calif., has been designed for use with small and medium size computers. This has been achieved by a simplification of the logic system and by elimination of some of the automatic features found on the Model 2101 Printer/Plotter.

The 1311 utilizes a 16" CRT (P-7 phosphor) for visual display of up to 2048 alphanumeric symbols. Smybols can be placed at any of 1024 x 1024 random locations on the screen or the equipment can be commanded to operate in an increment mode, where symbol follows after symbol in much the same way as a typewriter operates. The display is equipped with a Light Pen which can detect a symbol or a single point on a plotted curve. Its output pulse enables the computer to identify the address and selected symbol and it is then possible through subroutine programs to utilize this knowledge in many different ways. A Manual Interrupt push-button also can be used with subroutines in order to skip to the next frame or to switch over to recording. (Recording takes place on 35 mm microfilm — 16 mm is an option — at the rate of more than 6 full frames per second.)

A considerable amount of software has been generated and is made available to 1311 users at no extra charge.
(For more information, designate #61 on the Readers Service Card.)

SEALECTRO INTRODUCES STATIC CARD READER

A new static card reader capable of reading 960 bits of information from a standard 12 x 80 IBM data processing card has been introduced by Sealectro Corp., Mamaroneck, N.Y. The Sealectro 1280 static card reader features remote electrical contacts which are actuated by mechanical sensing of the punched hole in the card. This prevents electrical failures caused by paper lint building up on contact surfaces. As a safety feature to prevent erroneous readings, each card must be properly oriented when inserted, in order for the unit to operate. When the reading has been completed, the card is automatically ejected from the reader.

The card reader is available with a choice of terminations including a push-on connector, rather than the usual solder terminations. The device is compact (3½" x 10½" x 6") and is designed to provide maximum repeatability of the process to save time in programming.
(For more information, designate #60 on the Readers Service Card.)

BUSINESS NEWS

IBM NET BACKLOG PUT AT $3.9 BILLION

Computer market analysts were recently treated to several significant disclosures by IBM on the size and nature of its EDP business. The disclosures were made in the prospectus accompanying the recent offering to IBM stockholders of 1,324,136 common shares of IBM at a subscription price of $285/share . . . the net proceeds of the offering to be used principally to finance the manufacture of 360 computer systems for rental to customers.

Probably the most significant disclosure in the prospectus is that on March 31, 1966 IBM had orders on hand for the lease or purchase of data processing machines and systems having a net monthly rental value or equivalent of approximately $78 million, after deducting estimated replacements of installed rental equipment and estimated order cancellations. This $78 million figure represents the net increase in the total monthly rental value of installed IBM data processing equipment when the backlog has been worked off. Using a 50-to-1 purchase to rental price ratio, this backlog represents a potential net increase of $3.9 billion in the sales value of IBM computers installed.

Some of the other business disclosures in the prospectus include:

*Rental and sale of electronic and punched card data processing machines and systems accounted for $2.75 billion in 1965, 77% of IBM's total gross income.

*Approximately 20% of all IBM data processing equipment installed and in use worldwide have been purchased outright by customers or their agents.

*IBM World Trade Corp., which manufactures and markets IBM products outside the U.S., accounted for 30.4% of IBM's gross revenue in 1965, compared to 22.6% in 1961, and 27.5% in 1963. At the current time it also accounts for 32.9% of the total net property account.

*At the end of 1965, World Trade had more than 60,000 employees in 321 sales offices, 218 service bureaus, 15 manufacturing plants, six development engineering laboratories and other facilities in 102 countries around the world.

*Approximately 85% of the components and machines marketed by IBM World Trade are manufactured outside the U.S.

*IBM employs approximately 55,000 salesmen, systems engineers and customer engineers throughout the world, of which approximately 32,000 are employed by the Corporation in the United States, its territories and possessions.

*The super-scale 360/90 series, a limited production model, has been plagued with production difficulties on its high-speed integrated circuits. This will result in some delivery postponements, as well as an inventory loss estimated at $15 million.

*As of March 31, IBM facilities totaled 21.5 million square feet, of which 16 million were owned and 5.5 million were leased. At that time it had under construction 3.5 million square feet of manufacturing and development facilities scheduled for completion in 1966 or early 1967.

*Capital expenditures, principally for data processing maines, but also for new plants and manufacturing equipment that IBM makes and leases to customers totaled $1.2 billion 1965 and $3.7 billion for all five years ending December 31, 1965. For each of the years 1966 and 1967, IBM expects to "substantially exceed" the expenditures made in 1965.

*As of the end of 1965, IBM had rental machines and parts on hand and in customer locations with a cost value of $3.32 billion. Estimating a cost-to-sales ratio of 28%, this means that IBM had rental machines and parts on hand worth $11.8 billion as of December 1965. This figure includes typewriters, dictating equipment, spare parts, etc., as well as computers, peripheral equipment, and tab gear.

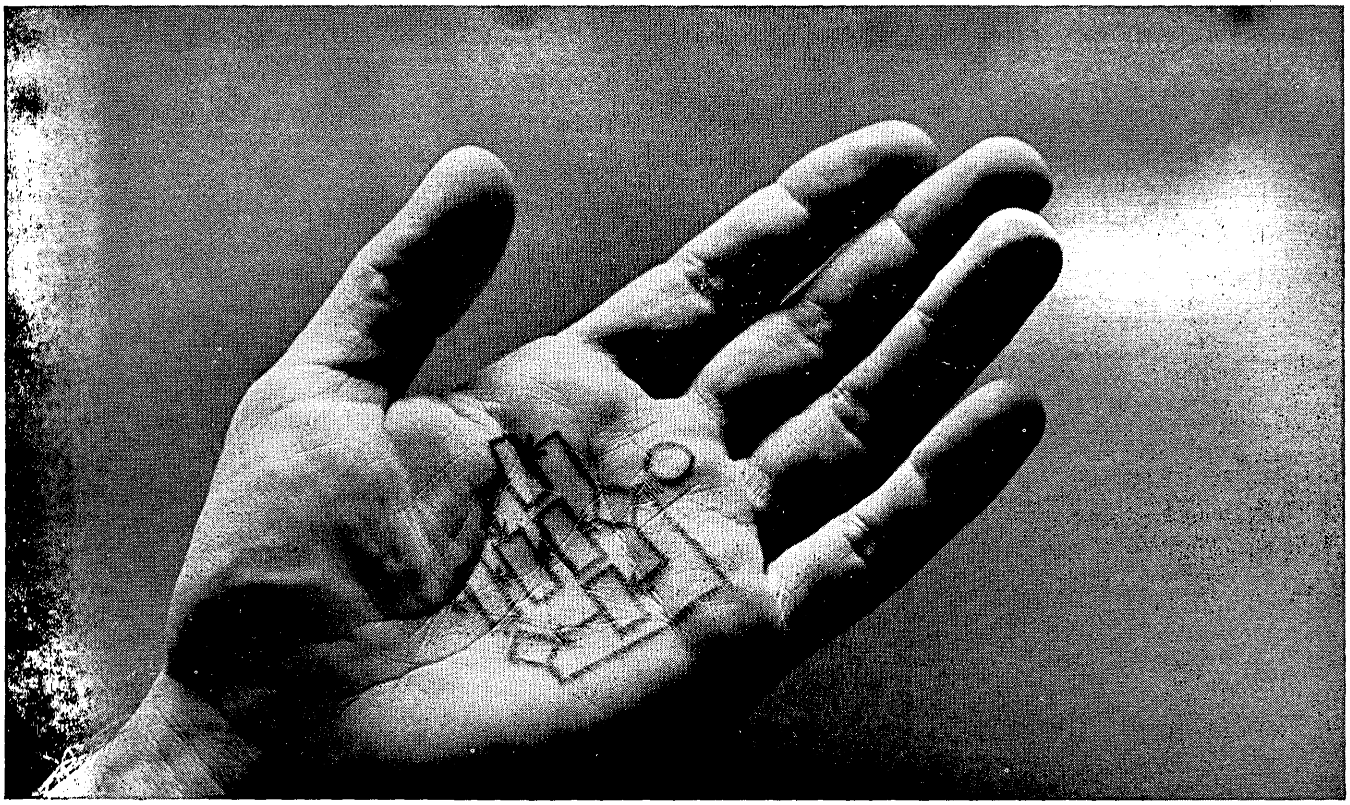
RCA REACHES RECORD SALES

Sales and earnings of the RCA set all-time records during the second quarter and first half of 1966, with sales exceeding $1 billion at mid-year for the first time in the company's history, Robert W. Sarnoff, President, reports.

Profits after taxes for the six months ended June 30 rose 27 per cent to $56 million from the previous first half high of $44 million a year earlier.

First half sales rose 18 per cent to $1.15 billion from the previous high for the period of $978 million set the year before. Sales volume in the second quarter totaled $567 million, up 14 per cent from the $495 million in the comparable three months of 1965.

Mr. Sarnoff noted that the RCA Spectra 70 computer line, supported by enlarged production facilities, responded vigorously to an increasing demand in the electronic data processing market during the first half of 1966.



MONTHLY COMPUTER CENSUS

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

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

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

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

AS OF JUNE 10, 1966

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Advanced Scientific Instruments	ASI 210	Y	$3850	4/62	25	0
	ASI 2100	Y	$4200	12/63	7	0
	ADVANCE 6020	Y	$4400	4/65	9	5
	ADVANCE 6040	Y	$5600	7/65	4	5
	ADVANCE 6050	Y	$9000	2/66	2	6
	ADVANCE 6070	Y	$15,000	10/65	2	6
	ADVANCE 6130	Y	$1000	11/66	0	3
Autonetics	RECOMP II	Y	$2495	11/58	42	X
	RECOMP III	Y	$1495	6/61	10	X
Bunker-Ramo Corp.	BR-130	Y	$2000	10/61	160	4
	BR-133	Y	$2400	5/64	20	3
	BR-230	Y	$2680	8/63	15	X
	BR-300	Y	$3000	3/59	36	X
	BR-330	Y	$4000	12/60	34	X
	BR-340	Y	$7000	12/63	20	X
Burroughs	205	N	$4600	1/54	49	X
	220	N	$14,000	10/58	40	X
	E101-103	N	$875	1/54	142	X
	B100	Y	$2800	8/64	145	20
	B250	Y	$4200	11/61	95	4
	B260	Y	$3750	11/62	224	8
	B270	Y	$7000	7/62	153	12
	B280	Y	$6500	7/62	128	15
	B300	Y	$8400	7/65	79	90
	B2500	Y	$5000	1/67	0	26
	B3500	Y	$14,000	5/67	0	20
	B5500	Y	$22,000	3/63	51	10
	B6500	Y	$33,000	2/68	0	2
	B8500	Y	$200,000	2/67	0	1
Computer Control Co.	DDP-24	Y	$2500	5/63	70	8
	DDP-116	Y	$900	4/65	58	30
	DDP-124	Y	$2050	3/66	16	18
	DDP-224	Y	$3300	3/65	25	20
Control Data Corporation	G-15	N	$1600	7/55	310	X
	G-20	Y	$15,500	4/61	23	X
	LGP-21	Y	$725	12/62	120	X
	LGP-30	semi	$1300	9/56	125	X
	RPC-4000	Y	$1875	1/61	55	X
	160*/160A/160G	Y	$1750/$4000/$12,000	5/60;7/61;3/64	450	5
	924/924A	Y	$11,000	8/61	29	X
	1604/1604A	Y	$45,000	1/60	59	X
	1700	Y	$4000	5/66	6	80
	3100	Y	$7500	12/64	74	35
	3200	Y	$12,000	5/64	90	X
	3300	Y	$15,000	9/65	12	40
	3400	Y	$25,000	11/64	19	X
	3500	Y	$30,000	9/66	0	10
	3600	Y	$58,000	6/63	50	2
	3800	Y	$60,000	2/66	3	12
	6400	Y	$50,000	5/66	2	14
	6600	Y	$85,000	8/64	14	9
	6800	Y	$130,000	4/67	0	4
Data Machines, Inc.	620	Y	$900	11/65	6	32
Digital Equipment Corp.	PDP-1	Y	$3400	11/60	60	X
	PDP-4	Y	$1700	8/62	55	2
	PDP-5	Y	$900	9/63	112	1
	PDP-6	Y	$10,000	10/64	19	4
	PDP-7	Y	$1300	11/64	69	50
	PDP-8	Y	$525	4/65	290	275
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	20	X
Electronic Associates, Inc.	8400	Y	$7000	6/65	4	6
Friden	6010	Y	$600	6/63	420	80
General Electric	115	Y	$1375	12/65	90	520
	205	Y	$2900	6/64	46	X
	210	Y	$16,000	7/59	50	X
	215	Y	$6000	9/63	56	X
	225	Y	$8000	4/61	214	X
	235	Y	$10,900	4/64	62	5
	415	Y	$7300	5/64	155	72
	425	Y	$9600	6/64	63	46
	435	Y	$14,000	10/64	27	18
	625	Y	$45,000	12/64	15	28
	635/645	Y	$55,000	12/64	9	31
Honeywell Electronic Data Processing	H-120	Y	$2600	1/66	90	300
	H-200	Y	$5700	3/64	770	110
	H-400	Y	$8500	12/61	120	X

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Honeywell (cont'd)	H-800	Y	$22,000	12/60	86	3
	H-1200	Y	$7300	2/66	8	50
	H-1400	Y	$14,000	1/64	12	1
	H-1800	Y	$35,000	1/64	19	4
	H-2200	Y	$13,000	1/66	6	46
	H-4200	Y	$20,500	6/66	0	9
	H-8200	Y	$35,000	3/67	0	3
	DATAmatic 1000	N	$40,000	12/57	4	X
IBM	305	N	$3600	12/57	160	X
	360/20	Y	$1800	12/65	200	6500
	360/30	Y	$7500	5/65	1200	4200
	360/40	Y	$15,000	4/65	740	1700
	360/44	Y	$10,000	9/66	0	500
	360/50	Y	$26,000	8/65	44	650
	360/52	Y	$55,000	11/65	1	X
	360/65	Y	$50,000	11/65	10	110
	360/67	Y	$75,000	9/66	0	55
	360/75	Y	$78,000	2/66	5	45
	360/90 Series	Y	$140,000	6/67	0	9
	*650	N	$4800	11/54	220	X
	1130	Y	$1200	11/65	275	3700
	1401	Y	$6600	9/60	6600	300
	1401-G	Y	$1900	5/64	1550	60
	1410	Y	$14,200	11/61	775	110
	1440	Y	$4800	4/63	3050	425
	1460	Y	$9000	10/63	2000	130
	1620 I, II	Y	$4000	9/60	1700	50
	1800	Y	$7600	1/66	15	275
	701	N	$5000	4/53	1	X
	7010	Y	$22,600	10/63	195	30
	702	N	$6900	2/55	7	X
	7030	Y	$160,000	5/61	6	X
	704	N	$32,000	12/55	36	X
	7040	Y	$22,000	6/63	118	12
	7044	Y	$32,000	6/63	130	18
	705	N	$38,000	11/55	58	X
	7070, 2, 4	Y	$27,000	3/60	335	X
	7080	Y	$55,000	8/61	80	X
	709	N	$40,000	8/58	11	X
	7090	Y	$63,500	11/59	45	1
	7094	Y	$72,500	9/62	122	4
	7094 II	Y	$78,500	4/64	124	10
Monroe Calculating Machine Co.	Monrobot XI	Y	$700	12/60	500	100
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	X
	NCR - 310	Y	$2500	5/61	20	X
	NCR - 315	Y	$8500	5/62	410	30
	NCR - 315-RMC	Y	$12,000	9/65	35	25
	NCR - 390	Y	$1850	5/61	1130	25
	NCR - 500	Y	$1500	10/65	425	850
Philco	1000	Y	$7010	6/63	20	X
	2000-210, 211	Y	$40,000	10/58	18	X
	2000-212	Y	$52,000	1/63	11	X
Radio Corporation of America	Bizmac	N	$100,000	-/56	2	X
	RCA 301	Y	$7000	2/61	647	4
	RCA 3301	Y	$17,000	7/64	50	14
	RCA 501	Y	$14,000	6/59	99	X
	RCA 601	Y	$35,000	11/62	5	X
	Spectra 70/15	Y	$3500	9/65	45	110
	Spectra 70/25	Y	$5000	9/65	25	70
	Spectra 70/35	Y	$9000	11/66	0	70
	Spectra 70/45	Y	$15,000	11/65	8	130
	Spectra 70/55	Y	$30,000	7/66	0	15
Raytheon	250	Y	$1200	12/60	175	2
	440	Y	$3500	3/64	14	3
	520	Y	$3200	10/65	10	6
Scientific Control Systems	650	Y	$500	4/66	0	3
	660	Y	$2000	10/65	3	2
	670	Y	$2600	5/66	1	2
Scientific Data Systems Inc.	SDS-92	Y	$1500	4/65	45	40
	SDS-910	Y	$2000	8/62	175	12
	SDS-920	Y	$2900	9/62	118	10
	SDS-925	Y	$3000	12/64	17	20
	SDS-930	Y	$3400	6/64	112	30
	SDS-940	Y	$10,000	4/66	3	14
	SDS-9300	Y	$7000	11/64	25	8
	Sigma 7	Y	$12,000	12/66	0	20
Systems Engineering Labs	SEL-810	Y	$1000	9/65	20	9
	SEL-840	Y	$1400	11/65	3	4
UNIVAC	I & II	N	$25,000	3/51 & 11/57	28	X
	III	Y	$20,000	8/62	82	1
	File Computers	N	$15,000	8/56	18	X
	Solid-State 80 I, II, 90 I, II & Step	Y	$8000	8/58	270	X
	418	Y	$11,000	6/63	80	40
	490 Series	Y	$35,000	12/61	98	65
	1004	Y	$1900	2/63	3350	120
	1005	Y	$2400	4/66	25	200
	1050	Y	$8000	9/63	290	50
	1100 Series (except 1107)	N	$35,000	12/50	11	X
	1107	Y	$55,000	10/62	30	2
	1108	Y	$65,000	9/65	9	28
	LARC	Y	$135,000	5/60	2	X
				TOTALS	34,362	23,251

X = no longer in production.

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

NEW PATENTS

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

The following is a compilation of patents pertaining to 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.

December 7, 1965

3,222,654 / Bernard Widrow, 775 Esplanada Way, Stanford, Calif. and Marcian E. Hoff, Jr., 76 Stony Point Road, Rochester, N.Y. / Logic Circuit and Electrolytic Memory Element Therefor.

3,222,656 / Sven Arne Olsson, Ekholmen, Alvsjo, Sweden / Telefonaktiebolaget L M Ericsson, Stockholm, Sweden / Magnetic Memory Arrangement.

3,222,670 / Abraham Harel, Framingham, Mass. / by mesne assignments to the United States of America as represented by the United States Atomic Energy Commission / Data Processing.

December 14, 1965

3,223,831 / Charles R. Halleran, Ann Arbor, Mich. / International Business Machines Corp. / Binary Division Apparatus.

3,223,982 / Giorgio Sacerdoti, Rome, and Ottavio Guarracino, Milan, Italy / Ing. C. Olivetti & C., S.p.A., Ivrea, Italy / Electronic Computer with Abbreviated Addressing of Data.

3,223,983 / Wilbur G. Hespenheide, Malvern, Pa. / Burroughs Corporation / Retentive Data Store and Material.

3,223,984 / Erich Bloch, Poughkeepsie, and Herbert Gelernter, Briarcliff Manor, N.Y. / International Business Machines Corp. / Magnetic Core Memory.

3,223,985 / Eric E. Bittmann, Downingtown, and Joseph W. Hart, Audubon, Pa. / Burroughs Corp. / Nondestructive Magnetic Data Store.

3,223,986 / Robert W. Clark, Centerville, Ohio / National Cash Register Company / Magnetic Memory Circuit.

December 21, 1965

3,225,183 / Maurice W. Horrell, Playa Del Rey, Calif. / Bendix Corp. / Data Storage System.

3,225,190 / William A. Robison, Jr., Pittsburgh, Pa. / Westinghouse Air Brake Company / Information Handling System.

3,225,220 / Jack Saul Cubert, Willow Grove, Pa. / Sperry Rand Corporation / Logic Circuit Using Storage Diodes to Achieve NRZ Operation of a Tunnel Diode.

3,225,329 / Jacob Rabinow, Bethesda, Md. / by mesne assignments to Control Data Corp. / Optical Logic Reading Machine.

3,225,332 / Frederick C. Hallden, Huntington, Louis S. Conover, Jr., North Babylon, Julius J. Farkas, Huntington Station, and Curtis H. Richmond, Plainview, New York / Cutler-Hammer, Inc. / Data Accumulation Systems.

3,225,334 / John H. Fields, Phoenix, Arizona, and Charles H. Propster, Jr., San Jose, and David W. Masters, Palo Alto, Calif. / General Electric Company / Data Processing System Including Plural Peripheral Devices with Means for the Selection and Operation.

3,225,342 / Thomas Harold Clark, Taplow Court, Taplow, England / British Telecommunications Research Limited, Taplow, England / Shift Register with Means for Displaying Stored Information.

December 28, 1965

3,226,565 / John Earle, Wappingers Falls, N.Y. / International Business Machines Corp. / Logic Tree Comprising Nor or Nand Logic Blocks.

3,226,571 / Alan R. Groendycke, Los Angeles, Calif. / Hughes Aircraft Company, Calif. / Tunnel Diode Shift Register.

3,226,572 / Akira Kuroda, Kawasaki-shi, Japan / Fujitsu Limited, Kawasaki, Japan / Trigger Circuits.

3,226,676 / Esmond Philip Goodwin Wright, London, England / International Standard Electric Corp., New York / Data Handling System with Modification of Data Control Patterns.

3,226,681 / Esmond Philip Goodwin Wright and Alan Douglas Marr, London, England / International Standard Electric Corp., New York / Data Processing Equipment.

3,226,685 / John T. Potter, Locust Valley, George E. Comstock 3rd, Huntington, and Andrew Gabor, Port Washington, N.Y. / Potter Instrument Company, Inc. / Digital Recording Systems Utilizing Ternary, N Bit Binary and Other Selfclocking Forms.

3,226,690 / John V. Sharp, Poughkeepsie, N.Y. / International Business Machines Corp. / Data Translator.

3,226,691 / Robin Frank Hazard, Stevenage, England / Internation Computers and Tabulators Limited / Data Processing Apparatus.

3,226,697 / William S. Fujitsubo, Reseda, Calif. / General Motors Corp. / Information Storage System Using Color Code.

3,226,698 / William James Mahoney, Darien, Conn. / American Machine & Foundry Co. / Magnetic Memory Circuit.

3,226,699 / John A. Kauffmann, Poughkeepsie, N.Y. / International Business Machines Corp. / Magnetic Universal Logical Circuit.

January 4, 1966

3,228,005 / James W. Delmege, Jr., and Charles R. Hollenbach, Saugerties, N.Y. John L. Ellsworth, deceased, late of Kingston, N.Y. by Charlotte E. McCullough, administratrix, Southboro, Mass. / Apparatus for Manipulating Data on a Byte Basis.
3,228,006 / Dan Allan Neilson, Monrovia, and James Russell Bennett, Glendora, Calif. / Burroughs Corporation, Mich. / Data Processing System.
3,228,007 / Gerhard Dirks, 12120 Edgecliff Place, Los Altos Hills, Calif. / Continuation of application Ser. No. 498,047, Mar. 30, 1955. This application Apr. 26, 1961 Ser. No. 107,283 Claims priority, application Great Britain, Dec. 23, 1954, 37,214/54; Germany, Oct. 1, 1948, P 11,464 / Magnetic Storage Device.
3,228,009 / Jesse David Wolfe, Bethesda, Md. / Marriott-Hot Shoppes, Inc. / Information Storage and Readout System.

January 11, 1966

3,229,115 / Saul Amarel, Princeton, N.J. / Radio Corporation of America / Networks of Logic Elements for Realizing Symmetric Switching Functions.
3,229,117 / John Moorhouse Chilton, Harborne, Birmingham, England / W. & T. Avery Limited, Birmingham, England / Logical Circuits.
3,229,119 / Richard E. Bohn, Danvers, and Richard C. Sirrine, Winchester, Mass. / Sylvania Electric Products Inc. / Transistor Logic Circuits.
3,229,253 / Joseph Carl Logue, Poughkeepsie, N.Y. / International Business Machines Corporation / Matrix for Reading Out Stored Data.
3,229,255 / John L. Anderson, Poughkeepsie, N.Y. / International Business Machines Corp. / Memory System.
3,229,257 / Samuel Lubkin, Bayside, and Morton Mondschein, Lynbrook, N.Y. and George A. Wulfing, Oradell, N.J. / Curtiss-Wright Corporation / Data Processing Apparatus.
3,229,258 / Harry L. Heibeck, El Cajon, and Charles G. Wilhelm and William M. Oleson, San Diego, Calif. / United States of America as represented by the Secretary of the Navy / Digital Storage System.
3,229,261 / Ennio Fatuzzo, Adliswil, Zurich, and Hans Roetschi, Horgen, Zurich, Switzerland / Radio Corporation of America / Storage Device with Heat Scanning Source for Readout.
3,229,262 / Charles John Quartly, Bletchingley, England / North American Philips Co., Inc. / Information Storage Device Employing Magnetic Cores.

January 18, 1966

3,230,311 / William C. Dersch, Los Gatos, Calif. / International Business Machines Corporation / Diode Logic Circuitry.
3,230,355 / Yaohan Chu, Chevy Chase, Md. / Melpar, Inc. / Matrix Logic Computer.
3,230,511 / John J. Lentz, Chappaqua, and Robert R. Seeber, Jr., Poughkeepsie, N.Y. / International Business Machines Corporation / Tag Addressed Memory.
3,230,512 / Robert R. Seeber, Jr., Poughkeepsie, and Arthur J. Scriver, Jr., Wappingers Falls, N.Y. / International Business Machines Corporation / Memory System.

January 25, 1966

3,231,723 / Maxwell C. Gilliland, Lafayette, Charles H. Single, Pleasant Hill, and John A. Brussolo, El Cerrito, Calif. / Beckman Instruments, Inc. / Iterative Analog Computer.
3,231,729 / Robert K. Stern, Point Pleasant, Pa. / Computer Systems, Inc. / Dynamic Storage Analog Computer.
3,231,753 / Joseph Reese Brown, Jr., Pasadena, Calif. / Burroughs Corporation / Core Memory Drive Circuit.
3,231,762 / Ole Johan Melhus, Ludwigsburg, Germany / International Standard Electric Corporation, N.Y. / Tunnel-Diode Read-Out Amplifier for Evaluating Data From Magnetic Data-Storage Devices.
3,231,763 / Robert N. Mellott, Los Angeles, Calif. / Assignor, by mesne assignments to The Bunker-Ramo Corporation / Bistable Memory Element.
3,231,859 / Louis G. Oliari, Brockton, Mass. / Honeywell Inc. / Error Encoding System for Sequentially Indicating Errors in Transfer of Digital Information.

CALENDAR OF COMING EVENTS

Aug. 17-19, 1966: Joint Automatic Control Conference, University of Washington, Seattle, Wash.; contact Prof. Arthur Bryson, Dept. of Aeronautics and Astronautics, Mass. Inst. of Techn., Cambridge, Mass. 02139

Aug. 22-24, 1966: COINS, Computer and Information Sciences Symposium, on "Learning, Adaptation, and Control in Information Systems," Battelle Memorial Institute Auditorium, Columbus, Ohio; contact Dr. Julius T. Tou, Battelle Memorial Institute, Columbus, Ohio 43201

Aug. 23-26, 1966: Western Electronic Show and Convention, Los Angeles Sports Arena and Hollywood Park, Los Angeles, Calif.; contact Don Larson, Wescon, 3600 Wilshire Blvd., Los Angeles, Calif. 90005

Aug. 30-Sept. 1, 1966: National ACM Conference, Ambassador Hotel, Los Angeles, Calif.; contact S. F. Needham, Exhibits Chairman, National ACM Conference, P.O. Box 90698, Airport Station, Los Angeles, Calif. 90009

Sept. 6, 1966: South African Council for Automation and Computation, Johannesburg, South Africa; contact Dr. A. Lutsch, C.S.I.R., Pretoria, South Africa

Sept. 7-9, 1966: The Computer Society of South Africa Limited, Johannesburg, South Africa; contact E. S. Russell, P.O. Box 7018, Johannesburg, South Africa

Sept. 26-28, 1966: International Systems Meeting, Systems and Procedures Association, Queen Elizabeth Hotel, Montreal, Canada; contact Richard B. McCaffrey, Systems and Procedures Association, 7890 Brookside Drive, Cleveland, Ohio 44138

Oct. 4-7, 1966: American Documentation Institute Annual Meeting, Miramar Hotel, Santa Monica, Calif.; contact Mr. Jules Mersel, Informatics, Inc., 5430 Van Nuys Blvd., Sherman Oaks, Calif.

Oct. 5-7, 1966: Allerton Conference on Circuit and System Theory, Conference Center, University of Illinois, Monticello, Ill.; contact Prof. W. R. Perkins, Dept. of Elec. Engrg., Univ. of Ill., Urbana, Ill.

Oct. 17-21, 1966: Business Equipment Exposition/Conference, Business Equipment Manufacturers Assoc., McCormick Place, Chicago, Ill.; contact George L. Fischer, Jr., BEMA, 235 East 42 St., New York 17, N.Y.

Oct. 18-20, 1966: Seventh National Symposium of the Society for Information Display, "Information Display as an Emerging Discipline," Hotel Bradford, Boston, Mass.; contact Glenn E. Whitham, General Chairman, Box 413, Wayland, Mass. 01778

Oct. 24-26, 1966: International Symposium on Microelectronics, Munich Fair and Exhibition Grounds, Munich, Germany; contact INEA — Internationaler Elektronik-Arbeitskreis e. V., 8000 Munchen 12, Theresienhohe 15, Germany.

Oct. 24-27, 1966: Annual Instrument Society of America (ISA) Conference & Exhibit, New York Coliseum, New York, N.Y.; contact Daniel R. Stearn, Public Relations Mgr., Instrument Society of America, 530 William Penn Place, Pittsburgh, Pa. 15219

Oct. 25-28, 1966: Data Processing Management Association Fall International Conference, Los Angeles Biltmore Hotel, Los Angeles, Calif.; contact R. Calvin Elliott, Exec. Dir., DPMA, 524 Busse Highway, Park Ridge, Ill. 60068

Oct. 31-Nov. 1-3, 1966: Annual Meeting of UAIDE (Users of Automatic Information Display Equipment), Vacation Village Hotel, West Mission Bay, San Diego, Calif.; contact Marvin J. Kaitz, Dept. 200-312, Space and Information Systems Div., North American Aviation, 12214 Lakewood Blvd., Downey, Calif. 90241

Nov. 8-10, 1966: Fall Joint Computer Conference, Brooks Hall, Civic Center, San Francisco, Calif.; contact AFIPS Hdqs., 211 E. 43 St., Rm. 504, New York, N.Y. 10017

Nov. 15-18, 1966: GUIDE International, Americana Hotel, Miami Beach, Fla.; contact Lois E. Mechan, Secretary, GUIDE International, c/o United Services Automobile Assoc., 4119 Broadway, San Antonio, Texas 78215

Mar., 1967: Fifth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Shamrock Hilton Hotel, Houston, Texas; contact Office of the Dean, Division of Continuing Education, the University of Texas Graduate School of Biomedical Sciences, 102 Jesse Jones Library Bldg., Texas Medical Center, Houston, Texas 77025

May 9-11, 1967: Spring Joint Computer Conference, Convention Center, Philadelphia, Pa.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N.Y. 10017

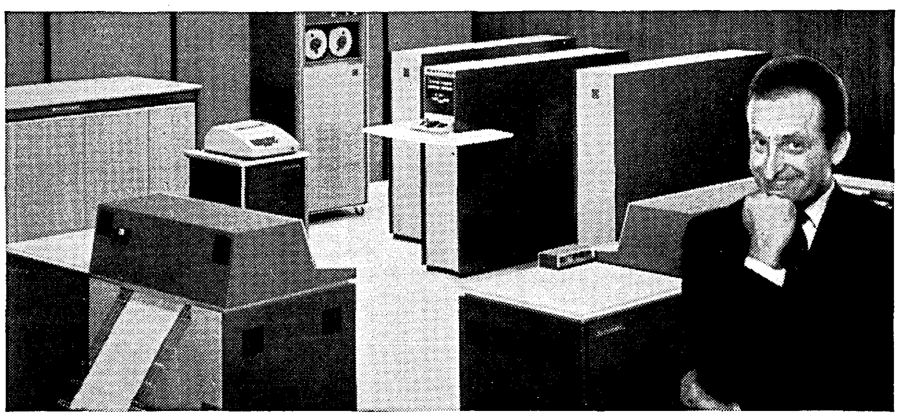
May 18-19, 1967: 10th Midwest Symposium on Circuit Theory, Purdue University, Lafayette, Ind.

June 28-30, 1967: 1967 Joint Automatic Control Conference, University of Pennsylvania, Philadelphia, Pa.; contact Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036

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

"If that computer of ours has all the answers, let's have a few...now!"



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