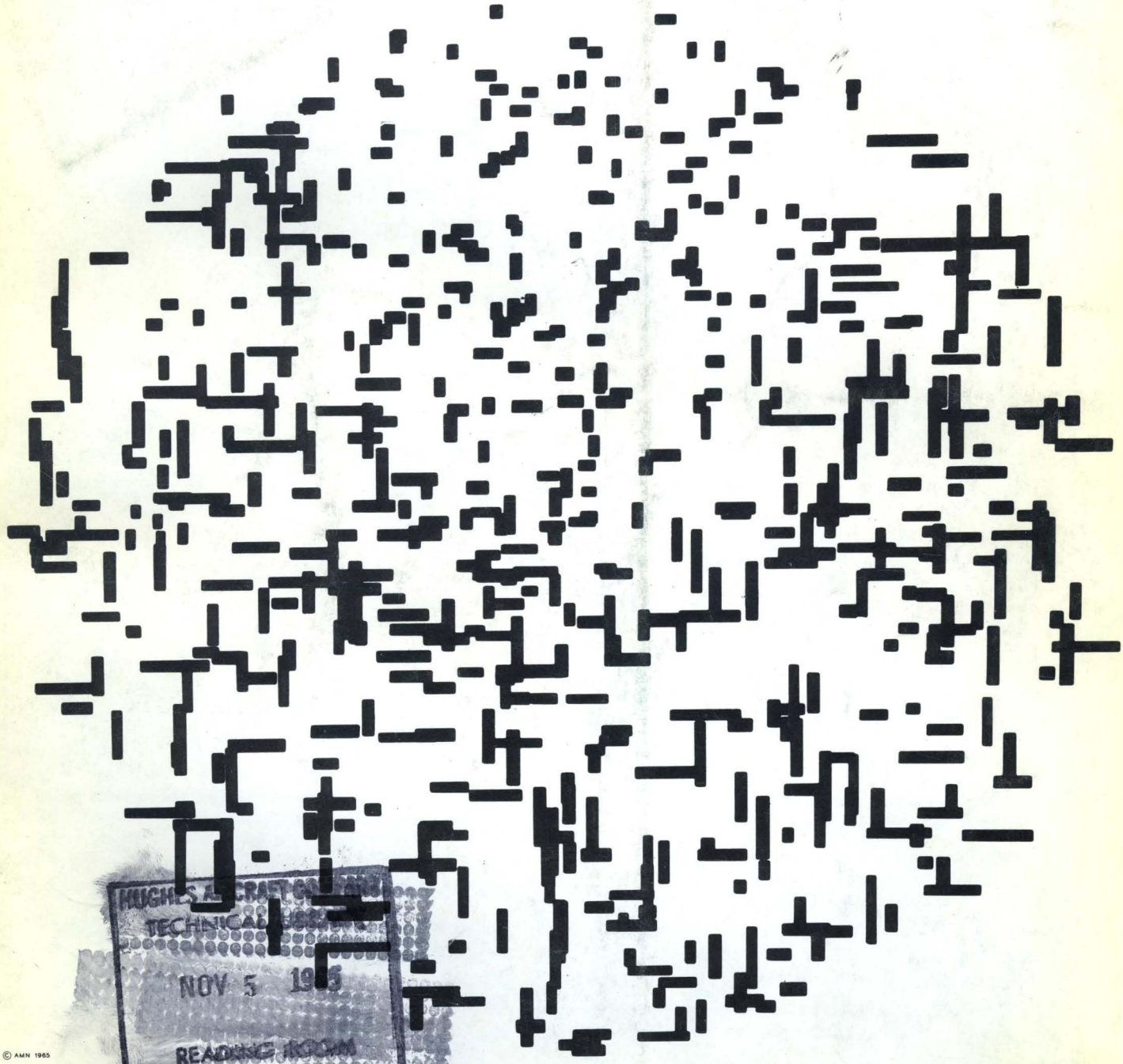
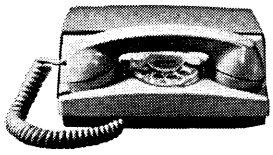
August, 1965

c. 2

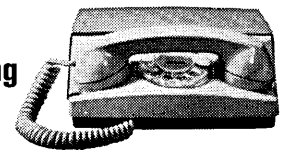
computers and automation



Computer Art Contest
First Prize



Navajo Freight Lines takes the shortest route to faster billing



Navajo Freight Lines, Inc., uses Bell System Data-Phone* service to speed some 4000 bills a day.

At originating terminals, freight bills are cut on 35 ASR teletypewriter machines. Copies of the bills and an 8-channel by-product tape are produced simultaneously.

The tape is then transmitted over telephone lines at 1050 words per minute (or a bill every 3 seconds) to destination terminals and to Navajo headquarters in Denver.

At the destination terminals, tapes are inserted in 35 ASR teletypewriters which produce delivery copies of the freight bills.

At the same time in Denver, tapes are processed through a magnetic tape converter direct to computers which check for accuracy and produce copies of bills for preaudit.

This operation has made substantial savings for Navajo Freight. Billing steps have been reduced from 10 to 4. Accounting now takes just 2 days instead of 8. Current revenue figures are always available to Navajo management within 24 hours.

Find out how Data-Phone service can work for your data systems by talking with one of our Communications Consultants. Just call your Bell Telephone Business Office and ask for his services.

*Service mark of the Bell System

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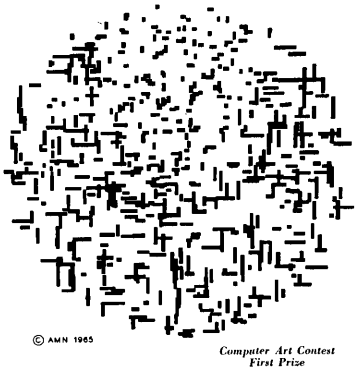
Circle No. 5 on Readers Service Card

The winner of our Annual Computer Art Contest is A. Michael Noll, for his entry entitled "Computer Composition with Lines." For more details, see page 10.



Computer Art Contest
First Prize

computers and automation

AUGUST, 1965 Vol. 14, No. 8

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

In This Issue

Special Issue on the Problem of Computer Personnel

In Every Issue

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A 2-usec, all-silicon memory system that meets rugged environmental specifications

The Fabri-Tek Series MR memory system offers systems designers the well-known Fabri-Tek Memory technology in a new, ruggedized version using components meeting the requirements of MIL-Std 242D. Capacities from 32 to 32,000 words of any bit length are available. Full cycle time is 2 microseconds. (A 8192 X 21-bit system is illustrated here with the front door removed.)

The Series MR meets these environmental specifications:

- Operating temperature . . . −40° C to +71° C
- Humidity . . . meets humidity test procedure 1, Para. 4.4 of Mil-E-5272
- Shock . . . unit operates satisfactorily after being subjected to 15g of acceleration having a duration of 11 msec in each direction of the 3 mutually perpendicular axes.
- Vibration . . . unit operates satisfactorily after being subjected to vibration of from 10 to 300 cps along each of the 3 mutually perpendicular axes as follows: ± 2.5g acceleration from 10 to 36 cps, 0.036" double amplitude from 36 to 46 cps, ± 4g acceleration from 46 to 300 cps.

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*T.M. Gardner-Denver Company

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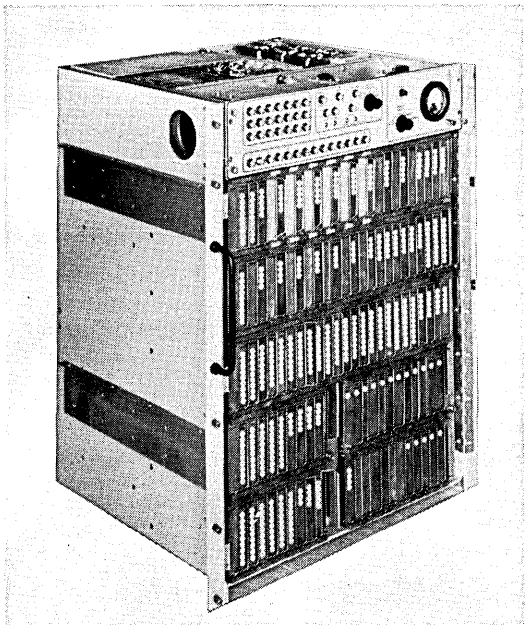

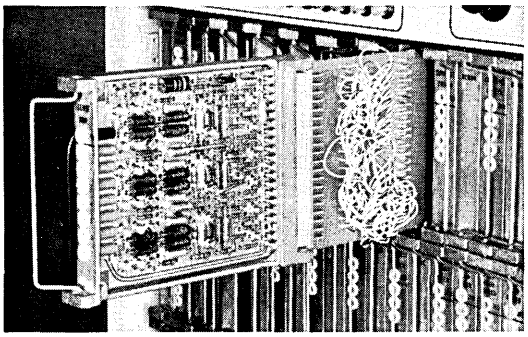

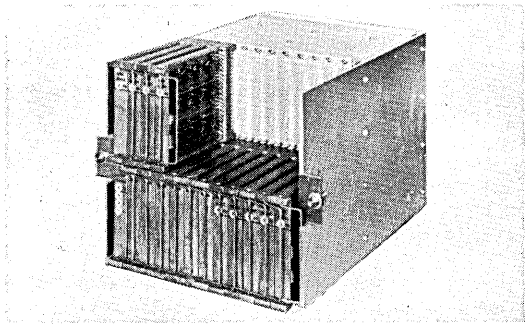

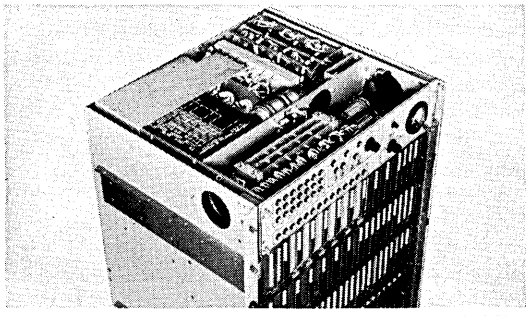

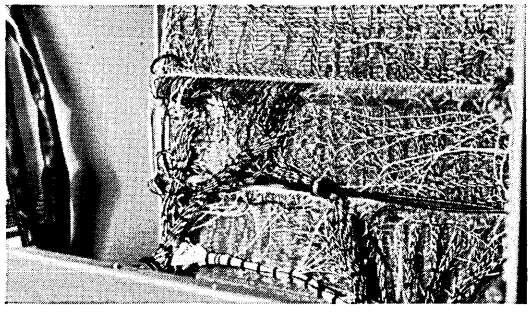

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The Progress in Programming Computers: Some Questions of Semantics

In our last issue we published an article "Intelligent Machines and Hazy Questions" by Richard K. Overton. It contained a description of a computer program named AGILE which simulates learning and generalizing, through, for example, conversational interaction with a human being. AGILE illustrates the recent progress in programming computers to deal with problems where either it is very tedious to explain or else very difficult to be precise about what one wants as an answer.

The work and examples described in Overton's article, and similar work and examples of the last year or two, appear to contradict many accepted dogmas of a few years ago in the computer field. For example, in "A Guide to Algol Programming" by Daniel D. MacCracken, published by John Wiley & Sons, New York, June, 1962, we find:

> . . . The computer does not solve problems; it only follows carefully defined computational procedures. (p. 4)
>
> . . . In specifying a problem-solving procedure to a computer, . . . everything must be specified in advance. (p. 5)
>
> . . . A computer cannot exercise judgment unless it has been provided with explicit directions for making a decision. (p. 5)
>
> . . . It must always be remembered that a computer has no common sense. If you enter angles in degrees into a computer system that has been set up to accept angles in radians, the computer will blindly carry out the computations specified even though the results are meaningless.

Remarks of this kind raise the general question of the meaning to be attached to sweeping statements, the semantics of asserting as completely true some principle which really requires a restricted context in order for it to be true.

In a sense it is true that "The computer does not solve problems." But "the programmed computer" certainly does solve problems. And don't people usually mean "the programmed computer" when they say "the computer?"

In a sense it is true that "In specifying a problem-solving procedure to a computer, . . . everything must be specified in advance." But if you sit at the console, and interact with the computer, using a comfortable programming language like LISP for example, surely you are not "specifying everything in advance." Instead, you are finding out where the program is not behaving as you wish it would, and you are correcting the program; and you may even arrange the program to be ready to respond a week from now to any one of a large number of different problems, to be presented then. So, isn't it true. that usually part of a computer program is specified in advance, while the rest of the computer program is specified when one is ready to specify it?

In a sense it is true that "a computer cannot exercise judgment unless it has been provided with explicit directions for making a decision." But isn't it often easily possible to supply directions for making a hundred decisions or more, and then isn't the computer exercising judgment?

In a sense it is true that "a computer has no common sense." But common sense often consists of a set of a hundred or more rules which a human being often knows, and which a human programmer can know. Then, if the programmer cares to take enough trouble, he can cause the computer program to show "common sense" by inserting decisions according to rules of common sense suitably into the program. So doesn't the computer then display "common sense?"

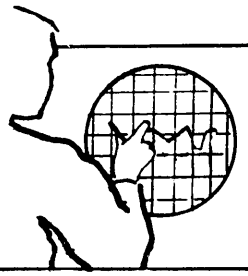
For example, at Cornell University, Ithaca, N. Y., a programming system called CORC has been worked out, for students and faculty to use, under which an unusually complete programming system can make deductions about what the user "probably meant" in case of a certain kind of error. So the average number of runs for novices in order to run their first program is reported to be 1.6! Doesn't this kind of program display common sense, to a remarkable degree, as well as judgment and helpfulness?

Talking of common sense, a great many human beings seem to show a great lack of it. A file clerk in your office is told to file folders in the order 52E, 52E(Aplns, 52E(Books, 52EA, 52EA(65; and you come back later and look, and the folders are in the order 52E, 52EA, 52E(Books, 52E(Aplns, 52EA(65, which are in accordance neither with your instructions nor common sense. Or you ask your bookkeeper to tell you the equivalent in U.S. money of $22.75 in Canadian money and she tells you $24.57 in U.S. money; but you know and she knows too that Canadian dollars are worth less than U.S. dollars; her result contradicts common sense, but on that occasion her common sense did not operate.

The moral of this argument is essentially that we need to be careful if we are to say what is precisely true when we talk about computers able or not able to solve problems, to use judgment, and show common sense. With care and thought, computers most certainly can be programmed to deal reasonably with vague and changing information, and to refer to a large set of sensible rules which we might call common sense.

Edmund C. Berkeley

EDITOR



c & a MARKET REPORT

WHAT'S THAT PRICE AGAIN, SIR?

The intense competition in the computer field has made detailed market planning a necessity for any computer manufacturer that wishes to preserve the good will of its stockholders no less its corporate shirt in the offering of a new computer system. However, even these detailed market plans often fail to foresee technical and competitive developments that can threaten the market life of a computer system.

When such developments do occur, the manufacturer has several market handles available for twisting which can possibly boost the selling success of a computer system closer to intended goals.

What are these market handles? To see these clearly, let's look through the eyes of a user evaluating a proposed new computer system. This user would be certain to judge the merits of the proposed new system on at least the following five points:

(1) Performance — how good is the system rated on strictly a unit performance basis? How fast is the central processing time? How effectively do the input/output control units handle their jobs?
(2) Benchmark Problem Performance — how fast will the proposed computer system in actual operation execute the major applications that the user has in mind? How effective is it in a real-time application? How fast will it process the user's major files?
(3) Software Support — how good is the software supplied by the manufacturer? How much of it is available? What is its delivery schedule?
(4) Back-up Services — what kind of a reputation does the manufacturer have for fulfilling his promises on delivery of special services, maintenance support, etc. ?
(5) Price — what is the actual cost of the proposed computer system?

Although price is listed here as the last factor, this does not necessarily mean that it is the least important; in fact, each of the five factors frequently have roughly equal importance in the decision to select computing equipment.

Within these five factors, the manufacturer has to find the market adjustments he can make to achieve the desired marketing goals on a computer system. The performance rating of the equipment is usually set in the research and development stage, and generally can only be modestly modified after the computer reaches the market. The benchmark problem performance is basically dependent upon the rated performance of the various units in the computer configuration, and therefore is subject to only modest improvements. Software improvement is a more continuous activity, but there is usually a considerable delay between the point when a manufacturer recognizes a marketing weakness in a capability of a particular software offering and the time when he can introduce an improved one to the customer or potential customer. This time lag is often a year or more. Reputation is probably the most lethargic of entities, and the manufacturer can not expect to change substantially his reputation in the field during the marketing life of a particular computer system. This leaves the last area of price as the one area in which the manufacturer has considerable competitive flexibility which he can use with a short response time.

One way of doing this, of course, is to offer direct price reductions. However in the computer field the more frequent and more subtle approach is to selectively adjust the price of and promote the incorporation of certain peripheral devices on to installed computer systems. This is because the percentage of profit in peripheral devices varies considerably. Some peripheral devices are considerably more profitable than the central processor. And the percentage of the rental cost of the system represented by peripheral devices can range from 40% on large-scale systems to nearly 80% on small-scale systems. These peripheral devices include the card reader punch, printer, magnetic tape transports, data communications terminals, data collection equipment, and external memory devices such as disc files and disc packs.

The selling success of individual peripheral devices themselves are not price sensitive to the same degree. For example, card handling equipment, paper tape equipment, and printers are relatively insensitive to price because a configuration usually needs one and only one of these units. However peripheral devices which vary the performance or the capacity of the system such as magnetic tape transports, data communications terminals, disc packs, disc files, data collection units, etc., are quite price sensitive. A 20% reduction in the cost of a magnetic tape transport might well result in a 20-30% increase in the sale of this unit to customers. Manufacturers will watch the market acceptance of these peripheral devices closely, and when a manufacturer adjusts his price on these units, he is probably reacting to supply and demand considerations.

Patrick J. McGovern

Associate Publisher

THE ANNUAL COMPUTER ART CONTEST OF "COMPUTERS AND AUTOMATION"

The front cover of our August issue is awarded to an entry by A. Michael Noll, Research Engineer, of Newark, N. J., entitled "Computer Composition with Lines". He says:

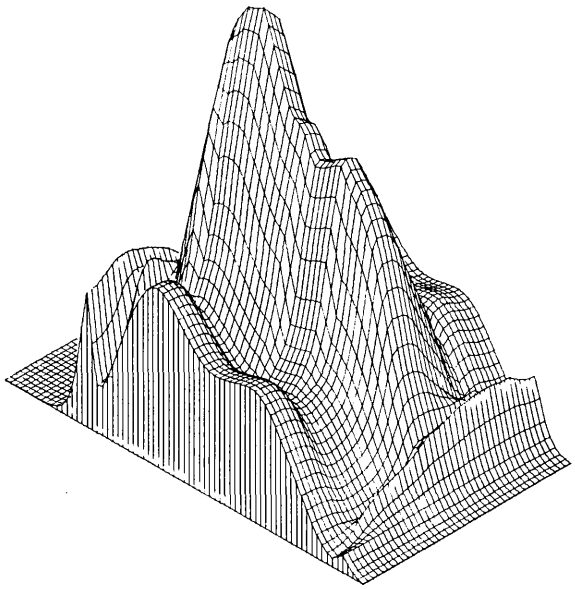
> The positions of the vertical and horizontal bars have been chosen at random with the constraint that the positions must fall inside a circle. The length and width of the bars was chosen at random within a specified range. If the position of the bar fell within a parabolic region in the upper half of the circle, the length of the bar was shortened by a factor proportional to the distance of the position from the edge of the parabolic region. The motivation for this type of pattern came from Piet Mondrian's "Composition with Lines", 1917, now in the possession of the Rijkmuseum Kröller-Müller, Otterlo, The Netherlands.

Four other computer art drawings are also included in our August issue with honorable mention. Each is explained with some notes next to the picture of the drawing.

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

NEUTRON FLUX DISTRIBUTION

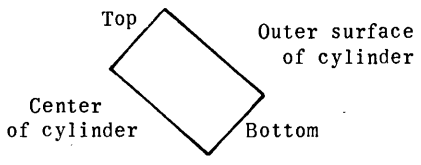
by D. J. DiLeonardo, Westinghouse Electric Corp., Bettis Atomic Power Laboratory, West Mifflin, Pa. 15122



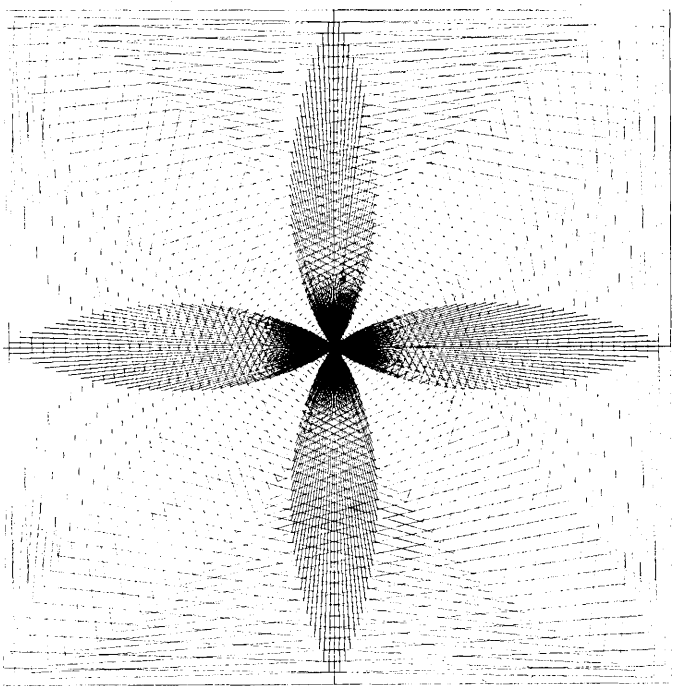
When studying the physics behavior of a nuclear reactor, the neutron diffusion equation in two dimensions is solved by finite difference techniques to determine the neutron flux (the product of the neutron density and velocity) and power density at various locations in the reactor core. Typical problems may consist of a mesh containing 5000 points.

To help interpret and digest the mass of data generated by the physics calculations, a FORTRAN program has been written to draw isometric plots of the data using a Calcomp Plotter.

Here is a plot obtained from a sample two-dimensional diffusion equation calculation. It shows the distribution of the neutron flux below 1 electron-volt in a vertical r-z slice through a fuel module assembly of cylindrical geometry. The orientation of the plot is shown in the figure below:



In addition to its quantitative value the plot seems to possess a certain artistic value.



TESTING PATTERN

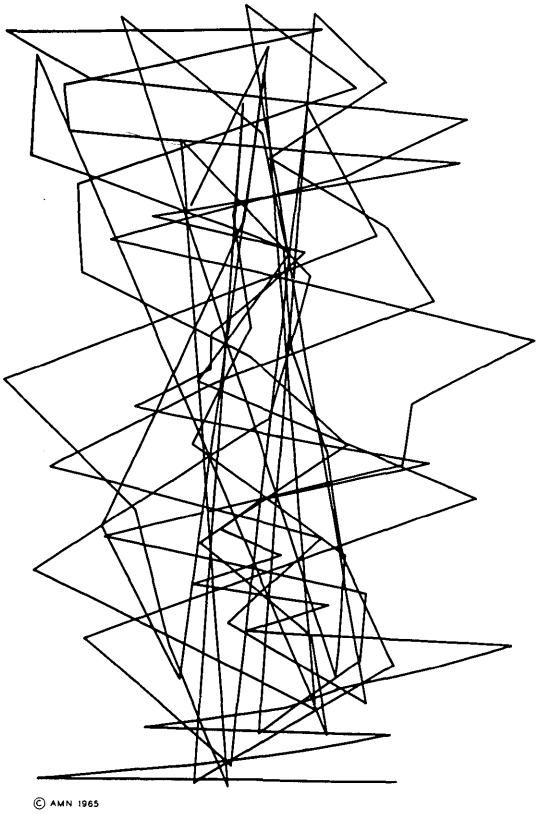
by California Computer Products, Inc.
Anaheim, Calif.

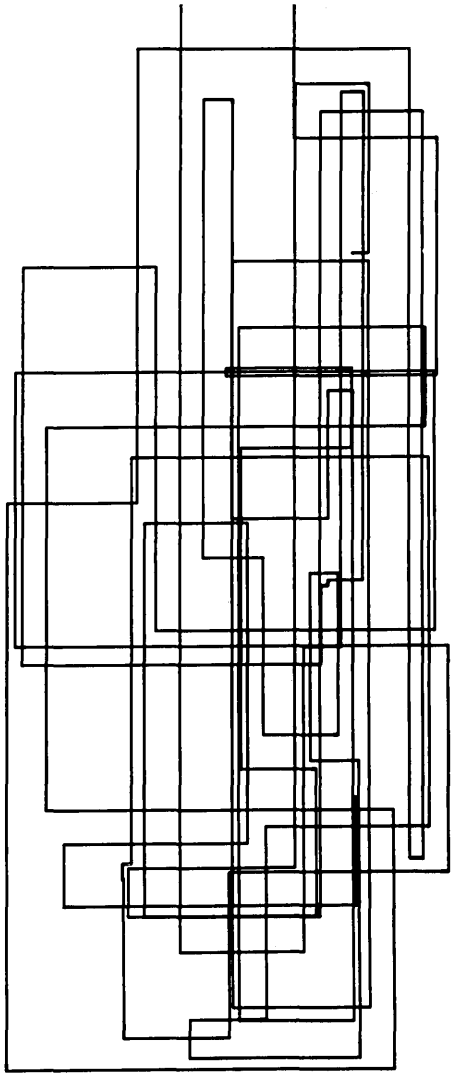
This is one of the patterns used for testing the operation of the Calcomp Plotter.

VERTICAL-HORIZONTAL NO. 3

by A. Michael Noll

101 randomly selected points (with x-coordinate less than the y-coordinate) were connected by vertical and horizontal line segments to form a single line. The lines were determined under the condition that only one of the two coordinates was changed (alternatingly) from one point to the next.





GAUSSIAN QUADRATIC

by A. Michael Noll

The horizontal positions of the end points of the line segments have a Gaussian or normal curve distribution; the vertical positions increase quadratically, until they reach the top, except that when any vertical position measured is greater than the constant height, then the constant height is subtracted. The result is a line that starts at the bottom of the drawing and randomly zigzags to the top in continually increasing steps; at the top, the line is translated to the bottom to once again continue its rise.

SOME PROGRAMMER-EMPLOYER PROBLEMS: A Report from the Field

Ned Chapin
Data Processing Consultant
Menlo Park, Calif.

It was a one-inch item:

> *Programer.* Expanding aerospace company has opening for programer with 1401 tape experience. Good salary, modern benefit program, and convenient location. A growth opportunity. Apply to Mr. Jones, XYZ Company, Suburb. An equal-opportunity employer.

Not an exceptional advertisement, true, but rather one that seemed average enough to show the operation of the programer-employer relationship in the market place. In order to get data on some of the actual personnel problems in data processing, I contacted the XYZ Company and obtained permission to interview the Data Processing Supervisor, and to contact those who responded to the advertisement. Most of the persons responding were interviewed.

This report summarizes four interviews: with the Data Processing Supervisor, who outlined the characteristics of the job and the person sought to fill it; with two of the unsuccessful applicants; and with the one successful applicant. The report closes with a summary of some major programer-employer problems illustrated by the experiences brought out in these interviews.*

The Supervisor's View

Interviewer: Could you please describe the job you have open?

Supervisor, Mr. Jones: We have a 16K IBM-1401 tape system which we recently upgraded from a card system. We work on a closed-shop basis here and have seven programers.

We are not a large company yet but we have important contacts in the aerospace field and are growing. Our upgraded computer capability helps us obtain contracts and to meet them successfully.

Because we do work for all parts of the company, the job we have open is one of considerable challenge. It offers a great deal of variety. It is difficult to forecast what the programing assignments will be from one month to the next: product development, simulation, accounting — we have a variety.

Interviewer: What about salary and working conditions?

Supervisor: We work an 8 to 5 day here; our programers share offices two or three to an office. We supply key-punch service for punching programs and test data, and computer operators for making runs. The programer need not waste his own time and our machine time running the computer, but we like to have the programer around when his program is being tested.

As to salary, we would like to hire at about $600 for this job, and after six months raise the man to about $675. After that, the raises would depend upon merit. We have a very up-to-date health insurance and life insurance program. We have an ample parking lot, and are close to the expressway.

Interviewer: What sort of a person are you looking for to fill this job?

Supervisor: We want someone with aerospace experience because part of our growth depends upon our ability to offer computer service to other parts of our organization. We would like a man between 28 and 35 who holds a BS in engineering or mathematics and has some business training too. He should have had 4 to 6 years of experience as an engineer or in accounting, preferably in the aerospace industry. He should have two or more years of programing experience with at least one year of that time on a 1401 tape system. He should get along well with people and have initiative and drive. I hate having to supervise a man closely. He ought to be a real self-starter who can turn out a good piece of work rapidly, accurately, and fully documented.

*The work on which this report is based was done in mid-1964, but it is believed to be still representative. All personal and identifying data have been altered in this report to protect the privacy of the persons and firms involved.

Interviewer: How is it that this position has become open at this time?

Supervisor: Things have been a little slack of late and we recently lost a programer who left to take a job with the ABC Company. So we need a replacement. The way things look business will be picking up, and soon I will be looking for additional programing help if things work out the way we expect. If I can find them, I'll hire two now, and be ready.

Interviewer: What recruitment aids are you using?

Supervisor: We are advertising in the newspaper, and from past experience that will probably work. If we don't get an adequate response within two weeks and have not filled the position, then we will list it with one of the personnel agencies specializing in types of computer personnel. But I don't think we will have to resort to that.

Unsuccessful Applicant F's View

Interviewer: Tell me about your experience in responding to the XYZ Company's advertisement for a programer.

Applicant F: I called up and made an appointment for an interview with Mr. Jones and went out to see him at the time specified. They have a nice place out there; it is easy to get to, the parking is good, but the offices looked a bit stark. They have a tape 1401 but I didn't see any of the programers using it. It seemed to be tied up on a production run when I was there.

Mr. Jones was very nice to me and showed me around. But he didn't seem to think much of my qualifications and the interview didn't last very long, although he said he would let me know if they wanted me.

Interviewer: Tell me about your qualifications.

Applicant F: I have a bachelor's degree in chemistry which I earned just after World War II. I got married during my senior year and never went on to graduate school because of starting a family. But my three children are now in high school and don't need as much of my time as before and the housework takes only a little time. I could easily hold down a job and still meet my family's requirements and the money sure would help with college expenses which will be starting in the Fall for my oldest son. For the last couple of years, I have been looking around for things that I could do. My husband, who is an accountant, suggested computers. I took one of the classes given by that AA trade school that advertises in the transit buses, and I finished their 1401 programing course.

I have been looking for a job ever since, but all I have found is some overload programing work on an IBM-1620 which I have been doing off and on for the last year for the MNP Optics Company. I got that because I know the wife of one of the engineers over there and they said they would give me a try. But they do not need another programer.

Interviewer: What did Mr. Jones say about your qualifications?

Applicant F: He was curious why I was applying for the job at all when I had so little experience. So I stressed to him that I was willing to learn, that I had had some experience with the IBM-1620, and that at the AA trade school, I was the best in my 1401 class.

Mr. Jones also said that I didn't have any experience in the aerospace industry and he didn't seem to think that a B.S. in chemistry would help his company very much. And he said since my degree was so long ago, he thought I must be pretty rusty even in my mathematics. Mr. Jones also did not seem to think much of people who got certificates from the AA trade school. He said something about none of them were any good and I felt pretty bad about that. I thought I learned a lot there. He also said something about how they would prefer a man for the job so they would have someone who would not have to be taking off for PTA meetings and the like. He doesn't seem to know that PTA meetings come at night.

Interviewer: Would you be willing to demonstrate your abilities by taking a test designed to measure programing aptitude, and to do a short tape 1401 programing task from start to finish?

On the aptitude test, the applicant scored at the A level. She had the programming task debugged and running in 3¼ hours. The same aptitude test and programing task were presented to all the applicants I interviewed.

Ned Chapin received his Ph.D. in Business and Economics from Illinois Inst. of Technology in 1959. He had five years of experience in data processing and operations research with Stanford Research Inst. (1956-61), and has been a consultant in data processing since 1961. He is the author of two books and dozens of articles and papers.

Unsuccessful Applicant M's Views

Interviewer: Tell me about your experience in responding to the XYZ Company's advertisement for a programer.

Applicant M: I called up for an appointment and went out to see Mr. Jones. He showed me around the place — they have a nice layout there. We went over my qualifications but he didn't seem to think much of them. He said he was looking for a man with more experience.

Interviewer: Tell me about your qualifications.

Applicant M: I got my start in data processing in the Air Force where I worked as a tab operator. After a while, I began to pick up 1401 programing. I used to help the programers debug their programs.

I am 26 now and I have been out of the Air Force for almost a year. At present, I am working as an engineering aid trainee in an electronics plant but until I got that job, I filled in with a few odd jobs that I found. The only data processings jobs that I have been able to find so far are tab jobs. I do not want to do that again.

Interviewer: Tell me more about your education.

Applicant M: I have had almost two years of college, but I never had to study in high school and college was easy too. It never really interested me. So that is why I joined the Air Force. I will be getting married soon, however, and I am going to go back to school at nights and get a degree. To do that I need a job first.

In order to get a job, I have been studying the 1401 Manual and I took a course at the Community college on the 1401. I got an A and I was doing work well beyond what any of the other students were doing. But that sure didn't seem to impress Mr. Jones.

Mr. Jones said he was looking for a man with a college degree, not a college dropout even if he did get an A in a programing course. I pointed out to him that I had a lot of experience in the Air Force, but he says that was tab experience and not programing and he wasn't going to count it.

Interviewer: What was Mr. Jones' attitude?

Applicant M: When he learned about my education, he really didn't take me seriously after that. He did ask about my background experience and wanted to know if I had done any aerospace work. I told him the Air Force was the closest I had gotten to that, and he thought that was funny. I was pretty disappointed about not really being given a chance to show what I could do. I feel I could do a good job for XYZ Company. The 1401 is a nice machine to work with but he just didn't seem to take me seriously.

Interviewer: Would you be willing to demonstrate your abilities by taking a test designed to measure programing aptitude, and to do a short tape 1401 programing task from start to finish?

On the aptitude test, the applicant scored at the A level. He had the programing task debugged and running in 2½ hours.

Successful Applicant S's View

Interviewer: Tell me about your experience in responding to the XYZ Company's advertisement for a programer.

Applicant S: I called up, made an appointment, and went over to see Mr. Jones. He seemed to like my qualifications. He called and offered me the job later that same day. I will start there the first of the month.

Interviewer: Tell me about your qualifications.

Applicant S: The thing Mr. Jones seemed to like best was that I have had experience in the aerospace industry as an engineer. After I got my engineering degree six years ago, I went to work to avoid the draft for one of the major aircraft companies near home as an engineer. I started in ground support and moved into checkout systems. I never cared very much for the work: it was pretty dull and I think I was mostly "on the stock pile." But one of the things I did do was learn FORTRAN programing. Then about 2½ years ago, I was laid off. I couldn't find any job near home; so we moved here where the job opportunities were better. Within a month, I found work as a 1401 operator. I did some programing in FORTRAN, and gradually branched out into SPS. After about seven months as an operator, they promoted me to programer, and I worked there as a programer for about 13 months. They would not give me a raise, however; so I hunted up my present job as a programer which I have held for the last ten months.

The major thing they didn't like about my qualifications was that I had no experience with tape systems. My present employer has only a card 1401. I have been to two of IBM's schools on 1401, one of them covering tape, and I am presently taking a course in systems at night.

Interviewer: What about salary and job assignment?

Applicant S: In my present position, I am making $625 so when he first offered me $600 I told him nothing doing. But he right away upped the offer to $685 and I accepted. He said I would likely get a raise within a year if they liked my work. Mr. Jones explained that the work consists of a great variety of stuff, and that he had no idea what my assignment would be from month to month. But to start with, I would be assigned to help revise an inventory cost program that is presently in use.

Interviewer: Would you be willing to demonstrate your abilities by taking a test designed to measure programing aptitude, and to do a short tape 1401 programing task from start to finish?

On the aptitude test, the applicant scored at the D level. He worked for just under six hours on the task, and then left it, explaining that that was all the time he could devote to it. It was not debugged adequately enough to run.

"Window Dressing" in Contract Proposals

The experiences of these three applicants with the XYZ Company illustrate some important personnel problems in data processing, but leave many untouched. Let us list briefly some that are illustrated.

Does an employer want a programer who performs as a programer or does he want a programer who looks like a programer? In terms of programing capability, this employer appears to have hired a weak programer. But this employer hired a programer whose qualifications look good when listed as part of a proposal seeking contracts. The "window dressing" in a proposal generally is silent on programing competence. The impression of competence in a programing staff may be more valuable to some employers than actually having competence in a programing staff.

Job-Hopping

Some programers make it a habit to flit from job to job. They spend a year or so on a job and then start looking for a new one. The reason for seeking a change they most commonly give is that their present employer will not give them more than a token raise, but that another employer will give them a higher salary immediately. They get their raises, and often fat ones by changing employers. This increases personnel turnover. It is significant that the personnel who are least able to job-hop are those with the least impressive-looking qualifications. For example, persons without a college degree find it more difficult to job-hop than do college graduates.

Men vs. Women

Some employers appear to prefer men to women for ill-documented reasons. Some claim that women are less satisfactory programers because their first attention goes to their families — they are not as committed or motivated to give their all for their employer. Yet typically most employers pay their female programers less than they pay their male programers for what appears to be equivalent work. The women typically do not have such fine sounding résumés or as much experience. But if female programers can be hired for salaries lower than for males for equivalent work, are employers perhaps getting a bargain in terms of programing work accomplished?

Programer Competence

Evaluating programer competence is a problem. Recommendations are often worth little because some employers give a good recommendation to an incompetent to get rid of him. Tests, although often adequate as to reliability, are generally weak on validity — this is certainly true of the two most common programer aptitude tests in use today. Using a test of weak validity and strong reliability is like driving a car with a stuck gas gage; it gives one a feeling of confidence to see the needle up near full all the time, but that feeling of confidence is of little aid in getting the car going again when the tank goes empty while the gage still shows near full. Performance on a sample programing task is subject to wide differences in response. Everyone has an off day once in a while. The particular task may strike an applicant's strong or weak points and the applicant may do correspondingly poorly or well in contrast to his normal level of performance. And the weakness of an interview for evaluating a skill has been well documented.

The Applicant's Experience

How valuable to an employer is the applicant's experience? The applicant who claims experience is usually valued and preferred above the applicant who through honesty or modesty does not claim experience. The real question the employer must face, however, is not "Does the applicant have experience in a particular area?", but rather "Has the applicant learned something of value to the employer from the experience?" Having existed or survived through a situation for a time does not mean the person has learned something of value to

a prospective employer from that experience. But employers typically rely on a claimed quantity and duration of experience rather than upon the applicant's learning from the experience because the first can be more easily verified and has at least given the opportunity for learning.

The Worth of Education

How much is education worth in lieu of experience? Some employers accept training by a manufacturer, but not by a community college or by a private trade school. Some want university training; some want some combination. But again, exposure is a poor index of learning; yet it is what the applicant has learned that is of value to the employer.

Cost of Programer Turnover

The cost of programer turnover is linked to the costs of training and break-in. A new programer at any installation has to learn the ways the particular installation likes to have work done. The programer has to adopt new work habits. This will not happen overnight, and impairs programer efficiency during the break-in period. Often new programers at an installation go through an on-the-job training period, or are sent to a manufacturer's or other school for a period of weeks. Yet the employer usually has to hire a new employee at a salary close to what he was paying for the employee who left, in the case of turnover. And employers universally complain about the high salaries they must pay for programers. Yet if they paid more in direct salary increases, would turnover, training, and break-in costs be reduced enough to pay the cost?

Conclusion

In making this report, it has been my objective not so much to offer solutions, but rather to point to the existence of significant problems in programer-employer relationships. Typically, employers by their behavior indicate that they have taken de facto positions on such problems. To an outside observer, these positions may appear based upon faulty evidence.

In defense of the employer, it must be said that most employers are in business to make a profit, and once they find a way to do something, they are reluctant to change. To persuade them to change usually implies showing them that their present stands needlessly cost them money.

CALENDAR OF COMING EVENTS

Aug. 13-14, 1965: 8th Annual Northwest Computer Conference, Olympic Hotel, Seattle, Wash.; contact Grant W. Erwin, Jr., Box 836, Seahurst, Wash.

Aug. 14-Sept. 6, 1965: National Science Foundation Conference on Digital Computers for College Teachers of Science, Mathematics and Engineering Univ. of Southwestern Louisiana, Lafayette, La.; contact Dr. James R. Oliver, Director, USL Computing Center, Box 133, USL Station, Lafayette, La. 70506

Aug. 23-27, 1965: 6th International Conference on Medical Elec. & Biological Engineering, Tokyo, Japan; contact Dr. L. E. Flory, RCA Labs., Princeton, N. J.

Aug. 24-26, 1965: Association for Computing Machinery, 20th National Meeting, Sheraton-Cleveland Hotel, Cleveland, Ohio; contact Lewis Winner, 152 W. 42 St., New York, N. Y. 10036

Aug. 24-27, 1965: WESCON, Cow Palace, San Francisco, Calif.; contact IEEE L. A. Office, 3600 Wilshire Blvd., Los Angeles, Calif.

Sept. 8-10, 1965: Industrial Electronics & Control Instrumentation Conference, Sheraton Hotel, Philadelphia, Pa.; contact Lewis Winner, 152 W. 42 St., New York, N. Y. 10036

Sept. 20-23, 1965: Second Systems Engineering Conference & Exposition, McCormick Place, Chicago, Ill.; contact Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y. 10017

Sept. 22-24, 1965: UNIVAC Users Association Annual Fall Conference, Hilton Hotel, Pittsburgh, Pa.; contact Bruce M. Wallis, O. E. McIntyre Inc., Prospect Ave., Westbury, N. Y. 11590

Oct., 1965: International Symposium on Economics of Automatic Data Processing, Rome, Italy; contact Symposium on Economics of ADP, International Computation Centre, Casella Postale No. 10053, Rome, Italy

Oct. 4-7, 1965: 20th Annual ISA Instrument-Automation Conference & Exhibit, Sports Arena, Los Angeles, Calif.; contact Public Relations Dept., Instrument Society of America, Penn-Sheraton Hotel, 530 Wm. Penn Pl., Pittsburgh, Pa. 15219

Oct. 27-29, 1965: Second National Conference on EDP Systems for State and Local Governments, N. Y. University Graduate School of Public Administration, New York, N. Y.; contact Prof. Herman G. Berkman, Graduate School of Public Administration, N. Y. Univ., 4 Washington Sq., No., New York, N. Y. 10003

Nov. 1-3, 1965: International Systems Meeting, Palmer House, Chicago, Ill.; contact Richard L. Irwin, Exec. Dir., Systems and Procedures Association, 7890 Brookside Dr., Cleveland 38, Ohio

Nov. 2-5, 1965: GUIDE International (User Organization for Large Scale IBM EDP Machines) Meeting, Jung Hotel, New Orleans, La.; contact Lois E. Mecham, Secretary, GUIDE International, c/o United Services Automobile Assoc., 4119 Broadway, San Antonio, Tex. 78215

Nov. 3-5, 1965: Data Processing Management Association Fall International Conference, Adolphus Hotel, Dallas, Tex.; contact R. Calvin Elliott, Exec. Dir., DPMA, 524 Busse Highway, Park Ridge, Ill. 60068

Nov. 10-16, 1965: INTERKAMA (International Congress and Exhibition of Measuring Instruments and Automation); contact Nordwestdeutsche Ausstellungs- und Messe-Gesellschaft mbH - NOWEA -, Düsseldorf, Messegelände

Nov. 16-18, 1965: Fall Joint Computer Conference, Ambassador Hotel, Los Angeles, Calif.; contact Phyllis Huggins, Public Information Director, AFIPS, P.O. Box 55, Malibu, Calif.

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

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

PERSONNEL PROBLEMS IN DATA PROCESSING SYSTEMS: The Approach of Top Management

Harvey W. Protzel
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Misplacement of Personnel

A good percentage of the personnel doing work in data processing and systems today should not be in those fields.

What is resulting from this misplacement of personnel? Excessive company operating costs; dissatisfied employees (in data processing, systems work, and all related functional areas); and frustrated manufacturers of data processing equipment, who are spending billions of dollars on research and production only to find their equipment misused, partially used, or blamed for problems which are not the fault of the machines (the machines cannot talk back). Nor can the salesman talk back, because few salesmen dare take the liberty of arguing with the customer who is paying for his livelihood.

As the use of data processing equipment increases, which, of course, is a certainty, the problems involved multiply. The seriousness of the situation can be illustrated with this one, most indicative, example: The top executives of many companies are making important operating decisions based upon reports received from their data processing equipment. In all my experience, I have yet to find an executive receiving management reports who could assure me that his reports were accurate or that they could not be redesigned to permit him better utilization.

Is this the fault of the machines? How could it be? Is this the fault of the machine personnel or the systems men? Indirectly, it seems to be. However, I have to put 100% of the blame on the top executives for three reasons:

1. They have not made certain that the personnel selected for operating their machines, designing their reports, and developing their systems should actually be selected for these jobs.
2. They have not given the proper training to their data processing and systems personnel.
3. They have not made certain that their reports were properly designed, all-inclusive, and completely accurate; they have substantially accepted what was given to them.

Let us pursue each of these "accusations" in greater detail.

Personnel Selection — Tests

We can all agree that the need for machine operators, computer programers, and systems personnel is acute and becoming worse. I know companies that will hire, on the spot, anyone that has seen a computer or who has an uncle that has taught him the word "modular" or "binary." The thinking is that, "This person is not completely ignorant of machines and therefore he can be trained." But, can he be or should he be? The training cost alone is not small.

International Business Machines Corp. has developed an excellent test to determine the technical potential of a person. Richard Wessler, our chief psychologist, has been permitted the use of this test on numerous occasions. He has told me that, although he has tests which will give him substantially the same type of results, he prefers to use IBM's test because it has been specifically designed for the purpose and is, therefore, most desirable. This test is available to every IBM customer. How many executives have taken advantage of its availability and insisted upon its use? Only a relatively few.

Business Experience

Technical potential and knowledge is essential, of course, for data processing personnel. But, if they are going to be of much value there are other things that they should also know, such as accounting and general business principles.

Harvey W. Protzel is president of his own firm, H. W. Protzel Inc., Consultants to Top Management, in St. Louis, Mo. He has had 25 years of experience in the field and 14 years of experience as a consultant.

Systems men should not only know these things but should also have extensive and diversified business experience: experience in a number of different types of businesses and various functional areas of any business.

One needs only to look through the want ads in the Wall Street Journal and the local newspapers to discover what most executives have decided is sufficient experience for the company's systems: "One to three years of systems experience" is called for in more than 90% of the cases. Does it seem intelligent for a company to trust the cost and methods of their operations to a person with "one to three years" of experience? What does this person know about the running of a company on an overall company-wide, properly controlled and functionally coordinated basis? I have never seen an ad state that a working knowledge regarding the requirements for good internal controls was necessary. Yet, most companies are losing an untold number of dollars due to internal control weaknesses.

Employment Standards

People are getting into data processing because there is an increasing need and because they want jobs. If the right people are to be placed in these jobs for the good of the company (and for the people themselves), the company executives must be properly selective. They must set up employment standards regarding background, experience, technical ability or potential, and personal characteristics. They will be in a much better position for a successful operation if they hire personnel with the proper potential and characteristics than if they hire people with experience who are actually not suited for data processing or systems work. The former, if properly trained, could become valuable employees. The latter will prove themselves to be of little value.

Personal Characteristics

A person's background and experience can be determined very easily. His technical ability and potential can be determined to a worthwhile degree by tests such as the one previously mentioned. But, what about his personal characteristics? Can interviewing do the job adequately? The answer is yes — but only if one is lucky.

A number of years ago, when directing the implementation of a computer operation, the client asked me to select a supervisor for them. I grilled a good number of experienced data processing supervisors and selected a man who knew all of the answers. He appeared to me to be a top-notch supervisor. He had, it was soon discovered, only one problem: he could not perform. He knew what to do and how but wasn't able to do it. This, of course, was most embarrassing for me since I had recommended the man. However, I made certain that this mistake was never repeated. Such a mistake often leads one to better things. I was led to psychological testing.

Psychological Testing

I had known that psychological testing was being used by a number of progressive companies as a material aid in their selection of executives and salesmen. Therefore, it occurred to me that, since data processing and systems work was becoming increasingly important to more and more companies, perhaps the selection of this type of personnel warranted this special attention. I tried a psychologist a few times and found his efforts to be of such great value that I brought him into my firm.

What is psychological testing? It is not, as some people have decided, the meanderings of a "head shrinker." Psychological tests are scientifically based and provide systematic information which are "pictures" of the individual. Characteristic requirements for the job (and any future possibilities that management wishes considered) are determined and the psychologist selects the battery of tests which will lead to the desired results.

His report aids management in determining if the person is suited for the job and, if so, how he can be made most productive in the shortest period of time. It also indicates the area in which the person's future should be directed and how he can best be helped to grow. Psychological testing is something that many people fear, but if used properly by management, it can only help.

Employment by Hunch

Here is an experience where psychological tests were not used: a company had hired and fired two machine supervisors within a short period of time. Not wishing to go through this costly and disturbing experience again, the president decided to utilize our psychological testing in order to be able to learn more about the job applicants before he hired one.

We tested some men; but none of these did he want to hire because each had certain characteristics which he felt were not desirable (to him, personally). One day, in sudden desperation, he hired a supervisor whom he enjoyed talking with (no testing). The machine salesman later told me that the president had stated, "I like this man and I'll be darned if I'm going to let Protzel get hold of him and maybe keep me from hiring him." The man lasted only two months, and we were brought back to complete what we had started. That is, to find a machine supervisor compatible with this type of company president.

Personnel Training — Turning Supervisory Potential into Supervisors

Many current machine supervisors and systems department supervisors are performing inadequately. Although the reason in some instances may be that they do not have supervisory ability, this is not always so. Even if a man is tested and is found to have supervisory potential, it could be many years before he has learned enough, through trial and error and at a cost to the company, to be able to do a good job of supervising his department.

What is the answer? Supervisory training for the people that are, or will some day be, responsible for some of the company's personnel. Many large companies provide this training — all companies could. We have even accomplished this by holding classes for a group of very small companies who recognized the need and value, and got together for this purpose.

Education about the Company's Operations

Some time ago, a large company was concerned about their computer department and the activities of their systems

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EMPLOYMENT, EDUCATION AND THE INDUSTRIAL SYSTEM

Prof. John Kenneth Galbraith
Harvard Univ.
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The Chances of Keeping Unemployment Down

The accepted test of successful economic policy in our time is the level of employment. That production of seemingly rather unimportant things is important is fairly well agreed. But that a high level of employment is vital is beyond dispute. We proudly tell of how much labor-saving machinery we have. But we measure success by how well we employ the labor that is saved. This means not only that recessions must be prevented but that there must be a rate of expansion sufficient to employ the annual increments to the labor force. If unemployment remains below a certain minimum — in the United States perhaps three to five per cent of the labor force and elsewhere less — economic policy by common consent is a success. If unemployment rises much above this level, it is not. There is a strong likelihood that, in the future, we shall produce things of increasing unimportance. And we shall do so with more and more machinery. What are our chances of keeping down unemployment and thus making our economic policy a success?

The prospect is not, I think, entirely bright. For it is one of the less agreeable tendencies of the modern industrial system that success along some dimensions causes failure along others. The technical virtuosity which serves us well in some respects will cause problems as regards employment. The problem will be increasingly difficult the more advanced the industrial system. It will be easier for Australia than Western Europe and easier in Europe than the United States.

The Environment of the Modern Industrial System

The modern industrial system strongly shapes its own environment. This includes the institutions and arrangements with which it is supplied the requisites or factors of production — capital, labor and materials. The role of different factors, notably of capital and manpower, have changed — and, in highly significant fashion, the position and prestige of their sources of supply have also changed.

The Days when High-Level Talent is Decisive

The rise of modern technology produces a radical change in these relationships. The banker becomes a convenience and not a power; he now competes to supplement the savings which the modern large corporation supplies to itself from retained earnings. Except for service to the community or exceptional eccentricity in the pursuit of business — the hiring of Japanese wrestlers to perform in the banking chambers, the provision of massage, or the purchase of abstract art — no American banker is now known beyond his immediate financial community.

On the other hand, in all industrial economies there has been growing concern about the quality of men available for employment. This becomes increasingly acute in the case of more sophisticated production in the more advanced economies.

The decisive problem in launching a new and comparatively technical enterprise by an established corporation in the modern industrial society is not where the money will come from. That capital will be available for a promising profit from an established enterprise can be assumed. The question is where the requisite higher-level talent can be located. The banker cultivates the corporation to seek a market for his funds; the corporate employer goes to the college and university in search of talent. Access to capital was once a factor in the location of the industrial enterprise; ready access to technology has now become a far more important consideration. For some years now we have been in an orgy of concern for the quality of education in the United States. This has commonly been attributed to a new and pervasive age of intellectual enlightenment. In fact it reflects, preeminently, the changed character and needs of the industrial system. Once the banker and industrialist sat on the college board in order to compensate for academic incompetence in practical affairs, as well, of course, as to dampen heresy. Now such honors are a useful liaison with the sources of technical and scientific talent. The academic scientist and engineer provides guidance through the mysteries of modern technology to the corporation of his choice; and helps the simple man of affairs to understand the implications of modern science. Were capital again to become scarce, bankers would again become men of distinction and investment bankers, the senior partners of brokerage houses and even life insurance presidents would live in their glow. For the foreseeable future, however, they are doomed to fall ever more deeply into the shadow of the physicist and engineer.

The Days when Capital was Decisive and Labor Plentiful

In the early days of the industrial system, when capital was decisive, banks were institutions of marked prestige and the stock market was a focal point of the culture. In the

(Based on a talk given at the International Congress on Human Relations, Melbourne, Australia, May 3, 1965)

United States the greater among the bankers and investment bankers — Cooke, Drexel, Morgan, Mellon, Lamont — were among the folk heroes of their time. Those who managed enterprises — in the manner of Judge Gary for Morgan or the latter-day Gates for Rockefeller — had something of the status of servants. In Australia and Japan until this century industrial enterprises were the proclaimed satellites of one bank or another. Elsewhere the power of Marx's finance capital over the enterprise — broadly speaking, the banking fraternity — might be debated but no one argued that it was inconsiderable. The belief of Soviet traditionalists and nostalgic American and European liberals in the ultimate power of capital has not, even yet, been entirely shaken.

The counterpart of the prestige, associated with the provision of capital, was the small interest in the supply of labor. This was a brutish and available mass. In its early stages, by lowering the reliance on traditional skills, it seems possible that the factory system substantially reduced and homogenized the qualifications required in the labor force. The manual dexterity and training of handicraft production were no longer needed; instead only physical stamina and patience were needed to conform to the pace and repetitive needs of the machine. A muscular illiterate was more employable, on the whole, than a feeble scholar.

Demand for Talent

The most critical demands for talent come from the upper technical and specialized strata of the industrial enterprise. Other factors deepen these technical and specialized strata and reduce relatively the demand for blue collar labor and especially those of lowest qualification.

One influence is simply the changing relation of the factors of production and the general advance of technology. With high incomes and continuing prosperity, savings and capital are becoming increasingly abundant. And technology is opening new channels to its use. In consequence, factor substitution in power of capital and against labor proceeds at a rapid pace. It is the most predictable of developments in an age of capital abundance.

It does not, however, have a uniform effect on labor supply. Simple repetitive physical effort is most readily replaced by machines; this means that the industrial system dispenses increasingly with that part of the working force which sells only physical effort unguided by significant intelligence.

It is true that numerous machine operations — such sensory-manipulative operations as, for example, the guidance of a power shovel or dump truck — must still be under the control of a man. And for these, educational requirements are not high. But it is also being said that there is no point in automating processes that can be accomplished more cheaply by manpower.[1] Thus it is held, both technology and economics combine to insure a continuing demand for more modestly qualified workers. This is not necessarily so.[2]

Among the standards by which the modern industrial enterprise measures success is its technical progressiveness; it does not replace profit but it is in addition to profit and it is not an especially surprising standard of performance in a society with high technology. It follows that there will be a certain bias in favor of capital intensive and labor saving processes even where the cost advantage is not clear.

Dr. John Kenneth Galbraith is Paul M. Warburg Professor of Economics at Harvard University, Cambridge, Mass. A Canadian by birth, he is now a citizen of the United States, and was United States Ambassador to India, 1961-63. He is the author of "The Affluent Society" and a number of other books and many papers.

Motivation of Workers

More important, the management of the modern corporation seeks to reinforce pecuniary motivation of workers with identification with the enterprise, and it seeks, as a matter of common prudence, to reduce the number of contingencies, dangerous to itself, which are beyond its control. Both of these ends are served by replacing production or blue collar workers with machines. Such workers identify themselves least readily with the corporation; they are most susceptible to control by the union. Once considerable thought went into fighting the unions. This is no longer considered tactful or even wise but the procedure of shrinking the number of employees susceptible to organization, and replacing them with machines, remains fully available. The capital available for this purpose is abundant; since retained earnings are the major source, the supply can be wholly under the control of the management. And there is not the slightest danger that capital will go on strike. I doubt that this step is often a matter of formal calculation. Nor is great point made of it in conservative and circumspect circles. But, in any candid view of the motives for mechanization, it can hardly be ignored.

Substitution of Capital for Labor

This substitution of capital for labor, either to or beyond the point of cost advantage, leads to expansion of the specialized and technical structure of the enterprise and the white collar employment on its periphery.[3] Requirements for coordination, planning, engineering, data control become more exacting. This exchange has advantages in worker morale and commitment. Employees whose tendency to identification is low are exchanged with those who identify readily with the technostructure or are part of it. The corporation thus becomes a much more closely integrated instrument. Again, I would imagine, this is a tendency that has gone farther in the United States than in Australia. But one of the advantages of having the United States — and needless to say we should lose no opportunity for enumerating them — is that it pictures the various forms of paradise and purgatory to which other countries can look forward.

Heavy Employment of the Qualified — Heavy Unemployment of the Unskilled

In summary then, the thrust of the industrial system is for mechanization and automation, for both economic and extra-economic strategies — and this means an increasingly high educational qualification. It may be that this tendency is uniform throughout the system. But it is most clearly visible at the extremes. Men of high scientific, engineering, coordinating, sales and other qualifications are strongly in demand; those with little but repetitive muscle power to offer

[1]A word of definition is in order here. The word automation, narrowly construed, refers to an industrial process which provides data from its own operations and feeds this back often through a computer, to controls which govern fully the process. It thus dispenses with all direct manpower. Automation in this rigorous sense of the term is a growing though not yet a dominant factor in the labor market. But automatic machinery, dispensing with much but not all human guidance, is, of course, very important. And this too is called automation. Because of this ambiguity, I have used the phrase automation sparingly.

[2]Cf Charles E. Silberman, "The Real News about Automation," *Fortune*, January, 1965. For a far more concerned and, I think, realistic view see Ben Seligman, "Automation and the Unions," *Dissent*, January, 1965.

[3]This is borne out by all recent trends in white collar employment. United States Department of Labor. Occupational Outlook Handbook Bulletin, No. 1375 — A. L963-64. pp. 12-13.

are little needed. In the United States efforts to find highly qualified talent go hand in hand with heavy unemployment of the illiterate and unskilled. The newspapers, in cities which report high unemployment, run many pages of advertisements for scientists, engineers and other specialized talent.

But even white collar operations are showing the same tendency. "While the staff as a whole was reduced during the year, the number of officers was increased, reflecting the mounting demand for competent men and women on the management level."[4]

The Shape of the Educational System

It is the vanity of educators that they shape the educational system to their chosen image. They are not without influence. But here, as elsewhere, the determining influence is the industrial system. This has shaped the educational system of most countries in the past. It continues to do so.

In its early stages, the need of the industrial system was for a limited number of managers, bookkeepers, engineers, and clerks, and then the brutish mass. This the educational system provided. Industrial requirements were in the shape of a very squat pyramid. A few men of no very profound qualification were needed at the top; the wide base reflected the large requirement for those for whom literacy and little more was sufficient. The educational system conformed.

In the United States, elementary education of poor quality was provided for the mass. More advanced education was scanty. To this time the educational systems of the older industrial areas in the United States — West Virginia, central and western Pennsylvania, north New Jersey, upstate New York — still manifest their ancient inferiority. It is still assumed almost everywhere that an old mill town will have bad schools.[5]

The Shape of Manpower Requirements

The manpower requirements of the industrial system are, by contrast, somewhat in the shape of a tall urn. It tapers out below the top to reflect the need of the administrative and technical structure for: administrative, coordinating and planning talent, scientists and engineers; sales executives, salesmen, and those learned in the other arts of persuasion; and those who program and command the computers. It curves in sharply at the base to reflect the limited demand for those who are qualified only for muscular and repetitive tasks that are readily replaced by machines.

The Lag in Social Response

The change in the pattern of these requirements — increasing demand at the top and the lessening demand at the bottom — is progressive. And the educational system responds. But, in the nature of any social response, there is a lag. In addition, the industrial system has had to learn, acknowledge and react to its dependence on the state for qualified manpower. This required a sharp break with the ideology of the older industrial enterprise which regarded the state, not unreasonably from its point of view, as an incubus when it went much beyond the provision of law and order and the protection of property. This need to convert to an essentially socialist attitude and advocacy to insure a vital factor of production has also slowed the response.

[4]Chase Manhattan Bank, Annual Report, 1964. The report adds that new vice-presidents were added to bring the total of those exalted officers to just under 200.

[5]The same is true of the rural areas of the South. Here too, the need was for crude, illiterate labor power, and provision, accordingly, was made for nothing more. Northern agriculture was far more demanding.

Unemployment as a Result of Delayed Educational Response

Unemployment in the United States is now largely the result of the delayed response of the educational to the industrial system; and it exists in the disparity between the two. It is especially marked among the youth of limited qualification who are without either work experience or seniority. Those who are in jobs with some seniority can protect their employment. Those who must break into the labor market have a far harder time. They are seeking access to a privileged and somewhat closed club. It is further aggravated because the industrial system expands its activities in areas where qualified talent is comparatively abundant. In the United States such areas as southern New England, California, Minnesota, Wisconsin attract the new industries, leaving the older industrial areas, already over-supplied by their poor school systems with workers of minimal qualification, to contend with an even greater labor surplus. There seems little doubt, moreover, that the least qualified workers are the least inclined to move in search of jobs. Given the limited opportunities in the industrial system for those with minimal qualifications, this may be a wise strategy.

Nonetheless, many do move. And we have, here, an interesting and important source of social tension. The community with a good educational system, a favorable industrial environment and, accordingly, good employment is the natural Canaan of those who were born in less favored communities.

They migrate but without the qualifications for regular employment in the industrial system. As a result they contribute heavily to welfare and unemployment rolls in communities which do a much better job of qualifying their own people for employment. This poverty and education inferiority arouses xenophobic attitudes which fix, in turn, on cultural or racial difference: "Things would be fine here if it weren't for the Negroes (or Niggers)"; "We've had a heavy influx of ignorant hill-billies."

The Old Conflict between the Rich and the Poor

If I may digress for a moment, we have here an interesting clue to the class structure of the industrial society. As always, social conflict in a community reflects its deeper character. When capital gave access to power and well-being, the conflict was between the rich and the poor. That made the difference; it was *the* difference worth quarrelling about. Sociology, economics and fiction celebrated the latent war between the two sides of the railway tracks.

The New Conflict between the Educated and the Uneducated

As intellectual qualifications have become the key, the conflict, increasingly, is between groups of differing educational level. In the United States, this is the difference that really divides. It is differences in education that foster contempt by the fortunate and resentment by the deprived. It is quite fitting, in this new class division, that ignorant millionaires should regularly turn up leading the ignorant or financing their political crusades. The Goldwater movement last autumn was, in some respects, a revolt of the financially well-heeled but intellectually under-privileged. Perhaps you will be spared this political development. You will not, I venture, be spared the increasing impact of education on class structure and the associated tensions.

High Specialization

The modern industrial system calls also for high specialization. The administrative and technical structure consists of

men who are deeply informed or experienced over a fairly limited range of matters.[6] The structure combines this diverse knowledge and experience to obtain a result that is far beyond the competence of any individual. Such organisation is more certainly available than genius, for which it is a substitute, and far more predictable.

There also continues to be need for specialized craft skills. The technical dynamic of the industrial system means that, at any given time, some kinds of knowledge, experience and skill are in rising demand. Others are becoming obsolete. There will be a question whether the categories of qualification available at any time fit the demand. If they do not, this will be a cause of unemployment.

Those with No Skill

However, this is a much less serious problem than that presented by those with no training or skill of any kind. Retraining is at least possible for someone who has been a member of the labor force; it is not for someone who has never been a member. Quite a few changes in need are taken care of in the normal turnover of the labor force — the sons of railway telegraphers do not follow in a dying profession but become sales executives. The sons of the ignorant are far more likely to follow in the footsteps of their parents and be nowhere.

In consequence unemployment in the United States consists overwhelmingly of those who are not qualified by education for employment in the industrial system. In the spring of 1962, when the official unemployment rate was 6.0 percent of the labor force it was 10.4 per cent for those with four years of schooling and 8.5 per cent for those with five to seven years of schooling. With adjustments for those not counted because they were not actively looking for work — discouragement begins to operate after a time —, the national rate was estimated at 7.8 per cent. The rate for those with four years of schooling or less was estimated at 17.2 per cent, but for those with five to seven years of schooling or more unemployment was 1.4 per cent. Of all those officially counted as unemployed at the time, 40 per cent had eight years of schooling or (in most cases) much less.[7]

The Problem of the Insufficiently Educated

The expansion of demand is not a remedy for this unemployment. The problem of the insufficiently educated is, it must be stressed, their unemployability in the industrial system. A more rapid accommodation of education to industrial need is a remedy.[8] National educational standards and a more uniformly qualified domestic working force combined (possibly) with a lower stage of technical development and the availability of a mobile force of imported workers have enabled European countries to keep unemployment at lower levels than in the United States. I would judge that you have had similar success. But it is the lesson of our experience that educational requirements become increasingly demanding. It will require great vigilance and great effort to profit from our experience and keep the qualifications of the labor force abreast of requirements. No part of the country and no economic sector — and in our case, no racial group — can be allowed to supply unqualified and hence unwanted labor power to the industrial system. And, to repeat, the industrial system is not static. There is a constant elevation of requirements; a continuing redundancy of those who fall below the minimum requirement.

Rapid Improvement of the Educational System

Accordingly there must be a rapid improvement in the educational system in order to keep even with the employment problem.[9]

Conclusions

What conclusions should one draw from this brief tour of the problem of manpower in the modern industrial community? Especially what conclusions should a slightly less industrialized country draw from the experience of the United States?

Let me, at the cost of minor repetition, suggest five of central importance:

(1) The modern industrial system has a technological dynamic that has a strong economic base and which transcends purely economic considerations. It has changed and will continue to change the nature of the demands on the working force.

(2) Since this dynamic has a thrust of its own, there seems little alternative to accommodating to it. Most of this accommodation is in the field of education.

(3) The basis of this accommodation is to expand the amount of very highly qualified workers, for which there is enlarged demand, and shrink the number of minimally qualified workers, for which there is a sharply declining demand. Countries such as Australia with uniformity by national standards of education, and less social or racial stratification than the United States, may have an easier passage in this regard. But they should be warned by our experience. We have not been able to keep educational preparation abreast of requirements and we are having increasing difficulty in doing so.

(4) Given the importance of education, it is not surprising that differences in educational qualification is a modern source of social tension — as differences in income were once a source of such tension. And, it follows, that equality of educational opportunity will become an increasingly important solvent of social tension.

(5) But perhaps the day is not distant when we will need to consider more carefully the purpose of the industrial system. I began by saying that our present test of its success is the employment it provides regardless of need. This might, if workers became increasingly expendable, be too difficult a test. Instead we might wish to consider how we can meet our needs with a minimum of well-distributed effort. This would require a drastic alteration in our attitudes. Toil would no longer be an end in itself. It would become, instead, a means to the end of providing for our needs. This is a disturbing note on which to end. But it is a prospect we might have to face.

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[6] In the wartime years in the Office of Price Administration of the U.S. Government where I was in charge of price control we once procured a pickle man from one of the food companies to prepare a price regulation on pickles. After a few days he appealed for help. He was, he said, primarily a dill man. The regulation would have to cover sweet pickles too.

[7] Charles C. Killingsworth. "Unemployment and the Tax Cut." Address before Conference on Economic Security. Michigan State University, October 26, 1963. Mimeographed.

By way of comparison, national unemployment was estimated at 25 per cent of the civilian labor force in 1933, the year during the depression when it was highest.

[8] The problem of organic mental retardation arises here — of those who are constitutionally incapable of education. However, recent studies indicate that this is comparatively unimportant as compared with environment and opportunity and related motivation. Race is another factor; a very large proportion of the unemployed in the lower educational levels are Negroes. But the prime discrimination against the Negro lies in poor environment and schools and related absence of motivation. The position of an educated Negro is less favorable than that of a white of equal education. But it is far superior to that of an illiterate white.

[9] We have the added problem of uneven regional development, and the low motivation which goes with life in urban and rural slums and among social minorities. This line of analysis led me to urge in the autumn of 1963 that we concentrate Federal funds for education on the poorer school districts. "Let Us Begin: An Invitation to War on Poverty," *Harper's Magazine*, March, 1964. From a speech "Wealth and Poverty" to the National Policy Committee on Pockets of Poverty. This has since become the course of policy.

IS COMPUTING A PROFESSION?

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Is computing a profession?

To put this discussion into perspective, let's consider a vocation which is fully accepted as a profession, and let it serve as an anchor for discussion. Among the several professions that are so acknowledged I have chosen medicine because I have some information readily available for it, mostly drawn from the issue of *Daedalus* for fall of 1963. That issue is devoted to the professions, with chapters on the various professions, their cultural impact, and the impact of the culture on them. I recommend it very strongly to anyone who is interested in the question of what is a profession.

An Example — The Medical Profession

Medicine in the United States began with the colonists in New England. As far as I'm aware there were no professional doctors, but a number of the clergy who accompanied those English colonists had taken the medical training that was then available and brought it over with them so that they could administer to the bodies as well as the souls of the people under their care. The influx of doctors continued for a while, but it became necessary for the new country to develop its own methods for providing itself with medical care.

In 1791 New York Hospital was established as the first teaching hospital in the country. In 1848, the American Medical Association was founded, with the same stated aims that it has today and with the promise that the medical profession would forthwith begin to keep its own house in order.

Professional Standards

How well it did this is reflected in the Flexner report in 1910 which was prepared for the Carnegie Foundation for the Advancement of Teaching. That report, which took something like two years to prepare, consisted of a detailed examination of virtually all of the medical schools then running in the country — both the university medical schools and the proprietary ones which then abounded — and it found something seriously wrong with almost all of them. The Flexner report had an effect which a good many similar reports don't have nowadays; the medical schools and the teaching hospitals did begin to put their houses in order. Within a very few years the standards of medical teaching and the standards of clinical research had reached very nearly the level at which they now are, and this, in my opinion, is a level of which the medical profession can well be proud.

The Professional's Relationship to His Client

From approximately the Civil War until just before the First World War we had the era of the private general practitioner — the horse-and-buggy doctor until he began buying automobiles. The relationship between the professional man and his clients was very close and personal. It was not unusual for the family practitioner to bring three and sometimes even four generations of the same family into the world. He knew the people he was serving. He felt responsible for them in ways outside of his strict professional duties, and they felt a confidence in him that's very hard for people living in these days to understand.

Before the Flexner report it is safe to say that that confidence was not based primarily upon the doctor's professional qualifications, which by and large weren't especially good. It was based on the professional-client relationship primarily.

Deterioration of the Relationship

Since the depression or since the First World War or since 1950, depending on exactly where you look, there has been a change in the medical profession resulting in a relaxation in this patient-doctor confidence which is frightening to me, and I think is beginning to be terrifying to some of the more perceptive members of the profession. There are a number of reasons why this relationship has deteriorated.

In the first place, there aren't very many GP's left per unit of population. The better medical students tend to prefer specialization. Those who stay in general practice have not increased very much numerically, while the population itself has increased substantially, and the fraction of the population who can afford their services, either from personal funds or because of increased institutionalized medical care, has increased even more. Consequently the general practitioner these days is an extremely busy man. He simply doesn't have time to get in his car and spend three or four hours on a house call, because he's either required urgently for a

(Based on a talk given at the 2nd Annual Conference of the Computer Personnel Research Group)

couple of operations at the hospital, or he has a waiting room full of patients who have made appointments and are entitled to his attention. So, one of the reasons for this deterioration, this lack of the personal relationship, is simply that he is very busy, and that's not his personal fault — it may or may not be partly the fault of the profession.

The Emergence of Specialists

The emergence of specialists, I think, has also had its effect on the patient-doctor relationship. When you had one horse and buggy doctor in a county, he was quite obviously *the* man who had medical knowledge, and it was quite easy to look up to him as the sole support of his profession. When you now go into a busy clinic and you find three or four interns around, any one of whom makes the first examination, and then you are referred apparently at random to any of a number of specialists, it becomes increasingly hard to think of the individual as the repository of professional knowledge (an aspect relevant to our own situation).

Also, during those days the doctor was on a pedestal whose height was measured from the ground on which it stood. Those were not days of broad general learning. They were not days of easy expertise. Nowadays anybody who has a subscription to the *Reader's Digest* feels entitled to tell his doctor what drug he wants for what ailment he thinks he has. Without discussing the wisdom of this approach to medicine, it certainly has not had a good effect upon the professional prestige, so to speak, of the medical practitioners.

Suing the Doctor

There are a number of evidences, other than those you can see by visiting your own family doctor's office, of the extent to which this lack of confidence is going. I have heard stories (I don't know how true they are) of doctors who were afraid to stop beside the road and treat an accident victim, because the probability of a resulting malpractice suit was getting up past point five. Your family doctor may have known in principle about the possibility of a malpractice suit, but I don't remember in anything that I have read that it was taken as a fact of life worthy of consideration — anybody can be struck by lightning, but you don't plan your life on that basis. Nowadays the question of a malpractice suit is very much in the forefront of every medical practitioner's mind all the time. This, when we think about it, is a bit frightening from a number of points of view.

Well, I think that this little summary may help us understand how the members of one profession attained prestige and held it for something on the order of three generations. I think the latter part of the history may show some of the dangers to which this prestige is subject in our modern society. I hope it may help show us what we might be able to do to guard against a similar deterioration if and when we ever become a profession.

Who is to Recognize the "Computing Profession"?

The next question that arises is: when you say that you want your vocation or avocation to be recognized as a profession — by whom do you want it so recognized? There are a number of groups of people who might reasonably be expected to give such recognition under suitable circumstances.

First of all, you might want the members of the field itself to agree that it was a profession and to act as if it were.

Second, you might expect recognition by other professionals that what you are doing is in fact professional work. This has more point than pats on the back at technical meetings. Before you can get curricula introduced into schools of higher study, those curricula and those who are to teach them must be — in all schools that I'm acquainted with — accepted by academic councils. These academic councils are faculties of other departments. They may say when computing courses are being discussed, "Well, I suppose we can introduce computing courses — we discussed five years ago whether we ought to teach typing." It's going to be very hard to get curricula and faculty in our field past the academic councils unless we can in fact get recognition from the members of the other professions that are represented.

The technical and trade journals seem to concentrate pretty much on recognition by one's own management. One study of technical manpower by Deutsch and Shea, of New York, mentions a number of comments about the fact that management doesn't seem to hold the high regard for the professional status of programmers that it should; I think that a good many programmers take quite a limited view of the kind of recognition that they would really like and would be quite willing to let some of the other forms of recognition take care of themselves later, if ever.

One might talk about recognition by government and specifically by state governments, which traditionally have had the responsibility for licensing practitioners in professions. Also, I think when we come down to the criteria we will find that without that recognition it would be hard to persuade a large fraction of the population that we are in fact a profession.

Finally, one might talk about recognition by the general public of the sort that the medical profession held during its heyday and still does to a very large extent.

When we talk about the advantages and disadvantages of recognizing the "computing profession" as a profession, we want to keep clearly in mind as we make each point which fraction of these recognizers the particular point applies to.

What are the Criteria for a Profession?

The next set of questions that one might ask is — how do you tell when a vocation is a profession?

Long Recognition

One of the most reliable criteria, of course, is long recognition. If the field has been recognized by everybody as a profession for a long time, then only real social change or real dereliction on the part of its members will cause it to cease being a profession. This may be possible even in long established professions, but it's pretty hard for it to happen.

Who is One and Who Isn't

The second major criterion is that you know who's in and who's out. When you get sick, you go to *a* doctor. If you've been around town a long time you probably have a favorite doctor, but in case of emergency you would be willing to go to any doctor with an MD after his name, unless you knew that he was personally unreliable. There is a recognized procedure by which a person is admitted to practice as a

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doctor in a state. Everybody knows that this procedure exists. There are legal sanctions against those who try to practice without going through the cursus honorum. As far as the general public is concerned, the human population is divided very clearly into two groups — those who are medical doctors and those who aren't. Anyone who is a doctor is admitted to the privacy of your body, so to speak. Anyone who isn't a doctor is not, and it's clear who is who. So a sharp distinction between those in the profession and those outside it is one of the most crucial criteria.

The Learned Professions

A profession, typically, or historically, was a vocation in which a gentleman's son could indulge himself. The oldest of these vocations were the military, the clergy, medicine, and the law. It was early recognized that there was a distinction between being a military officer on one hand and being a member of the bar on the other; a distinction was therefore made between the learned and non-learned professions, and when I use the word profession from now on I will observe that distinction.

For the learned professions, then, the criterion foremost in everybody's mind, especially in the minds of all those who belong to them, is that there is a substantial special intellectual content required. In the best recognized professions this intellectual content is so great that it requires a substantial amount of study after the bachelor's degree; as I understand, the standard right now is three years in the law, and four years of study plus either two or three years of interning in medicine. But the kind of intellectual content that we're talking about here is quite different from the intellectual content in training programmers. This is not a matter of whether it's two weeks or six months. This is a matter of whether it's three or four years devoted to the special intellectual content of the field.

Sanctions

The next criterion is the relationship of the individual professional to society. The individual doctor, as I indicated a little while ago, is personally liable to malpractice suits. The individual lawyer is personally liable to disbarment. The individuals in most of the other professions are subject to economic sanctions so severe that if they violate whatever their profession has decided upon as proper professional conduct they no longer practice that profession. They've got to go into something else. I think when you consider some of the hiring practices in our business you'll see how far we are from that, but it has been typical of a profession that you can get read out of it. This is really a concomitant to having a sharp distinction between those who are in and those who are out. Just as a profession has a mechanism for getting people in, a profession must, to protect itself, have a mechanism for getting people out. It is true and has always been true that military officers can be cashiered, and clergy can be unfrocked. Whenever a computer person says he wants to be a professional, he needs to keep this in mind.

Code of Professional Ethics

Very closely related to this is that the established and recognized professions have a formal and well recognized code of professional ethics. This is usually distinct from the code of personal ethics that every gentleman's son, so to speak, however far removed from the gentry, is assumed to have. There are certain things that they don't do, and they do or don't do these things under the severe economic sanctions that I mentioned just above.

The Strong Professional Society

There is typically a strong professional society. This professional society is strong downwards as well as upwards. John Lacey, who is patent attorney for the Laboratory, told me a story about a friend of his who was admitted to argue before the Patent Commissioner, which is distinct from admission to the Washington, D.C. bar, incidentally. He went down to Florida for reasons of health and started practicing patent law there. The Florida Bar Association pointed out to him that he had not been admitted to the Bar of Florida and was therefore not entitled to practice in that state. He said to them, "I practiced in the District of Columbia without being admitted to that bar; I am still entitled to argue before the Patent Commissioner; that's all I want to do; I will therefore continue." They said, "That's fine, you may continue then to do that portion of your activities which have only to do with the Patent Commissioner; you may not, however, practice any other law in the state of Florida. For example, you may not draft a contract between the present holder of a patent and licensees. This you have to get done by somebody licensed in this state." And none of the people who heard about this, including the poor fellow himself, thought such action strange, oppressive, or opposable. The local bar association says to a lawyer, "You shall not do such a thing in our jurisdiction"; then he won't. I don't know, as I think it over, whether I really want to give that amount of power to the Association for Computing Machinery, even though I highly regard that organization. One of the reasons for the strength of the American Medical Association and the various bar associations resides, of course, in the fact that a legal license of one kind or another is required for practice. These licenses are granted and taken away by legal procedures. But the people who exercise these legal procedures are, let me say, strongly influenced by the recommendation of the professional societies involved.

Another criterion for a learned profession is that it should have its own literature and that this should be a good and a full literature.

What are the Criteria That Do Not Make a Difference?

One of the things which is not a criterion, it seems to me, is the simple fact that you may spend all your time at it and be paid for it. We hear about the distinction between amateur and professional golf players; we hear lots about professional football and professional baseball. These may or may not be professions in some sense; but they are surely not learned professions within the scope of the present discussion.

Technical Ingenuity

Another thing that is not a criterion is the elaboration of technical skill or even technical ingenuity. A practicing programmer quite rightly takes pride in being able to write a tight, fast, efficient, easily readable, etc., program. In order to do this, he has to put a lot of intellectual effort into it. I think that there would be general agreement that the kind of intellectual activity that he has to put into it to get both AC and MQ cleared in one cycle instead of three, for instance, is not professional activity. It is technical activity. Technical competence is required in the practice of a profession at least at certain stages, just as it is required that a surgeon be able to tie knots with his left hand and gloves on. But this is not the essence of the learning required for a learned profession; I think we have to be careful to distinguish between technical and somewhat superficial skills on the

one hand and the deep special knowledge which makes the difference between a craft on the one hand and a profession on the other.

Years of Unrelated Formal Training

One of the other things that, it seems to me, is not a criterion is the amount of unrelated formal training required. It is usual in a number of installations not to consider seriously applicants who don't have bachelor's degrees; but the consideration tends to stop pretty much there. You don't care much what they had their bachelor's degree in. You may hope that they had a certain minimum of math or a certain minimum of business administration, depending on what your interests are. But a certain number of years spent studying something is not by any means the same as the special formal content of a profession that I discussed just above.

Years of Experience

Finally, it seems to me, one of the things that is not a criterion is experience or even the use to which that experience is put. I know janitors with thirty-five years' experience, and I'm sure they're good janitors. They are not members of a learned profession. So the length of time that somebody has spent at something, even how much he is paid at the end of that time, are not criteria in this discussion.

De We Want Programming to be a Profession?

We are now ready perhaps to ask the question "Do we really want programming to be a profession?" Here, we ought to keep in mind some of the costs that people in learned professions must be prepared to pay. They must be prepared to live their daily professional lives under a stringent code of ethics. They must be prepared in general to devote their lives to the fulfillment of those ethics. In other words, they have to take a professional attitude towards their full professional career.

Continuity

In this regard I think it's instructive to make one more comment based on the Deutsch and Shea study, which I referred to above. One of the questions asked of the respondents in that study was, "What do you expect to be doing five years from now?" Forty-seven per cent expected to be supervising or managing, in other words, primarily not programming anymore. Just enough others expected to have left the field completely to bring the response up to: just over half of the people did not expect to be practicing their profession five years from now. These 549 respondents were selected by taking every other member of the ACM (already a pretty highly selective body) and then counting only the ones who responded. If these people expect not to be practicing their profession five years from now (at an average age under 30), then are we really concerned about developing a professional code of conduct? You can hardly develop one in that period of time.

Rewards

As for the rewards for becoming a member of a recognized profession, I think we want to weigh these very carefully too, because professional recognition by itself carries very little in either prestige or reward. It seems to me that the prestige and the rewards actually given to the individual practitioners of a profession depend not upon their professional recognition primarily, but upon how they themselves contribute to society. Elementary school teachers are fairly low down on both the prestige and salary scale. Nevertheless teaching has long been recognized as one of the professions and for quite a while was among the most honored, as in fact it still is if you're teaching students who pay enough tuition. Salary in our present culture seems to be set pretty much by supply and demand on one hand, and by demonstrated competence and honesty on the other.

Intellectual Challenge

As for intellectual challenge, there again, I don't really know. Science wasn't a profession when Newton was working on it. It was the avocation of gentlemen pretty much, and I don't know that he would have done any better work if it had been a profession at that time. Some of the people who are intellectually active in our field are well known. I can't believe that those people could work any harder or do any better work under any circumstances, and in particular I don't think that professional recognition would really drive them very much further. I think that the degree of intellectual challenge and the way in which one meets that challenge is determined by the subject matter of the field and the individual's attitudes more than by professional recognition.

Some of the other pros and cons of recognition as a profession have already occurred to you many times and have been discussed in the press, and since my space is running short I'll let those go.

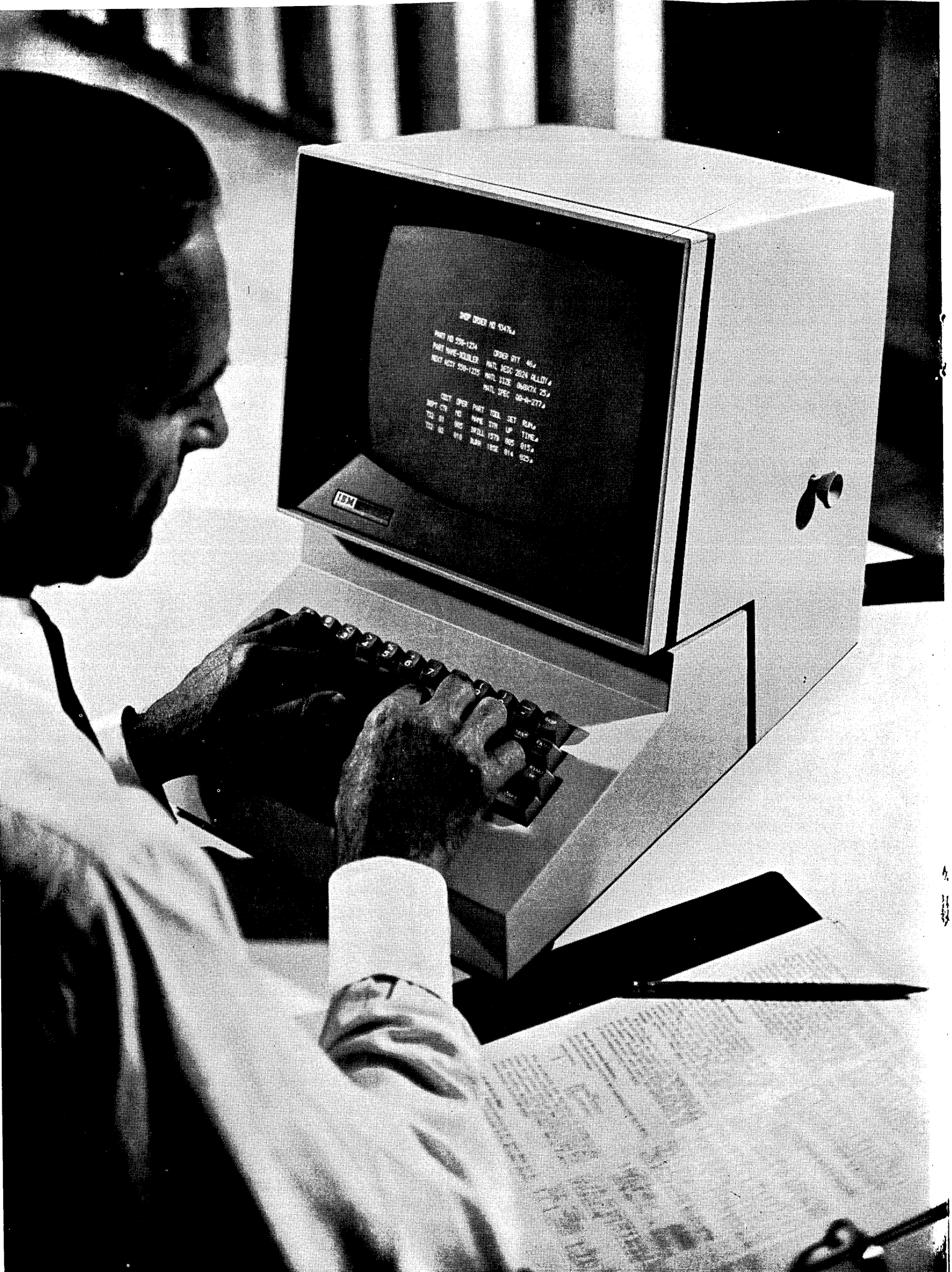
How Does Programming Become a Profession?

Assuming three things: (1) that we know what a profession is; (2) that we think programming should become a profession; and (3) that it is not now in fact a profession, we can ask, How does programming become a profession? That question may be answered very easily: by meeting the criteria for recognition.

The fundamental criterion — the one without which you cannot really meet any of the other ones — is a formal intellectual content which is agreed upon by the practitioners, which is taught in the schools, and which is formally recognized by some procedure equivalent to licensing.

One of the most encouraging things to me in this development of computing into a profession has been the increasing thoughtfulness and intensity of curriculum development in our field. All of you know that courses in computing, interpreted one way or another, have been taught for some time. Some of these courses have been excellent and well taught by excellent teachers. There have even been curricula designed in the computing sciences. These curricula have not been agreed upon to the extent that practicing managers like myself refuse to hire anyone who hasn't successfully completed one, and, as a matter of fact, I think that those curricula will have to be thought about a good deal more before that time will be reached.

It seems to me, therefore, that no one in the computing field has a right to yearn to be a professional until he has himself put in some minimum number of hours deciding what the intellectual content of his field is, and making the results of his thinking known, either formally or informally to someone who has the responsibility for curriculum development, either within the ACM or at a University, or in any other way. Since substantial intellectual content is the thing without which we can't possibly ever get a profession, the price of admission to this discussion is some hours of work deciding what the intellectual content of our field is, and until you have done those hours of work I think you don't have a right to yearn.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You can choose an IBM Display Station that has a 240...480...or 960 character buffer.

Each 2260 has 64 different display characters—both letters and numbers. Twenty-three of these are special symbols. When directly connected to a computer channel, IBM's 2260 Display Station has a data rate of up to 2560 characters per second.

On a telephone line, its data rate is 120 or 240 characters per second—depending on the data set used.

The 2260 offers you fast access to all kinds of files. It's inexpensive: as low as $89.00 a month.

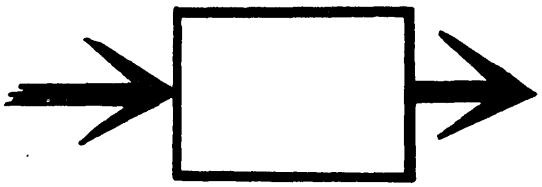
Wherever you use typewriters, files, or paper—you can use an IBM 2260 Display Station. It will save you money...time...and space.

It's another new device to help your SYSTEM/360 grow as you grow.

SYSTEM/360—The Computer with a Future.

IBM®

Circle No. 8 on Readers Service Card



The Personnel Development Problem - August 1965

The personnel requirements of the next five years in the computer and data processing field have been estimated in a number of different ways. Regardless of the size of the estimate, the number of people needed in the data processing industry is far higher than the number currently in the field; thus we have a problem in personnel development.

Generally accepted figures indicate that there are some 225,000 people in the industry today, in 22,000 computer installations at some 14,000 computer sites, and there are perhaps another 10,000 card processor installations planning conversion to a stored-program computer. Of these 225,000 people, approximately 140,000 are analysts or programmers, or a combination of the two.

Within this group of 140,000 analyst-programmers, some 80,000 spend more time in programming than in analysis, and some 60,000 are principally analysts. Qualitatively, approximately 25% of today's analyst-programmers are unqualified:

	Total	Majority in Analysis	Majority in Programming
Total 1965	140,000	60,000	80,000
Qualified 1965	105,000	45,000	60,000

Requirements in 1970 will increase and change in nature. The split between analysis and programming will widen, and a greater number of people will be required in analysis. Thus, we estimate a total of 350,000 planning personnel in 1970, with 200,000 concerning themselves principally with analysis. There seems to be no reason to assume an increase in the percent qualified; therefore, 1970's personnel picture appears as follows:

	Total	Majority in Analysis	Majority in Programming
Total 1970	350,000	200,000	150,000
Qualified 1970	262,500	150,000	112,500
Increase over Qualified 1965	157,000	105,000	52,500
Increase in % over 1965	150%	233%	87.5%

The greatest *training* need, therefore, is in analysis personnel. And yet, that is where the training programs today are weakest.

Today's training programs for analysts are, with few exceptions, based on programmer training. A good programmer, or one who does well in the programming course, is selected for analysis work, *without* any real systems or analysis training. His on-the-job training, vital in analysis, is largely trial by fire, with no second opportunity. No systems training is offered by most manufacturers, and certainly nothing comparable to what is required to meet the 1970 increase. Even the universities are not meeting the challenge; training offered there has limited initial applicability to the day-to-day analysis problems.

The manufacturers should meet this problem with a more comprehensive training program. A brief outline of such training, twelve weeks in length, is suggested below, to be followed by a minimum of four months of on-the-job training. This curriculum should be flexible, to accommodate the specific requirements of user organizations:

I. Orientation to Data Processing — 2 weeks

- A. Information Processing Concepts
- B. Types of Processing Systems
- C. Punched Card Principles
- D. Binary Numbers
- E. Basic Computer Concepts
- F. Stored Programming
- G. Personnel Functions
- H. Punched Card Operation
- I. Computer Operation

II. Principles of Programming — 3 weeks

- A. Tasks of Programming
- B. Use of the Specification
- C. Logical Analysis
- D. Coding
- E. Testing
- F. Program Documentation
- G. Programming Environment and Tools
- H. Instruction Format
- I. Instructions
- J. Optimization Concepts
- K. Programming Practice

III. Systems Analysis and Design — 7 weeks

- A. Systems Functions
- B. Analysis Concepts
- C. Design Concepts

D. The Systems Proposal
E. The Systems Specification
F. The Feasibility Analysis
G. Systems Techniques
   — Process charting
   — Flow charting
   — Document analysis
   — Lay-outs
   — Forms design
   — Interviews
H. The Analysis Process
I. The Design Process
J. Systems Test
K. Turnover to Programming
L. Clerical Systems
M. Programming Tools
N. Total Systems Concepts
O. Practice Workshop

The above curriculum is by no means complete; it represents the basic concepts required for an analyst-trainee, *prior* to intensive on-the-job training, under direct and constant supervision of a senior analyst.

The success of the industry, and the success of the 30,000 new installations going in by 1970, will depend to a great extent on the analysis training provided in the next five years.

Dick H. Brandon
Contributing Editor

PERSONNEL PROBLEMS IN DATA PROCESSING SYSTEMS

(Continued from page 17)

men. We were asked to review the physical operations and also test the personnel involved. We found that a complete overhaul of the computer functions and all related systems was necessary. One of the reasons was that many of the people did not belong in data processing or in systems work. But, we also discovered that almost all of the people felt that they did not know enough about the company's operations to be able to do an acceptable job.

Included in the initial training of data processing and systems people should be a thorough understanding of the company's policies, philosophies, goals, methods of doing business, and a look-see at the operations of each department. Education, on a continuing basis, should be provided to keep these people up to date technically. In addition, persons who are found to possess unusual management potential should be given specialized training to increase their rise as rapidly as it is needed.

A well-informed and well-trained employee will be a more valuable employee.

Management Reporting

No machine supervisor or systems man should be expected to know what is needed by top management if he has never been in the shoes of a top executive. If the company executives are to get the best tools for their jobs (management reports), the people designing and producing these reports must know more about the executives' jobs.

The top executives should take their data processing supervisors into their confidence and teach them what is going on at this level. They should work together very closely. Anyone should be able to do a better job if he has better tools. An executive, who will do what is suggested here, will be in a position to receive better tools. One thing more, Mr. Executive, make them prove to you that the controls are such that your reports are accurate. A decision or action, based upon an inaccurate report, could prove very costly.

Conclusion

When management decides that machines are not automatic cure-alls and will not solve their problems for them — and when management decides that it is most important to properly select and train their data processing personnel — then industry will be in a better position to prosper.

Data processing and systems personnel have more opportunity to get into more functional areas of a business than any other group of a company's employees. Therefore, these people should be selected and trained as good management potential.

If management would use every possible means to be most effective in selecting and training this type of personnel, the companies would get much more for their machine dollars; the companies would earn more profits; and the future executives would be more capable. The cost of testing and training is very small compared with the value that may be derived.

c & a CAPITAL REPORT

A Special Report from C&A's Washington Correspondent

The day-to-day use of optical scanners for reading mail moved a step closer in June when the Post Office Department awarded Philco Corporation a $1,800,000 contract for six scanners. Four systems will be field-tested on actual mail two in Detroit, starting November, 1965, and two in Buffalo, starting September, 1966.

In experiments with the Philco scanner, the Post Office reported 99 per cent accuracy in reading the second line of the address on Zip Coded mail, which Postmaster General John A. Gronouski called "a major breakthrough in mechanization." When used with a mechanical letter sorter, the Philco scanners examine the face of each envelope, locate and read into memory the Zip Code, then instruct the letter sorter where to distribute each letter.

Philco's pilot machine will be installed at the Post Office research department in Washington for further refinements. Meanwhile, the Post Office still has contracts with Burroughs, Rabinow Engineering (a Control Data subsidiary), and National Cash Register to reduce costs of scanners and simplify their design.

Computer manufacturers competing for Government contracts usually have a fair idea of the value of the other fellow's bid on a particular contract, but occasionally they miss. Seldom, however, do they miss by as much as they did in June when the Navy's Bureau of Supplies and Accounts told Bunker-Ramo and Honeywell EDP that Univac had underbid them on a new contract by $8.6 million and $7.1 million, respectively. This eye-opener clearly demonstrates the competitiveness of the computer industry.

These three companies were the only ones to respond to the Navy's request for bids on 68 shipboard digital computers, 57 for immediate use and 11 to be placed on option for possible use. Univac's actual bid was $9.8 million; Bunker-Ramo's was $18.4 million, and Honeywell's was $16.9 million.

The Navy's specifications call for a computer with a central processor, magnetic tape units, card reader and punch, and line printer. Since it will be used aboard ship, the computer will also be ruggedized to withstand shock.

Although the lowest bidder is sometimes passed over in Government contracts, Univac looks as if it is a sure winner here. It has considerable experience in military computers and has long been a vendor to the Navy. A few weeks before this latest contract activity, it delivered the first CP-823/U to the Naval Air Development Center at Johnsville, Penna. Known commercially as the Univac 1830, this computer will serve as the control center of an airborne antisubmarine system in the Bureau of Naval Weapons.

In other significant contracts, IBM was selected by the Space Agency to supply a huge computing complex for the Goddard Space Flight Center in Greenbelt, Md. With options, this contract will be worth $18 million. Initially, IBM will supply one System/360 Model 75 and two Model 92s. The option calls for five additional processors: one Model 91 and four Model 65s. Some of the equipment will go to Goddard's Institute for Space Studies in New York.

Back on the military side, RCA Electronic Data Processing received a $17.1 million lease contract to supply 13 RCA 3301s for six locations in the Defense Supply Agency, which is the buyer for much of the common military items. At the same time, DSA announced a $5.6 million contract to IBM for 8 System/360 Model 30s to be used for mechanization of warehousing and shipment processing. The RCA equipment will be used for a material management system.

These are the recent contracts of worthy size, but another is coming in the future that should bring in a tidy sum to someone. The Air Force Systems Command wants to replace IBM 7094 systems now used in four research and development spots: the Systems Engineering Group, Wright-Patterson Air Force Base, Ohio; the Ballistic Systems Division, Norton AFB, Calif.; the Flight Test Center, Edwards AFB, Calif.; and the Air Proving Ground Center, Eglin AFB, Fla. The computer selected must be three to four times faster than the 7094 Model I. Bids are due from manufacturers by August 10.

Don't be surprised if Defense Department contractors suddenly start buying more computers than they have in the past. Secretary of Defense Robert S. McNamara has approved a report on contract services that knocks down many of the arguments these contractors have used in the past for buying only 5 per cent of the computers they use.

Defense looked at 18 of its largest cost-reimburseable contractors. They rent 174 computer systems at a yearly cost of $62 million, which Defense considers "a disproportionate bias toward rental."

These contractors said the "uncertainties" of the future Defense business justify leasing computers instead of buying, but Defense pointed out that in five out of seven years all 18 contractors increased their defense business; in the two off years, their decreases were only 10 per cent and 1 per cent.

In addition, Defense rejected the claim that these contractors have unique problems in the use of computers, such as equipment obsolescence and insufficient capital or credit. These are problems common to all computer users, Defense said.

As part of its ammunition in this study, Defense put out some noteworthy statistics. It said contractors whose work is funded primarily by firm fixed-price contracts own 23 per cent of the computers they use; the Government as a whole owns 46 per cent, as of June 30; industry owns 15 per cent, and this figure is steadily increasing. Defense said it would like its cost-type contractors to own anywhere from 15 to 50 per cent, rather than the current 5 per cent.

In the conclusions to this study, Defense re-affirmed its belief in contractors' furnishing their own computers, whether they are purchased or leased. The General Accounting Office has been after Defense for some time to furnish them, but Defense still maintains that the management of contracts is best done by contractors, and this includes procurement of computers used for the contract.

"ACROSS THE EDITOR'S DESK"

Computing and Data Processing Newsletter

TABLE OF CONTENTS

APPLICATIONS

'INSTANT PROOF-READING'

Proof-reading once requiring 20 man hours can now be completed in less than 10 minutes by a digital plotter. "We call it 'instant proof-reading'," said Lester L. Kilpatrick, president of California Computer Products, Inc., when speaking at the annual "Share" design automation workshop held in June at Atlantic City, N.J.

Mr. Kilpatrick said that a digital plotter manufactured by his company in Anaheim, Calif., is used to check the accuracy of control tapes for automated machine-tools in experiments at IIT Research Institute in Chicago. "An error in the control tape shows up as a 'bulge' on otherwise smooth lines when the data is plotted in graphic form", he said. "It would take at least 20 hours for a man to check the 240 pages of numbers recorded by computer on the tape. A CalComp plotter pinpoints errors in less than 10 minutes".

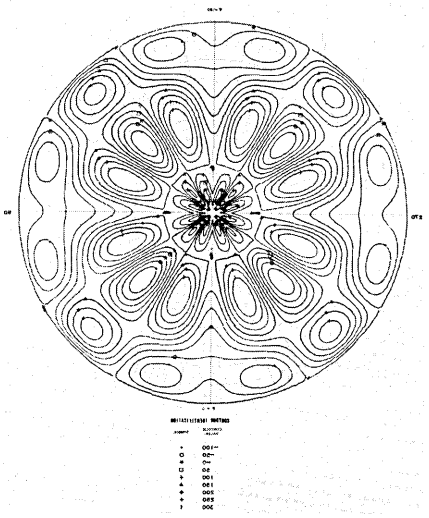
CalComp plotters display digital computer output as maps, charts, graphs or drawings — complete with numerical, symbolic and written annotations. The machine-tool 'proof-reading' operation produces a graph.

The digital plotter, according to Mr. Kilpatrick, "has become a very important addition to the data processing function of the digital computer". He cited contour maps of potential oil-yielding areas, automatic weather maps at government weather stations, air traffic recording, atomic structure analysis, navigation, sales analysis, inventory analysis, and brain pattern analysis as "a few of the many applications".

HELICOPTER ROTOR EVALUATION TIME CUT 500:1 BY DATAPLOTTER

The Boeing Company's Vertol Division (a leading manufacturer of transport helicopters) has cut the time required to plot computer evaluations of rotor design from two weeks to 10 minutes through the use of an EAI 3500 DATAPLOTTER, manufactured by Electronic Associates, Inc., West Long Branch, N.J. The resulting plot is an essential element in Vertol's continuous program of rotor design-analysis, evaluation and overall safety assurance.

Sensing elements mounted on rotor blades during test flights by Vertol collect information on stress, strain, pressure and rotor motion. The large amount of information collected is analyzed and evaluated by computer in approximately 20 minutes — a procedure which once required months of work — then plotted out on the DATAPLOTTER in 10 minutes. The normal plot consists of 15,000 points. The DATAPLOTTER connects these points into a continuous line — providing a display suitable for immediate visual evaluation.



— Complex contour plotting routines that represent information on stress, strain, pressure and rotor motion.

Vertol programmers indicate that the idea for this design evaluation procedure came from the study of complex contour plotting routines resulting from cancer research performed by the Bio-Medical Research Center.

COMPUTER WILL CONTROL OFFICE BUILDING SYSTEMS

The new headquarters building of the International Monetary Fund in Washington, D.C., scheduled for completion late this year, will be the first office building with basic equipment operated by a com-

puter. The 13-story building is an addition to an existing structure, and both will be controlled by the computer installation, which is being supplied by Westinghouse Electric Corporation.

According to Robertshaw Controls Company, Richmond, Va., and Washington consulting engineer, Nash M. Love, the computer automatically will determine air conditioning needs and operate equipment to provide the correct amount of cooling, control operation of the heating plant, start and stop ventilating fans, and turn lights on and off. The computer also is capable of automatically keeping track of and analyzing such data as power and fuel consumption and printing out a concise daily summary of facts and figures important to the building's operation.

Consulting engineer Love estimates that savings resulting from more efficient building operation will pay for the computer installation in a maximum of 27 months. Major areas in which these cost reductions will be made include:

Power and fuel costs for air conditioning, through computer-programmed operation of refrigeration compressors;

Increased efficiency of the building's heating plant, by programming loads on the four boilers;

Computer control of ventilating air drawn in from outside the building, related to the number of people at work inside;

Utilizing the building's lighting system as a heat source. On cool days, the computer will decide whether it is more economical to provide heat by turning on the lights early, rather than starting up boilers. If so, the computer will turn them on;

Computer analysis of operating conditions of mechanical equipment and automatic warning when maintenance is required, making possible more efficient use of maintenance personnel and equipment; and

Automatic shutdown of faulty equipment before major damage can result.

Another "first" in the building will be an automatic fire-alarm system which will include prerecorded voice messages. Instead of warning gongs or buzzers, the system automatically will select the proper recording and the building loudspeaker system will announce to building operating personnel and in the building superintendent's office something like: "Attention, fire brigade...there is an alarm in building area 9-B".

The Westinghouse computer, a Prodac® 50, is designed for flexibility of application and is built of standard modules which can be assembled in a variety of ways. Initially there will be 12,000 words of core memory, and as more building functions are computerized, its memory will be expanded to 16,000 words.

Key elements in the closed-loop control system are new direct-digital valve positioning devices developed by Robertshaw Controls Company. These automatically convert electronic impulses from the computer to precisely measured, pneumatically operated "push-pull" movements which partially or fully open or close vanes which regulate output of air conditioning equipment. A built-in feedback device then automatically reports to the computer that its command has been carried out, enabling the computer to control building conditions exactly as instructed by its program.

The control console for the building will have fewer of the lights, dials and pushbuttons normally built into such control centers. The computer and associated equipment are hidden from view, and the center of attention will be an emerging computer-written report of the facts important to the building engineer.

Love says the installation is the forerunner of a new era in building control which should be widely used within five to ten years. "In the building of the future, a computer not only will control lights, heating and air conditioning, it also will handle the building's elevators. It will perform bookkeeping, billing and a large part of the administrative duties."

"All this," Love said, "is not a dream. The equipment and the computers already are available. Engineers are making plans for computerized buildings of the future..."

ZOOM LENSES TO BE DESIGNED FOR BELL & HOWELL BY COMPUTER

Zoom lenses, which allow photographers to shift easily from telephoto views to wide angle photographs, will be designed automatically for Bell & Howell Cameras by an SDS 930 computer, according to Scientific Data Systems.

The SDS computer, being delivered this summer, will be used to solve the complex mathematical formulas required in design of both zoom and fixed focal length lenses. Bell & Howell will use the SDS system for military as well as commercial applications.

The computer, after designing the lens to meet specific requirements, will compute information for generating "spot diagrams" that pictorially represent the size and structure of the image the lens can be expected to produce. Bell & Howell also will use the SDS 930 to compute the "modulation transfer function". This is a test of lens quality that measures the combined resolving power and contrast of the lens. For special lenses requiring the use of aspheric surfaces, the SDS 930 will produce tapes that control aspheric lens grinding machines.

Walter Johnson, associate chief optical engineer for Bell & Howell explained that the use of computers for lens design allows camera makers to custom design lenses to fit each new camera. Before computers were available, camera makers had only a relatively small number of manually designed lenses which they fitted into their camera plans.

Bell & Howell's SDS 930 system includes 16,000 words of core memory, a Magpak magnetic tape unit, a card reader, keyboard/printer and other peripheral equipment.

NEW CONTRACTS

CONTRACT AWARDED SDC

The System Development Corp., Santa Monica, Calif., has been awarded a contract to assist the Federal Council for Science and Technology in developing guidelines for the national network of

scientific and technical information systems. Work on the project already is under way. A report, scheduled for early fall, is expected to produce recommendations for action by both governmental and non-governmental organizations in the collection, handling and dissemination of all scientific and technical documents.

AUTOMATIC FARE COLLECTION SYSTEM

General Electric (Somersworth, N.H.) has been awarded a $350,000 contract to build and test prototype equipment for a completely automatic fare collection system for the San Francisco Bay Area Rapid Transit District. The Transit District's consulting engineers, Parsons Brinckerhoff-Tudor-Bechtel, have retained GE's Meter Department to demonstrate its COMMUTA-CODE® automatic fare collection equipment. The contract is preliminary to construction of the world's most advanced rapid transit system — a $1 billion computer-controlled transportation complex at San Francisco.

In addition to building prototype COMMUTA-CODE equipment for the collection of a graduated fare, GE will conduct an eight-week simulated demonstration test of the equipment at the main gate of its Meter Department plant at Somersworth. The plant's normal employee traffic will be utilized to test the COMMUTA-CODE equipment's capability under a varied, multi-station transit system arrangement. The flow of employee "passengers" will be very similar to a transit system in habits of entry and exit. Vendors, visitors, community groups on plant tour and others will be encouraged to use the system for plant entry and departure.

NEW YORK CONTRACT AWARDED TO CUC

The New York State Department of Taxation and Finance has awarded a computer programming contract to Computer Usage Company (CUC) to assist in implementation of the state sales tax system which is in effect as of August 1, 1965.

Mr. Edward O'Connor, Manager of CUC's New York Operations, said that the system of more than 50 UNIVAC III programs will check sales tax returns along with consumer taxes and utility taxes. It also will establish and maintain a master file of tax information on each vendor in the state.

IBM TO BUILD TWO MEMORY SYSTEMS FOR AEC

Two large-scale computer memory systems, which use advanced photographic and optical technologies to store more than a trillion bits of digital information, will be built for the Atomic Energy Commission by IBM Corporation. Basic storage elements of the systems are film chips contained in plastic cells. Each cell, somewhat smaller than a cigarette package, can hold the equivalent of three typical encyclopedia volumes — about 4.5 million words.

— The tiny plastic cell, held by Melva Ellis of IBM, can store the equivalent of three typical encyclopedia volumes. Information is stored in the form of microscopic black and white coded spots.

The random-access systems being built under two contracts amounting to $2.1 million, are scheduled for the Lawrence Radiation Laboratory facilities in Livermore and Berkeley, Calif. Both facilities are operated by the University of California for the AEC. The Livermore system will have capacity to store a trillion bits of digital information and the second one for Berkeley will be one-third that size.

NAVY CONTRACT FOR $11.6 MILLION TO GT&E FOR SHIPBORNE COMPUTERS

General Telephone & Electronics Corporation has announced receipt of an $11.6 million contract to produce 59 shipborne computers, the largest quantity order for militarized computers and support equipment ever placed by the U. S. Navy. The award was made to Sylvania Electric Products Inc., a GT&E subsidiary, by the Bureau of Ships for the Naval Tactical Data System. Work on the three-year contract will be performed by Sylvania Electronic Systems (Needham, Mass.), a division of the company.

The compact, high-speed computers will perform an average of 125,000 computations per second and will be shock-mounted for shipboard use. In addition to a ferrite core main memory of 32,768 30-bit words, each will be equipped with a thin film control memory of 64 30-bit words and a "bootstrap" memory with a 2-32 word 30-bit capacity. The computers will be 72" x 38" x 37" and will weigh less than 2500 pounds.

In addition to the computers, Sylvania will supply paper and magnetic tape systems, key set central units, key set entry devices, teletypewriter adapters and test equipment.

ITEK ANALYSIS WILL AID ARCHEOLOGY

Itek Corporation's Data Analysis Center, located just outside Washington, D.C., has received a contract to perform a special scientific photointerpretation program for the Government. In essence the program is an aerial archeology project which utilizes photographic analysis to help pin-point valuable historical evidence for the Department of the Interior's National Park Service and the Smithsonian Institute.

The program involves a photographic phenomenon — the discernability, from aerial photographs, of surface traces of archaic habitations or other man-made objects, despite the deep coverage of soil or low vegetation. Detection, identification, and mensuration of these ancient remains can be materially aided by photointerpretation and photogrammetric techniques. In many cases, features

are photographically revealed that would not be detected by on-site inspection.

Interpretation is taking place now in conjunction with Government field explorations that are searching ancient Indian habitation remains along the Missouri River Basin in North and South Dakota. The Missouri River Basin field exploration hopes to salvage representative samples of the various prehistoric periods throughout the Basin before they are destroyed by the flooding of the large multi-purpose Federal water impoundment projects. Subsequent portions of the program will be completed later this summer and result in final reports that evaluate the effectiveness of various techniques, procedures and photographic materials for use in archeological photointerpretation.

NEW INSTALLATIONS

HONEYWELL 120 ORDERED FOR CON-DATA SYSTEMS

O'Shaughnessy, Dewes & Klein, Inc. has ordered a Honeywell 120 business computer for its subsidiary, Con-Data Systems, Inc., of New York City. The firm is one of the nation's leading resident buying offices, and the only one to operate a data processing service bureau for small-store clients.

The company represents more than 200 small department, junior department and specialty stores that have gross sales volumes of less than two million dollars annually. Through Con-Data, O'Shaughnessy, Dewes & Klein, Inc. provides EDP services which up to now have been available only to large retail chains.

The Honeywell data processing system, scheduled for delivery in early 1966, will replace an existing tabulating machine installation. Con-Data's H-120 system will consist of a central processor with 12,288 characters of memory, three magnetic tape units with a data transfer rate of 13,000 characters per second, a combination card reader/punch, and a 450 line-per-minute printer.

FAA BUYS ASI 210 COMPUTER

The Federal Aviation Agency has purchased an ASI 210 digital computing system valued at slightly over $100,000 from Advanced Scientific Instruments, Minneapolis, Minn., a division of Electro-Mechanical Research, Inc. (EMR). The ASI 210 has been delivered to the FAA National Aviation Facilities Experimental Center in Atlantic City, N.J., where it will be used for terminal air traffic control experimentation.

SUN OIL ORDERS CONTROL DATA 6400 SYSTEM

It has been announced that Sun Oil Company has ordered a Control Data 6400 Computer System for use in their oil production activities. The Control Data 6400 system will be utilized for the solution of large-scale engineering and scientific problems. Included in these applications will be the capability of the 6400 to accommodate remote terminals with efficient and reliable operation.

Located in Richardson, Texas, Sun Oil is a leader in the worldwide exploration and production of petroleum. Sun Oil not only discovers and captures the crude oil product, but also refines and markets finished petroleum products to a large segment of the population. The Richardson facility contributes to these corporate objectives by developing new and better techniques to locate and produce crude oil from beneath the earth's surface. Installation of the 6400 will provide Sun Oil with one of the largest computer systems for use in the petroleum industry.

NCR 315 COMPUTER TO BE INSTALLED FOR COOPERATIVE

The Mississippi Federated Cooperatives (MFC), Jackson, Miss., processes and sells 80,000 chickens a day, mixes tons of animal feeds, stores thousands of bales of cotton and stocks everything from barn hinges to tractor tires. The resultant paperwork problem is one of complexity.

To solve this problem, MFC is installing electronic data processing equipment which will be linked to conventional business machines. The resulting "total" system will be, it is believed, one of the most advanced to be installed by a cooperative.

A National Cash Register 315 computer has been ordered and is expected to be in operation by September 1 when the season's first cotton is picked. The system's punched tape input will be produced, variously, by NCR cash registers, accounting machines and adding machines.

SDS, BECKMAN HYBRID SYSTEM ORDERED FOR DOUGLAS R & D

Scientific Data Systems, Santa Monica, Calif., has announced that an SDS 925 computer has been ordered by Beckman Instruments for linkage with a Beckman 2200 analog computer.

The SDS/Beckman computation system will be used in a simulation facility at Douglas Aircraft Company, Missile and Space Systems Division, for research and development in space and missile systems. The SDS 925 will be used to perform arithmetic computations and multi-variable function generation in hybrid simulations. The hybrid computer will be used for problems such as digital auto pilot simulation and space flight control.

The SDS 925 computer includes 4096 words of core memory, a paper tape reader, paper tape punch, keyboard/printer, and complete hybrid oriented programming languages.

TABULATORS, INC. INSTALLS UNIVAC 1004

Tabulators, Inc. of Pueblo, Colorado has installed a Univac 1004 card processor. The 1004 will handle a highly specialized doctor billing service which amongst other features, has a built-in pre-collection service, direct billing of Blue Cross/Blue Shield and Welfare claims.

BERKSHIRE BANK INSTALLS COMPUTER

The Berkshire Bank and Trust Company, Pittsfield, Mass., has announced it is now using an IBM 1240 computer. This makes Berkshire the first small bank in the state west of Boston to acquire

this kind of equipment, according to President James R. Sloane.

The 1240 will be used primarily to handle the demand deposit accounts held by Berkshire Bank. The bank also is in the process of preparing the computer to take over other chores, such as savings accounts, payroll and installment loans. In addition, the bank will act as a service center to handle a variety of data processing jobs for the business community in its area.

LEEDS & NORTHRUP SHIPS DIGITAL COMPUTER SYSTEM TO ITALIAN STEAM POWER STATION

An LN 4000 digital computer system for Italy's National Electricity Board — Ente Nazionale per L'Energia Elettrica (E.N.E.L.) — has been shipped by Leeds & Northrup Company, Philadelphia, Pa. The system, to be installed at the new Fusina steam power station near Venice, will be used for performance computations, alarm monitoring, trend reporting and data logging.

FIRST GE-415 COMPUTER SYSTEM FOR BOSTON AREA INSTALLED BY REGISTRY OF MOTOR VEHICLES

The first General Electric 415 computer system to go into the Boston area has been installed at the Massachusetts Registry of Motor Vehicles Bureau. The GE-415 system, which replaces a GE-225 computer, was placed in operation within 65 hours over a weekend in order to provide continuity of operation for production of automobile excise tax bills and other administrative functions.

The computer system includes a 16K central processor; a 900-card-per-minute card reader; a 1000-card-per-minute card punch, with 41.6 KC tape handlers; a cross-bar tape controller and two 1200-line-per-minute printers.

PUBLISHING COMPANY ORDERS RCA SPECTRA 70/15 COMPUTER

Addison-Wesley Publishing Co., a leading publisher of text books, has ordered an RCA Spectra 70/15 computer to handle a wide range of accounting functions. The company specializes in text books covering such subjects as mathematics, physics, chemistry and other sciences.

The computer, to be installed at Addison-Wesley's Reading, Mass. plant, will begin operations by handling order processing, sales analysis, inventory control and other accounting functions. Future plans call for studying the application of electronic data processing to other phases of the publishing operation.

The installation will include the Spectra 70/15 central processor with 8000 characters of memory storage, four magnetic tape units, a card punch and reader, and a high speed printer. Delivery is expected during the first quarter of next year.

ORGANIZATION NEWS

AUTOMATIC FILM READING FOR EDUCATIONAL INSTITUTIONS

Information International, Inc. has announced a new policy with regard to educational use of its automatic, programmable film reader installed in its Cambridge, Massachusetts Office.

I.I.I. will make available its PFR-1 system, which has the capability of reading, digitizing and analyzing pictorial or graphic data under program control, to any educational organization whose efforts in research could benefit from its use.

I.I.I. is offering the use of the complete system, generally during second or third shift hours, at the reduced rate of $50.00 per hour. An example of what this could mean to the researcher: in one hour he could expect to read, digitize and record on magnetic tape over 5000 oscilloscope traces, at a cost of only $.01 cent per trace.

I.I.I. has instituted this program because of the large number of inquiries from Universities both in the United States and abroad, and because they operate on limited budgets and grants.

Users have the advantage of utilizing programs which I.I.I. has already developed. Any programs required which may not yet be available, must be programmed by the individual. Highly sophisticated programs may be developed using techniques originated at I.I.I., to implement judgments approaching those of the human in analyzing filmed data.

I.I.I. will support this activity by providing documentation on the operation of the system and existing programs.

Colleges and Universities developing programs for the PFR-1 are expected to fully document such programs and submit them to I.I.I. who will make them available to other users.
(For more information, designate #42 on the Readers Service Card.)

PROFIMATICS INC. FORMED AS CONSULTING FIRM TO PROCESS INDUSTRIES

"Profits Through Automation" is the slogan of a new consulting firm, PROFIMATICS INC. (Canoga Park, Calif.) announced by Dr. Thomas Stout, its president. Other founders of the company are Richard P. Cline, Vaughn A. Kaiser, and John D. Mahoney. These men all were previously associated with The Bunker-Ramo Corporation and its predecessor companies, for periods ranging from four to nine years. PROFIMATICS was established, according to Dr. Stout, to provide industry with the benefits of their years of experience in the design and installation of advanced process control systems, particularly those employing computers.

Services provided by the new firm will include studies of technical and economic feasibility for automation projects in the process industries; development of process simulation models; preparation of specifications and evaluation of bids; process analysis, system design, programming, installation, and project management for computer control systems; and assistance with recruiting and training of technical staffs to perform this type of work.
(For more information, designate #41 on the Readers Service Card.)

CONTROL DATA ACQUIRES PRESTON ASSOCIATES

William C. Norris, President of Control Data Corporation, and Glenn W. Preston, President of Glenn W. Preston Associates, Inc., have announced the acquisition of

Preston Associates by Control Data. The sale was an exchange of an undisclosed amount of Control Data Corporation common stock for the assets and business of Preston Associates, Inc.

Preston Associates, based in Philadelphia, Pa., is a highly regarded organization of scientists and engineers who have had notable success in the areas of airborne and satellite-borne radar systems development. Preston Associates will become a part of TRG, Inc. (a subsidiary of Control Data Corporation) and will continue their design and development programs in data processing equipment, antennas, and encoded communication systems in the areas of airborne and satellite-borne radar systems development.

C-E-I-R, INC. ACQUIRES AUTOMATION INSTITUTE

C-E-I-R, Inc., Washington applied research and data processing corporation, has purchased Automation Institute of America, Inc., a nationwide network of technical training centers headquartered in San Francisco (Calif.). C-E-I-R will operate AIA, and two affiliated companies which it also is acquiring, as separate subsidiaries. Terms of the purchase provide for payment in C-E-I-R common stock, and the acquisition is subject to clearance by federal and California government agencies.

Automation Institute franchises 47 schools in 27 states and the District of Columbia. The schools specialize in teaching basic automation skills, such as computer systems design and programming, punched card information handling, and machine operation. AIA courses, which run from 6 to 36 weeks, are aimed primarily at high school graduates seeking special training for the data processing field. AIA has an annual student body of approximately 20,000, and more than 150,000 graduates have been placed in industry.

Acquisition of AIA extends C-E-I-R into more than 40 additional cities, both for teaching and computer service bureau purposes. The firm expects to expand the number of AIA franchises rapidly during the next year. Additionally it will make other C-E-I-R services available to franchisees.

EDUCATION NEWS

CARNEGIE TECH TO ESTABLISH DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES

Carnegie Institute of Technology, Pittsburgh, Pa., has announced that a grant of $5-million has been received through the generosity of Lieutenant General Richard K. Mellon, and charitable trusts created by him, for the establishment of a new department of computer and information sciences in the College of Engineering and Science. In making the gift, General Mellon said, "Mrs. Mellon and I hope this grant will provide the basis for an expanded program leading to the practical and intellectual preeminence of Carnegie Institute of Technology in computer information sciences. It is our belief that such preeminence will be of measurable benefit and lasting value to the Pittsburgh community and the nation".

Current research programs related to computer sciences at Carnegie Tech include projects in the behavioral sciences, management sciences, fine arts and in all departments of the College of Engineering and Science. The Computation Center, which was established in 1956, at present has almost 100 full-time employees. Facilities include a paired computer with the second largest memory storage device in education or industry in the country.

Current courses presently are available for undergraduates in the departments of electrical engineering and mathematics. Some 1300 students and faculty regularly make use of the University's computers.

Dr. H. Guyford Stever, President of Carnegie Tech, said the grant will be used for the following projects: (1) construction of a $2-million building to serve as the focal point of research and education in computer science; (2) expenditure of $1,250,000 over a five-year period for research in computer development and applications, including existing projects in computer languages and system, thought processes, design, management information systems and other areas potentially beneficial to the community; (3) one million dollars towards the purchase of a new advanced computer (IBM System/360, Model 67) the acquisition of which will make Carnegie Tech's facilities the equal in quality of those of any college or university in the country; and (4) $750,000 to endow a named professorship.

In making the announcement, Dr. Stever pointed out that the gift would enable Carnegie Tech to expand its program and to co-ordinate, centralize, and increase the many areas of computer research. An important area of research to be intensified is the development of computer languages and systems. One objective of research in computer language is to allow man to communicate directly with the computer in English instead of a variety of symbolic languages. This program will be administered by Dr. Alan Perlis, distinguished international authority and pioneer in computer languages. He is currently Director of Carnegie Tech's Computation Center.

Work in the field of simulation of thought processes begun by Professors Herbert A. Simon and Allen Newell also will be increased. Such research, believed by many to be one of the great advances of the twentieth century, may lead to an increase in the effectiveness of human thinking. Other intensified research activities include problems of engineering design, and the development of complete information systems for business firms.

The new department initially will enroll only graduate students. It is expected that during the next few years it will be expanded to include undergraduate programs.

MASSACHUSETTS SCHOOLS TO HAVE EXPERIMENTAL COMPUTER NETWORK

It has been announced in Washington by Senators Saltonstall and Kennedy that the first formal program of its kind in the nation to use computers as a classroom teaching aid in elementary and secondary schools will be inaugurated this fall in five or more Massachusetts communities.

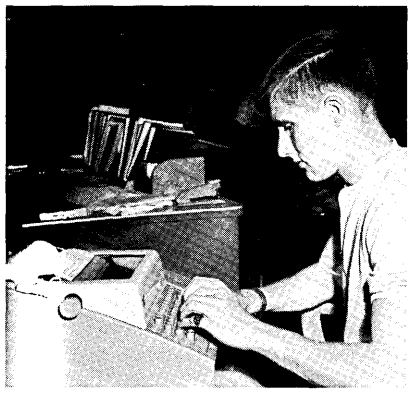
According to Dr. Owen B. Kiernan, Commissioner of Education for Massachusetts, the experiment is aimed at determining how computer-aided instruction can be used to improve the teaching of mathematics and problem solution at

grade school, junior high, and high school levels.

The system will consist of a network of teletypewriter terminals connected to a multiple access digital computer in the Cambridge facilities of Bolt Beranek and Newman Inc., one of the country's leading research and scientific organizations.

By means of easily learned programmed languages called Telcomp and Toll 1, students in the sixth grade at Belmont's Kendall School, in the ninth grade at Lexington High School, Brookline High School and Phillips Academy in Andover, and in the eleventh grade at Westwood High School, can call upon the computer to solve problems in math, algebra, geometry, trigonometry, or perhaps some higher disciplines...can explore mathematical functions...or can even play mathematical games. It is expected that arrangements will be made for students in some adjacent communities to also have some access to the terminals on a part-time basis.

Two terminals already have been installed, one in Westwood and one in Brookline. Both were on line until the end of the school year, with the others being added this summer. In both schools, students



— Gregory Wallace of Westwood, Mass., uses experimental computer terminal at Westwood High School to check mathematical functions.

have lined up early in the morning and late in the day for a turn at the terminal. In Westwood, for example, the computer was contacted by a student at 6:58 in the morning.

The $175,000 program is sponsored by the U. S. Office of Education under the Curriculum Improvement Program of the Cooperative Research Bureau. It will be directed by Jesse O. Richardson, Senior Supervisor for Science and Mathematics in the Massachusetts Department of Education. Bolt Beranek and Newman, in addition to providing the computer and assisting in conducting the in-school program, are providing the facilities for a six-week institute this summer to acquaint teachers from participating schools with the use of the computer terminals, the language, and the system capabilities.

Dr. Kiernan emphasized that the program is not limited to modern math, nor only to talented students, and does not involve any of the students in lengthy study of computer programming. Rather, he said, it is adaptable to any part of the math curriculum, is expected to be used by the average student as well as by scholastic leaders, and does not require any knowledge of how the computer works.

Jesse O. Richardson, who will serve as principal investigator for the project, and Wallace Fuerzeig, who will establish and manage the computer system for BBN under the direction of Dr. Jordan Baruch, stated that the potential of computer-aided instruction is limited only by the imagination that scientists and educators can bring to the problem.

NEW PRODUCTS

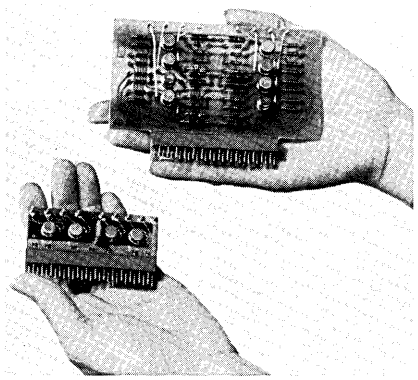
Digital

SEL 800 SERIES

A new series of general purpose digital computers, developed by Systems Engineering Laboratories (Fort Lauderdale, Fla.) mark the entrance of this firm into the highly competitive computer market. The computers, called the "SEL 800 Series" are said to offer the fastest throughput rate and highest data storage and instruction handling capacities of any machines in their size or price range.

SEL computers are designed for real-time processing and control operations or for scientific and general off-line computation. All are supplied with a complete software package that includes one-pass FORTRAN IV compiler, the MNEMBLER assembly language, diagnostics, utilities and a complete library.

One major innovation of the 800 Series is the use of all silicon monolithic integrated digital circuits in place of discrete component (either full size or microminiature) circuits. This new



— SEL integrated circuit card, left, is ¼ the size and does the same work as the old discrete component circuit board that it replaces.

type of circuitry significantly increases the reliability of the machines, which have a full cycle time of 1.75 microseconds and fully parallel operation.

The smallest machine in the series is the SEL 810, a 16-bit binary device capable of executing up to 60 instructions. In the medium scale is the SEL 840, which has a 24-bit capacity and is capable of executing 91 instructions. Both have 4096 word basic storage capacity and hardware multiply and divide capability.

The 800 machines also include two independent input/output channels; typewriter, tape reader and punch; hardware index register and program counter; complete software package for real-time applications and FORTRAN IV package for scientific computation.

There are a number of options available for both the 810 and 840 including magnetic core memory in the main frame expandable up to 32,768 words — all directly addressable; external drum or disc storage; up to eight independent input/output channels; up to six direct memory access channels and any standard peripherals.
(For more information, designate #45 on the Readers Service Card.)

Newsletter

HONEYWELL 8200 SYSTEM HANDLES NINE PROGRAMS SIMULTANEOUSLY

A new large-scale computer, using advanced microcircuitry throughout, has been introduced by Honeywell's electronic data processing division, moving the company further into the "third-generation".

The Honeywell 8200, according to Walter W. Finke, division president, combines key characteristics of the firm's two top computer lines into a single machine able to process nine separate programs at the same time. The new computer — designed for mixed business, scientific and real-time data processing — can operate on both "word-" and "character-oriented" programs. It also has full data and programming compatibility with Honeywell's Series 200 and Series 800 computers.

It was said, the entire H-8200 central processor — including logic, arithmetic and control sections — will occupy less than eight cubic feet.

The new computer contains three major subsystems: processor, memory and input/output.

The processor has within it 10 programming groups: nine running active programs and a tenth — called the master control group — monitoring the entire computer. The master control group provides intercommunication among all active programming groups. The processor also includes console, display and manual control facilities.

The memory subsystem has one to eight memory modules, and a memory multiplexor (MM) which can access up to three memory modules during each cycle. Each module holds 131,072 characters (16,384 words) for a total maximum core storage capacity of 1,048,576 characters (131,072 words). Memory cycle time is 750 nanoseconds per eight-character word. The MM handles and routes multiple requests for access to memory, assigns priorities, resolves conflicting requests and provides memory barricade control so that one active program will not disturb operation of another.

The input/output subsystem comprises an input/output multiplexor (I/OM) and up to 32 read/write channels. Up to 48 peripheral control units, and their associated devices, can be connected to the subsystem, enabling the H-8200 to operate up to 32 peripheral devices simultaneously. The I/OM continuously scans all peripheral control units connected to the system and requests time from memory whenever a data transfer is to take place.

In a time-sharing or data communications application, for example, each control unit can be linked to a 64-line communications device for a total of 3072 remote connections. Access to the H-8200 will, in effect, be instantaneous from the standpoint of the remote communications devices.

The H-8200 offers two effectual programming languages to new users of Honeywell computer systems; continuity of programming to current users of Honeywell's Series 200 and Series 800 systems; and the ability to automatically translate into Series 200 language (using the Liberator technique) programs originally written for six competitive computer systems. Also, a program translator is being designed to enable automatic conversion of H400/1400 programs into Series 200 language for users of H-400 and 1400 systems.
(For more information, designate #44 on the Readers Service Card.)

SPERRY RAND UNIVAC ANNOUNCES REAL-TIME COMPUTER SERIES

Sperry Rand Corporation's UNIVAC Division (New York, N.Y.) has announced three advanced general purpose computers which are known as the UNIVAC 490 Modular Real-Time Systems. The new series consists of three basic computing systems: the UNIVAC 491, 492 and 494. They employ a highly modular design approach that extends the real-time mode of processing from the medium to the very large-scale data processing requirements.

The basic models of the UNIVAC 490 Modular Real-Time Systems are the UNIVAC 491 and 492. These stored program computers are capable of concurrently handling extremely large quantities of data in batch processing and real-time modes. The standard medium scale 491 has eight input-output channels, which can be expanded to a maximum of 14. Cycle time is 4.8 microseconds per 30-bit word. The basic memory of 16,384 words can be increased in modules to a maximum of 65,536 words.

For growing processing requirements, the UNIVAC 492 System is a compatible, more powerful system with increased peripheral capacity, memory and real-time capability over the 491. Both the 491 and 492 can be linked to existing UNIVAC 490 installations where computer-to-computer hook-up is required.

The largest and most powerful of the 490 Modular series is the UNIVAC 494, with a 750 nanosecond memory cycle time, or 375 nanoseconds with overlapped operation. The 494 is six to ten times faster than the present UNIVAC 490 Real-Time System and processes several real-time programs concurrently with multiple batch applications.

Core memory capacity of the 494 starts at 16,384 words and is expandable in increments to a maximum of 131,072 words. The standard processor has 12 input-output channels and can be increased in optional increments in groups of four to a maximum of 24.

All three systems of the new series have a communications control feature — the Externally Specified Index (ESI). ESI handles a substantial number of communications lines through a single computer channel, using buffers in memory. This permits other transactions to run without interruptions while communications data comes into and out of the system.

The UNIVAC 490 Modular Real-Time Systems direct and control the operations of a variety of high capacity random access storage subsystems, data communications equipment in addition to a choice of card units, magnetic tape units, printers and other peripherals. In addition, on-line, remote communications devices, compatible with common carriers, are controlled by the 490 series processors.

A comprehensive software package will be available for the systems. Deliveries of the first UNIVAC 490 Modular Series will begin in the fourth quarter of this year.
(For more information, designate #43 on the Readers Service Card.)

Software

PDP-8 TYPESETTING SYSTEM

A low-cost typesetting system which uses an integrated circuit computer to produce 12,000 lines an hour has been introduced to newspaper publishers by Digital Equipment Corporation, Maynard, Mass. The new product, called the PDP-8 Typesetting System, accepts unjustified and unhyphenated ("idiot") tape punched by perforator operators; justifies according to column width, type size and font; hyphenates according to rules and an exception diction stored in the computer memory; and generates a clean operating tape for tape driven linecasting machines.

Digital claims the following advantages for the system: a complete package of field-tested hardware and software; a low-price, $24,900; more news in less space; better-looking type; elimination of linecaster hangups and matrix damage caused by tight lines; fastest delivery of any computer-based system; and a great deal of flexibility in modifying or expanding the basic system as new needs appear.

The basic system being offered consists of the PDP-8 computer with 4096-word core memory, complete hyphenation and justification program, reading unit for the 6- or 8-level idiot tape, and punching unit for the output operating tape. This system accepts tapes from 12 noncounting perforator operators and generates enough output tape to keep 12 linecasters busy. Hyphenation accuracy runs better than 90 per cent in the basic system.

Two possible new uses cited by Digital for a modified or expanded system are direct control of linecasters and the composing of display advertisements.
(For more information, designate #47 on the Readers Service Card.)

HONEYWELL EDP HAS NEW DISPATCHING APPLICATION

A new general-purpose applications package for truck routing and scheduling has been introduced by Honeywell's electronic data processing division, Wellesley Hills, Mass. The new package, called DISPATCH, is said to make possible maximum utilization of a trucker's available vehicles.

DISPATCH is designed to be used with Honeywell's Series 200 computers. It obtains information from the computer user's existing order processing system about the number of shipments to be delivered, where they are to be delivered, and the weight and space requirements for each one. It must know also the size and number of trucks and the expected delivery and unloading times.

With this information in the computer, DISPATCH will produce an assignment sheet listing the size of trucks to be used, orders to be grouped together, route to be followed, and time of departure from warehouse or store.

DISPATCH, written in the FORTRAN programming language, is scheduled for release to Honeywell Series 200 users during the fourth quarter of 1965.
(For more information, designate #49 on the Readers Service Card.)

CONSTRUCTS — COMPUTER-DIRECTED DRAWING SYSTEM

Control Data Corporation has demonstrated a computer-directed drawing system, called CONSTRUCTS (Control Data Structural System), which can produce detailed construction drawings 25 times faster than a draftsman. The system, developed by Meiscon Corporation, a subsidiary of Control Data Corporation, already has been successfully used to produce steel fabrication detail drawings for a multi-million dollar institutional facility to be erected on the east coast.

The CONSTRUCTS programming system is presently capable of handling more than 40% of the steel fabrication detail drawings required to construct a normal commercial or industrial building. Within a year this percentage will be more than doubled. A variety of non-building type structures can also be undertaken, as the system also has the potential to be used for other kinds of mechanical and electrical drawing work.

Using the CONSTRUCTS programming system in the steel fabrication detailing application, the computer accepts basic design criteria and determines the exact dimensions of steel members, how they should be cut, and the size of the connecting members. The number of bolts and lengths of welds to be used to interconnect members are also determined. CONSTRUCTS seeks out possible obstructions and connection problems, and automatically provides special solutions as required.

Once calculations have been completed, full-sized drawings are produced on a plotter, following currently acceptable practices for shop detailing. Drawings show accurate dimensions of each piece of steel to be cut and every connection, with proper allowance for all fittings. A complete printed bill of materials also can be produced.

James D. Harris, General Manager of the Company's Data Centers Division pointed out that a man familiar with detailing can prepare input data for the computer after only four hours of training, and that he can work independently of the system after a two-day training period.
(For more information, designate #48 on the Readers Service Card.)

Data Transmitters and A/D Converters

TRANSLATOR INTRODUCED BY REGENCY ELECTRONICS

What the Department of the Army terms the "world's smallest computer" recently was introduced at a special Washington, D.C., Pentagon press conference. The tiny "computer" designed and built by Regency Electronics, Inc., Indianapolis, Ind., translates the dots and dashes of Morse code into ordinary English. As ...— is sent, for example, the Regency Translator shows a "V" on its tiny "picture tube". The Translator allows those untrained in Morse code to read messages sent to them in code.

The Translator measures 1-1/4 x 2-7/8 x 2-7/8 inches and weighs less than a pound. It is called the "world's smallest computer" because the Translator must differentiate between dots and dashes and determine the spaces between characters. In a space the size of a cigarette package, Regency has placed 350 diodes, 75 transistor circuits, a display panel that frames letters with 17 tiny incandescent lamps and four rechargeable nickel-cadmium penlight batteries.

— Translator showing an "A" on its "picture tube".

To accomplish this, some of the most advanced electronic production techniques were used. In fact, advanced electronics permitted Regency to produce the device with only one moving part — the "on-off" switch. Even letter changes are made electronically.

The letter readout shows one letter at a time. It can be programmed to display these letters at virtually any rate of speed. The only limitation is the ability of the person receiving the message to read each letter and write it down. The person receiving transmission simply plugs the Translator into army radio through a small jack. A similar jack is used to connect an earpiece headphone (shaped like a hearing aid) which is used for tuning.

To date, Regency has supplied 27 of the tiny devices to the Army for field tests. Volume delivery of the Translator is expected in early 1966.

Army spokesmen indicate the Translator could be used by infantry and artillery in ground-to-ground, as well as in air-to-ground communications and ship-to-shore communication. Additionally the Translator could be employed to train personnel in code sending. (For more information, designate #52 on the Readers Service Card.)

MUIRHEAD AIDS NEWSPAPER PRODUCTION

An important advance in British newspaper production occurred recently when the DAILY MAIL began facsimile transmission of complete newspaper pages from London to production centers in Manchester and Edinburgh. Using the Muirhead Newspaper Page Facsimile System, manufactured by Muirhead Instruments, Inc., Mountainside, N.J., an entire newspaper page, including photographs and advertisements, is transmitted from the London office, where it was originally composed, to the Manchester and Edinburgh printing plants simultaneously, in a matter of minutes.

The definition of the equipment is such that each dot in the screened photograph, or the smallest serif in the type, is faithfully recorded on film at the receiving end. A printing plate is then made directly from this negative.

The Muirhead System has been adopted by newspapers in the U.S.A., Japan, Sudan, Italy, Maylasia, and the U.K. Throughout the world, Muirhead orders to date for this equipment total 77 machines.
(For more information, designate #50 on the Readers Service Card.)

EXPERIMENTAL IBM RADIO PERMITS MANY CONVERSATIONS ON SAME CHANNEL

An experimental radio-telephone that can handle hundreds of conversations has been described by Dr. Francis P. Corr, an engineer of IBM Corporation. The battery-operated VHF transceiver was detailed at the Institute of Electrical and Electronic Engineers Communications Convention.

Dr. Corr explained that the IBM device permits many calls to be transmitted on the same channel simultaneously by assigning each its own code. Special-purpose electronic equipment in each radio responds only to the appropriately addressed calls. Thus, each called party can receive, from the hundreds on the air, only the call to him.

According to Dr. Corr, when a user wants to make a call, he merely dials a six-digit code on the set's control panel and then pushes a call button. This signals the called party.

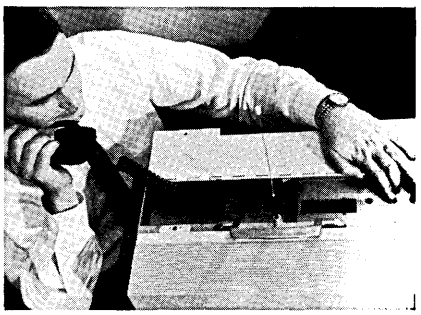
The transceiver's handset is wired to a conventional pulse-position modulator (PPM). When the caller starts talking, the PPM samples his voice waveform 8000 times every second and emits a pulse for each sample. The amplitude of the sample dictates the position of the pulse in a fixed frame of time. The information in the waveform is thus reflected in the pulse's position. Now, these pulses are put into a pseudo-noise generator where they are coded into seemingly random sequences of 0's and 1's. The particular sequence used is the code of the called party. Every pulse is coded, so that each pseudo-noise sequence carries both information and the code of the called party.

On the receiving end, the pseudo-noise pulses are fed into digital matched filters. These filters are the heart of the system, for they are the devices that recognize the code of the called party. Each filter is wired to recognize only its code. The outputs of these filters are processed to produce the original pattern of sampled pulses. The transmitting process is reversed in a pulse-position demodulator, and the original voice waveform is produced.

Designed strictly for experimental purposes, the transceiver provides almost the equivalent of automatic dial telephone service in a highly mobile radio system that employs no switching nodes.

The transceiver would be especially useful on the battlefield, where communications security is vital. Anyone listening on the tactical frequency would only hear noise unless their radios were equipped with exactly the right decoding circuitry.

Because the set permits many high-quality transmissions over the same channel, i.e., many talkers per megacycle, the device also has promising applications in satellite communications where many ground stations share the same satellite.



— Richard C. Crutchfield, Jr., IBM staff engineer, initiates the call-up process on the experimental IBM radio-telephone. His connection will be made in about 20 milliseconds.

AMPEX CARD-TAPE CONVERSION SYSTEM

A new system which converts computer data from punched cards to magnetic tape at twice the speed and one third the cost of previous methods has been placed on the market by Ampex Corp., Redwood City, Calif. The Ampex Model CTS-2000 Card-Tape Conversion System is said to offer substantial economies for commercial and governmental data processing users by taking essential card-tape conversion functions away from the computer and freeing it for its basic processing jobs.

The system is comprised of a high-speed card reader, a digital tape transport and solid-state editing, formating and error-control electronics.

— Model CTS-2000 Card-Tape Conversion System

An operator can place several thousand cards into the automatic feed-hopper of the card reader in a few seconds. The data is read and transferred to the tape transport, which records it on high-density tape. The tape then may be fed into a computer system at the user's discretion. The transport packs either 200, 556 or 800 characters per linear inch of tape and generates tape useable in IBM 7330, IBM 729 series, IBM 2400 series and other ASCII-compatible computer equipment.

Four versions, ranging in speeds from 400 to 2000 cards per minute are available to meet varying speed and volume requirements. Lease or purchase of the system carries full maintenance contract services from regional Ampex offices throughout the world.
(For more information, designate #51 on the Readers Service Card.)

Data Collection

A-M DATA COLLECTION SYSTEM PROVIDES VERIFIED SOURCE RECORD

Addressograph Multigraph Corp., Cleveland, Ohio, has announced the development of a data collection and transmission system that, for the first time, provides a low cost verified record at the input source. Through an adaptation of the Addressograph bar code system tied into standard telephone line transmission or over direct private line, new A-M equipment will enable users to send information directly to their computers from any decentralized point — and have a complete record of the transaction — on the spot. Preparation of the source document is automatic and simultaneous with the acceptance of the input data by the central EDP equipment.

Information transmitted can be sent directly from the source to a random access computer or drum storage. It also can be converted at the receiving end directly to punched cards, paper or magnetic tape, or into a visual display.

Equipment developed for the system by A-M includes an embossed Plastic Card Reader and Electric Recorders. These machines are employed at the collection source, along with either the Bell System's Data Phone Set or other transmitters.

— Pictured from left to right are an Electric Recorder, a Plastic Card Reader and Keyboard, the input equipment of A-M's new data collection system.

At the heart of the system is a plastic card embossed with both human sensible data and machine sensible data, in the form of a bar code pattern. These plastic cards, containing either customer or employee account numbers, machine or part numbers, tool identification numbers, or any other information embossed with numbers and bar codes, are used at the collection source. Full alpha-numeric descriptive information can also be embossed on these cards.

In a typical application of the system, the plastic card is placed into the new A-M Bar Code Reader, which senses and transmits the pre-embossed numeric data. Other variable data is transmitted through the use of a push button keyboard on the machine. The operator at the source then inserts the embossed card into an electric Recorder, together with a sales slip or transaction document.

In one configuration, if the information being transmitted is "acceptable" to the computer, it returns an "accept" answer-back signal which automatically triggers the Recorder to imprint a transaction document. "Off-line" system configurations could use magnetic or paper tape devices at the receiving end, as well as card punches.

A-M officials said that broad application of this system in the field of decentralized data collection is possible. Among the prospects for the system are retail accounts receivable, manufacturing production control, hospital accounting, parts ordering, Motor Vehicle Drivers' License Control, and professional billing.
(For more information, designate #54 on the Readers Service Card.)

Input-Output

UNIVAC 1001 CARD CONTROLLER

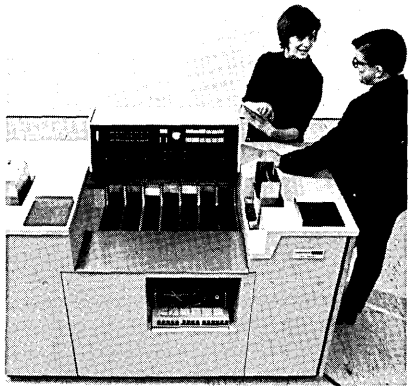
A punched card device, capable of both card arranging as well as multi-file on-line card processing operations, has been developed by the Sperry Rand Corporation's UNIVAC Division, New York, N.Y. The new device, known as the UNIVAC 1001 Card Controller is designed to handle a variety of punched card

functions off-line, and also can be used with the UNIVAC 1004 as a high speed multi-file input.

The 1001 combines into a single unit the functions of high speed collating, card editing and proving, sorting, statistical sorting and counting. It also has adding, subtracting and programmed multiplication capabilities. The Card Controller handles 2000 cards per minute, which is 50% faster than any available collator.

The UNIVAC 1001 has a 256 6-bit position magnetic core memory with a 12 microsecond cycle time. This provides the 1001 with large capacity to compare, classify data, to store constants used for range comparison, and to store totals and statistical counts.

The UNIVAC 1001 compares on the basis of 64 alpha-numeric and special characters. The 64 columns can be compared for merging and matching with simultaneous sequence checking.



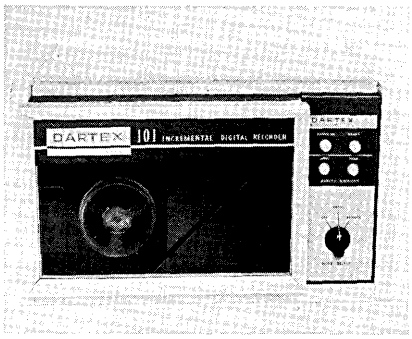
Operational simplicity of the device is increased by a Multi-Program Panel pre-wired to perform many standard collating and merging operations. The flick of a switch activates any one of 18 different functions. UNIVAC Card Controllers are available in 90 column and 80 column models. The 80 column unit also reads binary coded cards.

With the 1004 System, the UNIVAC 1001 has several operating modes, which can effectively double the processing capacity of the UNIVAC 1004.
(For more information, designate #65 on the Readers Service Card.)

MINIATURIZED DIGITAL MAGNETIC TAPE SYSTEMS

A family of low cost, miniaturized digital magnetic tape systems, for computer, data systems, or automated typewriter applications, has been announced by Dartex, Inc. of Anaheim Calif.

The Dartex-100 Digital Magnetic Tape Transport is the basic element of the systems. The device measures 9 x 12 x 6 inches and weighs less than 25 pounds. Storage capacity is 2.4 million bits of information on a 3¼-inch reel of quarter inch one-mil computer grade tape. It will search at 22,240 bits per second, and record or read out at controllable speeds compatible with medium-speed computers, electric typewriters, or Dataphone. Density is 556 bits per inch.



— Dartex-101 Incremental Digital Recorder utilizing the Dartex-100 Tape Transport.

The basic data system is the Dartex-101 Incremental recorder measuring 9½ x 16 x 8 inches and weighing less than 35 pounds in a self-contained desk-top enclosure. This includes the Dartex-100, a data controller, power supply, and control panel. The light weight and small dimensions are made possible by use of integrated microcircuits.

Dartex provides appropriate interface circuitry for each application.
(For more information, designate #60 on the Readers Service Card.)

THE 132 — SECOND ELECTRONIC CALCULATOR FROM FRIDEN

An all-purpose electronic desk-top calculator, with a special key for instantaneous square root computations, has been announced by Friden, Inc., a subsidiary of the Singer Company, San Leandro, Calif. This is the second electronic calculator model introduced by Friden in a year.

The 132 combines the speed and quietness of the electronic computer with the simple input and operational flexibility of the mechanical desk-top calculator. The new device operates at speeds measured in milliseconds with answers appearing almost immediately on the screen as control keys are released. The simple 11-key keyboard and clearly marked controls, automatic decimal control from 0 to 13 places, and multiple registers are among the features making the 132 easy to operate.

There also is the automatic transfer of terms or intermediate answers which permits a logical flow of calculations. The 132 has the added capability of holding a second constant in the top register.
(For more information, designate #62 on the Readers Service Card.)

MASTER-SLAVE TAPE SYSTEM BY DATAMEC

A new master-slave magnetic tape system for computers has been developed by Datamec Corporation, Mountain View, Calif. Datamec spokesmen said the new "combination" concept was developed to provide data processing systems with more input/output capacity for significantly less hardware investment.

The master-slave tape device combinations handle input/output access to several magnetic tapes through one input/output channel. They come in two model lines. The Model D3030 tape units operate at 75 inches per second tape speed, writing and reading IBM standard computer format tapes at recording densities of 800, 556 and 200 characters per inch. Model D 2020 tape units have 45 ips (or lower, if desired) tape speed.

In the Datamec system, a master tape unit works in combination with as many as three slave tape units. Only the master has write-read data electronics, plus a solid-state electronic switcher that shifts the data function among the various tape units as commanded by the external equipment. The master also automatically switches the control and status line functions to any tape unit as commanded.
(For more information, designate #56 on the Readers Service Card.)

SCM ANNOUNCES TWO NEW ELECTRONIC CALCULATORS

A new line of noiseless, fully automatic electronic calculators has been developed by SCM Corporation, New York, N.Y. The first two models announced, named Cogito 240 and 240SR, are compact versatile solid-state calculators with a completely automatic floating decimal system. Each model weighs 35 pounds, is 10 inches high, and requires only a 14 inch by 19 inch space on a desk top.

The capacity of Cogito 240 and 240SR enables them to handle computations involving two twelve digit numbers, calculating the 24 most significant digits for the answer. This ability, coupled with the completely automatic decimal, gives a total capacity in the product register of 52 decimal places.

Computations, noiselessly and rapidly accomplished, are displayed as on a T.V. screen. The three visible working registers are shown

— Shown left to right Cogito 240 and 240SR

on the screen permitting the operator to obtain proof of all entries and answers simultaneously. All zeros are distinctly "half size" for easier, instant readout.

The Cogito machines have three memory registers which can store three separate numeric entries, any one of which may be recalled for use in any computation. The ability to transfer factors and answers between all registers and memories eliminates the reentry of figures and provides greater speed, simplicity and flexibility for the most complex problem.

The Cogito 240SR offers the extra advantage of a square root feature and can accumulate the sum of squares and the sum of multipliers to the twelfth most significant digit. Both models will be available for delivery in the Fall. (For more information, designate #57 on the Readers Service Card.)

Components

GI BUILDS MICROCIRCUITS FOR SPACE EXPERIMENTS

General Instrument Corporation's Microelectronic Division announced that it is building for the Laboratory for Astrophysics and Space Research of the University of Chicago, new microelectronic circuits which need only 300 microwatts (millionths of a watt) of power to operate. The new microcircuits — 200 of which have been ordered by the Laboratory — are for use in NASA space experiments.

The microcircuits are "binary flip-flops" (which are basic "counting" circuits in computing equipment). They were especially designed by the University of Chicago group for space use, where every watt of power can be critical and space and weight is at a premium. Most other microelectronic circuits currently available need between 10 and several hundred milliwatts (thousandths of a watt) of power to operate.

These devices, developed by General Instrument's Multi-Chip Microcircuit Department, use transistor and resistor "chips" assembled in a "package" only 3/8 inch x 5/8 inch and less than 1/10 inch thick. The extraordinarily low power requirements of the new microcircuits are achieved by using special cermet (ceramic-metallic) resistors.
(For more information, designate #66 on the Readers Service Card.)

MAC TRANSITAPE

A special 200-foot reel of computer tape, MAC TransiTape, has been introduced by MAC Panel Co., High Point, N.C. George L. Athanas, president, said that MAC TransiTape is designed for any short job — especially those calling for interplant, inter-city or inter-state mailing. Because its size eliminates the need for wasting footage on 2400- and 1200-foot reels, it also is expected to be very useful for service bureau applications.

Each MAC TransiTape package comes complete with 200-feet of premium grade, heavy-duty computer tape, full-width tested at 800 bpi. The tape is on a special 5 3/4-inch reel with standard hub opening. The reel, enclosed in a reusable poly bag, comes packed in a box that has been constructed for mailing. The complete package (5¼ oz.) can be mailed anywhere in the country for only fourteen cents.
(For more information, designate #67 on the Readers Service Card.)

PEOPLE OF NOTE

THREE NEW DIRECTORS ADDED TO THE BOARD OF BRANDON APPLIED SYSTEMS

Brandon Applied Systems, Inc., a New York data processing consulting firm, has announced the election of three new directors. In alphabetical order, they are: Edmund C. Berkeley, President, Berkeley Enterprises, Inc.; James P. Hassett, President, Cyber-Tronics, Inc.; and Samuel B. Richmond, Professor, Graduate School of Business, Columbia University.

Edmund C. Berkeley has been a pioneer in data processing, since developing the basic ideas for a computerized premium accounting system at The Prudential Insurance Company of America in 1941. Mr. Berkeley has been publisher of Computers and Automation since 1951, and is the author of many significant books in the data processing field.

James P. Hassett is the President of Cyber-Tronics, Inc., a major leasing company in the data processing field. Mr. Hassett has over ten years of data processing experience, in all phases of equipment design, engineering and financing.

Samuel B. Richmond is a noted authority on operations research and statistics. Dr. Richmond is a professor of economics and statistics at the Graduate School of Business, Columbia University, a consultant to major corporations and the Federal Government, and an author of major texts in statistics and airline economics.

Newsletter

AUERBACH INTERNATIONAL DIV. HAS NEW DIRECTOR, OPENS 2ND EUROPEAN OFFICE

Isaac L. Auerbach, President of AUERBACH Corporation, has announced the appointment of Michael J. Samek as director of the International Division. At the same time, Mr. Auerbach announced that the company has opened a second European office, this one at Koninginnegracht 65, in the Hague, Netherlands, from which Mr. Samek will direct the European activities.

Mr. Samek, who will be responsible for the company's European operations, is a former vice president and director of the Data and Information Systems Division of International Telephone and Telegraph. He has had more than 20 years' experience in engineering and research management, sales and administration.

3C APPOINTS VICE PRES-CONTROLLER

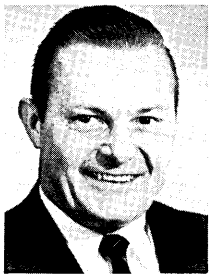
Richard F. Mills, until recently controller of Digital Equipment Corporation, has been appointed vice president-controller at Computer Control Company, Inc., Framingham, Mass., according to an announcement by Benjamin Kessel, 3C president.

Mr. Mills joins 3C after more than four years at DEC. He was formerly associated with Farrington Electronics, Inc., as controller, and the Foxboro Company as assistant to the treasurer.

The position of vice president-controller is new to the 3C corporate structure.

HONEYWELL EDP INTERNATIONAL TO BE HEADED BY BLUCKE

Robert W. Blucke, formerly assistant director of international operations, has been named director of international operations for Honeywell's electronic data processing division. He succeeds J. M. Sterling, who has been promoted to managing director of Honeywell's European computer organization, headquartered in London, England.



Mr. Blucke will be responsible for coordinating U.S. support of Honeywell's expanding international EDP sales activities which now extend into 13 foreign markets, for international sales administration and for manufacturing liaison. He will be headquartered at the EDP division's offices in Wellesley Hills, Mass.

NEW LITERATURE

MAGNETIC LOGIC COOK BOOK

The availability of its recently published 90-page textbook on magnetic logic has been announced by Di/An Controls, Inc., Boston, Mass. It is entitled, "The Magnetic Logic Cook Book" and is offered at $1.00 per copy in a soft cover edition ($1.25 post-paid).

The clear-cut advantages, in many applications, of magnetic shift-register and logic elements — and most particularly "transistor - magnetic" logic elements — have never been fully exploited (except in critical space applications) although they are quite generally acknowledged and appreciated throughout the digital-systems design field.

"The Magnetic Logic Cook Book" presents, for the first time, a comprehensive treatment of magnetic logic theory and application.

The following chapter headings extracted from the table of contents of the "Cook Book" illustrate the scope and depth of this publication: "...the Two Fundamental Circuits...Putting the Two Fundamental Circuits to Work...Advantages of Magnetic Core Logic...Magnetic Circuit Packaging and Specifications... Magnetic Core Ropes for Decoding ...Circuit and General Index... Cross Index by Application".
(For more information, designate #69 on the Readers Service Card.)

COBOL INFORMATION BULLETIN AVAILABLE

The Data Processing Group of BEMA has released another COBOL Information Bulletin. This information bulletin includes a working document entitled "Language Specifications for a Proposed COBOL Standard" and is number 6 in a series produced by the COBOL task group of the American Standards Association subcommittee X3.4 on common programming languages.

This 186 page multilith document contains a set of elements chosen from the total COBOL language, as defined by CODASYL to be considered for the proposed American Standard on COBOL (pASCOBOL).

Copies are available by writing to CIB Editor, Data Processing Group, BEMA, 235 East 42nd Street, New York, N.Y. 10017.

THE TAPE MANAGEMENT PROGRAM, FIRST IN SERIES OF FIVE

The first of a series of five papers covering the entire area of computer tape management has been published by General Kinetics Inc., Arlington, Va. The first paper to be released is titled THE TAPE MANAGEMENT PROGRAM. Subsequent papers will consider the need for tape preventive maintenance, the process itself, and its technology.

THE TAPE MANAGEMENT PROGRAM, Paper #1, outlines the essentials of a system for maintaining tape in the best condition and at the highest level of performance of which it is inherently capable. A significant feature of the paper is a chart that demonstrates how a Tape Preventive Maintenance and Rehabilitation Center functions as part of a computer installation to keep poor quality tapes out of the operations area.
(For more information, designate #70 on the Readers Service Card.)

NEW COMPUTER BOOK AND FILM GUIDE AVAILABLE

The Washington, D.C. chapter of the ACM has published a special

edition of its monthly news magazine, COMPUTOPICS, which consists of two annotated bibliographies: A Career Guidance Bibliography, and Computer Science Theater Bibliography.

This handy booklet provides an up-to-date listing of educational materials suitable for preparing a course on computers, programming, systems analysis, and related subjects.

Additional copies of the issue may be obtained for fifty cents each by writing to the ACM, 211 East 43 Street, New York, N.Y. 10017.

BUSINESS NEWS

COMPUTER TAPE MARKET EXPECTED TO INCREASE 10% YEARLY

The use of magnetic computer tape will increase by more than 10% each year through 1970 predicts F. B. Cameron, vice president and general manager of the Celanese's film and sheet products group. The prediction was made during a press meeting at Celanese's new plant in Greer, S.C. The almost surgically-clean plant produces the new Celanar polyester film used as a base for magnetic recording tapes.

The relatively slower growth rate in the use of magnetic computer tape versus the 20%-25% annual growth rate expected in the use of computer systems can be attributed to several factors. One is the increased use of on-line systems that rely on random access storage devices such as disc files, disc packs, and magnetic card systems for storage of frequently used files. Another is the development of low cost magnetic card and disc pack memories that provide on-line storage capacities equal to the information on one to three reels of magnetic tape. The cartridges of magnetic cards or discs are replaceable.

The world-wide market for magnetic computer tape in 1965 is currently expected to be about $38 million, accounting for the sale of approximately 900,000 reels of magnetic computer tape. A recently completed market study by staff of C & A of the magnetic tape-oriented computers used in the U.S. indicates that there are currently approximately 10,000 magnetic tape-oriented computers in use. These systems use a total of approximately 50,000 tape transports. Estimating that 85% of the world-wide sales of magnetic computer tape occur in the U.S., these figures indicate that the average consumption per year of magnetic computer tape in the U.S. is approximately 15 reels per transport.

Celanese feels it now has a strong stake in this growing market because of the technical features of its new tape base. Celanar polyester film claims a 25% to 35% increase in tensile break strength and a 10% to 15% advantage in F-5 value (stress required to produce 5% elongation) over its nearest competitor DuPont's Mylar.

The high F-5 value is of particular significance for computer magnetic tape. Tape transports in computer systems start and stop in thousandths of a second and employ tape acceleration speeds as high as 200 inches per second in 2 msec. Such movements exert very high momentary stress on the tape. High stress tends to stretch the tape and at critical value causes the tape to break apart. Generally a magnetic computer tape cannot be stretched more than 5% without having the information stored on it become valueless in high precision work.

RCA SALES, EARNINGS SET HIGHS

Profits and sales of RCA rose to all-time record levels during the second quarter and first half of 1965, Chairman David Sarnoff announced. RCA's second-quarter and first-half dollar earnings increased by 18 per cent and 17 per cent, respectively, over last year's levels. The quarter was the 17th consecutive three-month period in which profits improved over the comparable quarter of the preceding year.

Profits after taxes in the second quarter were $18,900,000, as against $16,000,000 in the same period last year. For the first half, after-tax profits were $43,900,000, compared to last year's first-half record of $37,600,000.

Sales in the first six months were $963,900,000, setting a new mark for any half year. The previous high was $913,300,000 in the second half of 1964. Second quarter sales were $488,400,000, an all-time record for any quarter. The best previous quarterly total was $486,200,000 in the fourth quarter of 1962. In comparison with the same periods last year, the gains in sales volume were 12 per cent for the second quarter and 7 per cent for the first half.

General Sarnoff credited this record performance to sustained momentum in RCA EDP sales, highlighted by mounting orders for the new RCA Spectra 70 computer series, among other company events.

Chairman Sarnoff said that more than 925 RCA systems have now been delivered or are on order. He said that the new RCA Spectra 70 series is gaining wide acceptance, and that continuing new orders have led to an upward revision in production schedules for the earlier 301 and 3301 systems.

3C INCOME DROPS

Computer Control Company reports net income for the first 28 weeks of fiscal 1965 of $140,645, as compared to $389,463, net earnings reported at mid-year for 1964.

First half sales of $11,606,779 for the current period exceed the $8,482,198 reported for the corresponding period last year.

High scheduled expenditures incurred in connection with three new major product lines in final design, programming, and release for manufacture contributed to restricted earnings in the first half of fiscal 1965, according to B. Kessel, president.

The high scheduled expenditures, Kessel said, relate to launching the new DDP-224 and DDP-116 computers that were released to full production during the first half. Initial shipments were made by the end of the half. Also, during the first half, he pointed out, 3C introduced and released for manufacture its new digital logic module line called "μ-PACS" (MICRO-PACS), which incorporates integrated circuitry.

In addition to the μ-PAC module line, 3C recently introduced the DDP-124, its first micro-circuit computer.

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 well 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 a documented data file which now covers over 80% of the 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 JULY 10, 1965

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTALS	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Addressograph-Multigraph Corporation	EDP 900 system	Y	$7500	2/61	11	1
Advanced Scientific Instruments	ASI 210	Y	$2850	4/62	23	2
	ASI 2100	Y	$3000	12/63	6	0
	ASI 6020	Y	$2200	4/65	2	4
	ASI 6040	Y	$2800	7/65	0	4
	ASI 6050	Y	$3000	10/65	0	1
	ASI 6070	Y	$3500	10/65	0	0
	ASI 6080	Y	$4000	1/66	0	0
Autonetics	RECOMP II	Y	$2495	11/58	55	X
	RECOMP III	Y	$1495	6/61	14	X
Bunker-Ramo Corp.	BR-230	Y	$2680	8/63	14	1
	BR-300	Y	$3000	3/59	40	X
	BR-330	Y	$4000	12/60	35	X
	BR-340	Y	$7000	12/63	19	2
	BR-530	Y	$6000	8/61	15	X
Burroughs	205	N	$4600	1/54	57	X
	220	N	$14,000	10/58	44	X
	E101-103	N	$875	1/56	165	X
	B100	Y	$2800	8/64	50	32
	B250	Y	$4200	11/61	105	7
	B260	Y	$3750	11/62	190	80
	B270	Y	$7000	7/62	145	25
	B280	Y	$6500	7/62	80	25
	B370	Y	$8400	7/65	0	40
	B5000/B5500	Y	$20,000	3/63	38	11
Clary	DE-60/DE-60M	Y	$525	2/60	324	3
Computer Control Co.	DDP-19	Y	$2800	6/61	3	X
	DDP-24	Y	$2500	5/63	65	4
	DDP-116	Y	$900	4/65	5	45
	DDP-224	Y	$3300	3/65	5	20
Control Data Corporation	G-15	N	$1000	7/55	328	X
	G-20	Y	$15,500	4/61	26	X
	160*/160A/160G	Y	$1750/$3400/$12,000	5/60;7/61;3/64	426	4
	924/924A	Y	$11,000	8/61	28	1
	1604/1604A	Y	$38,000	1/60	60	X
	3100	Y	$7350	12/64	21	35
	3200	Y	$12,000	5/64	73	27
	3300	Y	$15,000	7/65	0	35
	3400	Y	$25,000	11/64	11	20
	3600	Y	$58,000	6/63	40	12
	3800	Y	$60,000	11/65	0	18
	6400	Y	$40,000	1/66	0	2
	6600	Y	$110,000	8/64	4	9
	6800	Y	$140,000	4/67	0	1
Digital Equipment Corp.	PDP-1	Y	$3400	11/60	60	2
	PDP-4	Y	$1700	8/62	55	2
	PDP-5	Y	$900	9/63	110	4
	PDP-6	Y	$10,000	10/64	9	11
	PDP-7	Y	$1300	11/64	11	50
	PDP-8	Y	$525	4/65	30	155
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	24	X
Electronic Associates, Inc.	8400	Y	$7000	6/65	0	6
Friden	6010	Y	$600	6/63	197	191
General Electric	115	Y	$1375	12/65	0	95
	205	Y	$2900	6/64	25	15
	210	Y	$16,000	7/59	56	X
	215	Y	$6000	9/63	50	5
	225	Y	$8000	4/61	145	3
	235	Y	$10,900	4/64	48	6
	415	Y	$7300	5/64	58	80
	425	Y	$9600	6/64	30	50
	435	Y	$14,000	10/64	10	20
	625	Y	$41,000	12/64	4	21
	635	Y	$45,000	12/64	4	24
General Precision	LGP-21	Y	$725	12/62	135	X
	LGP-30	semi	$1300	9/56	410	X
	RPC-4000	Y	$1875	1/61	90	X
Honeywell Electronic Data Processing	H-120	Y	$2600	12/65	0	155
	H-200	Y	$5700	3/64	510	340
	H-400	Y	$8500	12/61	122	8
	H-800	Y	$22,000	12/60	81	10
	H-1200	Y	$6500	2/66	0	30
	H-1400	Y	$14,000	1/64	11	3
	H-1800	Y	$30,000	1/64	10	10

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTALS	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Honeywell (cont'd)	H-2200	Y	$11,000	10/65	0	40
	H-4200	Y	$16,800	2/66	0	5
	H-8200	Y	$35,000	3/67	0	1
	DATAmatic 1000	N	$40,000	12/57	4	X
IBM	305	N	$3600	12/57	185	X
	360/20	Y	$1800	12/65	0	2600
	360/30	Y	$7500	4/65	45	2300
	360/40	Y	$16,000	4/65	60	650
	360/50	Y	$30,000	7/65	0	290
	360/60	Y	$48,000	8/65	0	18
	360/62	Y	$55,000	9/65	0	5
	360/65	Y	$49,000	1/66	0	80
	360/66	Y	$49,000	10/66	0	5
	360/75	Y	$78,000	11/65	0	85
	650	N	$4800	11/54	275	X
	1130	Y	$850	11/65	0	900
	1401	Y	$4500	9/60	7300	350
	1401-G	Y	$2000	5/64	900	100
	1410	Y	$14,200	11/61	780	60
	1440	Y	$3500	4/63	1900	500
	1460	Y	$9000	10/63	1800	300
	1620 I, II	Y	$2500	9/60	1750	30
	1800	Y	$3500	12/65	0	70
	701	N	$5000	4/53	1	X
	7010	Y	$22,600	10/63	120	40
	702	N	$6900	2/55	8	X
	7030	Y	$160,000	5/61	7	X
	704	N	$32,000	12/55	44	X
	7040	Y	$18,000	6/63	105	25
	7044	Y	$35,200	6/63	50	10
	705	N	$30,000	11/55	62	X
	7070, 2, 4	Y	$27,000	3/60	355	8
	7080	Y	$55,000	8/61	73	1
	709	N	$40,000	8/58	11	X
	7090	Y	$63,500	11/59	58	4
	7094	Y	$72,500	9/62	140	15
	7094 II	Y	$78,500	4/64	70	30
ITT	7300 ADX	Y	$18,000	9/61	9	6
Monroe Calculating Machine Co.	Monrobot IX	N	Sold only - $5800	3/58	155	X
	Monrobot XI	Y	$700	12/60	550	140
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	X
	NCR - 310	Y	$2000	5/61	46	1
	NCR - 315	Y	$8500	5/62	318	45
	NCR - 315-RMC	Y	$12,000	9/65	0	65
	NCR - 390	Y	$1850	5/61	930	60
	NCR - 500	Y	$1500	9/65	0	170
Philco	1000	Y	$7010	6/63	16	2
	2000-210, 211	Y	$40,000	10/58	21	2
	2000-212	Y	$52,000	1/63	9	2
	2000-213	Y	$68,000	6/65	0	1
Radio Corp. of America	Bizmac	N	$100,000	-/56	3	X
	RCA 301	Y	$6000	2/61	597	15
	RCA 3301	Y	$11,500	7/64	29	20
	RCA 501	Y	$14,000	6/59	98	2
	RCA 601	Y	$35,000	11/62	5	X
	Spectra 70/15	Y	$2600	11/65	0	55
	Spectra 70/25	Y	$5000	11/65	0	45
	Spectra 70/45	Y	$9000	3/66	0	55
	Spectra 70/55	Y	$14,000	5/66	0	13
Raytheon	250	Y	$1200	12/60	170	10
	440	Y	$3500	3/64	11	6
	520	Y	$3200	10/64	0	6
Scientific Data Systems Inc.	SDS-92	Y	$900	4/65	10	40
	SDS-910	Y	$2000	8/62	137	18
	SDS-920	Y	$2700	9/62	86	8
	SDS-925	Y	$2500	12/64	3	25
	SDS-930	Y	$4000	6/64	50	25
	SDS-9300	Y	$7000	11/64	11	7
Systems Engineering Labs	SEL-810	Y	$750	8/65	0	8
	SEL-840	Y	$4000	10/65	0	2
UNIVAC	I & II	N	$25,000	3/51 & 11/57	30	X
	III	Y	$20,000	8/62	88	5
	File Computers	N	$15,000	8/56	21	X
	Solid-State 80 I, II, 90 I, II & Step	Y	$8000	8/58	315	X
	418	Y	$11,000	6/63	24	12
	490 Series	Y	$26,000	12/61	53	22
	1004	Y	$1900	2/63	2850	250
	1050	Y	$8000	9/63	175	165
	1100 Series (except 1107)	N	$35,000	12/50	13	X
	1107	Y	$45,000	10/62	28	1
	1108	Y	$50,000	7/65	0	15
	LARC	Y	$135,000	5/60	2	X
				TOTALS	27,814	11,613

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 conversions 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 computer and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U. S. Commissioner of Patents, Washington 25, D. C., at a cost of 25 cents each.

April 6, 1965

3,177,469/ Chao Kong Chow, Bryn Mawr, Pa./ Burroughs Corp., Detroit, Mich./ Character Recognition.

3,177,470/ Anthony Galopin, Reading, Mass./ —/ Character Sensing System.

3,177,472/ John A. Githens, Morristown, N.J./ Bell Telephone Labs./ Data Conversion System.

3,177,473/ Wijnand Johannes Schoenmakers, Eindhoven, Netherlands/ North American Phillips Co./ Magnetic Memory Device.

3,177,474/ Eric G. Wagner, New York/ IBM Corp., N.Y./ High Speed Binary Counter.

April 13, 1965

3,178,020/ Heinz M. Zeutschel, Arlington and Robert W. Cooper, Natick, Mass./ Itek Corp., Lexington, Mass./ Data Processing Apparatus.

3,178,178/ Heinz M. Zeutschel, Arlington, Mass./ Itek Corp., Lexington, Mass./ Data Processing Apparatus.

3,178,587/ Burtis W. Meyer and Hardison J. Geer, Palo Alto, Calif./ General Electric Co./ Information Storage Circuit.

3,178,692/ Douglas J. Hamilton, Tucson, Arizona/ General Electric Co./ Memory Sensing System.

3,178,693/ Edward Schwartz, Phila., Pa./ Sperry Rand Corp./ Memory System.

3,178,694/ John C. Mallinson, Palo Alto, Calif./ AMP Inc./ Shift Register.

April 20, 1965

3,179,926/ Robert M. Wolfe, Colonia, N.J./ Bell Telephone Labs., Inc./ Ferroelectric Logic Circuits.

3,179,927/ Edgar Heimbach, Munich, Germany/ Siemens & Halske Aktiengesellschaft, Berlin, Germany/ Magnetic Core Matrices.

3,179,928/ Robert E. Sorenson, Bloomington, Minn./ Sperry Rand Corp./ Search Memory Using Longitudinal Steering Fields.

April 27, 1965

3,181,004/ Henry Guckel, Urbana, Ill./ USA, as represented by US Atomic Energy Comm./ Binary Memory Device Employing Flip-Flop That Is Controlled by In-Phase Drivers.

3,181,123/ Esmond Philip Goodwin Wright and Donald Adams Wehr, London, England and Raymond Cecil Price Hinton, Teaneck and Boris Dzula, Clifton, N.J./ International Standard Electric Corporation, NY/ Data Processing Systems.

3,181,126/ Milton W. Green, Menlo Park, Calif./ Radio Corp. of America/ Memory Systems.

3,181,127/ Gerhard Merz, Rommelshausen, Waiblingen, Germany/ International Standard Electric Corporation/ Magnetic-Core Storage Matrix.

3,181,128/ Bruce E. Peck, Whittier and Calvin Fujimoto, Los Angeles, Calif./ The National Cash Register Co./ Magenetic Core Memory Structure.

3,181,129/ Arye Leib Freedman, London, England/ Decca Limited, London, England/ Digital Information Storage Systems.

3,181,131/ Richard L. Pryor, Haddonfield and Thomas R. Mayhew, Levittown, N.J./ Radio Corp. of America/ Memory.

3,181,132/ Hiroshi Amemiya, Levittown, N.J./ Radio Corp. of America/ Memory.

May 4, 1965

3,182,204/ Remo Galletti, Milan, Italy/ Ing C. Olivetti & C.S.p.A, Ivrea, Italy/Tunnel Diode Logic Circuit.

3,182,205/ John R. Sorrells, Rockville and Arthur W. Holt, Silver Spring, Md./ assigners by mesme assignments to Control Data Corp., Minneapolis, Minn./ Logic Package Including Input Gating Means D.C. Coupled to Amplifier.

3,182,293/ Robert E. Fruin, Schenectady, and Vernon L. Newhouse, Scotia, NY/ General Electric Company/ Cryogenic Memory Circuit.

3,182,294/ John W. Bremer, Sunnyvale, Calif. and Vernon L. Newhouse, Scotia, NY/ General Electric Company/ Cryogenic Memory.

3,182,295/ Joe B. Crank, Dallas and William F. Donnell, Richardson, Texas/ Texas Instruments Inc./ Shift Register Device.

3,182,296/ John A. Baldwin, Jr., Murray Hill and Andrew H. Bobeck, Chatham, NJ/ Bell Telephone Company/ Magnetic Information Storage Circuits.

May 11, 1965

3,183,363/ Kenneth E. Batcher, 1010 W. Green St., Urbana, Ill., Harold R. Greene, 47 Apple Orchard Drive, New Shrewsbury, NJ and Saul B. Yochelson, 10010 Lasaine Ave., Northridge, Calif/ Logic Mechanization System.

3,183,365/ Harri K. Ligotky, Chicago, Ill./ International Tele & Telegraph Corp./ Electronic Counter or Scanner Using Memory Means and Logic Gate.

3,183,370/ Kurt M. Trampel, Poughkeepsie, NY/ International Business Machines Corp./ Transistor Logic Circuits Operable Through Feedback Circuitry in Nonsaturating Manner.

3,183,371/ Kurt M. Trampel, Poughkeepsie, NY/ IBM Corp./ Nonsaturating Transistor Trigger Circuits.

3,183,483/ John R. Lisowski, Minneapolis, Minn./ Sperry Rand Corp./ Error Detection Apparatus.

3,183,484/ Richard A. Christiansen, Rochester, Minn., Norman S. Stockdale, Endwell, NY and Harry J. Tashjian, Rochester, Minn./ IBM Corp./ Serial By Bit, Serial By Character, Data Comparing Apparatus.

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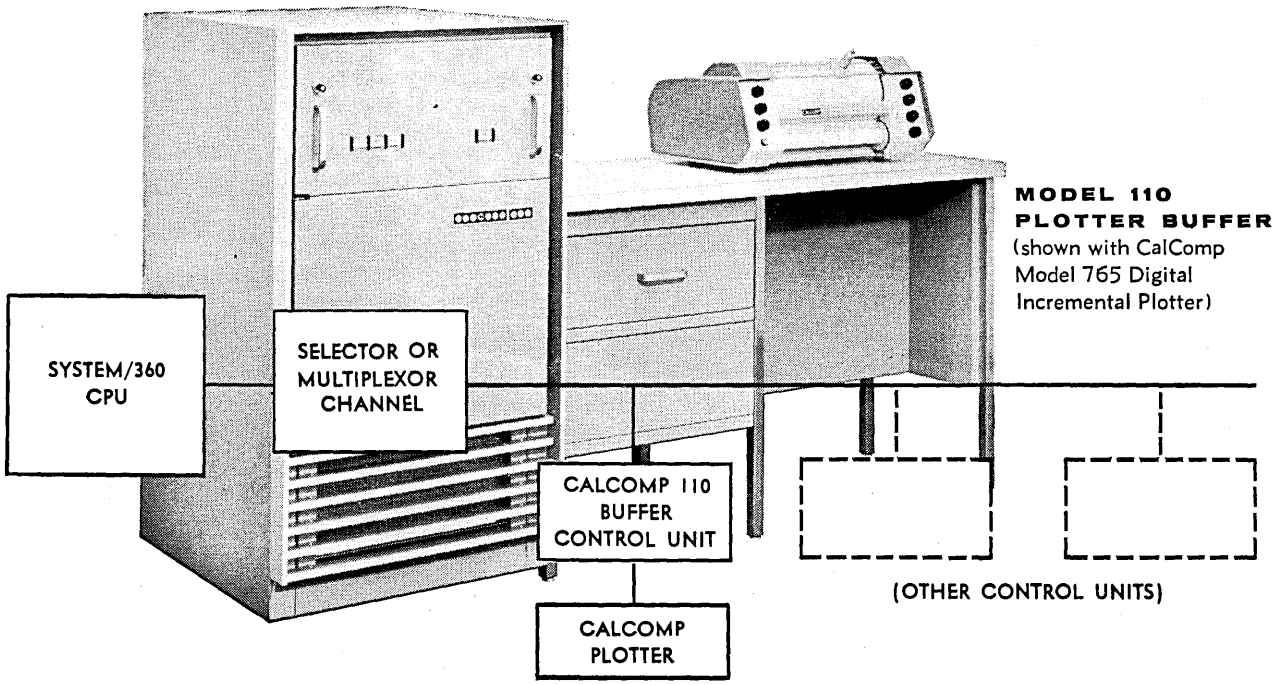

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Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

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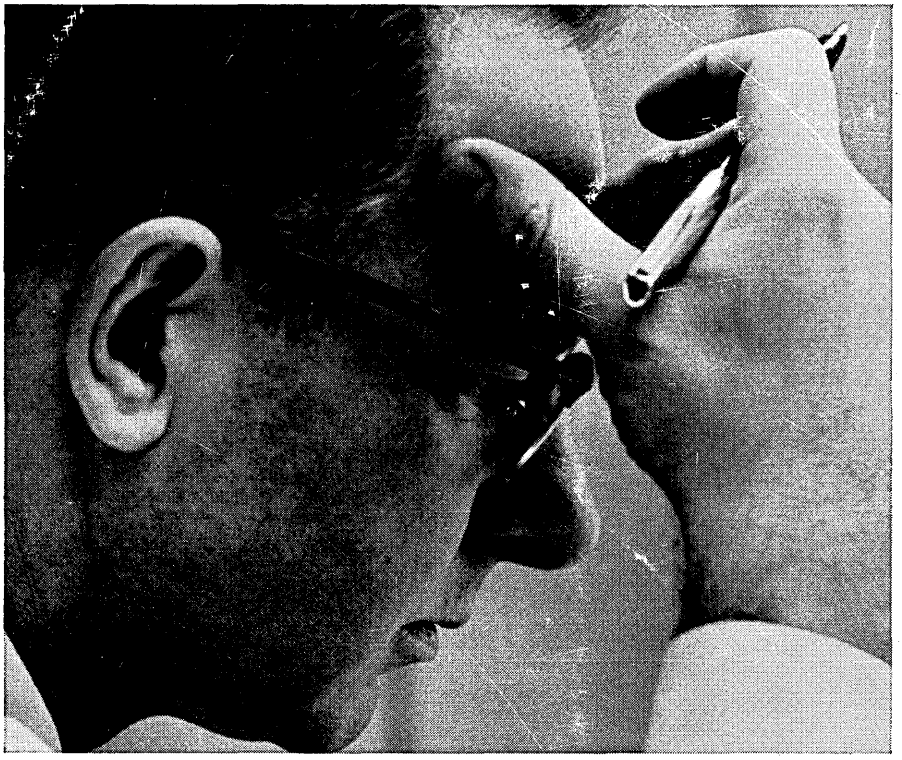

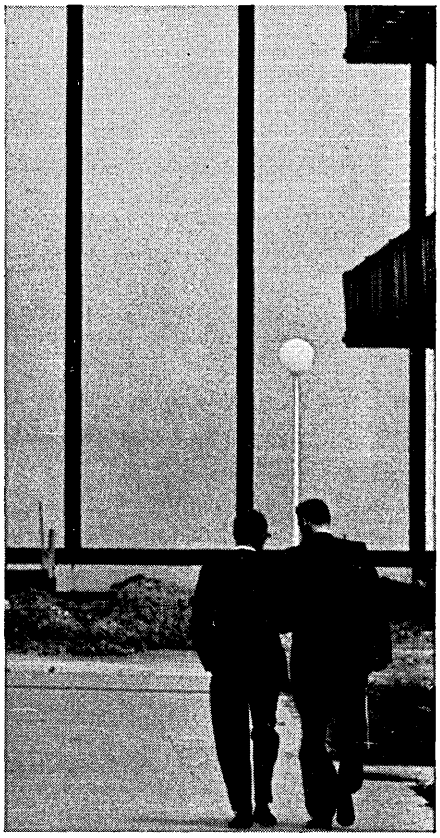

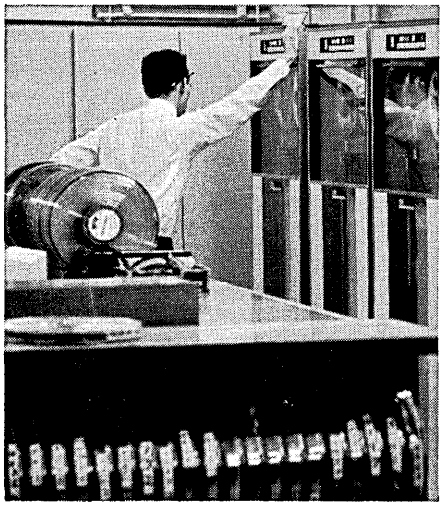

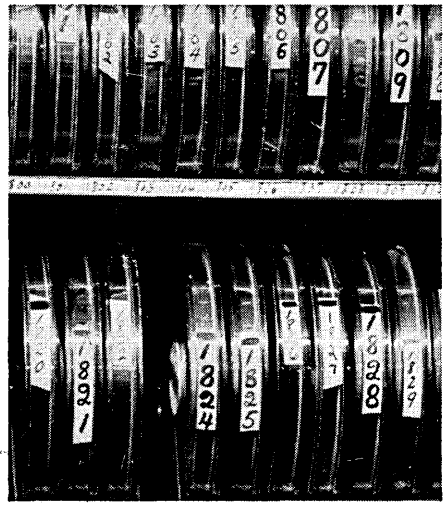

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