November, 1969

Vol. 18, No. 12

computers and automation

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Letters To The Editor

Seeks Computer Art

We are refurbishing portions of the space in which we have terminals installed. We'd very much like the space to avoid the institutional look that is so distressingly and depressingly prevalent. One decorating idea under consideration is using "computer-generated" art. I am writing to inquire, therefore, how I might obtain enlargements of some of the works submitted as entries in your most recent art contest (featured in the August, 1969 issue).

ROBERT M. GORDON
Director
Interactive Computing Facility
Univ. of Calif., Irvine
Irvine, Calif. 92664

Ed. Note—We do not have any reproductions of the computer art features in our August, 1969 issue, and we are not planning to produce any. You may request permission from us to make copies, full size or larger. Or you may want to write directly to the artists themselves to see if they have any works you might obtain. Their addresses are given on page 32 of the August issue.

Right Answers

I just finished reading your article entitled "Right Answers—A Short Guide for Obtaining Them" in your September issue (page 20). I was impressed! It appears to me that you have done some excellent thinking. I am glad you are writing a book. I want to get on the list of persons to be notified when your book becomes available. I am therefore enclosing two self-addressed post cards which you can put in your files for the big day. (The Dallas card is my parents' address—one can never tell where one is going to be in an industry as dynamic as ours; my specialty is software documentation.)

Keep up the good work.

BOB PARKINSON
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computers and automation

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Information Engineering and the Curriculum of the Future

According to an old joke, the specialist is a man who knows more and more about less and less until he knows everything about nothing, and the generalist is one who knows less and less about more and more until he knows nothing about everything. As the information explosion proceeds, will all of us in the computer field wind up in one or the other direction? or is there some more useful direction in which information engineering and the curriculum of courses in high school and college will — or should — proceed?

As the centuries pass, great changes take place in the knowledge which is taught in schools. What determines the content of high school and college courses? How should this content develop over the next fifty or hundred years for maximum utility to mankind? Reading, writing, and arithmetic will certainly remain — but what about the rest?

Forty-five years ago when I was in preparatory school at Phillips Exeter Academy, Exeter, N.H., there was a course in solid geometry offered for seniors in high school; I took it and found it interesting. But there was no course in probability and statistics, a mathematical subject of far more importance in the world of human affairs. Almost all that I learned of probability and statistics I have picked up here and there since finishing what is called my "formal education".

Naturally there was no course in computers and data processing. Nevertheless, "mathematical machines", fire-control devices, desk calculators, punch card machines, cash registers and many other kinds of machines for handling information and making calculations did great quantities of important and useful work in the world outside school. But I was almost unaware of this until I reported for my first job as a clerk in the actuarial department of the Mutual Life Insurance Co. of New York. Why had not high school and college taught me even a little about these non-sequence-controlled computers?

What is taught in high school and college is very largely determined by fashion, precedent, and what the older members of the teaching faculties happen to know, and often bears an inadequate relation to all that young people need—and want—to learn. What is taught is also critically influenced by (1) what the establishment, the ruling classes, the governing party, the bureaucracy, of the nation want or need to have taught, and (2) what the local community in its basic provincialism thinks should be taught. Thus the information taught is often inadequately related to the urgent problems of the real world. And many students who have good minds and enjoy learning find it easy and rewarding to become personally and emotionally involved in the subjects which they learn, and to accept without too much criticism many of the biases and myths which they are taught. So they quickly become part of the establishment and prolong the lack of adaptation.

From time to time, however, defeats in war, failures in competition, the spectacular rise of new technologies, and other revolutionary events occur. A good example for the United States was Sputnik in October 1957, the first artificial earth satellite, launched by the U.S.S.R. Then the fabric of learning and teaching stretches or tears, accommodates into the curriculum new subjects that need to be taught, and starts to congeal once more.

If we could look with imagination and foresight into the future, what would we see for the new courses in high school and college which almost all educated persons would want and need to learn? In comparison, a great deal of what we are taught today would seem as old-fashioned, misplaced, and provincial as the courses at Harvard University in the early 1800's which consisted thee-quarters of Protestant theology.

It seems to me that the largest single need in formal education is a need for truth — a need to escape from bias, one-sidedness, myths, failure to be cosmopolitan and broad-minded, pressure to be provincial and narrow-minded.

Take the sentence "Columbus discovered America in 1492". Well, Columbus did not discover America in 1492: the island he attained and thought was America was San Salvador in the Caribbean; European voyagers for over 400 years had visited the coasts of continental America and traveled inland; very large numbers of human beings were in North and South America before Columbus' voyage; etc. A tremendous amount of falsehood and provincialism is packed into that one sentence.

For human beings to become well-informed, broad-minded, and cosmopolitan, here are five courses that I would like to see conspicuous in the new curriculum of the future:

1. ***Man in Perspective.*** The planets and satellites of the solar system, and their comparison. The nature and biography of the Earth. Life and its environments on the earth. Structure of societies in insects, birds, animals, and man. The behavior of apes and monkeys. Other societies, cultures, languages, economic systems, technologies of machines and information, etc., contrasted with present civilized varieties. The long broad view of man. An attempt to escape from the provincialism of one time and one place.

2. ***The Engineering of Better Societies.*** Measurements and parameters of human societies and civilizations. The nature and origin of important characteristics of societies. The economic nature of societies. Ruling classes and ruled classes. Systems of control over ruled classes. The power and influence of computers, data processing, and information. "1984" by George Orwell. The changing and improvement of societies and systems, and techniques therefor.

3. ***Human Survival.*** Human beings and the environment. Famine. Disease. War. Nuclear weapons. Chemical, bacterial, and radiological warfare. Genocide. Armament systems. The nature and sources of war and peace. The

(Please turn to page 10)

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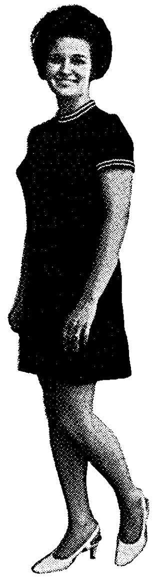

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EDITORIAL

(Continued from page 8)

segments of society that profit from war, and those that profit from peace. Disarmament systems. The growth of human populations, and pollution. Systems for the survival of humanity and the control of the environment. World-wide organizations. The role of information engineering.

4. *General Language.* The scientific study of language. The nature, development and origin of natural language. The relation of language to symbolic techniques permitting calculation, such as mathematics, symbolic logic, and computer programming. Words, meanings, and contexts. The different organization of thinking accomplished by the languages of different societies. Control over the development and greater usefulness of language, both for men and machines.

5. *Truth, Bias, and Lies.* The multiple nature of truth. Problem solving. Logical fallacies, particularly the fallacies of neglected aspect. The philosophy of science. Fashion, myth, bias, lies, and how to determine them and deal with them. Experimentation and its limits. Experience and its limits. The nature of common sense and of wisdom. The technology for handling information, avoiding mistakes, and determining truth.

Edmund C. Berkeley

Editor

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AS WE GO TO PRESS

THE AIR FORCE IS EXPECTED TO PLACE TWO GIANT ORDERS FOR COMPUTERS TOTALLING $750 MILLION BY THE END OF THE YEAR. The contracts are for the Worldwide Military Command and Control System ($500 million) and the data processing facilities of the Air Force Logistics Command ($250 million). IBM, Honeywell, General Electric, RCA, Control Data, and Burroughs are the main contenders for the contracts. But they may meet with some political opposition from some Dept. of Defense officials and Congressmen who want to divide up the contracts so that a single company does not benefit. Air Force officials reportedly feel it is to their benefit to buy all of their computers at the same store. The resolution of this conflict could have far-reaching implications encompassing the whole controversial area of military-industrial contracts.

NATIONAL CASH REGISTER (NCR) AND XEROX DATA SYSTEMS (XDS) HAVE ANNOUNCED CHANGES IN THEIR PRICING STRUCTURES. NCR has placed itself in the "partially unbundled" category with an announcement that the company will continue to supply "certain essential and predetermined systems support, educational assistance and software without extra charge", but will establish separate prices for additional services required above "that basic level". XDS (formerly SDS) has selectively adjusted prices and lowered some rental rates, and has expanded its previously limited policy of charging separately for hardware and software. Largest price reductions will be on systems with large memory configurations, and those requiring multiple magnetic tape units. Price adjustments and changes in structure will be effective Jan. 1, 1970.

The above announcements — together with Control Data's recent release of the details of the unbundling announcement that company made last month — complete the circle of examinations of pricing structures by the major computer manufacturers which began with IBM's unbundling last June.

NEW GUIDELINES FOR OBTAINING SOFTWARE PATENTS HAVE BEEN ISSUED BY THE U.S. PATENT OFFICE. Commissioner of Patents William E. Schuyler has announced that, as the result of recent court cases, patent applications for software will now be considered "on the basis of the merits of the specific inventions sought to be protected". Previously the Patent Office had discouraged applications for software patents by requiring that software be "represented as hardware" before patent protection could be provided.

A NEW WORLD-WIDE ORGANIZATION HAS BEEN ESTABLISHED BY HONEYWELL INC. To handle Honeywell computer activities in Europe, Latin America, the Middle East, South East Asia and Africa — and to support computer operations in Canada, Australia and Japan. The new International Computer and Communications Div. will have headquarters in Wellesley, Mass. Honeywell followed the announcement of its new division, with several key personnel changes, including the promotion of Charles L. Davis and Edson W. Spencer to executive vice presidencies. In these newly created positions, Davis and Spencer will "share the operating responsibilities for the entire company" with Honeywell President Stephen F. Keating.

c.a

MULTI-ACCESS FORUM

"THE ANTI-BALLISTIC MISSILE SYSTEM CALLED 'SAFEGUARD' AND THE SOCIAL RESPONSIBILITIES OF COMPUTER PEOPLE" — DISCUSSION

I. From T. H. Maguire, Jr., Pres.
T. H. Maguire and Associates
Wildwood Lane
Weston, Conn. 06880

In August, I resubscribed to your fine publication after eight month's abstinence. I'm delighted to be exposed to the thoughts expressed therein, even though I don't agree or, at times, even comprehend some of them.

For example, I feel as though you're straining to have reached some of the conclusions you did re "Safeguard" (page 8, September, 1969 issue). Certainly, there's room for further questioning re the workability of the system, but to make a categorical statement—"it just won't work"—is rather like having said, "It'll never get off the ground, Orville!"

I can agree with whomever those computer professionals are who say that the system can't be given an actual test. Could a test system be designed which would simulate actuality? I think so; we've done it many times in the past.

Scare tactics, e.g.—we'll be drenched by fallout—are somewhat demagogic when one assumes that the explosions are far north of the U.S. (poor Canadians) and quite high in altitude (what goes up must come down?).

I fear that we, as computer professionals (as is even true of lesser mortals), sometimes let our righteous desires for a better world get the best of us and slant our professional judgments. This being the age of the specialist, we all want to be the Renaissance man, but perhaps we should "do our thing" well and not try to tell the other specialists how to do theirs. Specialization does ***not*** demand subservience or blind acceptance, but does demand honesty in one's own specialty and trust in the honest competence of other specialists.

Thank you for your courtesy in reading *my* thoughts.

II. From the Editor

Thank you for your thoughtful and friendly letter rebutting some of the statements made in my editorial in the September issue. Of course we are glad that you find the issues of *Computers and Automation* stimulating.

1. *Complexity of the "Safeguard" ABM System.* Before you conclude whether or not the "Safeguard" ABM System is too complex to work or to be made to work, I wish you could read the article by Dr. J. C. R. Licklider in the August issue, which I expect you did not receive. There is much to think about in his article. I take pleasure in sending you separately a copy of our August issue, so that you may read it.

2. *Continued Verification.* I agree with you that specialization ought not to demand "subservience or blind acceptance". But I cannot agree with you that it also demands "trust in the honest competence of other specialists".

Even the most honest of specialists can be wrong, and this is proved on a large scale by how often science takes a new turn, abandoning many of the beliefs and theories held by a group of earlier, completely honest scientists. Take the change from Newtonian to Einsteinian physics, for example.

Not only must we "do our thing", but also we have to become (to a reasonable and socially responsible extent) "our brother's keeper"; we must evaluate, assess, verify, and check the statements of our "brothers"—as well as our own statements.

3. *The Pentagon's Record on Weapons Systems.* In the area we are discussing, weapons systems, of which the ABM system is one, the record of the Pentagon and the military-industrial complex on weapons systems is remarkably poor. Many systems after costing billions have been dropped as ineffective or have become obsolete before they could be finished. Another example, besides the "Safeguard" ABM, is the Thor and Jupiter missiles. Also, see the recent little book by John Kenneth Galbraith, "How to Control the Military", which is intensely interesting.

4. *Responsibility of Information Engineers.* It is my belief that computer people should look on themselves as information engineers; and every engineer is responsible not only for the structure that he designs, but for linking it to real facts of the world and of society, such as material strength and traffic patterns. You perhaps remember the story of the engineer who stood on the bank of the river watching the bridge he had designed break up into pieces and fall into the river: wringing his hands, he cried "Oh, that damn decimal point!". Information engineers have responsibilities not only for decimal points, but also for hitching their information machines to reliable factual data, not false, misleading, nonrepresentative, or lying data. ☐

"HOW MUCH SHOULD AN EDUCATED MAN — AND A TOP MANAGER — KNOW ABOUT COMPUTERS?" — MORE COMMENT

Jeremy Myer, Facilities Manager
International Software Corp.
800 W. 1st St.
Los Angeles, Calif. 90012

This is in response to your invitation for more discussion re: "How Much Should an Educated Man—and a Top Manager—Know About Computers?" I have just read Mr. Belden Menkus' comments appearing in your September, 1969 issue (page 13). He has hit a major artery of the problem of the data processing community: that management and technical specialists do not really "get together" for decision-making effort.

Top management must make accurate decisions if its company expects to achieve continued success. Needless to say, management is uneasy if required to make decisions based on data not fully understood, gathered by people it does not fully comprehend and who do not completely understand management, and presented, in most cases, in foreign terms. Unfortunately, today this defines the situation which usually exists between management and the data processing environment. This is supported by the recently published report by McKinsey & Co. (See *Computers and Automation* for April, 1969, page 24) which acknowledges that computer efforts in all but a few exceptional companies are in real trouble.

Data processing has become the largest single over-head expense of many companies. This is easy to understand if a company's only sources of data processing expertise are the data processing department and the equipment salesman.

Yet most managers appear not to accept the salient facts of computer life—i.e., they really do not comprehend "computereze". And most technicians, including DP managers, will never admit that their experience is too limited in the debit/credit approach to commercial applications development to be as effective as they should be in systems design and implementation, and also in their communicative sessions with management.

The gap will begin to close when management is provided with the understanding of what *should* be going on in the "machine room", by direct communication in terms that can be easily understood. ☐

COMPUTER PEOPLE AND THEIR SOCIAL RESPONSIBILITIES

I. From John McLeod, Editor
Simulation
Simulation Councils, Inc.
P.O. Box 2228
LaJolla, Calif. 92037

I have a letter from a friend who writes in part: ". . . someone with a good deal of good will toward social responsibilities of computer people is Edmund Berkeley . . . ." Since we exchange subscriptions with your magazine, I am wondering if you saw my editorial in the July issue of *Simulation* [reprinted below] which elicited my friend's remark.

I would certainly like to know your reaction to the editorial. Currently I am preparing a follow-up article based in part on the feedback from the July editorial. I await with great interest any contribution you might care to make to the discussion.

A STATEMENT OF PERSONAL BELIEFS AND INTENTIONS

I believe that much of the strife and unrest in the world today is the result of the improper handling of information. Improved communications have made available more information than can possibly be assimilated and evaluated in proper perspective by the human mind. Thus it must be, and is, filtered—first by the news media and then by the individual. Unfortunately, violence and sensationalism dominate the information that gets through. This incites to irrational action many individuals and groups already consciously or subconsciously worried by the ever-present possibility of nuclear or biochemical annihilation.

I believe that the trend in world affairs is now such that our very survival might well depend on our correcting the bias and making proper use of the information available to us. But we cannot do this unaided; we must call on some of the advanced technology which has contributed to the world chaos for tools to sort, store, manipulate and evaluate the vast amount of information that is pertinent to our problems. Fortunately, computers can do this. Furthermore, they allow the information to be assembled in the form of models which can include the effect of social, economic, political, and military forces as they act on and influence one another.

Simulation, the development and use of such models to study the dynamic behavior of otherwise incomprehensible and/or intractable systems, facilitates the design of experiments that will not only give insight into the complexities involved, but can also be made to yield quantitative data relating cause and effect. And, as these simulations can be run in faster-than-real time, they enable us to see the possible consequences at some future time of various alternative courses of action which might be contemplated today. And those consequences can be evaluated *before* action is taken.

I believe that those of us with the know-how and the means should proceed with all possible vigor to develop a World Simulation. It is very late. I do not underestimate the magnitude of the task, but I believe it must be accomplished if we are to survive. Fortunately, we do not have to start from scratch. War games are a well-developed technique for evaluating military strategies, and simulation of social, economic, and political systems—as well as simulations of human behavior—have been developed. True, most are based on incomplete or otherwise questionable models of isolated subsystems, but these can be improved and combined in a kind of hierarchy of systems to ultimately develop a useful model of the total environment. Then experiments must be designed to exercise and validate the model before it can be made to yield the vital information we need so desperately.

Viewed in the aggregate, the difficulties may seem insurmountable. Fortunately, however, it will not be necessary to complete and validate the model before useful results can be realized. There are three characteristics of the methodology of simulation that will yield benefits almost from the start:

1. The orderly thought-processes and data-gathering necessary for the development of a model give insight into problems such that useful results are often realized even before the model is computerized.
2. Models of subsystems, taken independently, often yield valuable information concerning the overall system.
3. Basic, or simplified, models which involve only the most important and sensitive parameters and variables can give important information concerning the gross behavior of a system. Details can be added as the model is refined.

I intend to pursue this matter as though the future of humanity depended on it: it might!

I intend to be a catalyst for the development of a World Simulation by working with others who believe that this is the way to go and that it's high time we got started.

I plan to try to stimulate activity by gathering and disseminating information among those who are or might be interested in the project. These will include those people taking an overall view—like A. Ben Clymer, organizer and chairman of the SCi Committee on Public Problems; R. Buckminster Fuller[1] of geodesic fame, who is actively pushing a $16 million project which he calls World Game at Southern Illinois University; and Hal Secrist[2] who presented "Concepts on the Utilization of a World Simulation Center" at a Western Simulation Council meeting (SIMULATION, June, 1969). It will also include all those of whom I have knowledge who are working on simulations of behavior, social systems, resource allocation, economics, politics, or other aspects of our global environment, who might contribute to a World Simulation.

What do you intend to do?

---

[1] Luncheon speaker and panel moderator at the Joint National Meeting of Operations Research Society of America and American Astronautical Society, Denver, Colorado, June 17-20, 1969.

[2] Chairman of a workshop, World Systems Center, organized in connection with the above meeting.

— Excerpt from *Simulation,* Vol. 13: No. 1, July 1969, p. vii.

II. From Edmund C. Berkeley, Editor Computers and Automation

Thank you for calling your fine editorial to my attention. I agree completely that much of the strife and unrest in the world today is the result of the improper handling of information. If you saw my September editorial in our magazine, you will see how once more I attacked misinformation, distortions, and lies.

I also believe that modeling the behavior of various segments of the world—"world games", "peace games", and "world simulation"—could lead to useful and significant insights. I do not believe that the difficulties are insurmountable.

Although my knowlege of simulation or models is limited to what I have read about them, I think the avenue you are choosing to pursue could lead to good results. I would be pleased if you would keep me (and our readers) informed of your activities, and I would be interested in seeing copies of your preliminary reports.

III. From John McLeod

I am sorry your comments did not reach us in time for publication in the November issue of ***Simulation.*** I would like to have been able to include your letter along with a dozen or so similar letters from other prominent people that will be published.

Thank you for sending me a copy of your excellent editorial from the September issue of your magazine; I don't know how I missed it—I do scan your publication. I think your editorial is so good, and so important, that I would like to publish it *in toto.*

Keep up the good work. Perhaps together we can help get the thinking people among our readers to think about things they ought to think about!

IV. From Edmund C. Berkeley

Your comments and support are sincerely appreciated. Of course you are welcome to reprint the September editorial from *Computers and Automation* in *Simulation.* □

INFORMATION INDUSTRY ASSOCIATION (IIA) PROPOSES CHANGES IN THE CONGRESSIONAL BILL TO CREATE A NATIONAL COMMISSION ON THE IMPACT OF THE COMPUTER ON COPYRIGHT CONCEPTS

Paul G. Zurkowski, Executive Director
Information Industry Association
1025 15th St. N.W.
Washington, D.C. 20005

The information Industry Association (IIA) is made up of commercial firms engaged in creating and marketing information products, mechanisms, and services through the use of advanced information technologies. Recently the Association released the text of changes it has proposed in the copyright revision bill (Title II, S. 543) which would create a national commission on the impact of the computer and other advanced technologies on copyright concepts. The text of the bill and the Association's proposed changes are shown below.

The changes developed out of a meeting held last summer on copyrights and related protection for information age products. The meeting was sponsored by IIA and attended by a wide spectrum of companies in the information industry. The proposed changes were sent to and further circulated by the Senate Judiciary Committee.

Comments from other organizations, firms, and individuals are invited. The Senate has requested prompt action on comments, since it is expecting to act on the bill during this session of Congress. Comments should be sent to the address above.

PROVISIONS OF S. 543	PROVISIONS OF IIA PROPOSAL *(Only changes are listed below)*
TITLE II—NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS.	**TITLE II—NATIONAL COMMISSION ON EFFECTS OF ADVANCED TECHNOLOGIES ON WORKS OF AUTHORSHIP.**
Establishment and Purpose of Commission.	**Establishment and Purposes of Commission.**
Sec. 201. (a) There is hereby created in the Library of Congress a National Commission on New Technological Uses of Copyrighted Works (hereafter called the Commission).	Sec. 201. (a) There is hereby created in the Library of Congress a National Commission on the Effects of Advanced Technologies on Works of Authorship (hereafter called the Commission).

(b) The purpose of the Commission is to study and compile data on the reproduction and use of copyrighted works of authorship (1) in automatic systems capable of storing, processing, retrieving, and transferring information, and (2) by various forms of machine reproduction. The Commission shall make recommendations as to such changes in copyright law or procedures that may be necessary to assure for such purposes access to copyrighted works, and to provide recognition of the rights of copyright owners.

Membership of the Commission

Sec. 202. (a) The Commission shall be composed of twenty-three members, appointed as follows:

(1) A Chairman, who shall be the Librarian of Congress.

(2) Two members of the Senate to be appointed by the President of the Senate.

(3) Two members of the House of Representatives, to be appointed by the Speaker of the House of Representatives.

(4) Seven Members, to be appointed by the President, with the advice and consent of the Senate, selected from authors and other copyright owners.

(5) Seven members, to be appointed by the President, with the advice and consent of the Senate, selected from users of copyrighted works.

(6) Four nongovernmental members to be appointed by the President, with the advice and consent of the Senate, selected from the public generally.

(b) The members of the Commission shall appoint by the vote of a plurality of the total membership, a Vice Chairman who shall act as Chairman in the absence or disability of the Chairman, or in the event of a vacancy in that office. The Register of Copyrights shall serve as an ex officio member of the Commission.

(b) The purposes of this commission are to study and compile data (1) on the reproduction and use of copyrightable works of authorship (a) in automatic systems capable of storing, processing, retrieving, and transferring information and (b) by various forms of machine reproduction, (2) on the creation of new works by the application intervention of such automatic systems or machine reproduction, and (3) on the effects such reproduction, use and creation are having on the accessibility of such works and the proprietary rights therein. The Commission shall make recommendations as to such changes in law or procedures that may be necessary to assure access to works, of authorship and otherwise, and to provide recognition of the proprietary rights of owners.

Membership of the Commission

Sec. 202. (a) The Commission shall be composed of twenty-one members, appointed as follows:

(1) A Chairman, to be appointed by the President with the advice and consent of the Senate.

(2) Five members, to be appointed by the President with the advice and consent of the Senate, selected from authors and other copyright owners.

(3) Five members, to be appointed by the President, with the advice and consent of the Senate, selected from users of copyrighted works and information.

(4) Five members, to be appointed by the President, with the advice and consent of the Senate, selected from creators of information systems, products, mechanisms and services.

(5) Five nongovernmental members to be appointed by the President, with the advice and consent of the Senate, selected from the public generally.

(b) The members of the Commission shall appoint by the vote of a plurality of the total membership, a Vice Chairman who shall act as Chairman in the absence or disability of the Chairman, or in the event of a vacancy in that office. The Librarian of Congress, the Register of Copyrights, the President's Science Advisor and the Chairman of the Federal Communications Commission shall serve as ex officio members of the Commission. ☐

"THE POWER OF THE PRESS TO REDRESS A GRIEVANCE" — DISCUSSION

I. From Louis H. Ray, Vice Pres.
Meta Systems Corp.
32 Scotch Rd.
Trenton, N.J. 08528

With regard to your case history on "Mrs. Isabel Cronin" and her problems with the "Tenarsippi Technical Institute" ("The Power of the Press to Redress a Grievance—A Case History", *Computers and Automation* for Sept. 1969, page 14)—I feel that you have done a grave injustice to the computing industry. Under the circumstances I am not able to comprehend the reason for withholding the name of the actual school involved. Considering the fact that it took "Mrs. Cronin" an entire year to receive a partial refund, and that she suffered a direct loss of $300, I feel that the public has a right to some protection from this kind of cheap, fraudulent operation. This protection can only come from the kind of publicity which your publication is capable of offering.

Since I am personally a graduate of a data processing school (an exceedingly good school, I might add), I am strongly in favor of unmasking the poor ones, so that the good ones can continue to provide their services untainted by this kind of terror story.

II. From the Editor

Our purpose in publishing the case history was twofold. We wished to remind our readers that fraudulent data processing schools do exist, and therefore one should be extremely careful in selecting one. And we wish to say that if one of our readers finds himself defrauded by a data processing school, we are willing to use our power to publish the story to try to redress the grievance.

Our efforts, of course, would be more effective if we could "name names". But we are a small business, and we do not wish to run the risk of libel suits. Nor do we have an outlying staff that can personally investigate situations. Until we become much larger, we do not have financial resources to devote to defense against unnecessary legal liabilities. Under present circumstances, therefore, what we can practically do remains rather limited.

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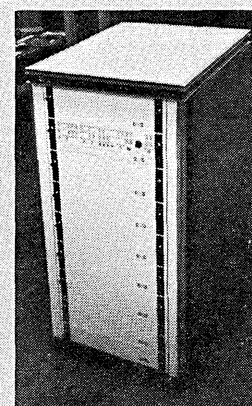

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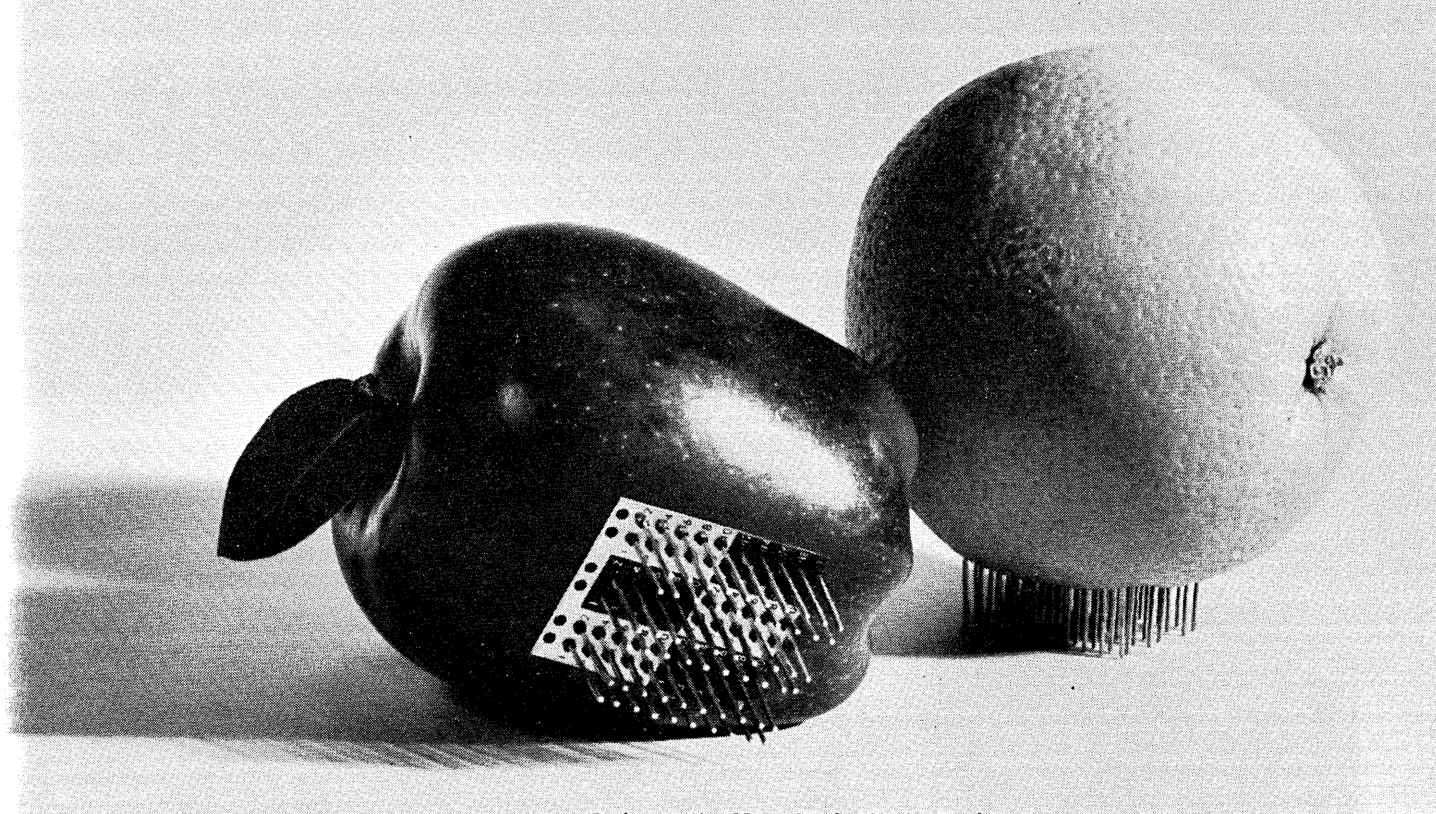

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C.a

IDEAS: SPOTLIGHT

The rules for choosing among these courses of action have been known for a long time, but the calculations are laborious . . .

All electric utility companies of large size are investigating the use of computers to obtain (generate or purchase) electrical energy in such a way that all demands are met at the minimum cost to the utility company. Small electric utility companies can also obtain the advantages of computer-controlled power distribution by pooling their facilities and supporting a single, jointly-owned computer scheduling center that serves a regional area.

The computer is provided with a description of the electrical distribution network in the area, showing the electrical losses in the network, and therefore the cost of transmitting power between any two points. The computer is also given descriptions of the generating stations available within the network; the available capacity of each, the cost of operation, and related factors such as the desired schedule of overhaul periods. The computer is also informed of the existing connections between the utility's network and those of neighboring utilities, and kept informed on a current basis of the costs of obtaining power by purchase from the utility's neighbors.

As the demand for electricity changes – dropping in one area, rising in another – the computer is assigned the task of determining the most economical way to meet the changed demand. If total demand increases, the computer will determine whether more of the company's generators should be brought into action, or whether more power should be purchased from the neighboring utility, or a combination of both, depending on the relative costs of obtaining the power and delivering it to the area in which the increased demand has occurred. If total demand has decreased, the computer determines whether it is more economical to shut down generators belonging to the utility or to decrease purchases of power from neighbors.

The rules for choosing among these courses of action have been known for a long time, but the calculations to find the answers are laborious because of the complexity of the problem, considering the many connections in the network and the many possible sources of energy. Since the utility must respond to a change of demand in a matter of minutes, there is no chance to perform the calculations manually. The computer has adequate speed, however, and it is so well suited to this application that its use for this purpose will probably become almost universal. The economic benefit can be very large, because an increase of a few percent in the efficiency of the utility's generating and distributing network can make an impressive difference in the profits of the company. The electric utility industry can apparently expect to recoup its investment in computers for control of power distribution many times over.

– From Withington, Frederic G., *The Real Computer: Its Influence, Uses and Effects,* Addison-Wesley Publishing Co., Reading, Mass., 1969, hardbound, 350 pp. □

COMPUTER SYSTEMS AVAILABLE FOR QUALIFIED INSTITUTIONS THAT TRAIN ELECTROMECHANICAL TECHNICIANS

Douglas M. Fellows, Chairman
Technical Education Consortium, Inc.
315 Hudson St.
Hartford, Conn. 06105

Technical Education Consortium, Inc. (TEC), recently developed a curriculum guide for a two-year electromechanical technology program for the U.S. Dept. of Education. Nearly 400 junior colleges and technical institutions have already requested copies of this guide. From these, 87 became so interested that they applied for one of a number of computer systems modified for instructional purposes and made available by IBM Corp. and the Univac Div. of Sperry Rand. To date 24 such systems have been awarded.

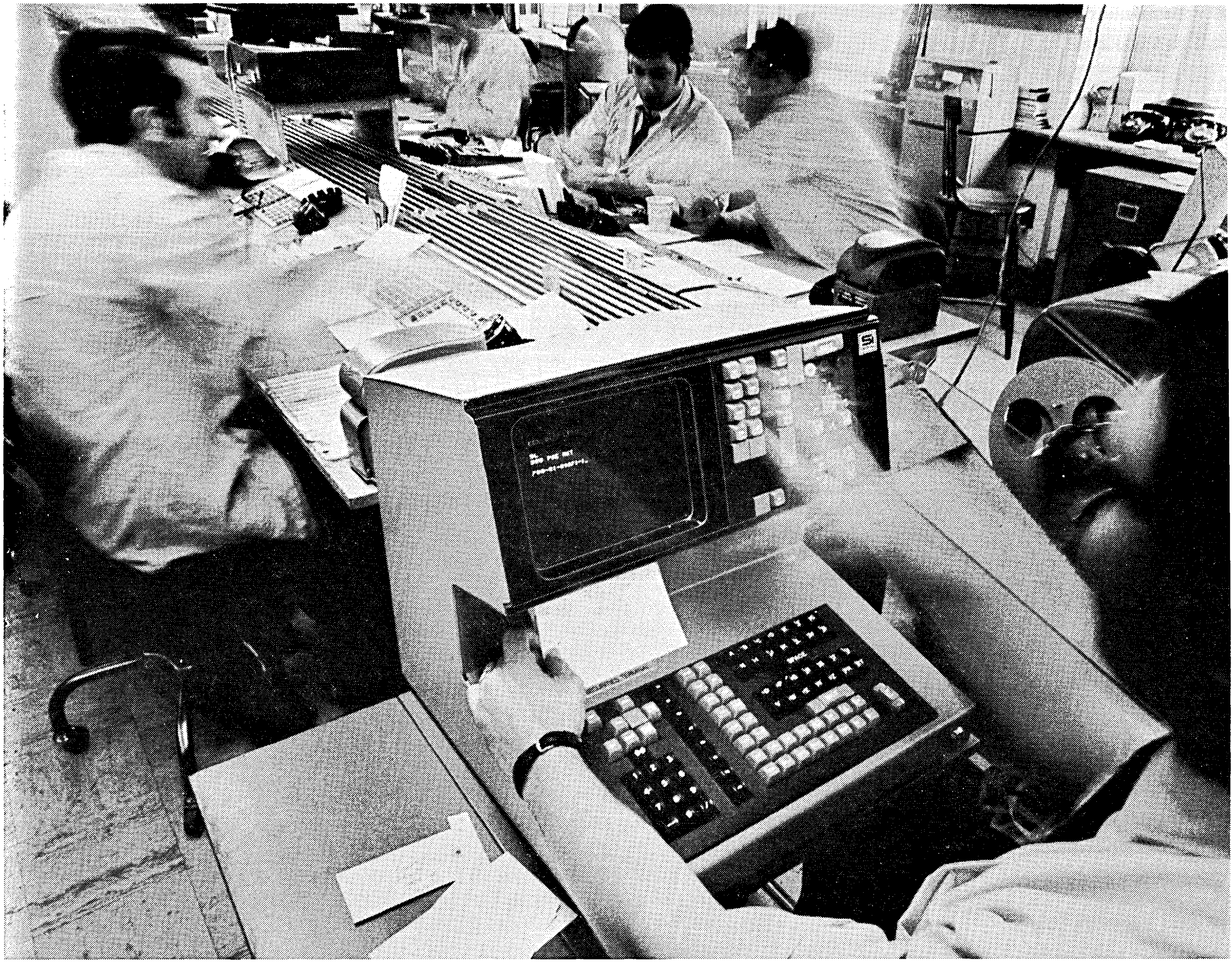
Because of the apparent interest of junior colleges and technical institutions in the use of computers in training electromechanical technicians, 27 additional modified computer systems have now been made available. They will be awarded to the best qualified institutions offering programs which will develop electromechanical technicians at the associate degree level.

This offer is open to any non-profit institution which is accredited and provides or will provide the kind of education recommended by TEC. Copies of the TEC curriculum guide are available from the above address.

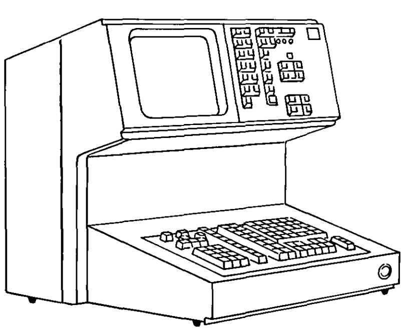
Institutions which have previously applied may revise their proposals and request assistance. Those submitting new proposals or planning to modify previous ones will receive guidelines designed to help institution officials meet the criteria recommended.

Schools that meet requirements and receive computer awards will be able to start the new program at the beginning of the second semester of this school year, with delivery of the computer system by the summer of 1970. Plans are being made for workshops to train teachers to instruct the electromechanical curriculum.

Conservative estimates indicate that two million electromechanical technicians will be required by 1975, as computer, business machine, and numerical control industries expand and new and faster devices for business and industry are developed. It is to meet this need that the National Industrial Conference Board, the U.S. Dept. of Education, and Industry have joined together to publicize opportunities in technical education, and to provide assistance to institutions planning to meet this need for skilled technicians. We invite your readers to write us for additional information. □



Wall Street installs "smarter" data terminals that reduce message errors 90%



Perhaps nowhere in the business world is the demand for error-free communication systems more acute than in the brokerage industry. A new type of *programmable* data terminal from SYCOR is helping satisfy this demand. Each one contains a mini-computer which can be custom programmed to match its intended use. These "smarter" terminals are able to take over a lot of the thinking expected of keyboard operators using conventional equipment. For example, they provide automatic message formatting, display of messages with a single keystroke, and automatic error-checking. Each step is displayed on a video screen where it can be electronically edited. The simplified keyboard is designed to be used by personnel who specialize in duties other than operating terminals. The terminal can be programmed to replace a model 28 or 33 teletype, and IBM1050 or other existing terminals *without* changing your system.

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Who's Who in Computers and Data Processing

Who's Who in Computers and Data Processing will be published jointly (as an annual publication) by Computers and Automation and the New York Times Book and Educational Division. The first annual issue is scheduled to be published in three volumes in hard cover in early 1970, and will include upwards of 8000 capsule biographies; the three volumes are scheduled as follows:

Vol. 1 — Systems Analysts and Programmers
Vol. 2 — Data Processing Managers and Directors
Vol. 3 — Other Computer Professionals.

Following are sample capsule biographies which will be published in the first annual edition of Who's Who in Computers and Data Processing.

Special Abbreviations		Main Interest Abbreviations	
b:	born	A	Applications
ed:	education	B	Business
ent:	entered computer field	C	Construction
		D	Design
m-i:	main interests	L	Logic
t:	title	Mg	Management
org:	organization	Ma	Mathematics
pb-h:	publications, honors, memberships and other distinctions	P	Programming
		Sa	Sales
		Sy	Systems
h:	home address		

PAGEN, Dr. John / director - CAI project / b: 1926 / ed: BS; MEd; EdD / ent: 1967 / m-i: A P Sy; computer assisted instruction / t: director - INDICOM / org: Waterford Township School District, 3101 W Walton, Pontiac, MI 48055 / pb-h: AERA; Phi Delta Kappa; MASA; AASA; reports on CAI / h: 463 Berry-patch, Pontiac, MI 48054

PALM, John N. / EDP management / b: 1938 / ed: BA, math / ent: 1957, part time; 1960, full time / m-i: P Sy; management of systems, programming, operations, etc. as applied in solving retail problems / t: vice president, information systems / org: Target Stores, Inc., 8700 W 36 St, Minneapolis, MN 55426 / pb-h: CDP, SPA / h: Route 1, Box 27, Wayzata, MN 55391

PALMER, Dennis W. / EDP mgr / b: 1937 / ed: 2 yrs college / ent: 1959 / m-i: Mg P Sy / t: EDP mgr / org: Protected Home Mutual Life Ins Co, 30 E State St, Sharon, PA 16146 / pb-h: DPMA, SPA, CDP / h: Rt 3, Box 700, Corland, OH 44410

PALMER, Fred E. / systems & programming / b: 1935 / ed: 3 years college / ent: 1960 / m-i: A B P Sy / t: manager of programming / org: Western Farmers Association, 201 Elliott Ave W, Seattle, WA 98119 / pb-h: CDP, DPMA / h: 19611 62nd NE, Seattle, WA 98155

PAN, George S. / senior technical management / b: 1939 / ed: BSEE, Illinois, MSEE, Syracuse / ent: 1960 / m-i: A Mg Ma P Sy; simulation / t: director, management sciences division / org: Interactive Sciences Corp., 170 Forbes Rd, Braintree, MA 02184 / pb-h: "Weighted File System Design Method", 1965 IBM National Systems Symposium, "Generalized File Structure and Optimum Design Considerations", 5th Nat'l Computer Conference of Canada / h: 5146 N 11th Ave, Phoenix, AZ 85013

If you wish to be considered for inclusion in Who's Who in Computers and Data Processing, please complete the following form or provide us with the equivalent information.

The deadline for receipt of entries in our office is November 30, 1969. (If you have already sent us a form some time during the past eighteen months, it is not necessary to send us another form unless there is a change of information.)

SEND US YOUR ENTRY TODAY!

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

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

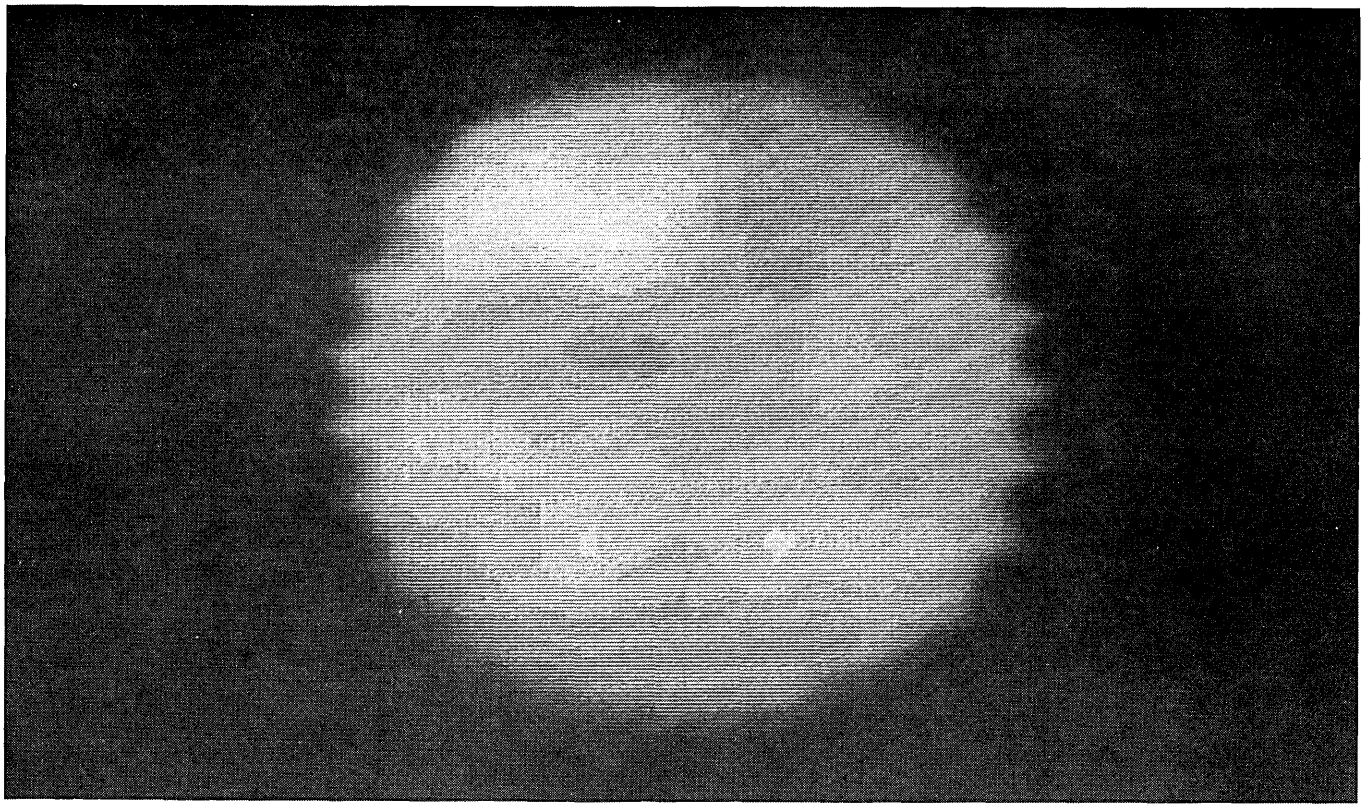
Applications	( )	Mathematics	( )
Business	( )	Programming	( )
Construction	( )	Sales	( )
Design	( )	Systems	( )
Logic	( )	Other	( )
Management	( )	(Please specify)	

7. Year of Birth?__________
8. Education and Degrees?__________
9. Year Entered Computer Field?__________
10. Your Present Occupation?__________
11. Publications, Honors, Memberships, and other Distinctions?__________
(attach paper if needed)
12. Do you have access to a computer? ( )Yes ( )No
 a. If yes, what kind of computer?
 Manufacturer?__________
 Model?__________
 b. Where is it installed:
 Manufacturer?__________
 Address?__________
 c. Is your access: Batch? ( ) Time-Shared? ( ) Other? ( ) Please explain:__________
 d. Any remarks?__________
13. In which volume or volumes of Who's Who do you think you should be included?
 Vol 1. Systems Analysts and Programmers
 Vol 2. Data Processing Managers and Directors
 Vol 3. Other Computer Professionals
14. Associates or friends who should be sent Who's Who entry forms?
 Name and Address

(attach paper if needed)

When completed, please send to:

Who's Who Editor, Computers and Automation,
815 Washington St., Newtonville, Mass. 02160



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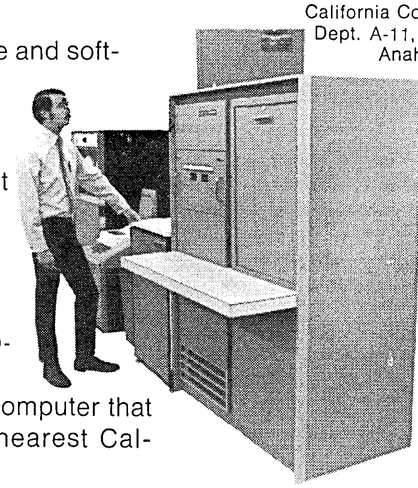

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APL: A PERSPICUOUS LANGUAGE

Garth H. Foster
Department of Electrical Engineering
Syracuse University
Syracuse, N.Y. 13210

"In APL, a great many highly useful functions which are required in computing have been defined and given a notation consisting of a single character."

The news and promotion copy now beginning to appear in many computer-related publications proclaiming APL (*A Programming Language*) to be everything from a successor to PL/I (Programming Language One) to the most powerful interactive terminal system available, has no doubt been widely noticed. Such copy has led many to wonder what APL is, and after seeing its notation, many wonder about its clarity.

This article is not intended to a tutorial on APL, for that would take more space than is warranted here. However, let us discuss some of the aspects of APL which have excited the academic communities at a number of colleges and universities and at least one high school system, and which have triggered a number of implementation efforts in Canada, France, and the United States. The interested reader may then investigate further the many features of APL which cannot all be covered here. To assist in this direction, a rather complete bibliography of APL source material is appended to this article.

Definition

The initials APL[1] derive from the title of the book "A Programming Language" by K.E. Iverson, published by John Wiley and Sons in 1962; and it was that publication which served as the primary vehicle for the publication of the initial definition of APL. Subsequent development of the language by Iverson has been done in collaboration with A.D. Falkoff at IBM's Thomas J. Watson Research Center, Yorktown Heights, New York.

The present form of APL is the APL\360 Terminal System, the implementation of APL on the system 360. Although there are implementations for the IBM 1130 and 1500 computers, when we speak of APL we shall mean APL\360.

The terminal system was designed by Falkoff and Iverson with additional collaboration from L.M. Breed, who, with R.D. Moore (I.P. Sharp Associates, Toronto) developed the implementation. Programming was by Breed, Moore, and R.H. Lathwell, with continuing contributions by L.J. Woodrum (IBM, Poughkeepsie), and C.H. Brenner, H.A. Driscoll, and S.E. Krueger (SRA, Chicago). Experience had been gained from an earlier version which was created for the IBM 7090 by Breed and P.S. Abrams (Stanford U., Stanford, California).

A computer language which is classified as algebraic is generally, but not exclusively, used to program problems requiring reasonably large amounts of arithmetic. Generally such languages have available, as formalized arithmetic operators with a notation, the operations of addition, subtraction, multiplication, division, and exponentiation; and there the list ends. To achieve other arithmetic operations either calls to pre-written subroutines must be made or the user must supply his own.

This is not true of APL; a great many highly useful functions which are required in computing have been defined and given a single character notation (some of these require 3 keystrokes, striking a key, backspacing and then striking another key; but usually only a single keystroke is required.)

The APL Keyboard

Figure 1 shows the APL keyboard. The letters and numbers all appear in their usual places on a typewriter, except that the capital letters are in the lower case positions (the lower case letters do not appear). The up-shift positions on the keyboard are occupied by symbols used to represent the powerful set of APL operators.

[1]APL should not be confused with "ABL — A Language for Associative Data Handling in PL/I," by George G. Dodd, General Motors Research, 1966 Fall Joint Computer Conference.

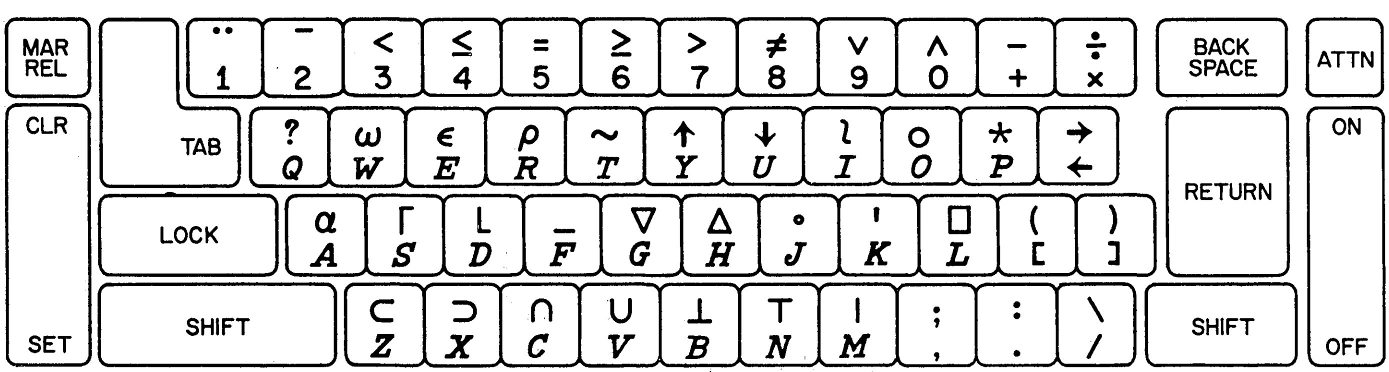

Figure 1

Besides +, −, x, ÷, (the familiar symbols for addition, subtraction, multiplication, and division located on the two right-most keys on the top row) and the symbol * assigned to represent exponentiation (the star over the P as in raising to a power), there are distinct single character notations for the operations of: negation; signum; reciprocal; logarithms (to both natural and arbitrary base); combinations and factorials; base e raised to a power; the residue of a number modulo any divisor. There are characters which represent taking: PI times a number; sines; cosines; tangents; hyperbolic sines, cosines, and tangents; and the inverse functions for the six preceding functions. Available too are: floor (truncating a number to the largest integer less than or equal to the number); ceiling (rounding up to the smallest integer greater than or equal to the number); and maximum or minimum of a pair of numbers.

APL also provides the relations which test whether two numbers are: less than; less than or equal to; greater than or equal to; greater than; equal; or not equal. The last two relations are also applicable to characters. These relations check to see, for example, if a relation is true and produce 1 (representing TRUE) or 0 (FALSE); these binary quantities may be operated upon by the logical functions of: OR; AND; NOT; NOR; and NAND. All these are also available as standard functions in APL, and are designated by a single character graphic. These operations are all summarized in Figure 2.

Monadic form fB		f	Dyadic form AfB	
Definition or example	Name		Name	Definition or example
+B ←→ 0+B	Plus	+	Plus	2+3.2 ←→ 5.2
-B ←→ 0-B	Negative	-	Minus	2-3.2 ←→ ¯1.2
×B ←→ (B>0)-(B<0)	Signum	×	Times	2×3.2 ←→ 6.4
÷B ←→ 1÷B	Reciprocal	÷	Divide	2÷3.2 ←→ 0.625
B ⌈B ⌊B 3.14 4 3 ¯3.14 ¯3 ¯4	Ceiling	⌈	Maximum	3⌈7 ←→ 7
	Floor	⌊	Minimum	3⌊7 ←→ 3
⋆B ←→ (2.71828..)⋆B	Exponential	⋆	Power	2⋆3 ←→ 8
⍟⋆N ←→ N ←→ ⋆⍟N	Natural logarithm	⍟	Logarithm	A⍟B ←→ Log B base A A⍟B ←→ (⍟B)÷⍟A
|¯3.14 ←→ 3.14	Magnitude	|	Residue	Case ‖ A|B A≠0 ‖ B-(|A)×⌊B÷|A A=0,B≥0 ‖ B A=0,B<0 ‖ Domain error
!0 ←→ 1 !B ←→ B×!B-1 or !B ←→ Gamma(B+1)	Factorial	!	Binomial coefficient	A!B ←→ (!B)÷(!A)×!B-A 2!5 ←→ 10 3!5 ←→ 10
?B ←→ Random choice from ⍳B	Roll	?	Deal	A Mixed Function
○B ←→ B×3.14159...	Pi times	○	Circular	See Table at left
~1 ←→ 0 ~0 ←→1	Not	~		
		∧	And	(see truth table below)
		∨	Or	
		⍲	Nand	
		⍱	Nor	
		<	Less	Relations Result is 1 if the relation holds, 0 if it does not: 3≤7 ←→ 1 7≤3 ←→ 0
		≤	Not greater	
		=	Equal	
		≥	Not less	
		>	Greater	
		≠	Not Equal	

A	B	A∧B	A∨B	A⍲B	A⍱B
0	0	0	0	1	1
0	1	0	1	1	0
1	0	0	1	1	0
1	1	1	1	0	0

(-A)○B	A	A○B
(1-B⋆2)⋆.5	0	(1-B⋆2)⋆.5
Arcsin B	1	Sine B
Arccos B	2	Cosine B
Arctan B	3	Tangent B
(¯1+B⋆2)⋆.5	4	(1+B⋆2)⋆.5
Arcsinh B	5	Sinh B
Arccosh B	6	Cosh B
Arctanh B	7	Tanh B

Table of Dyadic ○ Functions

Figure 2

Order of Operations

Of course when such a host of generalized and powerful operations are at the disposal of the programmer, there is immediate concern as to the order or precedence of operations in an arithmetic expression written without parentheses.

Traditionally in algebraic languages, exponentiations were performed before multiplications and divisions, and these were done before additions and subtractions. One of the reasons for this choice (of hierarchy of operations) was that normal conventions in algebraic notation provided that the expression

$$5.6y^3 + 8y^2 + 2.84z + 9.06$$

could be written as

5.6 * y * * 3 + 8 * y * * 2 + 2.84 * y + 9.06

without the use of parentheses.

If one wanted to make the compiler work more efficiently when programming in the higher order language, then parens (parentheses) ***were*** used and the polynomial was "nested", so that in the above example one coded:

((5.6 * y + 8) * y + 2.84) * y + 9.06

That is to say, one discarded the built-in precedence order.

Clearly, in APL having all the functions shown in Figure 2, the establishment of any hierarchy of operators would be arbitrary and open to question at best; and more than likely it would border on the impossible to justify the hierarchy in any reasonable way.

Thus in APL there is only ***one*** rule for evaluating all unparenthesized expressions (or within a pair of parens), and that rule is:

> Every operator takes as its right-hand argument the value of everything to the right of it (up to the closing parenthesis).

Now such a rule may seem strange and unfamiliar to someone who is now programming, but it has advantages:

(1) Uniformity—it is applied in the same way for all standard or primitive functions provided by the APL system as well as all functions (programs) written in APL by the user;

(2) Utility—this approach, for example, allows the nested polynomial to be written without parentheses as:[2]

9.06 + Y x 2.84 + Y x 8 + Y x 5.6

It is also possible to write continued fractions without parentheses and the rule given provides other interesting and useful results as a by product.

Sum Reduction

Another area in which looping (of computer instructions) is explicitly required in most programming languages but not in APL is that of summing the components of a vector, which we will call for the sake of example, X. The usual approach is to initialize the sum to zero and then use a running index variable of a DO or FOR loop, and then take the summation by an expression like

SUM = SUM + Z(I).

In APL we use what is called ***sum reduction.*** This is the name for ***conceptually*** taking the vector X, inserting plus signs between each of its components, and then evaluating the resulting expression; its notation is simply +/X. If we had wanted to take the product of the elements of a vector Q, then in APL we write x/Q and this provides the ***times reduction.***

---

[2]There are even more powerful ways to evaluate a polynomial expression in APL, but the availability of such methods does not reduce the effectiveness of the right to left rule just described.

The Value of Powerful Operators

Thus the first area in which APL provides clarity in programming is by providing a large set of powerful functions. Now one may ask whether writing A ⌈ B in APL is only marginally more compact than say writing MAX(A,B). However, in APL we are allowed to use A!B to denote the combinations of taking B things A at a time. Such an operation in languages other than APL generally require the user to write his own program, perhaps calling upon routines to provide the factorials and if they in turn are not available, writing that routine also. The claim is that the presence of the APL operator ! in a program provides much more clarity than the presence of the equivalent routine in another programming language.

Of course one may argue that factorials and combinations are not needed all that much anyway. In many cases such a point of view may be correct; however, the fact still remains that the need for, say, the FORTRAN Library of subroutines indicates a need for arithmetic computations which are more complex than the operations included in the language as primitives. What APL has done therefore is to move in the direction of a library increasing the sophistication of the language, and at the same time simplifying the notation for using a much more powerful set of operators.

Extending the Scope of Functions

The next step forward which APL has taken is to extend the scope of those functions shown in Figure 2, in the following way. In most languages extant today, if one writes A + B, then one commands the computer to add the number A to the number B. In APL the command still produces the addition of the single numbers, called scalars, if that is the nature of the variables A and B. If on the other hand, A and B are each names for a collection or string of numbers, called a vector, then the addition takes place on an element by element basis, with the first element of A being added to the first element of B, the second to the second, and so forth. The requirement is that either A or B may be a scalar while the other is a vector, but if they are both vectors, then they must have the same number of elements, that is, they must be of the same size.

If A and B are matrices of the same size (having the same number of rows and columns), then A + B in APL adds, on an element by element basis, matrix A to matrix B. To perform equivalent operations in most computer languages requires a DO or a FOR loop when adding vectors, or nested loops when adding matrices.

Two comments are relevant here. First, the explicit loops embodied in the DO or FOR loops are required by the language, but they are ancillary to communicating the process to be performed, say adding two matrices. Second, the utility of providing an extension of this nature, where the system assumes additional responsibility, is borne out, for example, in the MAT commands of BASIC. APL extends such ideas and applies them uniformly to all data structures treated in the language. In fact, from the programmer's point of view, one does not care in what sequence the operations in the loops implied in such an APL command take place. They could just as well be done all in parallel; the fact that the computer does not process the matrix elements in parallel does not matter. The extension of scope of the notation allows the algorithm to be thought of as acting on the data in parallel. Thinking about the computing process in this way gives new insight into the way the programs manipulate or transform the data.

Allocating Space for Arrays

The philosophy is that the system should perform the tasks which are required by the computer but not essential to the algorithm. A useful extension is to have the computer assume the burden of allocation of space for arrays on a dynamic basis. This is done in the APL terminal system; for example, if one creates the vector X having components 2, 5, and 10, then X ← 2 5 10 is the *specification* or *assignment* of those constants to be the value of the variable X. No dimensioning is required. Later if we wish to respecify

<table>
<tr><th>Name</th><th>Sign[1]</th><th>Definition or example[2]</th></tr>
<tr><td>Size</td><td>ρA</td><td>ρP ↔ 4   ρE ↔ 3 4   ρ5 ↔ ι0</td></tr>
<tr><td>Reshape</td><td>VρA</td><td>Reshape A to dimension V   3 4ρι12 ↔ E
12ρE ↔ ι12   0ρE ↔ ι0</td></tr>
<tr><td>Ravel</td><td>,A</td><td>,A ↔ (×/ρA)ρA   ,E ↔ι12   ρ,5 ↔ 1</td></tr>
<tr><td>Catenate</td><td>V,V</td><td>P,ι2 ↔ 2 3 5 7 1 2   'T','HIS' ↔ 'THIS'</td></tr>
<tr><td>Index[3,4]</td><td>V[A]
M[A;A]
A[A;..
..;A]</td><td>P[2] ↔3   P[4 3 2 1] ↔7 5 3 2
E[1 3;3 2 1] ↔ 3 2 1
11 10 9
E[1;] ↔ 1 2 3 4   ABCD
E[;1] ↔ 1 5 9   'ABCDEFGHIJKL'[E] ↔ EFGH
IJKL</td></tr>
<tr><td>Index generator[3]</td><td>ιS</td><td>First S integers   ι4 ↔ 1 2 3 4
ι0 ↔ an empty vector</td></tr>
<tr><td>Index of[3]</td><td>VιA</td><td>Least index of A   Pι3 ↔2   5 1 2 5
in V, or 1+ρV   PιE ↔ 3 5 4 5
4 4ι4 ↔ 1   5 5 5 5</td></tr>
<tr><td>Take
Drop</td><td>V↑A
V↓A</td><td>Take or drop |V[I] first   2 3↑X ↔ ABC
(V[I]≥0) or last (V[I]<0)   EFG
elements of coordinate I   ¯2↑P ↔ 5 7</td></tr>
<tr><td>Grade up[3,5]
Grade down[3,5]</td><td>⍋A
⍒A</td><td>The permutation which   ⍋3 5 3 2 ↔ 4 1 3 2
would order A (ascend-
ing or descending)   ⍒3 5 3 2 ↔ 2 1 3 4</td></tr>
<tr><td>Compress[5]</td><td>V/A</td><td>1 3
1 0 1 0/P ↔ 2 5   1 0 1 0/E ↔ 5 7
9 11
1 0 1/[1]E ↔ 1 2 3 4 ↔ 1 0 1⌿E
9 10 11 12</td></tr>
<tr><td>Expand[5]</td><td>V\A</td><td>A BCD
1 0 1\ι2 ↔ 1 0 2   1 0 1 1 1\X ↔ E FGH
I JKL</td></tr>
<tr><td>Reverse[5]
Rotate[5]</td><td>⌽A
A⌽A</td><td>DCBA   IJKL
⌽X ↔ HGFE   ⌽[1]X ↔ ⊖X ↔ EFGH
LKJI   ⌽P ↔ 7 5 3 2   ABCD
BCDA
3⌽P ↔ 7 2 3 5 ↔ ¯1⌽P   1 0 ¯1⌽X ↔ EFGH
LIJK</td></tr>
<tr><td>Transpose</td><td>V⍉A

⍉A</td><td>AEI
Coordinate I of A   2 1⍉X ↔ BFJ
becomes coordinate   CGK
V[I] of result   1 1⍉E ↔ 1 6 11   DHL
Transpose last two coordinates   ⍉E ↔ 2 1⍉E</td></tr>
<tr><td>Membership</td><td>A∊A</td><td>0 1 1 0
ρW∊Y ↔ ρW   E∊P ↔ 1 0 1 0
P∊ι4 ↔ 1 1 0 0   0 0 0 0</td></tr>
<tr><td>Decode
Encode</td><td>V⊥V
V⊤S</td><td>10⊥1 7 7 6 ↔ 1776   24 60 60⊥1 2 3 ↔ 3723
24 60 60⊤3723 ↔ 1 2 3   60 60⊤3723 ↔ 2 3</td></tr>
<tr><td>Deal[3]</td><td>S?S</td><td>W?Y ↔ Random deal of W elements from ιY</td></tr>
</table>

Notes:

1 Restrictions on argument ranks are indicated by: S for scalar, V for vector, M for matrix, A for Any. Except as the first argument of SιA or S[A], a scalar may be used instead of a vector. A one-element array may replace any scalar.

2 Arrays used in examples: P ↔ 2 3 5 7   E ↔ 1 2 3 4 / 5 6 7 8 / 9 10 11 12   X ↔ ABCD / EFGH / IJKL

3 Function depends on index origin.

4 Elision of any index selects all along that coordinate.

5 The function is applied along the last coordinate; the symbols ⌿, ⍀, and ⊖ are equivalent to /, \, and ⌽, respectively, except that the function is applied along the first coordinate. If [S] appears after any of the symbols, the relevant coordinate is determined by the scalar S.

Figure 3

```
     ∇AVERAGE[⎕]∇
   ∇ R←AVERAGE V
[1]  R←(+/V)÷ρV
   ∇
```

Figure 4

```
    ∇STATS[⎕]∇
  ∇ R←STATS X;SD;VAR;MEAN
[1] R←MEAN,VAR,SD←(VAR←(+/(X-MEAN←AVERAGE X)*2)÷¯1+ρX)*
    0.5
  ∇
```

Figure 5

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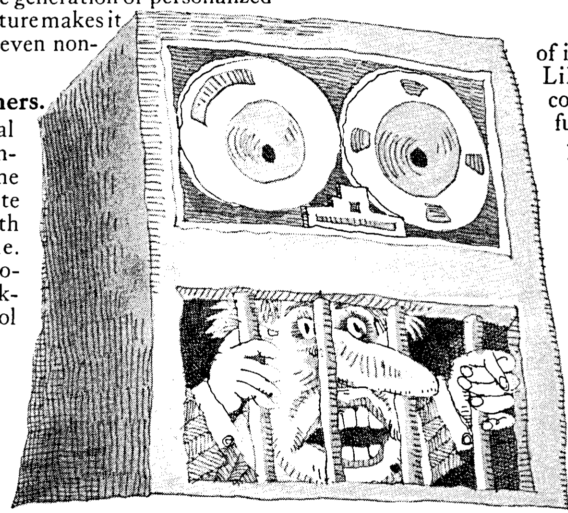

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X to be all of those elements currently comprising X followed by the numbers 1.5 and 20.7, then X ← X, 1.5 20.7 *catenates* the constant vector 1.5 20.7 to X and *respecifies* X. The variable X is now a data object with 5 elements where X[1] is 2 X[4] is 1.5 and X[5] is 20.7. We may query the system as to the size (number of components) of X by use of the function denoted by the Greek letter Rho. Thus, ρX produces 5. The functions of *size* and *catenate* are summarized together with the rest of the mixed APL dyadic functions in Figure 3.

We will not here treat further the powerful functions of data manipulation illustrated there. However, we have now exposed the reader to a sufficient amount of detail in APL to understand Figure 4. This shows the listing of a user-written function, the name of which is AVERAGE. The first or *header line* of AVERAGE declares the syntax for that function, that is, it indicates that the explicit result will be called R and the vector of data to be averaged will be denoted by V. The line numbered [1] is the algorithm; and it is self explanatory, even at this point.

Figure 5 shows how AVERAGE is called within the function STAT to calculate the mean, variance, and standard deviation of a set of values. Here the variable names of MEAN, VAR, and SD refer to the result of the AVERAGE program and the calculated variance and standard deviation.

We do not illustrate the comparable programs in other languages; we leave to the reader the task of noting the coding compression achieved by APL. The APL array operations obviously provide both brevity and clarity in expression, and in that sense the programs may be thought of as somewhat self documenting.

The symbolic nature of APL makes it multilingual.

Evaluation of APL

In these pages we have only scratched the surface of APL. The availability of a powerful set of functions having a generality and a sense of uniformity in definition is important in providing capability to program complex algorithms. The extension of operations uniformly to strings of quantities or tables of numbers is a step forward in programming, because a great deal of computing in science, government, and business may be cast in terms of those data structures. Also it is important to relieve the computer user of the burden of bookkeeping and housekeeping operations in computer programming in higher level languages, particularly in an interactive environment.

Enthusiastic supporters of APL have claimed that rather than standing for either *A Programming Language* or *Another Programming Language*, the initials APL stands for *A Permanent Language*. APL was first conceived of as a means of communication; and it will have importance in that regard independent of the availability of APL on a terminal system. The heart of communicating, describing, or programming a process is to make clear what is to be done. In fact I might suggest that Ken Iverson and his colleagues meant APL to be a tool so that we all could program lucidly. □

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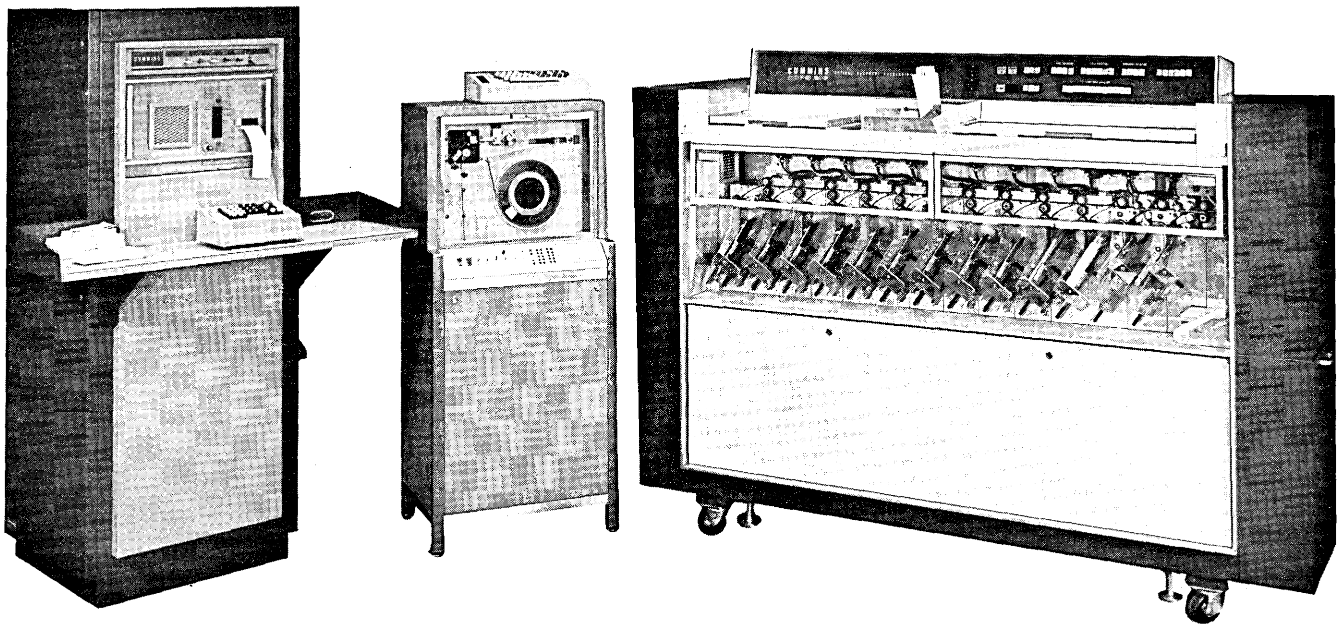

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Until recently, those who produce animated motion pictures professionally did not look at computers as true production aids for making animated films. This was primarily due to lack of understanding by both the motion picture industry and the computer industry. Those used to working with conventional motion picture equipment could not understand how computers could solve many of the intricate problems involved in producing an animated film; those who work with computers were ignorant of the technological requirements of professional motion picture animation.

The need for rapid, accurate, and repeatable operation of the special camera system used to make animated motion pictures (known technically as an "animation stand") has never been greater. The production schedules for animated films are tight—due in large part to the popularity of the medium on television—both for commercial messages and feature programs. In addition, labor costs have increased and skilled animators are not easy to find.

In order to explain what those involved in producing animated films of professional quality would consider "true computerized animation" of motion pictures, it is necessary to review the background of both animated films and early attempts to use computers to produce them.

Stephen A. Kallis, Jr. is an applications engineer at Digital Equipment Corporation. He is an active member of both the Society of Motion Picture and Television Engineers (SMPTE) and the Information Film Producers of America (IFPA), and has authored several articles and papers on motion picture production techniques and equipment. His duties include all current DEC film activities. He is a manager of the Boston section of the SMPTE. He received an A.B. in Philosophy from Columbia College in 1959.

Film Animation: Theory

The theory behind motion pictures is simple, and actually predates motion pictures as we know them. Motion pictures, television, and similar visual displays work on the principle of "persistence of vision," the quality that causes an image to remain on the retina of an eye for a period of time after the image itself has vanished (in the human eye, normally 1/16 second). By superimposing a second image before the first one has had a chance to subside, it will appear as if there were no intervening blank period between the two images. A motion picture is made up of a series of such images, each reflecting the change of positions of all moving objects in the scene between the time interval separating each image (in standard sound motion pictures, this corresponds to 1/24 second). The "moving" elements in a scene can either reflect natural motion or can reflect "manufactured" motion or animation.

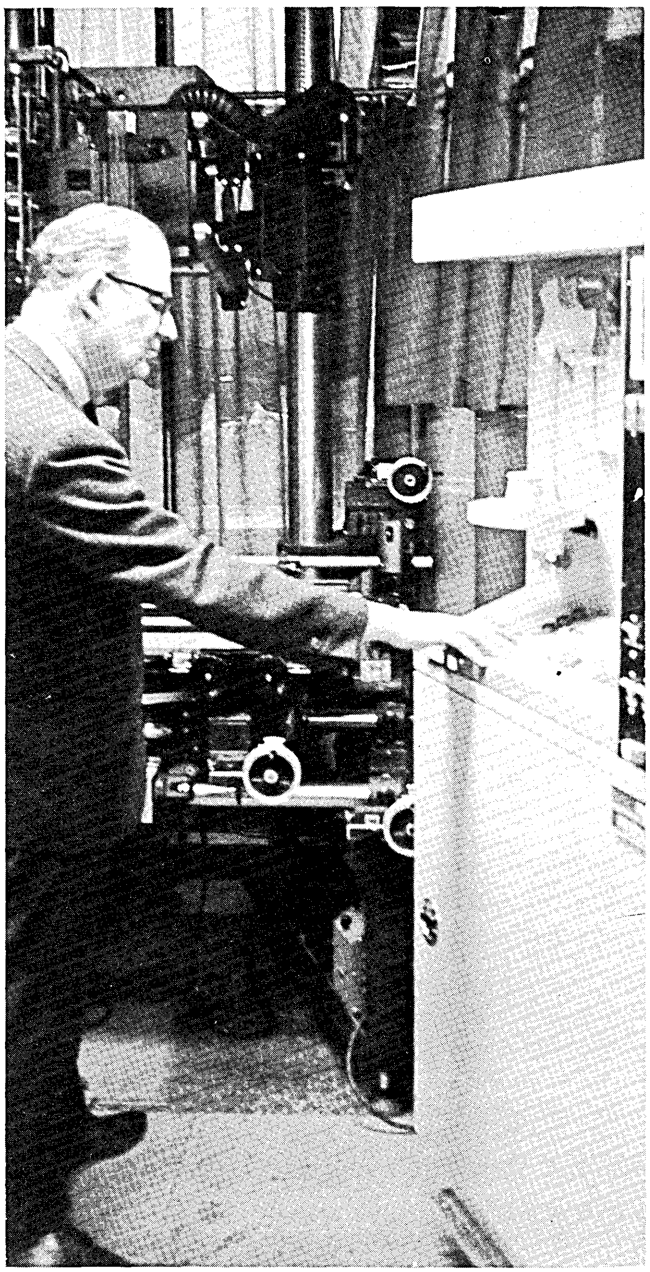
By understanding and utilizing this phenomenon of visual persistence, it was possible for toymakers to create devices that when spun or rotated would produce cyclic "motion pictures" of simple actions, such as a girl endlessly skipping rope. These cyclic pictures used drawings of the actions that were viewed through some system of synchronized interrupted motion such as spinning slits in the device. They were very popular in the mid-1800's, long before Eadweard Muybridge took his first time-successive photographs in 1877. It is, therefore, not improper to say that the first pictures depicting motion were animated cartoons.[1]

The earliest animated cartoons were a series of individual drawings, but such efforts were highly inefficient. Many innovative changes evolved, starting with improved drawing techniques, using a constant background for cartoon figures to be superimposed upon, transparent scene overlays, and the development of the animation stand. In addition, other forms of animation besides cartoon animation were developed.[2]

The Animation Stand

Modern animated motion pictures may be composed of a series of drawings, a selection of specific scenes taken from a larger photograph or drawing, or successive pictures of puppets (and/or other objects) that have been manipulated between the successive exposures. The film is exposed in the animation stand camera frame by frame, the changes in each successive picture—of whatever variety—being slight, and their cumulative effect appearing as natural motion.

"Computer control allows an animator time to be more experimental — and thus more creative."



An Oxberry animation stand (rear) is interfaced to the control tape reader. With the control tape in operation, "dry runs" of the sequence to be shot can be made.

Pictures appear through the courtesy of **Business Screen** magazine.

A modern animation stand is a highly complex, specialized photographic system that enables an operator to control the shutter, focus, and distance of the camera; the horizontal, vertical, and rotational screen motions of either the background image, the foreground overlays, or both. In addition, other controls, such as a device for controlling the "platen," or glass sheet that ensures proper contact of animation scene elements, are also used. Especially because of the intermittent nature of animation filming, the process lends itself to forms of digital control.

A few noncomputerized attempts at digital control of animation stands were made. Though an improvement over earlier models, even the best of these still left much of the complex or tedious calculations up to the operators.[3]

Computer-Produced Films: The Beginning

Early attempts to produce animated motion pictures by computer ignored the technology developed by the motion picture industry for producing such films. Beyond the initial understanding that motion could be simulated by shooting a successive number of still pictures on a motion picture filmstrip and projecting them, the efforts to use computers for animation tended to start from the beginning rather than build upon what was already available.

The standard approach for those experimenting with computers for this purpose was to couple the computer to some form of visual display, most often a cathode ray tube. The computer would then generate a visual display that would be photographed by a slave camera. Each display would correspond to a single frame of film, and with proper programming, full animated films could be made.[4]

Using computers in this manner could produce animated films much more rapidly than equivalent films could be produced using standard animation techniques. But the quality of such films was below that required for theatrical release. While useful for instructional films, the technique does not lend itself to professional production of animated cartoons, for instance, nor for most of the animation that the general public is used to viewing.

Those who developed this kind of animation system acknowledge that the results are not of professional quality. However, for instructional films in particular, they demonstrated a tremendous advantage over conventional animation techniques in cost.[4]

Improving Quality

It is not surprising that someone in the motion picture industry engaged in the production of animated films would be an innovator in developing computerized animation—the pressures of the industry practically forced such a development. The demand for animated features has become so great in recent years that a method has even been developed to simulate animated cartoons by photographing live actors and subjecting the resulting film to special processing to make the images appear to have been drawn.[5]

An animation stand adapts to forms of digital control easily. By coupling a computer to the controls, it is possible to perform both motion computations and control functions simultaneously. Although this could have been performed by using a time-sharing computer terminal, the pioneer systems in this field both use minicomputers. Presently, there are two computer systems in operation to produce professional quality animated films. One system, used in New York to produce animated television commercials, is configured for off-line operation.[6] In this system, the computer generates punched paper tapes coded in a form of numerical control to operate the animation stand.

Another system is in use in Canada. In this system, the computer is connected on-line to the animation stand for direct control.[7] Both systems have common operating characteristics, though each approach has certain advantages in terms of production that the other lacks. What is important, however, is that using either approach, films can be produced with considerably less effort than is required utilizing conventional animation techniques.

Numerical Control

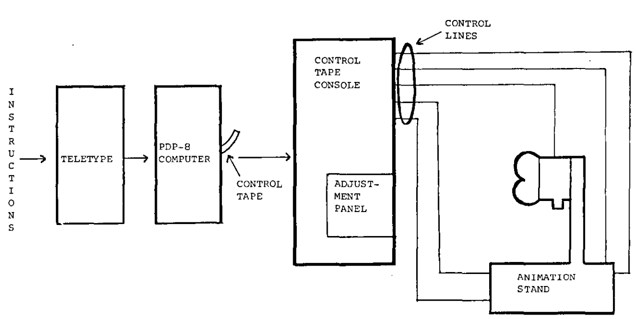
Computer control of an animation stand is very similar to the numerical control of a tool device in a machine shop. Just as a drilling machine can receive instructions from a computer (either directly or via tapes) to perform a series of motions resulting in a drilled pattern, so can an animation stand receive instructions that result in a sequence of pictures being taken. Once the motion requirements of motion picture animation were understood, a designer familiar with numerical control systems could configure an automated animation stand.

The motion requirements of animated films are very exacting, and necessarily peculiar to the industry. No matter whether a photograph or a cartoon feature is being animated, all motions in an animated film must appear to be natural, or the scene will appear wrong to the audience, destroying the illusion that has been built up.[2]

"Realism"

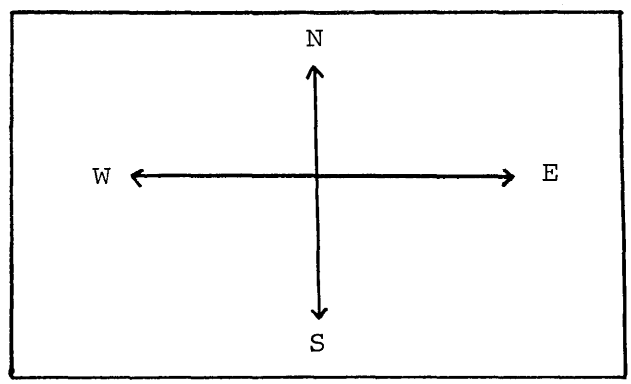
In order for a motion to appear natural, it should mimic a real action (though it can exaggerate it). As an example, consider one of the simplest animated sequences: a "pan," in which the camera moves from one side of a scene to the other side with no up or down movement. To appear natural, the picture would have to be taken in a sequence such that it would appear as if the camera accelerated from a standstill at the beginning of the movement to a final velocity that would be maintained through the pan. At the end of the pan, a corresponding deceleration would also be necessary. Without the acceleration and deceleration, the scene would appear artificial to the audience since they would not be used to seeing things reach a steady velocity in zero time.

Diagram of the Off-Line Automated Animation Stand System

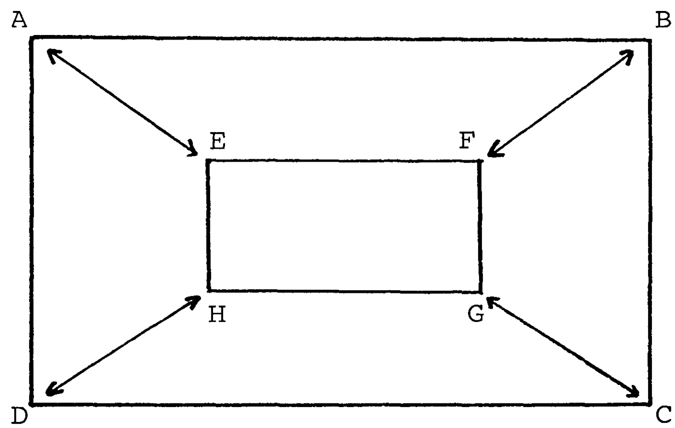


The off-line animation stand uses a form of computer-generated numerical control tapes for operation. The tapes can be used to duplicate scenes exactly or for other scenes requiring identical motions without having to use the computer again, freeing it to generate more intricate control instructions.

Basic Animation Movements



Horizontal movements of the camera are "pans" or East/West movements. Vertical movements are "tilts" or North/South movements.



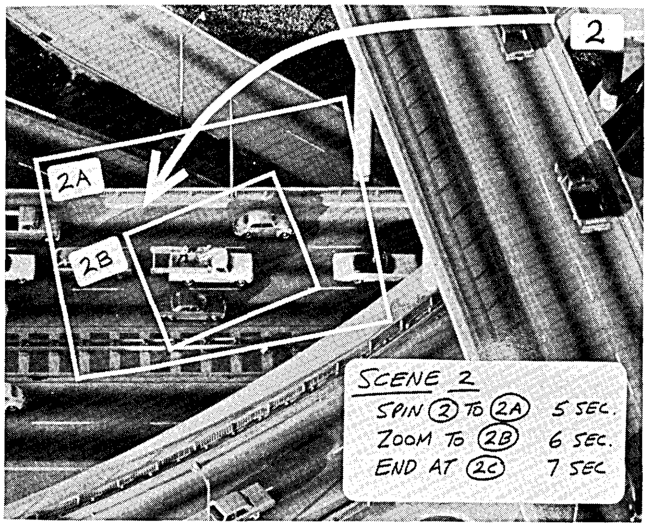
Moving an animation camera so that, for instance, the field covering a scene of the area in the rectangle ABCD to only the area in rectangle EFGH is known as a "zoom". Zooms can work in both directions (known as "up-zooming" and "down-zooming").

In the panning example, the animator, therefore, has two constraints—the acceleration and the deceleration. In addition, the animated sequence can last only for a specified period of time. For the sake of argument, let us suppose we are considering a 10-second pan. At sound speed (24 frames per second), that would mean that we have only 240 frames to complete the action. A certain number of frames must be used for the change of motion at the beginning and end of the scene, and beyond that a few static frames of each viewpoint should be maintained to permit the audience to see where the camera has been and where it has arrived. This means that the calculations for the change of camera position for this sequence can be rather complicated if performed manually. When calculated by computer, however, such a problem is almost trivial.

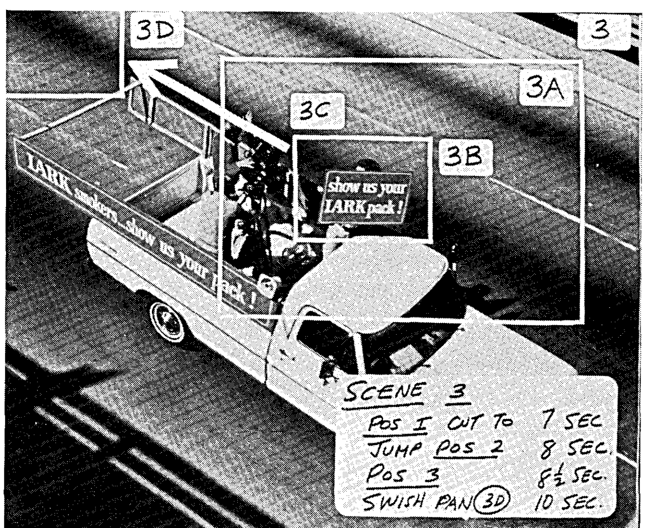
Controlling Camera Movements

Similar problems occur in the other basic camera movements—"tilt" (up and down movements with no sideways motion), rotations and "zoom" (in or out motions of the camera). The computerized systems presently in operation can compensate for each of these motions, individually and in combination. The computer programs are structured to make all corrections, including coordination between different camera movements, to prevent apparent slewing movements in the final scene that otherwise would be caused by different uncompensated accelerations in the different axes.

In addition to control of camera movements, the systems allow full control of the shutter of the animation stand camera. One feature of this is that the camera can bypass sections of film to expose only specific desired frames during a pass of film through the camera (for example, the camera could be set to expose only every twelfth frame). This permits an animator to shoot repetitive actions with a minimum number of artwork changes. For example, suppose a repetitive action takes 12 frames. Using



A portion of a television commercial being animated. Although the picture itself is a still, careful attention to animation camera motions can keep the audience from realizing that the scene is static.

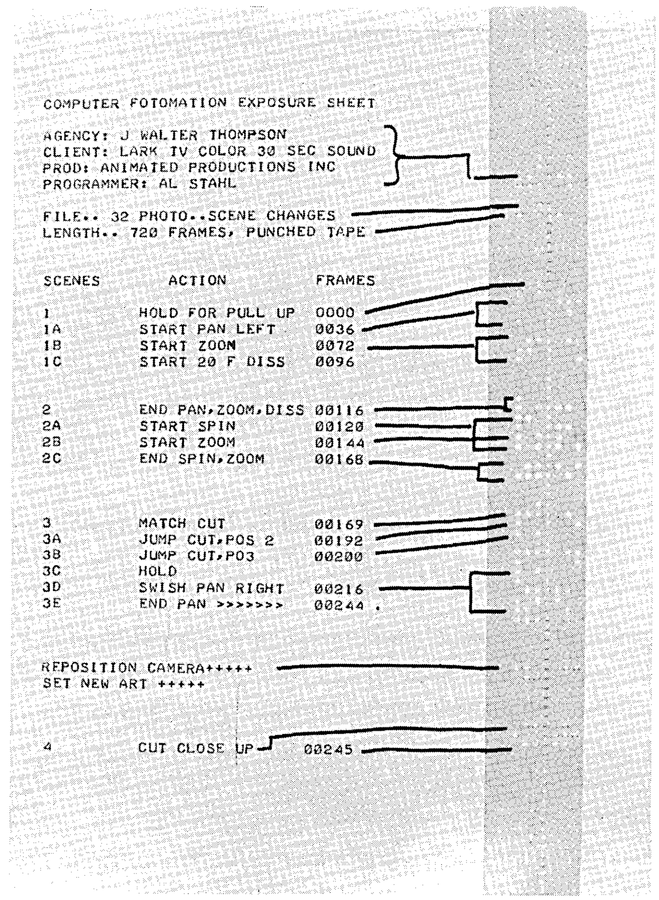


A matched scene from the previous picture by zooming from the truck to the sign, and then moving the camera across the scene quickly, the truck has the appearance of moving off-camera. Actually attempting to take a motion picture "live" under these circumstances would be a lot more hazardous and would have to be perfect in one "take." By using animation, all the scene elements are under control – and even an audience of professionals would have a hard time spotting that it is animation, given the scene lengths and camera manipulations.

this precision "skip framing" technique, an animator can shoot a sequence as long as he wants with only 12 changes of artwork. By contrast, using conventional animation techniques, he would have to make 239 artwork changes for a 10-second sequence. Such a feature is a great timesaver, permitting a sequence to be photographed in a fraction of the time that was necessary heretofore. In addition, it saves wear on the artwork, not to mention the animators.

Shutter Control

In addition, shutter control allows fade-outs and "dissolves" (one scene fading out as another scene fades in, superimposed over the first) to be made at the animation stand. The exposure characteristics of film are such that, especially on the part of fade-outs, computer control of shutter settings is highly useful to make the effect appear smooth. When the film is exposed to very small quantities of light, it is not as sensitive; if a fade-out is not to appear to get dark with accelerated speed at the last few frames, the computer has to compensate for the film's "sensitivity characteristic" to compensate for this effect.



COMPUTER FOTOMATION EXPOSURE SHEET

AGENCY: J WALTER THOMPSON
CLIENT: LARK TV COLOR 30 SEC SOUND
PROD: ANIMATED PRODUCTIONS INC
PROGRAMMER: AL STAHL

FILE.. 32 PHOTO..SCENE CHANGES
LENGTH.. 720 FRAMES, PUNCHED TAPE

SCENES	ACTION	FRAMES
1	HOLD FOR PULL UP	0000
1A	START PAN LEFT	0036
1B	START ZOOM	0072
1C	START 20 F DISS	0096
2	END PAN,ZOOM,DISS	00116
2A	START SPIN	00120
2B	START ZOOM	00144
2C	END SPIN,ZOOM	00168
3	MATCH CUT	00169
3A	JUMP CUT,POS 2	00192
3B	JUMP CUT,PO3	00200
3C	HOLD	
3D	SWISH PAN RIGHT	00216
3E	END PAN >>>>>>>	00244 .

REPOSITION CAMERA+++++
SET NEW ART +++++

4	CUT CLOSE UP	00245

A control tape showing instructions. The explanations are in motion picture terminology, and perfectly understandable to an animator who has had no programming experience. This particular sequence is to animate a series of still photographs for a television commercial.

In both the off-line and on-line systems, computerization has produced a dividend for animation stand operators. Besides increasing the speed of the actual shooting markedly, the animator can have his system go through a "dry run" to see what he is going to obtain before he commits it to film. With the exception of skip-frame sequences, he can adjust his stand camera so that he can see the image that

C.a BOOK REVIEWS

Neil Macdonald
Assistant Editor
Computers and Automation

We publish here citations and brief reviews of books which have a significant relation to computers, data processing, and automation. We shall be glad to consider any book in this category for future reviews if a review copy of the book is sent to us.

Each entry below contains: author or editor / title / publisher / date, hardbound or softbound, number of pages, price / comments.

If you write to a publisher or author, we would appreciate your mentioning *Computers and Automation.*

Withington, Frederic G. / The Real Computer: Its Influence, Uses and Effects / Addison-Wesley Publishing Co., Reading, Mass. / 1969, hardbound, 350 pp., $?

This book is an objective study of the effects computers have had on the people and organizations using them. Its purpose is to help concerned managers and individuals control these changes and adapt to them. It is a non-technical book which covers business, academic, scientific and governmental organizations, which computers affect. Included are more than 100 case studies in brief summary form. The book is arranged in 13 chapters, which are sub-headings of the 4 parts of the book. They are (1) "The Computer Unmasked"; (2) "How the Computer Changes Organizations"; (3) "How the Computer Changes Individuals"; and (4) "The Next Generation". Chapters themselves include, "The Computer's Strengths", "Compensating for the Computer's Weaknesses", "Standardization and Centralization" and "Opportunities Offered by the Computer".

Salton, Gerard / Automatic Information Organization and Retrieval / McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036 / 1968, hardbound, 514 pp., $14.50

This book deals with the computer processing of large information files, with special emphasis on automatic text handling methods. Although none of the chapters requires more than an elementary knowledge, the book is addressed primarily to readers who may already have some knowledge of computer processing.

The ten chapters are: "Automatic Information Systems"; "Information Analysis and Dictionary Construction"; "Dictionary Operations"; "The Statistical Operations"; "The Syntactic Operations"; "Retrieval Models"; "The Retrieval Process"; "The Evaluation of Computer-based Retrieval Systems"; "Auxiliary Information Services"; "Data Base Retrieval Systems". There are two appendices, a name index, a subject index, and a 14-page topical bibliography.

The author is Professor of Computer Science at Cornell University.

(Please turn to page 74)

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would be put on film. Then he can activate the system to see what will happen. If he does not like what he sees for artistic reasons, or if he discovers actual mistakes, he can correct them instantly before shooting the real thing. (Previously, he had to wait for the film to be developed before he could tell whether a mistake had been made. This process at best took several hours; at worst, several days).

Thus computer control allows the animator time to be more experimental—and more creative.

On-Line vs. Off-Line Systems

Although both on-line and off-line computer systems are in operation, it is difficult to predict whether future systems will favor one approach or the other. Each has its advantages:

- With an on-line system, the animator can formulate long and complex animation sequences that it would be impractical to put on control tapes. Direct control allows the computer to store vast numbers of instructions in storage devices, such as disk memories. Such sequences would be most useful in preparing films for theatrical production. In addition, sensing devices could be installed that would permit direct reading of camera coordinates by the computer-based system, which could eventually simplify input instructions.
- An off-line system, like a numerical control system, uses an intermediate controller to activate the device (in this case, the stand). The tape-reading stand, not being connected to the computer, cannot send any inputs back to assist in program modification, if any is needed. However, by using the computer off-line, it can service several animation stands. Even when restricted to one stand, the computer can be generating control tapes while the stand is operating.

For common animation sequences that will be used in more than one film, instruction storage could be made either by a memory-storage device in the case of the on-line system, or by saving the control tapes in the case of the off-line system. In either case, by using computers, it is possible to duplicate a sequence exactly, something that may be necessary if an accident should ruin the original film, but something that is practically impossible to do using manual animation techniques.

The reports of the two operational computerized animation stands are already causing interest and excitement in motion picture studios. With the increasing stringencies in schedule requirements and soaring production costs, computer-controlled animation stands will come into greater use. Perhaps within a decade, they will be the rule rather than the exception. □

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LYaPAS:

A PROGRAMING LANGUAGE FOR LOGIC AND CODING ALGORITHMS
edited by **M. A. GAVRILOV,** *Corresponding member of Academy of Sciences, USSR.*
and **A. D. ZAKREVSKI,** *Candidate of Physics and Math Sciences, Academy of Science, USSR.*
translated by **MORTON NADLER,** *Section Head, R&D, Bull-General Electric, Paris, France.*

A Volume in the ACM Monograph Series, edited by **Robert L. Ashenhurst.** Published under the auspices of the Association for Computing Machinery.

This book presents a programing language based on set-theoretical considerations oriented towards the programing of synthesis algorithms for finite-state and discrete devices. The power of the language is such that it is self-extending and self-compiling; the only part that must be written in machine language, the translator, is given in LYaPAS notation in the book, and can easily be implemented on any available or system. The major part of the book is devoted to applications. These cover many well-known and original algorithms in boolean systems, majority logic, sequential machines decomposition, error-detecting and correcting codes, and so forth.

*1969, about 450 pp., $24.50.**

*"A special price of $17.50 is available to members of the ACM for prepaid orders directed to the ACM. Members are asked to include their membership number."

UNIVERSITY EDUCATION IN COMPUTING SCIENCE

Proceedings of a Conference on Graduate Academic and Related Research Programs in Computing Science, held at the State University of New York at Stony Brook, June 1967.

edited by **AARON FINERMAN,** *State University of New York, Stony Brook, New York.*

A Volume in the ACM Monograph Series, edited by **Robert L. Ashenhurst.** Published under the auspices of the Association for Computing Science.

The talks and discussions reproduced in this book reflect the informed and experienced opinion from university, industry and government; they will provide much impetus for thought and action among the people responsible for the health of the future programs in this vital field.

*1968, 237 pp., $12.00**

*"A special price of $9.00 is available to members of the ACM for prepaid orders directed to the ACM. Members are asked to include their membership number."

METHODOLOGIES OF PATTERN RECOGNITION

edited by **SATOSI WATANABE,** *University of Hawaii, Honolulu, Hawaii*

This volume is a collection of papers presented at the International Conference on Methodologies of Pattern Recognition held under the co-sponsorship of the Air Force Office of Scientific Research with program participation by the Systems and Cybernetics Group of the IEEE.

1969, 579 pp., about 150 figures and illustrations, $16.00

COMPUTER-ASSISTED INSTRUCTION:

STANFORD'S 1965-66 ARITHMETIC PROGRAM
by **PATRICK SUPPES, MAX JERMAN,** and **DOW BRIAN,** *Institute for mathematical studies in the Social Sciences, Stanford University, Stanford, California.*
In collaboration with **DIANA AXELSEN, GUY GROEN, LESTER HYMAN,** and **BRIAN TOLLIVER.**

This book presents an account of the first substantial operational year in computer assisted instruction at Stanford University. The authors discuss the major aspects of a new technological venture that aims at providing individualized instruction in ordinary school contexts. In considering research elements of the project, the authors clarify how new empirical approaches to the learning of elementary mathematics have become feasible because of the data-analyzing capacities of the computer. The book concludes with a discussion of the programing language developed for the implementation of the curriculum materials in elementary mathematics.

1968, 385 pp., $7.50

ACADEMIC PRESS NEW YORK AND LONDON
111 FIFTH AVENUE, NEW YORK, N. Y. 10003

AN ADVANCED MANUFACTURING CONTROL SYSTEM STABILIZES INVENTORY AND EMPLOYMENT COSTS

Paul J. Miller, Director of Finance
Mixing Equipment Co.
Rochester, N.Y.

"We have been able to eliminate obsolete parts and identify slow-moving items. We have eliminated the annual physical inventory in favor of a cyclical or continuous inventory count. And we can value inventory at year-end within four weeks, when it used to take three months.

Sales up 40 percent, the number of parts in inventory up 50 percent, but—the dollar value of inventory up just 10 percent.

These figures, covering a key aspect of manufacturing operations here at Mixing Equipment Company over the past five years, show that the cost of inventory has been stabilized in the face of substantial and consistent growth.

Other facts round out the picture:

- The ratio of sales to inventory, by dollar, is now lower than ever—we estimate that without the controls which have been instituted, the value of inventory would be $1 million greater;
- The number of open shop orders at any given time has been reduced from 2,000 to 800;
- Employment has been stabilized, since we can absorb continued sales increases and expansion of parts in stock without disproportionate increases in personnel.

Paul J. Miller, Controller and Director of Finance (left) and Robert C. Berl, Manager of Data Processing at Mixing Equipment Co., discuss details of a new shop floor control program. Equipment in the background includes a high speed printer and three magnetic disk units. The company's entire inventory data base is housed on one disk pack, which can accommodate more than seven million characters of information.

In the Beginning

Paralleling these developments of the past five years has been the gradual evolution of a manufacturing control system which is still far from complete, but has already helped produce the advantages listed above. It began in 1964 when a computer was applied to our operations. We had no grandiose plans, no pre-set ideas, just the conviction that a number of profitable uses would be found for the computer. As one use has been added to another, the outline of an effective manufacturing control system has taken shape.

Our company is unique in the fact that it devotes itself exclusively to the design and manufacture of fluid mixing equipment. It now has subsidiaries in Australia and England, a licensing agreement with a Canadian Company and is planning further expansion in Latin America and Belgium. Products range from portable mixers to a recently developed float-mounted aerator for water pollution control.

Operations were originally my responsibility as Controller and Director of Finance. We designed the early applications so that information which might be desirable later on could readily be obtained. The basic accounts payable records, for example, made provision for the capture of cost data on purchased parts and material; the accounts receivable records were designed to include the value of sales dollars by individual job.

Inventory Data Base

The net result was to begin building the data base needed for an advanced manufacturing control system. In 1966, when a larger computer was ordered to replace the original, smaller one, and Robert C. Berl joined the company as Manager of Data Processing, the groundwork had already been laid for a natural evolution into inventory management, manufacturing scheduling, and shop floor control—the latter just recently implemented. The larger computer was installed in December 1967.

The inventory data base consists, essentially, of: item identification; current balance; reorder points; any quantities on order; lead times; economical order quantities (EOQs)—both for purchased items and those produced in-house; historical usage data, for constant re-evaluation of reorder points and EOQs; commitments by month; and dollar value of the item.

Also included is where-used information for those parts and assemblies we manufacture. The data base is structured in five levels:

1. Base raw material, whether roll or bar stock;
2. Semi-finished parts, purchased and manufactured in-house;
3. Finished inventory, which includes spare and replacement parts, whether purchased or manufactured in-house;
4. Sub-assemblies; and
5. Finished mixers (which are smaller, high-volume units).

Each item, at each level, is linked to the item or items three levels above and below. We could extend the links to include all five levels, but have found this is not necessary for our purposes.

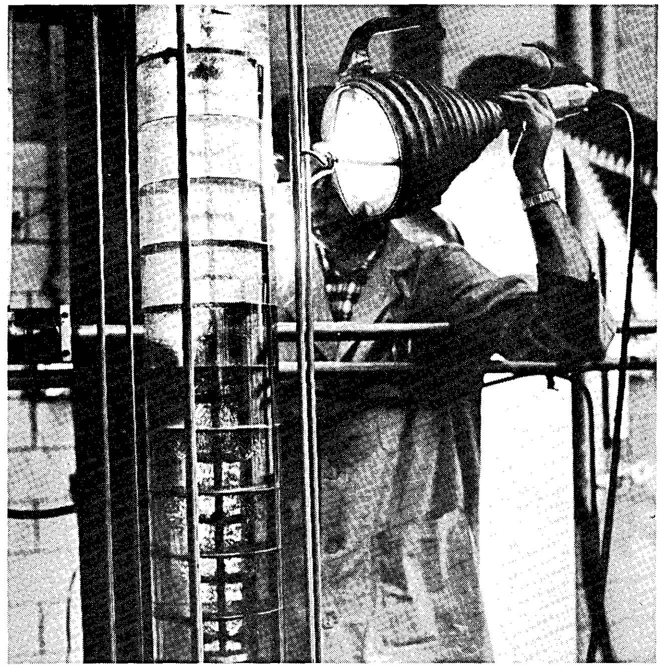
With all this information on a single magnetic disk pack, or file, immediately accessible to the computer for processing, the master file of 12,300 parts and material is readily controlled. Further, the basis is established for other systems such as purchasing, cost control, expediting, and shop floor control.

Processing an Order

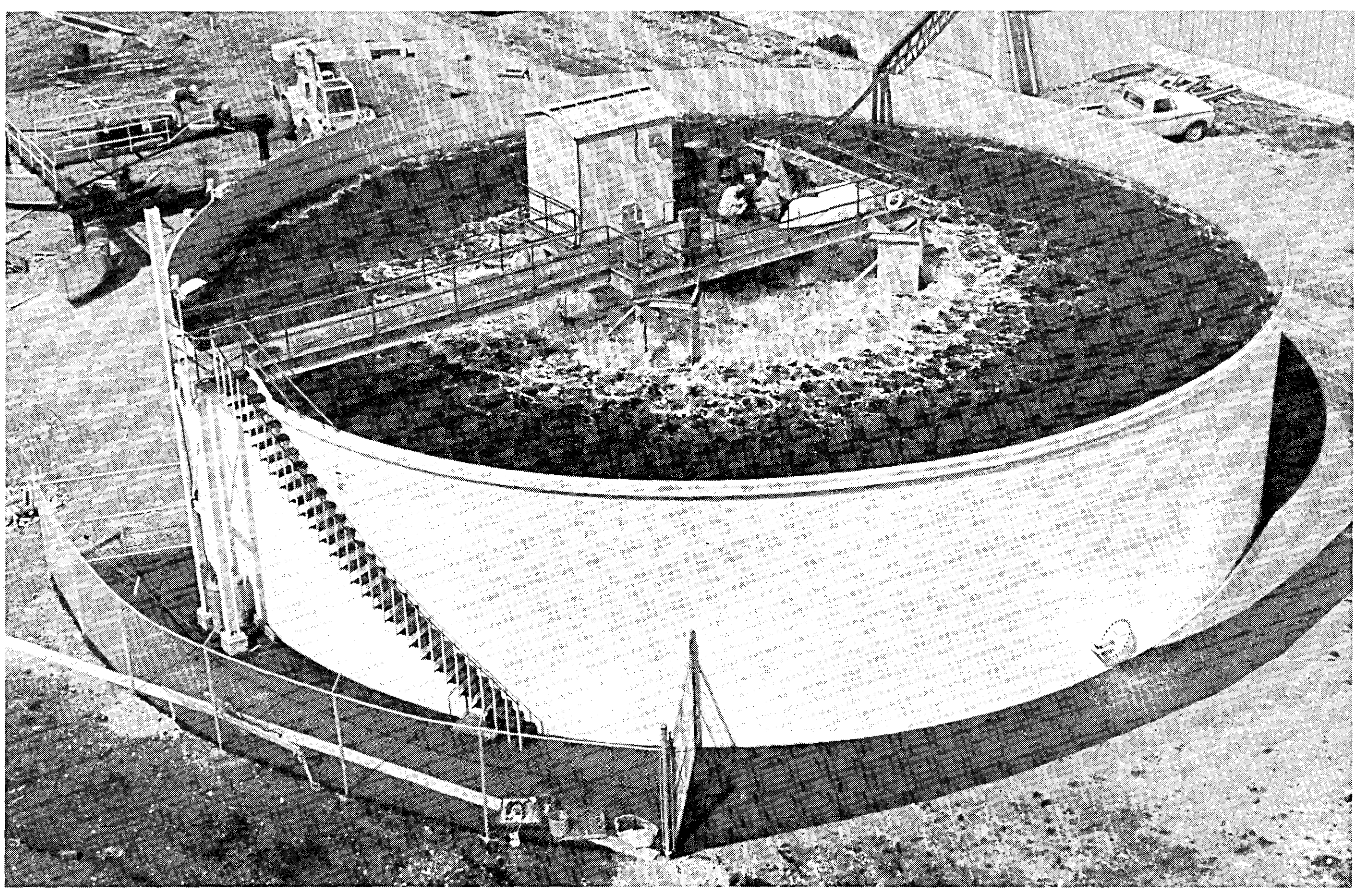
Orders come in at the rate of 800 per week, or about 40,000 a year. A booking copy of each order is prepared manually, from which cards are punched to run a daily booking report. Copies of the booking order go to purchasing—for an immediate check to determine whether a motor has to be purchased—and to engineering, which prepares the bill of materials. Factory then determines what has to be manufactured to fill the order, and which items have to be purchased.

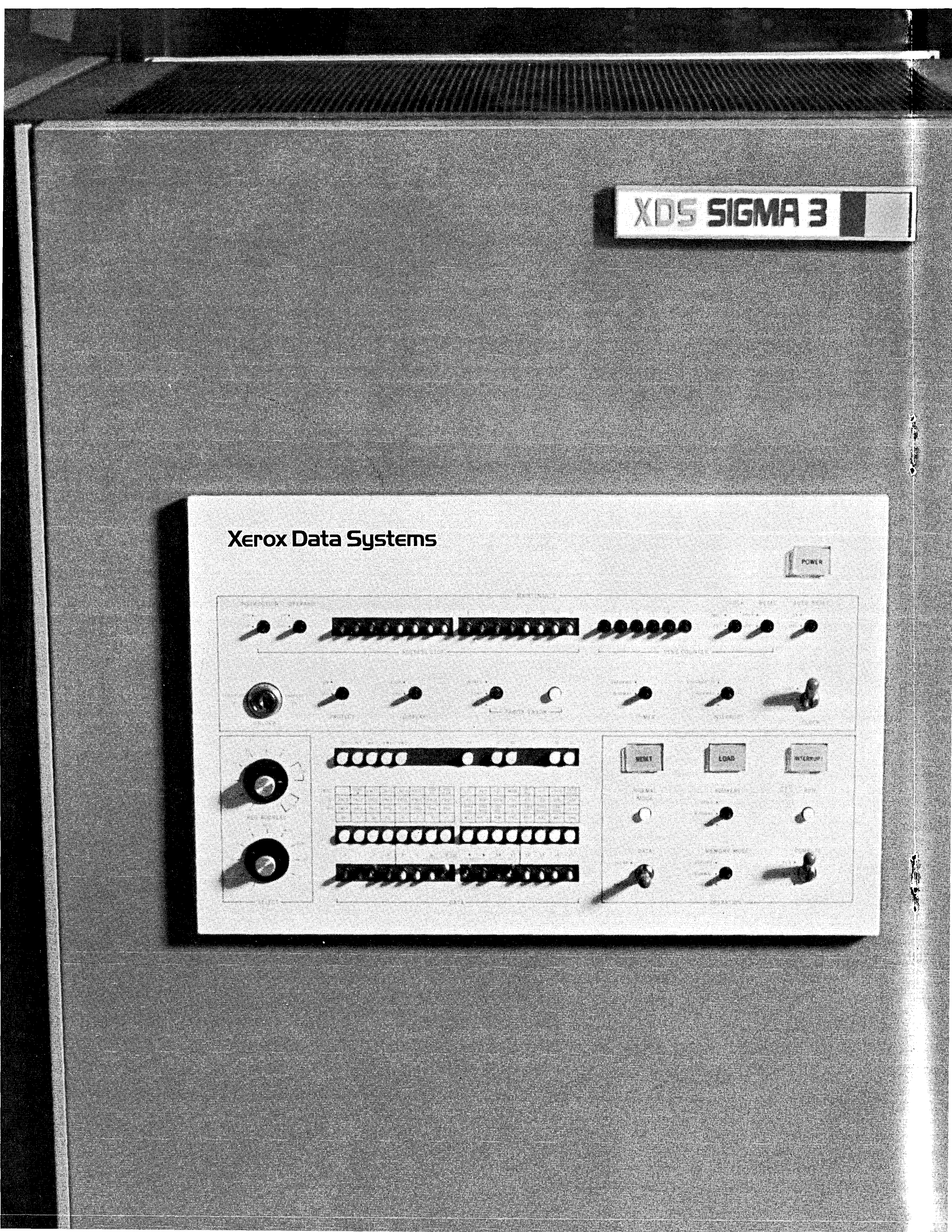
From the factory list, inventory (transaction charge-off) cards are punched—each covering four items and showing part number, raw material, the job for which needed, quantity, and job due date. These cards are fed into the computer to update the data base, allocate parts and

A mixer column used in a pilot plant study of counter current, liquid/liquid reaction.



This 600,000 gallon tank was recently developed for full-scale testing of aerators and mixers manufactured by Mixing Equipment Co. It is believed to be the world's largest facility for testing such equipment.




XDS SIGMA 3
Xerox Data Systems
POWER
RESET
LOAD
INTERRUPT

This is the latest Xerox machine:

the Sigma 3 computer.

Sigma 3 is the first computer to start life as a Xerox data system. And it's the most extensively tested computer ever introduced by the company that used to be SDS.

It's the lowest priced computer in the Sigma series. But it comes with big machine software and handles many problems that up to now required much more expensive machines.

An external Input/Output processor prevents I/O operations from stealing seconds from computation. A real time batch monitor provides file management and full overlay capabilities in both foreground and background computing.

In a real-time system, Sigma 3 can run general purpose programs concurrently with real time. All three operating systems, two FORTRAN compilers and a pair of assemblers are field proven and ready now.

Most system needs can be filled off-the-shelf by Sigma 3 in combination with our other standard products. If you have a very special problem our Systems Division will be happy to give you a custom job.

More information on the latest Xerox machine isn't available from the people who service your Xerox copier. But it's yours for the asking from the company that once was SDS.

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material to the particular job, accumulate cost data, and spot those items which fall below the reorder point as a result of the day's activities. As previously noted, we "chase" each item three levels above and below, automatically picking up all related items affected.

Every night, a shortage report is printed listing those items—both purchased and made in-house—which have fallen below the reorder point. At one time, ordering was to a three-month supply. Now, it is in terms of economical order quantities. An inexpensive item which we make and use frequently is often produced to a full year's supply. On the other hand, an expensive item less frequently used may be ordered to a one-month supply. Factored into the reorder point, of course, are the usual considerations such as lead times.

All purchase orders become part of an open order file, in which each supplier is identified by name. Seven to 14 days before delivery, each order is followed with a return postcard printed on the computer; the back half of the postcard lists the parts or material on order, and asks the vendor to indicate its status. Better than 75 percent of these are returned to purchasing for any appropriate action, then sent to the Data Processing Department to update the files. This helps keep anticipated deliveries on schedule, and avoids many last-minute phone calls.

The inventory data base permits regular analysis of parts and classes of parts, and determination of requirements well into the future for all levels. Reports on castings, for example, assist in working out order schedules with foundries; special orders are readily picked up for early followup. Delivery schedules are adhered to far more closely than ever before.

Changes in Costs

With the cost of every part recorded against each order, and with labor costs added, we get detailed costs of sales. We can analyze the relationship of component costs to assembly costs. When vendor prices change, we can immediately reflect those changes in all items at each level affected.

In the latest step towards complete manufacturing control, we are storing in computer files for each job the sequence or operation number, the work center at which it will be performed, time needed, and operation code. Along with the information available from the inventory file, we create shop packets at order issue time which include the routing card, component card, and one or more labor cards.

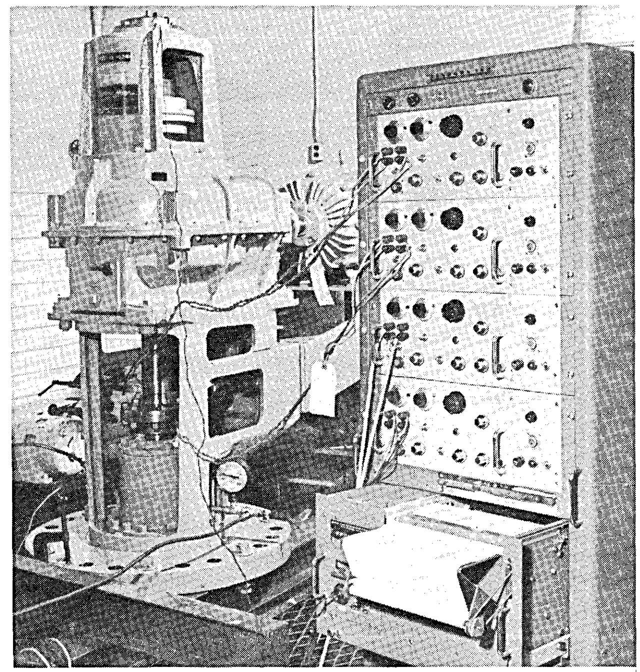
With the information on hand for order quantity, operations needed, and time, operations can be scheduled for each order. With scheduled operations filed in order by date within work center, shop load reports are easily produced. As the labor cards are completed and fed back to the Data Processing Department, we have information useful in payroll processing and in determining the exact status of a job.

Stabilizing Inventory

Further, standards can be set far more realistically for each work center, and evaluated regularly. Long range studies can be made to determine potential overtime situations and to help in facilities planning.

Gradually, we are "closing the loop" of manufacturing control, assembling, processing, and filing all the information involved from selling an item to shipping it. The results are shown in the stabilization of inventory with all that that implies in terms of savings, and in far better utilization of existing shop facilities.

We have long since been able to eliminate obsolete parts and identify slow-moving items. We have eliminated the annual physical inventory in favor of a cyclical or continuous inventory count. We can value inventory at year-end within four weeks, when it used to take three months. And we have the information needed to regularly evaluate stock for obsolescence and rate of usage.



As a new unit undergoes tests at Mixing Equipment Co., the data generated is captured on a control unit (right) and is later analyzed by the company's computer.

The Computer System

The computer (a System/360 Model 30), which handles this workload plus a number of other scientific/engineering and commercial jobs, is a medium-size system equipped with three magnetic disk units, a high-speed printer, and card units. A paper tape punch is connected to the computer to produce Numerical Control tapes; we have 10 NC machines in the shop, with another on order; and the computer is used to generate tapes for six of these units. About 20 tapes are produced each week; to date, more than 1,000 have been run off on the computer.

The system's time is split about 80 percent for so-called commercial work, and 20 percent for scientific/engineering. Since the development, production, and application of mixing equipment has become a science in itself, we conduct intensive research and development activities which generate large amounts of data. For the most part, the computer is used on an open shop basis by engineering people, who run their own programs. The system is operated on two shifts.

There is even a program which handles inquiries directed to our advertisements. They are analyzed to help determine such things as which magazines produce the best results and which individual ads pull the most inquiries.

All of this comprehensive range of computer applications has stemmed from the familiar data processing jobs of manufacturing—payroll, accounts payable, accounts receivable, sales analyses, and engineering. In a step-by-step, evolutionary manner they have been molded into a management information system whose total value would be difficult to measure.

We do know this much: our company could not have grown as rapidly—and as profitably—without this solid data processing base. And what has been gained up to now, should be just a prologue to the future. □

A PRAGMATIC APPROACH TO WORKABLE DATA PROCESSING CONTROLS

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"If a user does not pick up his data processing report within eight working hours after its scheduled completion time, there is a strong indication that the report is not needed, or that the publication schedule is not important."

Financial management, internal auditors, and data processing personnel are all concerned with the challenge of establishing and maintaining effective internal controls over the operations of the data processing function.

If controls are to be effective, it is essential that all parties concerned reach a common ground of understanding. This concept encompasses more than a mere dialog using technical terms. In fact, management must reach its decisions concerning data processing controls only after the fullest consideration of all facets of the situation. The task of relating the facts of a data processing control situation to the needed controls falls on the internal auditor in many instances. The success of the control measures which he may recommend will depend, in large part, upon his ability to convey to management the viewpoint of the data processing personnel involved, as well as his own convictions.

Defining the DP Department

In order for the internal auditor to arrive at any meaningful conclusions concerning the controls needed for a particular data processing department, he must first have a full understanding of the peculiarities of that department. He must know which other departments or functions it serves. He must know its actual position in the corporate organization.

In a recent survey it was found that the position of the data processing function within the corporate structure differed from company to company, although there appeared to be a trend to establish Data Processing as a separate entity with the head of the group reporting to the President of the company. One large data processing organization, headed by a Vice President of Management Information Systems, reported to the President. This group had within it the entire data processing function, including systems, programming, hardware operations, and tape library.

Another company provided for segregation of duties. One group of high level personnel, reporting to the President, established data processing policy as to systems to be installed and equipment to be used; the systems department, on the other hand, was a part of the procedures function, which reported to the Vice President of Administration; and the operations or hardware section reported to the Controller. Each functional organization within the company had a separate group of programmers.

Still another company had two data processing functions: one, Engineering and Scientific, reported to the Vice President of Engineering; the second, Business Operations, reported to the Controller. Each group was entirely independent of the other.

Obviously, there must be a different approach to the control problem in a situation where the data processing department is large, independent, serves many other departments, and is high in the organizational structure, than in a case where the data processing function is limited and within the responsibility of the accounting department.

Having sized up the particular data processing department involved, the internal auditor should then determine the approach he will use in his analysis of existing controls and in his evaluation of the effectiveness of those controls.

This paper will examine the following areas of the typical data processing operation and the control problems confronting the internal auditor in those areas:

- Input controls.
- Processing controls.
- Bursting, decollating, and binding.
- Distribution of reports.

Input Controls

To the auditor, input controls, established and maintained by Data Processing, are essential internal controls needed to assure the receipt of all data, accuracy of processing, reliability of completed reports, reduction of re-run costs, and efficiency of operations. They describe those records, procedures, and documents employed by Data Processing Operations to monitor the flow of input data within the processing facility and the conversion of the data within a computer program or series of programs. The recipient department shares responsibility with Data Processing in determining the reliability of these controls.

The Data Control Center is the most vital point in Data Processing because all operating controls over data being moved physically or by machine are centralized in this group. Operating controls should extend over:

1. Receipt of data from source and record of data received;
2. Issuance of data to operations and record of data issued to operations;

3. Return of data from operations and record of data returned from operations;
4. Return of data to source and record of data returned to source;
5. Receipt of output records and reports from operations and record of output records and reports received from operations;
6. Distribution of output records and reports to users and record of distribution of output records and reports to users.

The redundancy in these six listed controls was designed deliberately to highlight two significant control features:

a. Physical control over the physical movement of data, and
b. Record (paper) control over the movement of data.

Typically, controls over the physical and machine movement of data originate outside of the Data Processing Group. Commonly used "input" controls generally accomplish a multiple function: (1) A document count is established to control the physical movement of the data into the Data Control Center; and (2) A control total or group of totals (hours, rates, dollars, units, quantities, etc.) is developed to establish a base for controlling the machine movement of the data in terms of output records.

Although the format of source input controls varies with the requirements of each company, the purpose is essentially the same:

1. Batch controls — document counts and applicable totals for small groups of documents. This includes some form of Batch Transmittal advice on which applicable processing codes, sequential order number of the batch, document counts and control totals may be recorded.
2. Batch summary controls — summary reports designed to accumulate individual batch transmittals by processing codes (or other applicable system or program identifiers) at the conclusion of the input cycle daily or weekly. The report should list total batches processed, total documents in all batches, and summaries of all other control totals.
3. System summary controls — a daily or weekly summary of the Batch Summary Controls which provides the means of controlling an entire system. Since a computer system can encompass a large number of individual programs, such as a combined payroll/personnel system, this control is needed to summarize all changes affecting the entire system.

Processing Controls

The movement of data through a computer system involves a number of steps. These include the conversion of data from its original-document state to machine-language on a punched card; transfer to a magnetic tape record in order to achieve a medium for high-speed processing and greater sorting capability; and the additional conversions of the data from tape to tape. At the completion of processing, the tape records of the processed data may be used for transfers to various types of output records such as punched cards, individually printed document records (invoices, checks, notices), or tabulated listings or reports.

The auditor is, of course, interested in the mechanical or "built-in" controls in computer equipment which assure the accuracy and reliability of computer operations. But these controls relate primarily to the mechanical functions of the equipment; they furnish little or no visibility or control over the data. Parity checks, double circuitry, double tracks are operations performed within the computer and are not susceptible to outside verification during processing.

Program Controls

The controls of greater interest to the Internal Auditor are those program controls written as an integral part of the instructions governing the operation of the computer and the processing of the source data. These offer a variety of means for controlling the data during the transfer processes. The use of programmed controls depends on the controllable aspects of the data being processed. Controls can be programmed to generate console signals or messages for immediate action by the machine operator; they can be programmed to appear separately as output control reports or as an integral part of the data output. The following list represents some of the commonly used types of program controls:

Data Output Controls:

1. Columnar totals — totals of numerically recorded data, which are significant in and of themselves.
2. Hash totals — totals of numerically recorded data, which are not significant other than as a means of determining that all data have been included.
3. Record counts — a count of all the records pertaining to a specific transaction or to a specific account balance.

Error Controls:

1. Cross footing — a control employed by the computer to assure that columnar totals are in "agreement" or "in balance" condition.
2. Limit check — a computer comparison of the data to programmed limits. The computer generates an exception or rejection listing of any data which exceed the programmed limits.
3. Check points — control total generated at various points during processing to provide a means of locating errors quickly, making unnecessary the complete re-running of a program if an error is discovered during the processing.
4. Zero balance — a control over computer-generated computations which employs a reverse multiplication technique to prove the accuracy of computations.
5. Sequence check — a method whereby each item of information processed is assigned an identification "bit" or mark by the computer, for comparison by the computer to the preceding item of information to determine that the proper sequence of data is being maintained.
6. Audit check — computer audit of input or "new" data being processed against previous recorded data or standards to determine the legitimacy or acceptability of the input.

Balancing controls, per se, represents only one aspect of adequate internal control over Data Processing Operations. Control cannot be achieved without cost, and the relationship of cost to benefits derived must always be weighed. Adequate control must be planned, structured, implemented, and enforced in a manner calculated to achieve the desired level of reliability in Data Processing Operations.

Bursting, Decollating, and Binding

In the Bursting, Decollating, and Binding area, the Auditor is interested in determining whether standards which could operate as controls might be established. For example:

1. Paper standards correlated to the number of copies in each computer run.
2. Work standards for separation of carbons, bursting, separation of reports within the run.
3. Work standards for addressing reports for distribution.

It should be possible to establish sight check for control of forms or report format to assure more economical completion of reports.

Generally, form design is developed by the systems or program representatives in conjunction with the user. This need not be changed; however, a forms control section independent of the Programmer or Systems Section should be established. It might be a part of the Report Control Section.

Distribution of Reports

Reports may be delivered by Data Processing, by in-plant delivery service, in-plant mail, or by recipient department pick-up at a specific place and time or by combination of the above. However, the ultimate responsibility for prompt and accurate delivery of completed data processing reports rests with the Data Processing Department.

Control over the distribution of reports can be achieved through a variety of methods, several of which are considered here.

A Report Catalog

A catalog should furnish the information required by Data Processing to process each system, program and report. It should contain, for example, Report Format, Sort Sequence, Total Levels, Input Source, Originator, Bursting and Binding Instructions, and Distribution Information. The distribution information should disclose:

a. The method of distribution
b. The date of distribution
c. Name of the recipient department

A Report Tape

Some Data Processing Departments, by maintaining distribution information on the report tapes, print it each time that the program is run. Sometimes, the address labels are also created. Companies which follow this system have a fairly fixed organization and must caution the recipient department(s) to supply any change-of-address information prior to the next report delivery date to assure updating the report tape with the new address information.

In companies where organizational, personnel and facility changes occur often, the catalog system seems more appropriate. Updating a catalog can be done with less chance for error than changing a report tape, which involves the possibility of erasing the tape — a potential error in the user's report! Therefore, a catalog of reports is preferred as a source for distribution information.

Compliance with Controls

How can Data Processing be sure that its basic control-catalog information is correct? In several ways: One is to wait for a complaint, and then take corrective action. The preferred way is to use questionnaires. Every month, on a sampling basis, attach a card to each of selected reports, which states: "This report will be stopped (state date) unless this card is completed and returned to Data Processing by (state date)." The card should request distribution information, plus some use information; i.e., how information could be secured without the report and/or specific use of the report information.

If several cards are not returned some doubt might be raised as to the value of the program from which the report was derived. Prior to cancelling the reports, as a safety precaution, it might be well to notify the individual listed on the catalog that because he had not returned the information card the report would be discontinued. This precautionary step is necessary because the card may have become detached from the report so that the actual recipient and user of the report had no opportunity to complete it. Without a verification that the individual desires the report, it may be cancelled; a number of cancellations should lead to a questioning of the value of the program, since it is probable that some of the users of the report do not actually need it.

The problem of determining the validity or the need for a program provides an opportunity for cooperation between the Internal Audit and Data Processing Departments. A study may determine that (1) those who are using the remaining copies could secure the needed information from another report, or (2) they don't need the report but did not choose to disclose this fact. Possibly, the Internal Auditor can then determine if other programs may be adjusted to provide the information needed by the remaining users, resulting in elimination of the entire program.

An additional point of control over report distribution is located at the station where the data processing user picks up the report; this may be the computer center or remote satellite stations of the data processing center. If the user does not pick up his report within eight working hours after its scheduled completion time, there is a strong indication that the report is not needed or the publication schedule is not important. Either fact is important to Data Processing and should be authenticated as quickly as possible.

Some companies require that reports not picked up within 24 hours are to be forwarded to a central area in Data Processing. A departmental representative then attempts to contact the recipient or original requester by phone to determine whether the reports are needed or whether the schedule date may be relaxed. As before, this information can be furnished to Internal Auditing for further study and recommendation.

To assure optimum results, the report control function should be located in the accounting, financial, or administrative areas, rather than in Data Processing; for, in the latter section, the responsibility to provide service sometimes overrides good judgment in restricting user desires.

Some Test Questions

Here are some questions that can be asked to discover whether or not proper controls exist in one's own company:

1. Are external control totals used wherever possible to check the results of the data processed?
2. Is the processed data reviewed by analysis and comparison to determine its reasonableness?
3. Are the catalogs tested to verify that EDP reports produced are listed?
4. Do the report users have knowledge of the method by which the data is processed; and have they reviewed the testing of the program and approved it?
5. Are records maintained of errors occurring in the EDP system? Is the significance of such errors in relation to the operating programs reviewed?
6. Are the pages of reports numbered, so that all recipients know that they have received a complete report?
7. Is confidential information on reports prevented from going to unauthorized personnel?
8. Are other reports being prepared which contain similar information, but in different sequence?
9. Are survey sheets sent out periodically to recipients of reports to assure that they are still needed and used?

Controls established to guide efforts through the data processing function depend upon human skill and efficiency. And such efforts are also dependent upon activities which originate and terminate in areas beyond the control of the data processing function. □

AUTOMATIC DATA PROCESSING SYSTEMS –

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The considerations relating to the installation of a large complex of electronic data processing equipment might be familiar to the industrial or manufacturing manager, but it probably presents quite an awesome task to the office manager. This article is intended to familiarize those executives of the business community who are responsible for data processing equipment purchasing and equipment site preparation, with the factors to be considered in planning for the physical environment of the data processing system.

The following is an outline of elements which should be considered in planning a data processing installation.

Data Processing Installation Considerations

1. Installation Scheduling
2. Equipment Requirements
   a. Space
   b. Structural Support
   c. Power Supplies
   d. Environmental Conditions
   e. Layout Configuration
3. Site Selection
   a. Lease
   b. Build
   c. Buy
   d. Alterations
4. Site Preparation
   a. Flooring, Ceiling and Walls
   b. Lighting, Arrangement, Communications
   c. Power Supplies and Cable Layout
   d. Environment Conditions - Acoustics, Air Conditioning Temperature Control, Filtration, Humidity Control, Vibration
   e. Safety
   f. Appearance
5. Equipment Delivery and Installation

Installation Scheduling

No simple formula exists for creating a schedule that would be applicable to all installations. General guidelines are shown in Table 1. However, there are specific considerations and procedures which should be fitted into a program. It should be noted that the first activity follows the selection of the EDP equipment. The ensuing paragraphs present an elaboration of the phases denoted in Table 1.

	Number of Months Prior to Delivery of EDP Equipment	
Activity	Start Activity	Complete Activity
1. Begin Installation Study	12	10.5
2. Select Site	11.5	10.5
3. Establish Specifications	10.5	9.5
4. Design Layout	9.5	8.0
5. Prepare Site Plans	8.0	7.0
6. Let Contracts for Site Work	7.0	6.5
7. Start Site Work	6.5	1.0
8. Deliver Support Systems	5.0	1.0
9. Install and Approve Support Systems and Site Work	4.5	0.0
10. Deliver EDP Equipment	0.0	+1.0
11. Install and Checkout EDP Equipment	0.0	+2.0
12. Start System Conversion	+2.0	- - -

Table 1. GENERAL INSTRUCTION SCHEDULE

1. *Begin Study.* As noted earlier, the length of time for preparing for EDP equipment installation varies with the complexity and size of the proposed system. The installation study should commence soon after top management has given its approval to the justification report.

2. *Select Site.* Selection of the site for the computer equipment will be more fully covered below. Site selection is essentially an evaluation of alternatives related to the economics and the humanities of doing business, in order to choose the best all-around location and building for the installation. Site selection problems can be solved with the aid of such operations research techniques as linear programming.

3. *Establish Specifications.* The section on equipment requirements below presents an insight into some of the specifications that the Study Group must consider. During this phase, the Study Group completes overall building specifications which take into account equipment requirements as well as organization needs.

4. *Design Layout.* This phase is concerned with developing floor plans, electric and communications cable runs,

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PHYSICAL INSTALLATION CONSIDERATIONS

"A computer installation site selected solely because it fits the needs of the EDP equipment, may be so poorly suited for the people who will use it, that the overall system will lose its designed effectiveness."

heating and air conditioning duct work and general structural requirements.

5. *Site Plans.* These are detailed plans which will be provided to contractors to control actual installation and structural work. Contractors will use these plans for estimating their cost bids.

6. *Let Contracts.* Award contracts for the actual site preparation work.

7. *Start Site Work.* Commence building erection or alterations.

8. *Deliver Support Systems.* Support systems generally include: heating, cooling, primary power, lighting, communications and fire protection.

9. *Install and Approve Support Systems and Site Work.* It is imperative that all support equipment be in good working order, especially the subsystems, which will protect the EDP equipment, before the EDP equipment is delivered and installed. All structural and electrical work should be completed at this time. State and local inspectors must approve the structural, mechanical and electrical work, and the Study Group should ensure that all work meets the design objectives prior to installation of the EDP equipment.

10. *Deliver EDP Equipment.* The sequence of delivery of the equipment is usually the responsibility of the supplier; however, the user must provide storage, uncrating and other related support. Especially important in avoiding delays and damage to the equipment during moving is the planning of the moving routes both outside the site and within the site.

11. *Installation and Checkout of the EDP Equipment.* The supplier generally will provide the technicians and engineers required to install, adjust and put the equipment into operation.

12. *Start Conversion and Operation.* The user will generally have started conversion operations prior to the actual installation; however, now he can go full swing by moving in all his personnel, office furniture and supplies.

Equipment Requirements

There are certain specifications submitted by the equipment manufacturer that must be met by the user in order to qualify for the supplier's equipment guarantees and to insure that the equipment will operate efficiently.

The equipment installation specifications generally cover the following categories:

1. Voltage and frequency levels and allowable deviation
2. Operating temperature range
3. Humidity range
4. Space and load-support-requirements
5. Air filtration requirements
6. Vibration tolerances

The equipment requirements are usually specified on a per unit basis. That is, specifications will be given for each model of Central Processor, Card Reader, Magnetic Tape Unit, etc. Then the sum of the individual unit requirements are used in designing overall system requirements.

Site Selection

There are several approaches management can take in selecting a site. The direct approach would be one of matching site capabilities with equipment requirements. The site which offered maximum utility with minimum modification would be the prime selection. Another direct approach would be to match business requirements and site capabilities. This, of course, uses significantly different characteristics of the site for comparison than would be used in the former case. The usual disadvantages encountered with using the direct approach is the neglect of interacting relationships. A site selected solely because it fits the needs of the EDP equipment may be so poorly suited for the users of the system that the overall system loses its designed effectiveness.

Site selection is especially suited for the use of modern management decision techniques. Following is a list of factors that should be considered in site selection.

1. *Land Costs* in the different geographic areas under consideration should be compared.
2. *Building Costs* in the different geographical areas under consideration should be compared.
3. *Insurance Costs* are affected by the type of building construction used and by the location of the site in relation to fire hazards and fire-fighting facilities.
4. *Zoning Regulations* may affect the planning of an installation and its anticipated future expansion.
5. *Existing Facilities* may be disrupted temporarily by installation of additional data processing equipment.
6. *Accessibility of Site* for delivery of equipment and supplies should be considered.

7. *Adequate Space* should be provided for efficient operation, and to allow for anticipated future expansion.
8. *Display Area* use of the data processing equipment may provide additional benefits.
9. *Rated Floor Loading* of each site being evaluated should be compared to the floor loading imposed by the data processing equipment.
10. *Electric Power* of proper quality and reliability is required for data processing equipment.
11. *Air Conditioning* may be needed to maintain specified environmental conditions. This requires an adequate water supply and a fresh air supply of good quality.
12. *Communications Facilities* are important to proper operation of data processing equipment. The possibility of future connection to remotely located sites should be considered.
13. *Human Factors* relating to easy access by employees to the site, pleasant working environment, and convenience to sundry eating and shopping establishments are important to hiring and retaining personnel.

Site Preparation

In site preparation, as in site selection, three predominant factors need to be considered–equipment, business, and people. Each of these factors will be discussed in detail in the succeeding paragraphs.

Flooring

When selecting flooring, it is well to become acquainted with some of the terms used in structural design. These include:

- DEAD LOAD of a building shall include the weight of the walls, permanent partitions, framing, floors, roofs and other permanent stationary construction entering into and becoming part of a building.
- LIVE LOAD includes all loads except dead and lateral loads.
- LATERAL LOADS are those applied to the surfaces of a building (usually wind forces).
- CONCENTRATED LOAD is a load applied at a point or upon a very small area.
- DISTRIBUTED LOAD is a load spread over a very large area.
- RATED FLOOR LOAD is an indication of the maximum uniformly distributed load that may be safely applied to a given area.

The most common type of flooring used in a data processing center is a free-access raised floor. Some of the major advantages of this type of floor are:

1. Power and control cables and piping can be run beneath the floor as required between units without obstructing movement within the area.
2. If the entire false floor can be made a plenum, air can reach the base of each unit for cooling.
3. A well constructed false floor can dampen vibrations and reduce the ambient noise level.
4. The modular false floor can be quickly removed to get at cabling and other fixtures.
5. The raised, modular floor provides for easier expansion of the system or for changing the equipment layout.

Equipment manufacturers will specify the loading characteristics of their equipment; then it will be up to the structural engineer to analyze the floor load rating and the total loads to be imposed upon the floor. Where it appears that expected loads will exceed the floor rating, he, of course, will have to redesign the flooring to support the load. If the building cannot be reinforced to support the expected loads, it may be necessary to relocate the EDP site or make some tradeoffs on equipment used. It has been suggested that elimination of nonsupporting partitions will usually reduce the dead load by 20 to 25 pounds per square foot.

Ceilings and Walls

Wall and ceiling construction are an important factor in noise reduction, air filtration and humidity control. The mechanical drive units of punches and printers may produce noise levels that are uncomfortable and distracting to operating personnel. The proper selection of ceiling tile and wall material can materially cut down this problem. For cleanliness and trouble-free operation of the equipment, ceiling, wall and even floor finishes should be dust and lint-free. Ceiling and wall finishes should resist chipping, chalking and flaking.

Lighting

Some terms in common use by lighting engineers will help in understanding the lighting problem. These terms include:

- ONE CANDLE POWER is defined as a uniform point source of light of one *international* candle.
- ONE FOOT CANDLE equals the light intensity at one foot distance from a uniform point source of light of one international candle.
- ONE LUMEN is the total amount of light on an area of one square foot that is lighted to a uniform intensity of one foot candle. One candle power produces approximately 12.6 lumens of light.
- LUMENS PER WATT is a measure of the efficiency of a light. For example, a typical 40 watt fluorescent light has an efficiency of 54 lumens per watt.

The proper amount of illumination (lumens) required over a specific surface (desk, console, etc.) to enable a person to be able to perform a given task can be obtained from various books and reports put out by the National Bureau of Standards and the Society for Better Vision. For general vision comfort, it is best to have a uniformly lighted area. However, Chapin ("Introduction to Automatic Data Processing", 1963) reports that a common problem around the central processor is the difficulty encountered in observing control indicators because of the overall high intensity of light from the overhead fixtures. He suggests two alternatives to reducing the problem: (1) to provide a high level of illumination elsewhere with a dimmer control for lights near the console; and (2) to provide a high level of illumination and a light shield over the console and test equipment. It is important to provide sufficient illumination when maintenance work is to be conducted on equipment. With separately controlled lighting over each major area, illumination can be raised or lowered as required without disturbing other parts of the operating area.

In selecting fluorescent or incandescent lights, the following facts should be kept in mind. Fluorescents will give more illumination over a wider area than an incandescent lamp watt for watt, but incandescent lamps are more efficient where spot lighting is preferred; such as for display purposes. Generally incandescent lamps in a data processing center will contribute almost twice as much heat as that produced by fluorescents; consequently, the air cooling system will have to be designed for a bigger load, thus adding some costs for the cooling systems.

Communications

Throughout the EDP department various types of communications systems are employed. (Communications here are related to personal communications between people, and not data communications for computer processing.) These communications can be divided into three categories: inter-office, general announcing and external. Intercoms and direct dial telephones are most commonly used in inter-office communications. Especially where offices are geographically spread apart or have restricted admittance due to security regulations, an intercom or direct dial phone is an economy measure. External communication facilities may take several different forms, but probably the most popular are telephones and teletype units.

Power Requirements

The following are some electrical engineering terms which the reader will find useful in understanding equipment power ratings and the design of the electrical system for supplying power for EDP equipment, general office and test equipment, and lighting:

- ALTERNATING CURRENT (AC) is current that fluctuates between a positive value and a negative value at a specific cyclic rate. The common rate for power in the United States is 60 cycles per second. In a large number of foreign countries 50 cycles per second is more common than 60.
- DIRECT CURRENT (DC) is current that does not fluctuate but maintains a constant level. DC is seldom transmitted over long distances because of high power losses.
- CURRENT is the power supplied to equipment and is measured in amperes.
- VOLTAGE is the measure of potential to provide a certain amount of current for a specified load. For a fixed impedance raise in voltage will cause a rise in current.
- KVA is voltage (V) times amperes (A) divided by 1000 and is a measure of total power available at the source.
- KW is kilo-watts or a measure of the useful portion of the KVA delivered.

  KW = KVA times PF (Power Factor)
- PF is power factor or a relationship of current-to-voltage phasing. When the load is resistive, the PF equals 1. When the load is resistive-reactive like a motor, the PF is less than 1.
- SINGLE PHASE VOLTAGE is supplied over two wires and the live voltage is measured between these wires.
- THREE PHASE VOLTAGE is supplied on three or four wires depending upon the intended use.

Generally the basic power system must satisfy the present and future needs of: (1) the EDP equipment; (2) the general office equipment; and (3) the lighting and support system (heating, air conditioning, etc.). It is also wise to consider an auxiliary power supply system, for in some data processing operations short duration shutdowns may be very costly. The electrical utility usually can provide power that satisfies the voltage and frequency requirements of the EDP equipment. In areas where this is not true, the user may have to furnish his own primary power source, motor-generator sets, or special power and frequency regulation equipment. When the user must supply special equipment to generate or regulate power, his installation and maintenance costs usually will rise.

Environmental Conditions

Under this general topic, the following elements will be discussed: acoustics, air conditioning and vibration.

Reduction of background noise is important to employee efficiency, and EAM equipment, because of its electromechanical construction, is a constant source of noise. There are generally two schemes for reducing the noise level: one is to reduce the noise at the source, and the other is to use sound isolation techniques. Although the former method is preferable, it is usually harder to accomplish because of the operational restrictions placed on the equipment. In the latter case, there are three approaches to sound isolation. These are: (1) relocate the noise source; (2) use sound-absorbing material for walls, ceilings and floors; and (3) place barriers between noise source and the listener.

Air conditioning can be defined as the simultaneous control of temperature, moisture content, movement and quality of the air in enclosed spaces. It is under this broad definition that the elements of air heating, cooling, filtration and humidity control will be discussed.

Because air conditioning requirements are so stringent for the equipment and may differ significantly from those for the personnel, dual air conditioning systems are usually used in offices and equipment areas of data processing centers wherever possible. Some terminology that is used in air conditioning design is presented here.

- BRITISH THERMAL UNIT (BTU) is the amount of heat required to raise the temperature of one pound of water one degree F. Also, 3413 BTU's are equivalent to one kilowatt hour of electrical energy.
- ION OF REFRIGERATION is the amount of cooling required to freeze one ton of water at 32 degrees F in 24 hours, also equivalent to cooling at the rate of 12,000 BTU's per hour.
- DRY BULB TEMPERATURE is the temperature of air as measured by an ordinary thermometer.
- WET BULB TEMPERATURE is the temperature of air as measured by an ordinary thermometer with a moistened sleeve over its bulb.
- PSYCHROMETRIC CHART shows the relationship between a number of factors that describe the condition of air. It is used by air conditioning engineers to perform calculations in the design of an air conditioning system.

Safety

In data processing centers, safety is more than just a matter of personnel safety; it also includes the protection of equipment, data records (forms, tapes and cards) and the site. Hazards to data records can be further broken down into three categories: (1) loss due to fire, (2) loss due to mishandling by personnel, and (3) loss due to theft.

Personnel training is one of the best methods for combatting carelessness and for insuring that corrective action is taken when emergencies do arise. Personnel should be trained in: the proper procedures for turning off electrical power; operation of fire fighting equipment; first-aid procedures; evacuation or securing of valuable records; and the quickest method of securing outside help.

Fire damage to equipment and data records represent an almost incalculable monetary loss. Not only is the replacement cost high, but the money, time and effort spent to put the equipment into operation, prepare and test programs and acquire data is almost a total loss. Although fire damage presents the greatest threat to data records, loss due to mishandling and theft should not be overlooked.

Mishandling of data tapes or cards and even original input forms can cause considerable costly rework, and equally bad mistakes may creep into the reprocessing phase.

c.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 6911: TESTING RESISTANCE TO PI

"There's a danger in having easy access to a computer." There was a slight complaining note in Claude Liffey's voice.

"What do you mean?", John Lawthorne asked.

"Some of my students do their homework on the Bivac and they end up with no real understanding of the work. Last week, for instance, I gave them the series S = 1/5 + 1/6 + 1/31 + 1/931 + . . . to sum. Some of the sharp operators wrote a program and ran it. They got .39999 as the answer and handed in S = .4, which was right, but it would have been better if they had applied some of the principles we had been studying. Then they'd be able to handle lots of other cases instead of writing a separate program for each one."

"Maybe what you ought to do is make up a problem that has a solution close to an integer, say 2.9999 and let these sharp ones work it out on the computer and jump to the conclusion that the answer is 3. When you mark them wrong they may realize there are more important things than getting a numerical answer."

"Great!" Claude was immediately enthusiastic. "Actually the correct answer doesn't have to be close to an integer. Suppose it's 3.1416, correct to four decimal places. I don't think any of them could resist giving π as the answer."

"Yes, but you might have a job finding a way to get 3.1416 without using one of the series for π or something similar."

"Well, let's see. I could make up a complicated problem which merely solved a quadratic equation in a very roundabout way. The students who let a computer do their homework would probably not analyze it enough to see this."

"O.K.", John said. "Now find the quadratic equation having a root as close as possible to π."

"You could get as close as you like if you make the coefficients large enough. I think I'll keep the coefficients less than 100."

What is the equation?

Solution to Problem 6910: Chronic Computeritis

The value of $(1 + i)^{46}$ could be obtained in only seven operations, for example, by calculating $(1 + i)^n$ for n = 1, 2, 3, 5, 10, 13, 23, 46.

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

The latter situation may increase processing costs. It may also hurt the center's business by tarnishing its reputation. Loss by theft, although not too common, may occur if the data is of value to competitors or foreign governments.

In order to insure maximum safeguarding of the data recordings, the following policies and procedures should be put into effect:

1. Only authorized personnel should handle the data records.
2. An enclosed, guarded area should be provided for filing the data records.
3. For very valuable data or irreplaceable data, duplicate tapes or cards, or tape and card files should be maintained at separate storage areas.

Appearance

The appearance of the data processing center is important for employee morale and for selling itself to potential customers.

Most all computer equipment rooms are provided with "showcase" windows for visitors to observe operations; this also helps to keep visitors from getting underfoot in the operations area. Many data centers that occupy street floors of office buildings make a big show of their data center by arranging special views for the general public passing by.

The impact of packaging is felt in the data processing service industry also, not only in the appearance of published reports but in the appearance of the actual site. In doing business in today's highly competitive world, image and reputation are very important.

Equipment Delivery and Installation

It is the buyer's responsibility to obtain all licenses and permits for setting up the data center. He is required to provide facilities for uncrating the equipment and internal movement of the units. Supplier engineers and technicians will be on-site to install and check out the EDP equipment and to assist in putting it into operation. All supporting systems, like air conditioning, electrical power and lighting, should have been approved and in good working order prior to the delivery of the EDP equipment.

Some areas that the buyer should plan for during the delivery and installation stage are:

1. Moving routes from supplier to site;
2. Traffic expected around site during delivery;
3. In-house work stoppages during delivery of equipment;
4. Operating status of elevators, loading ramps, etc;
5. Movement routes of equipment through the site, door and ceiling clearances and other obstacles;
6. Safety precautions for personnel and equipment. □

WORLDWIDE

REPORT FROM GREAT BRITAIN

Competition for the Superscale Market

To those in Britain who saw IBM's announcement of a System 360/195 as a serious threat to Control Data Corporation, the end-September counterblast from CDC in London must have come as a distinct surprise. Long before an equivalent IBM machine is available anywhere, CDC plans to have installed and running in Britain one of its superscale 7600 machines, possibly to be joined by a second before the end of 1971. At the same time, the company will back this extension of its Cybernet service with the setting up of a European support centre and a Control Data Institute for the training of computer staff able to handle the power of this giant machine.

The battle is on in Britain and other European countries for the top end of the market. Many interpret the International Computers decision (which preceded the CDC announcement) to the effect that it had dropped the original design of the 1908A and was altering its architecture, and extending the target date for about half a year to some time in 1972, as one graceful way of bowing out of the top sector of the market. This ICL denies, as it must. But there is no doubt that the two companies are firm allies, that they do a brisk trade in peripherals, and that they are sharing the research and development burden.

Political Effect

ICL maintains that it is still developing a superscale machine of its own, that it is in close contact with European countries on the design of a still larger machine for the 1980's, and that the planning of its next series is on schedule. It is thought that the company has made up its mind on the design of this new equipment and that it will be extensively compatible with the CDC series machines. This is not to say an even closer marriage than a "marriage de convenance" is in the offing. But an election next spring in Britain cannot be ruled out. Indeed, with the economic climate so much less bleak than it has been for three years, the Labour Government must make the best of a tough position.

It could fall, though most pundits think it would just scrape home. We might see a Tory Government. If previous Tory policies with regard to the data processing industry are anything to go by, it would be logical to expect withdrawal of Government support from the only British computer company, ICL, which then would have to seek a powerful ally in a harsh and hostile world. Who better than CDC? This is the way the reasoning is going, and no one is blaming ICL for hedging its bets.

It is too much to expect a smallish data processing company to stand up to IBM on home ground, while holding off the cut-price attacks of newcomers breaking into the market. It is particularly too much when, at the same time, the company is seeking to establish the ICL brand name overseas — that is not only in the Commonwealth under Imperial Preference, but also in Europe. ICL also is accountable to shareholders and has no other source of income than computing. Only CDC and Digital are in a similar position.

Private Enterprise vs. a Semi-State Organisation

At end-September too, the basis was laid of what could be a really rip-roaring controversy between private enterprise and a semi-state organisation. Readers may remember when the British Post Office (now a Corporation following the first change in status in hundreds of years) put proposals for its National Data Processing Service (NDPS) before Parliament. The private bureaux were up in arms since the Post Office had and still has the monopoly of data transmission lines, which raises a host of interesting possibilities. Recently, this NDPS undertook the big contract, on behalf of the British Airports Authority, to supply a comprehensive data processing service to all international airlines freighting into London with a real-time, on-line information network and close links into Customs and Excise. This should speed freight documentation out of all recognition.

Now this was a Government organisation scratching the back of a semi-official organisation which had ordered its equipment from a Government-aided organisation — ICL. But still more recently, NDPS has taken a big contract from the Trustee Savings Banks in North West England to provide an on-line teller service in a whole area from North Wales to the Scottish border covered by 170 branches. The rub comes when it is realised that the computer to be used as the central machine is one of the ICL 4-70's originally supplied for the Post Office GIRO, but not used because that system has got off to such a bad start.

The bureaux are annoyed because here was a plum contract that could have been handled by one of the larger units among them and won with the expenditure of public money. ICL is annoyed because it could have sold another machine. By and large the only people who come out of the deal with real satisfaction are the Olivetti people who are supplying about $4m worth of equipment and have now placed not far from $10m worth of banking teller terminals in Britain in about 18 months, beating Burroughs to a frazzle outside the main clearing banks. And still the question remains unsolved as to how the section of the Post Office which provides data transmission services makes a choice between private industry and NDPS, when there is competition for lines and modems, still a bottleneck in many areas.

(Please turn to page 52)

CALENDAR OF COMING EVENTS

Nov. 3-7, 1969: GUIDE International, Denver Hilton Hotel, Denver, Colorado; contact Jack Eggleston, GUIDE Secretary, Mgr., Programming R&D, Mutual of Omaha Insurance Co., P.O. Box 1298, Omaha, Nebraska 68101

Nov. 5-7, 1969: IEEE Northeast Electronics Research and Engineering Meeting (NEREM), War Memorial Auditorium and Sheraton Boston Hotel, Boston, Mass.; contact NEREM, 31 Channing St., Newton, Mass. 02158.

Nov. 10-11, 1969: Digitronics Users Assoc. (DUA), 4th Annual Conference, Barbizon-Plaza Hotel, New York City; contact Secretary, DUA, Box 113, Albertson, Long Island, New York, 11507

Nov. 13-14, 1969: Conference on the Legal Protection of Computer Programs (sponsored by the Law Group of the British Computer Society), Bedford Hotel, Brighton, England; contact Conference Dept. of The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England

Nov. 13-14, 1969: NCR Century System Users' Group Initial Meeting, Houston, Tex.; contact R. E. Davis, Automated Systems Corp., Houston, Tex. 77002

Nov. 15-16, 1969: ACUTE (Accountants Computer Users Technical Exchange), Jack Tar, San Francisco, Calif.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001

Nov. 17-19, 1969: IEEE Eighth Symposium on Adaptive Processes, The Pennsylvania State Univ., State College, Pa.; contact Dr. George J. McMurtry, Program Chairman IEEE 1969 (8th) Symposium on Adaptive Processes, Dept. of Electrical Engineering, The Pennsylvania State Univ., University Park, Pa. 16802

Nov. 18-20, 1969: Fall Joint Computer Conference, Convention Hall, Las Vegas, Nev.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645.

Nov. 19-21, 1969: 51st Annual Meeting of the American National Standards Institute, Statler Hilton Hotel, Detroit, Mich.; contact American National Standards Institute, 1430 Broadway, New York, N.Y. 10018

Nov. 20-21, 1969: Conference '69: 1969 Data Processing Conference sponsored by the Empire Div. (13) of the Data Processing Management Association (DPMA), Statler Hilton Hotel, New York, N.Y.; contact Registrar, Conference '69, P.O. Box 1926, Grand Central Station, New York, N.Y. 10017

Nov. 25-27, 1969: Digital Satellite Communication Conference, Savoy Place, London, England; contact IEE Joint Conference Secretariat, Savoy Place, London WC2, England.

Dec. 1-3, 1969: Conference on Image Storage and Transmission for Libraries, National Bureau of Standards, Gaithersburg, Md.; contact: Madeline M. Henderson, Center for Computer Sciences and Technology, National Bureau of Standards, Room B226-Instr., Washington, D.C. 20234

Dec. 8-10, 1969: Third Conference on Applications of Simulation, International Hotel, Los Angeles, Calif.; contact Arnold Ockene, General Chairman, Simulation Associates, Inc., 600 North Broadway, White Plains, N.Y. 1601

Dec. 18-20, 1969: Third International Symposium on Computer and Informational Science (COINS-69), Americana Hotel, Bal Harbour, Fla.; contact Dr. Julius T. Tou, COINS-69 Chairman, Graduate Research Professor, University of Florida, Gainesville, Fla. 32601.

Dec. 27-28, 1969: Annual Meeting of the Association for Symbolic Logic, Waldorf-Astoria Hotel, New York, N.Y.; contact: Prof. Jon Barwise, Program Chairman, Dept. of Mathematics, Yale University, New Haven, Conn. 06520

Jan. 14-16, 1970: Third Annual Simulation Symposium, Sheraton-Tampa Motor Hotel, Tampa, Fla.; contact: Annual Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601, 813-839-5201.

Jan. 14-16, 1970: 1970 International Conference on System Sciences (IEEE), Honolulu, Hawaii; contact: Dr. Richard H. Jones (HICSS), Information Sciences Program, 2565 The Mall, University of Hawaii, Honolulu, Hawaii 96822

Jan. 19-21, 1970: Computer Software & Peripherals Show & Conference, Eastern Region, New York Hilton, New York, N.Y.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Feb. 5-6, 1970: The 1970 AIIE (American Institute of Industrial Engineers) Systems Engineering Conference, Sheraton-Dayton Hotel, Dayton, Ohio; contact Technical Services Director AIIE, 345 East 47th Street, New York, N.Y. 10017.

Feb. 17-19, 1970: Computer Software & Peripherals Show & Conference, Midwest Region, Pick-Congress Hotel, Chicago, Ill.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Feb. 18-20, 1970: IEEE International Solid-State Circuits Conference, Sheraton Hotel, Philadelphia, Pa.; contact: Mr. L. D. Wechsler, Program Committee Secretary, General Electric Co., Electronics Park, Bldg. #3, Syracuse, N.Y. 13201

March 17-20, 1970: IEEE Management and Economics in the Electronics Industry Symposium, Appleton Tower, University of Edinburgh, Edinburgh, Scotland; contact Conference Secretariat, Institution of Electrical Engineers, Savoy Place, London, W.C.2, England.

March 23-25, 1970: INFO-EXPO-70, technical meeting sponsored by the Information Industry Association, Shoreham Hotel, Washington, D.C.; contact Paul G. Zurkowski, Information Industry Association, 1025 15th St. N.W., Washington, D.C. 20005

Apr. 2-3, 1970: First National Symposium on Industrial Robots, IIT Research Institute, Chicago, Ill.; contact Mr. Dennis W. Hanify, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

Apr. 7-9, 1970: Computer Software & Peripherals Show & Conference, Western Region, Anaheim Convention Center, Los Angeles, Calif.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Apr. 13-16, 1970: Computer Graphics International Symposium, Uxbridge, England; contact R. Elliot Green, Cg. 70, Exhibition Organiser, Brunel University, Uxbridge, Middlesex, England

Apr. 14-17, 1970: Conference on Automatic Test Systems (IEEE), Birmingham, Warwickshire, England; contact: Conference Registrar, The Institution of Electronic and Radio Engineers, 8-9, Bedford Square, London, WC1, England.

May 5-7, 1970: Spring Joint Computer Conference, Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645

May 25-27, 1970: Forum of Control Data Users (FOCUS) Annual Conference, St. Paul Hilton, St. Paul, Minn.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

June 15-16, 1970: Conference on Solid State in Industry, (IEEE), Statler-Hilton Hotel, Cleveland, Ohio; contact: A. J. Humphrey, Technical Program Chairman, The Reliance Electric & Engrg. Co., 24701 Euclid Ave., Cleveland, Ohio 44117

June 22-26, 1970: 11th Joint Automatic Control Conference, Georgia Institute of Technology, Atlanta, Ga.; contact ASME Headquarters, 345 E. 47th St., New York, N.Y. 10017

June 24-26, 1970: Annual Joint Automatic Control Conference (JACC), Georgia Tech, Atlanta, Ga.; contact: Prof. J. B. Lewis, Dept. of Electrical Engineering, Penn. State Univ., University Park, Penn. 16802

Aug. 24-28, 1970: IFIP World Conference on Computer Education, Amsterdam, Netherlands; contact: A. A. M. Veenhuis, Secretary-General, IFIP Conference Computer Education 1970, 6, Stadhouderskade Amsterdam 13, Netherlands

Aug. 31-Sept. 2, 1970: American Society of Civil Engineers, Fifth Conference on Electronic Computation, Purdue University, Lafayette, Ind.; contact Robert E. Fulton, Mail Stop 188-C Structures Research Division, NASA Langley Research Center, Hampton, Va. 23365

Sept. 1-3, 1970: 25th National Conference, Association for Computing Machinery, New York Hilton, New York, N.Y.; contact: Sam Matsa, ACM '70 General Chairman, IBM Corp., 410 E. 62nd St., New York, N.Y. 10021

Sept. 2-4, 1970: The Institution of Electrical Engineers (IEE) Conference on Man-Computer Interaction, UK National Physical Laboratory, Teddington, Middlesex, England; contact Roger Dence, IEE Press Office, Savoy Place, London WC2, England

Oct. 5-9, 1970: Computer 70 — International Computer Exhibition, Olympia, London, England; contact M. F. Webster, Leedex Limited, 100 Whitechapel Road, London, E.1., England

Oct. 26-28, 1970: Forum of Control Data Users (FOCUS) Regional Conference, Statler Hilton Hotel, Washington, D.C.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

Oct. 26-29, 1970: 25th Annual ISA Conference & Exhibit, Civic Center, Phila., Pa.; contact K. F. Fitch, Meetings Coordinator, Instrument Society of America, 530 William Penn Place, Pittsburgh, Pa. 15219

REPORT FROM GREAT BRITAIN

(Continued from page 50)

Corporate Computer Services — A New Idea

We began with a story of the superscale, but there is a small UK company which has only been in operation for six months that has put forward some ideas likely to have far-reaching influence. Corporate Computer Services was set up with backing from the giant Tate & Lyle sugar group. Its primary purpose was to provide a service not so far available in Britain to design, advise on, and even build the proper environment for computers. Anyone who has been to as many totally unsuitable premises housing equipment as I have will know there is a real need for such a service.

To this form of service, the company has already added proposals for the day-to-day maintenance of environments, general air conditioning, heating and ventilating systems, and maintenance on contract of electronics of all types.

The company has captured a Harvard Business School graduate from Canada, Reg Ferguson, and his ideas could make a good few hardware manufacturers and software houses in America sit up and blink. The first one is for a generalised language for the construction of management information systems. It is no small project and will take about 18 months to complete.

The company had originally thought of tapping the vast resources of its parent organisation for leasing operations but — and this is despite the fact that leasing did not really start in Britain till the early part of 1968 — it has decided that there are too many big fish in this pond already, all facing starvation once new IBM ranges are launched.

With its many homely but nonetheless essential facilities to back up really advanced work on information systems analysis, manpower management and computing economics advice, it should go far. The company managing director, Roger Tomlin, has already had to refuse business in North America because he cannot recruit fast enough.

Ted Schoeters
Stanmore, Middlesex
England

C.a

NUMBLES

NUMBER PUZZLES FOR NIMBLE MINDS —AND COMPUTERS

Neil Macdonald
Assistant Editor
Computers and Automation

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

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

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

NUMBLE 6911

```
        O N C E
      X     I S
      ---------
      F L S F W
    E E N N W
    -----------
  = E C N I T W          C I = S Y
+ N W C L A S A C
  ---------------
= N O T O F T E N
```

and

16382 33847 10960 388

Solution to Numble 6910

In Numble 6910 in the October issue, the digits 0 through 9 are represented by letters as follows:

H = 0	S = 5
L = 1	A = 6
W = 2	I = 7
T = 3	F = 8
E = 4	O = 9

The full message is: The least foolish is wise.

Our thanks to the following individuals for submitting their solutions to Numble 6910: Chester C. Criswell, Cleveland, Ohio; T. P. Finn, Indianapolis, Ind.; James B. Morris, Jr., Los Alamos, N. Mex.; D. F. Stevens, Berkeley, Calif.; Robert R. Weden, Edina, Minn.; and Ricky Wyner, Port Chester, N. Y.

People and Computers — Part 2*

The Right Honourable Lord Robens
Chairman, National Coal Board
Woldingham, PC, England

The fallacy of the prophets of the problem of leisure is not just that they envisage implausibly swift productivity increases. The real, and most revealing deficiency is that their sociological thinking is extremely shallow. It is now so many years since the end of the First World War: real earnings have almost trebled, yet hours of work have *not* dropped. We would, therefore, be totally unjustified in assuming, without any further argument, as they do, that people wish to take a significant proportion of increased wealth in the form of leisure. Rightly or wrongly, in our present society it seems proved that people would rather have a car than increased leisure, indeed a second car than increased leisure. This is what we see in the United States; are we to assume that human nature is going to reverse itself overnight?

No doubt at some level of wealth, people will be satisfied, but at what level?

Suppose we had been discussing this in Britain in the 1920's, and suppose we had been asked the question: 'A nation has the possibility of working 20 hours a week for three times our present income, or 40 hours for six times our income, which will it choose?' Surely we would have found it incredible that anyone would make the second choice?; yet that is just what the Americans have already done. They work just 40 hours a week, and their average income is about six times the level of income in Britain in the 1920's.

The cause is perhaps not far to seek. If we had the needs and desires of our Victorian ancestors, we would already be working a 20 hour week. But we have quite different demands; for cars, television, travel abroad. And there are solid reasons why the same pattern may continue. There are many great and dynamic firms, filled with imaginative and ambitious people, who depend for their success on thinking up new products to bring them in ever-increasing income. Glance through the pages of any American magazine, and you will be convinced of that. Certainly, many of these new products will be so-called 'leisure products', most consumer goods are. But they all require money to buy them, and in the meantime, all our old wants are still with us. If someone wants a colour television, it is not a matter of selling the second car, it is a matter of continuing to work those four hours' overtime that he had intended to stop now the children are growing up.

So, summing up my views on limitless abundance and limitless leisure, I would say that while at some date in the future they may come about, and no one welcomes the prospect more than I do, it is not a matter that need concern us greatly as yet. Those who threaten us with leisure, as so many computer prophets do, are guilty of distracting us from the really important things.

The real problem of leisure is nothing to do with the computer, it is the problem of the retired. Medicine is now giving people more leisure than computers, and this form of leisure poses real problems, not like the problems of what the young and fit will do with two weeks extra holiday. And these problems have another important difference from those of science fiction: they are with us *now*. The old-age pensioner could do with some of this limitless abundance.

But it would still be an error to brush off these prophecies. All of them contain a grain of truth, even though buried under a monstrous accumulation of distortion and publicity seeking. Indeed the tragedy is that these myths are self-defeating. The exaggeration is too gross: people gasp and nod the head while the TV programme continues; it even becomes part of the conventional wisdom. But such science fiction can never form a basis for action. Its only influence on the real world is to throw a mist of suspicion around the whole idea of technical progress, in which what is potentially a beneficent power for man to use at his choice becomes instead an obscurely threatening spectre. Prediction should direct our line of march; science fiction merely makes people drag their feet.

Massive Unemployment

Next, we have the second computer prophecy to examine; that computers will lead to massive unemployment. It is more important than the first; because it is more directly

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Dudley Hooper was a pioneer in the training of business users of computers. He was on the staff of the National Coal Board for nearly 20 years. He joined the staff of the Board in 1948, shortly after it was nationalized, as a technical specialist on the application of accounting machines. He was appointed Chief Organising Accountant of the Board in 1954, and served in that capacity until 1964 when he joined the Institute of Chartered Accountants as Technical Officer.

Dudley Hooper was one of the founders and the first chairman of the British Computer Society. He served the Society as a council member and on various committees for several years, and remained a member of the editorial board of the Society's publication, *The Computer Journal,* until his sudden death in January of 1968.

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*This is the second of a two-part article based on the 1969 Dudley Hooper Memorial Lecture given by Lord Robens at London University on January 28, 1969. Part 1 appeared in this column last month.

liable to cause resistance to the introduction of new methods. It is a particularly dangerous threat in Britain, because mass unemployment represents the greatest disaster that has struck this country in modern times. We do not have, as do so many Continental nations, memories of runaway inflation, of military defeat and pillage, of famine, of bitter civil strife: it is, however, natural that we should be haunted above all else, by the shadow of the 30's. Then, for every four men in work in Britain, there was one on the dole; and in Scotland and South Wales it was one man on the dole for three in work. It is this memory that causes governments to totter when we have one man on the dole for every 35 in work.

And I should point out that the lack of opposition to the introduction of computers may not last. Up till now, the people whose jobs have been changed or eliminated have been clerks, particularly women clerks. They are weakly organised, and in the case of the women often do not attach very great importance to their jobs. The fun will start when we try to computerise some of Clive Jenkins' members.

So we must be very thorough and honest in the way we discuss the threat of technological unemployment. We might start by pointing out that the *highest* unemployment percentage since the Second World War is still less than one third of the *lowest* percentage in the 20 years before that war. So if computers cause unemployment, it is a long while showing its head.

As the speed of technical change quickens, so skills grow obsolete more rapidly. Technical change demands a continuous re-grouping of the range of skills required. The kaleidoscope is being constantly re-jigged. Clearly as the technological effervescence of our time gathers momentum the need for retraining grows. Technological change can be coped with if it is firmly harnessed to an effective retraining programme.

But in my judgement we must recognise that technological unemployment does happen. It is clear that, although technology may put men out of work, it is not technology that *keeps* them there. The fault lies in the field of regional policy and retraining policy: there is no sign at all of unemployment due to technical advance becoming widespread or uncontrollable.

New Jobs Created

What I have said should not be taken as reason for complacency and inaction, still less for defeatism and Ludditism. I intend it simply as a way of concentrating attention on the real problems. The first point is that it is quite wrong to single out the computer as the danger. Any form of labour-saving in this respect from the railways or the power loom in their day, or the car or the aeroplane in this. But there are then the new jobs being created to service and construct these machines. All these must be counted too in the total sum.

Mentioning these other developments makes a further point; the new technologies will all employ many people themselves. I note that one of the major questions in the matter of the Third London Airport is where to put all the people dependent on it. The Town and Country Planning Association estimate that a new major airport will involve a community of one million people. The computer itself, often thought of as the ultimate in automation, employs tens of thousands already, at a time when we have hardly scratched the surface of its potential. Sixty per cent of the costs of a computer installation are the costs of people, and this percentage is increasing. This excludes the multitudes concerned with producing such things as the special stationery, the air conditioning equipment, the electricity and so on and so forth.

Let us then recognise that technological change, in which the application of the computer will play a major part, will make vast numbers of people require to change their jobs perhaps two, three or even four times in their working life. This should not worry us one iota. Knowing that this will happen we need to gear our educational system to making adequate provision for this and our social services to ensure that during the period of retraining incomes must not fall below their previous earnings. Trade unions will not have to insist that an apprentice must be from 15 years of age to 21, and that extensive short-term training can equally produce skilled workers. With a continuing affluent society the need for the production of consumer goods and services will continue to grow. More and more machines will be designed to take the physical labour out of working. More and more people will be engaged in designing machines and making them and what we must recognise is that less and less people will be required to man them. We must not say: 'There will be unemployment and change and trouble caused by the computer', but, 'How can we get the computer to work?'

Education

All this change has important repercussions for our system of education. Before change became built into our society, education could be clearly geared to a fixed order of life. Time did not change things and the teacher knew with some exactitude the sort of role that each pupil would have to play. In a static society ploughman follows ploughman, shepherd follows shepherd. But how much more difficult the teacher's task is today. A teacher trains virtually for the unknown: he has no idea what sort of society his pupils will move into ten, 20 or 40 years after they leave his class. Far less does he know what part they will be called upon to play. The most worthwhile attitude that the teacher can impart into this situation is broadmindedness, the ability to accept and cope with change. This is a priceless commodity indeed in this changing society.

But none of this will come overnight. Let us suppose that technical progress continues, but only at a similar rate to that of the past 20 years. Since that includes satellites, civil jet aircraft, containerisation, nuclear power, and the computer itself, this should be rapid enough for most of us. The point on which we should concentrate our minds is that any technical change which comes now, must involve changes in men's skills of a greater degree than previously known. We have now reached a stage when every technological advance increases the skill content of jobs. Mechanisation reduces physical effort and also reduces skill: the computer reduces, first, clerical work, then the more mundane control duties. The computer thus tends to increase the skill required.

This means that the average level of skill required would rise even without new inventions. The computer alone probably has potential to occupy us for the next 50 years or so. Even if the proportion of men changing their jobs remains the same, the number needing new skills will increase. A labourer who leaves one building site and goes to another has practically nothing to learn. A craftsman will find a greater number of new things to get to grips with: while a systems analyst or a manager, even though bringing with him much greater skills, also has much more to learn.

I have already said that our stale educational system should be so designed that the ability to learn new techniques and accept change, both mental and physical is easily acquired. Training is a specialised function requiring highly intelligent and expert people. Like so much else, it is best done in large establishments enjoying economies of size. While many great firms and public bodies should be prepared to train more than they need, we are not entitled to assume that they can satisfy the whole demand.

The Industrial Training Act already recognises this, and the dues which the training boards levy and the premiums they pay out are designed to balance this. It is clear that the training boards have an absolutely essential part to play in giving people the skills needed for security, satisfaction and material reward in their work, and in enabling full use to be made of our productive potential. They represent a radical innovation, which must be made to work.

But however successfully they do their job, they face certain important obstacles due to unavoidable defects in their structure. In the first place, a single training board covering the whole of an industry, as for example engineering, will have to deal with a tremendous variety of needs. In their labours to provide the bread and butter skills, they may find it difficult to devote attention to the training of certain types of expertise involving small numbers. This might be because the particular skill, though vital, can be spread very thinly, as with very specialised branches of law or engineering consultancy. Or, and most important of all, it might be because only a few firms recognised the need for a certain recently developed skill. Few firms have qualified sociologists on their payroll – yet it might well be that the successful implementation of computer systems would be speeded with their aid. We must look for imaginative and dynamic leadership from the Training Boards to cope with this.

In the second place, many skills are not specific to a particular industry.

Change as the Norm

Computing skills are probably the most conspicuous example, although there are many others, such as work study, accountancy, statistics, sociology. I would feel happier in my own mind if I knew of positive action being taken to ensure that these skills of general application were being generated in sufficient quantities. We do not need cumbersome and unrealistically detailed manpower planning, but a system whereby the requirements of industry at large are swiftly made known and acted on.

Training is too narrow a field to confine ourselves to. Perhaps the most vital single lesson we must try both to learn and to teach is that change is the norm. So often it is the very idea of change, any change that frightens people. So we should be gearing our whole educational system to equipping people to deal with change. This means, quite simply, that everyone must get out of education the sort of thing that only the luckier university graduate got in the past. Educationalists over the years have emphasised that education ought not to be the uncomprehending acquisition of narrow skills, but a free and flexible ability to deal with the challenges of life, whatever they might be. *This can no longer be just a Utopian ideal, it is a pressing necessity.* Once we have truly educated people, the changing skills in their particular jobs can be added as and when necessary, without difficulty, and without the heartrending tear that a radical change in work now often means.

It is worth mentioning, in turn, that computers are almost certain to influence education deeply. Mathematical and logical skills will be revolutionised by it, in much the same way as the printing press led to general literacy.

The reference to the common ground shared by computers with other aspects of industry is a healthy reminder.

The Uniqueness of the Computer

Too often people speak of the electronic computer as if it represented a complete break with other forms of technological advance. This is not true, and it can lead to the dangerous attitude that previous experience has nothing to teach us.

Do not misunderstand me: the computer is unique in a number of ways. The most important one is the range of activities to which it can be applied. Information is needed universally, for virtually every field of human action and thought. Information is power or, as Carlyle put it, when a man *kens*, he *can*. It is hardly possible to name a single activity which it could not revolutionise, from the housewife planning her shopping to the police waging war on crime. Second, the speed with which computer technology has advanced must surely be unique; and we are assured that we may expect equally stupefying advances in the future.

But in the context we are discussing this evening its uniqueness is questionable. Problems of change are broadly the same for the clerk as for the man on the shop floor. The wealth made available by the computer offers similar opportunities and problems to the wealth made available by more conventional mechanisation. Radical change is a very new idea to most of the service industries which the computer can revolutionise; but radical change is also a stranger to many sectors of manufacturing. The computer will not often have such startling effects as those of containerisation on the docks. Rolls Royce are one of the most brilliantly successful users of computers: and they ascribe much of their success to their managing computers in exactly the same way as they manage their engineering.

So we may say that while the scale of the changes which the computer brings will be unique, the lessons we have to learn and the action we have to take are probably not. Other fields can learn from us and can teach us.

The advance of computer technology is likely to pose some problems for computer people too. They are not immune, and we must give thought to their problems also. For example, the development of programming techniques is likely to make the ordinary programmer much less of a rare and precious being than he is today. We may yet see a strike of programmers against remote terminals, or do-it-yourself programming facilities for engineers, if we do not plan well. And if we are to end up with a computer grid, companies will have to abandon their pride in possession of their very own machines.

This is perhaps a little fanciful, but it does remind us that technical progress happens to us all. As every systems analyst knows, it is fatal to accept traditional barriers if we are to get the best from the computer: and this does not apply only to the organisational boundaries inside companies. The systems analyst will make a grave mistake if he believes that he is concerned only with information systems: he will do well also to analyse social systems, and *if necessary to call in the sociologist to help him.* The point about people and the computer is not that we must protect ourselves from it, but that we must work through people in order to make the computer serve us. The barriers to communication, between workers and managers, managers and computer staff, between the professions, must come down, and with them will come down the fear and ignorance that hold us back.

Visions and Common Sense

I would conclude by reminding you of the lessons I drew from Dudley Hooper's career: first, that as the *Proverbs of Solomon* puts it, where there is no vision the people perish; but, second, that visions are corrupting if they are not accompanied by the energy and the practical sense which alone can make them real; and, third, that it is the problems of people that we need the machine for, yet it is the problems of people that impede us. The computer is the most astonishingly powerful tool that man has ever created; the task before us is not to argue whether it will redeem us or destroy us, but to go out and take action to ensure it is put to good use, and swiftly, but without hurting people, the people in whose name alone we act. The computer, rightly used, can help in the long struggle to develop the potential in human beings; to reclaim the sunken areas of man's development and create a humane, just and caring society. This must surely be the objective we all of us grasp in our different ways. The computer has its part to play, but let us remember that at the end of the day only people matter.

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

LOCKS IN ST. LAWRENCE SEAWAY WATCHED BY SMALL COMPUTER

The St. Lawrence Seaway (which just celebrated its 10th anniversary) is a 2300-mile waterway connecting the Atlantic Ocean with the Great Lakes, opening ports along the lakes to the ships of all nations. A small, 75-pound digital computer is helping discover new ways of improving lock efficiency. The two locks being watched are the third and fourth in the seaway and help overcome the difference between the levels of Lake St. Louis and the Beauharnois Canal. They are operated 24 hours a day, seven days a week, during the navigation season.

The small computer, a Digital Equipment Corporation PDP-8/S, using information supplied by the traffic control personnel, can keep track of each ship passing through the locks and record its history while in the lock complex. The PDP-8/S logs data on lock operations and vessel performance, automatically recording times for the lock operating equipment and microwave radar equipment that senses the presence of each ship in the area of the locks. The information is then recorded on a high capacity computer at Cornwall, Ontario, for analysis and storage.

SICK AND INJURED ANIMALS RECEIVE COMPUTER-AID

The Animal Medical Center (New York), which accepts all breeds and species as patients, is using an IBM 1130 computing system to organize masses of veterinary medical data. The center, an 8-story building on Manhattan's East Side, carries on most of the activities usually associated with hospitals. These include an intern program, outpatient clinic, pharmacy, clinical laboratories, and surgery and x-ray facilities. All of this activity generates a wealth of scientific data of potential value to administrators, researchers, specialists, and students, which the computer is helping to organize and make more accessible.

Among the advantages is a better exchange of data with institutions dealing in human medicine. Through a computer coding system based on the International Classification of Diseases, the center can exchange data with numerous human hospitals using the same classification. This facilitates joint studies in the diagnosis and treatment of many ailments, including tumors, cataracts and heart disease.

The computer staff at the center also has developed a descriptive coding system which covers 19 species and over 200 breeds of animals — ranging from the Affenpinscher (canine) to the wallaby (marsupial). Data on each animal's sex, age and condition is coded into the computer on the initial visit. Standard coding forms have been designed to record results of laboratory tests for the computer.

Dr. Robert Tashjian, the center's director, foresees the computer as a useful tool for the private veterinarian. "For example," he said, "We might set up a central medical record for a number of veterinarians. With typewriter terminals in their offices, they could query the computer about a particular case or group of cases, and get back a complete medical history."

OCEAN MAPPING SYSTEM USES 27 COMPUTERS

A new computerized system for charting the world's oceans has been developed by the Navy Oceanographic Office. The system, scheduled for completion shortly, employs four classes of ships and two types of computers that will replace manual data gathering and chart preparation. The ships include five diesel-powered and two steam-powered research ships, and a variety of smaller sounding boats. A total of 27 computers will be employed to collect data and produce hydrographic maps. All computers are equipped with plotters so that charts can be prepared almost as the data for them is acquired.

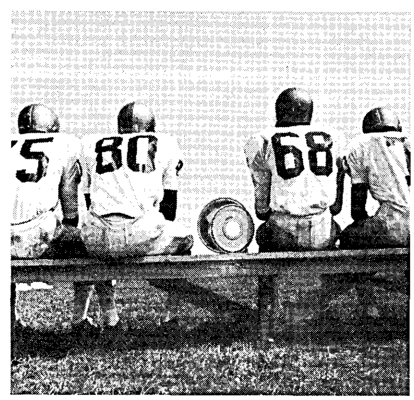
The large mother ships (ranging from slightly more than 200 to almost 400 feet in length) carry a crew of 44 and up to 30 scientists. These vessels will have a dual computer system made up of two Digital Equipment Corporation PDP-9 medium-scale machines. Each mother ship will operate with several sounding boats (plastic-hulled vessels 36 feet long). The smaller boats will have a small DEC PDP-8/L on board. Using the motherships' electronic navigation aids, the sounding boats operate with precise control over shallow uncharted waters, never venturing further than 50 miles from the mother ship.

Both the mother ships and the sounding boats will gather data. The computers can sample data at the rate of 2,000 samples a second. The PDP-8/L's will store it on magnetic tape which will be processed on the larger computers on the mother ships. The dual PDP-9's can gather and process simultaneously; one computer gathering data, the second analyzing it. The system also permits data to be stored for later or off-line analysis. The system will gather information on the sea floor, on the tides, currents and meteorological elements.

The ships for the system will be used on a continuing basis to develop new charts and update existing ones. They will be operated by the Navy's Military Sea Transportation Service which has responsibility for all waters outside the United States and its possessions. The charts are primarily for the Navy and American maritime interests. Additionally, the new system is expected to generate information that will be useful in planning harbor improvements, seaplane anchorages, and in silting, erosion and earth science studies.

KENT STATE UNIVERSITY'S COMPUTER WINS PLACE ON KENT'S FOOTBALL TEAM

Last year the Kent State University football team (the "Golden Flashes") won only one of 10 games for the worst record in the school's history. This fall, for the first time, the Kent, Ohio college is using its Burroughs B5500 computer system to determine tendencies of opponents, providing information to help them adjust defensive strategy and hopefully control opposition attacks. While such information has been available in the past, it was not as thorough and took much longer to compile. Using the B5500, the team will be able to devote more time studying the information, practically eliminating the time-consuming paperwork of the past.



— Magnetic tapes from a Burroughs B5500 computer add bench strength to Kent State University's football team

Chief engineer of the computer program at Kent State is Terry

Mallett, freshman football coach. Terry takes the statistics of each play and encodes them on magnetic tape. Statistics include the type of play, zone, yards and down, individual player, etc. The B5500 analyzes the information and prints out data showing the tendencies of the opposing team and its individual players. With the data, Kent players can get to know their opponents man-for-man.

Computer printouts show listings of all formations, total attempts of each, percentage used out of all formations, number of runs and passes, and types of runs and passes. The computer also gives a breakdown by down and distance of each formation for both passing and running plays off of that formation. It is conceivable that the B5500 will be adapted for use during games. Using special equipment, plays can be recorded and sent electronically to tape reels of the main computer on campus. Within a few minutes after the first half, information which now is taken from a film or scouting report, could be available for planning strategy for the second half.

RADIATION EFFECTS ON THE BODY BEING ANALYZED BY COMPUTER

Dr. Peter W. Neurath, director of the physics division of the Department of Therapeutic Radiology at New England Medical Center Hospitals (Boston) and assistant professor of Tufts Medical School, is using an IBM System/360 Model 30 to determine how much radiation a person can be exposed to without damage to the chromosomes. Chromosomes are threadlike bodies in cells and control an individual's heredity. Despite the extensive use of radioactive material by industry, science and the military, comparatively little is known about the cumulative effects of very small amounts of radiation on the body's chromosomes.

Badges worn by people working with radioactive material do not always reflect the radiation exposure, especially when it is directed at a particular segment of the body. Low levels of radiation, however, will always show up in the chromosomes — as a few abnormal chromosomes, maybe one in 100 cells, maybe three, depending on the amount of exposure. The advanced form of bio-medical pattern recognition employed by Dr. Neurath uses photomicrographs and an optical scanning device linked to a computer to measure a chromosome, usually isolated from white blood cells. The scanner measures the contour of the chromosome including its length, mass and the ratio of its short arms to total length.

Using a 35 mm photograph of a cell magnified 400 times, the scanner can measure the film density of 614,000 different points on each frame in a few seconds. The scanner transfers the most interesting of these points — which are like the dots in a newspaper photo — into the computer by measuring the dot's lightness or darkness. A report on the analyzed findings is then printed by the computer for review by the researcher.

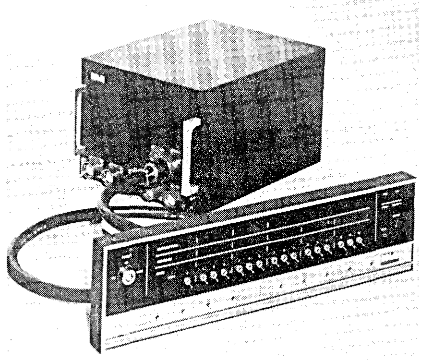
Dr. Neurath's work is funded mainly by the Atomic Energy Commission in an effort to develop an inexpensive method of detecting chromosome abnormalities. If an inexpensive method can be developed, it may be possible to monitor exposed populations while determining with greater accuracy how much radiation a person can absorb without genetic harm.

NEW PRODUCTS

Digital

MINI-COMPUTER, MODEL 1601 / Rolm Corp.

Working models of the new Rolm computer will be shown at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20 in Booths 7413 and 7414. Model 1601,



a 16-bit word general purpose digital mini-computer, is architecturally identical to the Nova manufactured by Data General Corporation, Southboro, Mass. All instructions, software and electrical I/O interface are identical to the Nova. However, the machine is smaller, weighs less and consumes less power than the commercial Nova. The Rolm computer is designed to meet the environmental requirements of Mil E-5400, Mil E-16400 and Mil I-6181.

The Model 1601 is a "go anywhere" severe environment computer which will be sold as an "off-the-shelf" item. The computer is packaged in a standard ATR box 7.61 x 10.25 x 12 inches. The box is designed to accommodate 14 rugged printed circuit modules plus the power supply. Five modules make up the central processing unit leaving the remaining nine for system options. (The machine also may be rack mounted.) In addition to the standard Nova options which may be used with the machine, Rolm has developed numerous additional options.
(For more information, circle #41 on the Reader Service Card.)

SIGMA 3 COMPUTER / Xerox Data Systems

Sigma 3, the fourth multi-use computer in the Sigma family, includes two multi-use operating systems, Real-Time Batch Monitor and Basic Control Monitor, each of which provides concurrent real-time foreground and batch background data processing capabilities; a third operating system, Stand-Alone, is primarily batch-oriented. The XDS Sigma 3 has a multiport core memory (expandable from 8,192 to 65,536 words); memory cycle time is 975 nanoseconds. An extensive selection of peripheral equipment also is available.

The combined hardware and software capabilities of the Sigma 3 permit it to be used for such varied applications as process control, biomedical and nuclear research, simulation, communications processing, and a variety of laboratory environments. Deliveries, with a full complement of field-tested software, are scheduled to begin in December. (Xerox Data Systems is the new name for the California-based firm which for eight years has been known as Scientific Data Systems.)
(For more information, circle #42 on the Reader Service Card.)

SYSTEMS 86 and SYSTEMS 88 COMPUTERS / Systems Engineering Laboratories

The new family of computers — SYSTEMS 86 and SYSTEMS 88 — represent a merger of the computing power found in traditional medium-scale computers and the real-time capabilities found in data acquisition, communication and control computers. The computers were designed specifically for real-time and general purpose scientific applications.

SYSTEMS 86 increases the speed of today's fastest medium-sized computers from 40 to 80 percent and at the same time reduces industry pricing levels for these computers 20 to 40 percent. SYSTEMS 86 is a 32-bit, 600-nanosecond computer. The average execution time is 1.2 microseconds. Real-time capabilities are designed into the input/output system, the interrupt structure, the task switching features, the control and test instruction set, and the data acquisition, control and communications elements available with the system. SYSTEMS 86 will be demonstrated for the first time at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.

SYSTEMS 88, intended for large system applications, includes the multi-programming and multi-usage applications of SYSTEMS 86 and extends these to multi-processing, using from two to four central processing units. SYSTEMS 88 with three central processing units and an input/output processor can execute 2½ million instructions per second.
(For more information, circle #43 on the Reader Service Card.)

META 4 COMPUTER SYSTEM / Digital Scientific Corp.

The META 4 is a flexible, logical processor controlled by a random access read-only memory (ROM). With a 90 nanosecond machine cycle instruction execution time, META 4 ROM selects specific operations of the arithmetic/Boolean and branch functions. ROM modifiers choose META 4 computer operations in addition to those picked by the basic instructions.

META 4 has been designed to emulate instruction sets from other computers such as the IBM 1130/1800 at several times their speed. It also is capable of serving as communications line controller, buffer, editor and preprocessor.

META 4 offers an alterable instruction set that can be tailored to the user's requirements, as well as easy field changeability permitting alteration of structure, repetoire or application. META 4 will be shown in Booths 19012-13 at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.
(For more information, circle #44 on the Reader Service Card.)

MINITS II / Jacobi Systems, Inc.

A small time-sharing computer system — MINITS II — permits 32 users (24 of them simultaneously) to communicate with the UNIVAC 1108 on a time-sharing and remote-entry basis. The 1108 can continue to operate in its normal modes under EXEC II and EXEC 8. Engineers and programmers can enter problems from Teletype terminals at their desks. The 1108 user can do program compiling and debugging on the small computer at a cost of approximately $2 per terminal hour instead of the considerably higher cost per equivalent hour of 1108 use.

MINITS II has a core storage of 32,768 (8-bit) bytes plus a 512,000 head per track disc memory. In addition, the mass storage of the UNIVAC 1108 is accessible to all MINITS II time-sharers. MINITS files can be extracted from 1108 storage, updated using the MINITS EDITOR, returned to storage or submitted to the 1108 jobstream for execution. MINITS will be operating in the Jacobi display (Booths 14001 and 2) at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.
(For more information, circle #45 on the Reader Service Card.)

IC-7000 COMPUTER / Standard Computer Corp.

Call-A-Computer (an independent time sharing company) and Standard Computer have spent two years developing the IC-7000 hardware and software simultaneously to assure maximum compatibility. The user-oriented fourth generation system is specifically designed for time sharing applications. With the Standard IC-7000 system's microprogramming capabilities, the outer functional elements (i.e., accumulators, registers, main memory, I/O devices) associated with conventional computers can easily be reformed, or problem adapted.

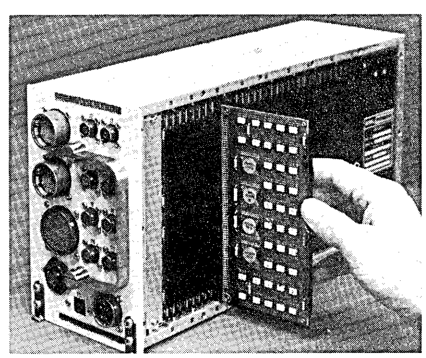
Standard Computer and Call-A-Computer designed instruction sets to (1) run the user's problem programs, and (2) regulate and control the time-sharing environment so as to maximize the throughput of the system. An arithmetic and language processor (ALP) was microprogrammed to handle compilations and program execution. A second instruction set, composed of "Directives", was designed for the Supervisory Processor Unit (SPU). The ALP and SPU operate in parallel and asynchronously out of main memory.

Cooperation between Standard and Call-A-Computer has an impact on the options that are available. Those who cannot initially justify an IC-7000 system for themselves can rent time on one — with no later software conversion problems — from Call-A-Computer. Anyone who can justify his own system can purchase the basic 65K (36 bit word) system,

or expanded systems for larger time-sharing users. A five year lease plan also is available.
(For more information, circle #46 on the Reader Service Card.)

ALPHA COMPUTER FAMILY / Control Data Corp.

Military users can tailor the new ALPHA computer family to their specific tactical needs. ALPHA computers feature compact size, integrated circuitry, high performance and modular design. A variety of central processors, destructive and



— ALPHA Central Processor with circuit card extended.

non-destructive readout memories, and input/output devices can be modified or expanded easily, thus enabling ALPHA to serve as a sensor signal processor and in such functions as command and control, communications, guidance and weapons delivery. The modular flexibility reduces the turn-around time now required for systems changes. Because of its compact design, ALPHA also can be used for airborne, shipboard or mobile communication systems.
(For more information, circle #47 on the Reader Service Card.)

Digital-Analog

AD/FIVE ANALOG/HYBRID COMPUTING SYSTEM / Applied Dynamics Inc.

The new 10-volt-reference analog/hybrid computer from Applied Dynamics will be introduced at this month's Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20. The AD/Five can be literally "married" to any commercially available digital computer to form a single hybrid system — and, when not serving as a multiple-console hybrid, the AD/Five can function as a stand-alone analog computer. Additionally, the AD/Five is a totally modular system that permits ease of expansion at a relatively low cost. Previous analog/hybrid computers have been modularized for certain components only.

While fulfilling the requirements of the advanced programmer, the AD/Five's "control-by-exception" technique also permits ready mastery by the relatively inexperienced user. Another feature of the new product is a reversible patchboard that can be rotated 180 degrees, to allow a single board to contain the patching for two distinct problems.
(For more information, circle #48 on the Reader Service Card.)

HYBRID COMPUTER SYSTEM / Hitachi, Ltd.

A hybrid system combining the capabilities of both analog and digital computers has been developed by Hitachi, Ltd. of Japan. The Hitachi system, largest of its kind in Japan, permits the use of any mix of three of their analog units with two digital units. Each of the five component computers also can be used independently. This new hybrid system has successfully completed a long sequence of tests at Hitachi's Central Research Laboratory and a similar system developed by Hitachi is in use at Tokyo University's Space and Aeronautics Institute in connection with rocket launchings.
(For more information, circle #49 on the Reader Service Card.)

Special Purpose Systems

DATACENTRAL SYSTEM / Computer Machinery Corp.

The low-cost computer communication system, known as the DataCentral System, is designed to collect data transmitted simultaneously from more than 50 incoming lines for recording onto a single reel of tape. The system can translate from transmission code to magnetic tape code, check for transmission errors and test for message validity before outputting onto tape.

The new CMC system interfaces with Data-Phone data sets or equivalent modems on either private wire or dial-up network service. Input is accepted from a variety of remote terminals which may be located across the street, across the country or around the world. The system is compatible with 100, 200 and 400 Series Data Sets.

The DataCentral System consists of a multiplexor, one or two computers, a monitor teletypewriter, a magnetic tape unit and the system's operating programs. Initial delivery is scheduled for the summer of 1970.
(For more information, circle #50 on the Reader Service Card.)

KEYTRAN DATA ENTRY SYSTEM / Systems Engineering Laboratories

KeyTran — a new data entry system — simultaneously enters information from up to 48 terminals onto a disc while under control of a sub-microsecond computer. The data is analyzed by a modified Systems 810B real-time computer system for either verification, editing, searching or outputting onto a master magnetic tape immediately ready for on-line processing by any conventional large-sized computer system.

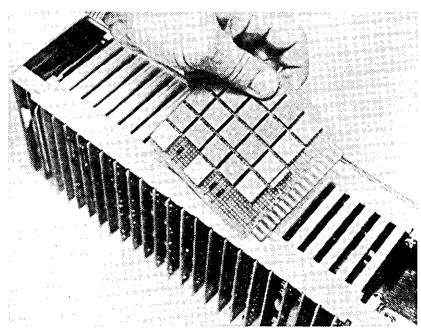
The KeyTran System includes full application software and a supervisor's console. The supervisor can communicate with each of the 48 keyboard terminals — without interrupting the flow of any information through the system — while coordinating the workload. KeyTran is designed for organizations that use eight or more keypunch stations for such applications as order entry, production and inventory control, payroll, billing, and insurance claims processing. Systems Engineering will demonstrate the new system at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.
(For more information, circle #51 on the Reader Service Card.)

Memories

MONOLITHIC MEMORY SYSTEMS / Cogar Corp.

Monolithic memory systems with access speeds of 40 nanoseconds and capacities to five million bits will be commercially available in early '70 — with a full five year warrenty against all defects and failure. The memories, products of Cogar Corporation's Technology Division, are complete subsystems — not components. Logic and memory functions are combined on a single semiconductor chip. The chips are mounted on standard dimension cards that plug into memory boards or gates.

The four inch-square monolithic memory system shown below has an access speed of 125 ns and a capacity of 512 words x 9 bits. It offers more than twenty times the density and ten times the performance of the 1.5 microsecond access ferrite memory below it.



The first members of the company's memory systems line are three performance classifications: high performance; medium performance; and cost performance memories. Each range includes compatible read/write and read-only memories.
(For more information, circle #52 on the Reader Service Card.)

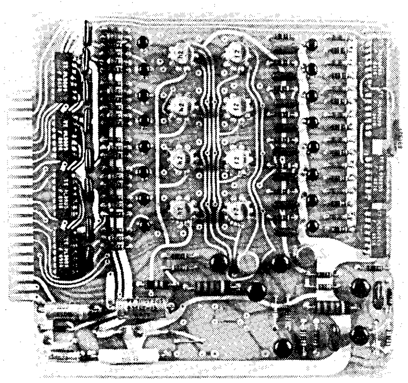
NANOMEMORY 2600 MEMORY SYSTEM / Electronic Memories

The NANOMEMORY 2600 is a fast, compact flexible core memory system. The new system has a full cycle time of only 600 nanoseconds, an access time of 300 nanoseconds, and plug-in modular IC packaging. Modules of a common type are directly in-

terchangeable, and no module selection or adjustments are necessary to ensure reliable performance over the entire operating temperature range. The compact design allows a wide range of storage capacities, 16,384 words by 18 bits or 8,192 words by 36 bits, to be accumulated in a single 19-inch rack approximately 7 inches high and 20 inches deep. NANOMEMORY 2600 will be introduced by Electronic Memories at the Fall Joint Computer Conference (Booths 301-304) in Las Vegas (Nevada), November 18-20.
(For more information, circle #53 on the Reader Service Card.)

SEQUENTIAL-ACCESS MEMORY SYSTEM / Cambridge Memories, Inc.

A semiconductor memory using MOS storage will be shown for the first time at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18. The sequential-access memory system, called the MOS-8S, is completely TTL interfaced, and stores up to 1,600 bits on a 5-3/4 by 5-3/4-inch plug-in card. The new



memory, designed to operate as a low-cost data formatting unit or line buffer at any speed up to one microsecond per character, is available in configurations ranging from 50 one-bit words up to 200 eight-bit words.
(For more information, circle #54 on the Reader Service Card.)

65K BYTE MASS CORE MEMORY / Interdata, Inc.

The 65K byte mass core memory, which will be introduced at the forthcoming Fall Joint Computer Conference in Las Vegas, November 18-20, employs a 16 or 18 bit 2-wire coincident current 2 1/2D system organized as a 32,768 word. Applications for the new memory will include information retrieval, real-time functions and communication systems.
(For more information, circle #55 on the Reader Service Card.)

READ-ONLY MEMORY SYSTEM / Memory Technology, Inc.

The Multiple Small Braid System (MSBS), a new family of Braid Transformer Read-Only Memories, stores up to 200,000 bits in one complete system. Word capacities range from 512 to 8192 words with 24 to 48 bits per word. The Multiple Small Braid System has an access time of 200 nanoseconds with a cycle time of 500 nanoseconds. The system is interface compatible with TTL and DTL and has a temperature range of 0 to +65°C. A Data Register with up to 66 bits and an Address Distribution Board are available as options. The MSBS system will be shown at the Fall Joint Computer Conference in Las Vegas, Nevada (Booths 4405 and 4406), November 18-20.
(For more information, circle #56 on the Reader Service Card.)

MAGNETIC CORE MEMORY / Datacraft Corp.

A high speed, 3 wire/3D magnetic core memory system, designated Model DC-22, has a full cycle time specification of 900 nanoseconds. Basic memory capacity is 8192 words x 20 bits/word or 4096 words x 40 bits/word. The DC-22, for use in computing and data-handling systems, requires no adjustments in the field. All parameters are permanently set at the factory to allow for the entire temperature operating range and for aging of components in the system. The device is enclosed in a 5¼ inch by 21 inch rack-mounted chassis with plug-in modular construction throughout including the core stacks and power supply.
(For more information, circle #57 on the Reader Service Card.)

3 WIRE, 3D MEMORY STACK / Electronic Memories

NANOSTAK NS-020, rugged enough for ground based military applications, yet priced for commercial use, has a 3-wire, 3-dimension organization with 22 mil cores, submicrosecond speeds, and word capacities from 4,096 to 16,384 of up to 40 bits. The new stack will be displayed in Booths 301-304 at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20. The NS-020 uses 2 diode/line decode, and is available with extended range and very wide range temperature cores.
(For more information, circle #58 on the Reader Service Card.)

Software

ALPS (Automated Library Processing Services) / System Development Corp., Santa Monica, Calif. / Designed to take over much of the clerical work involved in ordering, processing and cataloging books; system uses Library of Congress' machine readable catalog (MARC) data tapes. ALPS can be operated from libraries anywhere in U.S. using terminals hooked into SDC's Library Service Center.
(For more information, circle #59 on the Reader Service Card.)

ACCOUNTS RECEIVABLE SYSTEM / Delta Data Systems Inc., College Park, Md. / Designed for both private users and service bureaus, the System, consisting of 22 programs and sorts, is written in COBOL. A key feature is its ability to process both on an "open item" basis and a "balance forward" basis. Originally for the IBM 360/30, either in tape or disc configuration, it is 100 percent upward compatible on larger 360 configurations.
(For more information, circle #60 on the Reader Service Card.)

BLACKGOLD / Hub S. Ratliff, Houston, Texas / Aids the geophysicist in the interpretation of magnetic or gravity anomalies; designed for the RCA Spectra 70 series computer and is available in a version for Xerox Data Systems' Sigma series; only slight modifications to the program are necessary for other digital computers. This is the first in a series of geophysical programs.
(For more information, circle #61 on the Reader Service Card.)

CHAMP / Interface Systems, Inc., Ann Arbor, Mich. / Provides System 360 FORTRAN programmers with an efficient character manipulation capability. Functions performed by CHAMP include character to integer or floating point conversion, character comparison, and character movement — all without the usual word boundary limitations imposed by FORTRAN. Written in Assembly language, it is compatible with DOS FORTRAN, OS FORTRAN E, G, and H levels. Package consists of three control sections that load into 552 bytes of core memory. Object decks and user writeups of CHAMP and a demonstration program are available for $150.
(For more information, circle #62 on the Reader Service Card.)

CULPRIT (Cull and Print) / Cullinane Corp., Boston, Mass. / System retrieves and manipulates data and produces reports from existing data files; it features calculating and multi-line output capabilities. CULPRIT is written in BAL for the IBM System/360, DOS or OS, or the RCA Spectra 70. Output may be printer, punched cards, tape, or disk.
(For more information, circle #63 on the Reader Service Card.)

MACROGEN and MACROPRT / Macrodata, Inc., Union, N.J. / Two utility programs designed to assist the IBM 360/DOS user. MACROGEN provides the DOS user with a tool for modification of tape and disc files and for the creation of files of test data. MACROPRT provides the ability to call out and print any portion of a tape or disc file and is designed as a useful tool for the debugging of new programs. Both programs will operate on 2400 series Tape Drives, 2311 or 2314 Disc Drives and 2321 Data Cells. MACROGEN sells for $350.00, and MACROPRT for $250.00, including all necessary documentation and instruction manuals.
(For more information, circle #64 on the Reader Service Card.)

OS/200 SYSTEM / Honeywell Electronic Data Processing, Wellesley Hills, Mass. / A modular disk-oriented system designed to maximize performance through multiprogramming on medium-to-large Honeywell Series 200 computer systems; first version will be available later this year at no cost to Honeywell computer customers who have a Model 1200 or larger central processor with the required features and peripheral equipment.
(For more information, circle #65 on the Reader Service Card.)

SCOLDS (Spark Chamber On-Line Data System) / Digital Equipment Corp., Maynard, Mass. / Designed to increase the efficiency of physics experiments; system allows a user to add software modules for his specific information requirements. SCOLDS can control experiments and provide as much information during experiments as available memory will permit. It can be used with any PDP-15 or PDP-9 with a minimum configuration of 8,192 words of core memory, an oscilliscope, two magnetic tape transports and a tape control.
(For more information, circle #66 on the Reader Service Card.)

SCORE III / Programming Methods Inc., New York, N.Y. / Latest version of SCORE (Select, COpy, or REport) System. SCORE III expands the capabilities of SCORE II by permitting the COBOL source program created by the System to accept, and extract selected information from two input files in preparing reports, reformatting files, or in the many other uses of SCORE. SCORE is operational on IBM System/360 under DOS and OS, RCA Spectra 70, Honeywell 200, Univac 1108, and Burroughs B5500. The SCORE III System is available at a cost of $9,500 including installation, training, and first year's maintenance.
(For more information, circle #67 on the Reader Service Card.)

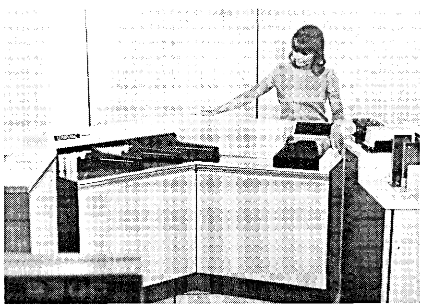
SPEEDBOL / Pioneer Data Sciences, Wilbraham, Mass. / A shorthand notation system for COBOL programmers which provides mnemonic abbreviations for the most frequently used COBOL reserved words. The system also permits the user the opportunity to abbreviate his own data and procedure names and to use and remember only those SPEEDBOL abbreviations he chooses. The complete system, including full documentation, consists of the abbreviated language and a processor to convert SPEEDBOL to COBOL. Total cost is $300. A demonstration deck (for an IBM System/360 under DOS, a 2540 card read punch and 1403 printer), which will analyze any COBOL source program, and a brochure, are available at no cost.
(For more information, circle #68 on the Reader Service Card.)

Peripheral Equipment

LOW-COST OPTICAL DOCUMENT READER / Sperry Rand Univac

A new low-cost optical document reader, known as the UNIVAC 2703, reads numbers, symbols, and marks on "turn-around" (return stub) documents which are widely used in such applications as utility bills, insurance premium notices, and retail customer billing. It functions as an on-line input device to a UNIVAC 9000 Series Computer which controls its operation and processes and stores the data derived from the documents.

Basic speed of the UNIVAC 2703 is 300 six-inch OCR (optical character recognition) documents per minute. Character reading speed is 1500 characters per second. The reader will scan documents from 3 to 8.75 inches long, and from 2.75 to 4.75 inches high. It recognizes numeric characters from zero to nine, plus special symbols, hand-printed vertical marks, or holes in punched cards. The machine is designed in a compact "L" shape, for easy access to machine input and output stations.



(For more information, circle #69 on the Reader Service Card.)

PORTABLE DATA TERMINAL / Technitrend, Inc.

This new terminal, to be shown for the first time at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20 (Booth 18003), operates on six ordinary batteries and weighs only 7½ pounds — including its attache carrying case. Desgined for use with computer-controlled voice response systems, the Portable Data Terminal converts an ordinary dial telephone into a remote input/output terminal.

To operate, the user places the telephone handset in the terminal's cradle, dials the computer, waits for an audible tone response, and depresses push-button keys to input messages to the computer. The spoken response from the computer is heard through the terminals' speaker.

Optional hard copy capabilities, specialized keyboards, packaging and other modifications are available to tailor the terminal to customer requirements.
(For more information, circle #70 on the Reader Service Card.)

DATA SORTER / Astrodata, Inc.

The new Electronic Data Sorter, designed to free digital computers (such as the IBM System/360) from the time consuming task of sorting, will be displayed for the first time at Booth 2600 at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20. The patented Data Sorter is an on-line device which stores data internally, sorts, and returns it on command to the computer. The Sorter requires no computer time other than that needed to place the data in the Sorter and remove it after the sort is completed. Capacity of the special purpose peripheral device is 65,536 words of approximately 40 bytes each. Data records up to 5,437 bytes in length may be stored.
(For more information, circle #71 on the Reader Service Card.)

TELEWRITER / Electronic Information Systems, Inc.

The Telewriter, a low cost input/output device for computers, is directly interchangeable with the Model KSR 33 Teletype. The use of solid state circuits results in a very low operating noise level; the only mechanics used in the Telewriter is that part of a typewriter necessary for key striking.

The printer input and the keyboard output is serial 8 bit ASCII code. The keyboard produces an even parity bit for error detection. The Telewriter operates at a speed of 10 operations/second (100 wpm). The printer provides 72 characters/line with 12 characters/inch in classic elite type. Telewriter uses standard ½" typewriter reversible ribbon with automatic ribbon reverse.
(For more information, circle #72 on the Reader Service Card.)

TELETYPE COMPATIBLE CRT COMPUTER DISPLAY TERMINAL / BEI (Beehive Electrotech, Inc.)

ALPHA 101 — an 800 character, Teletype compatible CRT computer display terminal — will be shown for the first time at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20, Booth 22015. ALPHA, a stand-alone, single-unit package, measures just 12-inches wide, 14-inches high and 20 inches deep. It weighs only 30 pounds.

ALPHA 101, a plug-for-plug replacement for a Teletype, has an adjustable internal clock, making it possible to transmit data at any synchronous rate up to 2400 baud. The 11-inch CRT can display 20 lines of 40 characters each. The standard terminal has a 64 character ASCII set, formed by an easy-to-read 5x7 matrix, plus functional controls for transmit, clear, 4-way curser direction, carriage return, repeat and print. A ten key numeric keyboard is optional.
(For more information, circle #73 on the Reader Service Card.)

DATA TRANSFER SYSTEM / Data Graphics Corp.

The DGC-300 Data Transfer System serves the needs of the data acquisition and data logging industries. The system has complete programming capability and contains all the controls necessary to record data, numbers, identification, and to activate the special features of various recording devices. Data is accepted in parallel from various digital output devices, stored in memory, decoded, and presented sequentially to the recorder.
(For more information, circle #74 on the Reader Service Card.)

KEYBOARD-TO-MAGNETIC TAPE RECORDING MACHINES / Burroughs Corp.

Burroughs Series N keyboard-to-magnetic tape machines permit recording of data directly from an alphanumeric keyboard to magnetic tape for entry into a computer.

Series N machines can be used with a variety of peripheral devices for collection of information on tape or for output of information from tape.

Three Series N models offering tape packing densities of 200, 556 or 800 bits per inch are available. Each operates with a continuous tape drive producing one-half-inch magnetic tape in the code sets required by Burroughs and other major computer manufacturers. Among the several options: seven or nine channel tape formats, record lengths up to 160 characters; check digit verification.
(For more information, circle #75 on the Reader Service Card.)

RANDOM DATA TELECOM TRANSMITS ANALOG SIGNALS BY PHONE / Baganoff Associates, Inc.

Transmission of analog signals, from source directly to computer, now can be accomplished over a conventional telephone with the new "Random Data Telecom" transmitter. The transmitter accommodates from 1 to 80 analog signals simultaneously with complexities from D.Z. to 20,000 Hz bandwidth — enabling analog data to be digitized, transmitted, analyzed by a computer and answers returned virtually immediately.

The portable device acoustically couples with any telephone at no additional cost over normal phone rates. Transmission errors are less than .05% for input levels from millivolts to 100 volts. System output is in the form of tabulation, plot, or digital tape according to the needs of the user. Among its many applications are noise and environment pollution, production control, bio-medical testing and remote seismic stations.
(For more information, circle #76 on the Reader Service Card.)

TERMINAL FOR REMOTE INPUT-OUTPUT / Honeywell EDP

The Series 2440 Remote Transmission Terminal is specifically designed for computer users that transmit large volumes of punched card data from a remote site to a centrally located computer and require as output, either printed reports or additional punched cards. The new terminal reads punched cards at the rate of 400 cards per minute, transmits data over standard communications lines at 250-300 characters per second, punches cards at the rate of 100-400 per minute and prints reports at the rate of 300 lines per minute. The Series 2440 terminal is available in four models that provide flexible input/output capabilities to meet a variety of user requirements in business, education and industry.
(For more information, circle #77 on the Reader Service Card.)

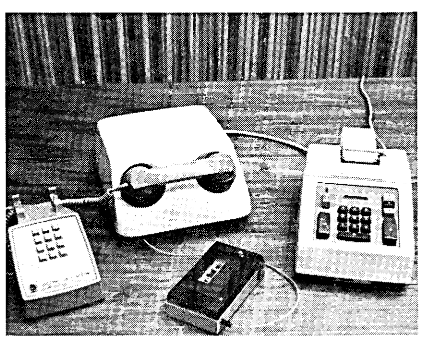
DOCUMENT READER, MDR-8000 / Motorola Instrumentation and Control Inc.

The latest reader in the Motorola series of Mark-Sense document readers, the MDR-8000, is now available. MDR data entry devices, besides reading punched data, read cards or page-size forms of varying sizes and shapes which are marked with an ordinary lead pencil. What separates the MDR-8000 from the other readers in the series is its ability to transmit information in parallel, in hard-wired applications. Documents can be read directly to magnetic or paper tape for subsequent entry into a computer at high speed. Or the information can be transmitted directly to a data processor.

The MDR-8000 reads the Hollerith input code. The 8-bit output code can be selected by the user from among USASCII alphanumeric, PTTC/BCD, and EBCDIC; the 12-bit output code is Hollerith.
(For more information, circle #78 on the Reader Service Card.)

ADDING MACHINE DATA ENTRY TERMINAL / Applied Peripheral Systems, Inc.

The new, low-cost DG 4 Adding Machine Data Entry Terminal utilizes a 10-key adding machine to enter data and produce hard copy. It is designed for entering, collecting and transmitting information for any application where numbers are the primary data. As entered, numbers are stored in memory, then recorded on a ¼-inch magnetic tape cassette. Data is transmitted using a self-contained acoustic coupler. ASCII-coded characters

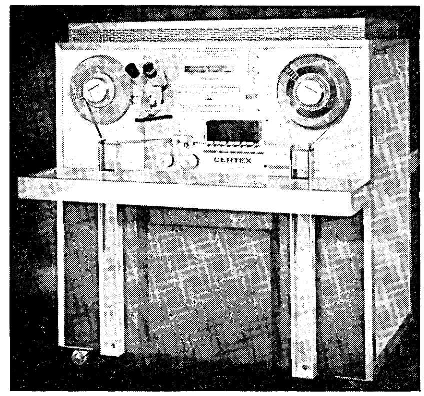


are transmitted in teletype format, at teletype speeds, using a standard telephone. The DG 4 Terminal is designed to fill the needs of accounting, inventory control or other areas of business where data is gathered from remote locations. The new DG 4 will be shown in Booth 6422 at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.
(For more information, circle #79 on the Reader Service Card.)

Data Processing Accessories

SYSTEM 99 TAPE CERTIFIER / Certex Corp.

The Certex Certifier performs 9 or 7 track noise certification, 9 track, 3200 FCI certification, 9 track, 800 BIT certification and 7 track, 800 BIT certification, all simultaneously. Stop time and operator fatigue are reduced by an automatic error removal technique.



Surface errors are removed by an electronically controlled scraper which functions only over the defective area. The Certex Certifier operates at a speed of 200 inches per second. This Certifier will be shown at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20 in Booths 6428 & 6429.
(For more information, circle #80 on the Reader Service Card.)

COMPUTER PERFORMANCE ANALYZER / Computer and Programming Analysis, Inc.

A low-cost, solid state computer performance analyzer, developed by CPA, gives any user of computers (large or small) the means to analyze the operation of their system accurately and economically, increasing its efficiency and reducing operating costs. The CPA Series 7700 Analyzer consists of modular units capable of monitoring up to 18 different computer functions without interfering with normal computer operations.

The diagnosis consists of counting, checking, measuring the time spent doing specific functions, time spent between functions and the number of times a function is done. Readouts are in digital form. Results obtained by the CPA Series 7700 Analyzer enable the computer user to increase the throughput of his system, reduce overhead costs, and evaluate system configurations.
(For more information, circle #81 on the Reader Service Card.)

11-HIGH DISC PACK TESTER / General Electric

General Electric's PT 1110 Disc Pack Tester enables verification of the acceptability of recording surfaces of IBM 2316 or comparable disc packs. The 11-high disc pack tester consists of a controller and one spindle. An optional dual spindle configuration (PT 1120) also is available in which each spindle may be used independently to double the throughput.

The system operates as a simulator furnishing signal inputs and the logic which provides a program capable of detecting marginal or error-defect tracks. The result is a test program and circuit design providing precise correlation to the flagged tract data currently used by industry. By critically qualifying the recording medium the product helps assure error-free performance from disc packs.

A General Electric Disc Pack Tester will be displayed at the Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20.
(For more information, circle #82 on the Reader Service Card.)

MAGNETIC TAPE CLEANER / Computer-Link Corp.

The C-LC Magnetic Tape Cleaner has been specifically designed to remove small dropout causing particles from both front and rear of the tape. Dual capstan construction completely isolates winding tension from the cleaning function, in both forward and reverse directions. The C-LC tape cleaner is a part of a complete tape maintenance program designed for 3rd and 4th generation magnetic tape.
(For more information, circle #83 on the Reader Service Card.)

COMPUTING/TIME-SHARING CENTERS

TIME BROKERS, INC. OPENS A TIME SHARING DEMONSTRATION CENTER IN NEW YORK

The recently opened "Walk-in Time-Sharing Democenter", first of a series, provides "retail" usage of a number of time-sharing terminals located at the Mid-Manhattan office of Time Brokers, Inc. The terminals are hooked up to a broad range of computer time-sharing services offering a multitude of programs and conversational computer languages. The company expects to attract large time-sharing users on an overload basis, and small users on a regular production basis. It has agreements with computer time-sharing companies throughout the United States allowing the use of their computers, and has a number of terminals, including Teletype and Datel, installed.

No reservations are required, thus explaining the name, "Walk-in Democenter". No contract is required, and usage can be charged or paid for in cash. Customers will be charged for each minute of terminal usage at prices ranging from twenty-five to fifty cents per minute, depending on the power of the individual time-sharing service used. The Democenter provides the terminals, pays for computer time, and supplies an instructor/consultant.

The new service plans also to operate in the evenings when students and programmers can use the terminals to learn new programming languages through interactive conversations with the time-sharing computers.
(For more information, circle #84 on the Reader Service Card.)

TIME SHARE CORPORATION ANNOUNCES NEW SERVICE FOR SCHOOLS AND COLLEGES

Schools and colleges now will have 24-hour a day access to computer facilities for a complete range of academic purposes. Richard T. Bueschel, president of Time Share Corp., Hanover, N.H., has announced a time sharing service specifically tailored to the needs of the academic market. The new service uses BASIC, the official academic language.

The company is planning to conduct regional seminars in its educational centers for teachers and administrators so they may make maximum utilization of the service. Time Share's new academic service will be made available first to schools and colleges in the Northeastern United States.
(For more information, circle #85 on the Reader Service Card.)

TOTAL DATA PROCESSING CENTER OPENED BY GRANITE MANAGEMENT SERVICES, INC.

A totally-integrated Master Computer Center has been opened in Los Angeles, Calif., by Granite Management Services, Inc., and is operated by Granite Data Services Corp., a subsidiary. The new center contains a computer time-sharing bureau; a computer school to train programmers and systems engineers; a software division to develop customized programs, as well as proprietary software packages for broad industry application; an equipment sales division for marketing unit record equipment, peripheral equipment for full scale systems and eventual distribution of new computer equipment; and a division specializing in the reconditioning and maintenance of computers for marketing.

The company plans to have "satellite" centers — each housing a service bureau, computer school and equipment sales division — in cities surrounding its master centers. The smaller units will also utilize the personnel, capabilities and facilities of the larger centers. The new Los Angeles center is the first of 12 Master and/or satellite centers scheduled to be opened within the next year. A total of 50 such centers is scheduled to begin operations in key cities across the United States in the next three years.
(For more information, circle #86 on the Reader Service Card.)

UCS VI, NEW COMPUTER SERVICE SYSTEM TO BE DEMONSTRATED AT FJCC

United Computing Systems, Inc. is demonstrating its new computer service system, UCS VI, for the first time at the 1969 Fall Joint Computer Conference in Las Vegas (Nevada), November 18-20. Multifunctional UCS VI is marked by two major elements: the vast central processor/storage capability of a CDC 6000 series computer and on-line availability in major cities for multiplexed time-sharing (toll-free) and remote batch processing.

The UCS National Datacenter, located in Kansas City, Mo., offers users a simultaneous National Database from Philadelphia to San Francisco, San Antonio to Chicago. Adjunct services include National Database applications, on-site batch processing, business and science applications programming, software development and systems design.
(For more information, circle #87 on the Reader Service Card.)

"TRIPLEX" COMPUTER COMPLEX BEING OPERATED BY COMPUTER TECHNOLOGY INC.

The $15-million "triplex" computer complex, being operated by Computer Technology Inc.'s Dallas, division, integrates, into a single system, three large-scale central computers, five smaller remote computers and more than 225 remote terminal units. Each week, the system can process some 4,000 remote-entry jobs while simultaneously handling more than 500 major business applications in a multi-programming time-sharing mode.

The "triplex" system's three-processor central complex combines two IBM Model 360/65 computers and a 360/75; they are linked on-line to four 360/20's and a 360/30. Its remote-access devices include more than 150 data collection terminals, 50 "conversational" programming terminals and 25 administrative terminals.

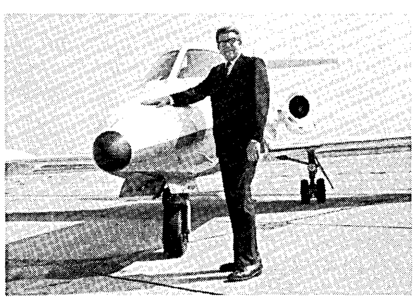
CT is currently using the "triplex" to provide computer management services for Ling-Temco-Vought, Inc., and all of its Dallas-based subsidiaries, and also providing data processing services for more than 60 non-LTV-affiliated customers in the southwest.
(For more information, circle #89 on the Reader Service Card.)

COMPUTER-RELATED SERVICES

EDP AIR TRAVEL FIRM OPENS OPERATIONS IN KANSAS CITY

Perhaps the first air reservation and scheduling firm to include commuter airlines and air taxi services has opened its doors for business. Compute Air-Tran Systems, Inc. (CATS) inaugurated its program October 1 in 15 states in the Central-Midwestern part of the United States, using more than 1,000 airports. The firm's system will encompass 10,000 American cities and communities and 500 commuter and air-taxi carriers — and within two years expects to be serving more than 4,000 airports across the entire nation.

CATS president, Charles E. Long, (shown in picture with one of the firm's contracted "air-taxis") explained the "simple yet complicated business he and his associates are setting up: "We are not



an airline and not a travel agency. We do not own any airplanes and have no plans to buy any. Our business is to bring together travelers and airplanes — anywhere, anytime. No matter where you are, no matter where you want to go, we will guarantee you an airplane within two hours."

CATS would not be possible without computer technology and the firm's EDP installation. The computers' memory bank contains an infinite number of airline routes, schedules, fares, aircraft inventory and instantaneously searches this data and processes each reservation request.

CATS' clients are furnished with the firm's "U-Write-N-Fly" tickets which are styled for computer operation and contain each traveler's account number. To schedule a flight — and receive confirmation — the traveler places a toll-free call to the Kansas City CATS computer-facility and states his travel requirements. The CATS reservationist processes the request, receives computer confirmation, relays to the traveler the air itinerary, times and dates — and the traveler fills in his own ticket before hanging up the telephone.

The traveler presents his CATS "U-Write-N-Fly" ticket at the boarding gate without any waiting. Necessary reservations, with all participating airlines, trunk carriers, or air-tran carriers, are placed by CATS. The traveler is billed later.

The CATS system of air reservations and scheduling has evolved after two years of planning. CATS "all-the-way-by-air" method provides effective and efficient utilization of privately-owned unscheduled aircraft. Mr. Long emphasized that CATS will book flights only on approved Air-Tran carriers (air-taxis, charter flights, commuter airlines) and only on federally inspected multi-engine aircraft. All Air-Tran carriers must be seasoned professionals rated for passenger transport.
(For more information, circle #90 on the Reader Service Card.)

COMPUTERIZED PAYROLL SERVICE FOR SMALL BUSINESSES OFFERED BY DATA POWER, INC.

Small and medium size companies (up to 500 employees) that have difficulty competing with larger computerized businesses, now are provided with computerized payroll services by Data Power, Inc., whose Manhattan Information Processing Center opened in mid-April. In offering computerized payroll, Data Power assumes the responsibility of a company's payroll, keeps records, and prepares file copies.

Information is furnished by the employer on pre-printed forms supplied by Data Power. Two working days later the employer has his checks. (If pressed for time, he can have same-day service.) Data Power also supplements computerized payroll service with hard-copy reports that back up management requirements. Data Power's price is $10.00 per payroll period for up to nineteen employees.

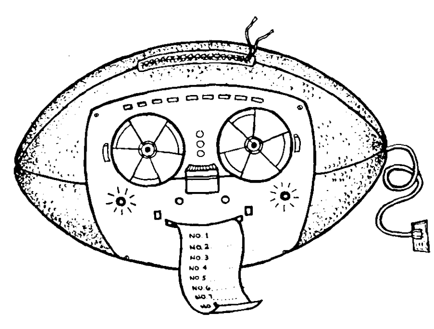
The firm plans to establish five more Centers in: Hartford, Conn.; Philadelphia, Pa.; Union, N.J.; Boston, Mass.; and Valley Stream, N.Y. From these first six Centers, Data Power District Managers will place additional, franchised Centers and expand services to include inventory and accounts receivable.
(For more information, circle #91 on the Reader Service Card.)

MISCELLANY

FLORIDA FIRM DESIGNATED AS "COMPUTER CONTROL CENTER" FOR JUNIOR SUPER BOWL

The Junior Super Bowl Committee (Miami, Florida), organized to present an annual football game for the "National High School Championship", has designated Digital Products Corporation of Ft. Lauderdale, Fla., the Bowl's "Computer Control Center." Funds generated by Bowl committee activities, will go to develop nation-wide educational programs which will be used to help teenagers suffering from drug abuse.

President of the non-profit Bowl corporation, Ray Smith, said the electronics manufacturing company will "play a series of games on computers to establish a Junior Super



Bowl ranking of the top 20 high school football teams in the country. It planned to release the rankings bi-weekly throughout the 1969 season.

The #1 and #2 teams will be invited to play for the "National Championship" in a real Junior Super Bowl in South Florida at end-of-season. Should circumstances prevent an actual meeting of the two top finishers, the play-off for the 1969 Junior Super Bowl Championship will be computerized.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Mycalex Corporation of America, Clifton, N.J.	Western Electric Co., Inc.	Memory planes to be used as a base to mount the logic circuitry for the Bell System's electronic switching system, designated #1 ESS	$9.7 million
Bull General Electric, Paris, France	l'Union des Assurances de Paris, France	Two GE-600 computers and related equipment the insurance industries' information processing system; nearly 10 million policies will be administered	$8 million
Univac Division of Sperry Rand Corp., Philadelphia, Pa.	U.S. Naval Oceanographic Office, Suitland, Md.	A UNIVAC 1108 computer system for data retrieval of information concerning contours of ocean floors, water temperature, pressure, and salinity of the world's oceans	$3.4 million
Librascope, Singer-General Precision, Inc., Glendale, Calif.	Department of the Navy	Automatic data recording equipment (the Librascope Data Gathering System - LDGS) to be used in weapon system accuracy trials	$3 million (approximate)
Auerbach Associates, Philadelphia, Pa.	U.S. Department of Labor	A three-year contract to evaluate the impact of the Work Incentive Program (WIN)	$1,150,398
Maxson Electronics Corp. (a Riker-Maxson subsidiary), Great River, N.Y.	U.S. Navy	The design and construction of electronic warfare trainers which provide intensive operator and team training in using and identifying typical radar and ECM signals	$1,313,000
TRW Inc., Software and Information Systems Division, Redondo Beach, Calif.	U.S. Air Force	Support of the Advanced Ballistic Reentry Systems Program (ABRES); calls for development and provision of a real-time guidance program, guidance equations, range and safety data, and flight support documentation	$1.1 million
Univac Division of Sperry Rand Corp., St. Paul, Minn.	U.S. Air Force, Rome Air Development Ctr., Griffiss AFB, Rome, N.Y.	Design, development and fabrication of a prototype solid state, random access mass-memory module; miniaturized memory unit will have a 72-bit word, and a capacity of 131,072 words; cycle time less than 10 ms	$934,580
Ampex Corporation, Culver City, Calif.	Hewlett-Packard Company	Magnetic core stacks which will be incorporated in main-frame core memories of Model 2116 B computers used in time-sharing systems	$900,000
COMNET (Computer Network Corp.), Washington, D.C.	ITC International Travel Corporation of Washington	An on-line computer reservations and invoicing system, including its development and operation over a three-year period	$400,000
Bucknell University, Lewisburg, Pa.	National Science Foundation	Improvement of computing services; grant will be used primarily to purhcase "hardware" for the computer center	$ 395,000
Computer Usage Co., Inc., Los Angeles, Calif.	Jet Propulsion Laboratories, Pasadena, Calif.	Designing, coding and implementing new business and management information applications	$357,000 (approximate)
P. G. Foret Inc., Sudbury, Mass.	General Services Administration, Washington, D.C.	EDP magnetic tape cleaners, which will be used for magnetic tape maintenance in government EDP installations worldwide	$356,212
Informatics Inc., Sherman Oaks, Calif.	Jet Propulsion Laboratories, Pasadena, Calif.	Continuing computer software support for the space program	$338,000
Sanders Associates, Inc., Nashua, N.H.	Defense Documentation Center (DDC), Washington, D.C.	A Microfiche Reproduction and Handling System to automate the annual distribution of over 2.3 million microfiche copies of technical and scientific documents	$265,530
Ampex Corporation, Culver City, Calif.	Data Products Corporation, Woodland Hills, Calif.	Model TMZ digital tape memories for use in off-line systems	$250,000 (approximate)
Tel-Tech Corporation, Silver Spring, Md.	Westinghouse Information Systems Laboroatory, Pittsburg, Pa.	Installation of over 30 of Tel-Tech's data communications multiplexers for Westinghouse's nationwide time-sharing network	$150,000+
System Automation Corp., Silver Spring, Md.	U.S. Army, Office of the Deputy Chief of Staff for Personnel	Design, development and installation of a management information system for manpower planning	$130,000
Information and Communication Applications, Inc. (ICA), Silver Spring, Md.	National Institutes of Health	Assisting the Program Analysis Branch, Chemotherapy, National Cancer Institute, in extending its clinical data processing system to include collection, storage and retrieval of additional items of data on patients under the care of the Leukemia Service of NCI	$70,000
Computer Data Systems, Inc., Silver Spring, Md.	U.S. Post Office Department	Assistance consisting of computer programming and technical documentation in support of the National Air and Surface Schemes Systems (NASS), a computerized scheduling and mail routing system	$20,000
Computer Sciences Corp., Los Angeles, Calif.	U.S. Geological Survey, Water Resources Division	Developing improved techniques for modeling and simulating groundwater flow systems to enable better conservation of underground water resources	—
California Blue Shield	E.D.S. Federal Corporation	Operating all of Blue Shield's computer functions — terms were not disclosed	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B3500 system	Argonaut Insurance Co., Menlo Park, Calif.	Handling the increasing accounting functions inherent with business growth (system valued at over $550,000)
	Hillcrest State Bank, Dallas, Texas	Savings, demand deposit, installment loan and other accounting operations for 7 Dallas-area banks (system valued at over $583,000)
Control Data 6400 system	Fluor Corp., Los Angeles, Calif.	Engineering and scientific data processing, as well as generation of reports for management control
Control Data 6600 system	Multiple Access General Computer Corp. (GCC), Toronto, Canada	Marketing of data processing services on a time-sharing and remote terminal basis; equipment includes CDC 6600 computer system with CDC 200 User Terminals, a CDC 3500 system with MATS/MASTER software and a variety of peripheral equipment (system valued at over $9 million)
Digital Equipment PDP-8/L	National Research Council, Applied Chemistry Div., Ottawa, Canada	On-line data acquisition in the study of nuclear magnetic moments
Digital Equipment PDP-10	Dataline Systems Ltd., Toronto, Ontario, Canada	Commercial time-sharing for scientific and design problem solving, accounting and accounting analysis, computer assisted instruction, and data banks for storing statistical and financial data
GE-115 system	District Grocery Stores, Inc., Washington, D.C.	Replacing tabulating equipment; applications include accounts receivable and payable, inventory, payroll, management reports, and stock status reports
GE-415 system	International Telephone and Telegraph, Semiconductor Div., West Palm Beach, Fla.	A variety of finance, marketing and manufacturing applications including extensive research and development work
	Republic National Bank, Dallas, Texas	Traditional major banking applications; is sixth GE-400 medium-scale system in bank's computer center
GE-635 system	Defense Intelligence Agency, Washington, D.C.	Local batch processing, remote batch processing and user-interactive time-sharing (system valued at almost $3 million)
Honeywell Model 110 system	City of Waltham, Mass.	Grade reporting, student accounting and scheduling in the school department; also city payroll, real estate tax billing, and water billing
	Harmony Dairy, Pittsburgh, Pa.	Accounts receivable, sales analysis, accounts payable, general ledger, production planning and route accounting
	Frank A. Serio & Sons, Inc., Baltimore, Md.	Daily invoicing, accounts receivable and inventory reporting
Honeywell Model 120 system	Confederation College of Applied Arts and Technology, Fort William, Ontario, Canada	A teaching tool, primarily; courses include an introduction to programming, and to data processing; Will also be used for some administrative tasks
Honeywell Model 200 system	South Texas Junior College, Houston, Texas	Instruction, primarily; some administrative use also
IBM System/360 Model 20	Yosemite Park and Curry Co., Yosemite National Park	Generating financial reports and dividend paychecks for its stockholders; also prepares weekly paychecks for its employees
IBM 1130 system	Wheeler Opera House, Aspen Chamber and Visitors Bureau, Aspen, Colo.	Computerized lodging-availability of about 15,000 sleeping accomodations in nearly 100 lodges and motels in the Aspen-Snowmass area
IBM 1800 system	University of Colorado Medical Center, Denver, Colo.	Directing and processing of blood tests
NCR Century 100 system	Fukui Vinyl Kogyo Co., Ltd., Fukui, Japan	Cost accounting, inventory and production control, payroll and other business and manufacturing tasks
	Hothman's Tobacco Co., Ltd., Napier, New Zealand	Inventory of leaf stocks, costing, invoicing and other applications
	Ocean Products, Inc., Dover, Fla.	Labor distribution, order billing, accounts receivable and payroll for about 700 employees
	Tijuana City Government, Tijuana, Mexico	A full range of data processing tasks
NCR Century 200 system	Banco Irquijo, Madrid, Spain	Handling some 17,000 accounts of various types
	Guardian Building Society, London, England	Mortgage and investment accounts
RCA Spectra 70/45 system	Owens-Illinois, Inc., Toledo, Ohio	Order entry and payroll, production scheduling, stock records, and inventory control; also for engineering and research projects
UNIVAC 1108 system	Det Norske Veritas, Oslo, Norway	Processing advanced scientific calculations involved in the Society's ship classification program, promotion of safety at sea, and in technical control and safety of materials and machinery used in ship construction; also a portion of computer's time will be made available for service bureau work to customers throughout Scandinavia (system valued at $2.3 million)
UNIVAC 9200 system	Interstate Milk Producers Cooperative Inc., Philadelphia, Pa.	Milk accounting, producer payroll, truck dispatching, label printing, producer patronage refunding
	Lombard Street, Inc., New York, N.Y.	General accounting, sales analysis and processing paperwork involved in sale and purchase of stock options

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

The following is a summary made by COMPUTERS AND AUTOMATION of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide. Please note the variation in dates and reliability of the information. Several important manufacturers refuse to give out, confirm, or comment on any figures.

Our census seeks to include all digital computers manufactured anywhere. We invite all manufacturers located anywhere to submit information for this census. We invite all our readers to submit information that would help make these figures as accurate and complete as possible.

Part I of the Monthly Computer Census contains reports for United States manufacturers. Part II contains reports for manufacturers outside of the United States. The two parts are published in alternate months.

The following abbreviations apply:

(A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND AUTOMATION
C -- figure is combined in a total
(D) -- acknowledgment is given to DP Focus, Marlboro, Mass., for their help in estimating many of these figures
E -- figure estimated by COMPUTERS AND AUTOMATION
(N) -- manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
(R) -- figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
(S) -- sale only, and sale (not rental) price is stated
X -- no longer in production
\- -- information not obtained at press time

SUMMARY AS OF OCTOBER 15, 1969

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part I. United States Manufacturers							
Autonetics	RECOMP II	11/58	2.5	30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III	6/61	1.5	6	0	6	X
Bailey Meter Co.	Bailey 756	2/65	60-400 (S)	17	-	-	3
Wickliffe, Ohio (R) (1/69)	Bailey 855	4/68	100.0 (S)	0	-	-	15
Bunker-Ramo Corp.	BR-130	10/61	2.0	160	-	-	X
Canoga Park, Calif.	BR-133	5/64	2.4	79	-	-	X
(A)	BR-230	8/63	2.7	15	-	-	X
(10/69)	BR-300	3/59	3.0	18	-	-	X
	BR-330	12/60	4.0	19	-	-	X
	BR-340	12/63	7.0	19	-	-	X
Burroughs	205	1/54	4.6	25-38	2	27-40	X
Detroit, Mich.	220	10/58	14.0	28-31	2	30-33	X
(N)	B100	8/64	2.8	90	13	103	X
(1/69-5/69)	B200	11/61	5.4	370-800	70	440-870	31
	B300	7/65	9.0	180-370	40	220-410	150
	B500	10/68	3.8	0	0	0	70
	B2500	2/67	5.0	52-57	12	64-69	117
	B3500	5/67	14.0	44	18	62	190
	B5500	3/63	23.5	65-74	7	72-81	8
	B6500	2/68	33.0	4	0	4	31
	B7500	4/69	44.0	0	0	0	13
	B8500	8/67	200.0	1	0	1	5
Control Data Corp.	G15	7/55	1.6	-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5	-	-	20	X
(N)	LGP-21	12/62	0.7	-	-	165	X
(2/69-4/69)	LGP-30	9/56	1.3	-	-	322	X
	RPC4000	1/61	1.9	-	-	75	X
	636/136/046 Series	-	-	-	-	29	-
	160/8090 Series	5/60	2.1-14.0	-	-	610	X
	924/924A	8/61	11.0	-	-	29	X
	1604/A/B	1/60	45.0	-	-	59	X
	1700	5/66	3.8	65-130	41-50	106-180	C
	3100/3150	5/64	10-16	68-90	15-20	83-110	C
	3200	5/64	13.0	40-45	15	55-60	C
	3300	9/65	20-28	38-100	17-25	55-125	C
	3400	11/64	18.0	12	4	16	C
	3500	8/68	25.0	1	0	1	C
	3600	6/23	52.0	30	9	39	C
	3800	2/66	53.0	18	2	20	C
	6400/6500	8/64	58.0	23-50	14-17	37-67	C
	6600	8/64	115.0	32-40	11	43-51	C
	6800	6/67	130.0	1	0	1	C
	7600	12/68	235.0	1	0	1	C
							Total: 160 E
Data General Corp. Boston, Mass. (A) (8/69)	NOVA	2/69	8.0 (S)	71	6	77	800
Datacraft Corp. Ft. Lauderdale, Fla. (A) (10/69)	DC6024	5/69	30-200 (S)	2	0	2	5
Digiac Corp.	Digiac 3080	12/64	19.5 (S)	12	-	-	2
Plainview, N.Y. (A) (10/69)	Digiac 3080C	10/67	25.0 (S)	4	-	-	1
Digital Equipment Corp.	PDP-1	11/60	3.4	50	2	52	X
Maynard, Mass.	PDP-4	8/62	1.7	40	5	45	X
(A)	PDP-5	9/63	0.9	90	10	100	X
(9/69)	PDP-6	10/64	10.0	18	3	21	X
	PDP-7	11/64	1.3	124	36	160	X
	PDP-8	4/65	0.5	945	378	1323	C
	PDP-8/I	3/68	0.4	940	293	1233	C
	PDP-8/S	9/66	0.3	575	269	844	C
	PDP-8/L	11/68	-	561	204	765	C
	PDP-9	12/66	1.1	262	115	377	C
	PDP-9/L	11/68	-	6	8	14	C

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Digital Equipment Corp. (cont'd)	PDP-10	12/67	8.0	76	21	97	C
	PDP-12	6/69	-	20	4	24	C
	LINC-8	9/66	-	108	40	148	C
							Total: 1200 E
Electronic Associates Inc.	640	4/67	1.2	60	17	77	10
Long Branch, N.J. (A) (10/69)	8400	7/65	12.0	19	6	25	2
EMR Computer	ADVANCE 6020	4/65	5.4	C	-	-	C
Minneapolis, Minn.	ADVANCE 6040	7/65	6.6	C	-	-	C
(N)	ADVANCE 6050	2/66	9.0	C	-	-	C
(10/69)	ADVANCE 6070	10/66	15.0	C	-	-	C
	EMR 6130	8/67	5.0	C	-	-	C
	EMR 6135	-	2.6	-	-	-	-
				Total: 90 E			Total: 30 E
General Electric	105A	6/69	1.3	-	-	-	-
Phoenix, Ariz.	105B	6/69	1.4	-	-	-	-
(N)	105RTS	7/69	1.2	-	-	-	-
(2/69-4/69)	115	4/66	2.2	200-400	420-680	620-1080	-
	120	-	2.9	-	-	-	-
	130	12/68	4.5	-	-	-	-
	205	6/64	2.9	11	0	11	-
	210	7/60	16.0	35	0	35	-
	215	9/63	6.0	15	1	16	-
	225	4/61	8.0	145	15	160	-
	235	4/64	12.0	60-100	17	77-117	-
	245	11/68	13.0	-	-	-	-
	255 T/S	10/67	17.0	-	-	-	-
	265 T/S	10/65	20.0	-	-	-	-
	275 T/S	11/68	23.0	-	-	-	-
	405	2/68	6.8	10-40	5	15-45	-
	410 T/S	11/69	11.0	-	-	-	-
	415	5/64	7.3	170-300	70-100	240-400	-
	420 T/S	6/67	23.0	-	-	-	-
	425	6/64	9.6	50-100	20-30	70-130	-
	430 T/S	6/69	17.0	-	-	-	-
	435	9/65	14.0	20	6	26	-
	440 T/S	7/69	25.0	-	-	-	-
	615	3/68	30.0	-	-	-	-
	625	4/65	41.0	23	3	26	-
	635	5/65	45.0	20-40	3	23-43	-
	645	7/66	90.0	4	0	4	-
Process Control Computers:	4020	2/67	5.0	113	38	151	53
(A)	4040	8/64	3.0	45	20	65	-
(10/69)	4050	12/66	7.0	22	1	23	-
	4060	6/65	8.5	18	2	20	-
Hewlett Packard	2114A	10/68	0.25	-	-	360	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	580	-
(A)	2116A	11/66	0.6	-	-	359	-
(10/69)	2116B	9/68	0.65	-	-	730	-
Honeywell	DDP-24	5/63	2.65	-	-	90	X
Computer Control Div.	DDP-116	4/65	0.9	-	-	250	-
Framingham, Mass.	DDP-124	3/66	2.2	-	-	90	-
(R)	DDP-224	3/65	3.5	-	-	60	-
(10/69)	DDP-316	-	-	-	-	-	-
	DDP-516	9/66	0.8	-	-	320	-
	H632	-	3.2	-	-	2	-
	H1648	-	-	-	-	-	-
Honeywell	H-110	8/68	2.5	10-20	2-5	12-25	0
EDP Div.	H-120	1/66	4.0	260-600	140-180	400-780	-
Wellesley Hills, Mass.	H-125	12/67	5.0	20-90	10-15	30-105	-
(N)	H-200	3/64	8.5	450-800	210-300	660-1100	-
(1/69-4/69)	H-400	12/61	6.2	32-40	14-30	46-70	X
	H-800	12/60	28.0	42-50	10-12	52-62	X
	H-1200	2/66	10.0	65-190	31-50	76-240	-
	H-1250	7/68	12.0	2-15	2-5	4-20	-
	H-1400	1/64	14.0	6	1-2	7-8	X
	H-1800	1/64	50.0	8-12	3	11-15	X
	H-2200	1/66	16.0-26.0	32-100	21-25	53-125	-
	H-3200	2/70	18.0	0	0	0	-
	H-4200	8/68	21.0-26.0	1-2	0	1-2	-
	H-8200	12/68	50.0	1	0	1	-
IBM	System 3	-	1.1	0	0	0	-
White Plains, N.Y.	305	12/57	3.6	40	15	55	-
(N) (D)	650	10/67	4.8	50	18	68	-
(1/69-5/69)	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	14	81	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	2	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7070, 2	3/60	27.0	10	3	13	
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-

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IBM (cont'd)	360/20	12/65	2.7	4690	3276	7966	-
	360/25	1/68	5.1	0	4	4	-
	360/30	5/65	10.3	5075	3144	8219	-
	360/40	4/65	19.0	1260	498	1758	-
	360/44	7/66	11.8	65	13	78	-
	360/50	8/65	29.1	480	109	589	-
	360/65	11/65	57.2	175	31	206	-
	360/67	10/66	133.8	9	4	13	-
	360/75	2/66	66.9	14	3	17	-
	360/85	-	150.3	0	0	0	-
	360/90	11/67	(S)	5	0	5	-
	360/195	-	232.0	-	-	-	-
Interdata	Model 2	7/68	0.25	-	-	16	2
Oceanport, N.J.	Model 3	3/67	0.4	-	-	163	52
(A) (10/69)	Model 4	8/68	0.6	-	-	80	57
NCR	304	1/60	14.0	15	2	17	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(R)	315	5/62	8.7	460	400	860	-
(9/69)	315 RMC	9/65	12.0	125	45	170	-
	390	5/61	1.9	240	500	740	-
	500	10/65	1.5	1700	950	2650	-
	Century 100	9/68	2.7	200	30	230	-
	Century 200	6/69	7.5	10	0	10	-
Pacific Data Systems Inc. Santa Ana, Calif. (N) (1/69)	PDS 1020	2/64	0.7	145	-	-	10
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	2000-210, 211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
Potter Instrument Co., Inc. Plainview, N.Y. (A) (10/69)	PC-9600	-	16.0 (S)	-	-	-	-
RCA	301	2/61	7.0	140-290	100-130	240-420	-
Cherry Hill, N.J.	501	6/59	14.0-18.0	22-50	1	23-51	-
(N)	601	11/62	14.0-35.0	2	0	2	-
(5/69)	3301	7/64	17.0-35.0	24-60	1-5	25-65	-
	Spectra 70/15	9/65	4.3	90-110	35-60	125-170	-
	Spectra 70/25	9/65	6.6	68-70	18-25	86-95	-
	Spectra 70/35	1/67	9.2	65-100	20-50	85-150	-
	Spectra 70/45	11/65	22.5	84-180	21-55	105-235	-
	Spectra 70/46	-	33.5	1	0	1	-
	Spectra 70/55	11/66	34.0	11	1	12	-
Raytheon	250	12/60	1.2	155	20	175	X
Santa Ana, Calif.	440	3/64	3.6	20	-	-	X
(A)	520	10/65	3.2	26	1	27	X
(10/69)	703	10/67	(S)	118	20	138	7
	706	5/69	(S)	8	2	10	25
Scientific Control Corp.	650	5/66	0.5	23	0	23	0
Dallas, Tex.	655	10/66	2.1	111	0	111	25
(A)	660	10/65	2.1	27	0	27	12
(10/69)	670	5/66	2.7	1	0	1	0
	4700	4/69	1.8	13	0	13	79
	6700	2/70	90.0	0	0	0	1
	DCT-132	5/69	0.7	23	0	23	509
	DCT-32	11/69	0.3	0	0	0	3
Scientific Data Systems (see Xerox Data Systems)							
Standard Computer Corp.	IC 4000	12/68	9.0	6	0	6	8 E
Los Angeles, Calif.	IC 6000	5/67	16.0	9	0	9	-
(N) (8/69)	IC 7000	6/69	17.0	3	0	3	10 E
Systems Engineering Laboratories	810	9/65	1.1	24	0	24	X
Ft. Lauderdale, Fla.	810A	8/66	0.9	135	2	137	30
(A)	810B	9/68	1.2	34	0	34	26
(6/69)	840	11/65	1.5	4	0	4	X
	840A	8/66	1.5	33	0	33	4
	840MP	1/68	2.0	20	0	20	11
UNIVAC (Div. of Sperry Rand)	I & II	3/51 & 11/57	25.0	23	-	-	X
New York, N.Y.	III	8/62	21.0	25	6	31	X
(R)	File Computers	8/56	15.0	13	-	-	X
(1/69-5/69)	Solid-State 80 I, II, 90,I,II, & Step	8/58	8.0	210	-	-	X
	418	6/63	11.0	76	36	112	20 E
	490 Series	12/61	30.0	75	11	86	35 E
	1004	2/63	1.9	1502	628	2130	20 E
	1005	4/66	2.4	637	299	936	90 E
	1050	9/63	8.5	138	62	200	10 E
	1100 Series (except 1107, 1108)	12/50	35.0	9	0	9	X
	1107	10/62	57.0	8	3	11	X
	1108	9/65	68.0	38	18	56	75 E
	9200	6/67	1.5	127	48	175	850 E
	9300	9/67	3.4	106	38	144	550 E
	9400	5/69	7.0	3	0	3	60 E
	LARC	5/60	135.0	2	0	2	-
Varian Data Machines	620	11/65	0.9	-	-	75	0
Newport Beach, Calif.	620i	6/67	0.5	-	-	750	350
(A) (10/69)	520i	10/68	-	-	-	60	230
Xerox Data Systems	SDS-92	4/65	1.5	10-60	2	12-62	-
El Segundo, Calif.	SDS-910	8/62	2.0	150-170	7-10	157-180	-
(N)	SDS-920	9/62	2.9	93-120	5-12	98-132	-
(2/69-4/69)	SDS-925	12/64	3.0	20	1	21	-
	SDS-930	6/64	3.4	159	14	173	-
	SDS-940	4/66	14.0	28-35	0	28-35	-
	SDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-

Books

(Continued from page 34)

Lazzaro, Victor, Editor, and 23 authors / Systems and Procedures: A Handbook for Business and Industry, 2nd edition / Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632 / 1968, hardbound, 528 pp., $14.60 (student's edition, $10.95)

This book is a handbook to bring together information on various systems and procedures techniques . . . into a single, comprehensive volume that can be used as a ready reference by readers desiring a general knowledge of the subject. The book is designed for students and staff personnel involved in the use of systems and procedures.

The eighteen chapters include: "The Systems and Procedures Department", "Systems Charting", "Work Measurement", "Forms Design and Control", "Budgets and Cost Control", "Electronics in Business" and "The Network System — PERT/CPM". There are two appendices; one is a case study; one is an outline for conducting and implementing a systems study.

Nolan, R. L. / Introduction to Computing Through the Basic Language / Holt, Rinehart & Winston, Inc., 383 Madison Ave., New York, N.Y. 10017 / 1969, paperback, 262 pp., $5.95

The purpose of this book is to acquaint the potential user with the capabilities of computing in BASIC, for solving many different problems. The BASIC language is explained for ordinary interested persons, not programmers. The ten chapters include "Introduction to BASIC", "BASIC Definitions", "Concept of a Computer: Computer Simulation Model", and "Computer Software". There are five appendices including "Techniques of Flowcharting" and "Introduction to Matrices and Mat Commands". There are also answers and solutions to problems, a bibliography, a glossary and an index.

Iliffe, J. K. / Basic Machine Principles / American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York, N.Y. 10017 / 1968, hardcover, 86 pp. $5.25

This short book is concerned with "the definition of a computer system from the programming point of view". "Its primary interest will be to logical designers and programmers who occupy themselves with the boundary between the "hard" and "soft" parts of a computer". The author created his own symbolic language called "Basic Language".

Its chapters are: "General Principles; Some Related Systems; Basic Machine; Basic Language; and Techniques." The book has one page of references; an appendix and tables, explaining Basic Language; and a two-page index.

The author is a member of the Advance Research and Development Division of International Computers and Tabulation Limited, Stevenage, Herts, England.

ADVERTISING INDEX

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

Allison Coupon Co., 206 S. Capitol Ave., Indianapolis, IN 46225 / Page 29 / Waldie and Briggs Inc.

APL-Manhattan, 254-6 West 31st St., New York, NY 10001 / Pages 64 and 76 / —

Academic Press, Inc., 111 Fifth Ave., New York, NY 10003 / Page 35 / Flamm Advertising

California Computer Products, Inc., 305 N. Muller St., Anaheim, CA 92803 / Page 23 / Carson/Roberts/ Inc.

COMPSO - Regional Computer Software and Peripherals Show, 37 W. 39th St., New York, NY 10018 / Page 12

DI/AN Controls, 944 Dorchester Ave., Boston, MA 02125 / Page 11 / Larcom-Randall

Houston Instrument, Div. of Bausch and Lomb, Inc., 4950 Terminal Ave., Bellaire, TX 77401 / Page 9 / Ray Cooley & Associates, Inc.

Interdata Inc., 2 Crescent Place, Oceanport, NJ 07757 / Page 2 / Thomas Leggett Associates

Keyboard Training, Inc., 292 Madison Ave., New York, NY 10017 / Page 3 / Nachman & Shaffran, Inc.

Lockheed-Georgia Co., Dept. 8211, 2363 Kingston Court S. E., Marietta, GA 30060 / Page 4 / McCann-Erickson, Inc.

Management Information Service, P. O. Box 252, Stony Point, NY 10980 / Page 63 / Nachman & Shaffran, Inc.

Metroprocessing Corporation of America, 64 Prospect St., White Plains, NY 10606 / Page 10 / Elmer L. Cline, Inc.

National Systems Corp., North American Institute of Systems & Procedures, 4401 Birch St., Newport Beach, CA 92660 / Page 61 / France, Free and Laub, Inc.

Path Computer Equipment, 20 Beckley Ave., Stamford, CT 06901 / Pages 6 and 7 / Nachman & Shaffran

Raytheon Computer Corp., 2700 S. Fairview St., Santa Ana, CA 92704 / Page 17 / Martin Wolfson

RCA, Information Systems Div., Cherry Hill, NJ 08034 / Page 75 / J. Walter Thompson Co.

Republic Software Products Inc., 715 Park Ave., East Orange, NJ 07017 / Page 27 / Nachman & Shaffran

Scan Graphics, 104 Lincoln Ave., Stamford, CT 06902 / Page 47 / Nachman & Shaffran, Inc.

Sycor Inc., 117 North First St., Ann Arbor, MI 48108 / Page 21 / R. W. Ferguson Advertising Agency

Xerox Data Systems, 701 S. Aviation Blvd., El Segundo, CA 90245 / Pages 38 and 39 / Doyle, Dane, Bernbach Inc.

The Octopeeper

RCA's Video Terminal. Our TV experience puts you eye to eye with Octoputer. It's your best view of remote computing.

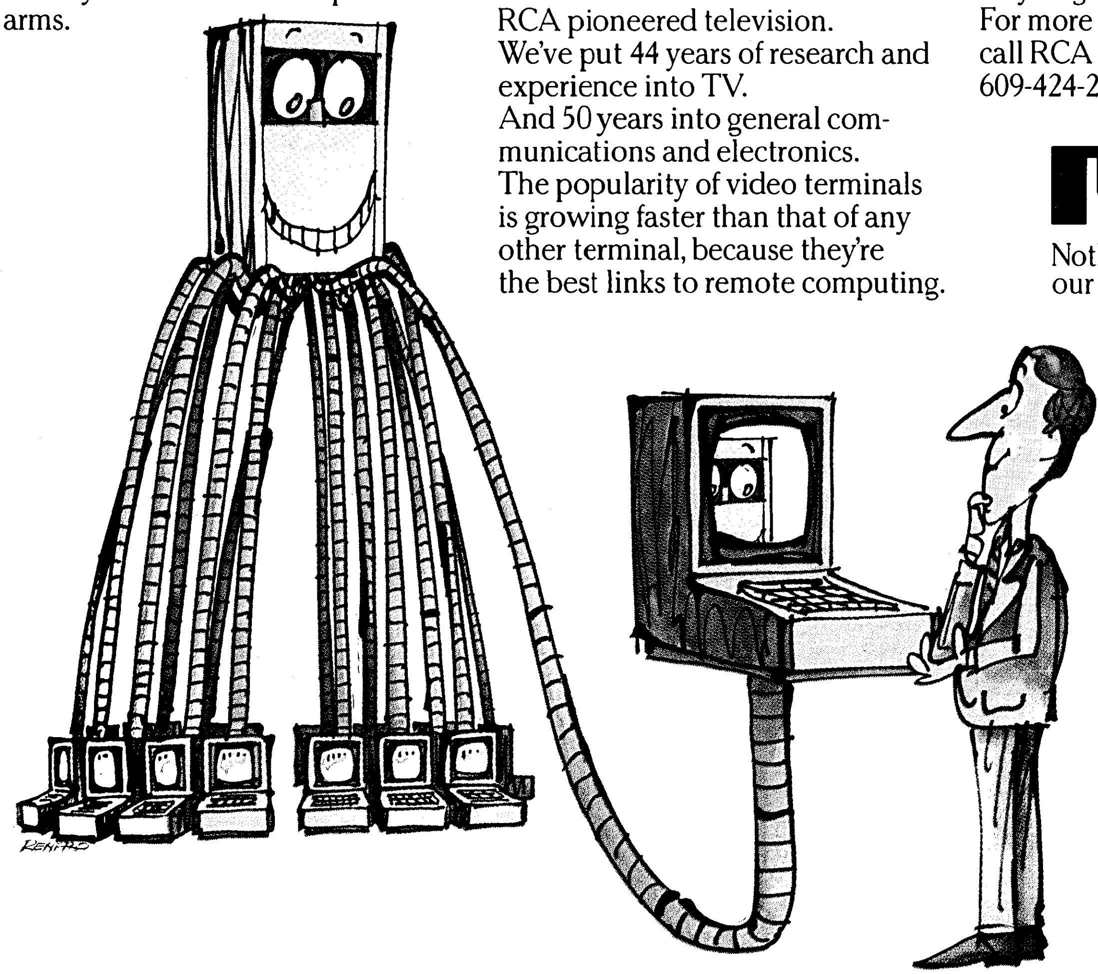
Remote computing is working with your computer from wherever you are to wherever it is.
It can be yards or miles away.
And hundreds of people can share it.
For those people, user terminals are hooked up to the remote computer.
There are all kinds of terminals, in all sizes and shapes.
But none of them sizes up to the terminal you see on the Octoputer's arms.

It's RCA's Video Terminal. The Octopeeper.
There's no better way to find facts, feed in facts, or solve problems.
It's like a combination TV and typewriter. You see what you type.
You see what the Octoputer says.
Instantly. Clearly. In bright letters on the screen.
The Octoputer's peeper is the best Video Terminal on the market.
It should be.
RCA pioneered television.
We've put 44 years of research and experience into TV.
And 50 years into general communications and electronics.
The popularity of video terminals is growing faster than that of any other terminal, because they're the best links to remote computing.

Remote computing is the coming thing in this business.
That's why RCA is concentrating on it.
We got there first because it's based on communications.
The Octoputer puts us a whole generation ahead of our major competitor.
It can put you ahead of yours.
And the Octopeeper is the best way to get to it.
For more Octopeeper information, call RCA Computers at 609-424-2385.

RCA

Nothing comes close to our remote computers



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