May, 1971

Vol. 20, No. 5

computers and automation

Computer-Controller Interface

IN THIS ISSUE:

Peter Denning joined ACM for technical information and contacts.

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Peter Denning, 29, is an Assistant Professor of Electrical Engineering at Princeton. He's also an ACM member and chairman of our committee on special interest groups and committees (SIGs/SICs). He wasn't always as active in ACM.

"I joined in 1965 while working on my thesis," says Peter. "Mainly for technical material and a chance to meet other computer professionals. In 1968, I was asked to edit the Operating Systems (SIGOPS) newsletter. I got involved and quickly

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Editor: Edmund C. Berkeley

For additional information see in the April issue the editorial on page 6 and the article pages 27-31.

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computers and automation

The magazine of the design, applications, and implications of information processing systems.

Computers, Science, and Assassinations

The Golden Trumpet

Computers and Puzzles

The Unemployed Computer Professional

Announcements

Front Cover Picture

The front cover shows some electronic circuit boards which form the "backbone" of computer-controlled automated warehouses and manufacturing plants. Such boards provide a link or interface between computers and the control systems which run materials through large factories and warehouses. The boards translate "slow" signals of 1/50 second from equipment into microsecond signals suitable for computers. The boards shown are from Cutler-Hammer Industrial Systems Division, Milwaukee, Wisc.

Departments

Key

[A] — Article
[C] — Monthly Column
[E] — Editorial
[F] — Readers' Forum
[G] — The Golden Trumpet
[N] — Notice

C.a EDITORIAL

How an Unemployed Computer Professional Might Start His Own Business and Earn a Reasonable Income as His Own Employer

It seems to me that many an unemployed computer professional could, if he wished, start his own business, and after a period of something like two to six months earn a reasonable income as his own employer.

He might thus attain the pleasant state of NEVER AGAIN being able to be fired. He might even ask himself "If I could work at whatever I wanted, what would I do?" And he might choose work which is closely in accordance with his deepest desires.

Important qualifications are needed however in order for that first statement above to be true:

- Not all unemployed computer professionals, only some, could do this (the others probably should not try);
- The usual entrepreneurial requirements (common sense, perseverance, keen observation, honesty, caution, shrewdness, etc.) must be met;
- Good business practices must be learned and followed (the median life of a small business is, I understand, about five years);
- In the early stages, both hard work and continual close attention, usually for over 60 hours a week, will be necessary;
- The choice of products and services to be offered is a critical question that has to be solved well; etc.

Contrary to what many people may think, "ample financing" at the start of a new business – for example, enough money to rent an office, buy furniture, and hire several people for several months before obtaining any sales – is I think not usually desirable. To be able to do this with other people's money (investors' money, for example) has a tendency to encourage wasteful and economically unsound business operation. Bad habits for both persons and businesses are hard to change: it is better not to acquire them.

But the large number of successful small businesses (carpenter, gift shop, salesman, copying service, electrician, shoe repair, record and music shop, real estate office, . . .) reveals how common are the qualities of the entrepreneur, the businessman. Even in a socialist country like the Soviet Union, the one-man business with no employees is a legal activity. Note that extensive formal education is often unnecessary.

The computer profession like a computer itself has much input and much output. Many computer professionals have come into the computer field directly from other fields and without much specialized education. They have previously been in fields such as education, or management, or mathematics, or electrical engineering, or systems design. Similarly, a great many computer professionals may, and will, leave the field for other occupations such as manager, engineer, administrator, lawyer, or entrepreneur. This editorial is a plug for becoming an entrepreneur.

In fact there is little reason why many computer professionals need continue to be computer professionals. It does not require seven years of specialized education to learn to be a computer professional – as it does to become a medical doctor. At least some persons with talent can become adequate computer professionals in about two months of assiduous learning and some practice on a computer. And, for many people, a computer or data processor is not hard to understand – not much harder to understand than a machine that will knit socks, or a machine that will weave a pattern in cloth.

If a computer person decides to change his main occupation to entrepreneur, what should he produce or offer for sale?

There are a great many products and services which consumers want, probably more than a million kinds. There are a great many varieties of manufacturing and service organizations which produce these products and services, from those which consist of one man and almost no capital equipment to those which consist of thousands of persons and tens of millions of dollars worth of capital equipment.

However, it is not true that all the competitive advantages lie with the big organization. Many kinds of laws such as Parkinson's Law, the Peter Principle, etc., work to the disadvantage of the big organization. And the big organization which may be effective in year N may be almost the opposite in year N plus 3 – after some key people have left or retired or other changes have occurred: witness the Penn Central.

In regard to products or services in the computer field, I have noticed at least three items which could have a large market. Also, so far as I know, nobody at present provides them. These are: (1) a negative line feed (i.e., a line rollback) on typewriter-like keyboard output from a computer (such as a teletype); (2) a non-standard typing keyboard (such as the Dvorak keyboard) which could save 30% to 50% of human time inputting information into a computer; and (3) methods of computer-assisted documentation of computer programs, which I believe could rescue upwards of a billion dollars worth of computer programs for which effective documentation is almost nonexistent.

Outside of the computer field, I have noticed several dozen products and services which it seems to me that many consumers would eagerly buy if the price were reasonable. One example is an electric clock with a nonbreakable plastic case. This would avoid the usual built-in obsolescence of the usual electric alarm clock, which breaks

(Continued on next page)

c.a

READERS' FORUM

WHY THE PUBLIC DISLIKES COMPUTERS

Leroy Pope
From "The News"
Framingham-Natick, Mass.
Jan. 8, 1971

A bachelor, leaving a hospital, is handed a bill for delivery of a baby.

A New Yorker keeps getting bills from the Motor Vehicle Violation Bureau for a parking ticket he paid three months ago, and each month the fine goes up $5.

An accountant loses his checkbook and the bank advises changing his account number. Within three weeks, the bank refuses to honor instructions to make automatic monthly accounts from either the old account number or the new one!

Another bank sends a statement to a depositor informing him cheerfully it has paid all his monthly bills – and has credited his account with the total instead of deducting it!

Literally thousands of persons across the country are infuriated and confused each month by such mistakes apparently made by computers. Credit card and other billing mistakes cause the most anguish.

"Others are terribly annoyed because they constantly see the computer as an invader of privacy that knows more about you than you want anyone to know," says Felix Kaufman, partner in the accounting firm of Lybrand, Ross Bros. & Montgomery.

"But the real reason so many people hate computers is that they are the first machines in history to really move in on our intellectual and emotional lives," Kaufman said.

"The computer can't think and certainly can't feel. Yet it gets involved in both intellectual and emotional decision making – such as casting horoscopes and computerized dating services," he explained.

An insurance company cancels a motorist's liability policy on the basis of a computer "throwout." Of course this is a human decision by an executive to throw out all of a certain class of policyholders. "But the computer gets the blame, and, in a sense, justly so," said Kaufman. "If the company didn't have all its policy data stored in a computer executives would have to hunt up and weigh every case individually before cancelling."

The computer thus becomes, in the public mind, either a Machiavellian intelligence or a colossal blunderer. It is neither, it is a slave that does exactly what it is told to do at amazing speed.

Nearly all so-called computer errors are human errors. A few are machine errors, mistakes of peripheral reading and printing machines not the computer itself.

Take the bachelor startled at being handed a bill for having a baby. Two human errors were involved. The key puncher transposed the code number for his minor operation into the code number for a baby case.

"But the programmer made the original mistake. He forgot to program an automatic red light in case an obstetrical or gynecological charge turned up for a male patient," said Kaufman.

People started hating computers when the banks began using numbers instead of names to control checking accounts. Women in particular resented it, according to Kaufman.

The bright ray in the computer cloud is the act of programming. While relatively young and error prone, it should get better. "Better programming," says Kaufman "eventually will reduce errors and overcome public dislike of the computer."

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when it is knocked off the bedside table, and falls on the floor. I once asked General Electric to make such a clock; they refused.

What qualifications do I have that I might speak as an authority on this subject? One is experience.

In 1948, 23 years ago, I resigned from a safe, salaried job in a large life insurance company home office, where I was doing actuarial and methods work, and I started in business for myself, with a part-time secretary. I have now had therefore 23 years of experience operating and running a small business; and we have met over 500 payrolls on time. The business has had ups and downs, and narrow squeaks; but I am still an eighty percent owner of Berkeley Enterprises Inc.; we have always had enough money in the bank to pay all our debts as they fell due. We have made a flock of mistakes, and have learned lessons from most of them. Certain misfortunes we have seen no way to avoid, but we have adapted to the limitations they have placed upon us.

If any computer person who reads this editorial is a subscriber to "Computers and Automation", is unemployed, is seriously interested in trying to develop a small business of his own, and is willing to send us certain data about his aptitudes, we will send him:

(1) a list of several dozen products and services for which we have observed a need;
(2) some further remarks and guidelines drawn from our experience and thoughts on the subject of operating one's own business.

For further information, see the details of this offer on page 29.

Edmund C. Berkeley
EDITOR

THE INFORMATION REVOLUTION —AND THE BILL OF RIGHTS

"The great danger is that we could become 'information bound', because each step in the development of an 'information tyranny' appeared to be constructive and useful. I suspect that it would be much easier to guard against a malicious oppressor than to avoid being slowly but increasingly dominated by an information Frankenstein of our own creation."

Dr. Jerome B. Wiesner, Provost and President-Elect
Massachusetts Institute of Technology
Cambridge, Mass. 02139

The way in which we use and control the great new capabilities being created by the information revolution will shape the future character of our society; it may be said, indeed, to be shaping it already. Technology has been providing mankind with new tools and new opportunities for a long time and, in response, society has evolved new institutions and has changed its physical form. Sometimes these responses have been comfortable and swift, as in the case of the telephone and radio, at other times, they have been halting and painful, requiring repeated trials with many errors to find a new equilibrium that was comfortable for the society.

Knowledge IS Power

For a long time, the rate of technological progress was sufficiently slow to enable society to adapt to the required change without permanent distortion of values. The pace of change is now very swift. We say "time is shorter now", and that is why we are faced with our present problem. To make the matter particularly urgent, information threatens to undo that subtle balance achieved in the Constitution between the people and the state which avoids anarchy on the one hand and tyranny on the other. Nowhere is it more true that "knowledge is power". Information technology puts vastly more power into the hands of government and the private interests that have the resources to use it. To the degree that the Constitution meant for the power to be in the hands of the "governed", the widespread collection of personal information poses a threat to the Constitution itself. There is also no doubt that technology can be and has been used to assist in the violation of the Bill of Rights. But it must be remembered that the violations are made by humans, not by machines. To my non-legal mind, there is even the question of whether the Bill of Rights, drafted in a simpler time, is adequate to protect man in his relation to the modern state and, whether there isn't a need for additional amendments providing protection for the individual against possible new infringements of his liberties.

Based on a statement delivered to the Constitutional Rights Sub-Committee of the Senate Judiciary Committee on March 11, 1971.

Because many of our difficulties stem from the unforeseen side effects of technology or from the misuses of technological capabilities, there is a growing resentment and antagonism toward science and technology. There is also a widespread feeling that mankind would be better served if we could retreat to a simpler time. Given the present size of the world's population and the complexities of modern society, this hardly seems possible. In fact, I am firmly convinced that only through the sophisticated and careful use of technology can we create a truly decent society. In this circumstance, we must learn to manage technological change effectively for the common good. This, it seems to me, is the particularly important and urgent task of the Congress. Many committees of the Congress are concerned with aspects of this problem (such as the present hearings on the SST), but there is little focus on the overall task.

1984 Could Come Unnoticed

Modern information technology provides the potential to add to our general well-being and to enhance human freedom and dignity if properly used by extending our muscles, brainpower and material resources. Yet it also threatens to ensnarl us in a social system in which controls could essentially eliminate human freedom and individual privacy. Improperly exploited computer and communication technology could so markedly restrict the range of individual rights and initiatives that are the hallmark of a free society and the foundations of human dignity as to eliminate meaningful life as we appreciate it. In other words, 1984 could come to pass unnoticed while we applauded our technical achievements.

The great danger which must be recognized and counteracted is that such a de-personalizing state of affairs could occur without specific overt decisions, without high-level encouragement or support and totally independent of malicious intent. The great danger is that we could become "information bound", because each step in the development of an "information tyranny" appeared to be constructive and useful. I suspect that it would be much easier to guard against a malicious oppressor than to avoid being slowly but increasingly dominated by an information

Frankenstein of our own creation. (Though we should recognize, I believe, that an effective means of citizen surveillance and intimidation could also provide attractive opportunities for a would-be dictator.)

Control of Information

Present and growing capabilities for surveillance and control are made possible by modern communication and computational techniques. It is very clear that such capabilities, through data-centralization and manipulation, will continue to grow at an ever increasing rate as our understandings of communications, computation and cognitive processes expand. At the same time, it is obvious that means for effective record keeping, information gathering, and data processing are essential needs of a modern society. The problem is to determine how to reap the maximum assistance from modern technology in running a better society and at the same time, how to keep it from dominating us.

In order to do this, we may have to adopt some stern measures in the form of very strict controls on who can do what with private information about any individual in the society. The present capabilities in information collection have already lead to clear-cut infringements of citizens rights. In fact, even without technological assistance, there have been serious violations of the Constitutional protections by many agencies of the government and by many private organizations. Furthermore, the awareness of security dossiers has inhibited many people in their political activities.

What Kind of Society Are We Building?

There is one specific point which I would like to stress. The issue of constitutional rights is but one dramatic aspect of the major problem of our time; namely: given so many options by a rapidly developing technological capability, what kind of a society are we going to allow to be created for ourselves and for our descendents? We live at a moment in history – I believe a unique moment – when the decisions we make, the paths we take, will shape the future of man's world for a long time to come. Technology allows us exciting opportunities for shaping a world to our liking, but it also poses the possibilities of a disastrous misstep. People everywhere have begun to appreciate that the thoughtless applications of technology on a large scale, done with the best of intentions and for the most constructive purposes, can frequently have large-scale destructive – at least, very unpleasant – side effects. We have slowly come to realize that we can intervene into the workings of the physical world on a scale and in ways that actually threaten man's survival on this planet. Fortunately, there is a widespread reaction against such careless actions; witness the growing concern for the environment and the growing disenchantment with war, particularly nuclear war, as an instrument of foreign policy.

The Effects of Small-scale vs. Large-scale Applications

We are also beginning to understand that we can affect man's social and psychological environments in equally disturbing ways. We have learned one particularly important lesson about all of this. It is that technological innovations that are wholly constructive when employed on a small or moderate scale can, with increased and constant application, have such serious impact on the environment or on the society that massive efforts are required to offset their disastrous side effects. Sometimes a technical innovation can affect both the physical and psychological environments. The automobile, electric power and the aeroplane all illustrate this point.

The early manufacturers of automobiles hardly anticipated that their machines would produce the Los Angeles smog, the blight of our cities, or the malaise of the suburbs. And even today, the individual user of a bit of technology such as the automobile, a pesticide or a polluting detergent clearly believes that his personal gain greatly outweighs the environmental hazards that his small transgression produces. On the other hand, it is perfectly obvious that citizens of our country are sufficiently concerned about these problems to be willing to legislate against pollution even at the price of considerable inconvenience and cost. They are ready to spend substantial sums of money for less destructive products and large sums to undo the environmental damage from the past.

Weapons Control

An important lesson can be learned too from our efforts to control weapons systems. It is much easier to stop the application of a specific piece of technology or a specific technique or a new strategy before it has been developed or widely applied, than after the fact. For example, it was relatively straightforward for the United States and the Soviet Union to agree to prohibit the introduction of nuclear weapons in outer space or on the ocean sea beds because these weapons did not exist. In contrast, it has proven impossible to curtail the emergence of anti-ballistic missile systems, even in the face of widespread agreement that they can't be effective, because they do exist and the decision to halt their development and deployment is contrary to the interests of large groups of people. It is perfectly obvious that this is a generally applicable theorem. If we want to avoid traumas from the mis-application of technology in the future, we should learn to recognize the inherent environmental or social threats in an early stage of a new technological development. I think that this point is particularly important in the matter of preserving privacy and freedom. The motto "eternal vigilance is the price of liberty" applies here with special meaning.

Surveillance of People

Modern electronic aids are not required for the operation of a comprehensive surveillance operation. In fact, the very effective security systems run by the Defense Department and the FBI during and after World War II made only modest use of electronic information storage and retrieval. But such systems were consequently quite expensive and also limited in the number of people that they could watch over closely. They frequently bogged down when presented with too much information. Large-scale data systems now operated by government bureaus and even private credit bureaus maintain files on tens of millions of people with no difficulty whatsoever. Furthermore, as you know, interconnecting communication networks allow information in separate files to be coordinated and centralized with great ease. In addition, as the software for data analysis becomes more sophisticated, it will be possible to simulate patterns of behavior for individuals and social groups and attempt to predict or anticipate their behavior with the purpose of maintaining better surveillance on individuals who, in one sense or another, might represent a threat to someone having access to the data system.

In a way, this was what the Army was doing when it selected anti-war organizers, speakers and demonstrators for particular attention. Apparently, their system was not very effective and it was detected before it could become a substantial threat to the freedom of the individuals involved and to the nation as a whole, but nonetheless, it is an indication of the threat to privacy and freedom that does exist.

Who Is Under Surveillance?

In fact, I wonder if the full extent of that Army surveillance system has really been exposed? When I was President Kennedy's Science Adviser, I found that it was frequently very difficult to find out the full scope of similar organizations. I have participated in anti-Vietnam war demonstrations, I have spoken at them, I have marched in them, and I have wondered lately whether I am being watched as a threat, as a dangerous enemy of the realm. How do I know if I am under continuous surveillance?

The answer is, I don't know. I doubt that anyone is aware of the full extent of the surveillance and information collection activities that go on in this nation.

Many people, myself included, have long operated on the assumption that our activities are being monitored. I have also operated under the premise that I should not allow myself to be inhibited by such a possibility. I do this because I have great confidence in the basic integrity of the safeguards built into the administrative and judicial system of the country. If I lacked such confidence and did not feel that I could defend myself, were there to be unjust conclusions or accusations, I would undoubtedly feel much more severely restricted.

Students Do Feel Inhibited

I know that many, many students are afraid to participate in political activities of various kinds which might attract them because of their concern about the consequences of having a record of such activities appear in a central file. They fear that at some future date, it might possibly cost them a job, or at least make their clearance for a job difficult to obtain. I don't know to what extent these student fears have any justification, but I can tell you that they are real fears and that they frequently have caused students to back away from activities which attracted them. I might add here that I am not referring to confrontations or planned violence, but participation in seminars, political study groups, etc., that were seriously questioning governmental and social arrangements or policies.

Technical Safeguards Are Not Enough

There are those who hope that new technology can redress these invasions of personal autonomy, existing or prospective, that information technology makes possible, but I don't share this hope. To be sure, it is possible and desirable to provide technical safeguards against unauthorized access to data banks or information transmission systems.

It is even conceivable that computers could be programmed to have their memories fade with time and to eliminate specific identity when the information was being processed to provide social profiles, etc., and such safeguards are highly desirable, but the basic safeguards cannot be provided by new inventions. They must be provided by the legislative and legal system of this country. We must face the need to provide adequate guarantees to individual privacy.

Specific Needs

I am a communications specialist, not a legal expert, and consequently, I hesitate to propose specific legislation. However, I have spent considerable time thinking about the issues involved and I would like to mention several specific needs which I see. These are:

1) A watchdog authority, perhaps an independent agency, possibly a division of the General Accounting Office, perhaps the FCC, to review regularly the public and private information gathering and processing activities within the country. The agency should have the authority to examine the nature and extent of such activities and should report its findings to the Congress and the public.
2) Congress should set rigid limitations on permissible surveillance activities and establish much stronger safeguards than now exist against misuse of data-file information.
3) Action should be taken as quickly as is feasible to re-establish public confidence in the sanctity of the boundaries of an individual's physical and psychological living space. This will require a number of steps. Outlawing some activities such as the free exchange of private information, collecting data not needed by an agency, etc., will help a good deal. Acknowledging publicly the extent of permissible surveillance and by whom is also important. Requiring disclosure of non-security type data to the concerned individual seems possible in many situations. In the few situations where this will not work, as in national security matters, judicial controls should be strong.
4) Technical means of insuring data security and safeguarding privacy should be developed vigorously and their use required.

A Balance Between Threats to Freedom — and Freedom

We should be prepared to accept the cost of considerable inefficiency in our various social and governmental processes to safeguard our privacy and, as I judge it, our freedom, dignity, happiness and self-respect. By costs, I mean both the financial costs and the loss of a degree of control that the state might otherwise have over genuinely threatening individuals such as criminals and violent revolutionaries. Our task is to achieve a proper balance between the ability to cope with individual threats to the society and its capability to abridge the freedom and happiness of its members. In countries where the legal system cannot be counted on, the people are at the mercy of the administrators and they must hope that the bureaucracy will be benign. Such a situation smothers freedom. Because I believe that an "information tyranny" poses a very serious threat to the survival of a free society in our country, I vigorously recommend that Congress take whatever steps are necessary to bring the Bill of Rights up to date. □

PROGRAMMING AND MINI-COMPUTER COSTS

"Computer ads and brochures often supply many words and few useful facts about software. Documentation on the subject often uses jargon and symbolism that makes it difficult for the novice to read. In fact there are few criteria available today to enable anyone to objectively compare the quality of existing software. Yet the difference between a costly and a cost-effective use of mini-computers depends on software."

David R. Ellis
Interdata, Inc.
2 Crescent Place
Oceanport, N.J. 07757

Minicomputers are gaining in popularity and acceptance at a phenomenal rate. One reason is the apparent get-something-for-nothing appeal that stems from computers with greater and greater power getting less and less expensive. While it is true that computer hardware costs are falling at a rapid rate because of technological advances, it is not always true that the cost of putting these computers to use is falling proportionately. In fact, the opposite is often the case.

Minicomputers of today provide the engineer an unprecedented opportunity to implement or improve an endless variety of data collection, automatic test, and control tasks which otherwise would be handled in a more expensive, manual fashion which is subject to errors. The difference between a costly and a cost-effective use of minicomputers for such applications depends on programming. Minicomputers must be programmed to handle each specified application with specific software. However, the hardware characteristics of many minicomputer systems – the computer architecture, memory size, and peripheral devices – do not lend themselves to easy generation of software. In fact, some minis are downright difficult to program. When applying a mini therefore, the application engineer must give careful attention to programming requirements.

David R. Ellis received a BSEE degree from Purdue University, and an MSEE and EE degree from the Massachusetts Institute of Technology. He joined Interdata in 1967, and is presently the Director of Programming. He has been active in the development of operating systems and systems software for minicomputers since 1964.

This article discusses the minicomputer software situation and sets down some guidelines for proper progamming. The phrase "proper programming" means implementing software and documentation that yields a minimum cost solution to some task, the specifications for which must cover operating performance, testing, training and maintenance requirements.

Sources of Software

The prospective buyer or user with an application problem to solve must ultimately face up to the question: How do I obtain the software necessary for my application? From a computer vendor? From an independent supplier? Or must I write the programs myself? Before trying to answer the questions, let one fact be made clear – the low dollar figures for minicomputers that are quoted in advertisements and news releases do not normally include the specific application software needed to solve your particular problem.

System Software

What is normally included in the price of the hardware is a set of the appropriate "system software" programs associated with that computer, such as:

a. Symbolic Assembler
b. Fortran Compiler (if any)
c. Other language processors (like Algol, Cobol, if any)
d. Operating Systems (i.e. DOS, RTOS, if any)
e. Math Library
f. Utility routines (i.e. program loader, debug program, editor, conversion routines.)

Another type of system program is a diagnostic or test program. Such programs are not normally associated with any application, nor are they used in the software development sequence.

The system software programs do not handle any application problems by themselves. Rather, they serve as tools which help the user to create the types of programs which can be used for specific applications. For example, the use of a minicomputer for process control requires additional programs which read the analog or digital inputs at a proper rate, perform control calculations appropriate to the process being controlled, and generate proper control signals to the valves or actuators which control the process. These programs could be generated with the assistance of the system software programs by someone who understands the process control environment.

A program preparation sequence using the assembler might run as follows:

a. Enter bootstrap loader into memory.
b. Enter program loader into memory.
c. Load the editor program.
d. Use the editor program to create source tapes of the user's programs.
e. Load the symbolic assembler.
f. Assemble the source tapes, which convert the symbolic language into binary machine language, punching binary object tapes.
g. Load the assembled binary object tapes into memory.
h. Test and debug the object programs using a debug program.
i. Repeat steps as necessary until the new programs are satisfactory to the user.

An exception to the statement that system programs are always provided with the minicomputer hardware occurs with those manufacturers that have unbundled, which means simply that they charge for the system software separately from and in addition to the charge for the hardware. Very few mini manufacturers are unbundled, but the buyer must watch for separate pricing policies.

Application Programs

To adapt a mini to your specific application, then, you must acquire application programs. Whether these should be purchased from the vendor, purchased from an independent organization such as a software house, or written by yourself depends on many factors. When dealing with the manufacturer, one factor is how many computers you will need. If several machines are involved, the manufacturer may be interested in producing your application software. On the other hand, if only one computer installation is involved, the manufacturer may not consider it economically feasible to write specific application software. Another significant factor is how closely your application conforms to what other people have done in previous situations. If your job, or a very similar one, has been solved many times before, you stand a much better chance of finding an interested supplier who will provide the needed software at a reasonable price.

Pre-Canned Packages

There are also companies who offer pre-canned packages that claim to solve certain general problems. Examples of application packages are as follows:

1. IDACS-8 from Digital Equipment Corporation for industrial data acquisition and control.
2. DC^2 from Fisher Controls Corporation for process control applications.
3. Key Logic from Redcor for keypunch to disc data collection tasks.
4. FFT from INTERDATA for on-line Fast Fourier Transform calculations.
5. HP 2000 Series from Hewlett Packard for general purpose in-house time sharing systems.
6. The 270X from INTERDATA for 360 front-end communications handling.

An obtainable application package might provide a complete program which performs some entire end-user function, or it might provide a partial solution to a problem, requiring the buyer to make extensive changes or additions. It is seldom clear from the designation or the descriptive literature just how complete an application package really is, or how it is tailored to one's needs. Application software claims need to be scrutinized carefully. To procure the proper application software, you have to know what obtainable packages are available, as well as the considerations involved in developing the system yourself.

The Development Process

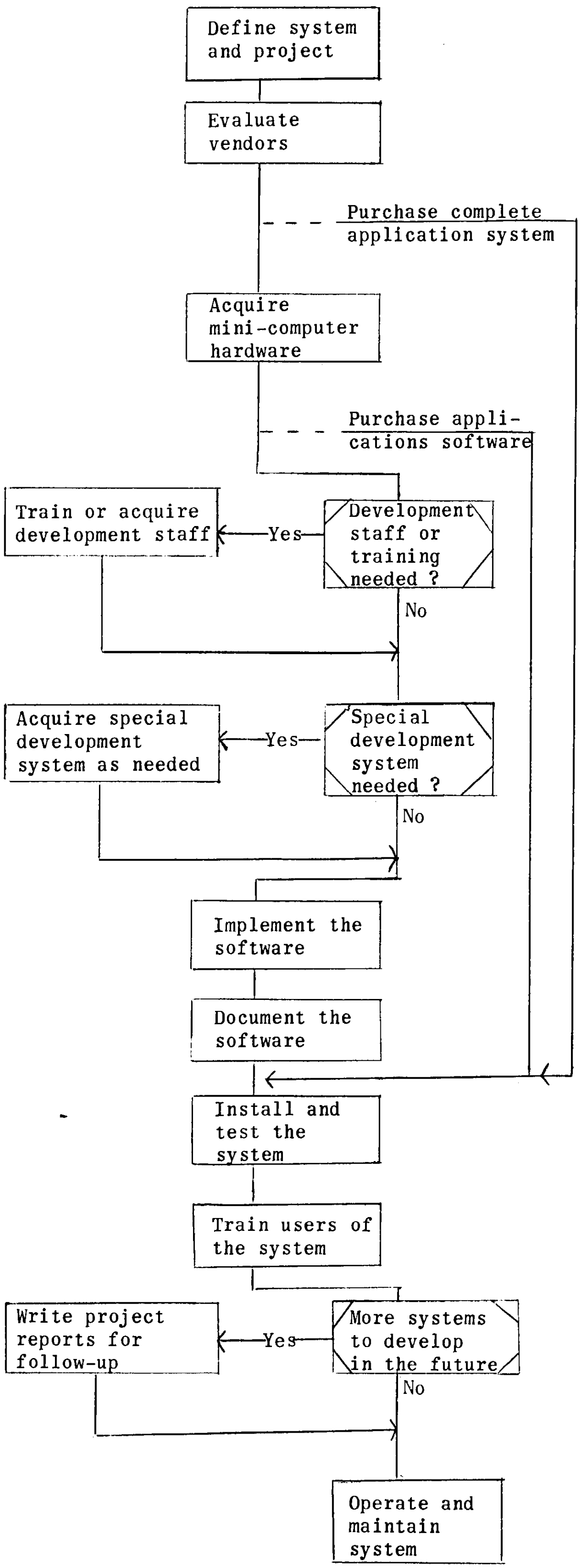
Here are the steps to follow in a typical development process for a minicomputer application system:

1. Define the system and the project.
2. Evaluate vendors.
3. Acquire minicomputer hardware.
4. Train or acquire the development staff, if necessary.
5. Acquire a special development system, if necessary.
6. Design, write, assemble and test the software.
7. Document the software (for training, operation and maintenance).
8. Install and test the system.
9. Train users of the system (on operation and maintenance).
10. Write project reports for follow-up on other development projects as needed.

In reality, the steps in such a process are iterative in nature, and overlapping in time. For discussion purposes, it is helpful to show them as discrete steps which proceed sequentially. If either the entire application system or the application software is purchased, rather than just the minicomputer hardware, then the development process changes somewhat. (See Figure 1.) The actual purchase of the minicomputer hardware (step 3) is but one step in ten. The cost of the hardware may in fact be a small part of the total cost, depending on how much time and effort is required to satisfy the other nine steps. While minicomputer prices have tended to shrink, the cost of people's time or talent has increased; as a result, the ratio of total system costs to hardware costs has risen dramatically.

To illustrate, consider a hypothetical application of a modest-configuration mini for automatic testing purposes in an industrial plant. The minicomputer system, assuming no large peripheral or bulk-storage devices are involved, may cost approximately $25,000. To estimate the total system cost, it is necessary to estimate the total amount of labor required for the development process. The system definition, vendor evaluation, and hardware purchase may be accomplished with a few people – let's say approxi-

Figure 1 – Application Development Process



mately six man months. The software costs, for training the programmers, implementing and documenting, may be large or small depending on the number and experience level of the people involved. Let's assume that two programmers are involved who need one month each of training, two months each for implementation, and three months each for documentation. Total software costs would then be approximately 12 man months.

Installation, Testing, and Training

Then comes the installation, testing, and training of users of the system. In an industrial operation, these tasks may involve many people, particularly if the automatic testing relates directly to company operations. For example, 10-15 people may be involved for two to three months, which means that from 20-45 man months might be required. Let us assume for this example that 32 man months is a good estimate. Total labor required, then, is $6 + 12 + 32 = 50$ man months. These figures are summarized in Figure 2. Assuming for the sake of round numbers that labor costs $1000 per month, then the development costs for the system are approximately $50,000, or twice the cost of the hardware.

What does all this have to do, you might wonder, with "proper programming." In the above example, the estimated software development costs are only $12,000. However, the labor expenses for the installation, testing and training of the system, which amounts to $32,000 are a direct function of the quality of the programs and documents produced during the software development phase. Therefore, proper programming in the first stage is essential to minimize the TOTAL system development cost, not just the software development cost.

It is worth noting that the software development effort follows (or should follow) the definition phase of a project. A good application and project specification should define the requirements for each phase of the project. For example, a need for good training material and tutorial documents for use by manufacturing personnel should be identified at the outset of the project, since this defines the type of software documentation required. A good definition, therefore, is fundamental to the success of a project. It is certainly necessary before a computer can be programmed properly for a particular application.

Programming Considerations

Computer ads and brochures often supply many words and few useful facts about software. Documentation on the subject often uses jargon and symbolism that makes it difficult for the novice to read. There are few criteria available today to enable anyone to objectively compare the quality of existing software. Here are some guidelines for preparing programs properly.

Software Purchase

The first point, at the risk of repetition, stresses that all good programs, even those that are purchased, must start with a good project definition. Even when software or an application system is purchased, it must be installed, tested and maintained once it is delivered. Therefore, the specs supplied to the vendor must define what level and quality of documentation is required to satisfy the needs of the users after delivery. Failure to specify this information at the time a purchase is negotiated can lead to later complications for both the buyer and the vendor.

Figure 2 – Estimated labor for development of hypothetical industrial test system

	Estimated No. of People	Estimated Man Months Required
Define system and project Evaluate vendors Buy hardware	2	6
Train programmers Implement software Document software	2	2 4 6
Install system Test system Train users	10-15	32
		50

Hardware Selection

The prospective purchaser of a mini is confronted with a bewildering array of vendors, and a wide range of products from which to choose. Often the cost tradeoffs for various items in the minicomputer product line are not obvious. For example, should the system have 8 KB[1] or 16 KB of memory? Should the buyer consider magnetic tape rather than paper tape? Is the Multiply/Divide option worth the money? There are no universal answers to these questions. It IS generally true that the smaller the hardware configuration, the more difficult to develop programs, and the more dollars required to write the necessary software. For example, if the application program requires about 8 KB of core memory, the buyer might opt for this memory size in an effort to save $3K to $4K in the cost of the computer, rather than buy a 16 KB memory. However, the 8 KB memory may not support the compiler for that computer model. Therefore, all programs will have to be written in assembly language, which may require additional training for the programmers.

Further, to get the program into 8 KB may require extensive optimization and recoding of the programs. If more than three to four man months of programming effort results from the choice of this memory size, it costs the buyer more money in the long run. The same applies to selection of a Multiply/Divide option, or Floating-point option, or other instruction set options that may be available. In general, scrimping on the cost of the hardware can be penny-wise and pound-foolish for the buyer, unless many machines are required.

Determining the best amount of memory for a particular application can be a difficult problem. One criterion is to get enough core to support the system programs (such as the Fortran compiler) on the chosen minicomputer. Another criterion is to get enough memory to support the largest amount of programs and data that must co-exist in memory at one time. Note that some minicomputers use a portion of core memory for dedicated functions, such as interrupt pointers. The area in memory reserved for these purposes is not available for program storage, and should be deducted when estimating the amount of memory available for programs and data.

If the right memory size for the end use is insufficient to allow program preparation, then some other method must be found to develop software for the application system. Some alternatives in this case are:

1. Buy an additional system for development purposes only.
2. Buy enough time on another computer of that model to develop the programs.
3. Use an assembler, if one is available, that runs on a 360 or some larger machine for purposes of development. (This approach may prove satisfactory for program assemblies, but program debugging may be difficult or impossible.)
4. Buy the necessary software outright.

Qualities of System Software

Most mini vendors supply a fairly standard set of systems software programs with the computer: assemblers, compilers, program loaders. Once the software development begins in the chosen mini, these programs become very important, since they are the tools with which the programmers must work to implement the desired result. While difficult to measure quantitatively, there are good and bad characteristics of system programs, and they should be assessed during vendor evaluation. The software characteristics to examine are as follows:

1. **Documentation.** This is the means by which your programmers will learn how to use the system. The documents should be clear and concise. For the novice programmer, some tutorial material should be available. The operation of system programs, and the computer for that matter, should be straightforward in design and easy to use.
2. **Performance.** The programs should be well-tested and perform consistent with their claimed operating characteristics. Evidence of testing may be hard to come by, but if the performance of a compiler is of interest to a user, it is not unreasonable to ask the vendor how it was tested.
3. **Adaptability.** Every user encounters needs to make some minor modifications to some programs. The changes may concern the use of some unique peripheral device, or the addition of some feature of particular interest. For this reason, programs provided by the manufacturer should be readily modifiable by the users themselves. To facilitate changes, source tapes or cards and listings should be available for all programs. In addition, program documents, such as listings, should be written clearly so that the program structure is explained. Device independence, which results from the use of an I/O monitor or operating system, when one is available with the computer, may obviate the need for changing many programs. Examples of such operating systems are DOS on the Data General Nova and Supernova, RTOS on the

[1] KB means kilo byte, where byte is an 8-bit unit of memory

INTERDATA Model 5, and the 2005A Real-Time Executive for the Hewlett Packard 2116.

4. **Vendor Support.** Most programs provided by computer manufacturers are subject to revisions, changes or improvements as more and more users have an opportunity to use the program. It is the responsibility of the manufacturer to inform the customers of these revisions and changes. Some companies convey news regarding changes or improvements through a newsletter to their user group.

Programmer Training

If programmers must be trained to use the new mini, then the effort required to explain the new machine should be explored. This is another aspect of computer evaluation which is difficult to quantify. An important factor is the availability of some well-written training material slanted toward the novice programmer. More important than this, however, is choosing a minicomputer with a straightforward design. Intricate complexities in a machine, such as fixed or relative memory paging or an involved addressing scheme, can slow down both learning and software development efforts.

Another factor in training concerns the type of documentation required for the project. Traditionally, English has been a much more difficult language to master than Fortran, and minicomputers offer no simple solution to the documentation problem. If well-written documents are required to explain the application system to its users, then it is important to get someone on the project who can write, as well as program. This move may require some extra training effort at the start of a project, but the long-range benefits to the users make this wise.

Choice of Language

Assembly language is still the cornerstone of most minicomputer software systems. For many functions, such as interrupt handling, input/output procedures for unusual devices, or optimatization for time-critical cases, assembly language is essential. In almost every application, some assembly language programs are used, and knowledge of the assembly language is required.

Some higher-level, or problem-oriented languages, such as Fortran, Basic, or Algol, are available, but not many others are in use today on minicomputers. The lack of numerous problem-oriented languages is a major distinction between minicomputers and larger computers such as IBM 360, CDC 6600, B5500.

The need for Fortran or an equivalent language on the mini is critical when the application program involves many arithmetic calculations. The job of programming an arithmetic expression such as:

$$y = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$$

using 16-bit fixed-point add/subtract/multiply/divide instructions can be an enormous job, particularly if much numerical precision is required. For problems involving such calculations, use of a higher-level language is a must.

Because many application systems involve both arithmetic calculations and I/O peculiarities, it is important that the mini's system software allows the user to intermix programs written on different language levels. Also, it pays the buyer to get those machine features, such as floating-point arithmetic instructions, that assist both the programmer and the system software itself in getting the job done efficiently. Floating-point instructions, for example, make the compiler more efficient, the arithmetic programs much smaller, and execution times much faster.

Optimization

In programming, memory space and execution time represent tradeoffs in a program design. That is, the smaller a program is made, using subroutine or interpretive techniques, the slower it will execute. Similarly, for faster execution times, more memory space is needed. Without delving into the theoretical justification for this phenomenon, let the user be aware that techniques which attempt to nest or pack programs too tightly into core memory tend to slow down program execution. A caution flag should be waved if a programmer advocates a special technique such as interpretive coding for packing more and more programs into less and less core. Another disadvantage of excessive program packing (space optimization) is that program logic becomes difficult to follow, difficult to test, difficult to document, and difficult to change. In general, the best approach is to insure that sufficient core is available to write straightforward programs that do not employ tricks or devious methods.

For time optimization, meaning minimizing the execution time, it is best to write programs in assembly language using straight-line code, with as few branches and subroutine calls as possible.

Testing the System

Thorough testing of a system is often necessary, but not always possible. A communications concentrator system, for example, may not get all facets of the program testing until the system is functioning on-line. At that time, it may not be possible to generate at will all possible error conditions, so the program's error detection and recovery may go untested. One alternative to this situation is to build special test equipment which simulates the real-world process. The testing procedures should be defined as early in the project as possible. One technique is to build trace points, loop counters, and special debugging messages into the program to aid in the testing process. These can be removed later to make the debugged program smaller. Where testing is difficult, dealing with a vendor that knows the application area, and has working installations in the field, can be a big help.

Program Maintenance

Maintenance activities include:

a. The analysis of the system for service purposes if the system should develop a malfunction.

b. The correction of the system if an error in its design is uncovered.

c. The changing of the system if a new or different operating feature is desired.

Such maintenance functions all require a knowledge of how the program was designed and implemented. Maintenance functions also require knowing the mechanics of making minor changes in the system. Depending on who will maintain the system, and under what conditions, maintenance documentation may be trivial or it may be monumental.

In general, a clean, well-commented listing which explains the internal design of the program is essential to perform any maintenance. Other documents, such as flow charts, diagrams and descriptive information may be required, depending on the application.

A final thought on maintenance is that the use of a minicomputer with straightforward architecture and simple addressing mechanisms does more to simplify the maintenance function than all the flow charts in the world.

Software: Make or Buy

Again, proper programming requires at the outset, a good project and design spec that defines the requirements for system performance, testing, training, and maintenance. Given the existence of such a specification, the prospective user of a minicomputer system has to determine what vendors can satisfy his needs – either with a complete "turnkey" system, or an application software package to supplement some standard mini, or just a plain mini with its library of system software to help the user write his own application programs. Even if some vendors offer a complete system, or an application software package that meets the requirements, the user should consider the cost trade-offs of making or buying the software. Figure 3 provides a summary of factors which affect the make-or-buy decision. If all the conditions in the right-hand column of Figure 3 are satisfied, the user should buy the system from a qualified vendor. If all the conditions in the left-hand column are applicable, then the user should develop the software himself. If some conditions on the right and some on the left are met, then the prospective buyer must evaluate the factors and establish priorities before making the decision.

Conclusion

Software needs are of prime consideration when evaluating a minicomputer application. Falling prices of minicomputer hardware do not necessarily mean that the software costs are falling; in fact, the converse is often true.

Programming is getting easier, due to more and better system software available from vendors, but there are potential pitfalls in selecting a vendor. Application programs with fancy names, or sophisticated operating systems may not help you – the end user – at all. Therefore, to minimize software costs, choose a mini that has good programming characteristics, has good quality system software available, and an established company behind the product, for support. Making that choice can get the programming off to a good start. The proper programming effort then requires the user to fully specify all the phases of the job to be done – from developing, to training, to operating, to maintaining the system. Good programs are those which satisfy all needs, both short term and long, at minimum cost. ☐

Figure 3 – Factors for Make or Buy Decision

MAKE	BUY
loose application specs	precise applications specs
specs may change with time	specs not likely to change
available application packages not similar or need extensive modification	appropriate system available from outside organization
programming talent in house	no programming talent in house
a. hardware good for programming development b. hardware not good for development i. 360 support available ii. development system available	hardware configuration not good for programming development
complete testing not easy	complete testing is practical
widespread or long term use in company anticipated for training, operation, and maintenance	little use or interaction expected with organization
other future application jobs likely	no jobs like it now or in near future

COST SAVINGS POSSIBLE IN DATA PREPARATION

"Some critical factors affecting the costs of data preparation are: operator productivity; machine utilization; error control; scheduling; pre-preparation of source data; and verification by computer using logic checks."

William J. Primavera
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Computer users of all sizes may save 20 percent to 30 percent or more of their current keypunching costs by increasing productivity, reducing verification, improving scheduling, or acquiring new equipment.

Although computers, systems and programming have been continually refined to their current level of sophistication, data preparation has largely been neglected. Many companies still prepare and enter input as they did in the early days.

Rising Costs for Data Preparation

While each succeeding computer generation has decreased cost per computation about tenfold, data preparation costs have actually risen. The main reason is the extra personnel expense incurred to process the burgeoning input that today's faster and more productive computers can handle. Management is often unaware of the opportunity for cost reduction and control in data entry. Take, for example, the following three broad observations recently made:

1. Data entry costs (keypunch and closely related activities) can represent 20 percent to 50 percent of total recurring expenses for electronic data processing. These tend to rise faster than processing costs.
2. Two critical factors are operator productivity and machine utilization, which affect the quantity per dollar of the EDP "product". Two more critical factors are error control and scheduling. These affect the accuracy and timeliness of the information, the quality of the "product".
3. Equipment alone does not solve data entry problems. Potential "trade-offs" with source data preparation preceding data entry and computer processing following data entry must be investigated. Formats, procedures, and managerial controls must also be scrutinized. In fact, careful analysis of the critical factors affecting data entry may help achieve significant economies without any equipment changes at all.

(Based on a report made for the "Lybrand Newsletter", March, 1971, published by Lybrand, Ross Bros., and Montgomery.)

Inefficient Practices

Several typical inefficient practices include the following:

- Keypunch operators leave their machines to get small, unscheduled batches of work.
- Supervisors are unaware of individual performance (since it had never been measured) and of "normal" production (since there have been no established standards).
- Some formats force an operator to search for data which is out of sequence.
- The company applies a policy of 100% verification despite the noncritical nature of most information.

Some Suggested Solutions

Much operator verification time can be eliminated by computer editing (i.e., having the computer verify the accuracy of the data by a variety of logic checks.) More realistic scheduling may level out workloads and raise productivity. In addition, simply measuring operator performance may increase productivity and decrease errors. New equipment may also offer some further savings and better control. Many advocates of keypunch replacements ("buffered" keypunch, keyboard-to tape, and keyboard to-disc-to-tape) promote this equipment as a way to save from 10 percent to 50 percent of data entry costs.

The accompanying chart of major data entry equipment characteristics illustrates the general advantages and disadvantages of each category. It does not, however, tell the whole story. Usually, a careful appraisal of an individual company's requirements, correlated with a detailed analysis of critical factors, is needed before a clear picture of the actual efficiency gains and savings of cost emerges.

Predicting Operator Productivity

Operator productivity is the most difficult, yet the most important factor to assess.

Experience with the automation of data input and output has led to the development of a technique for predicting data preparation times (without physical observation of a job) before actual installation. The technique is reasonably accurate, and permits a quick judgment of the

DATA ENTRY EQUIPMENT — MAJOR CHARACTERISTICS

	Standard Keypunch	Buffered Keypunch	Key-tape	Shared processor Key-Disc-Tape
1. Operator productivity				
A. Is operator limited by machine speeds of duplicating, skipping, and card positioning?	YES	NO	NO	NO
B. Is job setup easy and fast?	NO	YES	YES[1]	YES
C. Are more than two formats readily available to an operator?	NO	IN MOST CASES	NO	YES
D. Is it easy and fast to correct detected errors?	NO	YES	YES	YES
E. Can on-line editing reduce the need for verification?	NO	NO	NO	YES
2. Error control				
A. Is batch balancing an available option?	NO	YES	YES	YES
B. Are edit checks possible (beyond the usual field definition controls)?	NO	NO	NO	YES
3. Machine utilization				
A. Can one machine both enter and verify data?	NO	IN MOST CASES	YES	YES
4. Management control				
A. Are operator productivity and error statistics easy to obtain?	NO	NO[2]	NO[2]	YES
B. Does the equipment facilitate good, close supervisory control?	NO	NO	NO	YES
5. Operating costs				
A. What is the relative unit cost of equipment?	LOW	MEDIUM	MEDIUM	MEDIUM to HIGH[3]
B. What is the cost of supplies?	HIGH	HIGH	LOW	VERY LOW
C. Can subsequent computer processing costs be reduced?	NO	NO	SOMEWHAT	YES
D. Is a special physical environment required?	NO	NO	IN SOME CASES	IN SOME CASES
E. What are the operating conditions?	POOR	POOR	GOOD	GOOD
F. Is the system vulnerable to equipment failure?	NO	NO	SOMEWHAT	YES

1. With automatic program load option; otherwise, job setup requires keying in a new program.
2. Most key entry devices can be equipped with registers to record production and error statistics, but these must be accumulated and analyzed by hand.
3. From medium to high, depending on the number of operator stations.

effect on operator productivity of various equipment, formats, or methods. Preparation times are computed using predetermined standards for each individual machine and each human element required in a data entry job.

For example, consider a data entry job of 30-character records in an 80-column card "image" (20 key-entered, 10 duplicated, 50 skipped). Assuming an even mixture of alphanumeric data, an ideal source document, and an operator-detected-and-corrected-error rate of 7 per 1,000 keystrokes, the studies showed a productivity factor of .76 for key-tape. This figure means that this job can be prepared on key-tape in 76 percent of the time it would take on standard keypunch equipment.

Even greater operator productivity could be realized on this job during verification because of the ease with which detected errors can be corrected.

Evaluation of major jobs, using this approach, should establish the productivity gains and economic benefits that could be achieved by varying factors.

Some Results

One company, which had to replace its current equipment in order to attain compatibility with a new computer system, expects to save 4 out of 14 operators by data entry measurement and control, and another 2 because of improved equipment.

Another company, by applying basic production and schedule controls, and revising formats, reduced errors to 1/5 of the previous level, increased operator productivity by 25 percent, brought back in-house work (which had been done by a service bureau), and decreased its work force — and yet made no change in its key-tape equipment. □

MAYBE THE COMPUTERS CAN SAVE US AFTER ALL

"If part of the average citizen's feeling of impotence and disillusionment is caused by a lack of organized and readily-available information, would it not be possible to put such information at his fingertips with a computer?"

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We have known for several years that mortal men are incapable of managing large cities to the general satisfaction of their constituents. The 1970 elections have shown us that this pervasive feeling of disgruntlement has spread to the state level, and the 1972 elections may very well show evidence of a "throw the rascals out" mood at the national level. Perhaps then we will all agree that our society has grown too complex to be effectively managed by mere human beings.

Losing Faith

Before this national disenchantment became so strong, most Americans had what so many generations of men before us have had: *faith.* Men must have faith in themselves, in their social order, their leaders, and their government, or we would never have progressed past the point of feudal kingdoms. That faith usually persists even when the leaders of a country are slightly corrupt and inefficient, and even when the people are slightly hungry and unhappy. It is usually broken only by catastrophic failings of the system, failings as dramatic as those that brought on the French Revolution, the Bolshevik Revolution, or even our own American Revolution.

Somehow, we seem to be losing that kind of faith today, for reasons that are not entirely clear. Perhaps it is because political faith, like religious faith, depends on the faithful being kept relatively uninformed and unenlightened. Certainly, television and radio have brought us into much closer contact with those who would lead us. It is possible that this familiarity has begun to breed a slight degree of contempt for leaders who, after all, *do* contradict themselves and who occasionally *do* use poor grammar.

Perhaps our disenchantment is caused by the fact that faith seems to work only when surrounded by ritual, by familiar day-after-day repetitions of the same facts, the same speeches, the same political ceremonies. Maybe we have lost faith because Alvin Toffler's "future shock" has destroyed such comfortable rituals for us.

What Choices Do We Have?

Given this state of affairs, there seem to be several choices open to us; it seems to me that we *must* make a choice, either consciously or by default, by the end of this decade. The most obvious choice, of course, is to avoid doing anything at all. We lack a prophet who could tell us with certainty what will happen if we fail to make some basic changes in the form and structure of our government; at the very least, it would appear that we can look forward to great periods of restlessness and instability.

We have, sadly enough, no prophets; we have only leaders who persist in telling us "what's right with America". As a result, it seems likely that we will continue muddling along as we have been for the last several centuries.

Running Away

There are more drastic choices: we can attempt to bomb our outmoded society into oblivion, or we can simply run away from it. However, despite the wild antics of a few revolutionaries, I think the vast majority of Americans are profoundly committed and dedicated to this country. We were born here; we grew up here, for better or for worse; a number of us have fought on strange continents for the honor and the glory of America. We have no place else to go; we could not escape the influence of this country and its problems even if we wanted to. Those of us who run away to Canada or England are, for the most part, unhappy. Despite the way we move restlessly from city to city, America is, in the very deepest sense of the word, our home.

Back to a Rural Life

Still another choice is represented by the hippie communes and the "back to the earth" movement currently in vogue with the young. While this is a viable alternative for

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those who simply cannot cope with the Establishment, or for those who can afford to buy a farm in Vermont, it does not seem likely that the great mass of Americans would be either willing or able to settle down to the quiet rural life our forefathers knew. It is difficult to imagine that a rural economy would be capable of supporting 200 million Americans in the lavish style to which they have become accustomed.

A More Responsive, Computerized Government

There is yet another choice, though it seems to arouse violent feelings of paranoia whenever it is mentioned: we can attempt to make our government more automatic, more organized, and more responsive with the use of computers. At the moment, the vast majority of government computers are nothing more than glorified adding machines, used to spit out bills and process tax reports. We have made little or no use of the computer's ability to organize and retrieve *information,* information which could be used to help legislators govern more effectively, and which might help the average citizen better understand what is going on in government. There are a multitude of *major* changes which could be effected with computers, including the six which follow.

1. Voter Registration and Vote Processing

Computers have occasionally been used on the local and state level to help automate both voter registration and the actual counting of votes. While these efforts have been only partially successful, there is reason to believe that a *national,* unified computerized voting system would remove many of the inequities in our voting process. Since the computer would be capable of keeping tabs on every citizen, it would be easier to relax residency requirements so that *everyone* could vote in the national elections, if not in the state and local elections. The voting booths could be connected directly to a central computer complex, so that an individual's vote would be registered immediately. This would make it more difficult for political bosses to rig an election, though the possibility of fraud would not be completely eliminated.

2. Improved Information for Legislators

A good deal of the actual legislative work at the state and national levels is done by staff organizations; the lawmakers themselves are too busy (or so they would have us believe) to spend much time analyzing and researching information on legislation currently under consideration. Even with this staff help, though, the legislator must often make snap decisions in areas where he is relatively uninformed. A computerized information retrieval system would make it possible for a Congressman or a Senator to obtain information on any subject with a minimum of effort. The same kind of system might be used to provide *citizens* information on various subjects, as we shall discuss in detail presently.

3. Optimum Scheduling of Services

At the city and state level, it often seems that things like garbage collection, snow removal, road repair, bus schedules and street cleaning are performed on an inflexible, if not completely random, basis. Computers could be used to *optimize* such services on a relatively dynamic basis, so that as conditions changed, the services could be re-scheduled.

4. More Up-to-date Information on the State of the Economy

At the moment, there are a number of economic indicators which give government officials a rough feeling for the direction in which the economy is moving. In addition to the fact that these indicators are often contradictory and subject to different interpretations, there is a problem caused by the *delay* from the time the economic phenomenon occurs until it is noticed; and then the delay from the time it is noticed until something is done about it; and finally, the delay from the time some action is taken until the time the effect of that action is felt. The total delay can easily be as little as six months or as much as two years, and it can cause a great deal of economic damage.

What we need is a computerized *model* of our economy, an idea which has been of fundamental interest to economists for several years. To have any validity, the model would have to have several thousand inputs, including such things as the production and capital expenditure figures from major corporations, money supply and interest rates of the major banks, and employment, wages and spending figures of the American citizen. The output from the model could help economists and lawmakers review the state of the economy on a weekly, or even a daily, basis. Instead of taking six months or a year to react to an economic crisis, we would be able to take action within a matter of days.

Even more important, a comprehensive model would allow economists to *simulate* the effects of various proposed economic activities. The effect of the General Motors strike could be predicted by the machine, as well as the effect of a decrease in defense spending.

5. More Streamlined Administration of Government

It is conceivable that a large number of clerical tasks carried on by local, state and Federal administrations could be eliminated with a computer. Programs like Social Security, unemployment benefits, the processing of marriage licenses, and so forth, could almost be completely automated; exceptional cases, of course, would continue to be handled by people.

In the past, it has often been true that the computers were more expensive than the people they replaced. However, computers do not ask for raises, do not go on strike, and do not take long vacations. Since the cost of computing equipment has been decreasing as a result of improved technology, and since labor costs continue to spiral upwards, it might be wise for many administrators to reexamine the economics of automation.

6. Better Determination and Control of National and State Priorities

A common complaint in these times of tight money is that our *priorities* are wrong – we should be spending more on urban problems and less on foreign aid, or more for foreign aid and less for defense. The final decisions must, of course, be made by people, and the decisions often take highly political considerations into account. Nevertheless, a computer might be able to help in the decision-making process. The computer could, for example, easily tell a legislator how many extra schools or hospitals could have been built with the money being spent in Cambodia; it could tell how many jobs would be affected if $1 billion was shifted from defense work to mass transit or pollution control.

Equally important, a computer might be able to help *control* these priorities, once they were determined. It could point out cases of fraud and embezzlement, as well as pork-barrel projects and cases of extreme nepotism.

Why Hasn't Government Become More Computerized?

Some of these projects have been attempted on an experimental basis – the city of Wichita Falls, Texas, for example, is almost completely computerized. However, there has been very little concerted effort on the part of the Federal and state governments to move in this direction, and things are even more primitive at the city level.

Part of the reason for this backwardness is that many of the projects are difficult to define and specify. Most computer people know little or nothing of the *application* they are attempting to computerize, and they fail to program the computer for the exceptions that are inevitably present. On the other hand, applications-oriented people – the economists, legislators, and administrators – often have a difficult time describing their application in sufficiently precise detail for the computer people. Fortunately, there has been a growing familiarity with computers in these professional disciplines, and there is some hope that they will be willing and able to participate in more ambitious computer projects in the near future. Computer people, by the same token, are beginning to specialize in specific applications, and they should eventually be able to converse more intelligently with legislators and economists.

People Fear Computers

There is one obstacle, however, that will be more difficult to overcome: the ordinary man in the street is deathly afraid of computers. To many Americans, the word "computer" is a reminder of incorrect bills, all-digit telephone numbers, and the indignity of having to use one's Social Security number as a prime means of identification; to other more sensitive souls, "computer" evokes memories of George Orwell's *1984* or Karl Capek's *R.U.R.*

There is no doubt that a computer can bungle simple things like bills and invoices. In fact, when it comes to resolving an incorrect bill, we seem to be finding that a computer can be more petty, more arbitrary and more obstinate than any human bureaucrat. On the other hand, computer technicians are quick to point out that these problems are rarely, if ever, the fault of the computer *per se;* what has happened is that somebody has *programmed* the computer in a petty, arbitrary and obstinate way. If someone took the trouble to program a computer to be sweet, apologetic and understanding, much of the ill will toward computers would disappear.

For example, consider the fact that many current computer systems use *numbers* as a prime means of identification. When dealing with Blue Cross, American Express, or the local gas and electric company, one must know one's *account number* or there is no hope of getting anywhere with either the computer or its human attendants. Account numbers are used primarily because it is *easier* for the programmers to deal with a well-known 9-digit decimal number than it is to deal with a variable-length string of numbers and letters that he would find in a name and address; in addition, the programmer can be sure that the account number is a *unique* identification of the customer, while the name "John Smith" may not be unique. Nevertheless, the programmer *could,* if he wanted to make the computer system a little more palatable to its customers, dispense with the ubiquitous numbers forever.

Misuse of Computers

Unfortunately, this does not dispel the deeper fear of computers felt by laymen and scientists alike: the fear that the computers will eventually "take over" and start running our lives. If this happens, it will *not* be the result of the computer having acquired some innate intelligence of its own – while we can get computers to play a reasonably good game of tic-tac-toe and checkers, we computer people have all but given up hope, for the present time at least, of building a truly "intelligent" computer like HAL in the movie *2001.* The really important danger, as Norbert Wiener has pointed out in books like *God and Golem* and *The Human Use of Human Beings,* is that an unscrupulous leader can use a powerful computer to help subjugate his people, or that a thoughtless leader might abdicate some of his decision-making powers to a computer. The appearance of computerized war games, computerized military strategy-making systems like WIMMIX, computerized defense systems like SAGE, and the growth of computerized surveillance files certainly lend credence to these fears.

It would be absurd to minimize the dangers to this kind of misuse of computers – dangers that seem potentially far greater than those posed by the computers that generate incorrect bills. Since it is ultimately *people* that misuse the power of a computer, just as it is people that misuse atomic energy, a great deal more attention should be given to systems of human checks and balances to ensure that the rights and privileges of American citizens (and citizens of the rest of the world, for that matter) are not being endangered by computers.

Can We Have Faith in Computers?

It seems, then, that computers could bring about a tremendous improvement in various phases of government ... if one has *faith:* faith that the computers will work properly, faith that they will not be as petty and obstinate as many of the current computer systems, faith that they will not be misused by scheming politicians or over-zealous bureaucrats. We seem to have come full circle, first indicating that men had lost faith in their human leaders, and now suggesting that things will be better if they have faith in a cold-blooded mechanical computing machine.

In the long run, the advantages of computers will hopefully become self-evident. If, twenty years from now, people become generally aware that it is a *computer* that gets the garbage picked up on schedule; a computer that makes the telephone work properly; and a computer that keeps unemployment at a minimum, then they may gradually begin to feel a little more benevolent towards the machines.

Opinions: A Mixture of Facts and Faith

In the meantime, the garbage *isn't* being picked up, the telephone *doesn't* work, and unemployment is by no means at a minimum level. To make matters worse, even the pitifully primitive computer systems that currently exist don't work half the time. As a result, many of us are perpetually disgruntled, and do not feel kindly towards politicians, computers or the government. Our *opinions* on these subjects are a curious mixture of facts and faith, and the proportion of the two seems to differ from one generation to the next, from one neighborhood to the next, and from one ethnic group to the next. It is important to realize, I think, that our opinions and our views of the world are a function of our environment. Most of us have certain social and political attitudes formed and influenced by our parents, our friends, by the type of education we received, by the type of work we do, and by the newspapers, movies, and television shows that we happen to watch.

One of the problems in forming an opinion is that there is simply too *much* information available on any particular subject. In order to form an intelligent opinion on Vietnam, for example, one is faced with the difficult task of reading dozens of books, thousands of newspaper articles, reprints of Congressional hearings and investigations, as well as the speeches and statements by officials of the government and military. There is simply too much to read, too much to learn, and too much to keep up with. Our natural instinct, in many cases, is to block it out, or avoid it. Depending on our inclinations, we read selected articles from the *New York Times* and avoid the *New York Daily News;* we read *Time* magazine, but not *Ramparts;* we listen to speeches by Barry Goldwater, but turn off the television set whenever Eugene McCarthy's face comes into view; we expeditiously avoid books that run counter to our opinion on the subject.

On the other hand, there are times when desperately-needed information is not available to the average American. Listening to a debate between any two political candidates, for example, can be a highly frustrating experience – each accuses the other of having wrongly opposed or supported critical legislation, and it is extremely difficult, given the resources and the patience of the average citizen, to detect who is telling the truth. The "truth", such as it is, may be scattered through various official documents and reports, or it may be withheld from the public for reasons of national security and/or political expedience. It is highly ironic, given the nature of our national malaise, to hear leaders implore us to "have faith" that their programs will work out well.

Everyone Asks "Why?"

We are faced with a serious dilemma. Any manager or leader will point out that he cannot do his job properly if he constantly has to report every detail of his decision-making processes to his subordinates; this maxim becomes more and more true the higher one goes in management of any kind. On the other hand, the citizens of this country are faced with such staggering problems that they are no longer willing to submit meekly to the decisions of men who, as they have seen on their television screens, are often not much wiser than they. Everyone now wants to know "why": why haven't we gotten out of Vietnam, or conversely, why haven't we invaded North Vietnam? Why are we spending so much money on this program or that program? Since adequate answers to these questions are not forthcoming from our leaders, and since sufficient information is not available for the average citizen to answer his own questions, we have seen a growing disillusionment with *all* politicians.

A Computer in the Hands of the People

One way of improving the situation would be to put a computer in the hands of the people. If, as we have suggested above, part of the average citizen's feeling of impotence is caused by a lack of organized and readily-available information, would it not be possible to put such information at his fingertips with a computer?

I believe that it would be feasible, both economically and technically, to create a National Information Bureau, whose sole purpose would be to provide information to any citizen on any issue.

Creating a National Information Bureau

An example will illustrate the possibilities of such a system. Suppose a local citizen's group wanted more information on welfare, so that it could form an intelligent opinion of local political candidates. Not knowing where to begin, it might ask the National Information Bureau what information existed on welfare. The Bureau might respond that its files on welfare are broken into six categories:

1. Welfare legislation
2. Welfare statistics
3. History of welfare in the United States
4. Sociological and psychological effects of welfare
5. Attitudes towards welfare – speeches, interviews, etc.
6. Bibliography

Each of these categories could, of course, be broken down further. Thus, the section on "legislation" might be broken down as follows:

1. Legislation
   a. Federal legislation
      1. Currently pending legislation
      2. Recently enacted legislation
   b. State legislation
      1. Alabama
      2. Alaska
      •
      •
      •
      50. Wyoming
   c. Legislation passed by major cities
      1. New York
      2. Boston
      etc.

The local citizen's group could then request summaries of books, copies of articles, speeches and so forth. Similar information could be maintained on such subjects as Vietnam, defense spending, the economy, and crime. Information would be available in as much or as little detail as desired.

The major purpose of the National Information Bureau would, of course, be to serve as a central source of information on any subject of reasonable interest. However, it would also serve to illustrate the inconsistencies and the contradictions that exist in areas like the Vietnam war. If a political figure made one speech in the North and another contradictory one in the South, it would become evident in the files of the National Information Bureau; if his voting record in Congress was at odds with his public speeches to his constituents, it would also be recorded by the Bureau. If a politician quoted statistics or made charges that were contradicted by other reputable sources, that, too, would show up in the files.

Helping to Distinguish Between Fact and Faith

The National Information Bureau could also help people distinguish between matters of fact and matters of political faith. It might become evident, for example, that despite all the statements and speeches emanating from the White House, Richard Nixon's attitude toward youth is still summed up by his comment to Theodore White: "They were given too much, too easily; and this weakened them." In addition to showing what the public figures really believe in, the files of the Bureau could also show what "faiths" are involved in the major issues of the day. It might show, for example, that the question of welfare really boils down to an emotional argument between the liberal and conservative attitudes: the liberal feeling that *everyone* in a civilized country has a right to a decent amount of food, clothing and shelter, and the conservative feeling that *everyone* should work hard enough to be self-supporting. In other situations, the Bureau might show that there are five or six sides to an issue, each of which has its own combination of facts and faith.

The National Information Bureau would essentially be a large computer system. It would receive newspaper articles from every major newspaper in the country; speeches by all major public figures; books; polls, news analyses by television and radio commentators, and so forth. All of this would be filed, categorized and summarized automatically. The source material might be kept on microfilm; summaries, analyses and indexes could be kept on faster forms of storage. For those who merely wanted to "browse", information could be displayed on devices called CRTs, which look like television screens. Copies of source documents could be made on high-speed printers or microfilm reproduction equipment.

In computer parlance, such a system is known as an "information retrieval system". As long as the range of information is fairly well-defined, and the relationships between different pieces of information not too complex, information retrieval systems are certainly within the capabilities of current technology. A number of business organizations use information retrieval systems to extract information about their employees or about sales, production or inventory. Scientists often use information retrieval systems to find literature on a particular subject of interest. Even the government data files which pose such a potential threat to our privacy are, for the most part, information retrieval systems. The National Information Bureau would simply be an information retrieval system designed to handle a different kind of information for a different clientele.

Financing the National Information Bureau

Since computers are so expensive, financing such a system might well be a problem. It would be desirable to avoid government financing, since that would pose a number of thorny problems. On the other hand, it is not at all clear that the National Information Bureau could be self-supporting. To do so, it would have to charge its customers for the information it provided, and this would certainly discourage both the poor and many of the middle-class Americans who desperately need it. The only approach that seems viable, at the moment, is to provide financing from an independent, non-profit foundation.

False Data

There are other potential problems that should be explored before any money is invested in such an ambitious undertaking. For one thing, it is quite possible, if not almost *certain,* that false data would be supplied to the system at various times. Economic or military figures which would prove embarrassing would probably be "adjusted" before being released to the public and to the files of the National Information Bureau. This, of course, is already being done, but the exposure that would be provided by the Bureau would make it even more necessary. It might also make politicians attempt to withhold more information from the public.

This would not cause any great harm to the information retrieval system unless it took the form of a complete national conspiracy. There are still some politicians in this country with opposing viewpoints, and there is still some free flow of information; since *all* available information would be digested by the Bureau, the deceptions or inconsistencies of any one politician would soon become apparent. However, if the entire United States Government undertook a concerted effort to hoodwink the American people, it is conceivable that they could engage in such a massive propaganda campaign that even the National Information Bureau would be fooled.

The Bureau Might Be Biased

There is also the possibility that the Bureau itself might be biased. If the computer were programmed by a rabid segregationist, for example, the resulting system might reflect that bias. Since the National Information Bureau would be dealing with the categorization, the summarization and, to some extent, the analysis of information, it would be easy for even the most subtle personal prejudice to work its way into the computer. Hopefully, this problem could be resolved by subjecting the system to a constant scrutiny by people of varying political and philosophical attitudes.

Criticism and Pressure

It is almost certain that the system would be subjected to extreme criticism by any individual or group that felt it was being unfairly portrayed by the Bureau. Financial and/or political pressure could certainly be brought to bear on the system by lobbies, companies, individual politicians or even the entire government. If this happens, and if the pressure is strong enough to shut down the National Information Bureau, then we will indeed be in as much trouble as the young revolutionaries say we are.

The Greatest Danger: Lack of Interest

The greatest danger of all is that nobody will be interested in such a system. No matter how available the information is, there will certainly be some people that will be too lazy or too uninterested to obtain it. There may also be a number of people who will not want to have anything to do with the Bureau because it only seems to tell them bad things. The "it's-about-time-we-heard-what's-right-with-America" philosophy might find it very difficult to cope with a National Information Bureau that refused to sugar-coat the material it collected.

It is not really clear, then, whether such a system would work or would have any value. It *is* clear, though, that computers are here to stay; technology is here to stay; the information explosion is here to stay. American society will continue to become more complex, more confusing, and more technological in nature. No one seriously expects Americans to move back to the farms *en masse* in order to solve the ecology problem. Similarly, no one really expects the telephone company to give up its all-digit dialing system, or the government to give up on its attempts to reduce everyone to a social security number.

We have already spawned the monster; now all we can do is attempt to control its growth and its appetite. We can try to control the way technology is used, so that it becomes easier, not more difficult, for people to cope with the complexities of our age. The National Information Bureau might well be a first step in that direction. □

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. This month's Numble was contributed by:

Stuart Freudberg
Newton High School
Newton, Mass.

NUMBLE 715

```
       S E L F
   + T R U S T
   = C O F F E        H = L
   + I S T H E
   + O F I E F I

56748   43974   81542   99344
```

Solution to Number 714

In Numble 714 in the March issue, the digits 0 through 9 are represented by letters as follows:

T = 0	F,G = 5
M,N = 1	I,Y = 6
A,U = 2	O = 7
S = 3	E = 8
L = 4	D = 9

The message is: Folly does not see its magnitude.

Our thanks to the following individuals for submitting their solutions – to **Numble 713**: Gordon Bruno, Cliffside Park, N.J.; A. Sanford Brown, Dallas, Texas; T. P. Finn, Indianapolis, Ind.; John H. MacMullen, Eden Prairie, Minn.; Richard Marsh, Washington, D.C.; G. P. Petersen, St. Petersburg, Fla.; and Robert R. Weden, Edina, Minn. – to **Numble 712**: Twite S. Emerick, Harrisburg, Pa., and Vincent K. Roach, New York, N.Y.

THE ASSASSINATION OF PRESIDENT KENNEDY:
The Spatial Chart of Events in Dealey Plaza

In the May 1970 issue, "Computers and Automation" published a 32 page feature article by Richard E. Sprague, entitled "The Assassination of President Kennedy: the Application of Computers to the Photographic Evidence".

In this article, Richard E. Sprague, President, Personal Data Services, Hartsdale, N.Y., stated that analysis of the evidence proves that the Warren Commission conclusions (that Lee Harvey Oswald was the sole assassin, and that there was no conspiracy) are false; and indicates convincingly that there were at least four gunmen firing from four locations, none of whom was Oswald; and that the conspiracy to kill Kennedy involved over 50 persons (of whom several are identified in the article).

This article contained a spatial chart of the events in Dealey Plaza, Dallas, Texas, at the time of the assassination of President Kennedy, showing many details. The chart published here is a revision and contains corrections and some additional information: the scale in feet has been corrected; certain cars have been properly titled; and four or five names of persons or locations have been added or corrected. C&A will publish additional revisions and corrections when known.

1. Areas on the Chart. The spatial chart is divided into square areas 40 feet by 40 feet, each labeled by a letter A to K from top to bottom (I is omitted) and a number 1 to 15 from left to right.

2. Person Names. The name of a person in the following index refers to the location of such person.

3. Numbers. A number folowing the name of a person refers to the film (or roll) number of a still photograph, or the frame number of a movie sequence taken by such person. Numbers preceded by Z refer to frame numbers of the color movie film taken by Abraham Zapruder standing in area D 7.

4. Motorcade. The leading portion of the motorcade including President J.F. Kennedy is shown diagrammatically 7 to 8 seconds before the first shot. The motorcade is arranged in sequence along Houston St. and Main St. All these cars, of course, were moving and therefore occupied different positions at later times. The only successive locations shown for later positions of the motorcade are the locations of President Kennedy's head in the lead car. These head locations are marked by a sequence of dots along Elm St. These locations were carefully determined by the FBI; they are identified by the frame numbers of the color movie film taken by Abraham Zapruder; these locations were used by the Warren Commission in their investigation. Successive frames were 1/18 second apart.

5. Note. The information shown in the diagram of the motorcade (C-J 14, J 15) is not repeated in this index.

Much of the geographic information (such as locations of trees, white traffic lines, yellow marks on curbs, etc.) is not repeated in this index.

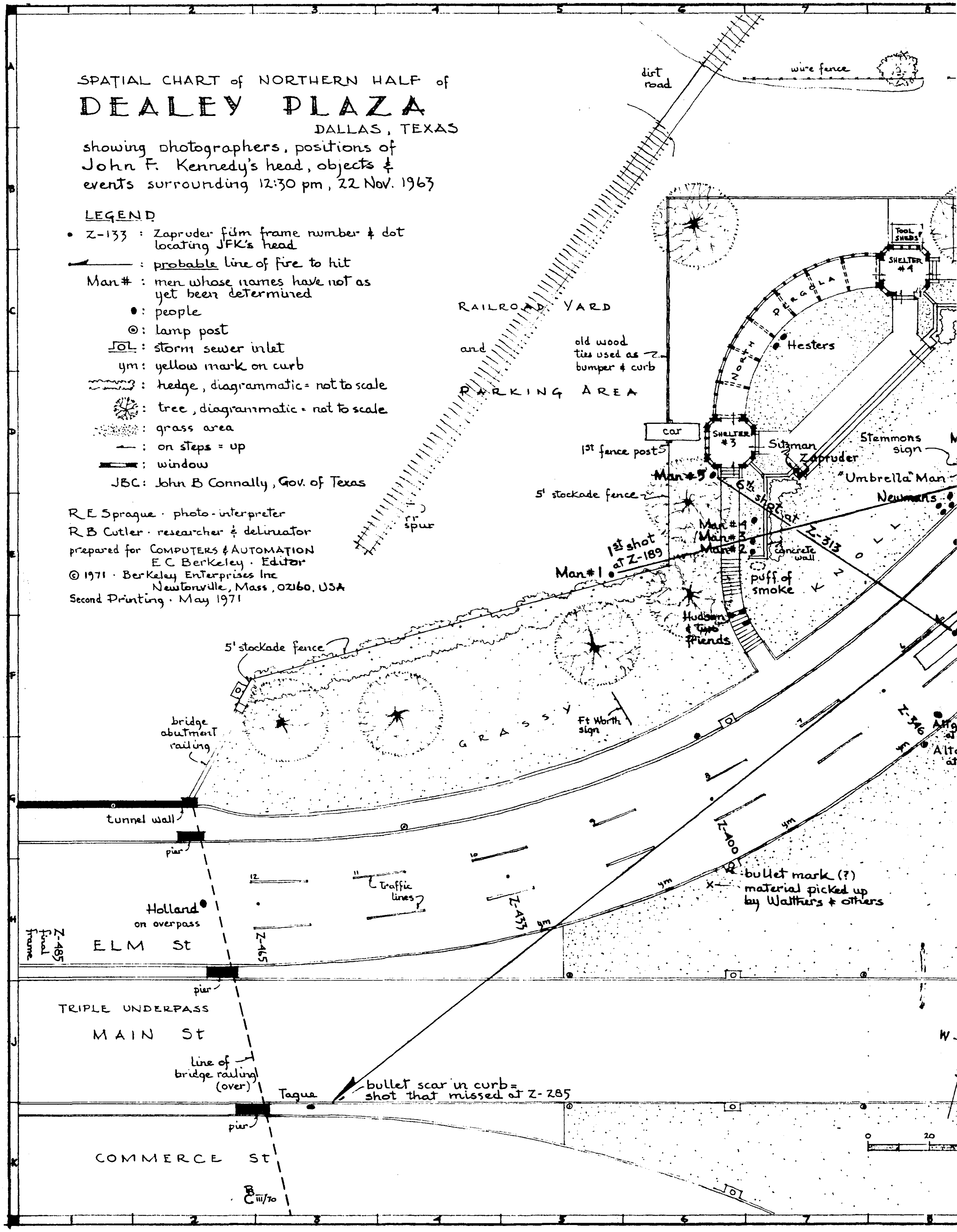
INDEX AND GUIDE TO LOCATIONS

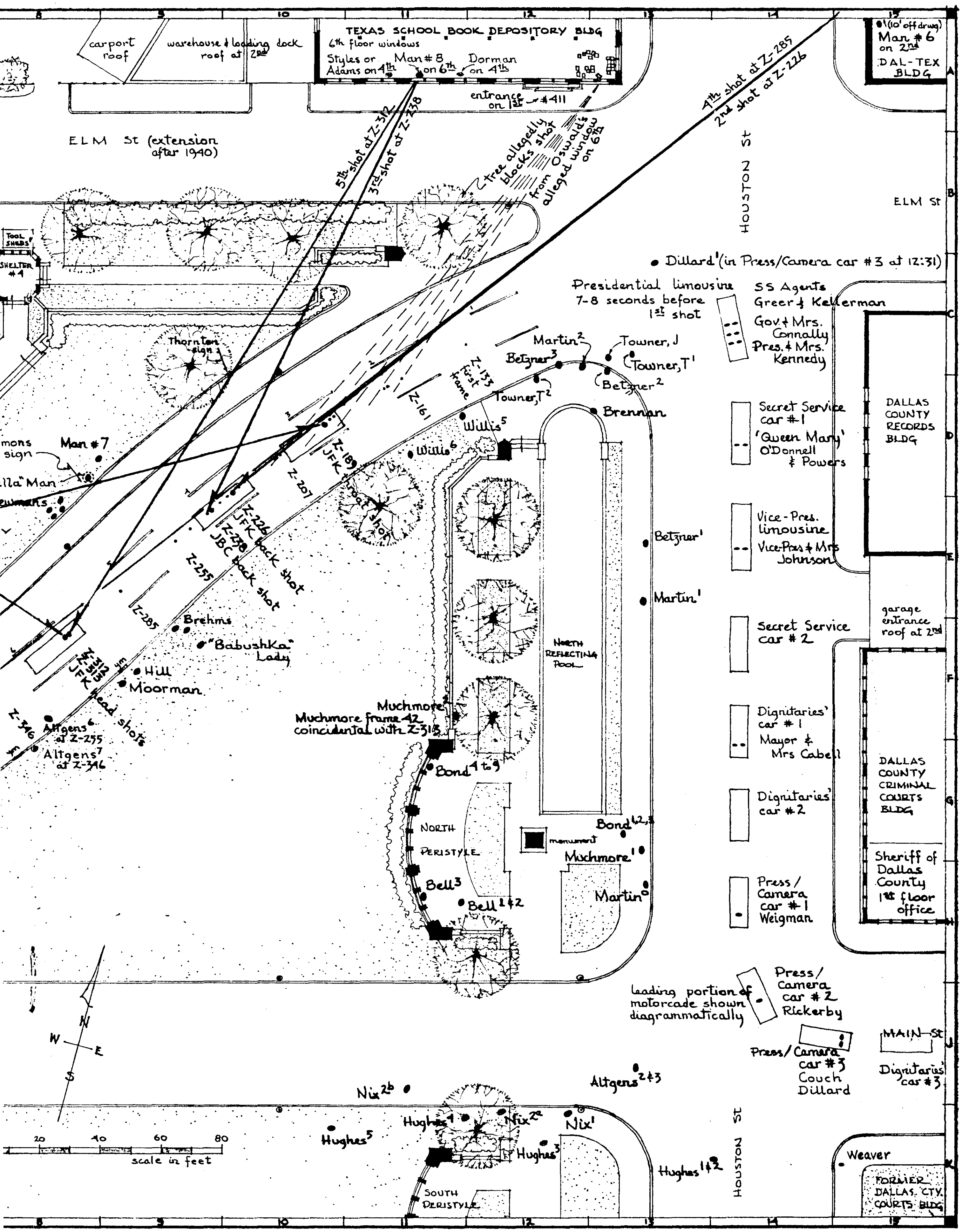
Person or Object	Location
Altgens 2, 3	J 13
Altgens 6 (at Z 255)	F 8
Altgens 7 (at Z 346)	G 8
"Babushka Lady" (who took an entire movie of the motorcade from the opposite side from Zapruder)	F 8
Bell 1, 2	H 11
Bell 3	H 11
Betzner 1	E 13
Betzner 2	C 13
Betzner 3	C 12
Bond, 1 to 3	G 13
Bond, 4 to 9	G 11
Brehm(s)	F 9
Brennan	D 13
bullet mark(s) on curb	J 3, H 6
Commerce St.	K 1-6
compass directions	J 8
Connally, Gov. J. B., back shot (at Z 238)	E 9
Dallas County Criminal Courts Bldg.	F-H 15
Dallas County Records Bldg.	C-E 15
Dallas County Sheriff's Office	H 15
Dal-Tex Bldg.	A 15
Dillard 1	C 13
Dorman, Mrs.	A 11
Elm St.	H 1 to B 15
Elm St. extension	A-B 6-12
former Dallas County Courts Bldg.	off map, see K 15
garage bldg. next to TSBD	A 8-10
grassy knoll	G 4 to C 10
Hester(s)	C 7
Hill, Jean	F 9
Holland	H 2
Houston St.	A-K 13-14
Hudson and two friends	F 6
Hughes 1, 2	K 14
Hughes 3	K 12
Hughes 5	K 10

Person or Object	Location
Kennedy behind "the" oak tree, from Z 161 to Z 207	D 10-11
Kennedy at:	
Z 133	C 11
Z 161	D 11
Z 189 (throat shot)	D 10
Z 226 (back shot)	"
Z 238	E 9
Z 255	"
Z 285	"
Z 312 (head shot)	F 8
Z 313 (2nd head shot)	"
Z 346	"
Z 400	G 6
Z 433	H 5
Z 465	H 3
Z 485	H 1
knoll, grassy	G 2 to C 9
Main St.	J 1-15
Man # ... : these were men whose names have not been determined	
Man #1, source of 1st shot at Z 189	D 5
Man #2	E 7
Man #3	E 7
Man #4	E 7
Man #5, source of 6th shot at Z 313	D 6
Man #6, off map in Dal-Tex Bldg, source of 2nd shot at Z 226 and 4th shot at Z 285	see A 15
Man #7	D 8
Man #8, source of 3rd shot at Z 238 and 5th shot at Z 312	A 11
Man with Umbrella	D 8
Martin 0	H 13
Martin 1	G 13
Martin 2	C 12
material picked up by Walthers and others	H 6
Moorman	F 9
Muchmore 1	G 13
Muchmore 2	F 11

Person or Object	Location
Newman(s)	E 8
Nix 1, 2a	K 12
Nix 2B	J 10
Oswald's alleged window	A 13
parking area and railroad yard	B-E 4-5
puff of smoke (shown in 9 photos)	E 7
railroad yard and parking area	B-E 4-5
scale in feet	K 8-9
shots, sources of:	
1st	E 5
2nd	A 15
3rd	A 11
4th	A 15
5th	A 11
6th	D 6
Sitzman	D 7
smoke, puff of (shown in 9 photos)	E 7
Stemmons-Freeway sign	D 8
Tague (who was hit in the face by a fragment of a shot)	K 3
Texas School Book Depository Bldg. at 411 Elm St. (TSBD)	A 10-13
TSBD, 6th floor easternmost window, from which Warren Commission alleged Lee Oswald fired 3 shots	A 13
Towner, J. 1	C 13
Towner, T. 1	C 13
Towner, T. 2	D 12
"Umbrella" Man	D 8
Willis 5, 6	D 11
Zapruder (location of Abraham Zapruder during the entire color movie which he took)	D 7

(See chart on next two pages)


SPATIAL CHART of NORTHERN HALF of
DEALEY PLAZA
DALLAS, TEXAS
showing photographers, positions of John F. Kennedy's head, objects & events surrounding 12:30 pm, 22 Nov. 1963
LEGEND
• Z-133 : Zapruder film frame number & dot locating JFK's head
: probable line of fire to hit
Man# : men whose names have not as yet been determined
•: people
⊙: lamp post
: storm sewer inlet
ym: yellow mark on curb
: hedge, diagrammatic = not to scale
: tree, diagrammatic = not to scale
: grass area
: on steps = up
: window
JBC: John B Connally, Gov. of Texas
R E Sprague · photo-interpreter
R B Cutler · researcher & delineator
prepared for COMPUTERS & AUTOMATION
E C Berkeley · Editor
© 1971 · Berkeley Enterprises Inc
Newtonville, Mass, 02160, USA
Second Printing · May 1971
dirt road
wire fence
RAILROAD YARD
and
PARKING AREA
old wood ties used as bumper & curb
TOOL SHEDS
SHELTER #4
PERGOLA
NORTH
Hesters
car
SHELTER #3
1st fence post
Sitzman
Zapruder
Stemmons sign
"Umbrella" Man
Newmans
Man #5
6th shot
Z-313
5' stockade fence
rr spur
Man #4
Man #3
Man #2
concrete wall
1st shot at Z-189
Man #1
puff of smoke
Hudson & two friends
5' stockade fence
GRASSY
Ft Worth sign
bridge abutment railing
Z-346
ym
tunnel wall
pier
Z-400
ym
bullet mark (?)
material picked up by Walthers & others
Traffic lines
Holland
on overpass
Z-437
ym
Z-485 final frame
ELM St
Z-465
pier
TRIPLE UNDERPASS
MAIN St
line of bridge railing (over)
Tague
bullet scar in curb = shot that missed at Z-285
pier
COMMERCE St
0
20
B C III/70



TEXAS SCHOOL BOOK DEPOSITORY BLDG
6th floor windows
Styles or Adams on 4th
Man #8 on 6th
Dorman on 4th
entrance on 1st
#411
carport roof
warehouse & loading dock roof at 2nd
Man #6 on 2nd
(10' off drwg)
DAL-TEX BLDG
ELM St (extension after 1940)
5th shot at Z-312
3rd shot at Z-238
tree allegedly blocks shot
from Oswald's alleged window on 6th
4th shot at Z-285
2nd shot at Z-226
HOUSTON St
ELM St
TOOL SHEDS
SHELTER #4
Thornton sign
Dillard[1] (in Press/Camera car #3 at 12:31)
Presidential limousine 7-8 seconds before 1st shot
SS Agents Greer & Kellerman
Gov. & Mrs. Connally
Pres. & Mrs. Kennedy
Martin[2]
Towner, J
Betzner[3]
Towner, T[1]
Betzner[2]
Towner, T[2]
Z-133 first frame
Z-161
Brennan
mons sign
Man #7
lla" Man
Willis[5]
Willis[6]
Z-189 JFK throat shot
Z-207
Z-226 JFK back shot
Z-238 JBC back shot
Z-255
Z-285
Secret Service car #1
'Queen Mary'
O'Donnell & Powers
DALLAS COUNTY RECORDS BLDG
Vice-Pres. limousine
Vice-Pres & Mrs Johnson
Betzner[1]
Martin[1]
garage entrance roof at 2nd
Brehms
"Babushka" Lady
Z-312 Z-313 JFK head shots
Hill
Moorman
Z-346
Altgens[6] at Z-255
Altgens[7] at Z-346
Secret Service car #2
NORTH REFLECTING POOL
Muchmore[2]
Muchmore frame 42 coincidental with Z-313
Bond[4 to 9]
Dignitaries' car #1
Mayor & Mrs Cabell
DALLAS COUNTY CRIMINAL COURTS BLDG
Dignitaries' car #2
NORTH PERISTYLE
monument
Bond[1,2,3]
Muchmore[1]
Bell[3]
Bell[1&2]
Martin[0]
Press/Camera car #1 Weigman
Sheriff of Dallas County 1st floor office
Press/Camera car #2 Rickerby
leading portion of motorcade shown diagrammatically
N
W
E
S
MAIN St
Press/Camera car #3 Couch Dillard
Dignitaries' car #3
Altgens[2&3]
Nix[2b]
Hughes[4]
Nix[2a]
Nix[1]
Hughes[5]
Hughes[3]
Hughes[1&2]
20 40 60 80
scale in feet
SOUTH PERISTYLE
HOUSTON St
Weaver
FORMER DALLAS CTY. COURTS BLDG
8 9 10 11 12 13 14 15
A B C D E F G H J K

PLAYING GAMES WITH A COMPUTER

James R. Palmer
Member of the Technical Staff
Space and Communications Group
Hughes Aircraft Company
Los Angeles, Calif. 90009

Playing games can be fun — and educational. Anyone who has played the game Monopoly has probably learned a lesson about undercapitalization and a liquidity crunch.

The advent of the computer offered a new vehicle for these lessons: the management game. Overnight a science of computerized education sprang forth. Statistical simulation was employed to develop some very elaborate and sophisticated game models. More recently computerized education has turned toward the concept of programmed learning as a vehicle for instruction.

The El Segundo Division of Hughes Aircraft Company was recently faced with a need for utilizing some of these techniques. The company was developing a detailed educational course on production control. It was felt that some type of game would be useful at the end of the course to summarize the basic principles. A survey of games and simulations then available uncovered no precisely appropriate packaged product. Hence authorization was given for a project to develop an educational game for this application.

The Development Project

From the beginning, the project was oriented towards a very clear objective: to design a game that illustrates the basic principles of production control. But coupled to this objective were three constraints.

First, the development and operation of the game had to be inexpensive.

Second, the game had to be simple.

Third, the game had to prove true-to-life realism.

These constraints were imposed by the particular application for which the game was designed.

Three educational tools were selected for use in the game. These were the computer, statistical simulation, and programmed learning. Tne computer was selected because of its speed, impartiality, and accuracy. To contend with the high costs attached to its use, a timesharing system was selected and special emphasis was placed on simplified game design.

Statistical simulation was selected as a tool because of the atmosphere of challenge and realism that it offers. But here a rather novel approach was taken. Because of the constraints on game simplicity and cost, the introduction of any random factor game elements was avoided. That is, the game was written in mathematically deterministic format. The goal was to keep the game elements simple enough to be understood but complex enough so the solution is not immediately obvious.

The third educational tool selected, programmed learning, also had to be modified for this application. The objective of the game was to illustrate principles, not to teach specific information. Hence the approach taken was to guide the participants toward considering a set of fundamental questions that the subject (production control) is designed to answer. That is, a production control system is designed to answer the questions:

What is being manufactured?

How is it being manufactured?

How many are being manufactured?

When are they being manufactured?

Therefore, the game was structured to force the student to repeatedly answer these questions as the simulation progressed. Included was a system of response checking to flag any illogical responses by the student, present an analysis of errors, and offer a chance for resubmission. This is similar to standard programmed learning techniques except that the questions were made cyclically repetitive, and the amount of conditional branching was sharply curtailed.

The Results

The game that resulted from this project is called DEFOG, or Deterministic Factory Operation Game. It is designed around a fictitious product having five parts. To conform to the "true-to life realism" constraint, a complete set of drawings and cost and technical specifications for the parts are included in the game. Several days before the simulation is to be run the participants (who may be separated into teams) are given an instruction manual for the game. They are told that for the game they have been assigned responsibility for meeting a specified delivery schedule on a fixed price contract. (Penalty costs are established for missed schedules.) Also, they are given a set of general instructions for pre-game study and planning.

The actual simulation proceeds in a month-by-month manner. Each simulation month starts by asking the participant which parts he wants to purchase, fabcate and assemble during that month. He is then asked for his order quantities in each category. His responses are checked to make certain he hasn't tried to purchase something that can't be purchased, assemble something he doesn't have parts for, etc.

At the end of each simulated month, a breakdown of the participant's inventory and manufacturing cost is presented. At the end of the game, the participant's profit on the contract is calculated.

Analysis

DEFOG has been successfully employed in several applications. In addition to its use in four classes of the company's production control course, the game was presented at the recent 1971 Systems Engineering Conference (SENCO 71) in Phoenix, Arizona. Post-game informal discussions by the participants have indicated that they did in fact develop an increased understanding of certain principles of production control. Comments like "inventory costs killed us", and "we found a way to avoid assembly overtime", indicated an understanding of various cost trade-offs. So it seems that the objective of the game was met.

Furthermore, the game does appear to remain within the constraints which governed its design. Total development cost was under $1500. Labor was by far the largest cost element. Development time was one month. It costs less than $9 per team to play the game. This may or may not comply with the constraint on being "inexpensive", but the company feels that DEFOG will be a very profitable investment over the years. With regard to the constraint on game simplicity, success is more obvious. Of the four teams that played the game on its premier opening occasions two teams discovered the optimum solution. The other two teams managed a profit on the simulated contract. Finally, the sense of realism in the game seems adequate. The first participants were operating manufacturing men; they were able to readily identify with the situation and the problem.

Some Generalizations

If the explicitly expressed satisfaction of DEFOG's users is a legitimate measure of success, then DEFOG is a success.

But perhaps the most significant success is not DEFOG itself but rather the technique used to develop it. This technique can be summarized in five steps:

(1) Determine a specific need or application, because it forms a particular part of a particular production control course being given to a particular group of individuals. In a different application DEFOG (or <u>any</u> game) might be irrelevant and worthless.

(2) Once it is decided that there is a valid application for a game, determine the precise objective of the game. A game designed to teach specific facts should be quite different from a game designed to teach general principles.

(3) Establish the constraints to which the design must conform. Most important is the financial constraint. Other constraints will stem from the particular application.

(4) Determine what tools are available, and which of those are most appropriate.

(5) Design the game to meet the objective within the constraints using the selected tools.

Acknowledgements

The author thanks Dr. Harry W. Steinhoff, Jr., of Hughes Aircraft Company and Dr. Alan Rowe of the University of Southern California for their generous contributions to the success of this project.

ESSENTIAL COMPUTER CONCEPTS FOR TOP MANAGEMENT

1. From Frank J. Gabriel
6740 Old York Road
Philadelphia, PA 19126

In your extraordinarily fine, perhaps the finest magazine on computer technology developments, "Computers and Automation", in the October 1970 issue, in your excellent editorial "What Top Management Should Know About Computers", you stated that you estimate that a member of top management would need to know and understand some 60 to 100 <u>important terms</u> and some 40 to 80 propositions about computers.

May I respectfully suggest, without imposing on your extremely busy time, that if it is in any way at all possible, you Sir should graciously make that compilation and publish it forthwith (as it is very much and urgently needed), either in your magazine or in a separate booklet; and that I would consider myself privileged to receive it either on a complementary basis or paying for it, which I would do gladly.

2. From the Editor

In an editorial in "Computers and Automation" for October 1970 I said:

> I would estimate that a member of top management would need to know and understand some 60 to 100 important terms, and some 40 to 80 important propositions about computers. Also he should have a short (3 to 5 day) course (of good quality) about computers. And the course should include interactive contact with a computer.

As a result of Mr. Gabriel's request, I have put together a beginning, a preliminary list of slightly over 100 important terms and topics, as candidate terms for top management to understand. (Definitions and propositions will be determined later.)

<u>1. General Concepts</u>

computer / data processor

digital computer vs. analog computer

desk calculator vs. slide rule

electronic data processing / automatic data processing / EDP / ADP

size / cost / speed / capacity / flexibility / reliability

communication / computing

<u>2. Computer</u>

definition of / history of / future of / programming of

computerized system / systems analysis

applications: what a computer can do easily vs. what a computer can do with difficulty vs. what a computer cannot do at all

final assembly principle vs. principle of successive models

stored program computer vs. externally programmed computer

input / output / storage / central processor / registers or locations / core

external storage: punched cards / magnetic tape / magnetic discs / punched paper tape

modem / console / terminal

<u>3. Programming</u>

hardware vs. software

machine instruction / machine coding / machine word memory reference

operation code

ASCII (pronounced "askee", and meaning American Standard Code for Information Interchange)

conditional transfer

microprogramming

pseudo operation code

standard coding form

4. Programming in General

programming languages

information / data

numbers / digits / characters / truth values / words / parameters / variables

mathematics vs. logic vs. programming

algorithms or calculating rules

accuracy vs. precision

problems vs. solutions

constants / expressions / statements / loops / variables / declarations / transfer instructions / conditional transfer instructions / subroutine calls

octal system vs. binary system vs. decimal system

fixed point operation vs. floating point operation

binary arithmetic

simulation / models

5. Programming Languages

machine language

symbolic language

assembly language

COBOL / FORTRAN / BASIC

problem-oriented vs. machine-oriented programming languages

6. Programming Operations

writing / debugging / documenting / flow chart / assembling / compiling / loading / operating / testing / storing / dumping / tracing / debugging / desk checking

amendment, correction, modification

7. Systems Analysis and Synthesis

observation / interviewing / investigation / typical examples of results / testing of typical examples on a computer / bench-mark problems / feasibility analysis / changeover / continued modification and adaptation

8. Computer Department

organization of department

open shop vs. closed shop

batch processing vs. time-shared vs. mote access vs. entire machine

operator vs. programmer vs. systems analyst

batch operations vs. real-time operation

turn-around-time

It seems to me that this is almost the total list of essential computer concepts and topics for top management. This list may even err a little on the side of fullness. However, a member of top management needs to "know his way around" so as never to be fooled or deceived.

Comments from readers are invited.

$290,000 AWARDED IN LIBEL DAMAGES TO AN INSURANCE BROKER SUING RETAIL CREDIT CO.

(Based on a report in "Computerworld", March 24, 1971)

A court in Oakland, Calif., has awarded $290,000 to an insurance broker Paul F. Roemer, Jr., plaintiff, in a precedent-setting case in which libel damages were filed against Retail Credit Co. This company is the largest dossier holder in private business, and has some 48 million dossiers on file. It deals largely with private business but also cooperates with government agencies.

The charge alleged that damaging information was supplied through a former business associate who had had disagreements with Roemer.

The credit company's report on Roemer said that there was a question of his honesty over misuse of funds. The conclusion of the report was that Roemer "is by no means recommended."

("DETAILS" – continued from page 7)

-------(may be copied on any piece of paper)-------

To: Computers and Automation, Dept. E
815 Washington St., Newtonville, Mass. 02160

( ) Yes, I am interested in the offer made in the editorial by E. C. Berkeley on page 6 of the May 1971 issue.
( ) I am an unemployed computer professional.
( ) I am a subscriber to "Computers and Automation".
( ) I am seriously interested in trying to develop a small business of my own.
( ) I enclose a statement about my education, background, aptitudes, resources, interests, purposes, and any prior experience I have had as a self-employed person.
( ) Please send me the list of the several dozen products and services for which you have observed a need, and some further remarks and guidelines on the subject of operating one's own business.

My name and address are attached.

RESTORATION OF SERVICE AFTER EARTHQUAKE

D.L. Talley
Redcor Corporation
21200 Victory Blvd.
Woodland Hills, Calif. 91364

Tabulating Consultants, Inc., a major computer service bureau in Burbank, California, faced a severe financial loss on Tuesday February 9th. Their company is located close to the epicenter of the major earthquake which struck Southern California at 6:01 am that day. Tabulating Consultants runs two shifts a day on their 16 terminal KeyLogic system.

Jack Moore, one of Redcor Corporation's customer service engineers, reported to Tabulating Consultants when they opened at 7 am. Power was off for over an hour. Moore assisted in clearing debris. When power was restored, he ran complete preventive diagnostic routines. The system was re-initialized and in a short time turned over to Jeri Borella, Data Transcription Supervisor for Tabulating Consultants.

Richard Kurzenknabe, Tabulating Consultants' president, said "I couldn't be more pleased with the Redcor initiative and assistance in getting us back into business. Redcor anticipated the problems which might have resulted from the earthquak and the resulting power failure. Their response allowed us to get back on the air with the minimum amount of lost revenue. You couldn't ask for better service than we received during this emergency."

UNINTERRUPTIBLE POWER SUPPLY PROTECTED NASA COMPUTER DURING EARTHQUAKE

Robert R. Bentley, News Bureau
General Electric
Bala Cynwyd, PA 19004

When rocked by one of California's strongest earthquakes on Feb. 9, the computer complex at NASA's Jet Propulsion Laboratory in California still functioned flawlessly, providing an important link in returning Apollo 14 astronauts to earth.

The sixty million dollar complex of computers was serving as a back up monitoring center for that manned flight, as well as receiving data from deep-space probes, when the earthquake broke incoming power lines.

An uninterruptible power supply provided continuous power, helping assure safe splashdown for the astronauts, and save irreplaceable information from deep-space. Even milli-second interruptions of computer power can cause misinterpreted data or loss of stored information.

JPL's uninterruptible power system was developed by the Custom Power Equipment Department of General Electric and it smooths out irregularities and provides battery power during major power breaks until emergency generators can take over and supply power.

"TO HELP LIBERATE ONE'S MIND FROM NEWSPEAK" — COMMENT

1. From M. L. Huber
E. I. DuPont de Nemours & Co.
Wilmington, Del. 19808

In your editorial "Computers, Language, and Reality" in "Computers and Automation", March 1970, you offered a copy of a list of books concerning relationships to reality.

I believe I sent a Readers Service Card (with 2 circled), as instructed, to obtain a copy of the list. To my knowledge, I have received no communication.

If this listing of books is still available, I would still be interested in obtaining a copy, if you please. I assume the copy would be available essentially free of charge.

Thank you for your assistance.

2. From the Editor

The list was referred to in March with the following description:

> I have put together a list of some dozen books that I think are useful to help liberate one's mind from the propaganda and Newspeak of today.

Because over 300 readers of "Computers and Automation" asked for the list, we decided to publish it with comments. In the June 1970 issue it was published with full citations and comments, under the title "To Help Liberate One's Mind from Newspeak", on pages 9, 10, and 13. For convenience, the books referred to there are here listed again, but for more information please see the June issue.

1. In General

1. Bertrand Russell / Sceptical Essays
2. Rudolf Flesch / The Art of Clear Thinking
3. Winston W. Little, W. Harold Wilson, and W. Edgar Moore / Applied Logic
4. Monroe C. Beardsley / Thinking Straight: Principles of Reasoning for Readers and Writers
5. George A. Miller / Language and Communication
6. Neil Postman and Charles Weingartner / Teaching as a Subversive Activity

2. On Propaganda, Fads, Crusades, and Lies in General

7. Alfred McClung Lee and Elizabeth Briant Lee, Editors / The Fine Art of Propaganda, A Study of Father Coughlin's Speeches
8. Martin Gardner / Fads and Fallacies in the Name of Science
9. Eric Hoffer / The True Believer: Thoughts on the Nature of Mass Movements
10. William McGaffin and Erwin Knoll / Anything but the Truth: The Credibility Gap -- How the News is Managed in Washington

3. Some Particular Struggles Between Doctrine and Reality

11. Senator J. William Fulbright / The Arrogance of Power
12. Jerome D. Frank / Sanity and Survival
13. James E. Bristol and 7 other authors / Anatomy of Anti-Communism
14. Mark Lane / A Citizen's Dissent

THE DEATH OF WALTER REUTHER

1. From Terrell L. Elrod
Systems Supervisor
Hoffman La Roche Inc.
Nutley, N.J. 07110

In the past I have applauded the efforts of you and others who have not been satisfied with the information released to the public surrounding the violent deaths of our national leaders. Supplementary data and the analysis of events published by you have been newsworthy and are a contribution to the search for the true facts that surrounded their tragic deaths.

However, your January 1971 article "The Death of Walter Reuther: Accidental or Planned?" was published prematurely since the investigator, "Leonard Walden," answered your questions in only a highly generalized manner adding nothing to the facts already known about this incident. For example, his comment on the altimeter was "The altimeter of the Lear Jet could have malfunctioned either accidentally or by design." How many other alternatives are there? The important points are: did the altimeter malfunction, and if so, what was the cause; was the altimeter tampered with, if so, by whom; and most of all — if the answers to these two possibilities are no — was pilot error involved.

In your apparent haste to publish an assasination hypothesis, you nowhere explore the possibility of pilot error. No mention is made concerning the possibility of unstable aerodynamic characteristics of the Lear Jet in turbulent weather.

I strongly feel that before you can begin to investigate a possible plot on the life of Walter Reuther you must first determine that there was no aircraft malfunction or pilot error involved.

Otherwise, we might soon start reasoning that because more than 50,000 persons are killed on our nation's highways that a possible conspiracy exists among the asphalt manufacturers of the country.

II. From the Editor

You are quite right that many aspects of the publication of the article on Walter Reuther's tragic death would entitle a reader to say that the article was "published prematurely".

But there are these other factors:

(1) It costs money to investigate further, and the employment of our investigator so far has cost several hundred dollars and we are not a rich magazine;

(2) We waited five months (from about July 15 to about December 15) to see if more information came out by other avenues, and none did;

(3) Before the sad event becomes staler still, it was desirable to raise the issue;

(4) There exists no public agency in the United States so far as I know which is charged with investigating the deaths of our important leaders, and therefore it is incumbent on ordinary people (like "Computers and Automation") to try to step into the breach;

(5) Our act of publication might lead to more volunteering of information.

I hope we shall have more information to publish.

A DATA BANK FOR NARCOTIC ADDICTS -- COMMENT

Bruce Madsen
10332 E. Lake Rd., RD-1
North East, Pa. 16428

Elmer Young ("Data Bank For Narcotic Addicts", C&A, October, 1970) missed a wonderful opportunity to use his computer tool to achieve understanding of a social problem.

Instead of using the results of studies by N.A.R.P. (Narcotic Addict Reporting Program) to educate computer and information engineers, he gives us statistics from unknown sources, modified by President Nixon. He continues to confuse the discussion with imprecise language:

> " ... A significant number of marijuana users become narcotic addicts. In a substantial number of cases ... marijuana ... leads to ... use of harder drugs."

The issue is less clear if one compares the statements to the "data" offered:

> 180,000 heroine users : 8,000,000 marijuana users -- 1 : 44.5

Is one out of forty a significant number? Is less than 2.5% substantial?

I would like to see a follow-up article with the goal of increasing our understanding of the narcotics problem.

PROVOKE THINKING

Mr. Vincent K. Roach
Product Applications Manager
COMRESS
1250 Broadway
New York, N.Y. 10036

I find "Computers and Automation" an extremely interesting publication. While some of the articles seem to go to extremes in their viewpoint or application of "logic", this is fine in that they provoke thinking on the part of the readers. I receive over 15 EDP-type magazines per month, and simply can't read everything. So I mark them up for later reading, scan to eliminate second-hand information, poorly-documented or -researched articles, and items of extremely limited appeal. Those that survive, I cut out and save. Of over 250 articles per month, I save perhaps a half dozen. Recently, I have saved "Computers and Automation" intact, as it contains as much useful, interesting information as the rest combined.

Keep up the good work. Our computer "profession" has much maturing to do. "Computers and Automation" is maturing with it, perhaps a bit faster.

BOOKS AND OTHER PUBLICATIONS

Stuart Freudberg
Newton, Mass.

Pylyshyn, Zenon E., editor, and 35 authors. / Perspectives On the Computer Revolution / Prentice Hall, Inc., Englewood Cliffs, NJ 07632 / 1970, hardbound, 540 pp., $10.50.

Contains a collection of important readings on many aspects of "the computer revolution", and includes statements on the historical, practical, theoretical, philosophical, social, legal, and moral issues of the computer field, from many distinguished authors.

The book is divided into three sections: (1) "The Development of Computer Science," which describes the development of computers and the intellectual heritage of computer science; (2) "Man and Machine" which explains the relationship between man, as a conscious thinking organism, and the machine; (3) "Society and Machine," which examines the relationship between society as a whole and the machine, which includes the impact of computers and related technological phenomena on our society.

Taviss, Irene, editor, and 30 authors / The Computer Impact / Prentice-Hall, Inc., Englewood Cliffs, NJ 07632 / 1970, hardbound, 297 pp., $7.95.

Using writings of many authors, this work examines the social implications of computers by looking at their potential and at their impact on the economy, political organization, and the culture of society.

Sackman, Harold / Man-Computer Problem Solving / Auerbach Publishers, Inc., 1101 State Rd., Princeton, NJ 08540 / 1970, hardbound, 272 pp., $12.50

This book is an examination of the growing experimental evidence on man-computer problem solving, particularly the competition between time-sharing and batch-processing computer systems. The author examines how people solve problems and how they can use computers most effectively to reach their solutions.

Gallagher, Cornelius E., New Jersey, Chairman, House Subcommittee on Invasion of Privacy, and others / The Computer and Invasion of Privacy: Hearings Before a Subcommittee of the Committee on Government Operations, House of Representatives, Eighty-Ninth Congress July 26 to 28, 1966: Reprint /

(Please turn to page 53)

LYING BY THE UNITED STATES GOVERNMENT: AN "ACCEPTABLE LEVEL"?

Edmund C. Berkeley
Editor, Computers and Automation

Every now and then these days I find out something that lacerates and splinters all my hopes and desires to have a good opinion of, an admiration for, the present United States Government, and its "national security" arm, the Pentagon and the military. In the years 1942-1946, I was on active duty in the U.S. Naval Reserve, and my last rank was Lieutenant Commander; and in those years, how much I admired the U.S. Navy!

I have wondered for a long time how reliable are the figures issued by the computers in the Pentagon about the number of deaths of Americans and Asians as a result of the war in Vietnam. The battle death toll of Americans is currently reported by the Pentagon to be somewhere between 50,000 and 55,000.

I happen to believe that the citizens of the United States, a democracy, are entitled to "the truth, the whole truth, and nothing but the truth" from the government which they have chosen to serve them.

Apparently, the truthful battle death toll (including the toll of the aftermath of battle and of the destruction of a soldier into a living corpse) is at least 200,000 Americans.

Following is an excerpt from a most important book, "Conversations with Americans" by Mark Lane, published by Simon and Schuster (630 Fifth Ave., New York, N.Y., 1970, 247 pp). Peter Schwed, the president of Simon and Schuster, told me in conversation that they had most carefully verified the information in the book before they published it. Most of the book consists of verbatim testimony from 32 Vietnam veterans, accounts based on tape recorded interviews of how the U.S. Marine Corps and other military groups trained them in torture tactics, and of the atrocities and massacres these soldiers witnessed or participated in. But in the introduction there occurs the following report:

"If Americans know less than all there is to know about the terrible cost the war is imposing upon the civilian population of South Vietnam, they know next to nothing of the real cost America is paying for its adventure.

"The real price is in the sacrifice of an entire generation.

"Some of the untold stories may be gathered in the hospitals in Japan, Germany, and the United States. Major Thomas Engelsing, now chief of the in-patient service in psychiatry at the Army's 97th General Hospital in Frankfurt, told me that as a result of immediate medical contact with the wounded in Vietnam —

> Lives are saved in this war. Lives of men who in any other war would have died. Men with multiple amputations, blinded, very serious brain injuries.

As a result,

> the Army facilities are now overfilled with men who are not rehabilitable.

He said that he had received

> a directive not to evacuate wounded to the United States because they are just filled up in the States; there is no more room.

"Major Engelsing said that the facilities in Germany are so overcrowded that he has had to ignore the directive. A colonel who had just returned to Germany from the United States had told him that conditions in Army hospitals and Veterans Administration hospitals in the U.S. are so deplorable and the facilities so overcrowded that a substantial number of doctors and nurses, unable to stand the depressing scene any longer, have asked to be transferred to Germany or even to Vietnam. Conditions in Army and Navy hospitals in Japan are similar —perhaps slightly worse.

"The Administration nevertheless has found a new method for reducing casualty figures. A man with both arms and legs blown off and suffering incurable brain damage is listed by the Pentagon merely as "wounded." When he dies in an Army hospital in the United States or in Japan or Okinawa he becomes a domestic military death — not charged to the war, not added to the total. In this fashion U.S. losses in Vietnam are kept at an acceptable level, to borrow a Pentagon term. But for each man who dies on the battlefield in this war, doctors and medics have told me, another probably dies elsewhere. And for each who has died, perhaps one or two others will be unable to function ever again. The official figure for American deaths in Vietnam is over 45,000. But a figure several times that would more accurately reflect the number of young men lost forever. Yet even that figure would fail to comprehend the permanent damage done to so many who have fought in Vietnam who have not been physically wounded."

(End of excerpt.)

Some confirmation in general of what Mark Lane here says may be found in an article in "The Washington Monthly" for April 1971, (published at 1150 Connecticut Ave., N.W., Washington, D.C.) This article is entitled "The Burn War" by Ronald J. Glasser, a major, 1968-1970, in the United States Army Medical Corps. Glasser more or less matter of factly tells the story of a burned and dying American soldier, David Grant, in an American-run hospital at Kishine, Japan. Grant, 20 years old, was carrying detonators in his rucksack, and they blew up, and put him on fire. The half dozen pages describe the death of David Grant from burns and bacterial infection. After his savage suffering and death, this boy is NOT counted as a battle death.

Every information system, computerized or not computerized, is foully contaminated by lies.

To say that American deaths from fighting in a war are 50,000 when they are actually over 200,000 is a lie.

Americans must not continue to tolerate lying by their government. The persons who lie, and the persons who cooperate in the concealment and the lying such as President Richard M. Nixon, who is responsible for knowing the "over 200,000" figure, must be voted out of office, or otherwise dismissed from the government of the United States.

LIFE SUPPORT AND WAR CONTROL SYSTEMS FOR PLANET EARTH

Howard Kurtz
War Control Planners
Box 35
Chappaqua, N. Y. 10514

Without danger to the national security of the United States, the President of the United States, with strong bi-partisan support in Congress, can launch new strategic initiatives to chart a new historic course for world civilization:

> All nations can be invited to direct a portion of their research and development budgets toward a cooperative war prevention decade.

No risk to the security of any nation will be incurred, because no nation will be asked to turn over its defense to the experimental global safety organizations.

The experiments can go forward with U.S. initiatives, no matter which nations join or hold back at present. Matters can be so arranged that any nation can enter into the experiment at any later date.

This mobilization of American creativity for world leadership will be in addition to continued essential defense efforts. The following tentative description of a large-scale strategic initiative is offered: to be debated; to be improved; to stimulate the creative thought of others, within their special fields.

1. Global Safety and Development Services

The United States will announce the commitment of a special ten-year continuing series of new earth-orbiting satellites and associated systems (computerized and other) to the future safety and wellbeing of mankind.

A giant open-to-the-public information display and model global safety and development management center will be built somewhere near the United Nations Headquarters, where the intelligence information garnered by these systems will be fully available to the press and the public.

All cooperating nations can build identical open-to-the-public management centers.

These will be in continuous communication and will operate simultaneously through a global information exchange network.

These satellites, associated systems and ground support centers and computers will have two principal functions:

> First, to maintain public inventory of all potentially dangerous military activity for planet Earth. This will be a new, additional level of world military intelligence, separate from each nation's military intelligence, and serving as an additional potential safeguard against a war starting by mistake, or misunderstanding.

> Second, to assist the economic development and human wellbeing of all nations by providing information of all types to nations on a continuing and immediate basis.

Military and technical and intelligence experts of all cooperating nations will work together developing and testing military surveillance capabilities. All information will be unclassified. Knowledge and experience will be accumulated pertinent to that future time when a world-wide peace-keeping authority will be in existence. It will be assumed that individuals will distort information due to political or national loyalty, and this will be a decade of experiment in multi-national checks and balances to correct for such distortions. It also will be a decade of experiment with increasing capacities and inadequacies of computers and cybernetic systems, in the evaluation of global safety intelligence.

2. Secrecy

Any nation may try to keep secret any information it considers essential to its security, but it will not be able to prevent other nations from making public such information if they are cognizant of it. The Soviet Union, for example, could make public to the world any information it has about American military activity, or the United States could make public similar information about the military activities of all other nations, from intelligence gathered through any source.

Although this ten-year prototype experiment will be inaugurated with information garnered from Earth-orbiting satellites and high flying airplanes, nations will be able to provide input from all intelligence channels.

3. Incidents or Crises

Whenever border incidents or war between nations occur, close-up surveillance of both sides, day and night, can supply the world's public with current facts of alleged or actual hostile actions. Audio-visual information from the centers may be transmitted onto home television screens in times of special emergency, by the flip of a switch.

All nations having the capability to launch Earth-orbiting satellites will be invited to provide their share of scheduled launchings. Otherwise the experiments will go onward with U.S.-launched satellites.

All nations will be invited to design and produce intelligence-gathering instruments to be placed on these experimental "eyes in the sky." A new kind of "race" will be launched in which all nations, large and small, can make contributions to the future safety and wellbeing of mankind, in contrast to the race to produce powers of violence to destroy world civilization.

4. Non-Military Benefits

Perhaps the greatest benefits will come from the non-military uses of global public inventory services.

In the United States, the National Aeronautics and Space Administration, the Department of Agriculture, the Department of the Interior, the Geologic Survey, the Department of Fisheries, the Federal Aviation Agency and many other departments and agencies already have experiments in progress for a series of Earth Resources Technology Satellites (ERTS) to be launched beginning in 1972 in Earth orbit.

Through the global information centers and other channels these powers being created in the 1970s will be utilized to serve mankind, rather than in the sole interests of the United States. Experiments are in progress to use satellites for air and sea and land navigation and traffic control, and for search & rescue and emergency help anywhere in the world. In time, even the smallest lifeboat in the largest ocean will be located by these new systems, to save human lives.

Experiments now under way will make it possible to maintain inventory of overy kind of agricultural crop and herd, in every country in the world, every day, from outer space. Other experiments in process will make it possible to determine the chemical content of surrounding soil, and its moisture content, and therefore predict the quality and quantity of all crops for the future global markets. Global meteorological services already are in existence using photography from outer space.

Satellites will be used to locate the largest schools of fish in the oceans of the world and to direct fishing fleets to them by radio, to facilitate feeding the hungry of the world.

Information will be made available to all nations to monitor the pollution of the air and water throughout the planet, daily. These same sensors will detect illicit military production as it changes the pollution in its environment. Geologic surveys from outer space will help nations locate oil and mineral and other natural resources. Global forestry management services and water management services will help all nations toward maximum productivity to meet their human needs.

5. The Changed Character of Government-Sponsored Research

Faculty, student and public support for government-sponsored research will grow to encourage the pioneering of peace technology...war safety control intelligence...war prevention control experiments... global development services...with research and development directed toward pro-human purposes.

All cooperating nations will be invited to participate in continuing series of war prevention games, seminars, workshops and conferences. (Where war games test the proficiency of nations in destroying each other, war prevention games will test the proficiency of nations in protecting each other from war.)

6. War Prevention Colleges

New kinds of multi-national military colleges and war prevention colleges will study future law enforcement structures to enforce world safety law, and to maintain lasting world peace, instead of to wage world war.

New kinds of multi-national engineering institutes and strategic "think factories" will pioneer the technical aspects of planetary armed forces management systems, eventually to bring an end to war.

New kinds of economics schools and business colleges will project new concepts of global organization to manage Earth-orbiting satellites and other global services, in the interest of all nations, rather than in the interest of the superpowers.

New kinds of law schools and bar associations and world law institutes will continue to pioneer new concepts of inter-nation conflict law, and undersea resource management law, and other unprecedented imperatives for planet-wide law, and enforcement power.

New kinds of political science colleges and schools of diplomacy will study unprecedented checks and balances and controls for the new world organization, or reconstituted United Nations of the future, in which all nations will find national security...and in which all nations will find national independence.

7. A New American Purpose

After World War I the League of Nations was established to bring an end to war. It was not given authority or power to achieve this objective. Then after World War II the United Nations was established to bring an end to war. It was not given the authority or power to achieve this objective. If we wait until after World War III to create the global public authority capable, in fact, of bringing an end to war...it will be too late. One thing is certain: no progress will be made through present global strategies of the two superpowers or until a massive research and development and testing commitment is made, and maintained, firmly committed to this goal of a future free from war.

No risk to the national security is involved in the experiments which are herewith proposed.

THE GROWTH OF THE COMPUTER INDUSTRY

James B. Hunter, President
Digital Scientific Corp.
San Diego, Calif.

We predict that the computer industry will double in size every three years in the near-at-hand future, but the number of companies in it will be reduced by half.

Our projections indicate that our industry will grow at a rate of at least 30% per year, or slightly more, for at least the next several years. Thus it will be twice today's size in just about three years, and we expect it to continue to grow at that rate."

We also predict a drastic shakeout, expecially among manufacturers of so-called "mini-computers." Today there are around 100 companies making small computers. We expect there will be room for 20 or 30 at the most.

We expect the greatest portion of growth in the computer industry to be in "midi-computers." A "midi-computer" is a high-speed computer which will operate alone or in concert with very large machines.

"Midi-computers" apply to communications processing, controlling high-performance peripheral devices, and many other tasks for science and business.

Based on our record to date, we expect to grow faster than a 30%-a-year rate. Our company is just over three years old; it has jumped from an annual sales rate of $4,000,000 last year to an anticipated $10 million in 1971. We see no reason why we can't continue or even increase this rate of growth.

CALENDAR OF COMING EVENTS

May 3-5, 1971: Data Processing Supplies Association, Affiliate Membership Meeting, Copenhagen, Denmark / contact: Data Processing Supplies Association, 1116 Summer St., Stamford, Conn. 06905

May 5-6, 1971: 16th Annual Data Processing Conference of Univ. of Alabama Graduate School of Business and Division of Continuing Education, Parliament House Motor Hotel, 420 South 20th St., Birmingham, Ala. / contact: C. E. Adams, Director of Conference Activities, Box 2987, University, Ala. 35486

May 11-13, 1971: IEEE (Institute of Electrical and Electronic Engineers) 1971 Region Six Conference, Wood Lake Inn, Sacramento, Calif. / contact: Dr. D. H. Gillot, Co-Chmn, IEEE Region 6 Conference, Sacramento State College, Dept. Of Electrical Engineering, 6000 Jay St., Sacramento, Calif. 95819; or, Dr. R. F. Soohoo, Program Chmn., IEEE Region 6 Conference, Univ. of California at Davis, Dept. of Electrical Engineering, Davis, Calif. 95616

May 12-14, 1971: Annual Regulatory Information Systems Conference of the Missouri Public Service Commission, Chase-Park Plaza Hotel, St. Louis, Mo. / contact: Sam L. Manley, Secretary, Missouri Public Service Commission, Jefferson City, Mo. 65101

May 12-14, 1971: 22nd Annual Conference of the American Institute of Industrial Engineers (AIIE), Boston, Mass. / contact: Anthony J. Jannetti, Exhibit Manager, c/o Charles B. Slack, Inc., Pitman, N.J. 08071

May 18-20, 1971: Spring Joint Computer Conference, Convention Ctr., Atlantic City, N.J. / contact: AFIPS Headquarters, 210 Summit Ave., Montvale, N.J. 07645

May 21-22, 1971: Communications Systems Management Association First National Meeting, New York City, N.Y. / contact: CSMA Convention, P.O. Box 2805, Wilmington, Del. 19805

May 24-26, 1971: Power Industry Computer Applications Technical Conference, Statler Hilton Hotel, Boston, Mass. / contact: P. L. Dandeno, Hydro Electric Power Commission of Ontario, 620 University Ave., Toronto, Ontario, Canada

May 24-28, 1971: 2nd International IFAC Conference and Exhibition "P.R.P.-Automation", Centenary Halls, Brussels, Belgium / contact: IFAC/P.R.P.-Automation, Jan van Rijswijcklaan 58, B-2000 Antwerp, Belgium

June 1-4, 1971: Seventh Annual Data Processing and Automation Conference, National Rural Electric Cooperative Association, The Riviera Hotel, Atlanta, Ga. / contact: C. E. Aultz, NRECA, 2000 Florida Ave., N.W., Washington, D.C. 20009

June 2-5, 1971: 3rd IFAC/IFIP Conference on Digital Computer Applications to Process Control, Technical University, Otaniemi, Finland / contact: 3rd IFAC/IFIP Conference, Box 10192, Helsinki 10, Finland

June 3-5, 1971: Conference on Area-Wide Health Data Network, School of Medicine, State Univ. of New York at Buffalo, Buffalo, N.Y. / contact: Continuing Medical Education, 2211 Main St., Buffalo, N.Y. 14214

June 7-9, 1971: International Computer Forum and Exposition (ComFor), McCormick Place-on-the-Lake, Chicago, Ill. / contact: National Electronics Conference, Inc., Oakbrook Executive Place II, 1211 W. 22nd St., Oak Brook, Ill. 60521

June 21-22, 1971: Ninth Annual Conference of the Special Interest Group on Computer Personnel Research of the Association for Computing Machinery, Center for Continuing Education, Univ. of Chicago, Ill. / contact: Fred A. Gluckson, EDP Systems Dept., National Bank of Detroit, Detroit, Mich. 48232

July 19-21, 1971: 1971 Summer Computer Simulation Conference. Sheraton-Boston Hotel, Boston, Mass. / contact Donald H. Niesse, McDonnell Automation Co., Dept. K676, Box 516, St. Louis, Mo. 63166, or, Peter Stein, McGraw-Hill Publishing Co., 607 Boylston St., Boston, Mass. 02116

July 19-23, 1971: Conference on Computers in Chemical Education and Research, Northern Illinois Univ., DeKalb, Ill. / contact: Dr. F. M. Miller, Dept. of Chemistry, Northern Illinois Univ., DeKalb, Ill. 60115

July 26-29, 1971: First International Computer Exposition for Latin America, sponsored by the Computer Society of Mexico, Camino Real Hotel, Mexico City, Mexico / contact: Bernard Lane, Computer Exposition, Inc., 254 West 31st St., New York, N.Y. 10001

Aug. 3-5, 1971: ACM '71 "Decade of Dialogue", Conrad Hilton Hotel, Chicago, Ill. / contact: Al Hawkes, Computer Horizons, 53 West Jackson Blvd., Chicago, Ill. 60604

Aug. 3-6, 1971: IFAC Symposium on The Operator, Engineer and Management Interface with the Process Control Computer, Purdue University, Lafayette, Ind. / contact: Dr. Theodore J. Williams, Purdue Laboratory for Applied Industrial Control, Purdue University, Lafayette, Ind. 47907

Aug. 11-13, 1971: Joint Automatic Control Conference, Washington Univ., St. Louis, Mo. / contact: R. W. Brockett, Pierce Hall, Harvard Univ., Cambridge, Mass. 02138

c.a PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 715: A RUN AROUND THE BASES

When Claude Liffey entered the classroom, he saw John Lawthorne at his desk studying a pageful of calculations.

"That's not right, is it," he said, pointing to an example John had just finished writing: 10.01 x 100.01 = 1010.0001. "Shouldn't the answer be 1001.1001 since 2 1/4 x 4 1/4 is 9 9/16?"

"That would be right if this were binary, but it isn't. That is, 1 and 0 are the only digits used, but the base isn't 2."

"Then it probably isn't positional. Something like Roman Numbers?"

"Not at all, it's completely positional, on both sides of the point", John said. He continued in the manner of a sightseeing guide. "On the left we have powers of the base and on the right we have reciprocals of the base and its powers."

"What is all this then?"

"Well, it's an exercise I was thinking of using in my class. We're studying number systems now and I thought I'd give them a change from the usual bases and develop some really far-out system for them. Look at this example," he said, pointing to 1000.1001 + 1010.0001 = 10101.0101. "Would you believe these are all integers?"

"Too much for me. Do you expect your students to figure this out?" asked Claude.

"Well, yes and no. I don't think anyone could determine the base used." Is this true?

Solution to Problem 714: The Numbers Game

He started with 3249, getting 0576 as the result of the first operation. The numbers 24 and 57 then repeated endlessly.

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.

ACROSS THE EDITOR'S DESK

APPLICATIONS

35-LB. COMMUTER COMPUTER UPS TRAFFIC FLOW 500% IN NEW YORK CAPITAL

A minicomputer-controlled network of traffic signals has increased the flow of cars and trucks in the business district of Albany, New York, from 1,000 cars per hour to nearly 5,000, while saving a significant amount of municipal money in manpower and congestion costs. The system, called RAPIDTRAC, uses Varian Data Machines' 620/i digital minicomputer.

Designed specifically for Albany's Central Business District by Computran Systems Corp., Hackensack, N.J., RAPIDTRAC -- for Real-Time Automatic Programmed Intersection Digital Traffic Control -- has provision for such interrupts as 'fire preempt'. Fire stations in the vicinity can use small consoles within the firehouse itself to interrupt the normal flow of traffic and command the 620/i to optimize the fire equipment's travel through downtown intersections.

The minicomputer accepts signals from a network of 65 traffic detection loops buried in the road pavement at selected locations. The 620/i's memory identifies and records measurements of the traffic on a continual "trend" basis, and alters the timing of each traffic signal to optimize the flow of traffic through the two-square-mile network. Typical cycle time of a signal is 60 seconds, maintaining about a 30-m.p.h. synchronized flow of traffic.

The system, designed with the prime consideration of safety, can adjust the delicate rhythms of traffic signals according to wet, icy or snowy weather conditions, as well as for unusual fluctuations in traffic density such as holidays, parades and various civic observations. The Varian 620/i provides RAPIDTRAC with automatic status reports on command. It also provides an interactive information retrieval capability via a teletype terminal for traffic engineers' communications.

CHURCHES ANNOUNCE NEW PERSONNEL INFORMATION SYSTEM

How can a congregation and the right pastor or priest find each other? The answer is the computerized Church Manpower System which was put into effect on March 15. On that date, notification and official input forms were mailed to over 25,000 priests and pastors of three leading denominations and the National Council of Churches.

The minister's input form now being distributed asks for a wide range of information, including interests and skills. This information will be fed into the computers of the various denominations and the National Council of Churches. Each participant then will receive a printout so that he will be able to review and approve his own record.

Beginning next fall, any congregation of the Episcopal, American Baptist or Lutheran Church in America that has a vacant pastorate may apply to its national headquarters data bank and receive personnel profiles on ministers looking specifically for its kind of parish. The congregation will then follow up by conducting interviews and making its own selection.

The system, designed by Information Science, Inc., New City, N.Y., is programmed primarily in COBOL to operate on IBM 360/30 (65 K) under DOS. Each denomination will maintain its own separate, but compatible, computer system. While they will use the same computer programs, each will maintain its own data base and have complete control of its own information.

In addition to parish ministers, the system will contain data about other personnel, such as agricultural, medical and other missionaries. It also will be used to assist in educational program planning, salary research studies and career counseling.

OTC QUOTE SYSTEM ACTIVATED BY BUNKER-RAMO

NASDAQ, a new system that makes OTC stock quotations instantly available on a nationwide basis, became fully operational in February, reporting bid and ask prices on 2,300 unlisted issues. The quotes of numerous market makers dealing in each stock are available in 700 trading rooms coast-to-coast through the new computerized network developed by Bunker-Ramo Corporation, Stamford, Conn.

The system employs dual UNIVAC 1180's, 8 modified Honeywell 516's, 30,000 miles of high-speed lines, and 1,500 CRT terminals. The central computers calculate median quotes on all issues and these are available to investors through thousands of brokerage offices which already have subscribed to the new service through their existing quotation systems.

Special Bunker-Ramo cathode ray tube terminals are used to look up, enter and update their bid/ask quotes. Unlike an exchange-traded stock which is quoted by a single specialist, an OTC stock is quoted by up to 40 market makers, each of whom may have a different bid and offer. NASDAQ enables trading room personnel to see all such quotes on any issue in a few seconds by entering a stock symbol on the terminal keyboard. Brokerage office personnel, through Bunker-Ramo's Telequote III or other similar services, obtain median NASDAQ quotes by a simple keyset interrogation similar to that performed for listed stock quotations.

The $25,000,000 system is operated by Bunker-Ramo under a contract with the National Association of Securities Dealers, a regulatory body for all over-the-counter securities trading. NASDAQ is an acronym for National Association of Securities Dealers Automated Quotations, and is a trademark of the NASD. NASDAQ is expandable to accommodate up to 10,000 stocks and to perform other functions for the securities industry such as the recording and clearing of all trades.

TRANS WORLD AIRLINES IS TESTING COMPUTERS WITH COMPUTERS

Trans World Airlines announced recently that one of two Bendix automatically controlled computerized test stations has been put into operation at TWA's Technical Services Center, Kansas City International Airport. The installation is the first major step taken to apply computer science to the testing of the advanced state electronic equipment on the airline's growing fleet of Boeing 747 wide-bodied jets.

The new equipment is currently programmed to automatically test generator panels, flight steering computers and the PB20 automatic pilot, all found aboard the Boeing 707's or 727's. According to J.T. Davis, staff vice president of maintenance and overhaul. In addition to a sharp reduction in test time, advantages of the new test station, include a check-out of equipment to a far greater extent and with greater assurance of complete reliability. An auto-pilot amplifier, for instance, is being checked out in less than two hours using the new equipment. Formerly, testing time could run as much as a full working day on each auto-pilot.

When fully implemented into TWA's maintenance operation, the Bendix test stations will be capable of checking out all auto-pilot and flight director type equipment and will extend the existing capability for testing digital avionics. The test stations, Bendix series model 260 and 270, also will be used for testing of communications and radio navigational aid avionics.

TIGHTER CONTROL OVER GUNS PROVIDED BY IBM COMPUTER FOR NATIONAL DISTRIBUTOR

Dayton Gun Headquarters (Ohio), a national distributor of firearms, hunting supplies, fishing tackle and archery equipment, has instituted further safeguards for the control and distribution of firearms with the installation of an IBM System/3 Model 10. The Model 10 provides more accurate record keeping and faster access to gun serial numbers.

Under the previous manual system, the chance of transcription errors taking place as serial numbers were recorded was always present, and the manual process was time consuming. With the new system, as guns come in from the manufacturer, the comprehensive inventory (including a listing of all serial numbers) is entered into the computer. When items are sold, the computer automatically deducts the individual units from inventory. Records of the guns shipped to a particular dealer also are recorded in the computer. Before the shipments are made, a final visual check of serial numbers is made to assure that all units are accounted for. In the event a serial number inquiry is received from some law enforcement agency, the computer can quickly identify the appropriate dealer that received the units.

The IBM system also reviews each order placed with the company and checks it against a master list of 1,500 gun dealers to insure the customer receiving the order is licensed for gun sales. In the event a dealer's license either is not registered or has expired, the computer will omit the guns from the order and print a notation on the invoice telling him why guns are not being shipped.

"In many cases," Lee Brock, treasurer of Dayton Gun, says, "a dealer simply forgets to send us a copy of his renewed license. But this system puts the burden of proof on the government to issue the license and the dealer to let us know of his certification." The system also provides a number of financial support and inventory control functions for the company.

DETROIT AREA RETAILERS CAN NOW SELECT STORE LOCATIONS WITH AID OF A COMPUTER

Retailers in the Detroit area, planning to establish new outlets, now can receive computer assistance to help them pick the best location to attract maximum customer trade. The service, operated by the Detroit News (Michigan), is made possible by a large-scale Sperry Rand UNIVAC 1108 computer system in Chicago and Computer Sciences Corporation's nationwide time-sharing network known as INFONET. Current and potential advertisers in the Detroit News can use the service, which is known as a Pilot Site Analysis Program.

The program estimates the number of households, total gross consumer income and dollar value of the total commodity market within a five mile radius of a proposed retail site. This trading area is subdivided into nine smaller segments. Households, income and commodity estimates and projections for each of the nine segments are based on dwelling unit intensity with each area. Results are then added to provide totals for a trading area.

To perform the analysis, the computer employs some programs already in its "library" plus others especially prepared by the Detroit News staff. Codes representing data on each of the nine trading area segments are transmitted over leased telephone lines from the Detroit News terminal to the Univac computer.

Within 20 minutes, the total data comprising a pilot site analysis is printed out on a low-speed printer. The analysis is photocopied with accompanying maps and bound into a report. Normally such an analysis would cost a retailer more than $1,000 if he used a consultant. It costs the Detroit News $7 and the retailer gets it free as a news service. To date, more than 76 pilot site analyses have been run by the newspaper.

EDUCATION NEWS

TWO RCA COMPUTERS HELP TEACH APPALACHIAN-AREA ELEMENTARY AND HIGH SCHOOL STUDENTS

The Eastern Kentucky Educational Development Corp. recently dedicated a new RCA computer installation to help teach almost 2,000 Appalachian-area elementary and high school students. A total of 34 teletypewriter computer terminals are located in 26 semi-rural and rural public and parochial schools, the Kentucky School for the Deaf and the Federal Youth Center, a correctional institution for boys. All 34 terminals are linked by telephone lines to an RCA Spectra 70/45 and an RCA 1600 computer, both of which are housed at the Holy Family Catholic School, Ashland, Kentucky.

According to EKEDC Director Edwin R. Jones, the CAI program is similar to those now operating in such metropolitan areas as Cincinnati and New York City. He noted, however, that this is probably the first time it has been attempted in an area where participating schools are so widely scattered.

The EKEDC is a non-profit cooperative serving 32 school districts. Most of the schools are anywhere from 50 to 200 miles away from the EKEDC computer center, with some of them being in such remote areas that telephone lines had to be installed before the terminals could be connected. Each teletypewriter terminal can accommodate approximately 60 students per day and offers an individualized "give and take" relationship with every child. "By individualizing instruction according to a child's level of ability, it provides the motivation needed by so many of our socially disadvantaged to compete in a world for which they are otherwise so poorly prepared," Mr. Jones said.

Besides computer assisted instruction, the RCA computer installation also will be used to process such school district administrative data as student schedules, grade reports and teacher payrolls.

KIDS AND COMPUTERS

At Polytechnic Institute of Brooklyn (New York) 14 typical youngsters -- not geniuses -- are receiving a thoroughly modern education, and having fun. The students -- fifth, sixth and seventh graders at Anna C. Scott Elementary School in Leonia, N.J. -- travel to Polytechnic's downtown Brooklyn campus every Saturday for their two-hour, non-credit weekly course.

"...One of the main reasons for our program is to insure that these kids don't develop the feeling of awe toward computers that is imbedded in most adults," said Dr. Norbert Hauser, head of Polytechnic's Operations Research and System Analysis Department. "We want them to get a basic understanding of what a computer can do -- to learn something about computer technology, modeling, mathematics and programming." Dr. Hauser, who donates his time, and two paid assistants are conducting the 10-week program.

The course was arranged through the elementary school's Home and School Association. Norman Falk, a Home and School Association member who drives the children to Polytechnic every week, said the members feel that this supplement to a normal elementary school education will have far-reaching and beneficial results -- not only for the 14 students enrolled, but for the entire educational process at the elementary school level.

Having learned an elementary computer language known as 'BASIC', the students use it to work math problems -- such as finding square roots -- and inventing random number guessing games in which the computer is programmed by them to answer correctly. Probably the most ambitious project undertaken by any of the students has been an attempt to write a program for estimating the number of cars which cross the George Washington Bridge in one day.

Mr. Falk said, "This boy had to take into consideration such factors as how many lanes are in use, how fast the vehicles travel, and how long the cars wait at toll booths. The problem finally became so complicated that he couldn't finish it. Right now, he's programming an imaginary game of Russian Roulette."

MOBILE OIL DONATES IBM SYSTEM TO PURDUE

Donation of an IBM 7094-1401 computer system by the Mobil Oil Corporation to Purdue University's Computing Center recently was announced jointly by the corporation and the university. Prof. Saul Rosen, director of the Purdue Computing Center, said the contribution provides "an added link in a unique multicomputer system." The Computing Center already includes two other 7094's, two 1401's and a third-generation CDC 6500, the key instrument in the Purdue system. Each of the 7094's has a memory of 32,768 36-bit words, or data units, while the 6500 has a memory of 98,304 60-bit words. Purdue now uses a 7094 to drive more than 60 terminals in a system called PROCSY (Purdue Remote On-line Console System).

Rosen said that one of the direct benefits to Purdue from Mobil Oil's gift would be the expansion of PROCSY to more than 100 terminals. The expansion will be achieved by using two 7094's as frontend machines, while continuing to run Purdue's PUFFT system on a third 7094. PUFFT is a fast FORTRAN compiling system developed at Purdue to run student jobs on the 7094.

At this time more than 2,000 such jobs are run every day and a 7094 could easily run twice that number, Rosen noted. More than 100 courses on Purdue's main and regional campuses, including courses in such diverse areas as engineering, English, psychology and even home economics, regularly have assignments that require computer use.

RESEARCH FRONTIER

MAP MAKING TIME REDUCED BY DIGITAL CARTOGRAPHIC SYSTEM

An experimental system for dramatically reducinh the time involved in color map making was described recently by an IBM engineer at the American Society of Photogrammetry Convention. The system uses a drum-type optical scanner/plotter, an IBM 1130 computer, and an IBM 2250 Model IV display unit to produce separation negatives for multicolor maps. It can reduce engraving time for map generation from months to as little as one day.

The system first converts colored-pencil line drawings into binary information (1's and 0's). Then the computer, acting in the role of an "engraver", puts together an image composed of microscopic spots, as commanded by the recognized colored-pencil codes. Film transparencies, each will millions of the square spots, are created on the optical scanner/plotter. These transparencies are used for making the lithographic plates for the color printing presses.

The system was developed for the United States Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. It is described in detail in a paper entitled "Computer-Aided Mapping: A Total System Approach," written by Dr. P. June Min and Donald R. Thompson of IBM's Systems Development Laboratory. A copy of the paper is available from IBM Corporation, Systems Development Division, Neighborhood Rd., Kingston, N.Y. 12401.

METALLURGIST DESCRIBES COMPUTER-MICROSCOPE COMBINATION

An unusual experimental configuration consisting of a scanning electron microscope (SEM) coupled to an IBM System/360 Model 44 computer has been described by IBM metallurgist Richard Pyle speaking at the American Chemical Society's 161st National Spring Meeting. The equipment provides "on-line" or immediate chemical analysis of the specimen under observation. Where the conventional light optical microscope can magnify up to 2,000 times, the SEM can make an object appear more than 50,000 its real size!

"Digital computers operate from digital inputs," Mr. Pyle explained. "Substituting a digital scanner for an analog scanner eliminates several roadblocks. The computer is no longer hindered from its task of collecting and analyzing data from the SEM. On-the-spot analysis is possible."

The paper, titled: "An On-Line Scanning Electron Microscope/Pseudo Electron Microprobe System," is co-authored by IBM's Poughkeepsie development laboratory engineers, Robert B. Togan, Timothy C. Hartmann, and Mark L. Shulman.

MISCELLANEOUS

JAPAN NOW EXPORTS TECHNICAL KNOW HOW

Hitachi, Ltd., Tokyo, Japan, has announced the availability of 513 of their U.S. patents for licensee arrangements. Selected from over 20,000 patents granted to the company, they cover equipment in several fields, including communications, electronic components, and electronic computers.

Examples of the Hitachi patents in the electronic computer category include: a system for curve plotting including interpolation; an electrical device for compensating a digital execution time in hybrid computer systems; a pen-tracking system in cathode ray tube display equipment; and an opto-electronic input and output memory device.

Further information may be obtained by contacting Licensing Operations, Hitachi America, Ltd., 437 Madison Ave., New York, N.Y. 10022.

NEW PRODUCTS AND SERVICES

Digital

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
CDC CYBER 70 family	For users whose computer requirements range from medium-scale operations to those combining large data bases, remote computing, and extensive remote and local terminal networks / CYBER 70® family's four systems are software compatible; and users may link with CDC's CYBERNET network whenever desirable	Control Data Corp. 8100 34th Ave. So. Minneapolis, MN 55420 Attn: Kent R. Nichols
Flexible MAC	A custom OEM version of the MAC Jr. minicomputer / can effect cost savings to 25% for many minicomputer users / provides expansion from 2 to 28K words of 16-bit memory within computer chassis / memory cycle is 1 usec; add time is 2 usec / I/O structure expandable / selection of standard peripherals / several options	Lockheed Electronics Co., Inc. Data Products Division 6201 E. Randolph St. Los Angeles, CA 90040 Attn: Wm. W. Orrange
Jumbo Nova 1200 and 800	Will accommodate 17 fifteen-inch printed circuit boards in 10½" of rack space / dual power supply has been added to standard 800/1200 power supply / Jumbo Nova 1200 can be upgraded to a Jumbo Nova 800 by simple exchange of plug-in memory and CPU boards / to be shown at SJCC	Data General Corp. Route 9 Southboro, MA 01772 Attn: Dick Brown
IBM System/360 Model 22	General purpose computer combining intermediate-scale DP capability with small-system economy / runs under DOS; provides opportunity for using COBOL, FORTRAN and RPG II / two main-storage sizes: 24,576 bytes and 32,768 bytes / basic cycle time of CUP is 0.75 usec	IBM Corp., Data Proc'g. Div. 1133 Westchester Ave. White Plains, NY 10604 Attn: R. F. Whalen
Magic 341	Aerospace computer for nearly any environment / adaptable to wide variety of applications by changing or substituting memory and input/output modules / basic M-341 includes digital bus card, parallel-type central processor card, core memory several I/O modules and power supply / uses include general testing and process control	Delco Electronics Div. of General Motors Corp. Milwaukee, WI 53201
PDP-16 Functional Computer	Custom designed to user specifications / 16-, 12-, or 8-bit word lengths / asynchronous machine with typical add times in 400- to 500-nsec range / application areas include educational, medical, machine tool, manufacturing	Digital Equipment Corp. 146 Main St. Maynard, MA 01754 Attn: Mark Nigberg
PPC-50	Business-oriented mini with 100-200K bits (48 bit word length) of magnetic drum memory / 2.5 msec average access time / direct memory access, accepts decimal as well as binary arithmetic, interface system can handle to 15 input and 16 output devices / two versions: Standard, 2048 words and Expanded, 4096 words	Peripheral Processor Co. c/o GHB Advtg. Inc. One East 42nd St. New York, NY 10017
SKC-2000	Multi-purpose aerospace digital computer, modular design / single data and control bus interconnects all modules to standard interface / major elements include central processor module, memory modules, I/O module with built-in-test-equipment submodule and power supply module / through-put varies with memory module used	Singer-General Precision, Inc. 1150 McBride Ave. Little Falls, NJ 07424 Attn: H. Magnuson
Xerox Sigma 8	For scientific and engineering applications / up to 131,072 words of core memory, 900-nsec memory cycle time, and 12 independent ports to memory / CPU is word-oriented (32 bits plus parity) and also is addressable in 8-bit bytes, halfwords and doublewords / compatible with Sigma 5 and 9 and all XDS peripherals	Xerox Data Systems 701 So. Aviation Blvd. El Segundo, CA 90245 Attn: Chuck Ramsey
Varian 620/L	General purpose minicomputer / includes 4096 words of core memory, a party line I/O bus, direct memory access, power supply, automatic priority interrupt, a front panel console with lock / 620/i compatible, software and peripherals / low-cost ($5,400) / to be shown at SJCC	Varian 611 Hansen Way Palo Alto, CA 94303

Special Purpose Systems

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
Automatic Tape Library Control System	A computer-controlled tape library retrieval system; also performs administrative functions of record-keeping / includes one or more tape vault modules, one or more shuttles, one minicomputer console / operates in OS or DOS / First model, LCS-5, for the UNIVAC 1108 and IBM System/360-65 which typically have libraries ranging from 2500 to 40,000 tapes	Advanced Digital Systems, Inc. 146 W. Main St. Mohawk, NY 13407 Attn: Norbert Andres

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION

Memories

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
L107 Disc Memory (dual-capacity)	3-million bit storage capacity at 3600 RPM / 1800 RMP version of same unit offers capacity of 3.7 Mbits / applications include field-expandable extension of minicomputer mainframe memory, communications terminal storage, main or auxiliary memory for inventory control	Librascope Div. The Singer Co. 808 Western Ave. Glendale, CA 91201
Memory Sequence Control	Increases memory capability of industrial robots / permits group of steps to be stored only once by robot / thereafter, robot will refer back to as often as required to complete program / may be added to Unimate industrial robot as field modification, essentially a matter of plugging it in	Unimation, Inc. Shelter Rock Lane Danbury, CT 06810
1771 Disc Memory System	For Data General NOVA family of computers / head-per-track system ranging in size from 65 thousand to 1 million words on single disc / 17 msec average access time; write protect switch / validity check in every data transfer	Data Disc Inc. 686 W. Maude Ave. Sunnyvale, CA 94086 Attn: Ron Troxell

Software

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
BASIC-1	Gives NCR Century 100 system on-line scientific-problem solving capability / two configurations: dedicated version, accommodating to 15 data terminals and entirely devoted to BASIC-1; dual installation accommodates to 10 terminals, using 32K memory with only 16K for BASIC-1	The National Cash Register Co. Main & K Sts. Dayton, OH 45409
Business Planning Language (BPL)	For developing and analyzing financial reports / uses standard accounting procedures to create and evaluate company's financial reports / easy-to-use language	Intrnatl. Timesharing Corp. 4620 W. 77th St. Minneapolis, MN 55435 Attn: R. E. Greiling
CBISLEARN	Computer assisted instruction (CAI) system for use of instructors not proficient in computers or programming / written in APL; operates under APL PLUS system of Scientific Time Sharing Corp. / implemented initially to work with multiple choice and true-false material	CBIS Informations Systems 6355 Topanga Canyon Blvd. Suite 307 Woodland Hills, CA 91364
EDP Auditor	For auditing computer-based systems / written in Assembly Language / runs on IBM 360 DOS, OS, and RCA Spectra computers, TDOS and DOS / can be used by any auditor regardless of EDP experience	Cullinane Corp. One Boston Place Boston, MA 02108
Extended BASIC Compiler/Interpreter	For small to medium scale time-sharing systems / permits multiple users to execute BASIC programs in fully interactive time-share environment / design is modular / may be tailored to particular requirements	Polymorphic Corp. 460 California Ave. Palo Alto, CA 94306
'MX03016', generalized format print module	An RPG-type program utilizing simple control cards to furnish lists and/or other formatted output from a single input card, tape or disk file / written in BAL for IBM 360/OS and DOS; core requirement, 20K	Computer Systems 29230 NW Evergreen Hillsboro, OR 97123
1401 SUPER/SIM	Simulator which executes 1401 programs on S/360 under the control of PCP, OS/MFT, OS/MVT / spooled output reduces operator intervention / supports all standard 1401 features / requires maximum of 80K core storage, including 1401 program	Hygain Technologies, Inc. 65 Whitney St. Westport, CT 06880
PRINT-FAST	For providing maximum overlap of processing and printing to yield maximum printer speed for Assembly Language and COBOL programs / runs on any TOS/DOS IBM 360 system / no modifications to system required	Atlantic Software Inc. 312 Lafayette Bldg. Fifth and Chestnut Sts. Philadelphia, PA 19106
SNOFLAKE Program Writing System	A function-oriented COBOL program writing system / user need not be programmer / available functions include report writing, label printing, file rebuilding and reformatting	Software Engineering, Inc. 143 Newland St. Norton, MA 02766 Attn: Stephen N. Mills
STENCIL	A parameter driven universal printing routine, first of a series designated FORMWARE / includes card, tape, or disk input; printed or spooled output / self-relocating, as small a partition as 10K / applications include personalized letters, mailing labels, formatted dumps / initial version, 360/DOS	Data Systems Auditors, Inc. 325 Chestnut St. Philadelphia, PA 19106 Attn: S. L. Carroll
Telecommunications Programming System (TPS)	Lets minicomputers serve as front-end processor for IBM System/360 and 370 / consists of three modules — a Communications Processor Program; a 360/370-resident communications access method for non-emulatory preprocessor applications; anda Communication Program Generation facility for creating new Communications Processor Programs without writing assembly language code for minicomputer or removing it from communications processing service	PHI Computer Services, Inc. 800 Massachusetts Ave. Arlington, MA 02174 Attn: John Pryke

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
Peripheral Equipment		
CMC 761 Printer	For CMC KeyProcessing© Systems / on-line or off-line / speeds from average 356 lpm to over 1000 lpm / multiple-copy printout / 64-character, EBCDIC / compatible with all industry-standard tape codes	Computer Machinery Corp. 2231 Barrington Ave. Los Angeles, CA 90064 Attn: Ruth Wishner
DECterminal I Display Terminal	Low-cost replacement of standard Teletypes on any computer using ASCII code / 72 characters/line; 12-inch screen, capacity of 20 lines / transmission speeds of 110, 150, 300 baud; options 600, 1200, and 2400 baud	Digital Equipment Corp. 146 Main St. Maynard, MA 01754 Attn: Edgar Geithner
DICOMED 36 Image Display	Offers both high resolution and ability to display four images simultaneously / converts digital image information to pictorial form, using array of over 4 million points / incorporates "random position" capability	DICOMED Corp. 7600 Parklawn Ave. Minneapolis, MN 55435 Attn: Stephen D. Posey
GTU-1 Interactive Data Input System	For use as either on-line or off-line data entry and-or retrieval unit / includes custom-designed keyboard, microprocessor, video display system, and 2 magnetic tape cassette recorder-reproducers	Hypertech Corporation 7343 West Wilson Ave. Harwood Hgts., IL 60656
IBM 3735 Programmable Buffered Terminal	Stores over 20,000 bytes of information on one recording track / data can be written and retrieved at rate of a million bytes per second / 3 disk tracks store data; 2 hold terminal's program / keyboard data entry / data may be stored for later transmission, unattended	IBM Corporation Monterey and Cottle Roads San Jose, CA 95111 Attn: B. J. Beers
Model ADAC 1200 Coupler/Modem	Main application expected to be with CRT terminals and printers operating in 30 cps to 120 cps speed range / maximum telephone handset data transmission rate of 1200 baud / transmission is asynchronous	Anderson Jacobson, Inc. 1065 Morse Ave. Sunnyvale, CA 94086
Multiplexor Input/Output Processor (MIOP)	A front-end processor for SYSTEMS 72 / uses only one memory cycle per data transfer; can handle I/O operations up to one million bytes per second / basic MIOP consists of 16 channels (expandable to 64), each dedicated to a standard computer, or systems, peripheral	SYSTEMS 6901 W. Sunrise Blvd. Ft. Lauderdale, FL 33313 Attn: Ted Swift
OMR-650 Desk-top Mark Scanner	Scans punched cards; marked forms up to 8½" x 11" / accepts mark scan forms without modification / user may mark to 4,000 positions on 8½" x 11" sheet / uses: as data terminal with associated teleprinter; connected to off-line data collection device; or, on-line to large scale CPU or minicomputer	Decision Inc. 5601 College Ave. Oakland, CA 94618 Attn: Bob Woodward
OPTRIX Unlimited Document Reader	Senses printed or written information on a document, regardless of ink used, at rates of 30 documents per second / ignores over-stamps, cancellation marks / sorts checks with less than one error in 50,000 / high speed writing detection applications	Optrix Unlimited Corp. 21 Spencer St. Stoneham, MA 02180 Attn: Harold J. Weber
Voice Response System, Model 7050	Converts any telephone to computer terminal / stores virtually unlimited vocabulary / interfaces directly and remotely with most general purpose computers / telephone data access lines expand up to 256 if desired	Marketing Dept. Phonplex Corp. 789 Park Ave. Huntington, NY 11743
Westinghouse 1600 Computer Terminal	Self-contained, interactive CRT display for direct users or original equipment manufacturers / built-in interfacing allows plug-for-plug teletypewriter replacement or operation at data rates up to 9600 baud / functions synchronously or asynchronously / data processing, time-sharing and process control applications	Canadian Westinghouse Co. Ltd. Information Dept. P.O. Box 510 Hamilton, Ontario, Canada
Computer-Related Services		
AUTOMED	A medical information system being offered initially in Illinois, Ohio, Indiana, Michigan / enables physicians to obtain instant access to patients' medical records by a visual display terminal connected to a Univac computer system in Cleveland / other benefits include partial or total automated billing, completing standard medical insurance forms, automated appointment routines, patient classification, providing medical literature in hard-copy form, etc.	Medical Data Systems Corporation (MDS) c/o Sperry Rand Corp. Univac Division P.O. Box 500 Blue Bell, PA 19422 Attn: M. M. Maynard
Commercialoan Monitor	Provides a complete on-line computerized service for banks /only equipment requirement is typewriter-like terminal which connects to BankCom's computer by telephone / service enables banks to analyze commercial loan experience through over 35 separate reports or combinations of reports for increased management control / operation easily learned in an hour's time	Bank Computer Network Corp. 333 N. Michigan Ave. Chicago, IL 60601

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Burroughs Corp., Detroit, Mich.	General Services Administration, Washington, D.C.	Forty-three (43) B3500 computer systems for the Navy's Uniform Automatic Data Processing System (UADPS) to be installed at 22 Naval locations in the U.S. and overseas; systems will be used for inventory control, movement of material from supply points to Naval fleet and shore establishments, and for financial control	$30.6 million
Redcor Corporation, Woodland Hills, Calif.	Transamerica Computer Co., San Francisco, Calif.	KeyLogic systems, communication systems, and data acquisition systems for lease to Redcor customers	$7 million (approximate)
Computing and Software, Inc. (C&S), Los Angeles, Calif.	National Aeronautics and Space Administration (NASA)	A one-year facility management contract with options for two additional one-year extensions; C&S will operate, maintain and manage NASA's Slidell computer complex at the Michoud Assembly Facility, Slidell, La.	$6+ million
	NASA's Goddard Space Flight Center, Greenbelt, Md.	Existing contract option renewal for one year; C&S supports variety of DP services at Goddard	$6.1 million (approximate)
Honeywell Information Systems, Phoenix, Ariz.	Internal Revenue Service	Installation of direct data entry equipment at three new IRS regional tax processing centers (Tenn., Calif., and N.Y.)	$6 million
Philco-Ford Corp., Communications and Technical Services (C&TS) Div., Willow Grove, Pa.	U.S. Air Force Air Materiel Area, Tinker AFB, Okla.	Engineering, furnishing and installing a telecommunications network (code-named, Scopecomm) for U.S. forces in Europe; it will link centers in the Federal Republic of Germany, Belgium, and the United Kingdom	$5.9 million
Qantel Corp., Hayward, Calif.	Computer Usage Co., Inc., Greenwich, Conn.	Purchase of Qantel business computer systems to be marketed through CUC's offices	$5 million
Xerox Data Systems, El Segundo, Calif.	TRW Controls Corp., Houston, Texas	Xerox Sigma 3, Sigma 5 and Sigma 7 computers which will be used in company's electrical utilities energy management systems and pipeline control systems	$5 million
Centronics Data Computer Corp., Hudson, N.H.	Core, Ltd., London, England	Purchase of at least 2,000 Centronics model 101 line printers, and related spare parts and accessories, over 3-year period; Core will have rights to market the 101 on the European continent and in United Kingdom	$3.7 million
F&M Systems Co., Dallas, Texas	Port of Seattle, Seattle, Wash.	Design, manufacture, installation of a computer-based Central Control and Communications Facility for the Seattle-Tacoma International Airport	$3 million
Ampex Corp., Redwood City, Calif.	Los Angeles County, Calif.	Second contract for equipment and engineering that will prepare previously ordered television records system to be extended for use by any law enforcement and justice agency in the county	$2.1 million
Universal Business Machines, Columbia, S.C.	United States Postal Service	Production of 50 letter-sorting machines; firm will provide the sorters, plus spare parts and chairs	$1.2 million (approximate)
Univac Division of Sperry Rand Corp., Blue Bell, Pa.	National Gypsum Co., Buffalo, N.Y.	A UNIVAC 1106 computer system, the first step in establishing corporate computer and nationwide wire communications center	$1.2 million (approximate)
Honeywell Inc., Information Systems Div., Framingham, Mass.	The Boeing Company, Seattle, Wash.	Three computers to be used in the "brassboard" phase (a development less detailed than a prototype) of the Air Force's Airborne Warning and Control System (AWACS).	$1+ million
PRC Information Sciences Co., Los Angeles, Calif.	Naval Electronics Laboratory Center, San Diego, Calif.	Completion of development and documentation for the Message Processing and Distribution System (MPDS), a communications system for the USS Chester W. Nimitz	$816,000
Digital Resources Corp., Hybrid Systems Div., Houston, Texas	Volkswagenwerk AG, Wolfsburg, West Germany	Three SS-100 Analog/Hybrid computers to be used in expanding research and development activities	$755,000+
Computer Complex, Inc., Houston, Texas	National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Texas	Computer timesharing services; includes data reduction of information received during Apollo missions	$50,000
Potter Instrument Co., Inc., Plainview, N.Y.	Department of Defense, Defense Supply Agency, Washington, D.C.	Lease (with option to purchase) of computer peripheral equipment, valued at about $5 million, for use on IBM computers	—
Leasco Information Products, Inc., Bethesda, Md.	U.S. Office of Education, Educational Resources Information Center (ERIC), Washington, D.C.	Operation of the ERIC Document Reproduction Service; firm will reproduce and market information products to the education community — primarily on microfiche	—
Electronics Associates Ltd., Burgess Hill, England	British Nuclear Design and Construction Ltd., Whetstone, Leicestershire, England	An EAI 8800 analog/hybrid computer to supplement BNDC's 1500 amplifier, 6 console analog known as 'Saturn' for nuclear reactor and power station design problems	—
Computer Communications, Inc., Culver City, Calif.	Midwest Stock Exchange Service Corp.	A nationwide computerized hihg speed message switching and brokerage data processing network	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B2500 system	Burger King Corp., Miami, Fla.	General accounting jobs and business applications, including payroll, profit and loss statements, sales analysis and forecasting, product mix analysis (system valued at more than $560,000)
	Gilbert Associates, Inc., Reading, Pa.	General accounting, cash flow forecasting, general ledger, manpower scheduling, and others (system valued at more than $460,000)
	Meister Brau, Inc., Chicago, Ill.	General accounting, inventory accounting, production scheduling and market reporting (system valued at more than $346,000)
Burroughs B3500 system	Control Industries Inc., Kansas City, Mo.	Improving and expanding services to over sixty business firms in 500-mile area; primary markets served include direct mail, bank processing and commercial type applications (system valued at more than $484,000)
	Pittsburgh National Bank, Pittsburgh, Pa.	Savings accounts, Christmas Club and check credit accounting, correspondent bank checking accounts and sixty other banking programs (system valued at more than $1 million)
Control Data 1700 system	3M Company, Minneapolis, Minn.	Research and development projects; system connected to laboratory instrumentation units — applications include chemical component analysis, spectroscopic, electrical and radiation data analysis
Control Data 3200 system	V. Vranas and Co., Athens, Greece	Training students in computer programming and computer usage, and providing a data center for its own requirements and for external clients
Control Data 3300 system	Innsbruck University, Innsbruck, Austria	Centralized computer services for the university's science, engineering, economics, philosophy and computer science departments
Control Data 6400 system	NASA's Langley Research Center, Hampton, Va.	Use as the scheduling element for the Center's Computer Complex which includes 3 CDC 6600s and a previously installed 6400; new 6400 will enable optimal utilization of the systems
	University of Aarhus, Aarhus, Denmark	University administration, faculty research, student training, and regional data center applications (system valued at $1.5 million)
Data General Nova 1200 system	Bullock's, Los Angeles, Calif.	Directing a point of sales system (American Regitel Corporation) in Bullock's new Northridge store; one Regitel system already is in use in the downtown Los Angeles Bullock's
Datacraft DC 6024/3 system	University of Wisconsin, Engineering Computing Laboratory, Madison, Wis.	Handling expanded work load built up over a ten-year period using older equipment; Computing Laboratory serves 2400 undergraduates, 800 graduate students as well as staff and faculty
Honeywell Model 635 system	U.S. Naval Academy, Annapolis, Md.	Increasing computer resources; Academy expects to double to more than 80 the number of courses a midshipman may take that require use of the computer
IBM System/3 Model 6	Gingiss Formalwear, Inc., Chicago, Ill.	Helping to assure proper size and style is available in headquarters and franchise stores in eight states as well as for general ledger, payroll, invoicing
IBM System/3 Model 10	Columbus Heating and Ventilation Co., Columbus, Ohio	Computerized job costing system; comprehensive accounting system planned
	Forest E. Olson, Inc., Van Nuys, Calif.	Real estate listings including as many as 1500 items of information about features of each piece of property
	Nicholson Terminal & Dock Co., River Rouge, Mich.	Financial control functions including payroll needs (in cash daily) of some 1200 stevedores; also extensive job cost reporting
	Pee Dee State Bank, Timmonsville, S.C.	Demand deposit accounting, aged trial balance and customer service applications
Lockheed MAC 16	Colonial Pipeline Co., Plainfield, N.J.	Reading meters, calculating and printing delivery tickets on ten pipeline systems; also will guard against pipeline leakage
NCR Century 100 system	Crown Construction Co., Johnstown, Pa.	Design problems encountered in development of shopping centers and enclosed shopping malls
	Good Samaritan Medical Center, Zanesville, Ohio	Controlling rising costs; over 100 programs in use; each of 30 different departments are monitored
NCR Century 200 system	First Computer Services, a subsidiary of the First National Bank, Ruston, La.	Maintaining a Central Information File for bank's customers; also offers data processing services to area public utilities, hospitals, schools, and commercial establishments
	Kansas State Bank & Trust Co., Wichita, Kans.	Automating all banking departments with NCR's Central Information File software package
Univac 1106 system	Commercial and Industrial Computer Services, Johannesburg, South Africa	On-line invoicing, stock updating, consumer credit and general accounting in batch, remote batch and time sharing modes of operation; also performs service bureau work for the government
	University of Freiburg, West Germany	A wide range of scientific and engineering applications as well as training of students in computer science (system valued at $1.4 million)

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 APRIL 15, 1971

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 1. United States Manufacturers							
Autonetics	RECOMP II	11/58	2.5	30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III						
Bailey Meter Co.	Bailey 750	6/60	40-250 (S)	32	3	35	0
Wickliffe, Ohio (A) (4/71)	Bailey 755	11/61	200-600 (S)	6	0	6	0
	Bailey 756	2/65	60-400 (S)	13	5	18	6
	Bailey 855	4/68	100-1000 (S)	8	0	8	17
Bunker-Ramo Corp.	BR-130	10/61	2.0	160	-	-	X
Westlake Village, Calif.	BR-133	5/64	2.4	79	-	-	X
(A)	BR-230	8/63	2.7	15	-	-	X
(3/71)	BR-300	3/59	3.0	18	-	-	X
	BR-330	12/60	4.0	19	-	-	X
	BR-340	12/63	7.0	19	-	-	X
	BR-1018	6/71	23.0 (S)	-	-	-	-
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/B500	7/65	2.8-9.0	-	-	-	-
(1/69-5/69)	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	60
	B7500	4/69	44.0	0	0	0	13
	B8500	8/67	200.0	1	0	1	5
Computer Automation, Inc.	208/808	6/68	5.0 (S)	143	7	150	130
Newport Beach, Calif. (12/70) (A)	216/816	3/69	8.0 (S)	157	13	170	215
Control Data Corp.	G15	7/55	1.6	-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5	-	-	20	X
(R)	LGP-21	12/62	0.7	-	-	165	X
(9/70)	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
	924/924-A	8/61	11.0	-	-	29	X
	1604/A/B	1/60	45.0	-	-	59	X
	1700	5/66	3.8	-	-	106-180	0
	3100/3150	5/64	10-16	-	-	83-110	C
	3200	5/64	13.0	-	-	55-60	C
	3300	9/65	20-38	-	-	200	C
	3400	11/64	18.0	-	-	20	C
	3500	8/68	25.0	-	-	15	C
	3600	6/23	52.0	-	-	39	C
	3800	2/66	53.0	-	-	20	C
	6400/6500	8/64	58.0	-	-	85	C
	6600	8/64	115.0	-	-	85	C
	6800	6/67	130.0	-	-	1	C
	7600	12/68	235.0	-	-	1	C
							Total: 160 E
Data General Corp.	NOVA	2/69	8.0 (S)	-	-	813	-
Southboro, Mass. (A) (4/71)	SUPERNOVA	5/70	9.6 (S)	-	-	102	-
	NOVA 1200	12/71	5.4 (S)	-	-	100	-
	NOVA 800	3/71	6.9 (S)	-	-	-	-
	SUPERNOVA SC	6/71	11.9 (S)	-	-	-	-
Datacraft Corp.	6024/1	5/69	54-200 (S)	11	0	11	3
Ft. Lauderdale, Fla. (A) (4/71)	6024/3	2/70	33-200 (S)	34	3	37	43
	6024/5	10/71	16-50 (S)	0	0	0	0
Digiac Corp.	Digiac 3060	1/70	9.0 (S)	30	-	-	5
Plainview, N.Y. (A) (3/71)	Digiac 3080	12/64	19.5 (S)	16	-	-	0
	Digiac 3080C	10/67	25.0 (S)	7	-	-	1
Digital Computer Controls, Inc.	D-112	8/70	10.0 (S)	45	5	50	300
Fairfield, N.J. (A) (3/71)							
Digital Equipment Corp.	PDP-1	11/60	3.4	48	2	50	X
Maynard, Mass.	PDP-4	8/62	1.7	40	5	45	X
(A)	PDP-5	9/63	0.9	90	10	100	X
(2/71)	PDP-6	10/64	10.0	C	C	23	X
	PDP-7	11/64	1.3	C	C	160	X

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-8	4/65	0.5	C	C	1440	C
	PDP-8/1	3/68	0.4	C	C	3698	C
	PDP-8/S	9/66	0.3	C	C	1024	C
	PDP-8/L	11/68	-	C	C	3902	C
	PDP-9	12/66	1.1	C	C	436	C
	PDP-9L	11/68	-	C	C	48	C
	PDP-10	12/67	8.0	C	C	145	C
	PDP-11	3/70	10.5 (S)	C	C	546	C
	PDP-12	9/69	-	C	C	475	C
	PDP-15	2/16	17.0	6	C	15	C
	LINC-8	9/66	-	C	C	142	C
							Total: 1350 E
Electronic Associates Inc.	640	4/67	1.2	95	55	140	7
Long Branch, N.J. (A) (4/71)	8400	7/67	12.0	19	6	25	0
EMR Computer	EMR 6020	4/65	5.4	C	-	-	C
Minneapolis, Minn.	EMR 6040	7/65	6.6	C	-	-	C
(A)	EMR 6050	2/66	9.0	C	-	-	C
(2/71)	EMR 6070	10/66	15.0	C	-	-	C
	EMR 6130	8/67	5.0	C	-	-	C
	EMR 6135	-	2.6	-	-	-	-
	EMR 6155	-	-	-	-	-	-
				Total: 107	12		Total: 15 E
General Automation, Inc.	SPC-12	1/68	-	-	-	-	-
Anaheim, Calif.	SPC-16	5/70	-	-	-	-	-
(R) (6/70)	System 18/30	7/69	-	-	-	-	-
General Electric	GE-PAC 3010	5/70	2.0	2	0	2	5
West Lynn, Mass.	GE-PAC 4010	10/70	6.0	2	0	2	16
Process Control Computers	GE-PAC 4020	2/67	6.0	172	49	221	59
(A)	GE-PAC 4040	8/64	3.0	45	20	65	X
(12/70)	GE-PAC 4050	12/66	7.0	23	1	24	X
	GE-PAC 4060	6/65	2.0	18	2	20	X
Hewlett Packard	2114A, 2114B	10/68	0.25	-	-	1060	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	319	-
(A) (4/71)	2116A, 2116B, 2116C	11/66	0.6	-	-	940	-
Honeywell Information Systems	G58	5/70	1.0	-	-	-	-
Wellesley Hills, Mass.	G105A	6/69	1.3	-	-	-	-
(A) (2/71)	G105B	6/69	1.4	-	-	-	-
	G105RTS	7/69	1.2	-	-	-	-
	G115	4/66	2.2	200-400	420-680	620-1080	-
	G120	3/69	2.9	-	-	-	-
	G130	12/68	4.5	-	-	-	-
	G205	6/64	2.9	11	0	11	-
	G210	7/60	16.0	35	0	35	-
	G215	9/63	6.0	15	1	16	-
	G225	4/61	8.0	145	15	160	-
	G235	4/64	12.0	40-60	17	57-77	-
	G245	11/68	13.0	3	-	3	-
	G255 T/S	10/67	17.0	15-20	-	15-20	-
	G265 T/S	10/65	20.0	45-60	15-30	60-90	-
	G275 T/S	11/68	23.0	-	-	10	-
	G405	2/68	6.8	10-40	5	15-45	-
	G410 T/S	11/69	11.0	-	-	-	-
	G415	5/64	7.3	170-300	70-100	240-400	-
	G420 T/S	6/67	23.0	-	-	-	-
	G425	6/64	9.6	50-100	20-30	70-130	-
	G430 T/S	6/69	17.0	-	-	-	-
	G435	9/65	14.0	20	6	26	-
	G440 T/S	7/69	25.0	-	-	-	-
	G615	3/68	32.0	-	-	-	-
	G625	4/65	43.0	23	3	26	-
	G635	5/65	47.0	20-40	3	23-43	-
	G655	12/70	80.0	-	-	-	-
	H-110	8/68	2.7	180	75	255	0
	H-115	6/70	3.5	30	-	30	-
	H-120	1/66	4.8	800	160	960	-
	H-125	12/67	7.0	150	220	370	-
	H-200	3/64	7.5	800	275	1075	-
	H-400	12/61	10.5	46	40	86	X
	H-800	12/60	30.0	58	15	73	X
	H-1200	2/66	9.8	230	90	325	-
	H-1250	7/68	12.0	130	55	185	-
	H-1400	1/64	14.0	4	6	10	X
	H-1800	1/64	50.0	15	5	20	X
	H-2200	1/66	18.0	125	60	185	-
	H-3200	2/70	24.0	20	2	22	-
	H-4200	8/68	32.5	18	2	20	-
	H-8200	12/68	50.0	10	3	14	-
	DDP-24	5/63	2.65	-	-	90	X
	DDP-116	4/65	0.9	-	-	250	-
	DDP-124	3/66	2.2	-	-	250	-
	DDP-224	3/65	3.5	-	-	60	-
	DDP-316	6/69	0.6	-	-	450	-
	DDP-416	-	-	-	-	350	-
	DDP-516	9/66	1.2	-	-	900	-
	H112	10/69	-	-	-	75	-
	H632	12/68	3.2	-	-	12	-
	H1602	-	-	-	-	-	-
	H1642	-	-	-	-	-	-
	H1644	-	-	-	-	-	-
	H1646	-	-	-	-	-	-
	H1648	11/68	12.0	-	-	20	-
	H1648A	-	-	-	-	-	-

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
IBM	System/3 Model 6	3/71	1.0	-	-	-	-
White Plains, N.Y.	System/3 Model 10	1/70	1.1	-	-	-	-
(N) (D)	System/7	11/71	0.35 and up	-	-	-	-
(1/69-5/69)	305	12/57	3.6	40	15	55	-
	650	10/67	4.8	50	18	68	-
	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 1, 11	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	-
	7020, 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	-
	7094-1	9/62	75.0	10	4	14	-
	7094-11	4/64	83.0	6	4	10	-
	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	19.3	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	12/69	150.3	0	0	0	-
	360/90	11/67	(S)	5	0	5	-
	370/135	5/72	14.4	-	-	-	-
	370/145	9/71	23.3	-	-	-	-
	370/155	2/71	48.0	-	-	-	-
	370/165	5/71	98.7	-	-	-	-
	360/195	4/71	232.0	-	-	-	-
Interdata	Model 1	12/70	3.7	45	10	55	70
Oceanport, N.J.	Model 3	5/67	-	N/A	-	200	X
(A) (4/71)	Model 4	8/68	8.5	200	100	300	90
	Model 5	11/70	10.5	25	5	40	30
	Model 15	1/69	20.0	40	24	64	13
NCR	304	1/60	14.0	15	2	17	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(R) (2/71)	315	5/62	8.7	400	300	700	-
	315 RMC	9/65	12.0	150	45	195	-
	390	5/61	1.9	950	500	1450	-
	500	10/65	1.5	1100	1800	2900	-
	Century 100	9/68	2.7	1100	300	1400	-
	Century 200	6/69	7.5	350	90	440	-
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	200-210,211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
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	115	20	175	X
Santa Ana, Calif.	440	3/64	3.6	20	-	20	X
(A)	520	10/65	3.2	26	1	27	X
(4/71)	703	10/67	12.8 (S)	172	31	203	2
	704	3/70	9.8 (S)	64	16	80	32
	706	5/69	19.0 (S)	55	14	69	3
Scientific Control Corp.	650	5/66	0.5	23	0	23	X
Dallas, Tex.	655	10/66	2.1	137	0	137	0
(A)	660	10/65	2.1	41	0	41	0
(6/70)	670	5/66	2.7	1	0	1	X
	4700	4/69	1.8	19	0	19	4
	DCT-132	5/69	0.9	45	0	45	23
Standard Computer Corp.	IC 4000	12/68	9.0	8	0	8	6
Los Angeles, Calif.	IC 6000	5/67	16.0	9	0	9	-
(N) (12/70)	IC 7000	8/70	17.0	4	0	4	5
Systems Engineering Laboratories	810	9/65	1.1	24	0	24	X
Ft. Lauderdale, Fla.	810A	8/66	0.9	111	5	216	32
(A)	810B	9/68	1.2	75	1	76	26
(6/70)	840	11/65	1.5	3	0	3	X
	840A	8/66	1.5	36	2	38	X
	840MP	1/68	2.0	31	0	31	2
	Systems 86	-	10.0	0	0	0	2
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

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
UNIVAC (Cont'd.)	File Computers	8/56	15.0	13	-	-	X
(2/71)	Solid-State 80 I,II,						
(A)	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	87	114	56	75 E
	9200	6/67	1.5	1051	822	175	850 E
	9300	9/67	3.4	387	49	144	550 E
	9400	5/69	7.0	8	0	3	60 E
	LARC	5/60	135.0	2	0	2	-
Varian Data Machines	620	11/65	-	-	-	75	X
Newport Beach, Calif.	620i	6/67	-	-	-	1300	400
(A) (4/71)	R-620i	4/69	-	-	-	50	30
	520i	10/68	0.4	-	-	150	330
	520/DC	12/69	1.6	-	-	25	25
	620/f	11/70	0.5	-	-	7	125
	620/L	6/71	-	-	-	-	65
Xerox Data Systems	XDS-92	4/65	1.5	10-60	2	12-62	-
El Segundo, Calif.	XDS-910	8/62	2.0	150-170	7-10	157-180	-
(R)	XDS-920	9/62	2.9	93-120	5-12	98-132	-
(2/71)	XDS-925	12/64	3.0	20	1	21	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	28-35	0	28-35	-
	XDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 3	12/69	2.0	10	0	10	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 6	6/70	12.0	-	-	-	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-
	Sigma 9	-	35.0	-	-	-	-

BOOKS *(Continued from page 35)*

Arno Press, Inc., 330 Madison Ave., New York, NY 10002 / 1967, hardbound, 311 pp., $?

Hearings, and statements from some dozen persons, on the positive and negative aspects of storing personal data in computers.

Enrick, Norbert L. / Decision-Oriented Statistics / Brandon Systems Press, Inc., 1101 State Rd., Princeton, NJ 08540 / 1970, hardbound, 216 pp., $8.95.

This book presents statistical analysis methods to help managers analyze relationships, evaluate courses of action, calculate risks, and arrive at decisions. The methods described include the use of statistical analysis for application in today's computer information systems. Some other subjects covered are computer simulation systems, network analysis, strategy under risk and uncertainty, and decision-making and the computer.

Katzan, Harry, Jr. / APL Programming and Computer Techniques / Van Nostrand Reinhold Company, 450 West 33 St., New York, NY 10001 / 1970, hardbound, 329 pp., $12.00.

This book is intended to give a thorough foundation in the APL language (of K. Iverson) and a terminal system, and to provide a thorough introduction to computer techniques for scientists, engineers, business analysts, and managers.

Cuadra, Carlos A., editor, and 17 authors / Annual Review of Information Science and Technology (Volume 5) / Encyclopedia Britannica, Inc., 425 North Michigan Ave., Chicago, IL 60611 / 1970, hardbound, 476 pp., $17.50

Gives 13 significant reports on individual research, laboratory, or experimental pilot programs of the past year in the field of information sciences.

Profit, A. / Structure et Technologie des Ordinateurs / Armand Colin, 103, Blvd. Saint-Michel, Paris 5, France / 1970, hardbound, in French, 648 pp., $?

This is a manual in French intended for students and engineers who wish to learn about the internal organization of machines and what may be loosely termed hardware. It covers two fundamental aspects: the description of circuits and the composition of computers, and a study of the organization of these different elements for the construction of systems.

The 22 chapters include "Algorithmic Structures and the Organization of Calculators", "Logic Systems of Semi-Conductors", "General Organization of a Calculator", "Unity of Command", and "The Structure of the Computer". There is an index and a bibliography.

The author is a professor at L'Ecole Superieure d'Electricité and has had some experience in the laboratories at the French National Center of Studies of Telecommunications. The manual is based on a course taught by the author.

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

STOP EXPRESSING POLITICAL POLEMICS

John Culleton
Data Processing Manager
Penberthy Mfg. Co.
P.O. Box 112
Prophetstown, Ill. 61277

Really, if you want subscription renewals, devote yourselves to computers and automation. Most of us are sick unto death of political polemics on every subject except the technical topics we want to learn about. I don't go to political social science journals to keep up with the state of the computational art and I certainly don't go to a technical EDP journal to hear about assassinations and court trials. The slim technical content is largely superficial. I get several better technical journals free. Advertisements are important too, and your ads are nearly nonexistent.

DON'T BLAME PRESIDENT NIXON

1. From James E. Crow
207 Mulberry Road
Newark, Del. 19711

I am sorry to read in the January issue of C&A that you blame President Nixon for "an economic depression and storm-sweeping through American business", etc. Apparently you haven't done your homework. Nixon found runaway inflation and had been attempting to control it. He didn't initiate Vietnam or "Vietnamization". Check the figures to see how he is winding down the Vietnam war, in both men and dollars. The cutbacks for defense have hurt. What do you want? Don't let your emotions carry you away and detract from the good work you are doing.

2. From H. Irvin Smith
54746 Yarnall
Houston, Tex. 77035

By inference you blame President Nixon and the United States' involvement in Southeast Asia for the declining advertising volume in Computers and Automation. This is somewhat surprising since one would think that the so-called "Military-Industrial Establishment" would be a much larger user of computers than would be the various radical groups and liberal social causes you so ardently champion.

Have you considered the possibility that many advertisers may prefer not to be identified with your left-wing editorial content? (Just as they don't advertise in far-right political journals.)

This also may be a factor in the eight-to-fifteen percent decline in your paid circulation over the past year. I, for example, plan not to renew my company's subscription.

MASQUERADING AS A COMPUTER JOURNAL

Patrick M. Cooney
RD 6
Carmel, NY 10512

In the March 1971 issue of Computers and Automation, Dr. Schwartz raised one point in his refutation of R. Sprague's article "The Assassination ....", with which I heartily agree. It's a complaint that I have had about an increasing number of articles in your magazine. The issue is one of relevance.

In the March 1971 issue, for example, you've published Kingman Brewster again. There isn't even the pretense of a computer connection in this one. A technical journal should apply itself to the field it professes to cover. Editorializing should be labelled as such, and segregated. Special purpose articles, unrelated to the technical area should be the exception, not the rule. No matter how much hair splitting you do in your "Responses", all your non-computer articles seem to be selling the same political ideas.

If you want to go into competition with "political comment" type of magazines, by all means do so, but be honest about it. Stop masquerading as a computer journal.

SURPRISE, DELIGHT, AND SUPPORT FOR YOUR VIEWS AND CONCERNS

John R. Macleod
130 Rosevale Valley Rd.
Toronto 5, Ontario, Canada

It was only recently that several delayed issues of "Computers and Automation" (May and November, 1970) crossed my desk, a publication I must admit I had not previously read, or, for that matter, even heard of. I am in the academic field, teaching Operations Research at Ryerson Polytechnical Institute in Toronto, and this not-having-read-it previously was very surprising, to say the least. It may be that we have only recently begun receiving it.

In any event, imagine my surprise to find social issues presented, discussed, editorialized, etc. — in a computer journal of all places! I was even beginning to think that I was alone among my esteemed colleagues in being concerned over social matters. To be interested in people might even seem to be mutually exclusive of being interested in things, the latter being usually all too true of people in technical fields. I therefore read with a great deal of interest your articles on John F. Kennedy's assassination, the plight of Clark Squire, etc. and all of the comments on these matters. It certainly is a refreshing change from the usual right-wing or not-giving-a-damn non-involved academic publications which are so widely circulated. I am even tempted to wonder if such enlightenment is more of a common denominator among systems people, a field which implies the broad interdisciplinary approach that only intelligence can cope with successfully. It sometimes does seem to me that the really competent people in this field do have a way above average intelligence and social concern. This is a field for further research, as the academic says.

This letter therefore is to express my surprise, delight, and continued support for your policies and views and concerns, and to provide a personal pat-on-the-back for someone who dares to make use of his opportunity to express a fair, balanced, enlightened, honest opinion in social matters in print, an all too rare occurrence in our unnecessarily complex society. Keep at it! You've got one more avid supporter and promoter in Canada now, that maybe you didn't realize you had.

PUBLISHING COURAGE

Robert W. Carter, President
QICSYS Systems Inc.
128 West 58 St.
Bayonne, N. J. 01702

I am writing to express my feelings to you on the generally excellent form and content of your publication, "Computers and Automation." I am currently in the position of wearing a number of "hats" which call for varied readings as a user, teacher, and manufacturer of computer science and technology. As a result, my readings cover a very broad spectrum, and I can easily rate "Computers and Automation" as one of the best.

Please accept my best wishes for your continued success and my admiration of your publishing courage.

OASIS OF TRUTH

Mrs. Grace P. Vale
St. Louis, Mo.

Computers and Automation is like an oasis of truth amidst the mass media fiction about the political assassinations, and I would like to express my appreciation to you for printing this information.

I have been having a great deal of trouble with my mail ever since I started to subscribe to Mr. Joachim Joesten's Truth Letter, one of the few other sources of information on this subject. I would greatly appreciate it if the circulation department of Computers and Automation would give me some information about an order I placed with you. ...

On Wednesday I received Computers and Automation, Harper's, and The Atlantic Monthly, and, of course, read C&A almost straight through before even looking at the others.

I especially enjoyed your answer to the attack on Richard Sprague's article. The articles on information or data processing, the book review, and several others in the March issue were also extremely interesting.

THE ANT AND THE OCTOPUS

Mark Nigberg
Digital Equipment Corp.
46 Main St.
Maynard, Mass. 01754

With the advent of general-purpose digital computers 25 years ago, everyone thought of the giant octopus reaching out to control the world. This thinking prevailed for the next 15 years. But on March 17, just 10 years ago, a new product and with it a new philosophy was introduced: the mini-computer.

The mini was but an ant compared to the octopus. But like the ant, it was dedicated to its work. It would work on a smaller scale, in a more simplified operation. And like the ants, the minis would work together, each doing its assignment and all together successfully completing the job.

As the ants greatly outnumber the octopus, the day when minicomputers greatly outnumber all others is imminent.

Since that March 17, 1961 when the world's first mini (costing $120,000) was delivered, Digital Equipment Corporation has installed over 10,000 more to perform a host of applications throughout the world. Today's mini is priced under $5,000 and has more power than the $120,000 original.

The estimated $1.2 billion market by 1975 for minis certainly implies many new and exciting developments.

THOMAS J. WATSON FELLOWSHIPS AWARDED TO 70 STUDENTS FROM 34 COLLEGES

Robert O. Schulze, Executive Director
Thomas J. Watson Foundation
220 South Main St.
Providence, R. I. 02903

The Thomas J. Watson Foundation announced on March 19 the award of 70 fellowship grants totaling $438,000.

The grants will make possible a year of independent postgraduate travel and study abroad for 70 students from 34 colleges and universities in the United States. Each of the 61 unmarried recipients will receive an award of $6,000 and each of the nine married winners will receive $8,000.

The fellowships are awarded annually by the foundation, a charitable trust established by the late Mrs. Thomas J. Watson, Sr., in memory of her husband, founder of IBM Corporation.

The winners were chosen from among graduating seniors nominated by participating colleges. They were selected primarily on the basis of their potential for creative leadership in their chosen fields, although academic records and extracurricular activities were also taken into account. Each will pursue a travel-study program devised by the fellowship winner to increase his or her personal or career potential.

The fellows' travel-study programs will take them to Europe, Africa, South America, Asia and other areas, with several visiting more than one continent.

Their interests range from the study of medical care in developing countries to the role of nonviolence in resolving conflicts. Richard A. Reines of Tufts University, Medford, Mass., will study the former in Africa and India; Michael W. Johnson of Whitman College, Walla Walla, Wash., will investigate the latter in Europe, Africa and Asia.

The fellowship program was begun in 1968 by the daughters and sons of the late Mr. and Mrs. Watson, Sr.: Mrs. Walker G. Buckner, the late Mrs. John N. Irwin II, IBM Chairman Thomas J. Watson, Jr., and Arthur K. Watson, U.S. Ambassador to France — working with Dr. Robert O. Schulze, executive director of the foundation.

Mr. and Mrs. Watson, Sr. were long interested in education and world affairs. For much of his business career, Mr. Watson, Sr. was involved with the Chamber of Commerce, and he vigorously supported the concept of "World Peace Through World Trade." He was an early and strong supporter of the United Nations. Both Mr. and Mrs. Watson traveled widely in connection with the global business requirements of IBM.