

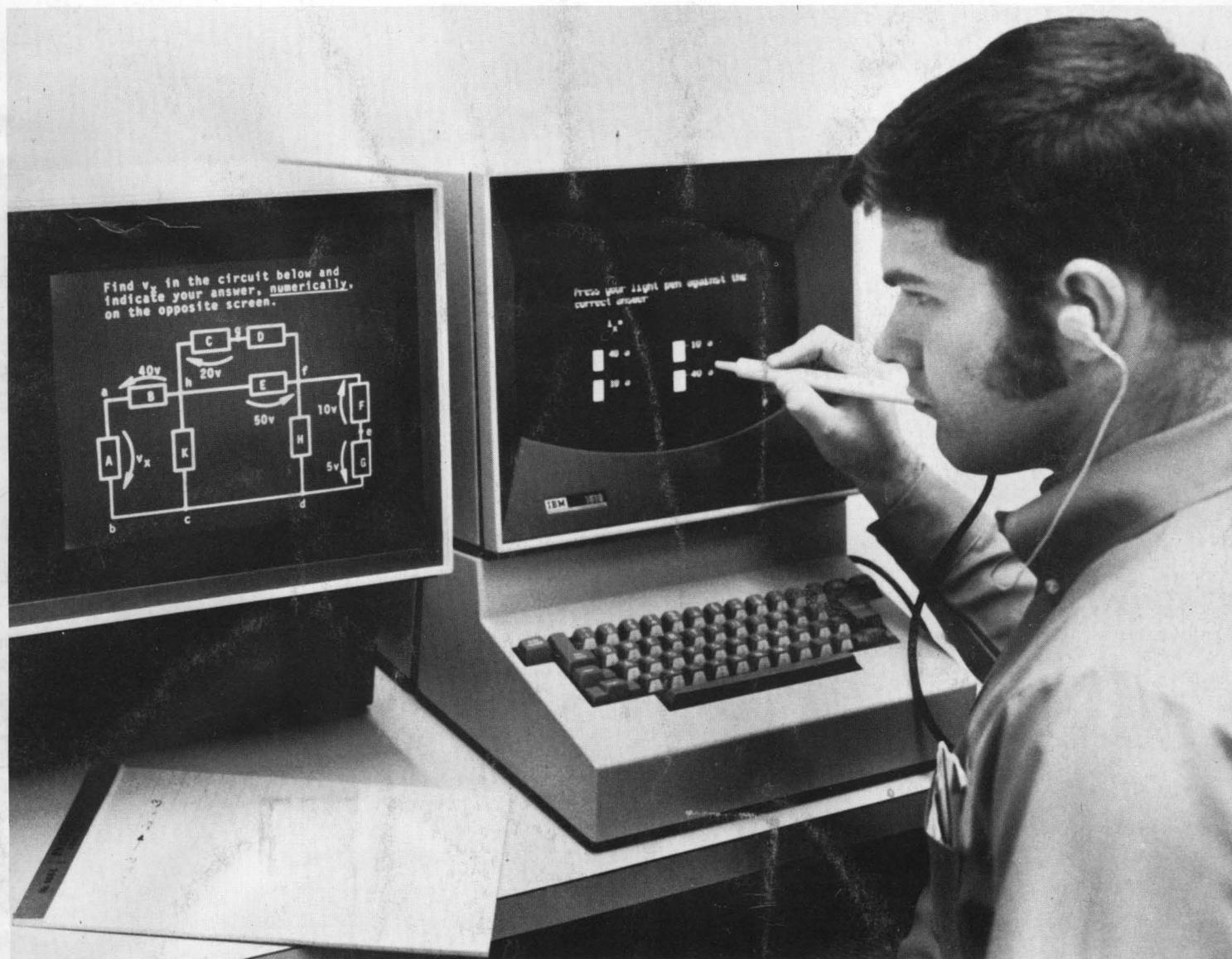
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SCIENCE & TECHNOLOGY

February, 1971

Vol. 20, No. 2

# computers and automation



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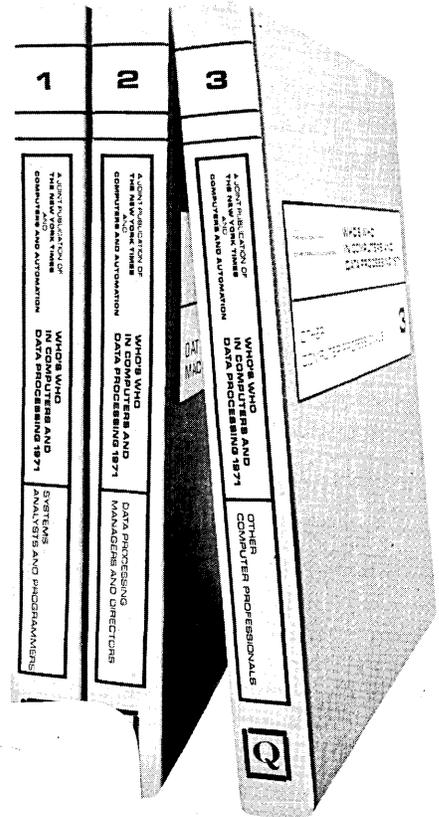
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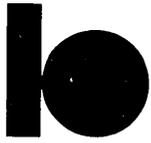
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# computers and automation

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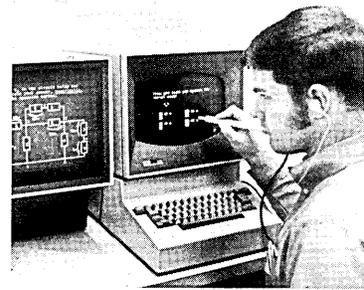
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Michael H. Boyd of Omaha, Nebraska, first year student at Rochester Institute of Technology, Rochester, N.Y., uses a terminal linked to an IBM 1500 instruction system to study electronic circuit analysis. Mr. Boyd is using a "light pen" to indicate his answer to a problem. The course is one of several sponsored by the National Technical Institute for the Deaf to help deaf students prepare for college-level technical studies. For more information, see page 55.

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## Not Understanding A Computer

One afternoon recently I tried for about four hours to explain what is inside a computer and how a computer works, to a very intelligent attorney. The purpose of our session was to try to organize a massive file of evidence into a computerized data base:

- What kind of information or data might go in?
- How should the coding brief be designed?
- What instructions should be given to the coding clerks?
- What sorts of problems would we want the computer system to deal with?
- What kinds of answers would we like the system to give us?
- What was feasible? What was trivial? What was impossible?

At the end of the afternoon I had the unhappy feeling that almost no progress had occurred, that due to some strange difference between his mind and my mind, he still had no systematic picture or concept or model of a computer in his mind from which he could correctly conclude what was reasonable and what was not reasonable for the desired computer system to produce. He did not understand a computer; it almost seemed to me as if he would not be able to; and I was very much surprised.

In order to grapple with this surprising experience, I started to wonder to what extent a person who drives a car understands a car. I inquired of my wife, who drives a car much better than I do. Did she know why a car goes? Did she know what the flywheel does? Did she know what the transmission is? Did she know why if one rear wheel is spinning, she can get no traction out of the other? I was utterly astonished by what seemed to me a surprising lack of understanding. She displays an excellent capacity to use and drive a car, together with what seems to me a primitive and even mistaken understanding of a car and how it works, and therefore what it is reasonable to expect a car to do.

"Understanding" according to several dictionaries has a number of synonyms such as "comprehending, grasping", etc. These words say nothing to an investigator, for they define one unknown in terms of another. But in one

dictionary I did find a good definition, "the capacity to distinguish truth from falsehood, and to adapt means to ends". This is a definition one can operate with.

Basically, to understand something is, I believe, to have in your mind a model (or concept or pattern or picture or map) such that:

- You can derive conclusions from the model;
- The conclusions can be applied in the real world;
- When they are so applied, they enable you to distinguish between truth and falsehood, they enable you to adapt means to ends, they enable you to make decisions that work reasonably well — or even very well —, and they keep you out of many kinds of trouble and mistakes.

For example, when does an assistant understand an instruction? I may ask a high-school student who works in the afternoon in my office to "go along Walnut St. to my house and bring back the 1966 World Almanac from my library". When he starts, he finds Walnut St. blocked by police on account of an accident; so he comes back and says, "I can't go right now — Walnut St. is blocked". So I then chide him gently and tell him to go another way, using Lowell Ave., a longer way, of course, but avoiding the blockage. He says to me, "But you told me to go along Walnut St." And thus he reminds me of the first version of a computer program which often does just what you say without understanding what you mean.

There is an immense future in working out better models for "understanding" things: maps, pictures, patterns, which people can take into their minds, and by means of which they can make better decisions and gain more understanding, including understanding of cars, instructions, and computers.

*Edmund C. Berkeley*

**Editor**

## READERS' FORUM

### GOVERNMENT REQUIREMENTS FOR THE COMPUTER INDUSTRY

Congressman Jack Brooks  
U.S. House of Representatives  
Washington, D.C. 20515

In any discussion of the effects of government requirements on the computer industry, we should distinguish between the sovereign powers of the United States, as contrasted to the proprietary interests of the government as the largest user of data processing in the world.

Sovereign actions in fields such as antitrust, the granting of patents and trademarks, the regulation of communications by the Federal Communications Commission, and the establishment of foreign trade policy, will continue to have a fundamental impact on the growing computer industry, which some experts have predicted will be the largest industry in America by 1985.

As computers extend the fundamental intellectual capacity of the individual, computer technology must be applied to the solution of that broad spectrum of social and economic problems that confront the nation. Progressive, forward-looking, and enlightened sovereign policies must, therefore, be evolved and maintained to encourage the effective and efficient use of computers and to maintain the overwhelming technological advantage the United States has in this area.

But, in practical terms, on a day-by-day basis, it is the federal government as the largest computer user, that will continue to have the most significant impact on the computer industry.

#### Procurement

Computer management, and particularly computer procurement, is an area of primary impact. For a number of

Based on remarks made at the Fall Joint Computer Conference, Houston, Texas, November 19, 1970.

years, the computer market, insofar as the cost is concerned, has been artificially influenced by the predominance of IBM and the antitrust consent decree that came about in the late 1950's. In the absence of this decree, IBM could, if the corporation had chosen to do so, imperil the existence of its smaller competitors through drastic price reduction. To a very great extent, the nation's computer industry operates under a price umbrella, making it impossible for the government or for private users generally to obtain truly competitive prices on computer equipment. Somehow (and I am not certain of the solution) we must discard this umbrella and bring true price competition to the market place.

The government is working toward a system of procurement based upon all-out competition on cost versus quality. Our goal is to develop performance specifications for computers and peripheral equipment, allowing the government to satisfy its computer needs by procurement of computer capacity rather than equipment of some specific manufacturer.

The impact of this policy on the computer industry will be that those vendors desiring to compete for government business will ultimately have to compete directly with IBM on a "no holds barred" cost competition basis.

#### Software

In this same general area, the federal government, as the world's largest computer user must, in a management sense, gain control over software. Fifty percent or more of the funds expended for computer acquisition flow into software, an area that — after 25 years — remains as abstract and as uncontrolled, in a procurement sense, as in the past.

The development of procurement guidelines and overall procurement control over software in government would have a tremendous impact upon the computer industry. For the software elements of the industry, it would be a traumatic experience, but the industry as a whole would benefit. Cleaner software procurement would increase computer exploitation and, therefore, sales and profits.

### Compatibility

This leads to the area of computer compatibility. As the largest computer user, the benefits to the government of reasonable standards are more obvious and perhaps more pronounced than they are to the average smaller user. In 1962, the Government Activities Subcommittee, which I serve as Chairman, supported a federal standards effort with primary reliance upon a voluntary industry-wide approach to these problems. As a policy, I still believe in a voluntary standards effort, with the government as an active participant reflecting the level of importance these standards can have on government computer operations.

During the past eight years, the government has participated in the nation's standards effort. And, we have developed federal standards in some instances when appropriate.

### Standards

The effort, however, has not moved along at a satisfactory rate. And, while continued federal participation on a voluntary basis is essential for an optimum result, the industry must recognize that it is not the sole alternative. If complicating and frustrating factors continue to retard progress in standards essential to the government's interests, then I believe the industry can logically expect the federal government to exercise sovereign powers in this area, despite the obvious disadvantages inherent in this approach. Federal procurement policies regarding standardization, therefore, can and will continue to have a significant effect on the industry and on the degree to which computers can be efficiently and effectively applied throughout the economy.

### The Need for User Orientation

In these areas that I have discussed, it is, of course, of fundamental importance that the federal government develop and maintain goals and policies that, on a long-range basis, accrue to the benefit of the nation as a whole. Foremost in these goals and policies should be the effort to make computers user-oriented. After 25 years, the user of a computer is limited to the trained technician. The time has come for the computer industry to respond to the needs of the consumer. Through development of more sophisticated software and hardware, the industry should make it possible for people in government, business, and industry who need computers to use them without months of training.

This goal is entirely reasonable, despite the monumental problems in achieving it. The problems will be a meaningful challenge to the industry. The achievement of this goal will broaden computer utilization and put computers at the forefront of American industry. As the world's largest user of computers, this will be the purpose and the goal of the federal government.

### Research and Development

In the area of research and development, the federal government will continue to spend countless billions annually in the development of sophisticated defense and space systems. The impact of the development and the procurement of these systems on the industry is to allow for a continuing advancement in the state of the art of

general benefit to all segments of the nation's economy. Federal funds invested in advanced military command and control systems, for example, can be translated into improved computer systems directly beneficial to all segments of the nation's business and industry. The industry must take full advantage of this research and development and see that the advances in the state of the arts that are brought into being for purposes of defense and space are translated into the general good of the entire economy.

If we are to exploit data processing techniques to the fullest in the government so as to have a lasting and beneficial impact on the computer industry and the nation as a whole, it is essential that all segments of the government fully appreciate and understand the importance of computers to the country.

Throughout the spectrum of federal activities in the Executive Branch, we must have sophisticated and capable policymakers who can rely upon the full support of the computer industry in the course of their efforts in determining federal policy. Should we, at any time, lose our overwhelming technological advantage over the rest of the world so as to become a second-rate computer power, we will at the same time, become a second-rate power in the world. □

## "THE DVORAK SIMPLIFIED TYPING KEYBOARD" — COMMENT

### I. Introductory Note:

In the December 1970 issue of "Computers and Automation" on page 8 is a discussion of the Dvorak Simplified Typing Keyboard, by Bob McCauley and the Editor. The sequence of letters on the three rows of the Dvorak keyboard is:

P Y F G C R L  
A O E U I D H T N S  
Q J K X B M W V Z

whereas the sequence of letters on the ordinary "standard" keyboard is:

Q W E R T Y U I O P  
A S D F G H J K L  
Z X C V B N M

The questions were raised: (1) How difficult is it for an adult who has learned the standard keyboard, to learn the Dvorak keyboard? (2) What kinds of adults relearn easily and what kinds cannot? (3) After such a person has "re-learned" the Dvorak keyboard, can he or she confidently expect a substantial gain in typing speed? (4) Is it not possible to provide an electrical overlay so that the Dvorak keyboard would be impeded but the impulses would be rerouted electrically to the mechanical keys, so that exactly the same mechanical keyboard structure could be used?

### II. From Dr. Kevin R. Jones

Director, Computing Center  
University of Delaware  
Newark, Del.

The Dvorak keyboard was developed by a man of the same name during World War II. At that time questions 1, 2 and 3 were, in effect, answered:

1. Between test and control groups of beginning typists, those using the Dvorak progressed faster and reached higher final rates. The difference was so great that it could be called qualitative, not merely a few percentage points.
2. An experienced typist who was willing to take the trouble found little difficulty in learning the new keyboard. The experiments, as I remember, did not reveal anyone who could not learn the Dvorak keyboard.

I don't recall the time required for retraining but my impression is that it took around a month to get back to the same speed on the new keyboard. From there on, speed was all upward.

3. Everyone who "relearned" the new keyboard came out with an improved speed.

In general this would be 30 to 50% greater speed for someone who just went back to work after a short retraining period. There may have been some "Hawthorne effect" here, but by no means enough to account for the great difference.

The last question (no. 4) wasn't asked in those days. What *was* asked was how this would affect the marketing aspects of the typewriter business.

Of course, the whole point is that for the Dvorak keyboard to be used with any real effect, it must supersede the present keyboard, not for some specific application, but everywhere. You couldn't effectively use one keyboard for typing and another for time-sharing. You couldn't have a secretary who used a different keyboard unless she could supply her own typewriter (some do). And, except for experimental purposes, no one is going to retrain himself to use a piece of equipment which is not generally available.

From much experience on keypunches, teletypes, and typewriters, I have become a fairly good typist. I would be happy to retrain myself to the Dvorak keyboard, but only if I can expect it to be available on all three.

It could be done. Every piece of equipment (even standard typewriters) can be converted. It would take a while, and there would be a cost, but the benefits to be gained within a reasonable time would be worth it, to say nothing of the tremendous favor it would do for future generations.

But the shame is that the typewriter companies had the chance to do it in 1945 when it would have been relatively easy and, instead, they consciously decided against it. Right after the war when much of our equipment was due for replacement and when there was much less equipment than now, they could have made the change, to the benefit of all of us now.

I never did understand why the manufacturers made the wrong decision. I would have thought that they would have sold many more new typewriters, to say nothing of change kits for old ones. In any case, the manufacturers made the wrong decision and then carried it out with a vengeance.

An example of what I think of as a "conspiracy", is that the decision killed typing contests. Before the war there were regular speed contests including "World Championships" and all. After the war suddenly there were no more. It wasn't for lack of interest. No, the fact was that everyone knew that the winner would be using a Dvorak keyboard. In order to forestall this, the companies quit sponsoring the speed contests.

I knew the man who would have won any contest. I clocked him in bursts of a minute at 195 words per minute.

He could go at nearly 160 for an hour. At that time the record was around 150 (on electrics — manuals were slower).

Good luck to anyone who wants to promote the Dvorak keyboard. He will be right. I doubt that he will be successful.

### III. From the Editor

It is evident that:

1. The Dvorak keyboard could be very beneficial to great numbers of persons;
2. Any electrical standard typing keyboard could be easily equipped with a supplementary alternate electrical Dvorak keyboard, so that either could be used at any time on any electrically operated keyboard with *no* mechanical changes, just a plug-out plug-in change;
3. A typing speed gain of 30 to 50% for almost everybody is a huge gain in productivity;
4. More and more persons who deal with computers through keyboards at computer terminals can obtain a 30 to 50% greater speed from a keyboard of better design (than the standard keyboard) from the point of view of human engineering.

Accordingly, "Computers and Automation" hopes to sponsor one or more keyboard typing speed contests — at which the Dvorak or other nonstandard keyboards may demonstrate their advantages in objective competition. The way to begin a change is to begin it.

For organizations looking for new and valuable products, here is an opportunity.

Any persons interested are invited to write to the editor.

## WHAT IS A "PROFESSIONAL"?

**I. Reprinted from "QA Sharing — The EDP Managers' Problem Corner", page 58, *Data Management* for Oct. 1970.**

Dear Q/A: Seminars, editorials and articles urge us to become "professionals." I have a degree and I thought that made me a professional, but I'm not so sure after I read some of the editorial comments. What in your opinion separates a professional from a non-professional?

Q/A says: The saying that you may have seven years of experience or one year of experience seven times sums up the difference between the professional and the non-professional. This may seem like an over-simplification, but it implies that the true professional has a good base of knowledge and then continues to perfect and add to that base of knowledge. He learns and uses the knowledge he acquires, to progress to more complex and responsible tasks.

In our opinion, the true professional gives a little more of himself, but not to the extent that he ceases to be true to himself as an individual. He performs each task meticulously, organizes his work, and is infused with a high degree of integrity.

The true professional has an interest in acquiring more knowledge and applying it to the task he is doing. He is continually preparing himself for the next "rung on the ladder."

The non-professional, on the other hand, "takes" from his present employer, then hops to another job, and repeats the same year of experience.

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

(Letter sent to Data Management, with a copy to C&A, in response to the above.)

I must disagree with an answer given in your October 1970 "QA Sharing" column. The question was, "What . . . separates a professional from a non-professional?" The answer was, essentially, that a professional works hard, tries to learn his job well, and tries to advance in his job, while a non-professional learns from more than one employer and (by inference) does not advance in his job.

There are many problems with the given answer. The distinguishing characteristics are not mutually exclusive. More important, the "professional" described is an ambitious worker, nothing more. A better description comes from *Computers and Automation*:

. . . the professional . . . includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for:

The reliability and social significance of pertinent input data;

the social value of the output results.

In the same way, a bridge engineer takes a professional responsibility for the reliability and significance of the data he uses, and the safety and efficiency of the bridge he builds for human beings to risk their lives on.

The important words are responsibility and social value. The responsibility is to society, not to one employer. The strong implication is a code of ethics. □

## THE LATENESS OF THE "1970 COMPUTER DIRECTORY AND BUYERS' GUIDE ISSUE"

I. From L. E. Hetland, Marketing Manager  
SISCO - Western Operations  
477 Division St.  
Campbell, Calif. 95008

I will be the first to admit that your EDP periodical is superior to all the others. But this year I've been more and more disappointed with the delay of your Directory issue.

The first "story" was publication in June, as in previous years. Then other months were given as the date of publication, and here it is December, and I still have nothing. What is going on? I've had many needs for reference to the Directory, and each time I get more irritated when I am reminded that it is not here.

Because of the delay, I can't help but think how outdated some of the information will be before I ever see it. I want to continue my subscription to C&A, but only if and when your fulfillment of our agreement is completed.

## II. From the Editor

By the time this February issue of *Computers and Automation* is printed, all copies of the 1970 Directory issue should have been mailed to our subscribers. On Dec. 30, 1970, the entire issue was in the hands of the printer and was scheduled for completion of printing on January 18.

As we explained in the "Preface and Editorial" to the Directory issue, we encountered unforeseen and unbelievable delays in our efforts to have a substantial portion of the Directory issue typeset by computer. We will not allow that to happen again. We are indeed sorry for the lateness of the 1970 Directory issue - and greatly appreciate the patience our subscribers have shown in accepting this delay.

We believe that the 1970 Computer Directory and Buyers Guide issue of *Computers and Automation* is better and more useful than any of the 15 previous editions. We know that it is 220 pages long as compared with 200 pages last year, and contains some new kinds of reference information not previously published. We hope it will prove to be really valuable to all of our subscribers who receive the directory issue (\*D on your mailing label). □

C.a

## PROBLEM CORNER

Walter Penney, CDP  
Problem Editor  
Computers and Automation

### PROBLEM 712: A NEW GEMATRIA?

"I think it would have been much better if they had made up some completely new symbols for those six hexadecimal digits instead of using the poor overworked letters," Al said to no one in particular.

"Oh, I don't know," said Bob who happened to hear this. "Once you get used to them it's not so bad."

"Seems like it's becoming the new gematria. People are trying to read meanings into numbers expressed by letters in hex."

"Is that what you're doing?" asked Bob, seeing Al working on a sheet covered with the letters A, B, C, D, E and F.

"No, I'm trying to reconstruct a problem Charlie worked out. It consisted only of letters and looked like one of those enciphered arithmetic problems. It involved two two-digit numbers, or rather two-letter numbers multiplied together to produce a four-letter number. I remember all six letters were used."

"Wouldn't eight letters be necessary even if you didn't show the partial products? And wouldn't this mean that two letters would have to be repeated?"

"No. Actually one of the digits occurred three times and the others only once."

What were the numbers?

### Solution to Problem 711: Chrystal or Crystal

According to the flow chart, A would be computed as

$$1 + \frac{2}{\pi^2 - 1} - \frac{2}{4\pi^2 - 1} + \frac{2}{9\pi^2 - 1} - \dots$$

which = csc 1. Therefore, E = sin 1, or approximately .84147. The reference was to Chrystal's *Textbook of Algebra*, p. 361, where the formula (in effect) is derived.

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.

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# ACORN (AUTOMATIC CODER REPORT NARRATIVE): AN AUTOMATED NATURAL-LANGUAGE QUESTION-ANSWERING SYSTEM FOR SURGICAL REPORTS

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*"ACORN, we believe, demonstrates the feasibility of a linguistically-based, automated, retrieval system, which allows a user to communicate with the system in his own natural language."*

A problem of growing concern in all fields of research today is that of handling an enormous and continually expanding volume of information.

At Roswell Park Memorial Institute (a cancer research institute in Buffalo, New York), for example, productive avenues of investigation are often blocked not because of a lack of raw data, but because the data is totally unstructured and unmanageable in form.

For this reason, a project was initiated in 1964 by Dr. Irwin D. J. Bross, Director of the Biostatistics Department at the Institute, to investigate the feasibility of automating both the storage of post-operative surgical reports written in ordinary English and the retrieval of information from them. The primary goal was to determine whether modern theories of linguistic analysis could aid in constructing a computer system which would allow surgeons to dictate their reports in a free, unrestricted style and still allow researchers to question this great catalog of stored data, also using natural English. In other words, the goal is to set up a system in such a way that no unnatural restrictions whatsoever are placed upon the human beings using the system.

The initial linguistics research on the project was done by Miss Barbara Anderson, now at the University of New Brunswick. She concluded that for our purposes, the linguistic theories of Dr. Zellig Harris of the University of Pennsylvania were the most useful. Although Dr. Harris' work was used as a basis, many modifications had to be made by the authors of this paper, because of peculiarities of the surgeon's jargon and limitations imposed by the computer system being used.

The programming on the project was done by the authors during the summers from 1965 through 1970 with the aid of National Science Foundation summer students<sup>1</sup> and the assistance of Dr. Roger Priore, Director of Computer Research at the Institute.

<sup>1</sup>Lawrence Perletz (1965); George Olshevsky, Francine Homberger, Peter McHugh (1966); Daniel Hansburg (1967); David Myerson, Greta Heintz, Benjamin Yalow (1968); Helen Means (1969); Thomas Giancarlo (1970).

This investigation was supported by Public Health Service Research Grant No. CA-11531 from the National Cancer Institute.

## Outline of the System

In this paper, we present a brief outline of the system called ACORN (Automatic Coder Of Report Narrative) now running at the State University of New York at Buffalo (SUNYAB) Computing Center. We include examples of the analysis and storage of actual post-operative reports and of the retrieval of answers to actual specific questions. Readers interested in more detailed descriptions of the system are directed to the references to previous publications listed at the end of this article.

The hardware structure of ACORN is shown in Figure 1.

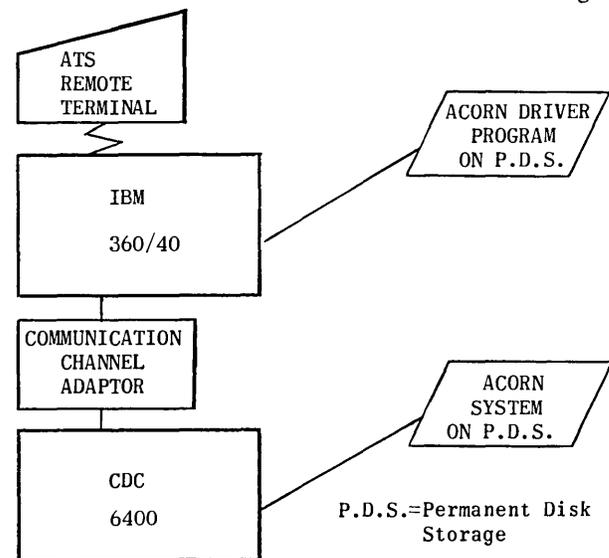


Figure 1 -  
Hardware configuration for ACORN System

The structured catalog of stored information is created in the following manner: First, the surgeon describes the sequence of events which occurred during the operation just completed into an ordinary recording device, speaking as he ordinarily would and with no external restrictions imposed on him at all. Next, a stenographer transcribes this natural-language document on to a magnetic disk file via the IBM 2741 communications terminal and the A.T.S. (Administrative Terminal System). A.T.S. is a software system on the IBM 360/40 for storing documents via a

typewriter terminal; it provides sophisticated editing capabilities for the user. Documents can be saved, deleted, and corrected with a minimum of effort.

The driver program for the entire ACORN system is stored on an A.T.S. permanent file, and the surgical report just entered becomes the data for the ACORN programs. The system is activated from the terminal by submitting the job (consisting of the driver program and the surgical report as its data) to the Control Data Corp. CDC 6400 computer via SUNYAB's TJE (Terminal Job Entry) system. TJE is a software system which permits submission of an A.T.S. permanent file as a job to be run on the CDC 6400 by means of a communications adaptor between the IBM 360/40 and the CDC 6400. This eliminates the need for card input and permits output to be listed back at the user's terminal. This system also allows for ACORN to be activated from any A.T.S. terminal authorized to make use of it.

When the job reaches the top of the 6400 input queue, the ACORN system programs (in binary code) are extracted from the 6400 permanent disk storage unit and ACORN is loaded and executed in 15 fragments known as "overlays". This fragmentation means that the independent modules of ACORN do not reside in core simultaneously but rather successively, enabling the entire process to be carried out within a maximum program size of 55k octal memory locations. By minimizing the program size in this way, the priority of the job in the CDC 6400's multiuser environment remains high, and turn-around time is excellent. In fact, an average sentence or question requires about 1 second of central processor time. Turn-around time at the terminal for retrieval of information is approximately 3 minutes on the average.

Once execution begins, the first step consists of a "dictionary lookup" (see the first block in Figure 2). In this operation each word in the sentence is looked up in an alphabetic dictionary by a search, in order to determine the part-of-speech and the "seme-number" of each word. The *seme-number* is a number denoting the meaning of the word; synonyms and related words are given similar seme-numbers.

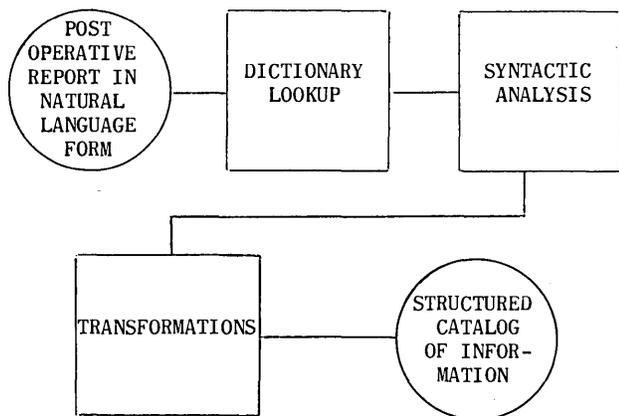


Figure 2 - Diagram of ACORN System for Storing Document Information

### Sample Sentence

As an example, we will first consider the sample sentence "The fascia was also closed with interrupted silk stitches". Figure 3a is a print-out of the dictionary lookup process for this sentence. From left to right on each line,

we see: Report number, sentence number, word number within sentence, word, seme-number, and part-of-speech.

### Syntactic Analysis

The next step of the process consists of a syntactic analysis of the sentence using our modified version of Harris's cycling cancellation automaton (References 2 and 3), in order to determine the syntactic relationships between:

- What is the subject?
- What is the main verb?
- Which words and phrases modify each other? and so forth.

0047	013	1	THE	024140	ART	
0047	013	2	FASCIA	009361	NBOD	
0047	013	3	WAS	026430	VB	
0047	013	4	ALSO	001850	ZZZ	DZDA
0047	013	5	CLOSED	002477	VINE	
0047	013	6	WITH	026740	P	
0047	013	7	INTERRUPTED	012680	ZZZ	ADZA
0047	013	8	SILK	021750	N	
0047	013	9	STITCHES	022710	N	

Figure 3a - Dictionary lookup

- (i) The fascia was also closed with interrupted silk stitches.



- (ii) AUTOMATIC SYNTACTIC ANALYSIS BEGINNING TOUCHDOWN\*\* ANALYSIS COMPLETE

WELL-FORMED SIMPLE SENTENCE

ANALYSIS OF SENTENCE

RESIDUAL FORM CLASSES

NBOD  
VB

SYNTACTIC ANALYSIS OF SENTENCE

LEFT	MIDDLE	RIGHT
0	ART	0
ART	NBOD	0
0	VB	VINE
0	D	0
D	VINE	DP
0	DP	N
0	A	0
A	N	0
N	N	0

Figure 3b - Syntactic analysis

This analysis will be used in the next phase of ACORN, in which the actual extraction of the information contained in a sentence occurs. A detailed description of the syntactic analysis component can be found in References 4 and 5.

Figure 3b is the output from the syntactic analysis programs for our sample sentence. After completion of analysis, the sentence was judged to be a well-formed simple sentence whose subject is "fascia" (part-of-speech: "NBOD" or "NOUN of BODY") and whose main verb is "was" (part-of-speech: "VB" or "VERB of BEING"). Part (ii) of figure 3b is a vertical representation of the manner in which the words in the sentence connect to each other. It is

a short-hand notation for the interconnection schematically shown in Part (i).

The analysis therefore conveys the following vital information:

- (1) "the" is an article modifying "fascia".
- (2) "also" is an adverb modifying "closed".
- (3) "interrupted" is an adjective modifying "stitches".
- (4) "silk" is a noun modifying "stitches".
- (5) "stitches" is the object of the preposition "with".
- (6) The entire prepositional phrase is an adverbial modifier of the verb "closed".
- (7) The past participle "closed" connects to the main verb "was".

### Semantic Analysis

Now, the final major stage of analysis occurs — the use of the linguistic transformation programs to decompose the sentence into its "kernels" or basic units of meaningful information. Although a given piece of information can be expressed in many ways in natural language, each paraphrase should of course produce the same kernels. A kernel regularly has three parts, F, X, and Y, which will now be explained. For example, "the tumor was removed" and "removal of the tumor" and "the surgeon excised the tumor" are all decomposed by appropriate transformations into the very same kernel:

OP(TUMOR) = REMOVED.

This kernel denotes that the surgeon performed an operative act (OP) on the tumor (TUMOR) — namely, it was removed (REMOVED).

Notice that the format for kernels is the mathematical function notation  $F(X) = Y$ . This says that a function F of the entity X has a value Y. Y need not be (and often will not be) a single value.

0047	EXISTS (FASCIA	)	0
	7 09361013		
0047	DSCR (STITCHES	) = INTERRUPTED	
	7 22710013	912680013	7
0047	DSCR (STITCHES	) = SILK	
	7 22710013	921750013	8
0047	OP (FASCIA	) = CLOSED	
	4 09361013	202477013	5
0047	MEANS (CLOSED	) = STITCHES	
	10 02477013	522710013	9

Figure 3c -  
Kernels of information

Let us return now to the sample sentence:

The fascia was also closed with interrupted silk stitches. For this sample sentence, the kernels were extracted by the transformations shown in Figure 3c. The first kernel in figure 3c signifies that the body-noun "fascia" was mentioned in this report; so, if a question was later posed asking which reports dealt with "fascia", one of the answers would be "report #47". The next two kernels are triggered by the syntactic information of (3) and (4) above, and signify that the "stitches" can be described as being "interrupted" and "silk". The fourth kernel is generated from the subject and main verb of the sentence and (7) above, and denotes that the surgeon performed the oper-

Table 1

### THE NATURE OF FUNCTIONS F

(1) Value of Function F	(2) Meaning of Function
EXISTS	To denote the existence of an object or condition
SIZE	To specify physical size
DSCR	To specify any description of an object or condition
DEGREE	To specify the degree of a description or condition
ACT2	To denote any action by the patient (person 2) during the operation
ACT3	To denote any activity by a body organ or tissue (entity 3)
OP	To denote any operation by the surgeon (person 1)
MEANS	To specify the means by which any action was accomplished
MANNER	To specify the manner in which an action occurred
WHEN	To specify the time when an action or event occurred
WHERE	To specify the location of an object or condition
POSSES	To specify the possessor of an object or condition
QUANT	To specify the quantity of objects of a particular type which are present

ative act of closure upon the fascia. Finally, the fifth kernel is generated by (5) and (6) above and specifies the means of closure.

### Semantic Functions

It is worth stopping for a moment and stating the functions being used in this system of information retrieval. At present, we are using a set of approximately 20 different functions in working with the surgical texts at Roswell Park Memorial Institute. In general, however, the nature of the set of functions and kernels will depend upon the particular universe of discourse being analyzed.

In our surgical texts, the most common of the functions that arise are shown in Table 1.

Examples of each of these functions, with sample sentences of text from which they might be generated, are shown in Table 2. It should be noted that the kernel of information that Roswell uses evolved quite naturally from the punch-card format of standard data-manipulation procedures.

Suppose, for example, that column 10 of the "tumor" punch-card was designated as the column for "location" of the tumor. Thinking in terms  $F(X) = Y$  this means that X corresponds to the particular punch-card on which a punch will be made, F corresponds to the particular column or field chosen, and Y corresponds to the particular character which will be punched. Thus a punch of 6 in column 10 of

Table 2

EXAMPLES OF KERNELS F(X) = Y

(1) Exam- ple No.	(2) Sample Sentence of Text	(3) Expression in Kernels
1	An 8 x 10 cm. mass was discovered	EXISTS(MASS)  SIZE(MASS) = 8 X 10 CM.
2	The mass was slightly irregular	DSCR(P(MASS)) = IRREGULAR  DEGREE(IRREGULAR) = SLIGHTLY
3	The patient tolerated the procedure well	ACT2(PATIENT) = TOLERATED PROCEDURE  MANNER(TOLERATED) = WELL
4	There were four lesions present	EXISTS(LESIONS)  QUANT(LESIONS) = FOUR
5	The tumor extended into the colon	ACT3(TUMOR) = EXTENDED INTO COLON
6	The tissue was approximated with sutures	OP(TISSUE) = APPROXIMATED  MEANS(APPROXIMATED) = SUTURES
7	Dressing was applied after approximation	WHEN(APPLIED) = AFTER APPROXIMATION
8	Lesions were present in the stomach	WHERE(LESIONS) = IN STOMACH
9	The patient's condition was good	POSSES(CONDITION) = PATIENT'S

the "tumor" card might be equivalent to WHERE(TUMOR) = STOMACH.

However, there is one very significant advantage of the kernel format of storage over the traditional format of punch cards. Suppose a situation arises like the following:

Prior to operation 3243, no tumors had ever been discovered in the liver, but in operation 3243 a tumor was found in this location.

Here a novel situation has arisen; chances are that no code number for "liver" exists for column 10; and a code-clerk would be stymied. ACORN, however, is not stymied; it simply generates "where" functions *automatically* from certain syntactic patterns in the text, and so it would respond with a kernel WHERE(TUMOR) = LIVER, with LIVER as the Y-value instead of STOMACH. ACORN should do this of course for any possible English paraphrase such as "A tumor was found in the liver". It is for this reason that much of the future work on ACORN will be devoted to improving the syntactic analysis and transformation components so as to handle a wider range of paraphrase constructions.

Once the kernels of information have been extracted from a large group of reports, they are stored on a permanent random-access disk file. The method of storage of the "F(X) = Y" kernels is to sort them first numerically by the seme-number of X. Then, each group of kernels with the same X value are sorted according to F value. Finally,

0046	005	1	THE	024140	ART
0046	005	2	MARGINS	007984	NPAR
0046	005	3	OF	016350	POF
0046	005	4	THE	024140	ART
0046	005	5	DEFECT	001213	N
0046	005	6	WERE	026434	VB
0046	005	7	APPROXIMATED	026470	VINE
0046	005	8	WITH	026740	P
0046	005	9	SILK	021750	N
0046	005	10	AND	001980	C
0046	005	11	THE	024140	ART
0046	005	12	PATIENT	017450	N
0046	005	13	WAS	026430	VB
0046	005	14	RETURNED	020330	ZZZ VOINE
0046	005	15	TO	024690	ZZZ TOZP
0046	005	16	HIS	017452	NSPP
0046	005	17	DIVISION	021330	N
0046	005	18	IN	012542	ZZZ DZPIN
0046	005	19	SATISFACTORY	001445	A
0046	005	20	CONDITION	005430	N

Figure 4a - Dictionary lookup

AUTOMATIC SYNTACTIC ANALYSIS BEGINNING TOUCHDOWN\*\* ANALYSIS COMPLETE

A CONJUNCTION BRANCH IS BEING ATTEMPTED WELL-FORMED COMPOUND SENTENCE

ANALYSIS OF SENTENCE

RESIDUAL FORM CLASSES

NPAR  
VB  
C  
N  
VB

SYNTACTIC ANALYSIS OF SENTENCE

LEFT	MIDDLE	RIGHT
0	ART	0
ART	NPAR	POF
0	POF	N
0	ART	0
ART	N	0
0	VB	VINE
0	VINE	DP
0	DP	N
0	N	0
0	C	0
0	ART	0
ART	N	0
0	VB	VINE
0	VINE	DP DP
0	DP	N
0	NSPP	0
NSPP	N	P
0	P	N
0	A	0
A	N	0

Figure 4b - Syntactic analysis

each of these groups is sorted numerically by the seme-number of Y. The result is a structured catalog of kernels of information.

Another Sample Sentence

The complete analysis of a more complex sentence is reproduced in Figure 4a. The steps in the process are identical to those above.

For this second sample sentence, the kernels (see Figure 4c) convey the following information:

- (1) "Margins", "detect", "silk", and the "patient" were mentioned in this report.
- (2) The "division" involved was that of the patient (a male).
- (3) The patient's "condition" was described as "satisfactory".
- (4) A descriptive restriction ("DREST" function) on any mention of the "defect" in any of the kernels is that only the "margins" of the "defect" are involved.
- (5) The next kernel says that location of the "division" is the "condition" and is a "garbage kernel" of pseudo-information generated by the syntactic ambiguity of the phrase "in satisfactory condition" which could modify either "division" or "returned". Experience has shown that storage of these garbage kernels (of which there are very few, running under 5%) is harmless since they are rarely retrieved.

EXISTS	(MARGINS	)		
0046	7	07984005 2	0	0
EXISTS	(DEFECT	)		
0046	7	01213005 5	0	0
EXISTS	(SILK	)		
0046	7	21750005 9	0	0
EXISTS	(PATIENT	)		
0046	7	1745000512	0	0
POSSES	(DIVISION	) = HIS		
0046	13	21330005171745200516	0	0
DSCRIP	(CONDITION	) = SATISFACTORY		
0046	7	05430005200144500519	0	0
DREST	(DEFECT	) = MARGINS		
0046	20	01213005 507984005 2	0	0
WHERE	(DIVISION	) = IN	CONDITION	
0046	12	213300051712542005180543000520	0	
OP	(DEFECT	) = APPROXIMATED		
0046	4	01213005 502470005 7	0	0
MEANS	(APPROXIMATED	) = SILK		
0046	10	02470005 721750005 9	0	0
OP	(PATIENT	) = RETURNED		
0046	4	17450005122033000514	0	0
WHERE	(RETURNED	) = TO	DIVISION	
0046	12	203300051424690005152133000517	0	
MANNER	(RETURNED	) = IN	CONDITION	
0046	9	203300051412542005180543000520	0	

Figure 4c -  
Kernels of Information

- (6) The operative act of "approximation" was performed on the "defect".
- (7) The means of "approximation" was "silk".
- (8) The "patient" was "returned" by a member of the surgical staff.
- (9) The place he was returned to was the "division".
- (10) The manner he was returned was in a "condition" previously described as "satisfactory".

3	101	10001	THROUGH	024352	P
3	101	10002	WHAT	026550	NPRO
3	101	10003	KIND	025351	N
3	101	10004	OF	016350	POF
3	101	10005	INCISION	012002	N
3	101	10006	WAS	026430	VB
3	101	10007	THE	024140	ART
3	101	10008	ABDOMEN	001150	N
3	101	10009	ENTERED	016471	VINE

Figure 5a -  
Dictionary lookup of question

DECLARATIVE FORM OF QUESTION			
10007	THE	024140	ART
10008	ABDOMEN	001150	N
10006	WAS	026430	VB
10009	ENTERED	016471	VINE
10001	THROUGH	024352	P
0	ADJ	032767	A
10005	INCISION	012002	N

Figure 5b -  
Conversion of interrogative to declarative

### Synonyms

It is worth mentioning at this point that the problem of synonymy is handled in a very simple fashion by ACORN. Words which are synonymous with one another have seme-numbers which differ only in their final digit. For example, in the first sample sentence above "closed" is listed with seme-number 02477 and in the second sentence "approximated" is listed with seme-number 02470. Later, when a question is asked, the retrieval programs are designed to ignore this final digit when searching through the kernel catalog of stored information.

### Questions

Once a kernel catalog has been permanently created by the process discussed above, it becomes a relatively simple matter to interrogate it. A user wishing to ask a question submits it as a job for the CDC 6400 from the same typewriter terminal previously described. He uses the same driver program that is used to submit surgical documents, but specifies that the input is in the interrogative mode.

ACORN then analyzes the question in a manner almost completely analogous to the analysis of a document. First, its dictionary-lookup program produces the same output as it would for a sentence in a post-operative report. As an example, Figure 5a shows the dictionary-lookup output for the question "Through what kind of incision was the abdomen entered?"

At this point, a special program used in the analysis of questions but not documents is loaded into core. Its function is simply to convert the question into a declarative form amenable to analysis by the remaining ACORN analysis programs already described. Frequently this special program must generate a "dummy" word to represent the unknown element in the question. For example, the phrase "what kind of" in the sample question generates the dummy adjective word "adj" appearing in Figure 5b.

From this point through the generation of the kernels, analysis proceeds just as it would for a sentence from a post-operative report. Figures 5c and 5d show the syntactic analysis and kernel extraction respectively for the sample question.

The kernels for the question convey the following information:

AUTOMATIC SYNTACTIC ANALYSIS BEGINNING  
TOUCHDOWN\*\* ANALYSIS COMPLETE

WELL-FORMED SIMPLE SENTENCE

ANALYSIS OF SENTENCE

RESIDUAL FORM CLASSES

N  
VB

SYNTACTIC ANALYSIS OF SENTENCE

LEFT	MIDDLE	RIGHT
0	ART	0
ART	N	0
0	VB	VINE
0	VINE	DP
0	DP	N
0	A	0
A	N	0

Figure 5c -  
Syntactic analysis of question

DSCR	(INCISION	) = ADJ		
3	7	12002101 732878101 6	0	0
OP	(ABDOMEN	) = ENTERED		
3	4	01150101 216471101 4	0	0
WHERE	(ENTERED	) = THROUGH	INCISION	
3	12	16471101 424352101 512002101 7	0	

Figure 5d -  
Kernels of information in question

THE FOLLOWING ANSWERS HAVE BEEN FOUND

- 517 MIDABDOMINAL  
THE ABDOMEN WAS OPENED THROUGH A LOWER MIDABDOM-  
INAL VERTICAL INCISION AND SUBCUTANEOUS TISSUE  
AND FASCIA WERE OPENED IN A SIMILAR FASHION.
- 2705 ABDOMINAL  
THROUGH A LOW ABDOMINAL MIDLINE INCISION WHICH  
INCLUDED EXCISING THE OLD SCAR, THE ABDOMEN WAS  
ENTERED.
- 2705 MIDLINE  
THROUGH A LOW ABDOMINAL MIDLINE INCISION WHICH  
INCLUDED EXCISING THE OLD SCAR, THE ABDOMEN WAS  
ENTERED.
- 903 SUPRAPUBIC  
FOLLOWING THIS, THE PATIENT WAS REPOSITIONED AND  
THE ABDOMEN WAS ENTERED THROUGH A SUBRAPUBIC IN-  
CISION WHICH RESULTED FROM PREVIOUS APPENDECTOMY  
OPERATION
- 3403 SKIN  
SKIN INCISION WAS MADE EXTENDING FROM THE XIPHOID  
PROCESS TO THE UMBILICUS THE ABDOMEN WAS ENTERED  
THROUGH THIS INCISION.
- 517 LOWER  
THE ABDOMEN WAS OPENED THROUGH A LOWER MIDABDOM-  
INAL VERTICAL INCISION AND SUBCUTANEOUS TISSUE  
AND FASCIA WERE OPENED IN A SIMILAR FASHION.
- 2705 LOW  
THROUGH A LOW ABDOMINAL MIDLINE INCISION WHICH  
INCLUDED EXCISING THE OLD SCAR, THE ABDOMEN WAS  
ENTERED.
- 517 VERTICAL  
THE ABDOMEN WAS OPENED THROUGH A LOWER MIDABDOM-  
INAL VERTICAL INCISION AND SUBCUTANEOUS TISSUE  
AND FASCIA WERE OPENED IN A SIMILAR FASHION.

Figure 5e -  
Answers to the question

- (1) The operative act of "entering" was performed upon the abdomen".
- (2) The location of "entering" was through an "in-  
cision".
- (3) The type of "incision" is the unknown element in the question.

Question Answering

Now, the final stage of the question-answering process consists of a matching procedure in which the catalog of kernels of stored information is searched in a fashion determined by the kernels in the question. In our example, the retrieval program requires that the second and third kernels in Figure 5d occur in the same sentence of the same report. When this condition is met, it attempts to find a match from the remaining kernels of that sentence for the "open-ended" kernel "DSCR (INCISION) = ADJ", with the dummy word "adj" allowed to match any word at all. If in fact a match is found, the word in that kernel corresponding to the "adj" in the question, is the answer desired by the user, and is printed out back at the terminal along with its report-number and sentence-number.

In Figure 5e, the first answer listed is "midabdominal" from report 5, sentence 17. The user has requested the option of having the sentence containing the answer printed out below each answer. It should be noted that each modifier of "incision" produces a separate answer during this process (for example: "midabdominal", "lower", and "vertical" in report 5, sentence 17, which were extracted from the phrase "lower midabdominal vertical incision"). This then is a brief outline of the overall question-answering process.

Summary

The system described in this article is now running at the SUNYAB computer center in Buffalo, New York, and the examples in Figures 3, 4, and 5 are actual computer output.

It should be understood, however, that ACORN is a demonstrational, rather than operational, system in that it is really a prototype. A truly operational system would need many linguistic refinements and retrieval features which are lacking in the current model.

Work on ACORN has proceeded only during the summer months for the past 6 years and with a very small staff and limited funds. Although the surgical jargon is merely a subset of the English language, the authors believe that ACORN demonstrates the feasibility of a linguistically-based automated storage and retrieval system which affords the user the luxury of communicating with the system in his own natural language.

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# SOURCE LANGUAGE DEBUGGING

*"One of the advantages of source language debugging is that the results present a dynamic view of the course of the calculation."*

Richard C. Taylor  
Senior Project Analyst  
United Aircraft Research Laboratories  
East Hartford, Conn. 06108

Source language debugging was a subject of concern and development in the early 1960's, and is currently available on a number of computer systems. The main advantages of source language debugging are that (1) the user makes debug requests in his own source language, and (2) the results, labelled with the user's own source language symbols, present a dynamic view of the course of the calculation.

It appears to be a rather general condition that the system for performing the source language debugging be integrated into the computer's operating system. But this need not necessarily be so.

This report deals with source language debugging by means of a previously-reported and well-known method, editing of source code. The power and versatility of this technique indicate that a re-emphasis is in order.

The implementation here reported, named DEBUG, was written at United Aircraft Research Laboratories for the UNIVAC 1108; it includes several features which are believed to be novel in source-language debugging. A year of user experience has shown DEBUG to be highly useful. It may well be that the description here is not entirely clear to some readers. The author will be glad to provide further information about DEBUG.



Mr. Taylor received a BA in Mathematics at Cornell University, 1950, and an MS in Education at the University of Wisconsin, 1953. He has been employed since 1954 at United Aircraft Research Laboratories, Computation Laboratory, as application programmer, programming group supervisor, and most recently in a staff function. His computer experience has been on large-scale scientific IBM and UNIVAC machines. He is a member of the Hartford Chapter, ACM.

Given the dual conditions of (1) system independence, and (2) the debugging program itself written largely in a higher level language (FORTRAN in this case), believe that this source language debugging program demonstrates a technique which would be generally useful if implemented on any other computer, for any other higher level language.

## Objectives

The DEBUG program was designed to meet these objectives:

1. A full range of selectivity for specifying *which* variables are to be printed, up to the point where a single, simple-to-use command calls for print of *all* referenced variables in a portion of code.
2. Flow trace of the execution of program logic, to include not only *where* flow of control has passed, but also the *why* at each point including the result of the logic evaluation and the values of variables used.
3. Automatic specification of format information needed for the debugging print.
4. A full range of selectivity for specifying *where* and *when* debug information is wanted.
5. Distinctive identification on each point of debug print, e.g., routine name and point within the routine.
6. Automatic limitation on the quantity of debugging output, to prevent inundation by paper.
7. The usual software requirements: simplicity of usage, minimum time penalty, minimum requirements for core storage and peripheral devices, general purpose language preferable to assembler language.

## Summary of One Run

The following is the course of one debugging run:

1. *Setup.* The user specifies debug requests by placing control cards in his FORTRAN code. The control cards are actually special purpose Comment cards.
2. *Precompile.* The precompiler reads the source code, constructs FORTRAN statements which are added to the code, and outputs the expanded source code to system drum storage.
3. *Compile.* A normal FORTRAN compilation is performed.
4. *Execute.* A normal execution is performed, with

	EXAMPLE I Automated print of program variables. Routine name is MAINXX	EXAMPLE II Flow Trace of Program Logic Execution. Routine name is SUBAAA
FORTRAN Code to be Debugged.	DDD=B*A - 0.5*C TTT(J)=(DDD-B)/2.0*A	IF (B**2-4.0*A*C) 95,30,25
Programmer inserts 'C\$' control cards	C\$ DEBUG (ALL)C,DDD,TTT DDD=B*A - 0.5*C TTT(J)=(DDD-B)/2.0*A C\$ DEBUG (OFF)	C\$ TRACE ON IF (B**2-4.0*A*C) 95,30,25 C\$ TRACE OFF
Precompiler output -- listed by FORTRAN compiler	C\$ DEBUG (ALL) C,DDD,TTT DDD=B*A - 0.5*C (00145) CALL DOOOOX('DDED C ;',DDD,C) TTT(J)=(DDD-B)/2.0*A (00147) CALL DOOOOX('DTTT(J) JJDDD ;', X TTT(J),J,DDD) C\$ DEBUG (OFF)	C\$ TRACE ON C IF (B**2-4.0*A*C) 95,30,25 A0000X=B**2-4.0*A*C (00215) CALL DOOOOX('AB A C ;',A0000X,B,A,C) IF (A0000X) 95,30,25  C\$ TRACE OFF
Print of Example I	MAINXX 00145 D DDD= 731248.29 MAINXX 00147 D TTT(J)= 356.74071	C= 984.17000 J= 4 DDD= 731248.29
Print of Example II	SUBAAA 00215 A EXPRESSION= 5727.7249	B= 109.93000 A= 29.160000 ... (value of C similarly)

Figure 1 - Two examples of DEBUG mechanics and printed output

debug prints from the added code and a special DEBUG print routine.

This debugging function takes place independently of the operating system. The added FORTRAN statements exist only within the computer, so the programmer is never concerned with removing these from his deck.

### Two Examples

DEBUG performs 2 kinds of functions: (1) automated print of program variables; and (2) flow trace of program logic execution.

Placement of the 'C\$' controls allows any degree of selectivity as to *where* the debug print is wanted. Any number of each control may be used. All debugging calls go to a common entry point, 'DOOOOX', in the execution-time print routine (ETPR). A special procedure permits a variable-length argument list for the CALL. Argument 1 is a character string: character 1 indicates the type of call (D = debug print, A = arithmetic IF, etc.), followed by the print labels of the variables, each with a suffix character indicating format type to the ETPR (blank = REAL, J = integer). A semi-colon is the end flag for the character string. Arguments 2 and following convey the variable values. For the trace, the user's logic decision statement (arithmetic IF in this case), is made a Comment card, and replaced by three new statements which are computationally equivalent. Variable 'A0000X' is added to the user's program ('LOOOOX' added for Logical IF). From the information of argument 1, the ETPR constructs a FORTRAN format to perform the print. The ETPR obtains the routine name and the compiler-generated sequence number (00145, 00147, 00215) from the "walk-back" information in the calling sequence. Provision is made to enable printing any number of variables which may be

needed in the statement or expression, four variables per line or less, for as many lines as needed. For the trace print 'EXPRESSION' is the evaluation of the IF-condition. For a logical IF, the evaluation is printed as T or F.

### Control Options

C\$ DEBUG (NEW) list  
C\$ DEBUG (NEW)  
C\$ DEBUG (ALL) list  
C\$ DEBUG (ALL)

The DEBUG (NEW) option was adapted from the 'INIT' feature of IBM 360 FORTRAN DEBUG, and the concept was extended to DEBUG (ALL). Each of these controls directs the precompiler to search the following statements (until turned off by C\$ DEBUG(OFF)) for arithmetic statements, either to locate listed variables or (no list) to locate all variables of the specified category. 'NEW' requests the newly-computed variable on the left side of the arithmetic replacement statement. 'ALL' requests variable references on both sides of the arithmetic statement, so that 'ALL' with no list gives a complete run-down on all referenced variables.

C\$ DEBUG list

This causes a "breakpoint" print, interrupting calculation at the point of insertion to print the listed variables.

The Trace function is turned on/off by -

C\$ TRACE ON  
C\$ TRACE OFF

When the trace is on, the processor searches for logic decision statements: arithmetic IF, logical IF, Computed GO TO (Assigned GO TO was arbitrarily omitted). When one of these is found, it is replaced by several statements which print, then perform the logic control functions.

The ETPR will limit the amount of DEBUG produced

output. If the linecount limit is exceeded, execution continues with DEBUG output inhibited. Default line limit is 1,000, but a user may override this value with a card of the form —

C\$ MAXLINES = n

The user may specify alpha format for certain variables —

C\$ ALPHA list

or he may specify octal format for all variables —

C\$ OCTAL

The user may access an on-off print control switch in the ETPR —

C\$ PRINT ON

C\$ PRINT OFF

Normal status is 'ON'. When turned 'OFF', entries to ETPR are still made, but no print and no add to line count are made. Normally either of these 2 controls is combined with an added FORTRAN IF statement to determine whether debug print is or is not wanted. These enable precise user control as to *when* debug output is wanted.

### Implementation

The DEBUG program has been implemented on a UNIVAC 1108 using the EXEC2 operating system. Both pre-compiler and ETPR function independently of the operating system. The I/O section of the precompiler (about 1/2 of the code) includes both FORTRAN and assembler routines. This relatively large I/O proportion reflects the importance attached to the goals of providing maximum simplicity for the user and the facility to precompile-compile-execute all in one run. The I/O section conforms to EXEC2 system standards in accessing system drum storage (PCF) and so in that respect must be considered machine and system dependent. At the price of this dependence there has been achieved a system which operates very fast, with notable simplicity for the user.

The non-I/O half of the precompiler is entirely FORTRAN code. This contains isolated spots of 1108 dependent code (pack, unpack, conversion). The ETPR is FORTRAN plus one assembler routine. The ETPR, about 550 (decimal) core storage locations, is the only portion of DEBUG which occupies core storage simultaneously with the user's program.

The total number of source cards for precompiler and ETPR is about 2300. DEBUG required a total of about 5 man-months of effort. It was done on a sparetime basis spread over a period of about 1 1/2 years.

Timing considerations have not been an appreciable factor for the user in appraising the use of DEBUG. The precompile typically requires 1-2 seconds per routine. Execution time increases on the order of 5-10 percent.

### Source Statement Analyzer

The overall concepts of the precompiler are quite straightforward. The source statement analyzer routine perhaps warrants further comment. This routine performs the function of scanning the source code statement, extracting either certain variables previously specified in a list, or all variables. There are several considerations involved in this:

1. Regardless of the number of references to a variable in a statement, the variable name is wanted only once per statement.
2. For a subscripted variable, we need the complete

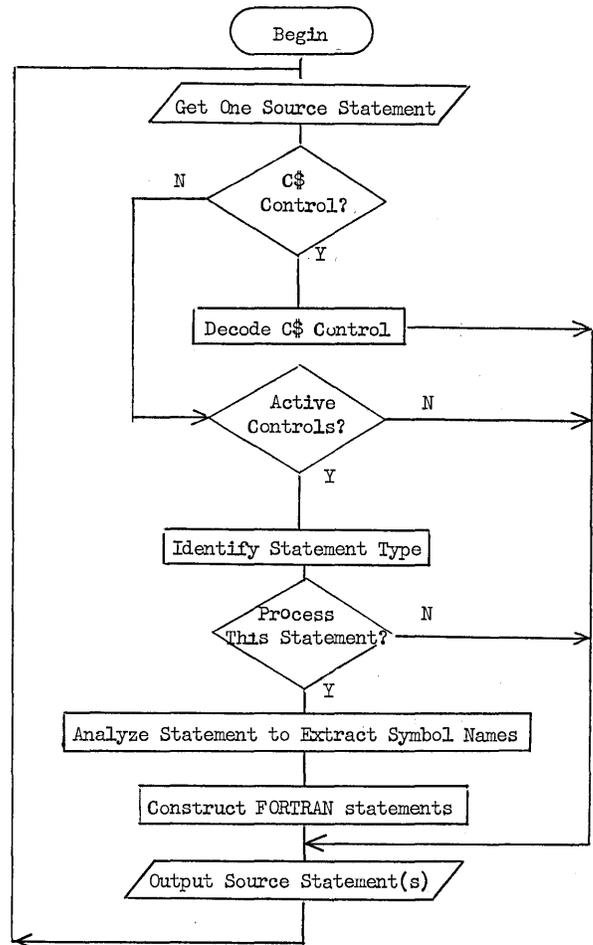


Figure 2 - Precompiler Functional Structure

reference, which is variable name plus complete subscript. Then, we also need any variables in the subscript as separate variable names. Two references to the same variable but with differing subscript values are construed as two separate variable references.

3. When extracting all variables, we may encounter a function reference. This is handled exactly like a subscripted reference, giving the complete reference and then the breakdown of all variable arguments. But this gets nasty: the argument itself may be either a variable with variable subscript expression, or another function reference! The approach finally settled on here was to provide complete generality, for any level of nesting, subject to a reasonable maximum number of characters (18 was chosen as the limit here).

An example: A(B(C(D(X(J))))))  
 X(J) is a subscripted variable reference. A, B, C, D are nested function references. The source statement analyzer would return the following 6 expressions for debugging printing:

A(B(C(D(X(J))))))  
 B(C(D(X(J))))  
 C(D(X(J)))  
 D(X(J))  
 X(J)  
 J

### Usage Experience

Surprisingly, the least popular feature has been the "break-point" print. The TRACE ON option has received good usage, but the favorite has been DEBUG (ALL) with no list. I admit to some trepidation on first making available such a Pandora's box of debugging plenitude. True, there have been instances of abuse, but such fears have been dispelled by the good sense and restraint of most users. On balance, it would seem that the simplicity in use of this control, coupled with the high index of usefulness of results, argue rather strongly that this type of debugging option should be made more widely available.

### Extensions

The FORTRAN code and operational system independence make relatively simple the maintenance of DEBUG and the extension of debugging functions. Of the latter, there are many interesting possibilities. First of all, there are short-cuts. Processing of double precision and complex variables was omitted; Assigned GO TO was omitted from the Trace; printing of arrays on "break-point" print was omitted; these could go in. User comments indicate that edit of DO's to reference an added CONTINUE(2) would be desirable. Capability for reporting entry to and exit from subroutines would not be difficult to add. New combinations of circumstances for requesting debug print are possible, e.g., whenever a listed NEW variable is encountered, print all referenced variables in that statement. Special purpose debugging might also be done on DO, CALL, and I/O statements.

It seems evident that such a higher-level language pre-compiler lends itself readily to adaptation for unique debugging requirements at individual installations.

### Conclusion

Editing of source code to add debugging statements to FORTRAN source programs has been employed to produce an effective debugging tool. The tool is simple to apply and has proven popular in one year of use at a large aerospace concern.

The general method is applicable to any general-purpose language, on any general-purpose computer.

The edit program itself can be done in a higher-level language independently of the computer's operating system.

Thus a debugging tool is made which can rather easily be maintained and extended at the local level. □

### Acknowledgements

S. Smith, UARL, assisted in an early phase of the project. M. Baab and T. Martinetto, both of UARL, coded several assembler routines.

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# VERIFICATION OF SOFTWARE PROGRAMS

*“One approach to verification of software performance is to tentatively accept the program as issued, but require the manufacturer to fix bugs as they happen. Unfortunately, this can lead to a feeling of uneasiness about undiscovered bugs. Not all bugs in payroll programs, for example, are brought to the immediate attention of management by those who are overpaid.”*

*LTC Fletcher J. Buckley  
U.S. Army Computer Systems Command  
Fort Belvoir, Va. 22060*

## Introduction

The unbundling of software is proceeding throughout industry, and more and more software firms are springing up. Each firm is offering a uniquely defined product for which various claims of performance are made. At the same time, the users have become more knowledgeable and more wary of accepting these claims. Accordingly, the verification of the performance claimed for software packages has become a matter of some interest to the customers.

The purpose of this article is to present a generalized method of software verification.

## Approaches

One approach to verification of software performance requirements is personal knowledge. This can be expressed as “I know Joe X Company Z, and therefore, I know they will do a good job”. This approach is finding less and less favor as incidents of software problems increase and consequent slippages of programs occur.

A second approach is to accept tentatively the program as issued, but to require the manufacturer to fix bugs as they happen. Unfortunately, this leads to intermittent

performance on the part of the program as bugs are found, and even more significant, a feeling of uneasiness concerning the effect of undiscovered bugs. Not all bugs in payroll programs, for example, are brought to the immediate attention of management by those who are overpaid.

A third approach is to require compensation from the software manufacturer. From this can come a feeling of satisfaction (the noblest feeling is that of revenge). However, during this time, the payroll has not been met.

## Terminology

In the context of this article, a software specification is a detailed listing of the individual performance requirements of the software program. These performance requirements will normally include such statements as:

- (1) The program will fit in not more than 2,000 words of core storage . . . .
- (2) The program will interface with and use the following supporting software . . . .
- (3) The program will check all files to see if the identified data is present and . . . .

A different approach, and the one projected here, is a Formal Qualification Test.

## Performance Verification

The purpose of a Formal Qualification Test (FQT) of a software program is to verify that each of the individual requirements in the specification has been met. This type of test includes such things as an approved test plan and official witnesses, and is directly contrasted with the "Well, the high speed printer works, let's go to lunch" type.

Formal tests are not new in Government software contracting; see, for example, Searle, L. V., Rosove, P. E., and Sydow, E. H., *Systems Management Applied to Large Computer Programs in BUIC III, Review of Experience*, ESD-TR-69-302 AFLC, USAF, June 1969. They do not appear to be used in civilian practice, however.

## Test Plan Review

Review of the test plan by the customer is critical to the entire process. As a by-product knowing ahead of time of this review, the contractor programmers, realizing their product is going to be tested, may be motivated to examine their own product more rigorously than otherwise. Review of a proposed plan for FQT is in two parts.

## Completeness

First, there should be a check to insure that everything which has been stated in the FQT Plan is clear and complete. At times, it might be found, for example, that the guts of how the test is to be run are stated to be in document Z. Alas, when a call is made for document Z, it is found to be a "to be provided" item, scheduled to be completed at a later date.

In the same way, it is sometimes stated that the FQT will be run under the basic philosophy expressed in document Y. At test time, you may be surprised to find out what this "basic philosophy" really is. The customer should insist that appropriate portions of referenced documents be extracted and attached to the FQT Plan. As a specific example, the procedure used for initialization and check-out of the hardware is required (a normal operator's check or morning start-up routine), and this should be an annex to the FQT Plan.

The FQT Plan should completely define the state of the machine at the start of the test, including the state of all switches, register contents, etc. In addition, the detailed step-by-step actions required to perform the validating actions should be completely specified. The successful running of a test should not, for example, be dependent on the stream-of-consciousness and extemporaneous actions of the programmer whose software is being tested. As his fingers flit across the keyboard, he may indeed sound the Great Amen. However, when the program comes to you, the programmer does not (except at a high price — commonly called "System Support").

## Validity

A detailed check of each individual verification procedure proposed in the FQT Plan is also required. This insures that:

- (1) The test plan contains a verification of every performance requirement. This can be quite effectively checked on a "show me" basis. Pick up

the list of performance requirements, take a random sample, and say "Show me how this is checked". The resulting answer, and the means by which the answer is obtained, can be quite illuminating.

- (2) The successful completion of each verification procedure tested provides a reasonable degree of confidence to the customer that the individual requirement of each performance subparagraph has been met.

## Methodology

To a first degree of abstraction, the software documentation (flow charts, narratives, etc.) is the program. Therefore, detailed examination of the software documentation is a necessary step in the verification process. This places an extremely stringent requirement on proper and timely software documentation; of itself, this is not a bad thing. This implies, however, a second necessary step, that of "tacking down" the software documentation to the actual program. This is done, preferably, by analysis of output data produced by the program in response to specified input data.

## Input Data Requirements

Each program or subprogram has a variety of acceptable and nonacceptable inputs. The preferred method for insuring that every possible input combination could be handled in the prescribed manner (processing, error messages, etc) would be to actually input each combination. In most cases, this is impracticable since the amount of time required for this effort would be excessive. To resolve this, sample data should be entered which provide an adequate degree of confidence that the program will perform as required. To insure that this data is an adequate representation of all inputs:

- (1) The data supplied by the contractor should cover the entire range of the input variables used, including extremes and incorrect inputs.
- (2) Provision should be made by the contractor for entry of input data supplied by the customer. This data would be entered after the contractor had completed all the other actions detailed in the FQT. Entry of the customer-supplied data should not disturb the conduct of the actions described in the FQT Plan.

The extension of the input data to cover all elements, both acceptable and unacceptable, should be done as part of the documentation check.

## Validity of the Output Data

The contractor, in addition to providing output data, should show that the output data results from the correct functioning of the programs.

It is not appropriate for the contractor to provide two large stacks of fan-folded paper and say either: "It is obvious that I have met the contractual requirements," or "Lots of luck in finding anything wrong."

The contractor's burden is two-fold:

- (a) To show that the output data are properly derived from the input data, as tracked through the model of the software program provided by the software documentation.

(Please turn to page 27)

# THE COMPUTER REVOLUTION—AND THE RAILROADS

*“Some think the computer revolution, if not complete, is well underway on U.S. railroads. I don’t. In fact, I think the payroll, accounting, and even the so-called ‘real-time’ computer uses are barely the beginning.”*

*Alan S. Boyd, President  
Illinois Central Railroad  
135 E. 11th Place  
Chicago, Ill. 60605*

In my opinion, universal codes covering the basic data used in transportation will hasten coordination, speed technological modernization, and improve the capacity and quality of transportation available to the public.

Some think the computer revolution, if not complete, is well underway on U.S. railroads. I don’t. In fact, I think the payroll, accounting and even the so-called “real-time” computer uses — such as roads like Illinois Central have — are barely the beginning. The ability of modern computers to hold and retrieve information has gotten so vast that the thoughtful man can get lost in contemplation of possibilities for the future.

## A Quiet Breakthrough

What *will* be the next great breakthrough in use of computers by railroads? The next breakthrough will, I predict, be a quiet one. There will be little fanfare. There will be no great change in the way people and things are moved from one place to another. There will, on the surface, be just a steady downturn in problems of production, capacity, revenues and, perhaps, even a downturn in the intermodal noise levels. There could also be a steady movement toward modal meshing — as a clear social view of public and private investment in transportation capacity emerges.

How will all that happen?

It will come in bits and pieces.

At Illinois Central, we are starting up a profit/loss calculator that should become a powerful aid to those who price railroad service. The calculator should become more potent as codes of the TDCC (Transportation Data Coordinating Committee) achieve universal acceptance. In time, it will improve our ability to quote good, competitive and compensatory rates for anyone, anywhere, wanting to move anything, wherever, by any route.

## Interface Between What Customers Want and What Carriers Want

The TDCC codes, as I mentioned, will help simplify that important work. Universally “readable” data to express the demand curves of major commodities would help us create a useful computerized interface between customers’ wants and carriers’ wants. Perhaps, by then, we might have come to grips with the work of the ages, and established the origin, line haul, interchange and terminating economics of *every* carrier, *every* route, every kind of equipment and time expense that could possibly be incurred by our transportation system. With such numbers matrixed into the cost-curves of major groups of commodities, questions addressed to a computer in the universal language envisioned by TDCC’s codes could ultimately lead us toward rate-making capability now almost unthinkable.

However, I’m not so simple minded as to imagine that costs determine pricing decisions in transportation. Nor am I trying to take jobs away from our friends at the Interstate Commerce Commission. Quite the contrary, maintaining the integrity — and perhaps the basic intelligence — behind such computerized analysis of rate levels, would be even more demanding than the Commission’s present work. But, it might be much more rewarding to our dedicated public servants than the presently cumbersome and inexact constraints imposed by public policy and murky precedents.

Stop and think of what such capability could mean to carriers, shippers and public. Think of what it could mean to the regulatory process and to the ultimate policy decisions that are always in-the-making for private and public investment in transportation.

What are some of the obvious implications?

## The Need for Fewer, More Rational, Rates

For one thing, with such capability at our fingertips, we would quickly reduce the entire rate structure to a shambles — unless we attack our problem in all its important dimensions. We do not need *more* rates. We need *rational*

---

Based on a talk at the Transportation Data Coordinating Committee Seminar, Washington, D.C., October, 1970.

rates . . . and a lot *fewer* rates. I have been told the rate structure consists of more than a trillion rates; it just has to be obvious that billions of rates are never used.

A question that cries for an answer before TDCC gets too far down the road after universal codes is obvious: How do tariffs get written?

I have a copy of the Interstate Commerce Commission Tariff Circular 20, as published in 1928 and revised in 1956.

### The Tariff Makers "Bible"

It is the Bible of the man interested in building a tariff. Tariff Circular 20 was once a couple of hundred pages of good advice. It is now a couple of hundred pages of the only advice available to people who create tariffs. It was written, of course, before computers were ever heard of.

The following is a quote from the section in the Circular that describes the manner in which you make an index:

An alphabetical index of all points from which rates apply, and a separate alphabetical index of all points to which rates apply, together with the names of the states or territories in which located, except that when the rates apply in both directions between all or substantially all of the stations, the points of origin and destination may be shown in one index — provided such index or indexes must contain the item numbers in which rates from or to such points appear, except that when station numbers are arranged in numerical order or when stations are alphabetically arranged in commodity items, and such commodity items are referred to in the commodity index described by Section (C) of this rule, item numbers and page numbers may be omitted from the index of points — further provided that when item numbers are not used the index or indexes must contain the index numbers of the points and the pages on which rates from or to such points will be found, except that when the index numbers are arranged in the rate tables in numerical order the page numbers may be omitted from the index. However, if there be not more than twelve points of origin or twelve points of destination, the name of each, if practicable, may be shown in alphabetical order on the title page of the tariff and the index of such points of origin or destination, as the case may be, may be omitted.

What do you imagine that'll do to your universal codes? If TDCC wants to have codes relevant to the computer opportunities ahead, Tariff Circular 20 should be dragged into the space age by a group with an eye for tariff compatibility with computer storage and retrieval.

A Tariff Circular is for people who need to know how to write a tariff, and the Circular should be geared to produce a tariff that anybody can understand. Above all, it should be compatible with the codes being created by TDCC. If such revision is done well, computerized creation of tariffs would become possible — as standardized codes for all input data needed to construct tariffs (origins, destinations, commodities, weights, units, etc.) become available.

### Eliminating Some of the Trillion Existing Rates

Rather than risk drowning in an attempt to surround the historical trillion-or-so rates that already exist — perhaps

the Interstate Commerce Commission, other involved agencies, and a grateful nation could simply ask the railroads to simplify the task of rate rationalization by simply maintaining a record of all tariffs actually *used to move freight* for three years. Whatever tariff items were actually used could become the railroad tariffs — and all other tariffs could be abolished.

This would *not* be a rational rate structure — but it *would* enable us to get a fix on what the rate structure *is*, and perhaps give us an idea of what it *ought* to be.

Once we know that, the top comes right off the expectations one can legitimately have of the price list. Ultimately, a dynamic, responsive rate system can help to rationally allocate capacity and investment. It can creatively distribute capacity by raising rates for capacity in heavy demand and lowering rates for capacity in plentiful supply. And it can immensely simplify regulation and aid the policy-makers who now simply grope for insight with no guides save that of lobbies, the interests that make themselves heard, and precedent.

### The Implications of a "Responsive" Rate System

Think of the implications. Ultimately, when shipper Alpha wants to move a shipment of commodity Beta from C to D, in a specific kind of equipment and in a specific time period, he may be able to query a regional computer for his *cost* of doing so. The computer might reply with a charge constructed specifically for that commodity moving from C to D under exactly the capacity and time conditions specified by the shipper. Depending upon the sophistication of the programming, he might also get charges for using alternate sets of capacity and time specifications — giving him a range of choices from which to decide.

Some not-so-obvious implications?

Think of what a dynamic, continually adjusted rate system could mean to the regulatory process. As a data pool of current, continually updated data being "fixed" by profit/loss calculators sweeping the system to change numbers so that they reflect current cost levels, general rate increases could become a thing of the past. Shippers could, in fact, be getting charges for their transportation service as sensitive to economic trends as their own price lists — and perhaps even more so.

### Investment Decisions

Public and private investment decisions for transport capacity might not be as difficult in this way as they have been in years gone by. Shipper and public preference, as it showed in response to such computerized choices, would provide very visible evidences of utilization. Investment placement could become very accurate.

There would tend to be less waste and duplication in capacity, and there would be strong incentives for technological progress in directions reflecting clearly visible demands from the public. There would be little argument about disinvestment — when patronage for services declined past a certain point. Also, superficially "irrational" choices being made by shippers would probably signal technological and organizational opportunity in-the-making for railroads with entrepreneurial instincts. Patronage failures, when incurred with accurate, up-to-the-minute, market-fitted prices — would be a clear signal of obsolescence or techno-

logical retardation. Short term, such a condition would be a red alert to management. Longer-term, it would serve as clear warning in investment decisions.

There are other subtleties in such space-age pricing capability for tomorrow's railroads.

### Allocation of Resources

Imagine the consequences from such capability if the railroads can achieve demand-based charges. Such charges are common for barge capacity. The price of barge space is high during periods of top demand, and low when there is little demand. Railroads could use such capability to spread demand away from peaks in demand, and you might see an equilibrium built between available transport capacity and storage facilities at both origin and destination points. Such equilibrium would reflect optimum allocation of resources in the economy.

Imagine the possibilities for refining national transportation policy. The need for rate regulation would, of course, begin to fade as such rational, up-to-date charges were more and more in use. The case for all promotion and regulation activity would, increasingly, be based upon accurate knowledge as to how such moves would affect traffic flows and the shippers, receivers and modes concerned by such change. It would, with such awesome evidence at our fingertips, make it difficult, and maybe impossible, for powerful lobbies, however well-financed, to succeed in stamping out even primitive common sense in national transportation decisions. Logic, the public interest, and our increasing concern with both environment and the economic spending of national resources could, with such capability, become the benchmarks for transportation decisions, high and low, in the seventies.

Such systematic codification of the transportation industry's essential data as the TDCC task forces have undertaken, is the key to all that, with, of course, proper attention given to drastic modernization of Tariff Circular 20 so that computerization can proceed efficiently.

### Prospects for Success

The railroad industry, through an inflow of young and talented marketing people, and through an increasing capability built up over the past decade as the railroads computerized, are beginning to get a grip on some of their cost problems. Mergers are helping. There are fewer and fewer factors that need to be reckoned with. The regulatory authorities, I am glad to say, are more and more alive to and sympathetic with the problems that get built into such anachronistic relationships as we have between one mode and another.

Everyone recognizes the gap that is widening between our need for intermodality and our practical ability to solve the technological, economic and regulatory problems that have to be resolved before any kind of satisfactory fit can be hoped for. Yet, not everyone recognizes that the time is late, indeed, for the sort of salvation we've gotten in time past from the battle of the lobbies, the power of rhetoric, and the influence of strategic interests.

Thus the work of those — like the TDCC — who want to use computers to simplify transportation data is of the utmost importance. The potential savings to shippers, carriers and, ultimately, the public, are enormous. The improvements in service quality are equally great. □

(Continued from page 24)

(b) To show that the output data are properly derived from the input data, as required by the performance requirements.

### Error Analysis

If sample data are used in place of comprehensive data for checking mathematical routines, a preliminary feeling of confidence can be obtained that the program will meet its requirements. To provide a sufficient degree of assurance that all cases of input data can be handled to the accuracy required; i.e., that the program will not "blow up" under certain combinations of data, an error analysis should be provided by the contractor. The subject of error analysis is a large field of endeavor by itself. For a good basic text, see Scarborough, J.B., *Numerical Mathematical Analysis*, John Hopkins Press, sixth edition. For specific applications to computer programming, see Hastings, C., *Approximations for Digital Computers*, Princeton University Press, 1955.

### Associated Considerations

A number of other items bear on the validity of software tests.

The software tests should be reproducible; specifically, the capability must be provided to repeat FQTs with the identical conditions under which the tests were previously performed. To this end, both the program to be tested and the supporting programs used during this test should be under formal configuration control prior to the initiation of test.

In certain cases e.g., verification of a compiler, "the chicken or the egg" situation may arise, where the software which supports the software to be tested, has not been formally verified. In such case, this supporting software, e.g., Operating System and Programming Aids, should be those items which the contractor intends to submit to the customer for verification. They should also be under configuration control.

The hardware units used to support the test of the software should have previously completed their acceptance tests. Untested software should not be accepted on untested hardware under any conditions.

For sale by a vendor of a particular program, it may be unwarranted that repeated tests of a particular program be made. The verification could be accomplished by bringing data forward from other tests. However, to bring data forward from a previous test the following should be done.

- The new customer should receive test plans, test data, and test reports.
- The previous test report should identify the results of the test as satisfying a particular requirement.
- The program be placed under configuration control prior to the test and all changes identified.
- The actual test should be witnessed by an independent test agency. Test results produced by tests conducted and witnessed by contractor personnel only should not be accepted.

### Conclusion

A "Formal Qualification Test" for software should provide a customer with well-founded assurance that the software being provided under contract does, in fact, meet its performance requirements. □

# COMPUTERS IN COMMUNITY SERVICE: Can the Cultural Gap be Bridged?

*"The desire to structure the community culture in ways familiar to the computer culture is a selfish desire that the computer culture must abandon."*

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## A Bridge Between Cultures

If computer services are going to help communities, a functioning bridge has to be built between these two cultures which have little substance in common, despite their occupation of a common territory and their use of what superficially appears to be a common language. The functioning bridge can be built only by computer technicians solving their daily system-design and system-implementation problems while working in the community itself — by technicians *who want enough* to move their technology into the new market to learn its cultural conventions, and then to operate with regard for them.

The community respondent is the key. Systems serving the community come to rest on him eventually, even those which support police security functions or pollution control. The systems must speak to him *in his terms*. The bridge to him is built by the computer technician who gets a datum out of him into a form the computer can handle, or translates a computer output into a practical service for him. The bridge provides help for the community culture and a market for the computer culture.

One market virtually untouched by computers is community service. Head Start, community health clinics (for migrant workers as well as the urban poor), community action programs, model cities programs, legal service for the poor, police and security support services, pollution control

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authorities, etc. — all have jobs to be done which depend on the collection, moving, structuring, correlation, and interpretation of large amounts of data.

Computer systems can do these jobs. Funds for the purchase of these systems are available, and the outlook for further funding is bright.

Community service responds to the needs of a distinct community culture which has existed in this country for a long time, but which only now is gaining recognition. Computer technology is a product of a different culture, the dominant culture, which we shall here call the computer culture. The computer culture does not understand the community culture. This is why both cultures run into problems when computer technicians try to install their systems in the community.

We have to determine the relationship between "helping humanity (the community)" and the thousands of tiny tasks which have to get done for any broad venture to succeed. The tiny tasks are done one by one, without systemic regard for a transcendent goal.

It is as though we had a pail of problems and a pail of solutions, as miscible as oil and water. "Helping humanity" is defined as combining the contents. The man who is concerned with the transcendent goal mixes the two pails, stirs, and hopes for the mixture to take place. He is the philosopher. The functioning catalyst who seizes each molecule one-by-one and forces it to combine with another is the worker-technician. The worker-technician is not oriented towards helping humanity, but the sum of his successful jobs combines the contents of the pails.

This article is addressed to the computer worker-technician who seeks to move his product — his terminal, his software, his computer utilization advice — into the new community domain. The bruises of those who have spent time at the intersection of computer technology and community services are marketable. They help those who follow to learn less painfully how to function here and how

to take what has been learned here as the point of departure for carrying on the work further.

This amounts to an instruction manual. If it supports the transcendent goals of Ralph Nader and the editor of *Computers and Automation*, good! But that is not its prime purpose.

### Requirements of the Computer Technician

There is a hierarchy of requirements laid on the computer technician who plies his trade successfully in the community, whether it be selling or the implementation of computer services.

1. The technician must have superior knowledge of his own discipline, together with an ability to stand on his own two professional feet. (This is the only requirement which does not differ from requirements generally laid on him.)
2. He must recognize that there *are* two cultures, each superimposed on the other geographically, but different from each other functionally and representationally.
3. He must realize that both perception and the language used to express what is perceived are different in each of the two cultures.
4. He must accept the *span* of the other culture's language which extends beyond mere words. It includes intonation, gestures, stance, and dress. It is often a language of attitudes.
5. He must understand the use and meaning of humor in the other culture, and avoid misusing his own humor.
6. He must learn to distinguish each culture's membership, exerting care to address the members of each in ways indigenous to their own culture.

### Superior Technical Knowledge and Self-Reliance

Computer technicians rarely have to stretch their technology to its ultimate in dealing with problems from out of their own culture. They do need to stretch in connecting computer solutions to community problems.

The community culture tends to be analog, drawing from art to life, mixing the apples and oranges of existence without regard to classification. Part of the distance to be travelled by the computer culture in dealing with the community culture is the absence of a sense of the discrete and of the finite in community respondents, and a lack of concern for the rigors of digital disciplines. This is not necessarily undesirable in a life style, but it is an absence which is unacceptable where needed to institute or maintain a technical operation.

It is hard to make up for the absence. The orientation of the computer culture is embedded in its members by the time they are six. In dealing with members of his own culture, even those the least quantitative, the computer technician is dealing with those culturally at least ten years more mature, *in his terms* of course. To speak to members of the community culture in the same terms means bridging a ten-year gap.

### The Acceptance of Forms

To illustrate this, let us assume a problem of a sort common to the computer culture, of collecting (for billing

and medical purposes) the names of a family using the facilities of a clinic.

If the clinic serves a middle-class area, there is no problem. The data collection form may look something like this:

PLEASE WRITE YOUR NAME BELOW

— — — — — (Last Name)  
1 2 3 4 5 6 7 8 9 10

— — — — — (First Name)  
11 12 13 14 15 16 17 18

— (Middle Initial)  
19

PLEASE ENTER ON THE FOLLOWING LINE THE SUM OF THOSE ITEMS WHICH APPLY

— (Status in the Family)  
20

- 1 if you are male;
- 2 if you are female;
- 0 if you are the family head;
- 2 if you are the spouse of the family head;
- 4 if you are a child of the family head;
- 6 if you are a parent of the family head;
- 8 if you are another blood relation; and
- 10 if you are not related by blood.

No part of the above form can be used to collect data from a community respondent.

The hostility of the members of the community culture to any form is high. The hostility towards forms disciplining each stroke of the pencil is very high.

The computer culture associates service with impersonal forms: electric, gas, and water. It accepts time cards, military forms, job-application forms.

The community culture does not.

Much of the hurt the members of the community feel they have received from the established culture has come to them in the shape of impersonal forms: summonses, payment-overdue notices, eviction notices, welfare terminations.

### What's in a Name?

The part of the form in the example above which deals with the name speaks to usage the computer culture assumes normal and all-encompassing, but which is not part of the community culture.

For example, if a man's name is José Figueres Alvarez Gonzalez, his last name is probably not his family name. It is his mother's. To be addressed by it is a slur on a man's *machismo* and ensures his withdrawal from activities associated with the slur. The father's name is probably Alvarez and that is the name a man looks to see himself in.

To handle both the conventions of the community culture and its mechanical divergences from the computer culture, the computer technician must ask more of his programming than he needs ask of it when he deals with people like himself.

To handle the name, it appears worthwhile to give the respondent the freedom of a large unboxed space and his own choice of the style in which to write his name. Thus:

| 18 |

PLEASE WRITE CLEARLY YOUR NAME, IN YOUR USUAL WAY. PUT A DASH (–) JUST BEFORE YOUR FAMILY NAME. PUT A DASH (–) JUST AFTER YOUR FAMILY NAME.

| 19 |

There is no problem in the computer handling either *José Figueres -Alvarez- Gonzalez* or *John Paul -Jones-*. Assembly language, COBOL, and PL/I allow instructions to the computer which say, in effect:

Scan the data stream.

When you come to a |18|, note that what is about to come next, until you reach a |19|, is going to be a name.

Scan the name.

When you come to a dash, note that what is about to come after it, until you reach another dash, is going to be the family name.

That which comes in front of the first dash are elements of the given name. Each element is separated by a space.

That which comes after the second dash, if anything, are elements of the family name.

If any name elements come after the second dash, alert the billing and information systems of the installation to the need for Spanish translations in its mailing to this name.

This is no great task for programming, but it is a technique rarely requested where respondents are disciplined to perform functions as the technicians direct them. It is a task which represents the kind of stretching the technicians operating in community environments must do much more of.

### Family Status

The format requesting an indication of the family status of the respondent irritates many community sensitivities in the same way as other products of the computer culture often do.

Families in the community are not necessarily constituted in the way members of the computer culture think they should be. A family may be any group which lives together. A family from Puerto Rico that lives in East Harlem may be made up of a group from a village back home where the functional relationships are not the same as the blood relationships. The family head may be the twenty-five-year-old son who works and assumes the responsibility for holding the family together. He makes command decisions despite the presence of both his 45-year-old blood father and blood mother who may function more as a dependent aunt and uncle. Youngsters functioning as his children, for whom he accepts parental responsibility, may be unrelated by blood, and may not be the same persons from year to year. Children are freely rotated between the island and the mainland and between parents.

No member of the community culture, be it city-black, Appalachian-white, or Indian, is going to tolerate having to

add up the digital values of entries which apply to his family status!

### Obtaining Useful Responses

The community-member's response to a form he does not like, is to fill it out spuriously, or to dictate spurious answers to the interrogator, in order to get the service represented by the use of the form.

Organizations involved in providing computerized services to a community are advised to employ a "translator" familiar with the community culture being served — migrant worker, Indian, core-city — who reviews the completed forms, making such adjustments as speed their conversion into machine terms.

The desire (or need) to structure the community culture in ways familiar to the computer culture is one of several selfish desires or needs the computer culture must abandon.

The only questions which can be asked in the case of family status are: Whom do you turn to in your family when you need help? What is your sex? What is your age? These must be asked in a way invoking a single response for each possibility, not in the form of complex decision paths confronting the respondent with several choices.

Because of these types of considerations, there is more need for self-reliance on the part of the computer technician operating within the community than there is in his home territory. He follows the rule-books he knows when at home. In the community, the rule-books have not yet been written.

### The Realization of Two Cultures

The hardest concept in the world for a member of a dominant culture to accept in a multi-cultural society is the possibility that his world is not all-encompassing. This must have been a problem for the first several generations of the French-speaking Norman conquerors of England. It must have been a problem for the children of the Latin-speaking overlords of Gaul. It is a problem for the members of the technical class in this country.

We realize there are those we see on the street who are not members of our own group, but we see them as individual outsiders not able to deal with us. We do not see them as insiders of some other group, as good as ours perhaps, or even better, which we are not able to deal with in turn. We rarely see a burden on ourselves to learn to communicate with them. If they want what we have, they will learn to talk with us! Did the Norman learn Anglo-Saxon? Did the Roman learn Celtic? The answer is that the Norman who wanted mutton on his table did learn at least enough Anglo-Saxon to call his mutton "sheep" when in the field. The Roman who wanted his troops safe did learn enough Celtic to ask the native scouts the way back to camp.

The computer technician who wants to move his wares into the community culture will do that culture the courtesy of acknowledging its existence. The community has something the computer culture needs today: it has jobs to be done. It has business for the computer culture.

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Part Two of this article is planned for next month's issue. It will consider the following aspects of the community culture: perception and language, the span of language, humor, and culture membership.

# THE SOCIAL CONTROL OF SCIENCE

*"We do not have, and we do not want, any organized social controls over the active pursuit of basic science, other than the inherent controls which exist in the minds and hearts of the scientific investigators themselves."*

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The subject of the social control of science is, of course, a broad one and a difficult one to discuss. It is hard to find two people who agree on what is meant by social control; in addition, people do not always agree on what is meant by science.

## What Is Science?

I shall arbitrarily assume, for the purposes of this article, that when we speak of science, we are talking about *natural* science — that is, the study of nature. Thus, I shall not discuss the social sciences, but only the physical and life sciences.

But at once we face the critical question: as we speak of science are we referring to the basic sciences themselves — the pure search for knowledge? Or are we talking about the applications of the knowledge we have already gained to the solution of practical problems of whatever kind we may think of — industrial products, military defense, the cure of disease, the growing of more food, the improvement of the comforts of living, or the alleviation of many social ills?

Let me say at once that when I use no qualifying adjectives or phrases, I shall refer to **BASIC** science. But, I shall use the term *science* in both the active and the passive sense. In the passive sense, basic science means the body of knowledge about nature which has been accumulated over the many centuries during which men have sought to probe the secrets of nature. In the active sense, science means the search for new knowledge about nature — new knowledge about the atoms and the stars, about matter and energy, about simple and complex molecules, about living cells and the process of heredity and the mechanism of the brain.

When we speak of science in the passive sense, I assume we must all agree that there is not much we can do about it. The knowledge is there; it exists. Nothing we can do will diminish the storehouse of knowledge which we have

accumulated. All we can do is ask how that storehouse may be enlarged — by pursuing science in the active sense, or how that knowledge is to be put to use — the subject of applied science, which I shall discuss later.

My first thesis is that we do not have, and we do not want, any organized social controls over the active pursuit of basic science — the pursuit of new knowledge — other than the inherent controls which exist in the minds and hearts of the scientific investigators themselves. Scientists must be free to pursue the truth wherever they can hope to find it.

## Inadvertent Controls

There may, of course, be inadvertent controls over the areas which a scientist investigates, because some investigations are more expensive than others, and therefore the necessary funds are harder to find. Most private and public sources of funds have their own special interest and programs, and thus we may easily find that some fields of inquiry are less adequately funded than others. The total supply of money which any nation can make available for scientific purposes is limited, and hence not every one can get all he wants or all that he, with perhaps perfectly good reasons, thinks he needs. The persuasiveness of a particular investigator or group of investigators may, of course, sometimes uncover new sources of funds or succeed in attracting funds from other areas which are at the moment less popular or less glamorous, or are represented by less ardent advocates.

But all of this is inherent in the nature of things in any society whether it be democratic or autocratic. These are the inadvertent controls over the pursuit of knowledge which, however they may affect individual cases, are not going to go away. I know of no one who has proposed a way for getting unlimited funds for scientific research — or who has discovered how to find a single person or invent a single agency which is so wise that it can distribute limited funds in a way that is right in the minds of everyone. It is, however, a lot easier to get adequate funds for more kinds of research in this country today than it was when I was a post-doctoral fellow forty years ago.

The point is that no federal, state, or local agency, public or private, nor any combination of such agencies in the United States, is now trying to suppress or prevent the

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Dr. DuBridge was formerly the president of the California Institute of Technology, having served in that office from 1946 to 1969.

## THE PROFESSION OF INFORMATION ENGINEER AND HIS BRIDGES TO SOCIETY

*Computers and Automation* believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for:

- The reliability and social significance of pertinent input data;
- The social value of the output results.

In the same way, a bridge engineer takes a professional responsibility for the reliability and significance of the data he uses, and the safety and efficiency of the bridge he builds, for human beings to risk their lives on.

Accordingly, this department of *Computers and Automation* will publish from time to time articles and other information related to socially useful input and output of data systems in a broad sense. To this end we shall seek to publish here what is unsettling, disturbing, critical — but productive of thought and an improved and safer "house" for all humanity, an earth in which our children and later generations may have a future, instead of facing extinction.

The professional information engineer needs to relate his engineering to the most important and most serious problems in the world today: war, nuclear weapons, pollution, the population explosion, and many more.

valid pursuit of scientific knowledge in any field. Quite the contrary, there are many agencies, public and private, which are actively seeking out scientists with good ideas whom they can support within the limits of the funds available to them. And taking all these agencies together, there is support available for essentially any field of basic science.

On that basis, I will repeat my thesis: We do not want and we do not have any social controls over the pursuit of basic knowledge. We do not desire special controls over how a man thinks or what he seeks to learn. All we want is more money!

### What Is Social Control?

But if we agree that there CAN be no social control over the knowledge which already exists, and we do not want social controls over the pursuit of new knowledge, then what do we mean by the social control of science? Do we mean the control of applied science by the government — federal, state or local? Do we mean control by society at large, through the powerful force of a pervasive public opinion? Do we mean control by the scientists themselves by choosing, in accord with their own consciences or interests, the field of applied science in which they choose to work? Do we mean that the scientists who uncover new knowledge about the physical world shall somehow be organized in such a way as to dictate how that knowledge shall be used? (If we mean this, how do we bring in people like Newton, Galileo, Lavoisier, Darwin, Maxwell, Bohr, Einstein and all the rest who are no longer with us?) In short, what kind of social controls over applied science do we want, what kind do we have, and what is the purpose of social control?

Whether we like it or not, social controls over applied science do exist and will always exist. The nature and direction of these controls will vary from one nation to another, even from one year to the next, and from one subject to another. But they are there — in a variety of forms and with a variety of objectives. The question is are they the right forms and do they aim at the right objectives?

Before we can answer this we must examine just what these controls now are, how they operate, where they succeed and where they fail. Let us enumerate some of the ways in which what we might call social controls now operate.

### Control Exerted by the Individual

First, of course, there is the control exerted by the individual — acting either alone or in concert with his colleagues, through formal or informal organizations or associations, large or small. When individuals in some numbers, independently or together, decide they will or will not work in a certain field of applied science, this will result in a certain degree of control over progress in that field.

This can, of course, if widespread, be a very important source of control. In recent years, for example, large numbers of able college students have elected NOT to seek degrees in engineering. Thus, enrollments in this area have levelled off or even declined. Applied science as a whole is therefore not progressing as rapidly as it would had there been an increase in engineering degrees. Some areas such as civil engineering have been affected more than others, such as electronics.

No scientist or engineer can possibly be forced to work or study in any field of pure or applied science (or in science at all) if he does not so choose. No scientist or engineer can be forced to accept a job in a brewery, a tobacco company, in a pharmaceutical company, in a space laboratory, in a military laboratory, or in the laboratory of any company or agency which is engaged in any kind of work of which he disapproves or for which he has no taste. By the same token, no one has the right, of course, to prevent any other individual from accepting or continuing a position in any legally constituted laboratory of *his* choice.

The success of a company, a government agency, or an educational institution in recruiting talented people for any area of applied science in which it is interested will, of course, determine the rate of progress of their work — may even determine whether such work can be pursued or not. Here, then, is a social control of very potent possibilities,

depending in a perfectly democratic way on the voluntary choices and/or the persuasive efforts of many individuals.

People being what they are, we cannot of course expect that such voluntary action by individuals or groups will very often bring to a complete halt any specific area of applied science — for other individuals or groups may think this endeavor very worthwhile or important or attractive and will enter into it with enthusiasm and effectiveness.

When an individual argues therefore for additional social controls over applied science, he is not advocating something which will force him to do what he does not choose to do, but he is seeking to interfere with the free choice of others.

But there are, of course, other social controls more potent than these kinds of action by individuals or informal groups.

### **Control by Universities**

The second agency of control is the universities which can fund, or fail to fund, depending on their resources and objectives, specific applied science projects. Many institutions are now funding research and development in urban affairs, food, population, health, the technology of developing countries, aeronautics, communications, space technology, and hundreds of other specific areas. Each such institution is seeking to apply our knowledge of science to areas which it deems appropriate, desirable or important to the general welfare. Collectively such institutions have great influence on the directions which applied science is taking or may take. If universities as a group do not pursue applied research in a particular field, the progress in that field will be hampered.

Lack of talent or of funds may impede progress in some areas and emphasis may then turn to other areas where such shortages are less serious. But funding levels available may depend on conditions outside the control of a particular institution. A private university may find donors willing to fund some specific areas, but find no one to fund other specific areas. State universities must depend on actions by legislatures. Both public and private institutions will depend on federal funds in certain fields — but will again fail to secure them in others. However, universities plus their non-governmental funding sources do constitute a control and set a direction for applied research.

### **Control by Commercial Companies**

\* Commercial companies carry on a large segment of our applied science activities. Leaving aside for the moment that portion which is supported through federal sources, companies have powerful incentives to pursue engineering and development work in areas which will improve their productive efficiency or result in new or improved products for the consumer. Out of industrial research there has emerged in the 20th century, and especially in the last 20 years, an amazing array of products which have enormous appeal, desirability and usefulness to millions of people in this country and throughout the world.

### **Control by the Market Place**

Here we find the great example of social control in a democratic society — the control of the market place. No one is forced to purchase a product which he does not like or which he thinks is harmful to himself, his family, or his

community. And many an industrial company has found that a huge investment in research and development on some consumer product has come to naught because consumers in large numbers do not buy the product.

The control by the market place can be a very powerful one, and is one that can be altered markedly through the action of individuals and voluntary or government organizations. Consumer organizations can encourage people to buy one product and discourage the purchase of others. Massive advertising campaigns can have pervasive market influences, positive or negative. We are witnessing right now a two-sided campaign for and against the smoking of cigarettes. The market effect of this is still uncertain — but in the end it may be very great indeed.

However, there are those who believe that though the control of the market place is great and, for the most part, constructive, it is not enough. People insist on buying things that are not good for them, or buying things that are useless or things that may harm others. But the market place is there, and it is very powerful. Our task is to find ways to use it and guide it into even more constructive channels. Public information campaigns, government regulations to enforce truth in advertising, consumer organizations which test products and disseminate their findings — these and other mechanisms in which we as individuals can participate and which we can encourage may greatly influence the use of scientific knowledge in the field of consumer products.

### **Control by Government**

But we turn now to a major mechanism of social control of science which most of us think of first when we discuss this subject — control by government — federal, state or local. Yet before coming to this subject, I did want to emphasize the importance of all these other non-governmental controls which are in use and which are available to us.

Governmental agencies may exert control over applied science in several ways: 1) by the regulations which they adopt and enforce on the advertising and/or the use of products which are judged to be harmful or dangerous or which have adverse environmental or other effects; 2) by the way in which funds are allocated for the pursuit of research and development aimed at specific end-products; and 3) by the things which government agencies build or buy, or seek to buy, be they military weapons, airplanes, highways, dams, power stations or any of the hundreds of products or facilities which government agencies believe are needed to promote the public welfare or to satisfy a public requirement — some of which, of course, are not happily received by some segments of the public.

It would, of course, take a very large book to describe and evaluate all of the actions of government which influence the way in which scientific knowledge is put to use. *In toto* they constitute an enormously powerful and pervasive social control over applied science. And this control can, in the long run, be expanded, contracted or altered in whatever ways the public, through its elected representatives, may demand.

### **How Should Social Controls Be Used?**

The problem, therefore, is not so much how to invent social controls, as it is how we shall use more effectively

and constructively the ones that we already have. The mechanism for social control is already present. The question is: What do we want these controls to achieve that they are not now achieving?

It is not difficult to set forth in a general way the goals we all seek to achieve in the use of scientific knowledge. In the negative sense, we all wish to prevent or discourage applications of science which are harmful to individuals or to groups of individuals, or which despoil our environment, or which unnecessarily waste our precious natural resources, or impede our progress toward social welfare and justice and toward world peace.

On the positive side we wish to encourage and support those applications of science which enhance the welfare of people, which make our country and the world a better place in which to live, which will improve the quality of life in our cities and in rural areas, which will reduce the dangers of wars between nations.



### An Example: Air Pollution

All this is easy to say and very hard to accomplish. For example, we all wish to reduce air pollution. One way to do this (in part) would be to prohibit the use of any vehicle which burns gasoline or to prohibit the sale of gasoline itself. (That would cure the smog problem in Los Angeles, for example.) We might also prohibit the operation of any industrial facility which discharges contaminating products into the atmosphere. But such sledgehammer methods are clearly undesirable and unworkable. A better way is to encourage research aimed at the development of better technology for reducing such pollution. And then when better technology is available, to encourage or require its utilization. This is indeed being done — though the pace of advance may seem slow. More funds are needed for the support of research in pollution technology and for environmental technology in general. New knowledge and new technologies are needed as well as better regulation and management, using existing technologies.

This is but one example in which a primary role of government should be a positive and not solely a negative one — where government should not retard but should advance the progress in applied science in a variety of ways which will contribute to social progress. Science, throughout the ages, has on the whole been put to enormous beneficial uses — and even greater opportunities lie ahead. Positive measures to enhance our opportunities to capitalize on our knowledge and on our talents can pay great dividends. An important role of government is to remove barriers and to speed progress in many fruitful areas.

American universities can assist in this endeavor. They can invent innovative ways for organizing interdisciplinary programs for bringing our knowledge and our talents in science and social science to bear on the problems of our society. I hope that private and local funds can be found for these enterprises, since Federal funding is bound to be slow and cumbersome and often inhibiting when wholly new and radical approaches are being studied.

### Control of the Science of Military Weapons

Now let us approach the real issue which is usually in mind when we talk about the social control of science — namely, how do we prevent scientific knowledge being used for producing lethal military weapons or other devices

which will be either purposely or inadvertently harmful to large numbers of human beings?

I left this subject to the end because I first wanted to emphasize the positive social mechanisms which we have which can be used to put scientific knowledge to work for beneficial purposes.

What, then, about military weapons?

First, I must express my conviction that during World War I and World War II, the scientists and engineers of this nation did a tremendous service to their country and to the free world by bringing their knowledge and talents to bear so effectively to help the Allied Nations survive and to win those two horrible conflicts. Without the help of scientists and engineers, the results might have been tragically different.

Everyone in this nation and in the free world would have been most happy if, after the conclusion of World War II, it would have been possible to establish a world of peace, friendship and confidence among nations so that all our military weapons could have been buried for all time to come. Unhappily this did not happen. The United States offered to give up nuclear weapons and other weapons of mass destruction provided other nations would do likewise. This offer was not accepted. The long and difficult and frustrating efforts to reach such agreements are all painfully familiar to many of us. We failed — and an era of tragic danger has ensued. And in an era of danger every great and free nation must attend to its defenses. No nation has ever insured peace for itself and its friends solely by failing to be prepared to defend itself and its allies from a military attack, when unfriendly nations were clearly building their own military machines. Sorrowfully and reluctantly, therefore, the U.S. has devoted great efforts and large resources to building a military force adequate to deter or to defeat an aggressive attack against us.

### The Responsibilities of Scientists for Defense Systems

There are, of course, those who think we have overdone this job, and others who think we have not done enough. Still others think we might have proceeded more effectively or more economically or with a better balance among our various defense weapon systems. These matters are, however, beside the point for our present purposes. The question is: If a defense system of some kind is necessary, is it not appropriate for scientists and engineers, if they wish, to participate in the endeavor to make the system as effective and economical as possible? Whether we like our present system or not, or whether or not we object to certain aspects of it, I can assure you it would all have been much worse if talented scientists and engineers had not participated energetically and effectively in developing newer and better equipment and techniques and advised the military services how such new equipment could best be used. If we had allowed military research and development to come to a halt after World War II or if we allow it to come to a halt now we would now or soon be in very grave danger indeed. A weak or disarmed America would be an invitation to the destruction of the free world. This will continue to be the case until firm disarmament agreements are reached which we all hope will be soon.

The question, in my opinion (and this has been my opinion for the past 20 years, not just since I came into Government) is not whether we need the help of scientific and engineering knowledge and talent to insure the defense

of our country, but how shall that talent be used to give us the most effective and economical defense system possible.

### Responsibilities of Universities

I agree with those who say that it is not appropriate for secret military research to be carried on within university campuses. Not many universities do this now, and I would urge others to phase out any classified weapons research which they are doing. There are other laboratories where such work can be done.

I do not agree with those who say that universities should not accept any research support from the Department of Defense. Many agencies within DOD have for many years been supporting in a fine and intelligent way, excellent basic research projects in physics, chemistry, astronomy, mathematics, aeronautics and other fields without any visible relationship to weapons work and without any restriction on full publication of the results. This is fine, and I hope such research support will continue. Under present circumstances we need every nickel of help we can get for basic university research — of the sort that the university itself thinks it appropriate and educationally valuable to carry on.

### Civilian Advisors and Employees for DOD

I also believe it quite appropriate for university professors to voluntarily advise the government on its problems of defense technology. A most wholesome influence on the military establishment can be and is being exerted by independent advisory bodies.

Civilian scientists and engineers can also fruitfully serve as full time civilian employees in the defense establishment for long or short periods. Many scientists and engineers have found such work exciting and valuable — though, of course, no one needs to participate in any of these ways if he does not so wish.

Have we then lost social control of science when we use scientific knowledge to help in the defense of the nation?

Certainly not! A powerful mechanism of social control is the Federal Government. We look to it to encourage and support beneficial applications of science. We also look to it to insure that our country is reasonably safe from military attack. The government would be remiss if it did not bring to this task all the knowledge and talent that we can muster. If we do not maintain a free society, we will have no free science and no free opportunity to develop and use its beneficial applications.

Today about two billion dollars a year of federal funds are going to the support of basic university science. About seven billion dollars of federal money and several billion dollars of private money is going into non-military applied science. These sums are of an order of magnitude greater effort than any nation has ever spent on the extension of knowledge and its beneficial applications. We hope these sums can soon become even larger. If you wish to insure this, write to your Congressmen and ask them to support in full the budget requests of such agencies as the National Science Foundation, the National Endowment for the Arts and Humanities, the National Institutes of Health, and the research budgets of HUD, Interior, Agriculture and similar departments.

That is a kind of social control which we should all welcome. □

## 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 712

```

The  F E D
    x H O U N D
      H H U N
      T D D D
      F R N N
      D F U H
      R R D O
    = R N N H F T T N      67571  29630
  
```

#### Solution to Numble 711

In Numble 711 in the January issue, the digits 0 through 9 are represented by letters as follows:

0 = 0	N = 5
Y = 1	S, U, V = 6
R = 2	G, T = 7
A = 3	E = 8
M = 4	C = 9

The message is: Many can argue, not many converse.

Our thanks to the following individuals for submitting their solutions — to **Numble 7012**: A. Sanford Brown, Dallas, Texas; Gordon and Debbie Bruno, Cliffside Park, N. J.; T. P. Finn, Indianapolis, Ind.; Frank Komorowski, Philadelphia, Pa.; Robert R. Weden, Edina, Minn.; and Brian C. Whitaker, San Diego, Calif. — to **Numble 7011**: Edward A. Bruno, North Bergen, N. J.; G. P. Petersen, St. Petersburg, Fla.; Vince Roach, New York, N. Y.; and D. F. Stevens, Berkeley, Calif. — to **Numble 708**: SSG Raymond L. Cowen, Gunter AFB, Ala.

# THE CASE OF CLARK SQUIRE: COMPUTER PROGRAMMER, BLACK PANTHER, PRISONER — INTERIM REPORT

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## Note

For prior discussion of this case, see:

The Life and Times of Clark Squire: Computer Programmer, Black Panther, Prisoner	Joe Hanlon
— article in C&A, November, 1970, p. 36	
Responsible Journalism	Edmund C. Berkeley
— editorial in C&A, November, 1970, p. 7	
"Responsible Journalism" -- Comment	Clark Squire
— in Forum in C&A, January, 1971, p. 8	

## 1. ACTION BY THE COUNCIL OF THE ACM: ANNOUNCEMENT

George Capsis  
Association for Computing Machinery  
1133 Ave. of the Americas  
New York, N. Y. 10036

In response to a plea to help raise bail for imprisoned computer programmer Clark Squire, the Council of the Association for Computing Machinery, on December 3, 1970, agreed that while individual members might respond, ACM action was outside of its constitutional purposes.

The Council further urged members of the Association as individuals to familiarize themselves with the facts in this case and to take whatever action they regard as appropriate.

The request for aid came from "Computer People for Peace" during ACM's September conference in New York.

In an effort to give the Council information on which to make a judgement, Council member Herbert Grosch had requested of President Walter Carlson the formation of a fact-finding committee.

The chairman of that committee, Dr. Kenneth King, delivered his report on December 3 to the Council.

The 40-page report (including appendices) was based on interviews with: former employers of Squire; the District Attorney's offices of Bronx and New York County; the American Civil Liberties Union; the attorney for the defendant; representatives of the CPP; attorneys for ACM; and a written interview with Clark Squire obtained during the trial in New York.

The report is available at ACM Headquarters in New York City.

## 2. REPORT OF THE ACM AD HOC COMMITTEE - INTRODUCTION

Kenneth M. King  
c/o ACM

In brief, this Committee was invoked as a result of the following circumstances. At ACM 70, a group of ACM members and non-members identifying themselves as members of "Computer People for Peace", distributed a flier calling on attendees to aid them in raising bail for a computer programmer named Clark Squire (included as Appendix I is a copy of the flier). At a press conference at ACM 70, Mr. Edward Elkind, an ACM member and member of CPP, issued a statement on Clark Squire (a rough transcript of this statement is included as Appendix II). At a public town hall meeting at ACM 70, members of CPP issued a plea for funds to be used for bail for Clark Squire and passed a basket through the audience soliciting contributions. Subsequently, a member of the Council expressed the view that ACM had an obligation to determine whether or not "Clark Squire in fact existed" and I was asked by Walter Carlson to head an ad hoc committee to answer the question and to report at the next ACM Council meeting.

With the help of Professor Monroe Newborn of Columbia University and Gordon Smith and George Capsis of the ACM staff, the following information has been elicited.

Clark Squire "in fact exists" and is presently on trial with 20 other defendants in New York City on a variety of charges. The defendants have been collectively referred to in the press as the "Panther 21". A copy of the indictment handed down by a New York County Grand Jury which includes the charges against Clark Squire and 21 other defendants is included as Appendix III. (One of the defendants in this indictment, Fred Richardson, had his bail reduced to \$25,000 and has subsequently disappeared according to Assistant DA Weinstein). Clark Squire has been in jail since April 2, 1969. His bail has been set at \$50,000 and he has been unable as of this date to raise that amount. Attorneys representing a variety of organizations, including the American Civil Liberties Union, have attempted to get bail reduced and, according to Assistant DA Weinstein, have appeared before 42 judges, all of whom have refused to reduce bail. Appeals have been carried unsuccessfully all the way to the Supreme Court. Included as Appendix IV is a copy of a brief filed with the U.S. Supreme Court on behalf of Clark Squire and 13 other defendants in this case requesting a reduction of bail. (This brief was supplied by Barbara Shack of the New York Civil Liberties Union.)

George Capsis and Gordon Smith were asked by me to contact the attorneys prosecuting Clark Squire to obtain whatever information they could about Clark Squire. Since the case was about to go to trial, these attorneys stated they were unable to divulge any details not already made public. Mr. Weinstein, an Assistant District Attorney, stated that the following was recorded on Squire's police record:

1. 8/9/65 - Arrested for drug violation - convicted.

2. 5/3/66 - Queens County - arrested for possession of drugs and a gun - convicted - placed on probation - probation to expire on 11/6/69.
3. 1/18/69 - Arrested for possession of drugs.
4. 2/6/69 - Arrested for attempted robbery, possession of weapon and reckless endangerment - charges still pending.
5. 4/2/69 - Arrested on charges including conspiracy, attempted murder, and arson - trial commenced 10/19/70.

Clark Squire is presently represented by Attorney Charles T. McKinney of 401 Broadway, New York City. A search of ACM records by Irene Hollister reveals that Clark Squire has apparently never been a member of ACM.

Monroe Newborn was asked by me: to attempt to obtain biographical data on Clark Squire; to obtain from Clark Squire, his attorney, or friends, Clark Squire's version of the events leading to his present indictment; to obtain from Computer People for Peace a statement of what they think ACM should do about this case; and what their plans were with respect to any bail money raised; and to develop any other information he could elicit on the character of Clark Squire. His report follows:

## 3. REPORT OF THE ACM AD HOC COMMITTEE - CONTINUED

Monroe Newborn  
c/o ACM

### Preface

The following information was gathered in one week of effort.

While there are still several points that could use greater elaboration, I believe it presents a reasonable picture of Clark Squire as gathered by (1) communicating with him via his attorney (see Appendix V), (2) talking with his Attorney, Charles McKinney, (3) talking with one of his former employers, George Langnas, (4) observing the trial in person on the day of November 10, 1970, (5) receiving background information from the CPP (Computer People for Peace).

Perhaps three points should have been investigated in greater detail. (1) To my understanding, (based on the CPP), his present employer is willing to have him return to his job when he becomes free. I would have liked to confirm this by direct communication with his employer but was unable to contact his employer. (2) I would like to have had a better explanation of his narcotics background. From all that I can gather, he never used hard drugs. (3) I would have liked to have had knowledge of several other similar court cases so that I could have, in fact, confirmed the charge that bail was extremely high. In discussions with the CPP, it was discussed that in some cases where bombings had actually occurred, bail was much less.

The material is presented by me in as unbiased a manner as possible. The activities of the last week have been quite rewarding. The witnessing of the trial was an action that I would encourage others to take.

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The Association for Computing Machinery, a professional society of more than 26,000 computer specialists, is dedicated to advancing the science and art of computer usage. Through its publications, educational programs, chapters, and committee activities, ACM promotes and provides for the dissemination of technical and non-technical computing information to its members and the public.

**Brief Resume of Clark Squire**  
(source: Squire and CPP)

Age: 33

Born: Decatur, Texas

College: At 15 (or maybe 16) went to Prairie View A&M College of Texas (affiliated with Texas A&M). Graduated at age of 19 (1956). Slightly above average student (in his own words). Degree in math.

**Work Record:**

According to Squire, he worked for NASA in California, November 1956-November '57. Had "Secret Clearance" then and for subsequent work at Rome Air Dev. Center at Griffus AFB, Rome, N.Y. Had clearance until age of 26.

Subsequently employed by Comp. App. Inc. 1964-66. Then Real Time Systems, Inc. (1966-68), then Computer Decisions Inc. (now called Computer Deductions, Inc.) until now (about 2-1/2 months).

According to Squire, his salary while at CAI was about \$14,000. At time of arrest, was making about \$17,000.

Former employer at CAI, George Langnas, stated that Squire was "very competent, personable, highly regarded, dependable, worked long hours. No problems with the law or drugs." He also stated salary figure of \$14,000.

Work was described by Squire as in the area of "systems analysis, systems design, proposal writing and estimations, programming and project leader."

**Activities in the Black Panther Party**  
(as indicated by Squire)

He was "active in community control, school programs, hospitals, made and distributed survey forms asking Black community what were their important problems and suggestions for solutions, also breakfast for children's program."

He was also "finance officer - keep financial records and money transactions. Attend political education classes, sell papers, assist in laying out community programs, attend meetings with other organizations, and general party work."

His attorney, Charles McKinney, stated that Squire was a member of the BPP for less than 4 or 5 months.

**Arrest Record**

According to the information gathered by George Copsis, Squire was arrested four times, twice on narcotics charges (1965, 1966) and twice in 1969.

Narcotics charges: In discussions with Squire's attorney and former employer, both stated that they knew of no hard drug use by Squire.

Squire stated in response to a badly asked question that "the narcotics involved in my '66 arrest were a few leaves of marijuana scraped from my jacket pocket following a strip-down search at JFK airport upon returning from overseas. The narcotics charge was subsequently dropped."

The following statement appeared in a letter to members and friends from the CPP Squire Committee. "He was arrested in January 1969 because a car he had rented was being driven by another defendant, Miss Joan Bird, at the time of her arrest, Miss Bird was accused of shooting at the police in an incident on the Harlem River Drive in New York City. Squire was arrested for complicity. Two weeks later, charges in this case were dropped for lack of evidence; and Squire was rearrested in the courtroom for armed robbery of a subway change booth in the Bronx. This robbery was alleged to have occurred three months earlier and was totally unrelated to the initial charge." This case is still pending.

The present arrest for conspiracy occurred on April 2, 1969. (A copy of the indictment is included as Appendix III). It appears that his name is mentioned explicitly in regard to:

1. Possessing a 38 caliber Smith and Weston [sic] revolver and a 308 automatic rifle;
2. Possessing a bomb;
3. Being Lieutenant for Finance in New York City.

He appears implicated by his involvement in the party, to be charged with other crimes and the conspiracy to commit other crimes.

**What the CPP Would Like the ACM  
To Do About Clark Squire**  
(as obtained from the CPP Squire Committee)

CPP feels ACM should become involved in the Clark Squire case because ACM has responsibility for the well-being of members of the profession. In this case, a member in good standing of the profession is having his constitutional rights violated.

**In particular:**

1. An individual is assumed to be innocent until proven guilty, and further,
2. One is entitled to a speedy trial.

In this case, Squire has been deprived of his freedom for 18 months and in violation of both points (1) and (2).

3. His bail is extremely excessive (\$50,000) and far out of line for a person with Squire's background. His bail effectively guarantees that he will remain in jail — which is not the purpose of bail. Other individuals in political groups have actually bombed buildings and received less bail. (Jane Alpert bombed a building in New York City and received \$20,000 bail).

4. While in prison, his rights have also been violated. Most importantly, he has effectively been denied the opportunity to prepare his case. His visitors are limited to his own relatives and lawyers. Reporters cannot visit him. His treatment in prison has been unreasonably cruel.

Thus, CPP is asking that the ACM endorse the collection of bail money for Clark Squire and send out a mailing to its members to collect bail money for the CPP.

**What Happens to the Money that is  
Collected by the CPP?**

(as stated by Joan Dublin and Ed Elkind  
of the CPP Squire Committee)

Several possibilities exist in this regard.

If the money is not used for bail — (1): All the money whose source can be identified will be returned. Money not identified would be used in the future for bail in other cases deemed appropriate by the CPP. (2): The National Committee to Defend the Panthers (853 Broadway, NYC) and CPP would discuss mutually how to use the money most effectively.

If the money is used for bail and returned, then option (1) above would be followed.

If the money is used for bail and not returned, the contributors would not receive their money back.

**4. REPORT OF THE ACM AD HOC COMMITTEE —  
CONCLUSION**

Kenneth M. King  
c/o ACM

The Clark Squire case raises, in my view, a number of issues, the most important of which is what kind of an issue is it, and does the ACM constitution permit us as an organization to deal with it.

Legal counsel for the ACM has provided us with the following comment: "Any activity on the part of ACM in this issue other than the humanitarian effort to determine (a) that he has a good lawyer and (b) that institutions such as the American Civil Liberties Union are aware of the circumstances, represents ACM taking sides in a controversy completely unrelated to its purposes."

From a legal standpoint, when ACM goes outside the legal terms of its Charter, it is "ultra vires", which means it is going "beyond its powers".

Our legal counsel therefore indicates that neither ACM, its President, nor the Council has the right to intervene in this action without a change in the Constitution and Charter.

If the issue is regarded as a deeply political and social question, a recent ACM referendum would be relevant. In response to the question "Shall the Constitution of the ACM be revised to permit Association comment or action on deeply political and social questions?", the ballot count was 2,059 yes and 7,938 no. (See Appendix VI)

Joan Dublin of CPP has stated that in her view, the issue is whether or not ACM should permit the violation of the civil rights of a member of our profession in good standing.

It is my hope that this report will be useful to the members of the Council.

**5. REPORT OF THE ACM AD HOC COMMITTEE —  
APPENDICES — LIST**

Following are the six appendices to the report:

- 1) Resume of Clark Squire (1 page)
- 2) Transcript of a statement made by a representative of the Computer People for Peace at the ACM '70 Conference (2 pages)

- 3) Grand Jury indictment of 22 Persons including Clark Squire (22 pages)
- 4) Petition to the United States Supreme Court for Relief for 13 persons including Clark Squire — Additional Supplemental Memorandum re writ of certari in the matter of granting Reasonable Bail (6 pages)
- 5) Questions directed to Clark Squire by Monroe Newborn, and his Answers (2 pages)
- 6) Reprint (1 page) from the "Communications of the ACM", July, 1969, reporting the result of a ballot of members on:  
Shall the Constitution of the ACM be revised to permit Association comment or action on deeply political or social questions?

These appendices are available on request from the ACM, 1133 Ave. of the Americas, New York, N.Y. 10036, so long as the supply lasts.

**6. \$50,000 BAIL FOR CLARK SQUIRE RAISED;  
THEN JUDGE DECLARES BAIL IS \$100,000;  
THEN JUDGE DECLARES "NO BAIL"  
FOR NINE DEFENDANTS STILL IN JAIL**

Computer People for Peace  
The Dolphin Center  
137A West 14 St.  
New York, N.Y. 10011

After four months of hard work, the CPP Squire Committee succeeded in raising \$50,000 bail for Clark Squire, programmer and Panther 21 co-defendant. However, on December 28, 1970, Judge Murtagh claimed that Clark's bail was \$100,000 despite the fact that in May, 1969 Judge Shapiro had lowered Clark's bail to \$50,000.

Judge Murtagh then stated "whatever his bail was, it does not matter, it's now NO BAIL."

According to the New York Times on December 29:

Justice Murtagh said that because of "information in the possession of the court" relating "not only to the defendant Squire but relating to all the defendants present", he was revoking bail "for the remainder of the trial" for the defendants who were in jail. The seven held in lieu of bail have been in jail since April 2, 1969, following indictment of all 13 on charges of conspiring to bomb public places and murder policemen and possession of dangerous weapons and explosives.

A trial is supposed to be an integral part of the democratic process.

- But how can we have democratic process when excessive bail is set? (Defendants in jail cannot gather evidence nor find witnesses.)
- What is the meaning of democratic process when even after the money for bail is raised, the bail is revoked? People are told to play by the rules and when they do the rules are changed.
- How is democratic process served when bail is used as leverage against defense counsel? (Judge Murtagh stated that he would entertain motions for bail reduction only if the defendants and their lawyers "improve their behavior.")

## 7. THE QUALITY OF JUDGE MURTAGH AS A JUDGE

Edmund C. Berkeley  
Editor, Computers and Automation

The Bill of Rights in the Constitution of the United States contains:

### Article VI: Right to Speedy Trial, Witnesses, etc.:

In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the State and district wherein the crime shall have been committed, which districts shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining witnesses in his favor; and to have the assistance of counsel for his defense.

### Article VIII: Excessive Bail or Fines and Cruel Punishment Prohibited:

Excessive bail shall not be required nor excessive fines imposed nor cruel and unusual punishments inflicted.

It is clear that the behavior of Judge Murtagh and the actions of the associated court system in New York County are in violation of the Constitution of the United States — as well as in violation of elementary principles of fair play.

i) Judge Murtagh has set excessive bail, two and then four times the amount of \$25,000 set in similar cases, when there were white defendants who had actually exploded bombs. (The grand jury indictment of the Panthers arrested in New York on April 2, 1969, contains no charge that the arrested Panthers had actually exploded any bombs.) This violates Article VIII.

ii) Judge Murtagh (according to the New York Times account) has "information in the possession of the court" which he is not disclosing, which is therefore secret, and therefore cannot be challenged as to truth or falsehood, and therefore may be false. This violates Article VI, that the accused shall know "the nature and cause" of the accusation.

iii) On the basis of this secret information, after several months of trial with bail established, as soon as it appears as if one of the defendants (computer programmer Clark Squire) has raised the bail of \$50,000, then Judge Murtagh doubles the amount of bail to \$100,000 — and promptly thereafter declares "no bail" for any of the defendants not already out on bail. Such action is contrary to the elementary rules of fair play, and Article VIII.

iv) For almost a year and a half these defendants have been in New York County jails before being brought to trial. This is far from the "speedy trial" guaranteed by the U.S. Constitution, and violates Article VI.

v) The entire reason for any trial is to test the validity of an accusation. Many accusations are untrue, for many sorts of reasons. In the United States a man who is accused is legally innocent (and entitled to be free on bail) until proved guilty. It is not true that an accused person is legally guilty (and to be imprisoned) until proved innocent.

The behavior of Judge Murtagh would be appropriate for a Nazi judge in Hitler's Germany in the 1930's — not for an American judge in the United States.

Such behavior is calculated to infuriate oppressed members of society in the United States — especially since such behavior is never used towards business men, or wealthy people, or even members of the American middle classes.

It is as if Judge Murtagh had been hired by a group of persons desiring to overturn the constitutional American system of justice, by means of the policy: "Oppress them, infuriate them play the tyrant, and when their tolerance breaks and they become violent, shoot them or imprison them in the name of 'law and order', and then say on television to the people of the United States, 'You see, we told you these persons were dangerous and violent and good for nothing.'"

The behavior of Judge Murtagh is a disgrace to the Constitution of the United States, and to the traditional English and American system of even-handed justice begun with Magna Carta in 1216.

If computer programmer Clark Squire and the other Panthers being tried in New York County are legally and fairly determined to be guilty of any crimes, then they should be sentenced and punished according to established law. But it is wrong to punish them (or anybody) by extra-legal and unconstitutional actions of any kind. And no respect for the United States or admiration for the United States can be fostered by tyrannical actions or "frame-ups" — of any kind.

## 8. ADDRESSING RELEVANT SOCIAL PROBLEMS IN "COMPUTERS AND AUTOMATION"

Michael B. Griswold  
4437 Brighton Ave.  
San Diego, Calif. 92107

This is just a note of encouragement for your position of addressing relevant social problems in your technical publication.

The case of Mr. Squire is only a recent example of an exemplary policy. In this instance you are doing for the computer industry what sports journalism should have done for Cassius Clay and boxing.

Technical achievement is meaningless without corresponding social accomplishment.

As an increasingly vital segment of our community, computer professionals should be concerned less with the quality of systems and concerned more with the quality of life. That responsible technical literature espouses such an ideal is indeed gratifying. Thank you.

## 9. RIDICULOUS LACK OF OBJECTIVITY

E. C. Witt  
7933 Berkshire Blvd.  
Powell, Tenn. 37849

The editorial and article pertaining to Clark Squire in your November issue are so lacking in objectivity as to border on the ridiculous. His personal success story (prior to his becoming active in a revolutionary organization) refutes his own charge that a black man can't expect a decent break in our society. Any society would react violently against a group which thinks shooting policemen and bombing buildings are justified and equivalent responses to exploitation, poverty, ignorance and disease. Both

Mr. Squire and you are confusing "political activity" with revolutionary activity, which is prohibited even in a democracy.

It was reasonable for the police to conclude that Clark Squire either was in his auto when they were fired upon from it, or that he at least conspired with those who were. The circumstantial evidence was extremely strong, even though the case was later officially dismissed for insufficient evidence. Last year there were over 80 uniformed officers assassinated from ambush, mostly in black neighborhoods. Many of these men were never the object of criticism for racism, indeed some were themselves black. They were simply murdered because they symbolized the establishment. Any prime suspect in such a crime should be considered (and handled as) armed and dangerous.

A robbery charge is not necessarily absurd just because the accused makes a good living. A well-to-do youth recently charged with robbery in a large city explained that his act was required for admission into a neighborhood gang. As for the charge that '\$50,000 bail is outrageous . . .', Black Panthers, Weathermen, and other such radicals have a way of disappearing after release on bond, only to show up later in some Communist country. Bail is intended to guarantee appearance; the comparison with that of the Minutemen indicates only that theirs was too low, not that Squire's is too high.

You define responsible journalism as "important, factual, useful", and yet in the same editorial admit that you'll publish anything if the author signs his name and "stands back of what he's saying", whatever that means. Thus you're caught in your own web of confusion. Hanlon's general irresponsibility is typified by such things as his comment on page 37 that "(damage was minor and there were no injuries)" in two bombings attributed to the Panthers — as though this made the act trivial!

Clark Squire diagnosed his own problem — he became schizoid.

I close with one simple question — which would you prefer to have roaming about your society with guns and explosives, FBI agents or Black Panthers?

## 10. RESPONSE

Edmund C. Berkeley  
Editor, Computers and Automation

What I like about Mr. Witt's letter is the clarity, vigor, and degree of logic with which he expresses his views, and the almost complete absence of name-calling and other unfair propaganda devices (two exceptions are "web of confusion" which is name-calling, and "which would you prefer . . .", which is the false dilemma.

Furthermore, I do not know if Clark Squire and other Black Panthers engaged in plotting bombings in or around New York City. They might have, and they may be dangerous men. I am not in favor of such violence any more than I am in favor of the violent shooting of Vietnamese civilians (old people, women, children, and babies) that took place at My Lai — or the violence of chemical defoliating of 20% of South Vietnam, which is wicked.

But the treatment the arrested Panthers are receiving is not fair and not just and not constitutional. If a man has jumped bail and become a fugitive from the law, then it makes sense to hold him when caught again without further bail. If he has not become a fugitive from a justice, but someone "thinks" he will be — that is not sufficient according to the Constitution of the United States to deny him bail. Finally, when the set bail of \$50,000 has been offered to the judge, for the judge to raise the bail to \$100,000, that is wrong and wicked.

To reply to Mr. Witt's last question in a brief and preliminary way, I prefer that nobody whatever "roam around my society with guns and explosives". In London, England, I understand no policemen are armed; from my own experience I know they are courteous, friendly yet firm, towards everyone; and I believe they are held in high esteem by almost everybody including the underworld, who are said to have an unwritten understanding that they will never shoot a policeman. Let us hope that someday New York will become that civilized.

There is much more to be said about Mr. Witt's points. I challenge his assumptions and more besides — but that will have to be gone into at some other time.

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The following are copied from the engraved mottoes at the entrance to the building at 100 Centre St., Borough of Manhattan, New York, N.Y., which holds the Supreme Court of New York State (On the 13th floor of this building the trial of the 21 Panthers is taking place.)

IMPARTIALITY IS THE LIFE OF JUSTICE, AS  
JUSTICE IS OF GOOD GOVERNMENT.

THE ONLY TRUE PRINCIPLE OF HUMANITY IS  
JUSTICE.

JUSTICE IS DENIED TO NO ONE.

On Monday, January 18, I stood in line for two hours in the corridor on the 13th floor waiting behind wooden barricades for admission into the courtroom as a member of the public. Then at 10:45 am. court was adjourned for two days, because the assistant District Attorney prosecuting had no witnesses to be heard. And the line in the corridor of some twenty people standing (or sitting on the floor), waiting to go into the courtroom, went away.

I did not see the interaction between the attorneys and the judge from 10:30 to 10:45 while the adjournment decision was being reached — nor even the inside of the courtroom. And even a subway provides some seats on the platform for those waiting for trains.

There are many ways of indicating to the "lower classes": "we provide one kind of consideration to some people and another kind of consideration to others."

## THE GOLDEN TRUMPET

This department of Computers and Automation is devoted to providing a "golden trumpet" for any computer people (and probably some other people) who wish to argue and perhaps shout their views — and who thus collide with other people's opposing views. In this way we can give a voice to some of the parts of public opinion. However, name-calling and other logically fallacious arguments will be drastically edited or cut before publication.

Most of the emphasis here will be on topics related to computers and society.

The reason for the phrase "golden trumpet" will be clear from the following parable by Mike Gold written more than thirty years ago.

### THE GOLDEN TRUMPETS OF YAP YAP

The famous explorer, Dr. Emery Hornsnagle, in his recent book, Strange Customs of the People of Yap Yap, makes some interesting observations on the practice of free speech among the inhabitants of that little-known island.

While being entertained in the palace of Iggy Bumbum (High Chief), the Slobob of Yap Yap, Dr. Hornsnagle asked the ruler whether free expression of public sentiment was allowed by the law.

"Yes, indeed," replied the Slobob. "The people of our island have absolute freedom of speech, and the government is conducted in exact conformity to public opinion."

"Just how does that work?" asked Dr. Hornsnagle. "By what method are you able to tell what public opinion thinks about the various matters that come up?"

"That is very simple," explained the Slobob. "Whenever any policy has to be decided, we assemble the entire population in the large courtyard of the palace. The High Priest then reads from a scroll to inform them of the business at hand. When that is finished, I determine the will of my people by listening to the Golden Trumpets."

"And what are the golden trumpets?" asked Hornsnagle.

"Golden Trumpets," said the Slobob, "are the only means by which public opinion may be expressed. I raise my right hand above my head and call out: 'All those in favor blow.' Instantly, all those in favor of the proposed action blow upon golden trumpets. Then I raise my left hand and call out: 'All those opposed, blow.' This time the opposition blows golden trumpets. The side making the loudest noise is naturally the majority and the issue is decided in their favor."

"That," said Dr. Hornsnagle, "is to my mind the most complete democracy I have ever heard of. I would like very much to witness one of these ex-

pressions of public opinion and take some photographs."

On the next afternoon, Dr. Hornsnagle had the opportunity he desired. The people of the whole island were assembled in the palace courtyard to decide an important issue. They numbered about three thousand and were all quite naked except for loin cloths. However, just before the ceremony was about to begin, four richly clothed gentlemen were carried in on bejeweled litters. Glittering with priceless gems and reeking with perfume, they were deposited at the very front of the crowd, where they squatted on silken pillows and were fanned with peacock feathers by attendants.

"Who are they?" asked Hornsnagle.

"They," replied the Slobob, "are the richest men on the island."

Immediately after the arrival of the wealthy class, the High Priest read off his scroll. Then the Slobob stepped forward and raised his right hand.

"All those in favor, blow," he shouted.

The four wealthy citizens all lifted golden trumpets and blew lustily.

The Slobob now lifted his left hand. "All those opposed, blow," he shouted. Not a sound came from the giant assemblage. "It is so decided," announced the Slobob, and the affair was over.

Later on, Dr. Hornsnagle asked the Slobob why the four wealthy citizens were the only ones who blew trumpets.

"They are the only ones who can afford to own Golden Trumpets," explained the Slobob. "The rest are only poor working people."

"That doesn't seem very much like free speech to me," remarked Hornsnagle. "All it amounts to is a group of rich men blowing their own horns. In America we have real public expression."

"Is that so?" exclaimed the Slobob. "And how do you do it in America?"

"In America," said Hornsnagle, "instead of having Golden Trumpets, we have newspapers, magazines and radio broadcasting stations."

"That is very interesting," said the Slobob. "But who owns these newspapers, magazines and broadcasting stations?"

"The rich men," replied Hornsnagle.

"Then it is the same as Yap Yap," said the Slobob. "It is the rich men blowing their own horns that make all the noise."

— From "Dangerous Thoughts", pp. 26-27, by Mike Quin, published by "The People's World", San Francisco, Calif., 1940, soft-bound, 102 pp.

## FEAR

I. From "Anonymous"  
Brooklyn, N.Y.

I regret having to write anonymously, but as programming manager of a staid, well-known, corporate giant, I feel I must. If not, my comments could prove embarrassing to my company by association.

I believe Dick Sprague's articles have no place in your magazine. There was a connection in the first article which appealed for computer time and programming to try to prove a thesis. The later articles, including the one in your December issue, have no relations to computers at all.

As they say in Brooklyn ... "enough, already."

## II. From the Editor

The above request from "Anonymous", as he calls himself, needs a reply, although regularly we pay no attention to unsigned letters. The reason is that he brings up the important subject of FEAR within an organization, fear of being out of line, fear of being found reading something "radical" by one's supervisors and colleagues, etc. This fear is then rationalized into arguing that "Computers and Automation" being a computer magazine should not cover the prospective applications of computers to the difficult problem of solving important political assassinations, etc.

I know that fear. I have felt that fear myself. I remember once working in the home office of a large life insurance company. There I was completely sure that a number of unpleasant things would happen to me if I seriously stepped out of line, such as joining a union. I would not be fired, no. I would not be totally ostracized, no. But I would lose all my chances of promotion, PERMANENTLY. In addition to the label which I bore, "Ed Berkeley always goes off on tangents", I would have another label, and this label would mean essentially: does not play the game according to the rules; rebellious; undependable; pink; leftist; not a good organization man; not reliable; and the like. I am sure that the same kind of fear exists in the majority of large American business organizations, because the same causes operate.

But that fear is wrong, and is un-American. Discrimination against anybody on account of race, color of skin, creed, nationality, sex, age, or similar irrelevant factors is wrong also. The fact of its existence must be adjusted to from time to time, sad to say -- but not at the expense of morally agreeing with it as desirable and appropriate.

In regard to prospective applications (as yet unimplemented) of computers in sensitive areas such as political assassinations, I wish to make two comments.

One is the comment expressed by Dr. E. S. Savas, Deputy City Administrator, of the City of New York [see the October, 1970 issue, page 7]:

"I sense that talented professionals in the computer field are beginning to realize ... that their systems-oriented way of thinking can ... be applied successfully to larger problems -- even to important problems in which information need not be sanctified by traversing the innards of an electronic computer prior to its useful employment."

The other comment is that not so very long ago all the applications of computers that were talked about in magazines were prospective and unrealized.

In the early 1950's in the computer field, it was often said that the computers worked only Thursday afternoons when the moon was full. And almost all the articles being published about applications of computers that people had boldly planned, but had not yet happened.

## POLITICAL BLURP SHEET

I. From William E. Thibodeau  
Sarnia, Ontario, Canada

The evolution of Computers and Automation is quite evident. It has gone from "an ordinary magazine" (May, 1970 editorial) to a political blurb sheet! It appears to start this trend in July, 1969, and not "since 1957" (November, 1970, editorial) with "The Social Impact of Information Systems". Since July, 1969, Multi-Access Forum and far too many articles and editorials, devoted to politics, are taking up space in a magazine that used to be of value to computer professionals.

I feel that the November, 1970 issue finally proves that C&A no longer pretends to be a computer-oriented magazine. That issue included: "Confidential and Secret Documents of the Warren Commission Deposited in the U.S. Archives"; "Patterns of Political Assassinations"; "The Life and Times of Clark Squire"; and "Responsible Journalism."

On your postcard insert you state: "Change ... Who? Us? No, not for the sake of change ... but we do strive to improve."

My query is: Towards what are you striving?

## II. From the Editor

First, I would like to correct the timing that Mr. Thibodeau refers to. "Computers and Automation" ceased being a "respectable", computer-oriented trade journal in 1957. In February, 1958, we published an editorial which should have borne the title, "Is There no Horror Point?", and which read substantially as shown in the adjacent exhibit.

Ever since that time "Computers and Automation" has been devoting some space quite often to the subject of: the social responsibilities of computer people; the implications of computers for society; and the social aspects of the profession of "information engineer". Our circulation now is more than three times our circulation then.

Second, we believe that it makes good editorial sense to devote a large portion of our magazine rather pertinently and strictly to the computer field, and a small portion to peripheral matters, especially those of great importance outside of the computer field.

Finally, anybody who does not wish to read something that is published in our magazine may skip it; of course there may be other readers who would like to read it, and so we should retain that information. In our editorial opinion there are a significant number of readers who are interested in "off-beat" subjects. In fact, in a ballot held by the Association for Computing Machinery not long ago, about one fifth (2,059) of those voting (9,997) thought the ACM should comment or act on "deeply political and social questions".

## IS THERE NO HORROR POINT?

Edmund C. Berkeley  
(Editor, Computers and Automation)

(Reprinted, with some condensing, from "Computers and Automation", February, 1958)

One of the papers recently submitted to "Computers and Automation" to consider for publication was entitled something like "Diffusion Calculations on the [trade name] Electronic Computer". It came from a writer at the U.S. Army Chemical Corps, and referred to a "chemical munition, which is designed to disseminate an agent in the form of a gaseous or aerosol cloud which will travel near the surface of the earth." The phrase "poison gas" was avoided, but that is the concept which leapt into your editor's mind.

This paper reminded me of some of the problems which the Nazis put into arithmetic books for young German boys to study in the days when Hitler was developing the Nazi state. One problem that I remember asked a youngster to calculate how many bombs would be required to destroy a circular town, given that one bomb would destroy such and such an area, and given the diameter of the town.

I can well imagine that if automatic electronic digital computers had been available in Nazi Germany, they would have been applied to computations such as finding out how much nerve gas would be economically necessary to kill stated numbers and distributions of Jews in the concentration camps of Buchenwald, Dachau, Maidanek. ... (The Nazis in fact put to death over 6 million Jews, unarmed and captive.)

There are weapons which can be used for defense and not for offense, like a radar-warning network. There are weapons which can be used for defense and offense both, like a fighter air-

craft. And there are weapons that can be used for offense only, like poison gas and biological warfare, such as the spreading of a mortal disease that only one combatant has an antitoxin for ... Incidentally, successful biological warfare is probably more scientifically efficient than any kind of atomic bomb because it selects human beings and puts them to death, leaving enemy property intact and the air and earth uncontaminated by any radioactivity ...

To look back in history, there are other weapons used for offense only, and especially against captives: torture, starvation, operations to change the character or virility of a prisoner, the torture of the prisoner's wife and children in front of him ...

All these fields are open to science, the scientific method of experiment and investigation, the solving of intricate problems by automatic computing machinery.

But is there no horror point?

Is there no point at which a self-respecting human being should say "I cannot do this -- I cannot study this, investigate this, publish this, ... I cannot have anything to do with this, this is horrible"?

President Eisenhower on January 10, 1958, in his State of the Union Message to Congress, said, "In the last analysis there is only one solution to the grim problems that lie ahead. The world must stop the present plunge towards more and more destructive weapons and war, and turn the corner that will put our steps firmly on the path towards lasting peace."

In agreement with that view, we trust it will be a very long time, if ever, before "Computers and Automation" publishes articles dealing with "diffusion calculations" on the spreading of poison gas.

## CONSUMER INFORMATION SYSTEM, COMPUTERIZED, RALPH NADER STYLE

To the Editor from  
T. D. C. Kuch  
7554 Spring Lake Drive  
Bethesda, MD 20034

Ralph Nader's Public Interest Research Group has given me your name as one of those who responded to his call at ACM70 for volunteers to aid in the use of computers for the consumer.

The scope of the work to be done is very great.

The initial task is to conduct a feasibility study on a computerized Consumer Information System of retail goods and services.

Basically, we should provide recommendations to the P.I.R.G. on what can be done at what cost. Can a small, expandible system be implemented, or would it become useful only if it were done on a large scale initially? How should it be designed? These are some of the questions that immediately come to mind. We should focus on technical feasibility first, financial feasibility (cost/effectiveness)

second. Although legal questions will enter into any discussions of this sort, they should be, as much as possible, left to the attorneys on the P.I.R.G. staff.

Following is some material which may help you get started, in the form of quotations from letters and articles.

Although most of us are members of ACM, I would like to emphasize that we are doing this as individuals, and no presentation to the P.I.R.G., to Congress, etc., will imply that any opinion is the opinion of ACM or of any of our various employers.

The initial membership of this volunteer group is 32 persons, who volunteered at ACM70. There is room for perhaps 50 or 60 more volunteers before it will become unwieldy. If any reader of Computers and Automation is interested, would he please write to me?

Since you may not know me, I should introduce myself: I am a supervisory computer specialist with the National Cancer Institute, have been an ACM member since 1962, am a member of ACM SIGCAS, a senior member and local officer of ACPA, and a

sometime contributor to Datamation, Computers and Automation, and other computer publications. Our group contains some of the best-known names in the field of computers and data processing, and I am looking forward to working with each of you. If we apply our expertise energetically, we can be of great service to our country, and to our profession.

Supplement:

A Consumer Information System: Material for Study

1. From Ralph Nader, "Computers and the Consumer" in Computers and Automation, October 1970 (adapted from the keynote address to ACM70):

"The first subject that interests me is the use of the computer in the consumer area; its use fits in beautifully with classical economic theory.

"The basic theory of the free market system -- which of course doesn't exist any more in the world, much less in this country -- is buyer knowledge. Without buyer knowledge the free market mechanism feeding back preferences and dispreferences to the producer or seller, is impossible.

"Moreover the quality of competition that increases in excellence rather than decreases toward trivia, shoddiness, and camouflage must rest, again, on buyer knowledge about various competing products and services. That is the only way the market mechanism can aggregate the rational choices of consumers in such a way as to reward the superior products and services, and penalize the shoddy products or fraudulent services.

"We need the kind of feedback which is based on the disclosure of product and service information ....

"The consumer and the computer should be a major concern of somebody in the society. At the present time the capability for gathering and providing information about products and services for consumer use is as primitive as the Gutenberg printing press. It has not gone any further."

2. From a letter from Ralph Nader to T.D.C. Kuch, November 18, 1970:

"There are areas in which computers could render great benefits to the consumer; for individuals, maintaining ready access to medical records and accident reports; for specific products, providing comprehensive data on test results, accident reports, consumer complaints, useful life, safety and similar factual information necessary for a rational choice in the marketplace. A highly developed consumer information service, utilizing computers, could offset the fantasyland of media advertising with much-needed information....

"What is needed for the present is for you to give us your pertinent ideas, materials and recommended priorities for utilization of computers as a tool to serve the consumer. You who understand computer technology and who see the directions in which it is headed must devise systems for the consumer. The question is whether the data bank will remain the tool of the corporation or whether it will become an information resource for the benefit of the public to use."

3. From a letter from Christian S. White (Public Interest Research Group) to T.D.C. Kuch, December 8, 1970:

"One area in which computers can be of great value to the consumer is in providing a service comparable to credit reporting for consumers with questions about specific businesses. Storage and retrieval of complaints, accident and injury reports, and similar data by store, manufacturer, and product model are some uses which come to mind. Are the elements necessary to such a system in existence? Is the cost of such a system in the range of feasibility? Obviously this will be a massive undertaking. As you can see, much expertise is needed for this project. I look forward to hearing any proposals that you have."

4. From Computerworld, December 9, 1970, article "Consumers Get a Data Bank":

"MADISON, Wis.--Wisconsin has set up a data bank to analyze consumer complaints. The attorney general...said the programs were developed to show how initial sales contracts were made, the industries involved, and the nature of the practices that gave substance to the complaints....

"The state's Bureau of Systems and Data Processing's IBM 360/50 runs the program for the bank.... The data bank, the state said, will enable authorities to pinpoint trouble sources by industry, location, and type of offense with the vendors guilty of unfair practices categorized and located more easily."

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## "The House is on Fire"

In the computer field, there are basically two kinds of attitudes about the applications of computers and data processing—information handling—to the solving of problems.

On the one hand there is the attitude:

Computers are tools like matches—and we are just mechanics. We take the data as given (the kindling). Our responsibility is the processing—swift, economical, correct (making a fire with matches). The answers belong to our employer (he uses the fire as he sees fit). The group who holds this attitude—let's call it Group I—takes the data and the problem as given—given by the corporation or the government, the employer or the client, who has the problem.

This group works on payrolls, etc.—and on the targeting of nuclear missiles and on calculations of the dissemination of nerve gases. And they work on the latter with the same "I'm just doing my job" attitude that they work on the former. In Nazi Germany Group I would have worked "under orders" on the design of ovens for efficient mass incineration of thousands of corpses from the gas chambers. (The Nazis put to death in concentration camps over 11 million Jews, Russians, Poles, Czechs, French, etc., in pursuit of the "final solution".) If you read "Treblinka" by Jean-Francois Steiner (Simon & Schuster, New York, 1967) you find out how one Nazi scientist graded corpses from fat to thin so the fires would burn better.

On the other hand there is the attitude:

Computers are tools like bridges—and we are professional engineers. We take the data as given (the materials and the site) but we check the data independently. Our responsibility is not only processing—swift, economical, correct (building a bridge with girders)—but also worthwhile answers (bridges that work). The bridges we build must carry people, and we don't want them to crash.

The group who holds this attitude—let's call it Group II—works on payrolls, etc.—but they will refuse to work on calculations for the dissemination of nerve gases, or on calculations for targeting of nuclear weapons, or on calculations for the design of crematoria for thousands of human corpses. They see a responsibility greater than that to their government or employer—they see a primary responsibility to their fellowman.

A recent vote of members of the Association for Computing Machinery indicated that the proportion of Group I to Group II is about two to one. In other words, two-thirds of the computer people who replied to the survey on the "questions of importance", voted that the ACM should not "take a stand on deeply political questions."

The attitude of Group I is a characteristically conservative attitude: "The world is going along pretty well"—"Let us not rock the boat"—"The existing system should be tolerated"—"Things will eventually work out all right"—"Professional people have their major allegiance to the persons who pay them"—"A computer professional has no social responsibility different from that of the nonprofessional man". . . .

The attitude of Group II is a characteristically liberal attitude: "The world can be a much better place than it is now"—"It is important to try to improve the world"—"Such a vast number of sad and evil things happen in the

world that everybody must do something significant to help prevent them"—"The fact that thousands of human beings have been killed by both sides in the Viet Nam conflict requires people everywhere to seek withdrawal of foreign armed forces from that unhappy civil war."

Scientifically it is easy to show that the attitude of Group I will lead to the destruction and extinction of the human race, just as the dinosaurs became extinct. Scientifically it is not possible to show that the attitude of Group II will lead to the survival of human beings on the earth: it is only possible to show that the attitude of Group II offers human beings some hope of survival in the increasingly more difficult environment on earth, the "house" for all of us.

For "the house is on fire": the earth as an environment for human beings has changed enormously in the last 25 years and is deteriorating fairly rapidly. Before 1945, the factor of sufficient distance from a danger could almost always save human beings alive. Now, distance is not enough. Now, because of interlocking planet-wide systems of consequences, the environment of the earth is no longer safe for human beings. For example:

Large-scale nuclear war (and its radioactivity) between two countries in the Northern hemisphere can kill all the inhabitants of that hemisphere. International anarchy allows this to break out at the choice of one government.

The explosive increase in the number of human beings alive—the so-called population explosion—seriously threatens the power of the earth to support them. Worldwide anarchy allows any man and woman to bear children unrestrictedly.

Pollution of the air, the water, and the land by man's activities is becoming world-wide. Again, international anarchy allows this to happen everywhere. Etc.

"The house is on fire". So it is necessary for all persons living in the "house" to take some time away from their play rooms, their work rooms, and their bedrooms, their computer rooms, their laboratories, and their ivory towers—and to try to help put out the fire. The fire is licking at the edges of the roof and the walls and the floors—and time is pressing and will not wait.

Accordingly, **Computers and Automation** with this issue is starting a department in the magazine which for the present will bear the subtitle "The House is on Fire" and the title "The Profession of Information Engineer." Here we plan to publish information from time to time which will help focus the attention of computer professionals in the direction of becoming information engineers, "bridge" engineers,—not mechanics, not artisans. For we are, first of all, human beings with professional training, and secondly, we are computer professionals. We need to shed light on major urgent problems of the earth today. These are the great problems which cause our children to be "a generation in search of a future," to use the phrase of Professor George Wald, Nobel prizewinner in biochemistry. These are the great problems which raise the great question:

Will there be any future at all for our children?

Edmund C. Berkeley  
Editor

# CALENDAR OF COMING EVENTS

- Feb. 17-19, 1971: Sixth Annual Conference on Use of Digital Computers in Process Control**, Louisiana State Univ., Baton Rouge, La. / contact: Dr. Cecil L. Smith, Dept. of Chemical Engineering, Louisiana State Univ., Baton Rouge, La. 70803
- Feb. 18-19, 1971: 31st Management Conference of the Association of Data Processing Service Organization (ADAPSO)**, Mountain Shadows Hotel, Phoenix, Ariz. / contact: ADAPSO, 551 Fifth Ave., New York, N.Y. 10017
- Feb. 22-24, 1971: DPI's 1971 Data Processing Conference and Trade Show**, Skyline Hotel, Ottawa, Ontario, Canada / contact: Revett Eldred, Conference 71 Publicity, Data Processing Inst., Box 2458, Postal Station D, Ottawa 4, Ontario, Canada
- Feb. 22-24, 1971: San Diego Biomedical Symposium — 1971**, Ramada Inn, Harbor Island, San Diego, Calif. / contact: Richard D. Yoder, M.D., Univ. of California, San Diego, University Hospital of San Diego County, 225 West Dickinson St., San Diego, Calif. 92103
- Mar. 1-3, 1971: Data Processing Supplies Association, Spring Membership Meeting**, The Doral Hotel & Country Club, Miami, Fla. / contact: Data Processing Supplies Association, 1116 Summer St., Stamford, Conn. 06905
- Mar. 1-3, 1971: First International Symposium on Fault-Tolerant Computing**, Huntington-Sheraton Hotel, Pasadena, Calif. / contact: Dr. Francis P. Mathur, Sec'y, IEEE Technical Comm. on Fault-Tolerant Computing, Jet Propulsion Laboratory, Calif. Institute of Tech., 4800 Oak Grove Dr., Pasadena, Calif. 91103
- Mar. 9-13, 1971: INEL 71, the 5th International Exhibition of Industrial Electronics**, Basel, Switzerland / contact: Sekretariat INEL 71, CH-4000, Basel 21, Switzerland
- March 10, 1971: Fourth Annual Symposium on Automatic Data Processing** (sponsored by Federal Executive Board of Federal ADP Council of New England), Sheraton-Boston Hotel, Prudential Center, Boston, Mass. / contact: Thomas T. Donovan, Air Force Computer Operations Div. (MCCO), L. G. Hanscom Field, Bedford, Mass. 01730
- March 17-18, 1971: Spring Conference of The Association for Systems Management**, Royal York Hotel, Toronto, Ontario, Canada / contact: Donald T. Laughton, Chmn., Special Conference, North American Life Assurance Co., 105 Adelaide St. West, Toronto 1, Ontario, Canada
- Mar. 22-24, 1971: Ninth Annual Symposium on Biomathematics and Computer Science in the Life Sciences**, Univ. of Texas Graduate School of Biomedical Sciences / contact: Office of the Dean, Univ. of Texas Graduate School of Biomedical Sciences at Houston, Div. of Continuing Education, P.O. Box 20367, Houston, Tex. 77025
- Mar. 22-24, 1971: Numerical Control Society's Eighth Annual Meeting and Technical Conference**, Disneyland Hotel, Anaheim, Calif. / contact: William H. White, Numerical Control Society, 44 Nassau St., Princeton, N. J. 08540
- Mar. 22-25, 1971: IEEE International Convention & Exhibition**, Coliseum & N.Y. Hilton, New York, N.Y. / contact: IEEE Headquarters, 345 E. 47th St., New York, N.Y. 10017
- Mar. 23-26, 1971: Third National Meeting of the Information Industry Assoc.**, Host Farm Resort, Lancaster, Pa. / contact: Paul G. Zurkowski, IIA Washington, 1025 Fifteenth St., N.W., Washington, D.C. 20005
- Mar. 29-Apr. 2, 1971: Datafair '71 Conference**, Nottingham Univ., Nottingham, England / contact: Datafair '71 Conference Office, The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England
- Apr. 1-2, 1971: ACM Symposium on Information Storage and Retrieval**, Univ. of Maryland, College Park, Md. / contact: Dr. Jack Minker, Computer Science Center, Univ. of Maryland, College Park, Md. 20742
- Apr. 5-8, 1971: The First National Educational Technology Conference**, American Hotel, New York, N.Y. / contact: Conference Manager, Educational Technology, Englewood Cliffs, N.J. 07632
- Apr. 13-16, 1971: Ninth Annual Convention of the Association for Educational Data Systems**, Royal York Hotel, Toronto, Ontario, Canada / contact: AEDS Convention, P.O. Box 426, Don Mills, Ontario, Canada
- 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 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: 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 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 Rijswijklaan 58, B-2000 Antwerp, Belgium
- June 1-4, 1971: Seventh Annual Data Processing and Automation Conference**, National Rural Electric Cooperative Assoc., Marriott Motor 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 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. 3-6, 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
- Aug. 16-19, 1971: International Symposium on the Theory of Machines and Computations**, Technion — Israel Institute of Technology, Haifa, Israel / contact: Sheldon B. Akers, Secretary, IEEE Technical Comm. on Switching and Automata Theory, General Electric Co., Bldg. 3, Room 226, Electronics Park, Syracuse, N.Y. 13201

# REPORT OF THE NATIONAL COMMITTEE TO INVESTIGATE ASSASSINATIONS

Bernard Fensterwald,  
James Lesar, and  
Robert Smith  
CTIA

Note: Following are a number of excerpts from "The CTIA News", January 1971 issue, Vol. 1, No. 1. This bulletin is to be published quarterly by the Committee to Investigate Assassinations, 927 15th St., N.W., Room 409, Washington, D.C., 20005. Bernard Fensterwald, an attorney, is executive director of the committee. Any persons interested are invited to write to the Committee, ask to receive the bulletin, and make a contribution to the Committee's work.

## CTIA COMPUTER PROJECT

The CTIA has undertaken to computerize some voluminous files of written data compiled in the course of the investigation into the assassination of President John F. Kennedy. At present, we are storing data on various kinds of association or connection between people, places, organizations, and activities (including dates or other chronological data) as reported in selected source documents. The information is tabulated on a coding sheet, converted to numbers according to a numerical key, and then punched into IBM cards for input into computer storage and processing.

When complete, we expect to be able to supply quick answers, within the limits of the data available to such questions as: Where was Lee Harvey Oswald on November 5, 1963? What acquaintances, if any, did Jack Ruby and David Ferrie have in common? What organizations did Marina Oswald belong to while living in Minsk? Questions of this type frequently come up, yet are often beyond the reach of the memories of individual experts. The computer, on the other hand, can store large volumes of such data, sort it out in various ways, and print it out on demand.

The coding system for this project was devised during the summer of 1970 through the collaborative efforts of Dick Sprague, Bud Fensterwald, Bob Smith and Dick Ehlke. Most of the coding that has been done to date, which includes the Warren Report, several books, and many of the CTIA office files, is the work of Dick Ehlke. Others are developing the programs for storage, retrieval, and correlation of the data.

The CTIA needs help from persons willing to spend time reading and extracting data from source documents in their possession. This work requires no knowledge of computers, but demands careful and systematic tabulation of information. Standard forms and instructions are available from CTIA offices. Write us if you can help. Most of the 26 volumes of Hearings and Evidence published by the Warren Commission still await extraction; so there is plenty to do.

## ASSASSINATION LAWSUITS

### 1. James Earl Ray

On the judicial battlefield, a number of assassination-related suits are slowly wending their way through the courts. Foremost, perhaps, is James Earl Ray's petition for a new trial. [Ray was convicted, by an act of plea-bargaining, of the murder of Reverend Martin Luther King, Jr.; see the article "The Assassination of Martin Luther King, Jr., the Role of James Earl Ray, and the Question of Conspiracy" by R. E. Sprague, in "Computers and Automation", December, 1970, p. 39.]

Midway through the September 2nd hearing in Memphis, Tenn., Judge Williams indicated a desire for further details in support of Ray's allegations, particularly the allegation that Ray's former attorney, Percy Foreman, negotiated the guilty plea directly with Judge Battle rather than with the District Attorney's office.

To meet this request, the hearing was continued over. We subsequently filed a supplemental petition containing many additional facts in support of our allegations.

Our next bout in court is now set for February 23rd. That is five months from September 22nd, when we filed our Supplemental Petition. It took the State of Tennessee two and a half months to produce a two-page reply to the Supplement.

However brief, this time the State's reply clearly joined issue by denying the facts alleged in our Supplement, rather than merely asserting, as in the past, that our petitions contained only "conclusionary allegations" which were insufficient grounds for holding an evidentiary hearing.

This means that on February 23rd we will move for an evidentiary hearing, since the State's denial of our allegations has created issues of fact which can only be resolved by such a hearing. Under Tennessee law James Earl Ray is required to testify at such evidentiary hearing.

### 2. Sirhan B. Sirhan

On the west coast, Sirhan Sirhan's appeal is getting under way. Sirhan's attorney, Luke McKisack, recently filed a 700-page brief alleging some 18 grounds for relief. It is now rumored that Melvin Belli will represent Sirhan on appeal.

### 3. Spectrographic Analysis

In an attempt to shake loose some of the vast mound of suppressed assassination documents, a number of civil suits have been filed under the Freedom of Information Act. More such suits will be filed in the near future.

The Freedom of Information Act suit with perhaps the greatest potential -- one which may ultimately go all the way to the Supreme Court -- is the "Spectro suit." This suit, filed by Harold Weisberg, seeks access to the spectrographic analyses made of bullets, bullet fragments, and the clothing of President Kennedy.

Judge Sirica recently granted a motion by the United States Attorney to dismiss the Spectro suit. Oral argument on the Spectro complaint was severely circumscribed by the Judge -- to less than 30 minutes. Assistant United States Attorney Robert Werdig asserted that it had been determined by the Justice Department it was "not in the national interest" to make public the spectrographic analyses.

While the Freedom of Information Act provides that certain agency records may be exempt from public disclosure on grounds of "national security," the law says nothing at all about "national interest," and, in any event, neither can be invoked purely on the say-so of an assistant U.S. Attorney. In addition, it is difficult to see how it would be against the national interest to learn whatever truth may be revealed by scientific tests like spectrographic analysis.

### 4. Nuclear Activation Analysis

Somewhat along the same lines as the Spectro suit is a complaint filed by Dr. John Nichols in Topeka, Kansas. The Nichols suit requests that he be allowed to examine the bullets, bullet fragments, and articles of clothing of President Kennedy by a process known as nuclear activation analysis.

There are two important advantages to nuclear activation analysis. The first is that the tests may be performed without in any way mutilating, diminishing, or even marking the specimens which are analyzed. Secondly, nuclear activation is ten times more refined than spectrographic analysis; it can detect very minute quantities of a trace element which might not be revealed by spectrographic examination alone, thus improving the chances of making a unique determination of the origin or history of the specimen.

Unfortunately, when Warren Commission staff member Melvin Eisenberg raised the question of whether nuclear activation analyses would show if a bullet had passed through President Kennedy's tie or shirt collar, J. Edgar Hoover rejected any inquiry in that direction, merely asserting "it is not felt that the increased sensitivity of neutron activation analyses would contribute substantially to the understanding of the origin of this hole and frayed area." (Vol. XX, p. 2)

### 5. Clothing of President Kennedy

There are two other Freedom of Information suits now before the courts. Harold Weisberg has filed

a suit, pro se, which asks that he be given access to inspect articles of the President's clothing, or, alternatively, that photographs of the clothing be made for him or copies of existing photographs of the clothing made by the Archives be given him. The first hearing on this suit will probably come in early 1971 before U.S. District Judge Gerhard Gesell.

### 6. Access to FBI File for Senator Kennedy

In the second suit, the Committee to Investigate Assassinations has filed a complaint against the Department of Justice for access to the 6,000-page FBI report on the RFK assassination. This file was made available to Sirhan's defense counsel and to author Robert Blair Kaiser (author of "R.F.K. Must Die"), but the Justice Department has refused to grant us access to it.

A number of other Freedom of Information suits relative to the assassination of President Kennedy are being contemplated. These include suits for access to: (1) the FBI reports on David Ferrie; (2) the file on Lee Harvey Oswald which the Russians turned over to the U.S. Government; and (3) the raw materials used by the autopsy panel which Ramsey Clark convened just prior to the trial of Clay Shaw in New Orleans.

### NEW ASSASSINATION BOOKS

In the literary field, two books dealing with assassinations have been published recently, and a third is expected to hit the bookstands in early 1971.

Robert Blair Kaiser has authored the first critical examination of the investigation into the RFK assassination. "R.F.K. Must Die: A History of the Robert Kennedy Assassination and its Aftermath," published by E.P. Dutton Co., presents the thesis that Sirhan shot Kennedy under the influence of post-hypnotic suggestion and points to a possible conspiracy in that assassination. It contains much data not otherwise available in published form.

A Heritage of Stone, by District Attorney Jim Garrison of New Orleans, has also been published by G.P. Putnam's Sons, New York. A favorable review of it appeared in the New York Times. Garrison's book largely avoids any discussion of the Clay Shaw trial. Instead, Garrison concentrates on the politics of the assassination. Basically, the book argues the thesis that President John F. Kennedy was assassinated because he threatened the political interests of the military-industrial-intelligence complex. In particular, Garrison feels that the JFK assassination was tied to policies which the President had begun to implement to abate Cold War tensions, including a planned withdrawal of American troops from Vietnam.

Harold Weisberg has now written a book on the assassination of Dr. Martin Luther King. It is to be published early next year by Outerbridge and Dienstfry, New York, under the title of Frame-Up. The book argues very persuasively that: 1) James Earl Ray did not shoot Dr. King, 2) the assassination could not have been carried out as officially described, and 3) there is abundant evidence of a conspiracy.

## DOES THE ARMY MONITOR ASSASSINATIONS, TOO?

Grounds for belief that intelligence components of the military services might have been conducting surveillance operations at the scene of the assassinations of Martin Luther King, Jr., and Senator Robert Kennedy were established by disclosures made during NBC's "First Tuesday" telecast on December 1st, 1970. The second hour of the telecast, narrated by Sander Vanocur, documented numerous and widespread instances in which agents gathered data on attendees at various political functions. Some of the functions covered include the 1968 political conventions in Miami and Chicago, the MLK funeral, and the Poor People's March on Washington. According to various former Army agents who appeared on the telecast, the Army monitored communications, took photographs, and prepared detailed reports of individuals observed at these functions, purportedly in the interest of preventing civil disturbance. Extensive files from these surveillances are stored at Fort Holabird, Md.

Although not mentioned in the telecast, the visit of Martin Luther King, Jr., to Memphis and the campaign wind-up of Senator Robert F. Kennedy in Los Angeles were events of the same character as had drawn the attentions of the Army observers, both on earlier and later occasions. Notwithstanding the absence of public reports in these instances, the presumption is that they were covered, at least in some degree. Or if not, it might be asked, why not?

In a subsequent statement published in the Washington Star, former Defense Secretary Clark Clifford denied any knowledge that such things were going on. Therefore he implied that the military operates independently of the Office of the Secretary of Defense in such matters. Apparently, surveillance of the American public by our own military services can and does occur without the knowledge of responsible officials.

Senator Ervin has now announced that he will hold hearings on the subject sometime in late February or early March.

The possibility that some sort of early version of such surveillance might have been operating in Dallas ought not to be dismissed. Students of the assassination of President Kennedy were aware long ago that an agent of the Army Intelligence Corps was present in Dealey Plaza. He took a photograph of the TSBG some 30 seconds after the shots and subsequently entered the building and "worked with the Sheriff's Deputies at the rear." He reported to the FBI that he had submitted a report of his activities to his unit and that the report would be made available on request (see pp. 312-313 in "Six Seconds in Dallas", by Josiah Thompson, published by Bernard Geis and Associates, New York). Neither his photograph nor his report have ever been disclosed, nor is his name mentioned in the Warren Report or the 26 volumes of "Hearings and Evidence".

We hope that Senator Ervin will see fit to ask questions about the Army's possible knowledge of these assassinations. Was it present, officially or unofficially, at any of the three major assassinations? Where are its reports? Why, in its self-appointed role as monitor of potential civil disturbances, has the Army been unable to provide any protection to our leaders?

## "Computers And Automation"

### New Article Series:

## Computers, Science, And Assassinations

- |   |                 |
|---|-----------------|
| "The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence"         | May, 1970       |
| - Richard E. Sprague<br>Computer Consultant   |                 |
| "Computer-Assisted Analysis of Political Assassinations"  | May             |
| - Edmund C. Berkeley<br>Editor, <u>Computers and Automation</u>   |                 |
| "Visual Re-creation of a Scene by Computer Graphics"  | July            |
| - Leslie Mezei<br>Prof., Univ. of Toronto   |                 |
| "Confirmation of FBI Knowledge 12 Days Before Dallas of a Plot to Kill President Kennedy"                           | July            |
| - Edmund C. Berkeley<br>Editor, <u>Computers and Automation</u>   |                 |
| "The Second Conspiracy About the Assassination of President Kennedy:"   | July            |
| - Richard E. Sprague<br>Computer Consultant   |                 |
| "The Assassination of Senator Robert F. Kennedy: Two Men with Guns Drawn at Senator Kennedy's Assassination"        | August          |
| - Statement to the Press by Theodore Charach, Free-Lance Journalist   |                 |
| "Patterns of Political Assassination: How Many Coincidences Make a Plot?"   | September       |
| - Edmund C. Berkeley<br>Editor, <u>Computers and Automation</u>   |                 |
| "Computer-Assisted Analysis of Evidence Regarding the Assassination of President John F. Kennedy — Progress Report" | September       |
| - Richard E. Sprague<br>Computer Consultant   |                 |
| "The Conspiracy to Assassinate Senator Robert F. Kennedy and the Second Conspiracy to Cover It Up"                  | October         |
| - Richard E. Sprague<br>Computer Consultant   |                 |
| "Index to 'Special Unit Senator: The Investigation of the Assassination of Senator Robert F. Kennedy'"              | October         |
| "Confidential and Secret Documents of the Warren Commission Deposited in the U.S. Archives"                         | November        |
| - Neil Macdonald, Assistant Editor<br><u>Computers and Automation</u>   |                 |
| "The Assassination of Reverend Martin Luther King, Jr., The Role of James Earl Ray, and the Question of Conspiracy" | December        |
| - Richard E. Sprague<br>Computer Consultant   |                 |
| "The Death of Walter Reuther: Accidental or Planned?"   | 1971<br>January |
| - Edmund C. Berkeley, Editor, and<br>Leonard Walden, Investigator   |                 |

# ACROSS THE EDITOR'S DESK

## APPLICATIONS

### COMPUTER AIDS RESEARCH OF FEMALE REPRODUCTIVE CYCLE

At the University of Illinois Medical Center Campus in Chicago, Neena B. Schwartz, director of the psychiatry department's Biology Laboratory in the U. of I. College of Medicine, is using a computer to simulate the female ovulation process. The computer-simulated model permits the testing of many hypotheses on rats in a laboratory. Among the many possible experiments, the computer model helps identify the critical ones that must be performed on the rats, explained Dr. Schwartz. "The critical element, ultimately, is not how the computer model behaves, but how the rats behave," she said.

With the help of Paul Waltz of Equation Models Associates in Arlington Hgts., Ill., Dr. Schwartz is gradually developing an increasingly complex computer model, a "systems analysis" of the role ovulation plays in regulating reproductive cycles. Creating a realistic computer model has helped Dr. Schwartz to refine her laboratory research, forcing her to make new biological measurements that previously were not made, e.g., measuring how much Luteinizing Hormone (LH) is necessary to cause estrogen (a sexual hormone in females) secretion from the ovary. "This sort of by-product is one of the real payoffs from the computer," she said. (Dr. Schwartz is a physiologist specializing in "neuroendocrinology" (study of the brain's relation to hormone secretions in the body).

Using IBM's special simulation language "Continuous Systems Modeling Program," which permits continuous systems to be simulated in a digital computer, models are being formed to simulate ovulation, estrogen secretion and LH secretion. Various kinds of data are programmed into the computer, including the negative feedback effect of estrogen on LH and the 24-hour "clock" that simulates hours of lightness and darkness (which affect rats' reproductive cycles). Eventually the computer simulation leads back to the laboratory for verification of the computer's results.

All of the laboratory and computer studies are aimed at a more complete understanding of the ovulation process to give man the power to stop or start it. One eventual clinical use for Dr. Schwartz' re-

search would be in preventing conception in women who, for medical reasons, cannot take the birth control pill and would be endangered by pregnancy. More generally, the research is aimed at helping determine what factors account for the various cycles within the human body.

### ART PROFESSOR GENERATES 3-D ART USING COMPUTER

University of Massachusetts Art Professor Robert Mallary has been using a computer as an assistant in generating three-dimensional art. Mr. Mallary is one of the pioneers in this country in developing specific computer programs for sculpture which allow the computer to determine shapes. TRAN 2, Mr. Mallary's program, establishes sets of numerical co-ordinates in the computer's memory which can be used to sketch out an abstract, three-dimensional shape. Varying the numbers can squeeze, stretch or twist this shape in a nearly infinite number of variations. He uses an IBM 1130 computer because its output hardware includes a computer driven plotter that can draw out his shapes. The computer and plotter can be programmed to draw the shape from a variety of sides and a variety of angles.

The plotter also can be directed to draw out a set of contour slices. The contour printout is photographed, projected onto plastic, plywood or other material, thus forming the pattern for the sections of the finished sculpture. Mr. Mallary cuts out the sections, drills a center axis, and cements the slices into the finished shape around a metal center rod. Smoothing and finishing completes the piece.



Quad III

His first computer work, a laminated plexiglass piece, named Quad I, was exhibited at the Institute of Contemporary Art in London in the summer of 1968. Quad III, at the left, a laminated luau veneer piece sixty inches high, was included in a 1968 Whitney Museum exhibition of the contemporary American sculpture, and the following spring at the Contemporary Crafts Museum in New York City.

Mr. Mallary sees a big future for computer sculpture. "Linked to a tape-driven machine tool a computer might produce 100 or 200 small carvings an hour. Most of these might be thrown away but one or two could become the prototypes for large-scale works." He predicts that ultimately the computer may even be able to "learn" the stylistic preferences and idiosyncracies of the sculptor who is using it, retain this information and be able to produce works "in the manner of" the sculptor.

### DESIGN, DEVELOP AND TEST AIRCRAFT BRAKING SYSTEMS WITH AID OF EAI COMPUTER

Goodyear Tire & Rubber Company's Aviation Products Division is using an EAI 580 computer system (manufactured by Electronic Associates Inc., Long Branch, N.J.) in a new aircraft simulation program. The computer has been taught to "perform" like an airplane to help engineers design and develop new braking systems for present and future aircraft. The equipment simulates the dynamics of an airplane during taxiing, take off and landing and the resulting action of wheels, brakes, tires and antiskid equipment.

The EAI 580 can operate exclusively with mathematical models of aircraft and landing gear characteristics or with a combination of math models and actual gear hardware. This means that new landing gear equipment can be checked for proper performance during all stages of development. Total Braking System Responsibility reduces flight testing time required for new landing gear equipment by integrating components into a single system. This permits engineers to know exactly how all components will perform before they are actually installed and test flown on the aircraft.

First aircraft programmed for computerized take-offs and landings was the McDonnell Douglas DC-10, a new wide-body tri-jet airliner that made its maiden flight in July.

### DISRUPTIVE "DIG-UPS" BY CONSTRUCTION CONTRACTORS AVERTED WITH COMPUTERIZED "LOOK-UP" CENTER IN CALIF.

A new computer-based service, to prevent disruptive "dig-ups" of underground telephone facilities, has been put into operation by General Telephone Company of Cal-

ifornia, a subsidiary of General Telephone & Electronics Corp. Initiated this past fall throughout the telephone company's operating territory, early results have been termed 'good' — with an average of 12 calls a day from contractors requesting the location of underground facilities — up 150% since the service was established.

Under the arrangement, all contractors planning to dig into the ground are asked to make collect telephone calls to the company's underground "look-up" center in Monrovia. At the center a clerk queries a time-shared computer which (by means of a display screen) tells her whether or not any underground telephone facilities are located in the area to be excavated. If the reply is negative, she tells the contractor to proceed with his digging. When the computer reports a cable or other facilities in the vicinity of the work, the clerk arranges a meeting between the contractor and a telephone company inspector at the construction site to spot the exact location to be avoided. (The file of conduit and buried cable locations stored in the computer's memory was compiled by General Telephone of California engineers from maps showing the locations of outside plant equipment.)

In 1969, General Telephone of California paid out \$456,000 to repair damage to underground cables, conduits, manholes, and other facilities caused by contractors' digging activities. About \$134,000 of the total represented a loss to the company, while the balance had to be collected from the contractors. Based on about 1500 calls a month (the number the company ultimately expects to be receiving), estimated cost for the look-up service will be \$36,000 a year — a sizeable reduction over the cost for repairs to damaged facilities in 1969.

#### OHIO STATE UNIVERSITY'S LIBRARY CIRCULATION SYSTEM NOW IN FULL OPERATION

Ohio State University President Novice G. Fawcett placed a telephone call, on November 16, 1970, from his office to the circulation center in the campus main library. He requested a book entitled "Lives and Letters," by Ohio State Professor of English, Dr. Richard Altick. The operator typed the name of the book and author into the computer keyboard. Instantaneously the display screen showed that copies of the volume were available in the main library, the English graduate library and in the undergraduate library, President Fawcett told the

operator he wanted the main library copy. The operator typed Dr. Fawcett's faculty number onto the keyboard, and the book he requested was charged to him, then taken from the shelves, and held at the main desk for pickup.

The new system ties in the more than 2,400,000 books, 400,000 music scores, 677,000 microfilm units and 150,000 maps to one of the institution's several computers — the IBM System 360, Model 50, located in the Learning Resources Computer Center. (In addition to keeping track of all library materials, the computer will continue its support in other areas.) All 23 of Ohio States' campus libraries are included in the system. A full-time systems analyst-computer programmer, Daniel Underwood, will monitor and adjust the system continuously.

With a telephone call from any phone, anywhere, a student or faculty member can find but in seconds if the books he needs are available and have them reserved for pickup. (A book also may be taken from the shelves by a patron and brought to the circulation desk where the library assistant at the desk types the transaction into the computer.)

As the computer records a book check-out, it also stores the name and number of the user and the date. The computer will send out notices to users of overdue books (indicating the amount of the overdue cost) and notify the library circulation center of the overdue item. When a library user returns a book, he must return it to the same library from which it was obtained. Return information is typed onto the computer keyboard, and the account is squared.

The system is designed to link into any other library in the state if that library has the proper equipment. This is a very distinct possibility for the future, said Dr. John T. Bonner Jr., vice president for Educational Services. This would mean that any user in any part of Ohio could, by calling on the telephone, find out immediately if a book, map, microfilm or music score was available in any library in the network. The caller could reserve the item and pick it up or have it mailed.

Librarians and administrators from institutions across the nation already have inquired about the new system. Many visited the campus in Columbus to observe its installation and early testing. Hugh Atkinson, assistant director of libraries, said, "The Ohio State library is now by far the most modern and usable of any library anywhere."

#### FLYING ELECTRONIC BILLBOARDS

Two of the famous Goodyear blimps, the America and Columbia, recently were outfitted with electronics by their manufacturer, Goodyear Aerospace Corporation. On each side of each airship, 3,780 red, blue, green, and yellow lamps are linked by 80 miles of wiring to form patterns measuring 24½ feet high by 105 feet wide. The lamps may be controlled individually or in a variety of intricate combinations. The coordinated four-color animation that results shows brightly-lit public service and holiday messages which Goodyear calls "Super Skytaculars".

The blimps' simple, light-hearted messages result from a complex procedure which begins in an electronics laboratory at Wingfoot Lake, near Akron, Ohio. A technician, at the computer facility, using a light pencil draws cartoons by outline on a cathode ray tube (CRT) receiver that simulates the relative positions of the blimp's lamps. As he paints the picture frame by frame, the CRT transfers the animations to a Xerox Data Systems Sigma 2 computer which converts it to digital format. The computer transfers data onto magnetic tape with one of Ampex Corporation's TM-9 tape drives. For word messages, the operator instructs the computer as to what size lettering is desired and then types the message on a keyboard. As he types each letter, the Sigma 2 draws the letter on the screen and transfers it to the tape with the TM-9 tape drive. A second Ampex tape drive enables the technician to add more digital words and pictures and edit the tape according to his script. Once completed, the tapes are copied by using the TM-9s in tandem operation.

They are then sent to the blimps' home bases in Houston and Los Angeles. Aboard the blimp, the tapes are fed into electronic "readers" which control lamp and color selection and the speed at which messages are run. A typical six-minute tape contains 40 million "on-off" instructions to the blimp's 7,560 lamps.

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#### EDUCATION NEWS

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#### CLASSROOM ON WHEELS PREPARES DISADVANTAGED STUDENTS FOR CAREERS IN COMPUTING

Since early Spring of 1970, a giant trailer truck has rumbled the streets of San Diego with an unusual cargo — a medium well-equipped classroom and a general purpose IBM

computer. On the outside of the trailer, foot-high letters spell out "Computer Jobs Through Training". According to Dr. M. Granger Morgan, Director of Computer Jobs Through Training (CJTT), more than five introductory programming classes have been run for disadvantaged San Diego area junior and senior high school students during 1969 and 1970. Operating from the San Diego campus of the University of California, CJTT's mobile classroom makes it possible to take the training facilities directly into the student's own community.

Computer programming has an aura of excitement associated with it which is very important in student recruitment and motivation. More importantly, unlike other high entry level jobs, it requires few cultural prerequisites, such as the ability to speak dialect free English or a working familiarity with business world interpersonal relations. To capture the excitement of the program, CJTT instructors have eliminated formal lecture presentations and rely heavily on the 'hands-on-the quipment' approach. This approach, augmented with visuals, has proven very effective, according to Dr. Morgan. By the end of the formal course, students have learned the fundamental aspects of programming and it is apparent which students are suited for the various available jobs. The students then enter a Terminal Workshop of intensive full-time training for a period of several weeks which readies them for their job.

#### DEAF STUDENTS LEARN MATHEMATICS VIA COMPUTER

The computer has been diagnosing educational shortcomings of deaf students and teaching them secondary mathematics. Sponsored by the National Technical Institute for the Deaf, the program is called Mathematics Diagnostic System (MDS) and is unusual because this is the first time computers have been used diagnostically in education on such a large scale.

The program uses an IBM 1500 Instructional System and thirty-two terminals to ascertain student deficiencies in pre-college mathematics and to provide remedial instruction in subjects ranging from arithmetic to analytic geometry. The computer was selected for this pilot project in remedial diagnosis because of its ability to use conditional branching to sift, winnow and select output data in response to the nature of the input.

As the deaf student enters the program, he immediately interacts

with the computer. The computer asks pertinent questions, and based on the responses of each student is able to evaluate exactly those areas that the student has not learned. Once the diagnosis is made, the computer then can proceed — at the pace required for the individual student — to present the necessary information to 'teach' the concept. Additional diagnostic tests are given to the student, throughout the process, to determine his level of proficiency on each conceptual task.

Deaf students are especially handicapped in learning, due to the obvious communications problems. The MDS program is particularly beneficial for deaf students, because the computer has infinite "patience" to combat the communications difficulties. MDS works in such a way that it teaches only what the student doesn't know, and does not repeat information previously learned. At the same time, it enables a student to spend as long as he needs in a specific area to master the concept in question.

The National Technical Institute for the Deaf, a division of the Rochester Institute of Technology, is the only educational entity devoted exclusively to education of the deaf in technical and scientific studies beyond the secondary level.

#### SCHOOL/PTA BID WINS COMPUTER TIME FOR ITS ELEMENTARY STUDENTS

Students at an elementary school in Berea, Ohio, recently had access to a time-shared computer located in Kansas City, Missouri. The unusual learning opportunity occurred when a combined School/PTA bid was



— Students at R. H. Lechner Elementary School working on math problems

successful in obtaining the computer time donated by United Computing Systems, Inc., during the local

Educational Television station's auction to raise money.

Volunteer parents taught some of the sixth grade students problem analysis, flow charting, and programming using the BASIC language. After about ten hours of instruction the students could write programs involving looping. Students punched, debugged, and ran their programs at a Teletype terminal.

Some younger students had a chance to practice math facts using programs written by parents. First graders concentrated on addition, while third graders worked on subtraction and multiplication as well.

### RESEARCH FRONTIER

#### SIMULATED ENVIRONMENT MODEL MAY AID CITIES OF TOMORROW

Cities of the future will be designed on a far more rational basis than those now in existence, predicts a University of Utah engineer, Dr. Harold R. Jacobs, associate professor of mechanical engineering, along with Dr. S. K. Kao, professor of meteorology, and Dr. Po-Cheng Chang, assistant professor of civil engineering, is developing a computer model of atmospheric pollution patterns in the Salt Lake valley from which they should be able to formulate projected patterns for any part of the nation. Their assault on the problem involves designing both a mathematical computer model and a physical scale model of the Salt Lake valley, incorporating all of the region's prominent topographical and atmospheric characteristics.

The first seven months of the U.S. Public Health Service-sponsored research, has been spent constructing the two models and perfecting Utah's first wind tunnel capable of duplicating atmospheric wind motion. The miniature of the Salt Lake valley is installed inside the closed environment of the wind tunnel. It is equipped with a maze of tiny pipes that belch pollutant gases in the proper quantities and locations to simulate contaminants in the Salt Lake valley. Wind velocity and direction also are varied to duplicate normal atmospheric conditions.

The capability to predict pollution diffusion patterns will make it possible to determine where heavy industry and new population centers should be located to minimize environmental damage and optimize healthful living conditions. Cities already with a pollution crisis will also benefit from mathematical models of pollution flow patterns.

# NEW PRODUCTS AND SERVICES

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
<b>Digital</b>		
ICL System 4-52	Increased peripheral handling capability by a total throughput rate of 1.3 million bytes per second and low central processor hesitation time associated with selector channels' accesses to store / compatibility with System 4 software / full range of store sizes; basic 32K bytes with successive steps to 64K, 128K, 256K	International Computers Ltd. ICL House Putney, S.W.15 London, England Attn: Dudley Paget-Brown
NCR Century 50	For small businesses / fully compatible with NCR's Century Series / an 800 nsec thin-film rod memory; an 8.4 million-byte dual-disc unit; and a 200 line-a-minute alpha-numeric printer are standard / options for larger capacities available / will be in competition with IBM's System 3	The National Cash Register Co. Main & K Streets Dayton, Ohio 45409
PDP-12 based systems	Four new PDP-12 based systems — <u>PDP-12/10</u> ; for users with fund restrictions, or first time computer users who want a simple system, yet easily expanded; can be used for real-time computer programming and scientific calculations / <u>PDP-12/20</u> : up-to-date version of DEC's Laboratory Instrument Computer System (LINC); for a variety of life and physical science laboratory uses / <u>PDP-12/30</u> (Advanced LINC System): for a variety of industrial testing, educational, analytical, and clinical chemistry applications / <u>PDP-12/40</u> : adds Floating Point Processor (FPP-12) to the PDP-12/30 enhancing its performance in such applications as gathering and manipulating data from analytical instruments with high data rates	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Dimitri Dimancesco, Jr.
<b>Memories</b>		
MK 4006 P, random access MOS memory	1024-bit read-write chip / maximum access time, 400 nsec; minimum write cycle time, 650 nsec / full input TTL/DTL compatibility / for use in small memory systems; also provides greater packing density, less noise generation for large main memory systems	Mostek Corp., an affiliate of Sprague Electric Co. 1400 Upfield Drive Carrollton, Texas 75006 Attn: Gordon Hoffman
RAMM 1024 MOS Memory System	For high speed information storage and retrieval applications / contains 1024 words; up to 10 bits on one printed circuit card / input-output section has Non-Destructive Read Out / read-write cycle time, 600 nsec	Standard Logic Inc. 1630 South Lyon St. Santa Ana, Calif. 92705 Attn: Bruce Billington
Read-Mostly Memory (RM-256)	A 256-bit array consisting of silicon and amorphous semiconductors combined on a monolithic chip / circuit has non-volatility, electrical alterability, random access, fast read speed, non-destructive readout / applications include microprogramming, character generation, sequencing and logic control	Energy Conversion Devices, Inc. 1675 West Maple Rd. Troy, Mich. 48084
<b>Software</b>		
ANAGRAFIC Software System	Operates with a Science Accessories Corp. (SAC) Graf/Pen connected on-line to a PDP-8 Computer / provides convenient, low cost means of digitizing data for direct input to the computer / modular design permits expansion for operation with wide range of output devices / applications include as a laboratory tool, a design facility, a production or quality control instrument	Input Output Computer Services, Inc. 142 Mt. Auburn St. Cambridge, Mass. 02138 Attn: Thomas A. Farrington
Bank General Ledger System	For use in unit or branch banking with processing capability for single and multiple banks / daily and monthly reports; modular design; wide range of price and service options / written in COBOL: operates on IBM 360's	Information Systems Division Computer Sciences Corp. Century City Los Angeles, Calif. 90067
1130 NOVA Support System	Affords NOVA or SUPERNOVA user the advantages of a macro assembler and linkage editor to prepare NOVA programs on a more powerful 1130 computer system / system includes a free-form macro assembler, a flexible subroutine binder (linkage editor), macro and subroutine libraries, and a NOVA on-line debugging package	Intercomp 243 Vassar St. Cambridge, Mass. 02139 Attn: Michael L. Mark

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Software, continued)		
GENIE	A proprietary software package which generates files of data for testing of computer programs where input files of data are not available / a stand-alone COBOL program / may be used under either IBM DOS/360 or OS/360; requires minimum configuration of 32K, a reader, and one output device	Applied Cybernetics Corp. 1285 Forgewood Ave. Sunnyvale, Calif. 94086 Attn: Michael F. Nolan
MACH I	A demand deposit reserve system/posting throughput up to 1/5 million accounts per hour / allows banks to incorporate processing for a personal line of credit (by account option) as integral function of system provides wide range of bank options for multi-bank processing / runs on IBM 360 or 370 under DOS or OS	Scientific Computers, Inc. 919 Second Avenue South Minneapolis, Minn. 55402 Attn: Dave Jorve or R. A. Walter
SCRIBE	A subroutine for plotter and CRT users / will draw curved letters, which at user option can be italicized / proprietary software package can be used with or instead of the common plotter subroutine called SYMBOL basic package consists of 46 characters; extra characters and symbols available /	Applied Computer Graphics Corp. 816 Thayer Ave., Suite 300 Silver Spring, Md. 20910
SERIES	A comprehensive information systems development tool / includes a higher level language which assists users in designing systems and producing COBOL programs / comprised of three integrated parts: the Program Generator; advanced File Structures and Access Methods; and On-Line Services / available under new 60-day trial lease/purchase plan	Information Systems Management, Inc., a subsidiary of Western Operations, Inc. 120 Montgomery St. San Francisco, Calif. 94104
SUPERDOS II	A DOS supervisor modification which reduces I/O overhead during fetching or loading of core image phases / multiphased applications may often achieve a 10% or greater reduction in running time	Universal Software, Inc. 12 Horseshoe Drive Danbury, Conn. 06810 David W. Kearns
TOPS-10	A second version of operating system for PDP-10 computer systems / new performance features and increased documentation include: improvements to communications system; real-time programming during time-sharing at the FORTRAN level; capability to lock privileged jobs in core	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Edgar E. Geithner
<b>Peripheral Equipment</b>		
Adaptive Drive Control, Series 600	Single and multi-axis servo drive control systems include the prime mover; the servo valve; a servo amplifier (if electric motor is used); the digital feedback unit; and the solid-state controller / measures to 100 million pounds per inch / speed ratio is over 100,000:1 / interfaces with tape control, direct computer control or manual data insertion / standard and custom units available for OEM and retrofit use	Anocut® Engineering Co. 2375 Estes Ave. Elk Grove Village, Ill. 60007 Electronic Systems Group Attn: Dr. Yechiel Shulman
CCS 120 Remote Printing Station	Teletype replacement requiring no software changes / chain printer; 64 character ASCII set; 80 column; 120 lines per minute / uses voice-grade telephone lines at rates to 1800 baud / accommodates multipart forms up to 11-3/4"	Custom Computer Systems 40 South Mall Plainview, N.Y. 11803 Attn: Don White
COMPCARD Computer Terminal	Microfiche storage and retrieval system holds up to 73,500 pages of data; displays any page in four seconds or less / system includes firm's CARD® unit with Teletype, Selectric typewriter or CRT display / reduces transmission, mass storage and programming loads	Image Systems, Inc. 11244 Playa Court Culver City, Calif. 90230 Attn: H. D. Sandeffer
Data Secretary	Editing typewriter for general office use / uses magnetic tape cassettes or magnetic cards for word and format storage; can be edited or repeated indefinitely / erase typing errors simply by backspacing, retype correct word and go on / utilizes program control techniques of digital computers	Redactron Corp. 100 Parkway Drive South Hauppauge, N.Y. 11787 Attn: Ros Willett
Model 8600 Card Reader	For computer input or terminal applications / 96-column with rated capacity of 1,000 cpm / read error rate is less than one in 300 x 10 <sup>6</sup> possible data bits / input hopper holds 1,000 cards; stackers, (2) have 1,000 card capacity each	Bridge Data Products, Inc. 738 South 42nd St. Philadelphia, Pa. 19104 Attn: Gene Gibbons
OCR/S 2000 Document Processor	Designed for European banks / provides high volume optical reading of bank documents including checks, plus microfilming, endorsing, and sorting of documents / reads single lines of machine-printed numerics in OCR-B and 1403 fonts / throughput rate in excess of 2000 documents a minute / plugs directly into IBM 360 and 370	Recognition Equipment Inc. 1500 W. Mockingbird Lane Dallas, Texas 75222 Attn: Bob E. Killian

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(OCR/S 2000 Document, Continued)		
	computers as well as Recognition Equipment's Programmed Controller	
Read Only Tape Transports, 100R Series	IBM compatible, specifically aimed at Computer Output Microfilm, offline, printing and plotting, typesetting / packing densities: 200, 556, 800 bpi / 7- and 9-track configurations / search/read feature permits search at high speed and read at lower speed of output device	Cipher Data Products, Inc. 7655 Convoy Court San Diego, Calif. 92111 Attn: Peter Gilbody
SOVAL (Single Operator Validation)	Data verification system can be operated accurately and quickly by one operator / document field, operator and machine form a closed loop system tolerating no errors / heart of SOVAL is an optical jumbling and electronic system / maximum acceptable word or field length depends only on number of channels in optical modules and length of memory	British Equipment Co. Ltd. 51 Wandle Rd. Croydon CR9 1BL, England Attn: A. E. Cox
TELEX 6000 Series Magnetic Tape subsystem	Comprised of Telex 6803 Tape Controllers and 6420 Magnetic Tape Drives / direct replacements for IBM's 3803 controller and 3420 tape drives / fully compatible with both IBM Systems 370 and 360 / free 30-day evaluation trial offered	Telex Computer Products, Inc. 6422 East 41st Tulsa, Okla. 74135 Attn: Harry Ashbridge

### Data Processing Accessories

MEDIA Magnetic Tape	100% certified for 3200 FCI operation, double cleaned, conditioned / fully compatible with all current computer systems / available in all popular configurations / has lifetime guarantee / 48 hour delivery	General Kinetics Inc. 11425 Isaac Newton Sq. So. Reston, Va. 22070 Attn: Lynn C. Metcalf
Universal Perforator Tape	New paper-mylar laminate (patent pending) reduces punch-and-die wear and downtime in computer, data processing, office machine and numerical control applications / conventional rolls (ZPMA-15) and fanfold style (RPMA-15) in 1,000-foot lengths / certified 100% opacity	Robins Industries Corp. Data Products Div. 15-58 127th st. College Point, N.Y. 11356

### Computer-Related Services

CYBERNET/CENSTAT System	Joint undertaking with Westat Research, Inc., Rockville, Md., to provide statistics from 1970 U.S. Census data for government planners and market researchers / available through CDC'S CYBERNET network / includes access to 1970 Census summary tapes and CENSTAT, a computer software program for census statistics	Control Data Corp.. 8100 34th Ave. So. Minneapolis, Minn. 55420 Attn: Kent R. Nichols
Computer Analysis of Electrocardiograms (ECG)	System (developed by Telemed Corp., Schiller Park, Ill.) permits instant, two-way communication between Telemed computer center and medical facilities via ordinary telephone lines / mobile ECG unit allows technician to record patient's ECG while simultaneously transmitting ECG trace to computer facility / computer analysis is teletyped back in minutes for physician's assessment	Pfizer Inc. 235 East 42nd St. New York, N.Y. 10017 Attn: Joseph P. Callahan
MAILGRAM Service	Designed for next business day delivery / message originate on teleprinter in sender's office; routed over WU's circuits by computer to receiving post office near final destination / delivered as first class mail / service offered in 12 cities on test basis last year; plans include general public by early summer	Western Union 60 Hudson St. New York, N. Y. 10013 Attn: R. V. Spelleri
Telprice/70 Historical Pricing File	For research departments of banks, brokerage houses and insurance companies / provides 75-day review of market action and other data on nearly 12,000 securities / also contains a year's background of weekly closing prices / data provided on magnetic tape / adjustable to needs of subscribers	Telstat Systems Inc. c/o Jack Bernstein Associates, Inc. 37 West 57 Street New York, N.Y. 10019

### New Literature

The Computer Display Review	A four-volume, 2,000 page reference source / contains a state-of-the-art hardware and software tutorial, review and analysis of commercially available display devices / extracted data is available without charge in a pamphlet, giving prices and technical characteristics of 73 alphanumeric and 46 line-drawing display devices	Keydata Corporation Publications Div., Dept. T-1 108 Water St. Watertown, Mass. 02172
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# NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Control Data Corp., Minneapolis, Minn.	CERN (European Organization for Nuclear Research), Geneva, Switzerland	A CDC 7600 system to be used with an existing CDC 6500 system by 12 nations in international research, principally in sub-nuclear physics	\$9 million
Datacraft Corp., Ft. Lauderdale, Fla.	North Electric Co., Galion, Ohio	A large quantity of DC-38 core memory systems to be used in electronically controlled switching system	\$3.5 million (approximate)
National Cash Register Co., Dayton, Ohio	United States Postal Service	Five contracts for research in new concepts and equipment including facer-canceler machines, sorting coder, encoding desk, letter sorter, & airmail dispatcher	\$2.6 million
Univac Division of Sperry Rand Corp., Blue Bell, Pa.	Systems, Science and Software, La Jolla, Calif.	A 1110 computer system for calculations on scientific business & commercial projects including computer aids for doctors	\$2.5 million (approximate)
Ampex Corp., Culver City, Calif.	Autonetics Div. of North American Rockwell Corp., Anaheim, Calif.	A supply of core memory stacks to be used in the carrier aircraft computer of the new U.S. Air Force short range attack missile (SRAM) system	\$575,000+
RCA Corp., New York, N.Y.	United States Air Force	Development of a communications system to link ground-based & airborne computers that help control the nation's nuclear retaliatory forces	\$575,000
	Indian Hill Lab. of Bell Laboratories, Naperville, Ill.	Checking the data programming of electronic switching systems for telephones, using Model 3DM-2000 core memory systems	\$500,000
	United States Army	Core memories for research & development work on the U.S. Army SAFEGUARD Ballistic Missile System	\$384,000
Computer Automation, Inc., Newport Beach, Calif.	Intercole Systems Ltd., London, England	Fifth Model 216 & 808 minicomputers to be used in the company's Compulog systems	\$250,000
Interdata, Inc., Oceanport, N. J.	Pan American Petroleum Corp., Tulsa, Okla.	Purchase of three Model 4 computers for use directly in oil fields to analyze data at production locations	\$87,000+
Middle Atlantic Educational & Research Center (MERC), Lancaster, Pa.	United States Steel Foundation	A grant to support computer software packages to improve the efficiency of college & university alumni fund raising	\$10,000
Recognition Equipment France, S.A., Dallas, Tex.	Societe Generale de Banque, Belgium	Lease of a large-scale optical character recognition system, with purchase value of \$1 million; to capture transfer orders from bank's 220,000 customer accounts	—
University of Michigan	Office of Naval Research, Arlington, Va.	Research to improve design & performance of man-computer interactive decision systems following the Navy approach that computers are best used as an aid in making complex decisions	—
Computer Sciences Corp., Los Angeles, Calif.	LFE Corp., Waltham, Mass.	An award to develop an automated system to control airport traffic on taxiways at John F. Kennedy International Airport, N.Y.	—
Synergistic Computer Systems, Inc., Fullerton, Calif.	Geolabs, Inc., Santa Ana, Calif.	SYNCOMP MICRO/1 designed specifically to process engineering, plotting & management accounting requirements of engineering & architectural firms	—
Univac Division of Sperry Rand Corp., Blue Bell, Pa.	Italsider S.p.A., Genoa, Italy	Four computers including two 418-III & 1106 & 9300 systems to augment two 490s oriented to study & utilization of decisional models	—
Beaumont, Hiller & Sperling, Inc., Reading, Pa.	Biomedical Computer Services, Inc., St. Paul, Minn.	Installation of a computerized medical & management health information system	—
EMR Computer, Minneapolis, Minn.	State of Washington	Complete hardware & software for two EMR 6135 systems to give law enforcement officials immediate access to vital data concerning criminals & criminal activity	—
Burroughs Corp., Detroit, Mich.	American Bank & Trust Co., Baton Rouge, La.	A B3500 system valued at \$570,000+ to provide a total information system & an on-line inquiry operation	—
Decision Making Systems, Department of American Cyanamid Co., Bound Brook, N.J.	Trans World Airlines, New York, N.Y.	A contract for development of an automatic baggage tag reading system to facilitate luggage handling at major airline terminals	—
McDonnell Douglas Automation Co., St. Louis, Mo.	Federal Reserve Board, Washington, D.C.	A consulting service to examine computer operations & recommend ways to improve them, including computer hardware, software, facilities & staffing resources	—
IBM Corp., Federal Systems Division, Owego, N.Y.	Sanders Associates, Inc., Nashua, N.H.	A subcontract award to produce an advanced airborne drum memory system for the Navy's Submarine hunting aircraft, Lockheed S-3A	—
Lockheed Missiles & Space Co., Division of Lockheed Aircraft Co., Sunnyvale, Calif.	Children's Hospital, San Francisco, Calif.	Contract for a computer system to control hospital business office operations including payroll & staffing analysis	—
General Dynamics, Electro Dynamic Div., Orlando, Fla.	Central & Southern Florida Flood Control District, Orlando, Fla.	Award of a contract to study remote control water management, analyzing application of communications systems for water control	—
Northern Michigan Computer Center, Division of Belfour Stulen, Inc., Traverse City, Mich.	College of American Pathologists, Chicago, Ill.	Providing data processing services for a new nationwide, daily medical quality assurance program made available by the professional association of pathologists	—
Executive Computer Systems, Oakbrook, Ill.	Chicago Board of Trade, Chicago, Ill.	A long-term contract for off-site computerized price reporting & management information system on contracts bought & sold	—
Burroughs Corp., Detroit, Mich.	State of Colorado, Division of Employment	A B3500 system used to process employment applications, referrals & job openings, unemployment insurance & cost accounting	—

# NEW INSTALLATIONS

OF	AT	FOR
Burroughs B2500 system	Beaumont Hospital, Royal Oak, Mich.	Keeping track of maintenance schedules for everything from fan motors in air conditioning equipment to transistorized patient monitoring
Burroughs B3500 system	Tactical Air Command (TAC), U.S. Air Force, Little Rock, Ark.	A worldwide computer network to process records & management information in personnel, accounting, payroll, maintenance aircraft & aircrews, etc.
Control Data 3100 & 1700 systems	LIB, Northrhine-Westfalia State Center for Air Pollution Control & Preservation of Land Use, Essen, Germany	Two systems including the 3100 as the central system for research analysis of measured data & scientific & statistical calculations & the 1700 for monitoring of air pollution & data collection (system valued at \$700,000)
Control Data 3300 system	Procesos y Sistemas de Informacion, S.A., Subsidiary of Ingenieros Civiles Asociados, Mexico City, Mexico	Handling technical & design applications, solving engineering problems, processing payroll & other administrative applications (system valued at \$720,000)
Digital Equipment PDP-12	Cambridge University Engineering Department, West Cambridge, England	Direct digital control applications in Turbo-machinery Laboratory & on-line recording of the performance of machinery under test
Honeywell Model 110 system	City of Pasadena, Pasadena, Tex.	Utility billing, payroll & municipal accounting applications
Honeywell Model 115 system	City of Crawley, Crawley, England	Handling routine accounting applications, street lighting & housing rent applications
Honeywell Model 120 system	City of San Buena Ventura, San Buena Ventura, Calif.	Water billing, budget, payroll, business licenses, cost accounting & fixed asset inventory
Honeywell Model 3200 system Model 4200 system Model 8200 system	Blue Cross / Blue Shield, Service Center, Detroit, Mich.	Four computers for routine accounting & claims processing functions as well as a management tool in long-range, complex decisions
IBM System/3 Model 6	Matco Transportation, Inc., Kearny, N.J. SI Handling Systems, Inc., Easton, Pa.	Processing accounts payable & receivable, maintenance, fuel, rate changes & management control Payroll, simulated operation of the company's automated lines of handling systems & advertising in several hundred publications
IBM System/3 Model 10	KPRS Broadcasting Corp., Kansas City, Mo.  Prince William Hospital, Manassas, Va.	Composing daily logs for AM & FM broadcast days, weekly time availability studies, sales analysis, payroll, billing & general accounting Inventory & medical records, expansion of a central pricing system, accounting & meal planning
IBM System/360 Model 50	University of Notre Dame, Notre Dame, Ind.	Lease of the system to increase Notre Dame's research & teaching capability until the IBM 370/155 is ready for delivery (system valued at \$1.4 million)
IBM 1130 system	Arabian American Oil Co., New York, N.Y.	Production planning, projecting & updating inventory & coordinating shipments at world ports
NCR Century 200 system	Bank of New Hampshire, Manchester, N.H.  Community College, Auburn, N.Y.	Two computers to be the nucleus of an advanced Central Information File system to maintain complete records of customer banking activities Use as a teaching & administrative tool, including 90% of its time training students; remainder of time for processing of college records
UNIVAC 1108 system	Max Planck Institute, University of Goettingen, West Germany	Specific use as research in physics; will also be used by the University's social science and economics departments
UNIVAC 9200 system	Documentation Computer Institute, Flushing, N.Y. Fawick Airflex Division, Cleveland, Ohio  Great Lakes Towing Co., Cleveland, Ohio  H. Corenzwit & Co., Hillside, N.J. Hillcrest Foods, Inc., Lewiston, Me.  D. Meredew Ltd., Letchworth, Hertfordshire, England Yasuda Gakuen Senior High School, Tokyo, Japan	Student training in programming & computer operation, including programming languages, RPG & BAL Communications to parent company, Eaton Yale & Towne, in manufacturing & inventory control applications as well as financial reporting Business operations for the company's fleet of tugboats, including accounting, billing, payroll processing & sales analysis Applications of billing, accounts receivable, and inventory control for the company. Flock control, production control, inventory, billing, general ledger & payroll processing for the poultry & food processing firm Order analysis, sales analysis, job ticketing & accounting applications in furniture manufacture Provision of computer training for students
UNIVAC 9300 system	Tobu Railway Company, Tokyo, Japan	One of the largest private railroads in Japan to use in compiling statistical information on passenger traffic as well as payroll processing for 1700 employees
UNIVAC 9400 system	Fairview Hospitals, Minneapolis, Minn.	Expediting retrieval of patient medical records & business procedures; also providing shared services to rural hospitals as well as serving the two Fairview facilities in the Minneapolis area
UNIVAC 9400 system	Northwestern State University, Natchitoches, La.  Union County, Elizabeth, N.J.	Assisting the University in student applications files, enrollment, financial aid, payroll, library research & other administrative programs; will aid the student in registration, grading & the provision of material for personal instruction Enabling probate court judges to gain immediate access to all county records through UNISCOPE 100 visual display terminals situated on the bench; also county-wide aid for law enforcement officials & payroll, budget & welfare analysis & tax billing (system valued at \$640,000)

# 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 JANUARY 15, 1971

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS	
				In U.S.A.	Outside U.S.A.	In World		
<b>Part II. Manufacturers Outside United States</b>								
A/S Norsk Data Elektrikk Oslo, Norway (A) (Dec. 1970)	NORD-1 NORD-2B NORD-5	8/68 8/69 -	2.0 4.0 (S) -	0 0 0	43 4 0	43 4 0	15 10 1	
A/S Regnecentralen Copenhagen, Denmark (A) (Sept. 1970)	GIER RC 4000	12/60 6/67	2.3-7.5 3.0-20.0	0 0	40 11	40 11	0 6	
Elbit Computers Ltd. Haifa, Israel (A) (Dec. 1970)	Elbit-100	10/67	4.9 (S)	-	-	210	75	
GEC-AEI Automation Ltd. New Parks, Leicester, England (R) (Jan. 1969)	Series 90-2/10/20 25/30/40/300 S-Two 130 330 959 1010 1040 CON/PAC 4020 CON/PAC 4040 CON/PAC 4060	1/66 3/68 12/64 3/64 -/65 12/61 7/63 - 5/66 12/66	- - - - - - - - - - -	- - - - - - - - - - -	- - - - - - - - - - -	13 1 2 9 1 8 1 0 9 5	X X X X X X X X - - -	
International Computers, Ltd. (ICL) London, England (A) (Sept. 1970)	Atlas 1 & 2 Deuce KDF 6 - 10 KDN 2 Leo 1, 2, 3 Mercury Orion 1 & 2 Pegasus Sirius 503 803 A, B, C 1100/1 1200/1/2 1300/1/2 1500 2400 1900-1909 Elliott 4120/4130 System 4-30 to 4-75	1/62 4/55 9/61 4/63 -/53 -/57 1/63 4/55 -/61 -/64 12/60 -/60 -/55 -/62 7/62 12/61 12/64 10/65 10/67	65.0 - 10-36 - 10-24 - 20.0 - - - - 5.0 3.9 4.0 6.0 23.0 3-54 2.4-11.4 5.2-54	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 7 58 1 59 13 17 30 22 16 83 22 68 196 110 4 1690 160 138	6 7 58 1 59 13 17 30 22 16 83 22 68 196 110 4 1690 160 138	X X	
							Total:	525
Japanese Mfrs. (N) (Sept. 1970)	(Mfrs. of various models include: Nippon Electric Co., Fujitsu, Hitachi, Ltd., Toshiba, Oki Electric Industry Co., and Mitsubishi Electric Corp.)					Total: 4150 E	Total: 800 E	
Marconi Co., Ltd. Chelmsford, Essex, England (A) (Jan. 1970)	Myriad I Myriad II	3/66 10/67	£36.0-£66.0 (S) £22.0-£42.5 (S)	0 0	37 17	37 17	9 12	
Saab-Scania Aktiebolag Linköping, Sweden (A) (Dec. 1970)	D21 D22 D220	12/62 11/68 4/69	7.0 15.0 10.0	0 0 0	38 24 10	38 24 10	- 5 5	
Selenia S.p.A. Roma, Italy (A) (Jan. 1971)	GF-16 GF-16R	7/69 6/70	13.7 (S) 10.6 (S)	- -	39 1	39 1	21 1	
Siemens Munich, Germany (A) (Sept. 1970)	301 302 303 304 305 306 2002 3003 4004S 4004/15/16 4004/25/26 4004/35 4004/45	11/68 9/67 4/65 5/68 11/67 - 6/59 12/63 - 10/65 1/66 2/67 7/66	0.75 1.3 2.0 2.8 4.5 6.5 13.5 13.0 4.0 5.0 8.3 11.8 22.5	- - - - - - - - - - - - -	- - - - - - - - - - - - -	56 27 67 57 73 - 40 35 4 97 47 164 208	C C C 43 C C C C C C C C C	

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Siemens (Cont'd.)	4004/46	4/69	34.0	-	-	7	C
	4004/55	12/66	31.3	-	-	16	C
	404/3	-	1.1	-	-	-	C
						Total: 274	
USSR (N) (May 1969)	BESM 4	-	-	-	-	C	C
	BESM 6	-	-	-	-	C	C
	MINSK 2	-	-	-	-	C	C
	MINSK 22	-	-	-	-	C	C
	MIR	-	-	-	-	C	C
	NAIR 1	-	-	-	-	C	C
	ONEGA 1	-	-	-	-	C	C
	ONEGA 2	-	-	-	-	C	C
	URAL 11/14/16 and others	-	-	-	-	C	C
							Total: 6000 E

*16th Annual*  
**COMPUTER DIRECTORY  
AND BUYERS' GUIDE**  
*Issue of Computers and Automation*

softbound edition, 220 pages, off press January 18, 1971, and IN STOCK

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## MARTIN LUTHER KING MEMORIAL PRIZE CONTEST -THIRD YEAR

(Please post this notice)

*Computers and Automation* has received an anonymous gift and announces the annual Martin Luther King Memorial Prize, of \$300, to be awarded each year for the best article on an important subject in the general field of:

The application of information sciences and engineering to the problems of improvement in human society.

The judges in 1971 will be:

Dr. Franz L. Alt of the American Institute of Physics; Prof. John W. Carr III of the Univ. of Pennsylvania; Dr. William H. Churchill of Howard Univ.; and Edmund C. Berkeley, Editor of *Computers and Automation*.

The closing date for the receipt of manuscripts this year is April 30, 1971, in the office of *Computers and Automation*, 815 Washington St., Newtonville, Mass. 02160.

The winning article, if any, will be published in the July issue of *Computers and Automation*. The decision of the judges will be conclusive. The prize will not be awarded if, in the opinion of the judges, no sufficiently good article is received.

Following are the details: The article should be approximately 2500 to 3500 words in length. The article should be factual, useful, and understandable. The subject chosen should be treated practically and realistically with examples and evidence — but also with imagination, and broad vision of possible future developments, not necessarily restricted to one nation or culture. The writings of Martin Luther King should be included among the references used by the author, but it is not necessary that any quotations be included in the article.

Articles should be typed with double line spacing and should meet reasonable standards for publication. Four copies should be submitted. All entries will

become the property of *Computers and Automation*. The article should bear a title and a date, but not the name of the author. The author's name and address and four or five sentences of biographical information about him, should be included in an accompanying letter — which also specifies the title of the article and the date.

"Many people fear nothing more terribly than to take a position which stands out sharply and clearly from the prevailing opinion. The tendency of most is to adopt a view that is so ambiguous that it will include everything and so popular that it will include everybody. . . . Not a few men who cherish noble ideals hide them under a bushel for fear of being called different."

"Wherever unjust laws exist, people on the basis of conscience have a right to disobey those laws."

"There is nothing that expressed massive civil disobedience any more than the Boston Tea Party, and yet we give this to our young people and our students as a part of the great tradition of our nation. So I think we are in good company when we break unjust laws, and I think that those who are willing to do it and accept the penalty are those who are a part of the saving of the nation."

— From "*I Have a Dream*" — *The Quotations of Martin Luther King, Jr.*, compiled and edited by Lotte Haskins, Grosset and Dunlap, New York, 1968.

Reverend Martin Luther King, Jr., was awarded the Nobel Peace Prize in 1964, when he was age 35.

He was in jail in the United States more than 60 times.

He was assassinated in Memphis, Tennessee, April 4, 1968.

## ADVERTISING INDEX

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GATES ACOUSTINET, INC., Box 1406, Santa Rosa,  
Calif. 95403 / Page 64 / Gates Advertising

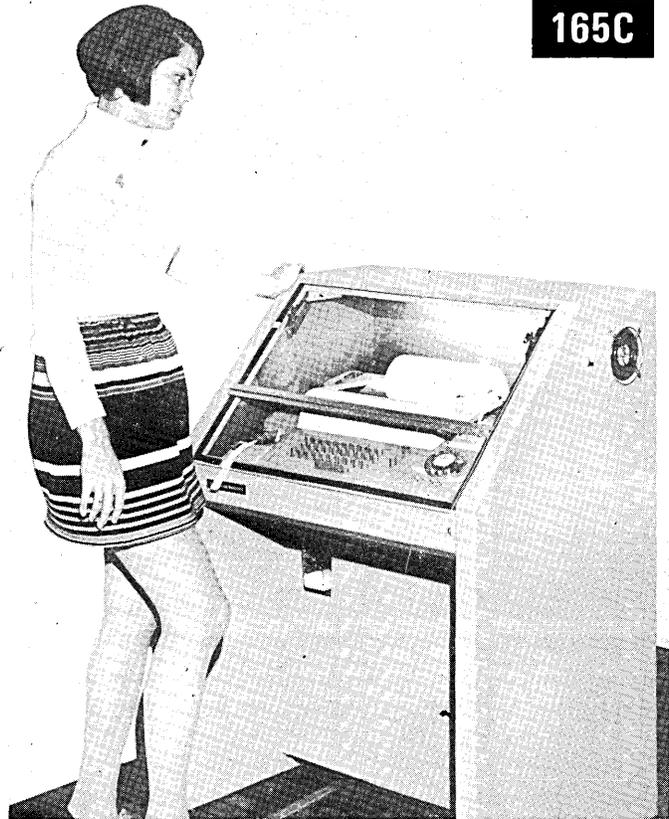
NEW YORK TIMES Book & Education Div., 229  
West 43 St., New York, N.Y. 11036 /

Page 3 / Kingen Feleppa O'Dell

WANG LABORATORIES, INC., 836 North St.,  
Tewksbury, Mass. 01876 / Page 45 /  
Chirurg & Cairns, Inc.

WM. C. BROWN COMPANY PUBLISHERS, 135 S.  
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# 4 good numbers to quiet any noisy machine



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Simply dial the Telex number and give full particulars\* on the noisy machine bothering you. We will prescribe the appropriate Gates Acoustinet model number to solve your problem.

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