May, 1973

Vol. 22, No. 5

computers and automation

and people

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by Edmund C. Berkeley, Author and Anthologist

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"RIDE THE EAST WIND:
Parables of Yesterday and Today"

Table of Contents (partial)

The Fox of Mt. Etna and the Grapes

Once there was a Fox who lived on the lower slopes of Mt. Etna, the great volcano in Sicily. These slopes are extremely fertile; the grapes that grow there may well be the most delicious in the world; and of all the farmers there, Farmer Mario was probably the best. And this Fox longed and longed for some of Farmer Mario's grapes. But they grew very high on arbors, and all the arbors were inside a vineyard with high walls, and the Fox had a problem. Of course, the Fox of Mt Etna had utterly no use for his famous ancestor, who leaping for grapes that he could not reach, called them sour, and went away.

The Fox decided that what he needed was Engineering Technology. So he went to a retired Engineer who lived on the slopes of Mt. Etna, because he liked the balmy climate and the view of the Mediterranean Sea and the excitement of watching his instruments that measured the degree of sleeping or waking of Mt. Etna. The Fox put his problem before the Engineer. . . .

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computers and automation and people

The magazine of the design, applications, and implications of information processing systems — and the pursuit of truth in input, output, and processing, for the benefit of people.

The Profession of Information Engineer and the Pursuit of Truth (continued)

The Golden Trumpet

Computers and Puzzles

NOTICE: The official name of this magazine throughout 1973 is *Computers and Automation.* We expect to change the name officially as of January 1, 1974, to *Computers and People.* During 1973 from time to time, unofficially, and irregularly, we plan to use the name *Computers and Automation and People* as a way of informing our subscribers and readers of the intended change on January 1, 1974.

Front Cover Picture

L. A. Lavigne of South Burlinton, Vt., suffered a stroke in 1971 which left him paralyzed and unable to speak. Four Univ. of Vt. students enabled him to communicate with the world again. The students shown standing are (from the left) Michael E. Grant, Gary Hazard, John C. Lang, and Romaine N. Tomlinson. For more information, see page 40.

Departments

Key

[A] — **Article**
[C] — **Monthly Column**
[E] — **Editorial**
[F] — **Forum**
[G] — **The Golden Trumpet**
[NT] — **Not Technical**
[R] — **Reference Information**
[T] — **Technical**

NOTICE

*D ON YOUR ADDRESS IMPRINT MEANS THAT YOUR SUBSCRIPTION INCLUDES THE COMPUTER DIRECTORY. *N MEANS THAT YOUR PRESENT SUBSCRIPTION DOES NOT INCLUDE THE COMPUTER DIRECTORY.

Burying Facts and Rewriting History

One of the efforts of this magazine is to pursue truth.

One of the ways in which truth is pursued is not to let statements of the utmost importance be buried and forgotten in the pages of daily newspapers, nor unreported and lost because they are no longer well covered in national news magazines.

Among those statements are three of great interest in connection with the Watergate Caper (this phrase is establishmentese for "the Watergate Crime").

- The statement by Bernard L. Barker, one of the convicted operatives, which explains his motivation and background (see November 1972, *Computers and Automation*);
- The statement by Alfred Baldwin, 3rd, ex-FBI agent, an employee of the Republican Committee to Re-elect the President, telling what he did and saw while five men burglarized the Watergate offices of the Democratic National Committee on June 17, 1972, about 2:30 a.m. (see December 1972, *C&A*);
- The statements of Martha Mitchell (wife of former Attorney General John Mitchell) who was molested and who forced her husband to resign and who has continually referred to "dirty politics" (see December 1972, *C&A*).

In addition, we have published five installments of reports on the Watergate Crime by our contributing editor, Richard E. Sprague (a computer professional of 25 years standing) who as an avocation has studied for many years dirty political operations in the United States, including the assassinations by conspiracies (not "lone assassins") of President John F. Kennedy, Senator Robert Kennedy, and Reverend Martin Luther King.

Three years ago in May 1970, when we began to publish this type of article, we could not have spoken confidently of "the assassination by conspiracies" of two Kennedys and one King. But the articles we have published — which are listed and characterized on the following pages — have together a remarkable impact.

Taken together, the information published May 1970 to May 1973 in *Computers and Automation* effectively destroys a large segment of the beliefs, the rewritten history, that the establishment in the United States has arranged for people in the United States to believe. I do not assert that the establishment is a conscious organism or organization; perhaps the best description is this: a loose confederation of overt conspiracies, silent conspiracies, and biased wealthy persons, with very intelligent orchestration stemming from the Pentagon, the Central Intelligence Agency, and the Presidency.

We challenge any fairminded person to read this collection of articles (back copies of *Computers and Automation* should be available in many large public libraries), and after reading them, to still believe that the assassinations are actually the actions of "lone psychopaths," instead of fitting together into a plan to install a certain kind of autocracy in the United States.

This kind of autocracy claims to be democratic, to stand up for "national security," "executive privilege," "separation of Constitutional powers," etc. It offers appearances of democracy, but it seizes the realities of money and power. It cuts programs of social benefit; but it allocates $80 billion a year to be paid to the military-industrial-Pentagon complex.

In the 1940's there was a name for this kind of autocracy. Its name was "fascism," effectively a dictatorship in the interests of big business. What is now appearing in the U.S. is "fascism" in the form of a dictatorship by the military-industrial complex.

Here in a nutshell is an example of the present uneven contest: it takes the form of two sentences in a report by E. Drake Lundell, Jr., in *Computerworld* for April 11, 1973:

- The Antitrust Division of the Justice Department is "outmanned and outgunned" when it comes to prosecuting cases like the current action against IBM, Senate investigators were told last week.
- In addition, witnesses before the Senate Antitrust and Monopoly Subcommittee stated that often the division cannot do its job properly because of political pressure from the White House. . . .

These two statements contain a world of implications.

Essentially, the Department of the United States Government which is charged with enforcing certain U.S. laws against monopoly, can no longer properly function because of (1) the enormous power of just one business, IBM, and (2) political pressure from the White House (this phrase is establishmentese for "President Richard M. Nixon").

We must dig up facts, remember them, and write history the way it is.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

The Watergate Crime

Articles Published in *Computers and Automation* August 1972 to April 1973

Inventory of Titles, Authors, and Summaries

The Watergate Crime consisted of the breaking in of the offices of the National Committee of the Democratic Party, on the 6th floor of the Watergate Office Building, Washington, D.C., and resulting arrests. The forced entry took place around 2:30 a.m., Saturday, June 17; five men were arrested by Washington police. They had with them extensive photographic equipment and electronic surveillance devices, and wore rubber surgical gloves. The five men arrested were:

- James W. McCord; a Lt. Colonel in the U.S. Air Force Reserve; 19 years service with the CIA; head of a security agency; on the payroll of the Committee to Re-elect the President as late as May 31, 1972; an organizer of the CIA for the Bay of Pigs invasion of Cuba in 1961.
- Bernard L. Barker; a Cuban-born Miami business man; long associated with the CIA; he established secret Guatemalan and Nicaraguan invasion bases.
- Frank Fiorini (alias Frank Sturgis, Edward Hamilton); former American marine; soldier of fortune; friend of Jack Anderson; anti-Castro-Cuban organizer; involved in the Bay of Pigs preparations.
- Eugenio R. Martinez (alias Gene Valdes); former CIA agent; real estate agent for Bernard L. Barker in Miami; anti-Castro activist; friend of E. Howard Hunt.
- Virgilio R. Gonzales (alias Raoul Godony); former CIA agent active in the Bay of Pigs affair; anti-Castro activist.

These men were closely connected with:

the Republican Party,
the White House,
President Richard M. Nixon
the Central Intelligence Agency, and
the Committee for Re-Election of the President.

These five men and two more, E. Howard Hunt and G. Gordon Liddy, were tried in the court of Judge Sirica in Washington, D.C., and found guilty.

Political Assassinations in the United States

Articles Published in *Computers and Automation* May 1970 to May 1973

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10 **The Shooting of Governor George C. Wallace, Candidate for President**
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24 **The Assassination of Senator Robert F. Kennedy: Proofs of Conspiracy and of Two Persons Firing**
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English translation of the French newspaper report on José Luis Romero, which was reprinted in French in the December issue.

40 **Why I Distrust the Romero Story**
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26 **Analysis of the Autopsy on President John F. Kennedy, and the Impossibility of the Warren Commission's "Lone Assassin" Conclusion**
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How the U.S. National Security Agency intercepts, decodes, and understands almost all secret and top secret electronic communications and signals of all nations all over the world.

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31 **U. S. Electronic Espionage: A Memoir — Part 2**
by *Ramparts,* Berkeley, Calif.
How the National Security Agency intercepted and decoded enemy messages in order to direct bombing strikes in Viet Nam, and often failed; and how the hideousness of what the American military forces were doing in Southeast Asia finally led this interviewee to resigning and terminating.

April, May 1973

34 **The New Orleans Portion of the Conspiracy to Assassinate President John F. Kennedy — Four Articles:**
(1) by Edmund C. Berkeley, in the April issue; (2) by Jim Garrison, in the April issue; (3) by F. Irving Dymond, in the May issue; (4) by Jim Garrison, in the May issue
On November 20, 1972, the Supreme Court of the United States refused to permit Jim Garrison, District Attorney, New Orleans, to prosecute Clay Shaw for perjury. On November 21, Jim Garrison issued a statement commenting on this refusal, which is Article 4 of this set; Article 1 is an introduction; Articles 2 and 3 are opening statements to the trial jury, by Jim Garrison, Prosecutor, and F. Irving Dymond, attorney for the defendant, in the February 1969 trial of Clay Shaw in New Orleans; Clay Shaw was charged by the grand jury with "having conspired with David W. Ferrie and Lee Harvey Oswald to murder President John F. Kennedy" — in regard to which the trial jury found Clay Shaw "not guilty".

The Evolution of Man-Computer Symbiosis

C. J. Testa
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"User instructions for interacting with the computer are often difficult and complex. In most cases, the user is a manager with little or no computer experience. If he cannot easily interact with the computer, he may not interact at all."

In a seminal paper on man-computer symbiosis, Licklider (1960) described the expected development of a cooperative interaction between men and computers. He viewed this symbiosis as occuring somewhere on a continuum between "mechanically extended man" and "artificial intelligence". A major objective of his argument was to have man and computer closely interact in the problem-solving sequence.

Human-factors handbooks list various capabilities which make humans essential in the problem-solving environment. These include the ability to: project missing information from experience; perceive pattern in a situation; develop hypotheses about cause-effect relationships; make probability estimates of conditions; optimize on uncertain criteria and objectives; and generalize from one context of events to another.

Thus, man is uniquely suited to set goals, formulate hypotheses, develop models, define criteria, and evaluate results. On the other hand, computers can be used to convert hypotheses into models for testing, perform simulations, and display results. The integration of these capabilities should lead to better system performance.

Licklider listed certain prerequisites which he believed were essential to the development of this symbiotic relationship. Among these prerequisites were the following: time-sharing systems for more efficient and economical computer operation; increased memory hardware capability; language for easy communication with the machine; and input/output equipment other than electric typewriters (visual and audio).

It is interesting to note that in spite of the fact that these broad prerequisites have been met, advancement of the symbiotic concept has indeed been limited. What are some potential reasons for this lack of advancement? First, the frequent occurence of response delays in time-sharing systems can be disruptive to problem solving. Miller (1968) estimated that delays of approximately 15 seconds cause deteriorated performance in problem-solving situations. Second, user instructions for interacting with the computer are often difficult and complex. In most cases, the user is a manager with little or no computer experience. If he cannot easily interact with the computer, he may not interact at all. Finally, although other input/output modes have been demonstrated in research applications, the major device in practical applications remains the teletypewriter. Since the user may not be a typist, he will have to develop some "skill" to interact with the computer.

Charles J. Testa is an assistant professor in the Information Systems Management Department at the University of Maryland, College Park, Md. He received a B.S. from Lafayette College in 1964, a M.S. in business administration from U.C.L.A. in 1966, and a Ph.D. in biotechnology from U.C.L.A. in 1969. After serving as a member of the technical staff at BELLCOM for one year, he joined the faculty at the University of Maryland where he has worked on curriculum and course development in information systems management. He is a member of the Human Factors Society and the Association for Computing Machinery.

Time-Sharing vs. Batch Systems

In recent years the concept of man-computer interaction has almost been synonymous with online, multi-access, time-sharing computer systems. For purposes of the discussion which follows, an online system is defined as one with direct access to the central processing unit of the computer. This capability permits managers to query the system for "immediate" responses to questions. A batch system is defined as one which requires submission of jobs to a particular site and a varying amount of time (turnaround) to receive output.

A major topic of investigation in recent years has been the comparison of human performance in a time-sharing (online) environment versus a batch environment. Studies by Grant and Sackman (1967) and Erikson (1966) support the contention that debugging language is the main reason that online data processing involves less man-hours than batch. Grant and Sackman, however, attribute differences in online vs. batch performance to turnaround time, i.e., if turnaround time is decreased, differences tend to disappear. Erikson, on the other hand, suggests that the interactive mode itself is a factor since batch users can utilize waiting time by working on program bugs. One of the main findings of both studies was the very large individual differences between subjects regardless of whether the sample population was experienced programmers or trainees.

With the recent development of fast batch processing, both conventional and remote, the interactive distinction may not be as critical. A study by Adams and Cohen (1969) compared subject performance in a programming course on time-sharing and "instant" batch systems. Although students expressed a subjective preference for the instant batch mode, there were no significant performance differences between methods. This unusual preference may be explained by the slow terminal response and frequent busy signals experienced by subjects on the time-sharing system. As in the previous studies, the main finding was the large individual differences between subjects; this led to the conclusion that a good programmer was more important than the mode of operation.

Problems in Comparing Studies

It is difficult to make comparisons among reported studies because of differences in computer systems, programming languages, and user's experience and capability. Computer systems vary from small machines such as the PDP-8 to large machines such as the IBM/370 or UNIVAC-1108. Each of these machines is characterized by certain distinct hardware features which affect response time and which make comparison difficult. In a previously described study, Adams and Cohen defined "instant" batch processing as requiring from a few seconds to 10 or 15 minutes for short jobs. Variability in time-sharing response is not as unfavorable but delays do range from a few seconds to minutes depending on the system load. It is not certain what effect these variable delays have on human performance. Users are annoyed by unpredictable system response time, but one cannot conclude that a reduction in system response time will necessarily improve human performance. In fact, Simon (1966) contends that a standard or consistent response time is more important than immediacy of response.

Another problem area has been the lack of applied research to investigate the comparative effectiveness of different general purpose languages such as FORTRAN, COBOL, and PL/1. The scope of these languages is constantly increasing so that almost any programming task can be accomplished using these high-level languages. The FORTRAN programming language is used primarily for solving mathematical or scientific problems while COBOL is used for processing large volumes of business data. The PL/1 language is reputed to be capable of handling both scientific and business problems and thus, probably has the broadest scope.

Few studies have investigated the utility to users of specific language features. As a result, the following questions naturally arise: 1) how difficult is it to learn a particular language? 2) is an English-like quality desirable? 3) how adjustable is the language to the experience of different users? 4) what criteria should be used to evaluate languages? and 5) how efficient are the coded programs?

In order to examine some of these questions, my comments will be limited to the COBOL language. The organization of COBOL results in its being easy to learn and understand. Thus, it is very useful for both man-to-man and man-to-machine communications. Because of COBOL's narrative nature and English-like syntax, a certain amount of documentation is inherent. Generally, the quality and quantity of documentation produced by the use of COBOL is superior to that of other languages. This is very important for the maintenance and revision of programs. COBOL is a language for programmers. While it is not intended to be used by people unfamiliar with computers, it can be used by systems designers who are oriented to applications.

The preceding features have been used to justify the adoption of COBOL in particular processing environments. A familiar criticism of COBOL was expressed by Moressi (1967) who claimed that COBOL was incapable of translation into efficient computer code. It is true that certain COBOL elements contribute to inefficiency. However, a programmer can consciously and consistently strive to write efficient COBOL programs by adhering to guidelines such as: 1) minimize the number of READ and WRITE statements; 2) denote items used in arithmetic operations as usage computational not display; 3) avoid use of the rounded and size error options, if possible; 4) limit the use of GO TO and IF statements, utilize PERFORM; and 5) avoid use of verbs such as DISPLAY, EXHIBIT, etc. except for debugging purposes.

In a related study using a time-shared system, Jutila and Baram (1971) found that the choice of programming language had a significant effect on the user's learning rate for a particular type of problem solving application. Turnaround time at the terminal was significantly lower for those users coding in BASIC rather than FORTRAN. Surprisingly, factors such as previous programming experience, instructor, grade point average, and typing experience were not significant. Since the problem-solving tasks were not described, one may question whether or not the tasks were too simple to be discriminating. From this summary of results, it seems clear that performance standards must be developed before any meaningful comparative evaluation can result.

User Differences

In the final analysis, however, the major problems will be caused by the vast differences that exist in user experience and capability. As pointed out by Nickerson et al (1968), novices prefer instructional assistance from the computer and detailed error diagnostics. On the other hand, experienced users prefer abbreviated commands and coded messages. These differences will have a major impact on the training programs developed to assist users in implementing complex systems.

Large individual differences between subjects are reported in the reviewed studies, and these differences focus on the potential benefit of developing a preliminary screening tool to equalize subject "ability" before experimentation. If valid results are to be attained in future man-computer experiments, the differences which have been described (computer systems, languages, etc.) must be controlled.

Programmer Aptitude Tests

Many organizations throughout the country use aptitude tests to screen computer programmer applicants. The results of these tests are claimed to be valid and reliable indicators of programmer potential.

Among the most popular tests are the IBM aptitude test for programmer personnel (ATPP), the computer programmer aptitude battery (CPAB) developed by Science Research Associates (SRA), and a test battery developed by Rigney et al at the University of Southern California. These tests all utilize number series, arithmetic reasoning, geometric figures, etc. as measures of programmer aptitude.

In a recent study conducted by Testa (1973), the author attempted to find a predictor which would have a logical relationship to programmer aptitude. An analysis of the programming task revealed perceptual and cognitive factors which seemed related to Witkin's (1962) concept of perceptual style. Programming requires an ability to perceive the whole and a concomitant ability to proceed from the general to the particular. After conducting numerous studies, Witkin concluded that a person's manner of

(please turn to page 39)

Good Management of Computer Operations :

1. Finishing the Software Job: There Must Be a Better Way

2. Data Communications: Solving the Puzzle is Possible

ADL Systems, Inc.
A Subsidiary of Arthur D. Little, Inc.
Acorn Park
Cambridge, Mass. 02140

1. Finishing the Software Job: There Must Be a Better Way

Finishing the Software Job

"*...All of the big problems seem to surface after 90 per cent of the job is supposed to have been done.*"

With that statement, the vice president of one of the nation's largest commercial banks came to grips with the most difficult task in software development – getting the job done.

For as long as computer users have built software, they have lamented their inability to achieve that final ten per cent that means project completion.

There are, of course, no easy ways to reach completion milestones in major systems projects. It takes sound planning, hard work, and the commitment of good people. But even with those factors working for you, reaching the final goal of fully operational software systems is a real challenge.

But it is a challenge that can be met, especially if management is alert, early in the life of a project, to the "telltales" that signal danger. By acting on these early warning signs as they appear, the likelihood of finishing the job on schedule and on budget is greatly enhanced.

What are some of these telltales? They can be classified, for memorability, by their most glaring attribute. In our experience, the presence of any one of these conditions on a major development program will spell tail-end trouble. So be wary of:

The Slippery Specification

Every software project begins with a set of specifications, which is simply a detailed statement of the requirements to be met by the project. If it doesn't, then that already portends labor problems.

If minor and major specifications continue to change, and user departments continue to "evolve their needs" after work has begun, there is little chance of satisfactory or timely completion. The rippling effect that small changes create over an entire project is probably the most common cause of delays. And yet this insidious practice is considered, by many software developers, as a preferred method of project management.

They theorize that systems that develop in small incremental steps permit greater project control, firmer measurement guidelines and the flexibility to introduce the newest concepts at various stages of project development. The fallacy of that theory, verified time and again in cases we have participated in over the past decade, is that control, measurement and the freedom to introduce new techniques are in fact seriously impaired in direct relation to the number of specification changes initiated.

A preferred approach is to plan systems efforts in major steps, during which design specifications are frozen. Each step should be equivalent to a significant and free-standing segment of the total project. Important changes or additions can be accumulated in parallel with the work effort, and designed into successive stages after each major milestone is accomplished. In this manner, the desired control, measurement and improvement requirements can be met in orderly fashion.

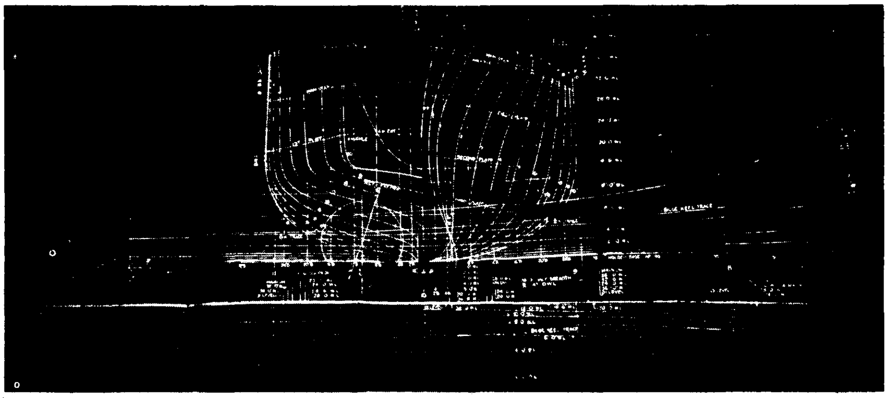
The analogy to this recommended approach is the aerospace industry, in which modifications are introduced by generations, thus assuring consistent progress. The slippery specification must be made to conform to an engineering discipline, rather than an evolving art form.

Excessive Confidence

Because of the complexity of large systems projects, there is a high probability that many problems, unforeseen obstacles, and delays will occur. In fact, it is rare that a project does not encounter at least one or two major crises during its development. Time and again we have seen it demonstrated that: "If it can happen, it will..."

While this truism is known to every experienced systems designer, it is still common to see systems scheduling, staffing, budgeting and resource allocations that represent the height of optimism. Such confidence is rarely justified, and its predictable consequence is major budget overrun, disenchantment of the user department, management and the technical staff, and often hastily drawn compromises that fall far short of the original design goals.

Avoid excessive confidence by building in appropriate cushions during the initial design phase. If you insist that this is done as a routine condition of planning your software projects, you



will quickly discover that the confidence level will reach new and justified heights.

The Missing Manager

A general management precept, and one that applies particularly to software development projects, is: "If the senior manager doesn't know fully the status of the project, then he has every right to expect it to fail."

This rule-of-thumb fits software projects in two ways. The first and most obvious is that the senior responsible executive must exercise management control by being informed and interested in the progress of each project. This is easier said than done, because for reasons of management span and "the buzzword gap" senior management is often dissociated from the actual conditions of each project.

Yet, despite the pain of having to confront and understand such cataclysms as "We had a B37 ABEND in our new job set up," the precept of involvement from the top must apply.

The second and perhaps most dangerous application of that old saw is at the project management level. The project manager is and should be an executive fully knowledgeable in the details of the task to be done, with sufficient authority to get it done. Most computer sites have personnel qualified for such tasks. Invariably, however, project managers are assigned to direct major efforts on a part-time basis. This easily correctable problem is a major cause of project failure, and yet it persists throughout computer sites around the world. Missing managers cannot manage. And since control of a complex project is always more than a part-time job, personnel assignments should be made accordingly.

The Last-Minute Test Plan

A component of every software project is a test plan. The purpose of these plans is to enable program developers to fully exercise, debug and tune up system components before they are integrated into the final production system.

Very often, plans for testing are built into the latter phases of a project, which is too late in terms of discovering the myriad of little problems that cause aggravating delays and overruns.

It is common to find major systems well into their development, yet lacking in such simple features as restart or rerun facilities, intermediate methods of output, adequate formatting and carefully designed diagnostic routines to spot programming flaws.

It is relatively simple to avoid such problems by building into a systems plan adequate time, progressive documentation of work accomplished, and easy-to-attain standards for testing each component of work as it is completed.

Last-minute testing will guarantee that the last ten per cent of the job will be tough to finish.

The "Lack of Resources" Excuse

Every software developer knows that, in the priorities of his computer center, production work always takes precedence over development work. In fact, this excuse prevails today as one of the biggest barriers to getting new projects finished.

"Our test time was bumped by the monthly bill of materials update" is a frequent complaint of development programmers. And often it is a valid one.

Senior managers should insure that every new software project has assigned to it the proper equipment resources to complement the financial and personnel resources. Lack of computer time to test programs and experiment with file organization, diagnostics and other programming techniques wastes time and money, and for little reason.

In addition, there is a tendency for designers to build systems that require more memory, or more disk drives, or more peripherals and terminals than are presently on site. If budgets don't permit additional hardware, then the system must be redesigned. If budgetary funds are available, they often must clear a long approval cycle. In either case, the undesirable effect is project delay.

Insist that your development teams work within the resources available—and make sure they have access to those resources to get their jobs done.

The final ten per cent will always be difficult to achieve. But if you plan through these "telltales," you'll reach it much more efficiently.

2. Data Communications: Solving the Puzzle is Possible

"Data communications is like a jigsaw puzzle which changes before your eyes. Lots of subtle parts that are tough to piece together, with new ones coming all the time."

That view of one of the fastest-growing functions in information processing is shared by many senior executives with whom we talk.

With costs decreasing and hardware, software and people better able to handle the technology, data communications is fast becoming a key element in information systems.

Data communications provides more immediate access to information in files and permits immediate updating, thereby reducing—or eliminating—the cycle time in information processing and related business operations. Through immediate and selective access, data communications also makes possible one of the fundamental goals of modern information systems—to provide the information which is needed just when it is needed.

Yet data communications is a complex technology, often more complicated than the central computer facility. In this issue of *The Casebook*, we will stake out the broad parameters and present some of the principal functional considerations and trade-offs faced by communications systems designers in an effort to make that jigsaw puzzle a little more understandable.

What It's All About?

As we will discuss it, data communications deals with the transmission of (digital) data between a computer and some other device (another computer or one or more terminals) over a link such as a telephone line.

That loose definition appears to emphasize the transmission link, or communications path, as the new element to consider. Data communications actually involves much more. Figure 1 illustrates the eight major components of a typical data communications network. It is the interaction among these components in a manner that assures efficient utilization, control and message reliability that introduces the complexity.

Creativity Can Cut Costs

Within this network structure, for example, many functional design alternatives are possible, with a range of hardware and software options. And these options are further complicated since most networks are put together with products and services from a number of suppliers. Add to this the host of network considerations—from line noise problems to message routing and priority processing—and one begins to appreciate the intricacy of these systems.

The costs of the data communications system relative to the central site equipment can vary widely depending upon the application and general processing mix. But it can be great or even greater than the central site costs. Even more important is the effect of design decisions. Quite frequently systems of comparable cost can differ greatly in capacity, reliability and responsiveness.

Define Performance Goals, Then Architecture

What Are The Design Considerations?

Whether you are developing a new communications system or modifying an existing one, there are two basic questions to answer: What performance do you want from the system, and what architecture is required to do the job?

This seemingly obvious approach to problem-solving is made complex by the number of elements to consider, and by the fact that variation of one element will affect the performance of all others.

Moreover, data transmission over common carrier lines is not precisely controllable. Although engineered to certain standards, the performance of circuits will vary from circuit to circuit and with time, depending upon particular cables, the routing used, and the transient behavior of devices such as repeaters and switching equipment, many of which were designed and installed long before data communications was even known.

Furthermore, a user has no control over the operation of the common carrier line. Consequently, considerable design effort is devoted to compensating for the uncontrollable variability of common carrier performance.

In defining performance standards and architecture, it is necessary to isolate the major factors affecting the system and deal with each separately. We can classify these into five groups:

- ☐ FUNCTIONAL DESIGN—defines the qualitative and quantitative aspects of the system. What types of messages are required? What is their number? Length? Variability? Service characteristics, such as response time and operating duration? What message pattern—i.e., peaking?
- ☐ NETWORK DESIGN—defines the basic modes of communication, the flow of data, and the connection of the various devices. What data path is proper? What form of message routing? With what degree of security? How much simultaneity of transmission, and from how many points?
- ☐ RELIABILITY DESIGN—relates to the degree of error tolerance to be built into the system. How much error detection? And correction? How much automatic retransmission? Line testing? Restart features? Checkpoints to maintain data integrity? What levels of partial or total systems failure is acceptable? With what back-up provisions?
- ☐ HARDWARE DESIGN—The nature, type and number of hardware components must be dealt with—from the central computer facility to the terminals, modems, concentrators, front-end devices and even such units as line testing equipment.
- ☐ CONTROL SOFTWARE DESIGN—relates to the central processor functions in the system, which can include message analysis, buffering and queuing, scheduling (or dispatching) for internal processing, and support capabilities such as restarts, and controlled slowdown in case of overloads.

Underlying all of these questions, of course, is the matter of cost. How much is any component worth, and what return-on-investment tradeoffs are tolerable?

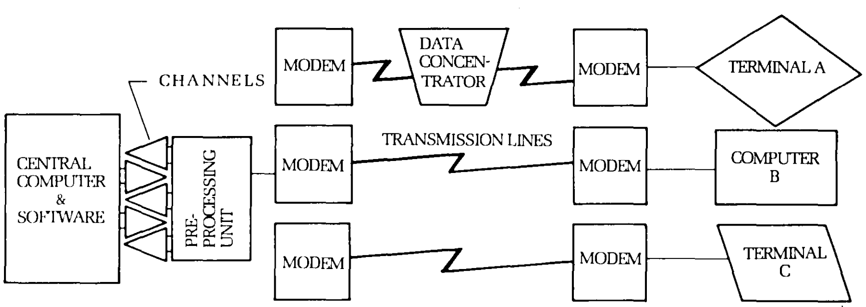


Figure 1. Typical Data Communications Network

A typical data communications system consists of up to eight elements, including the central computer and its associated communications control *software*, and *channels* through which data passes to and from it, the controller or *front-end device* used to organize data for transmission or processing, *modems* that convert data signals to appropriate communications formats, the *transmission lines* themselves, and the *terminals* which originate or receive information. In larger systems, some form of remote *data concentrator*, or controller, may also be present.

Let's Look At The Network

In a data communications system, the network presents some of the critical design problems, and yet we find that it is this aspect which is least generally appreciated by data processing management. And so we will look at this aspect in more detail, covering other items, such as the terminals and control software, in a later issue.

Figure 2 presents a simplified list of some major elements of line and network design and their basic meanings. Each of these has important implications and the effort spent in seeking ways to optimize them can return superior performance at large cost savings.

For example, a major distributor recently went through a communications system redesign—from a dedicated to a dial up system—in order to take advantage of a new WATS network being installed for regular voice traffic. Although the redesign was costly, the continued savings from after-hours data communication using the WATS lines will be very substantial. Such resource-sharing potentials can, with some imagination and investigation, be found in most computer-using organizations.

The ability to optimize hardware by adding certain features to software is another important optimization technique.

The choice of modem, for example, offers a good illustration of this principle. The modem determines the speed at which data is sent over the line. Better quality modems (which are expensive in a large network) make it possible to send data at high speeds over lines rated at a low speed—some operate at 3,600, 4,800 or even 9,600 baud on a line rated for 2,400 baud. By spending more on modems, one can significantly increase the data transmission capacity of his network (since capacity is the product of line speed and time).

However, the same result often can be achieved by some simple software routines which pick up and react to error signals from much lower-cost modems. The effect is a considerable hardware savings for a very low-cost, one-time programming task.

Software can often help solve signal distortion problems inherent in communications links. Using software to monitor, analyze and control transmission problems not only adds to network resiliency and reliability, but can also help reduce the costs of line conditioning, retransmission and special engineering.

Communications tariffs are a jungle of complexity, but efforts spent in understanding them can produce significant cost savings. Network designers can save substantially by using low-cost interstate routes rather than more expensive intrastate circuits.

For instance, with a central site and 12 terminal points in New York City and 2 terminal points in Philadelphia, it is more economical to run two circuits, with each circuit going to one of the points in Philadelphia and picking up six of the points in New York, than to run one circuit to Philadelphia and one to New York.

In designing a data communications system, it is essential to anticipate operating problems with the network. For instance, it is quite common for noise or distortion to occur, which can interfere with transmission for a period ranging from seconds to hours. Often it is not possible to identify the cause of such disruptions and it is necessary for the data communications system to be able to recover from such problems.

For instance, it may be necessary to remove a terminal from the polling sequence for awhile, or to be able to backup and retransmit a particular block of data. The detection, analysis, and hardware-software procedures to cope with such problems are a major fraction of the design and development of a smoothly functioning data communications system.

These are just a few design tradeoffs. But they serve to demonstrate the most important fact in communications systems development: informed involvement is the only way to understand, plan and develop such systems.

To help that learning process, future issues of *The Casebook* will discuss other aspects of data communications design.

It may still be a puzzle, but it is one that can be solved.

Network Tradeoff Checklist

What kind of data communications network do you need? Here are just a few of the design trade-offs you must consider:

☐ LOCAL OR REMOTE
Does the interconnection require short (1000-foot) cable or use of a common carrier such as the telephone system?

☐ DEDICATED OR DIAL-UP
Dedicated implies use of leased lines on a permanent basis with a fixed cost while dial-up requires telephone calling on the public network on an as-needed basis, with costs depending on usage.

☐ BATCH OR INTERACTIVE
Batch suggests one-way transmission of a volume of data, while interactive is quick response two-way communication.

☐ HIGH-SPEED OR LOW-SPEED
Baud rate is the rate at which digital bits of information, together with control bits, are sent over a line. They range from 100 baud to 50,000 baud (bits per second).

☐ SIX-, SEVEN- OR EIGHT-BIT CODE
Data characters can be formed in any of these bit lengths. Six-bit is Teletype code, seven-bit is ASCII, and 8-bit is EBCDIC

☐ SYNCHRONOUS OR ASYNCHRONOUS
This is the transmission mode, in which pulses (bits) are sent in either a regular or irregular pattern over the network. Bisynchronous is a form of synchronous transmission which provides additional control capabilities.

☐ POLLED OR INTERRUPT
A message is sent in response to a poll, or command, from a central site, or it is initiated by a remote site which interrupts the system to transmit.

☐ DUPLEX OR HALF-DUPLEX
Two types of telephone lines available, a full duplex which enables messages to be sent in both directions simultaneously, and half-duplex which permits only one-way transmission.

☐ CONDITIONED OR REGULAR
Conditioned lines, available on dedicated circuits, improve transmission speeds and reliability.

☐ CONCENTRATE OR DIRECT
Data concentrators (also called multiplexers) consolidate several low-speed lines into one high-speed transmission from a remote point. Consolidation may be achieved by interspersing information (time division multiplexing) or by overlaying frequencies (frequency division multiplexing).

☐ ROUTING: MANY WAYS TO GO
Innumerable options are open in terms of network paths, with important cost implications, including multi-drop lines.

☐ MODEMS: SIMPLE OR POWERFUL
Modems (modulators/demodulators) convert digital data to the analog signals which move along transmission lines, and transform them back to digital data at the receiving end. Modems determine speed, and can affect error checking also. Many versions are available. ☐

PROTEST: A Language for Testing

M. H. Gill
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"Because the writer of the test specification does not have to concern himself with the idiosyncrasies of the test equipment used, he is able to concentrate his attention on the equipment to be tested. This leads to immediate and obvious advantages."

Introduction

Background

The operation of an automatic test equipment is controlled by a set of instruction codes which are unique to the equipment type. Experience shows that it is only the equipment specialist who becomes fluent in the use of this set of codes or language.

Within any large international organization many different automatic test equipments are in use, each with its own specialists. This diversity of test routine languages, which are difficult to understand, can lead to the isolation of the various test groups. Under these circumstances it is not possible to exchange test data thus adding to the difficulties of manufacture. Nor is it possible to compare the test routines written by different groups for testing similar equipments. In consequence test methods for essentially similar products may be widely divergent.

With these difficulties in mind, several interested houses of ITTE came together with the intention of defining a common test language suited to the particular needs of switching systems. At this time a similar exercise was being undertaken by the American Aviation Industry. It was decided to define a separate language for the needs of ITT because the time scale envisaged by the American project was too extended.

Choice of Language

The test language which was eventually agreed upon by all parties was called PROTEST. This is a high level language for defining and communicating test specifications.

Using this language, specifications are written in a form that is entirely independent of the test equipment to be used. Such independence allows the test specifications to be written in a way that is easily understood by test personnel. Also, because the writer of the test specification does not have to concern himself with the idiosyncrasies of the test equipment used, he is able to concentrate his attention on the equipment to be tested. This leads to immediate and obvious advantages.

Productivity

When the engineer uses a language that is easy to read and understand, he writes fast. The tests make sense as they are written, so mistakes are reduced. During proving trials the tests are easy to follow and therefore to correct if necessary.

Experience has shown that using a high level language, a reduction of 40 to 50 percent is achieved in the time taken to write test routines. The full PROTEST language has advanced features which should enable this to be further improved.

Because the routine is a readable document the rework section of the production line will function more effectively. This will reduce the time taken for testing and contribute directly to efficiency.

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Michael Howard Gill was born in 1938. He obtained his BEng in 1962 at Liverpool University. He then spent a year in the department of communication at Imperial College, London, and was awarded a DIC. In 1963 he joined GEC Hirst Research Center as a research engineer working on storage devices for use in telephone switching control.

Mr Gill joined Standard Telephones and Cables in 1966, where he worked on computer aided design. In 1968 he transferred to Standard Telecommunication Laboratories as a research engineer working on the automatic layout of printed boards. He is now a project leader working on software aspects of automatic test languages.

Understanding

PROTEST is based on English and uses terms easily recognized by all engineers. The layout of the statements is simple and easy to understand. This understanding is a considerable aid in the writing and control of test routines. Also, because the tests are written in a comprehensible form, management is able to review, at the time they are generated, both the tests themselves, and the test philosophy being used by the test routine writer. This is very difficult to do when the test itself is written in a form that can be understood only by the expert test routine writer.

This understanding also aids the maintenance and improvement of existing test routines which no longer have to be done by the original test routine writer, nor, as is the case at present with some companies, the original designer of the test equipment. Using the new language, anyone with an elementary knowledge of the subject and an understanding of the comments, may correct and improve an existing test routine, and it will be apparent to everyone involved what has been done.

Interchangeability

Test routines written in the language may be interchanged either between test equipments of different types or between variations of the same type. The interchange may also be between companies, because the routines are written in a standardized form. Interchange between test equipments is possible because the computer program accepts PROTEST as a standard input language, and from it generates appropriate instructions for each test equipment.

Interchangeability is useful where production is moved from one ITTE house to another, or when, within one house, standby test equipment is being used because of the failure of the first line equipment, or when the test equipment used in a repair section is perhaps slower or differs from the test equipment used by outgoing inspection. Interchangeability between test equipments that are variants of the same basic equipment is an extremely useful facility required by companies who wish to update their existing test equipment because of design changes or improved versions of the test equipment.

At present the latter is difficult to achieve because of the large investment which has been made in test routines written in machine dependent language, which can only be understood by the designers of the original test equipment. Thus, if a test equipment is improved, expensive and scarce manpower has to be used to alter the existing test routines. However, using the PROTEST high level language approach, all that is necessary to keep in step with the hardware change is for the compiler to be changed to generate new test instructions. When the compiler has been changed to cater for the new version of the test equipment, then test routines can be produced automatically because the original input is still valid, and will still produce tests which are functionally the same.

Language Structure

General

The PROTEST language is used by test engineers to write down details of a test specification. The details are written as statements on specially designed forms. These are then passed to a punching room for transcription to, for example, punched cards or tape. This is then input to the computer operating the software programs, checked for errors, and reprocessed until it is error free.

When all the errors have been cleared from the statements, the compiler program within the computer decides what each statement means and how it is to be performed on the test equipment. The program then produces a tape which drives the test equipment. The test routine must now be checked against the unit under test to ensure that it accepts only "good" units and rejects all "bad" units. Il faults are found in the routine at this stage, the original is modified accordingly and a new test tape produced. Figure 1 shows the preparation of a routine and its use to test a unit.

If the test is to be performed by a different test equipment, only part of the compiler program has to be changed.

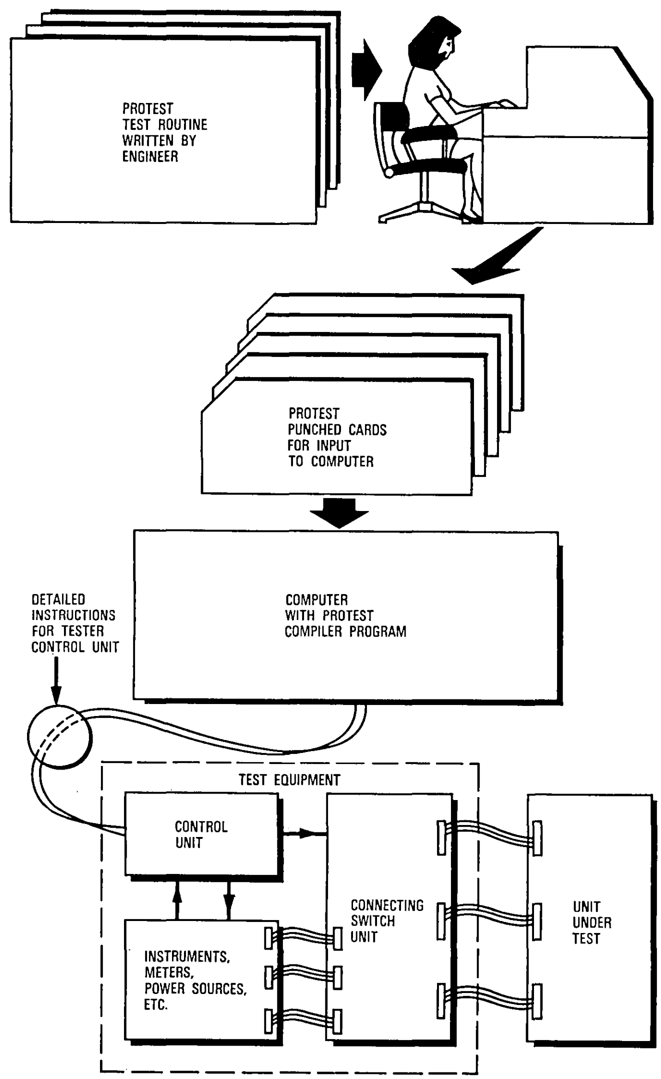
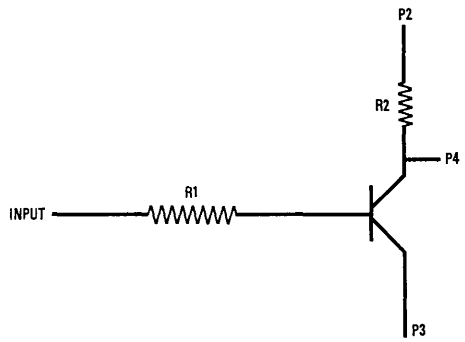


Figure 1 - A block diagram of PROTEST equipment.



1	SEQ	—	—	—	N61J	PJP1	—	—	—
2	CON	12 V	P2	P3	8261	P48P	8262	P48P	88J1
					P54P	81J3	P54P	L98P	2P3J
					50P1	3JJ2	P1P1	—	—
3	CON	2 V	INPUT	P3	8241	P48P	8821	P48P	8846
					P48P	L98P	2P38	5086	P2JJ
4	READ	1V/1·5 V	P4	P3	9PJ1	P54P	JPL1	P54P	82P2
					P48P	2P5P	4NP1	P1P8	—
					N8JJ	2J11	N9JJ	2J31	—
5	ACT	—	—	—	L7P1	2PK6	2161	—	—

Figure 2 - A PROTEST sequence forming part of a test routine for a simple circuit.

It has to be noted that the compiler might either be in the computer controlling the test equipment (computer controlled tester) or in a separate computer if this is more convenient.

Operators

Each statement contains a meaningful word known as an operator. For example, to make a connection we use the operator CON and to take a reading we use the operator READ. Each operator is followed by a suitable parameter. For example, CON 12 V would be a command to connect twelve volts, or READ 1 V/2 V means read a voltage and signal a failure if the value is not between these limits. Following the value we write the names of the pins on the unit under test which are to be used for the connection or where values are to be measured. Some operators require no additional information, for example the Operator SEQ which signals the start of a new test sequence.

In PROTEST a statement is comparable to a sentence. Figure 2 shows 5 statements. These form a sequence which is part of a test routine for the simple circuit shown. Here power is to be connected between pins P2 and P3, a driving signal is to be connected to the input, and the output on pin P4 measured and checked against acceptable limits.

The last statement of the sequence is an ACT statement. When this command is received the devices are connected to the unit under test, and allowed time to settle. The measurement or measurements are then taken and the limits checked. Any failures detected are recorded by the test equipment.

The machine code required to implement this sequence on the tester is also shown. The detail of this code is not important but it amply demonstrates the difficulty of attempting to control a universal test system using anything other than a high level language.

The second example shown in Table 1 demonstrates one of the shorthand facilities available to the writer of PROTEST routines. Here it is necessary to confirm that no pin from a given list is connected to earth and if this condition does not hold then to identify the faulty pin.

Having defined the list the routine writer needs to write only 4 statements in the language to carry out this routine. The output from the compiler is now in two parts: the machine language to operate the test equipment and an expanded output as shown in Table 1. For the troubleshooter in the production test area the compressed format of the compiler input can be a liability since the test equipment gives him only the identity of the failed sequence. However armed with this information he refers to the fully expanded test specification from the compiler as shown in Table 1 to discover the significance of the failed test.

Other operators which simplify the task of the routine writer are shown in Table 2. This table also shows a selection of the basic operators available.

Keywords

If during manufacture, the circuit of Figure 2 has been assembled with the wrong resistor values, the test as it is written could destroy a perfectly good transistor. One way in which this can be prevented is to limit the current supplied by the 12-volt supply. Statement 2 in Figure 2 would then become

CN 12 V/IMAX = 100 MA   P2   P3.

This statement exemplifies the use of the keyword feature, in this case the keyword "IMAX=". Such key-

Table 1 – Compiler input and outputs

PROTEST language

```
L1  LIST    P1/P2............/P100
    GEN     P=L1
    READ    1MR/INF          P     EARTH
    ACT
    GENEND
```

Compiler

Expanded PROTEST language

```
SEQ
READ   1MR/INF   P1     EARTH
ACT
SEQ
READ   1MR/INF   P2     EARTH
ACT
•
•
•
•
SEQ
READ   1MR/INF   P100   EARTH
ACT
```

machine language for test equipment

Table 2 – Some typical operators

Operator	Function
General Test Operators	
SEQ	Marks the start of a new test sequence.
CON	Connects a test bay stimulus device to the unit under test.
READ	Measures a value and checks that it lies between specified limits.
ACT	Marks the end of the test sequence specification and starts the test hardware performing the required actions.
WAIT	Delays the action of all operators which follow.
CYCLE	Marks the start of a new cycle of test sequences.
PRINT	Causes test hardware to print a message.
Branching Operators	
IF	Conditional branch. Condition is the success or failure of the test sequence.
GOCYCL	Unconditional branch to a cycle operator.
General Assistance Operators	
CALL	Obtains a subroutine from the library, passes the necessary values to the subroutine and performs the tests which result.
LIST	Allows a name to be given to a string of pin names.
PARAM	The parameters which specify some test conditions are very complex and are used many times in a test routine. The operator allows a name to be given to such a list and this name is used in place of the list.
EQUATE	Relates PIN names on the plug of the unit to user names which may be more convenient for the routine writer. Either may then be used in the routine.

Keywords

The PROTEST language allows the user to specify values in any of the units generally used by engineers. In most tests simple values are sufficient. Typical entries would be 12V, 10KR or 100NS. However values in some test steps require further clarification, this is achieved by the use of keywords. A typical selection is shown below.

Keyword	Function
IMAX=value	Defines the cut-off current for an applied voltage.
FREQ=value	Defines the frequency of an alternating current or pulse waveform.
AMPL=value	Defines the amplitude of a pulse.
RISE=value	Defines the rise time of a waveform.
WIDTH=value	Defines the width of a pulse.
LEVEL=value	Defines the value of an applied logic signal.
GT=value	Defines the value which a received logic signal must exceed to be acceptable.
TYPE=rise, width, et cetera	Defines the type of measurement being performed during a waveform analysis.

words are a powerful and useful feature of PROTEST. Some of the currently available keywords are also shown in Table 2.

A sequence is the smallest part of a test routine that gives rise to a GO/NO GO decision by the test equipment. Sequences are grouped into cycles for the convenience of routine writing and also for the convenience of repair work.

Connections usually exist only for the duration of the sequence in which they are specified, this relieves the routine writer of the chore of specifying disconnection. However, this rule can be easily changed by the writer for those connections which he wishes to maintain.

PROTEST Compiler

As mentioned above, the test specification, as written by the test engineer, has to be translated into a set of instructions which drive the test hardware. This translating operation is performed by a computer program called the compiler.

At present there are many different types of test equipment being produced and offered on the market. The varying needs of a large company will dictate the use of different equipments for different testing requirements. In addition, advances in technology will lead to more advanced test equipments and in this way further increase the variety of equipments in use.

It would, of course, be prohibitively expensive to develop a completely new compiler for each of these test systems. However it has proved possible to construct the compiler as two separate programs. The first is concerned with the PROTEST language and does not vary for different machines. The second program has a structure which is designed to be easily adaptable to the variations of different test equipments.

The first program checks each language statement for self consistency and correct usage. These checks principally involve checking that the syntax of the statement agrees with the requirements of the operator specified. A check is also made to ensure that the operators, parameters, and keywords specified belong to the subset of the language being used.

In addition all pin names are checked to see if they exist, and the information which relates a pin name to a particular outlet of the test equipment is found automatically by the program and assimilated at this point. This program also expands all implied instructions, that is, all shorthand forms of writing instructions in PROTEST are expanded to their full, simple, status. Finally, as a protection against damage to the test equipment, a check is made to see that none of the branching rules have been violated in this particular module.

The program prints each statement as it is checked and any errors are marked as they are found. If errors are not associated with individual statements, they are printed after the listing is completed. If no errors have been detected the module, after expansion, is stored in the module library.

The second program takes modules from the module library, assembles them into a complete test routine, and then generates the machine instructions required by any particular test equipment. Here again errors may be detected. For instance, a particular performance check, or perhaps, a particular feature of the test equipment, is used too frequently, and there is not sufficient hardware to allow the test to be performed in this way. All errors that are detected are noted and listed. When no errors are detected, a tape is generated to drive the test equipment.

As an aid to the engineer developing the test routine, each statement is listed with the machine code that it generates.

Further Possibilities

If the computer on which the compiler is to be run is a mini-computer, then the facilities available are restricted to the basic set required to define test routines. If, however, the computer is a large data processing machine with a large backing store, then the following facilities are available.

Reference Documentation

Programs can be written which generate the reference documentation for the test routine. This documentation is tailored to the needs of various users. In each sequence the test engineer writes comments, that indicate the faults that are likely to cause the sequence to fail. These comments are edited and printed to form a fault dictionary. This is then used by the repair section to correct the majority of faults.

However to trace more obscure faults it is essential that the repair section have a record of the test routine which is clear and exhaustive. For this purpose a full simple listing is provided. This allows the actions of the test to be fully understood and if necessary further manual tests constructed to isolate faults. In addition, a listing of major test statements is provided to enable the engineer to shorten any necessary manual procedures.

Library Service Programs

These programs control the operation of the module library, the copy library, and the subroutine library. These libraries, which are used by the routine writer in preparing his test routine, have to be created and periodically entries are deleted from them as they are no longer required. After several deletions have taken

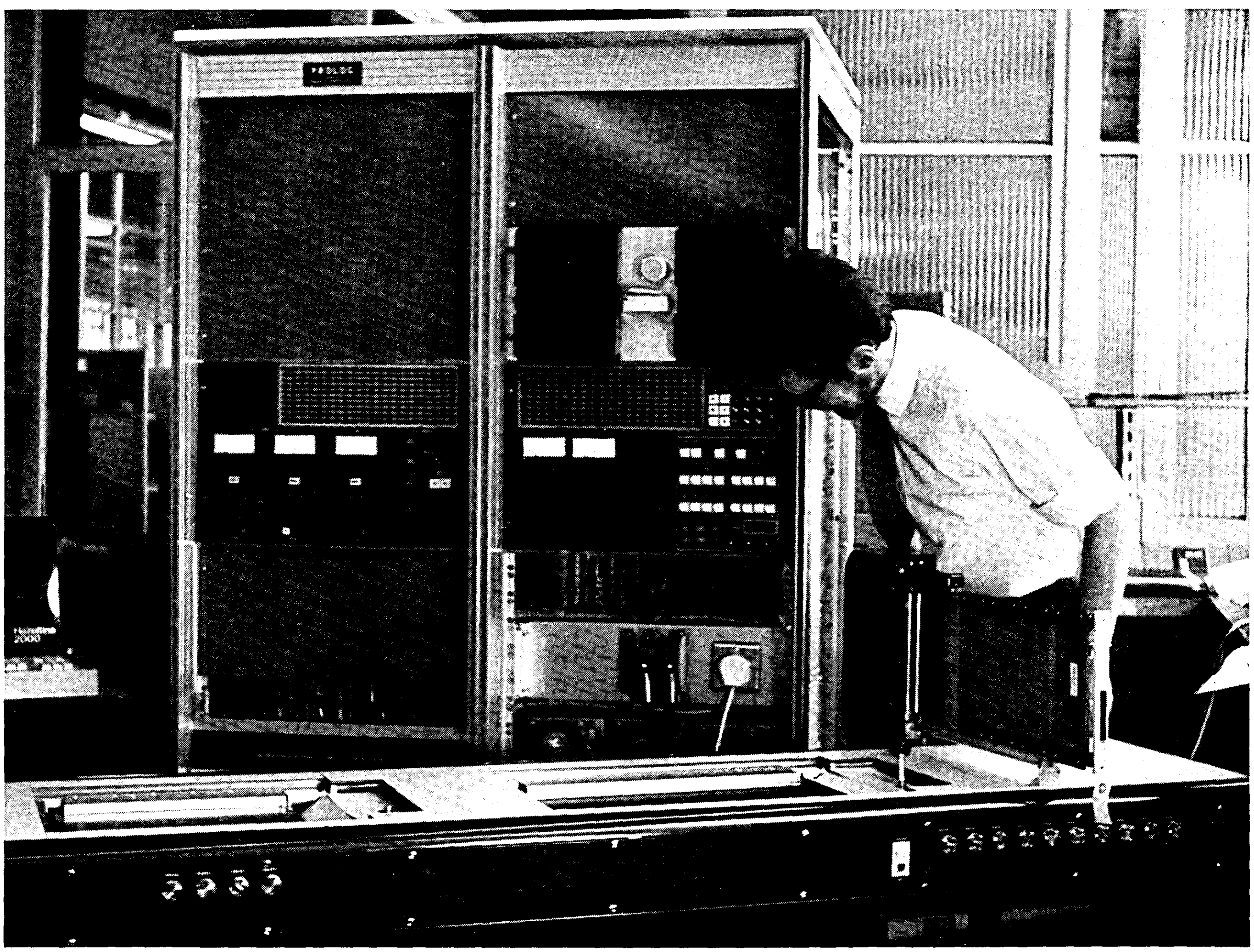


Figure 3 - TXE4 switching exchange printed boards being checked out using PROTEST language to control the test routines at STC's factory, New Southgate, England. The PROTEST tape can be seen in the top right hand corner of the tester. The compiler and software are situated at ITT Data Services and can be reached by the test personnel using normal telephone lines.

place it is necessary to condense the library to give further working space for new members to be added. Programs exist for all these functions.

Compiler Generator

This is not strictly a program but is fundamental to the solution of the technical problems inherent in the introduction of a unified test language. To understand the problems, it must first be realized that each test equipment has its own compiler. This is necessary because the tape that is produced for a particular test equipment is unique to that test equipment. Any variations of the test equipment will require that the compiler has these variations described to it, so that it will take the necessary action when generating a test to cope with these variations. The program which has been written at STL is not the compiler for a particular test equipment. It is rather a compiler-generator system that allows the generation of a PROTEST compiler for a particular test equipment. What happens is that the compiler generator is given a definition of the particular test equipment in terms of macro instructions. This is then used by the macro language program to generate control cards for the linkage editor and also to generate test equipment description modules. The control cards are then used to drive the linkage editor to tailor a compiler to match the particular test equipment requirements. In principle this is a complex operation, but in practice anyone wishing to generate a compiler has only to follow a simple set of rules.

Applications

PROTEST is the standard test language in ITT Europe and is used for factory testing of printed boards for all semi-electronic switching systems. Figure 3 shows PROTEST in action at STC's New Southgate factory. Here it is checking out printed boards from a TXE4 telephone switching exchange being developed for the British Post Office. Other ITT associate companies employing the language are Bell Telephone Manufacturing Company, Belgium; Standard Telefon og Kabelfabrik, Norway; and Standard Elektrik Lorenz, Germany. To facilitate computer access, the PROTEST compiler has been made available via a computer terminal (remote job entry).

A number of new areas for application for the language are presently being studied and may lead to language extensions. These extensions will be tightly controlled centrally to maintain the interchangeability of the language.

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[1] PROTEST Language Definition: *ITTE Engineering and Manufacturing Standard no 001 ITT 09410*, September 1972 (language for test routine).

[2] The ATLAS Test Language is defined in *Abbreviated Test Language for Avionics Systems (ATLAS)*, Aeronautical Radio, Inc. ARINC Specification no 416 (latest issue).

[3] *Proceedings of the Conference on The Automation of Testing*, University of Keele, Staffordshire, 20—22 September 1972, Institution of Electrical Engineers Conference Publication no 91, 1972, 226 p.

[4] *Proceedings of the Joint Conference on Automatic Test Systems*, University of Birmingham, 14—17 April 1970, Institution of Electronic and Radio Engineers Conference Proceedings no 17, 1970, 595 p. □

C.a

NUMBLES

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:

Andrew M. Langer
Newton High School
Newton, Mass.

NUMBLE 735

```
        P L A Y
      A L O N E
    -----------
      P P L P A
      U N L L
    O N O U
  L A E L
A E U A
-----------------
W L U I A L O A
```

Solution to Numble 734

In Numble 734 in the April issue, the digits 0 through 9 are represented by letters as follows:

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

The message is: Half the truth is often a great lie.

Our thanks to the following individuals for submitting their solutions – **to Numble 733**: Marijoe Bestgen, Lenexa, Kan.; T. P. Finn, Indianapolis, Ind.

The Case for Benchmarking

Norris S. Goff
Computer Specialist
United Stated Department of Agriculture
Washington, D.C. 20250

"My opinion is that benchmarking is at present the only available means of evaluating large and complex ADP systems by a common standard. . . .Complexity, diversity, and the dynamic nature of system software, also preclude their simulation by a common model."

The November, 1972 issue of Computers and Automation contains an article entitled "Benchmarking vs. Simulation" by Fred Ihrer, President of Comress (which in turn is the proprietor of the SCERT simulation program). The article constitutes an argument in favor of simulation over benchmarking in evaluating automatic data processing (ADP) systems proposed for procurement by the Federal Government. In my opinion, Ihrer fails to present the reasons for benchmarking, and indeed his description of the benchmarking process is inadequate. The purpose of this article is to provide another argument which presents benchmarking in a more favorable light.

Fair Opportunity to Competitive Vendors

Federal Government ADP procurements must be carried out in a way which offers a fair opportunity to all the appropriate vendors to make a competitive bid. The primary and official advertising medium is a Request for Proposals (RFP), containing the system requirements, which is issued by the procuring agency. Functional and performance requirements must be specified in the RFP in sufficient detail to enable each vendor to propose a particular hardware and software configuration. If the vendors are expected to be responsive to changing requirements over a period of time, for example increasing transaction volumes, then sufficient detail must be provided to enable the vendors to propose augmentations that would be favorable to their respective product lines.

Requirements

When the vendor's proposals are evaluated, it is necessary to determine whether or not each proposed system meets the requirements. If a system does not meet some requirements, the vendor may be given an opportunity to modify his proposal if that is practical. However, if after reasonable opportunity has been given, he still cannot meet the requirements, he must be disqualified. The technical reasons for his failure are not especially important to the Government (as long as the basic rules of fairness have been observed in the evaluation), although they may well be important to the vendor. Likewise if a proposed system meets the requirements, it is not important to the evaluation process why or how the requirements are met, nor how far the requirements are exceeded.

Typically, the RFP will include a summary list of specific requirements, and ask the vendors to provide similar lists in their proposals with references to sections describing how they will meet the requirements. A major part of the evaluation can be achieved by study of these written responses. This could be true of requirements to be met by previously-released and known system components such as compilers, data management systems, and operating systems. Also, few would question the rated speeds of proposed peripheral devices, communication channels, and memory, if indeed specific speed requirements had been established for these system components.

Total Throughput Capability

There are normally other requirements for which the responses cannot be evaluated by study of the written material. Almost surely the total throughput capability of proposed systems will have to be measured by some more precise means. The same could well be true of response times, turn-around times, and required functions, which are likely to employ relatively new and untried system features. The exercise of judgement founded on experience and knowledge of the industry is the only way known to me of deciding what must be examined. The means of examining these characteristics of proposed systems is here discussed.

The Anatomy of a Benchmark

A benchmark, in the context of this article, is a set of live tests designed to examine ADP systems proposed in response to an RFP, to determine if they meet certain requirements. The benchmark must not unnecessarily favor one system over another, and it must not impose undue constraints on how a requirement is met. A benchmark may be comprised of a number of elements, the most common being those listed below:

- A mix of jobs, representative of the users' projected peak workload, over the life of the system. This mix constitutes a throughput test which must be completed within a limited time.

It may be necessary to perform more than one test of this type if system augmentations are proposed. The test may also include measurements of turn-around times, response times to on-line queries, and other requirements to be examined under full-load conditions.

- Demonstration of data storage equipment and techniques for the purpose of establishing the configuration of direct-access equipment needed to meet the requirements.

At least three recent procurements have required direct-access storage for several billion data characters. It is not always possible to establish from available literature how efficiently the proposed storage devices can be used, nor how much storage will be required for directories and indexes.

- Computer programs designed to test specific required functions.

It may be that a function can be examined more thoroughly if it is done independently than if it is incorporated in the throughput mix.

- Requests for the vendors to demonstrate that their systems meet other requirements which do not lend themselves to testing by common computer programs.

Benchmark Programs in COBOL

Nearly all Government data processing installations are required to use COBOL. ADP procurements by these agencies normally require COBOL processors which meet some language standard. Benchmark programs are normally supplied in source COBOL to be compiled by the vendors for their own equipment. It is also common to provide source FORTRAN programs for computational applications.

The development of a benchmark is a technical effort which requires the same kinds of management control as other projects. The requirements for the benchmark are determined by selection of a subset of the system requirements. (The benchmark obviously cannot be any better than the projection of system requirements, nor for that matter could any other evaluation technique.)

Throughput Job Mix

For the purpose of further discussion of the benchmark development process, we will consider only the first of the four elements listed above, the throughput job mix.

The projection of peak workloads must be made and incorporated in the RFP as a set of basic system requirements. These workloads are independent from application system designs, and represent snapshots of the aggregate throughput rates which must be achieved in worst-case situations. More often than not in modern systems the workload is expressed in terms of on-line transaction rates for various transaction types. They also may appropriately include quantifications for compilations, batch processing, and other categories of applications.

The underlying objective is that all processes which will be performed during the peak period must be included in proper proportions. If seasonal or daily fluctuations are such that different kinds of processes peak at different times, and it is not clear which constitutes the greatest workload, it may be necessary to plan multiple mixes to be run as separate tests. The length of a throughput run must be established as a matter of judgement. Runs of one to two hours are common.

Preparation of Benchmark Programs

The technical approach to preparation of the benchmark programs must of necessity depend on the nature of the new system relative to current procedures. That is, if the new system is intended to replace current equipment, and a reprogramming effort is not planned, then operational application programs may be used in the benchmark. If, on the other hand, the system is to perform a new application, or a redesign is in store, then special programs will have to be written in time for use in the benchmark. In either case, it is necessary for the programs to be realistic in terms of their number, size, complexity, and input/output operations, if they are to constitute a valid benchmark.

Finally, data and transactions must be provided in the proper quantities. It is probable that far more data will be required for other reasons than to perform the tests under discussion. The numbers of transactions, statements to be compiled, etc., must be in quantities proportionate to the selected execution time. Often twenty or more magnetic tape reels of data and transactions have been provided to each vendor.

Variables

Numerous variables affect the format of the test itself, including the identity of the components to be benchmarked. Telecommunication inputs might be simulated by having the front-end equipment read a magnetic tape file. Some benchmarks have required that concentrators read tape files of transactions and transmit them over communication lines to the computing system. There may be a requirement to input the transactions at a constant rate. If response times are also to be measured, additional transactions may be entered through on-line terminals, with stop-watches being used to time responses. Remote and local batch jobs may all be submitted at the start of the test, or over any required period.

The benchmark tests are conducted in the vendor's facilities, by the vendor's employees, in the presence of Government examiners.

The Mix

The term "mix" as used in referencing this test is descriptive. Work which uses every type of required support will be included, i.e., local, remote, batch, conversational, etc. There may be dozens of different applications which share the system resources in some combination of ways. They should constitute the best representation available of the workload that the system will be expected to handle.

Some Comments on Simulation

It would be desirable if a true simulation model were delivered with every ADP system. It would be invaluable for evaluating design alternatives, data configuration alternatives, and other options. However, that might not be practical.

System software has an overwhelming impact on performance of a large system. Few people outside the manufacturer's systems programming staff really know precisely what happens in the numerous queing algorithms, dispatchers, spooling routines, and other contributors to system overhead. If an accurate model were produced of a total system, it would have to undergo continual maintenance as the operating system which it simulates was improved. We all have witnessed the evolution of operating systems like EXEC 8 which limp out of the factory and go on to become champions after three or four years of use.

Modeling of Hardware

The modeling of hardware is not particularly difficult. That is, the specifications for hardware, unlike operating systems, are generally available and are not likely to change rapidly. A number of general-purpose models have been developed which can simulate the performance of hardware with reasonable accuracy as long as the hardware can be described within the scope of the model. (Don't expect them all to accept the description of a Control Data 6600 or an Illiac IV.) These models are useful for determining the expected performance of systems when software does not have a major impact on performance.

Modeling of Software and Actual Behavior

However, software begins to have a major impact as soon as multi-programming is attempted and becomes dominant when hundreds or thousands of users are sharing system resources. Furthermore, the endless variety of complex hardware configurations which is available has long ago outstripped the capability of general-purpose models.

Even if a manufacturer possessed a reasonably accurate model of his standard total system, it is difficult to see how it could be used in lieu of a benchmark. Some of the reasons are:

- Vendors often must propose different, even unique, hardware and software configurations to be responsive to Government RFP's. The model would have to simulate the system as proposed.
- The proficiency of compilers would have to be incorporated into the model, including compilation speeds, object programs efficiency, and object program size.
- Those responsible for evaluation would have to be convinced of the accuracy of the model.
- The fairness doctrine requires that all proposed systems must be measured by the same scale. Losing vendors can be relied upon to see that the doctrine is enforced.

Summary

It is my opinion that benchmarking is at present the only available means of evaluating large and complex ADP systems by a common standard. The diversity of computer hardware and techniques employed in large systems precludes their simulation by a common model. The complexity, diversity, and dynamic nature of system software also precludes their simulation by a common model.

Perhaps our industry will eventually stop changing its tools very rapidly and then we will be able to construct adequate system models. If that happens, I believe everyone would prefer that to the expense of benchmarking. In the meantime, benchmarking is in my opinion unavoidable. □

c.a PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 735: VARIABILITY

As soon as Joe entered the Computer Center he was greeted by Pete, who said, "You're a mathematician. Maybe you can help me with a little problem my son brought home from school."

"Well, my job title is mathematician," said Joe, "but . . . go on."

"My son is just starting Calculus and the teacher gave the class an assignment which consisted of finding the error in a certain problem."

"Are you sure there is an error in it? Maybe it's correct, but the teacher may think that if he tells the students it's wrong some of them may find an error, or perhaps manufacture one. It might be very revealing to a teacher to see what students would do in such a situation."

"Oh, it's wrong, no question about that." Pete was emphatic. "After all, 2 does not equal 1."

"One of those 2 equals 1 fallacies, eh? I'll bet there's division by zero somewhere in the picture."

"No, I don't think so. The teacher told the class that x^2 was equal to $x + x +$, etc., with this series having x terms. Then he differentiated each term separately getting $1 + 1 +$, etc., that is, x 1's, which is equal to x. So if the derivative of x^2 is 2 x, as we know it is, and this equals x, we have $2 = 1$ on dividing by x, which is not zero since it is a variable."

What is wrong?

Solution to Problem 734: Gray Code

The square with the binary equivalents of 0 1 9 8, 2 3 11 10, 6 7 15 14, 4 5 13 12 in successive rows has the property that each number differs from its neighbors in only one bit.

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.

ADVERTISING INDEX

The Dvorak Keyboard, The Qwerty Keyboard and Others

1. From: John J. Seitz
Champlain Regional College
P.O. Box 5000
Sherbrooke, Quebec, Canada

I have just read, with considerable interest, Robert Parkinson's article on the Dvorak Simplified Keyboard in "Computers and Automation", Nov. 1972.

I have heard it rumored, but have been unable to verify, that a major contributing factor to the strange design of Christopher Sholes' original keyboard was that he was left-handed. If true, this might throw additional light on the obvious left-handed bias shown in the illustrated stroke analysis.

From my own experience, I suspect there are far more key-driven machines which would require conversion than the author indicated in the article, if the Dvorak standard were to be adopted, some at considerable cost. For example, I learned to type in the newspaper business, on a very small paper where I had to both type copy and run a linotype machine. Later, I was involved with a press teletype, and, following entry into the computer business, with data teletypes, keypunches, consoles, and a variety of other devices.

This variety of keyboards and devices has caused me to adopt what I call the Seitz Complex Functional Method, which consists of using the index and middle fingers of both hands and the left thumb. I attain a speed of 45-60 words per minute without excessive error on virtually any machine I address, and have done it long enough that (1) I am virtually untrainable in other methods, and (2) I rarely find it necessary, after one or two day's familiarisation, to actually look at the keys very much.

It is interesting to note that the Dvorak method itself is, however, functionally parochial. A cursory knowledge of cryptanalysis makes it clear that letter frequency is highly language-dependent; any truly international standard would have to take cognizance of that fact. (Here in Quebec, where I type more French than English, it is particularly maddening to find that each manufacturer has salted the various accents, etc., around a standard English keyboard in locations most convenient to him.)

I wish to congratulate you on your magazine, which I find most appealing.

2. From: Robert Parkinson
Motivational Communications Corp., Ltd.
2425 Confederation Parkway
Mississauga, Ontario, Canada L5B 1R8

I have read with interest Mr. J. J. Seitz's letter.

I hope he does not think that I advocate wholesale mass conversion of all keyboard-driven devices to the Dvorak Simplified Keyboard. Such conversions should only be carried out where sufficient benefits would accrue (e.g., cost savings, increased productivity or accuracy, etc.). However, the fact that a large number of machines are currently using inefficient keyboards does not mean the problem should be ignored.

I'm glad that Mr. Seitz has such good luck with his "Seitz Complex Functional Method" of typing. I suggest he stick with it if he is satisfied with 45-60 words per minute ... and especially since he is "virtually untrainable in other methods". Obviously the DSK (or any other improvement ??) is not for him!

As far as the DSK being "functionally parochial" (which is evidently fancy language for "limited in scope of application or design"), Dr. Dvorak is the first to admit that the DSK was designed expressly for the English language. It turns out the DSK is also much better than the standard keyboard for all other Latin-based languages, French included.

Dr. Dvorak has indicated a willingness to devise an international keyboard, based on his principles. However, nobody wants to pay for that.

I sympathize with the difficulties Mr. Seitz has in typing French, with all of its accents being placed in different places by different manufacturers. May I extend a personal invitation to Mr. Seitz to become a member of the Canadian Standards Association keyboard committee (of which I am a member), if he would like to help alleviate this problem?

May I make some further comments on standardization? Henry Ford "standardized" his Model-T cars. You could have any color ... so long as it was black. Other car makers came along with new snazzy colors and varied options. Ford's standard went out the window in the face of such "user choice" competition.

Alvin Toffler, in his book FUTURE SHOCK, tells what happens when the public has readily available choices in the products they buy. You offer them a few options, and they soon demand more. Diversity breeds diversity. That's what happened to the auto industry.

In the past, diversity or interchangeability was not a feature of typewriter keyboards. Each individual type slug (activated by striking one key) was soldered securely on a single type bar. To change keyboards, all the slugs had to be re-soldered. This was difficult, requiring a skilled mechanic; time consuming; and expensive.

Now, in laboratories around the world, new electronic typewriters are being developed. It is now technically possible to encode a description of your own personal keyboard on a small plastic card. In the future, you may insert your card into a special slot on any electronic typewriter, and have the keys light up underneath your fingers with your own preferred arrangement of characters. The technology for lighting up each key button with the specified characters will be similar to that now being used for the answer displays in the new little pocket calculators currently flooding the market.

When you can choose the keyboard that you want — especially if you are one of those people who don't type now — I'll bet you might well decide on whichever keyboard is easiest to use, and fastest to operate. The Dvorak Simplified Keyboard would thus be a strong contender ... assuming you knew about it!

Today, most people don't type. Many don't think they need to know how. But, the time is fast approaching when electronic typewriters may be found in most homes. Connections over phone lines will allow keyboard communications with centralized computer "utilities." Through these utilities, you will be able to balance your bank account and pay your bills. A world of computerized information will literally be "at your fingertips" ... if you can type. Such setups could become as popular in our homes and businesses as the telephone is today. The DSK would let you learn to type, so you could use this equipment, with minimal effort.

Frank Gilbreth, the father of time-and-motion efficiency analysis is quoted as saying: "It is cheaper and more efficient to fit machines to people rather than trying to force people to conform to machines. The QWERTY keyboard forces you to adopt it. Dr. Dvorak designed his keyboard to be "kind to people." If you don't type now, which would you rather learn: QWERTY in a year or more, or the DSK in only a few months?

I think the choice should belong to the customer. And, the customer ought to have enough information to realize what he wants. □

Unsettling, Disturbing, Critical . . .

Computers and Automation, established 1951 and therefore the oldest magazine in the field of computers and data processing, 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 and truth 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, Computers and Automation publishes 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 seek to publish 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.

Who's Who in Computers and Data Processing

Edition 5.3 = Edition 5 + 2 Supplements published + a 3rd Supplement now being prepared

If you wish to be considered for inclusion in the *Who's Who in Computers and Data Processing* — or if you have already been included and your biography should be updated — please complete the following form (which may be copied on any piece of paper), and send it to: Who's Who Editor
Computers and Automation and People
RFD 1
No. Grosvenordale, CT 06255

Who's Who in Computers and Data Processing is published jointly by Quadrangle Books (a *New York Times* company) and *Computers and Automation and People.* The Fifth Edition (in hard cover, in three volumes, over 1000 pages) containing over 15,000 capsule biographies was published in the Spring, 1971.

Two supplements, together containing over 2000 entries, have been published, bringing updating through the autumn of 1972.

WHO'S WHO ENTRY FORM

(may be copied on any piece of paper)

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

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

7. Year of Birth?________ 8. Education and Degrees?________
9. Year Entered Computer Field?________ 10. Your Present Occupation?________
11. Publications, Honors, Memberships, and other Distinctions?________

____
(attach paper if needed)

12. Do you have access to a computer? ( ) Yes ( ) No
    a. If yes, what kind of computer? Manufacturer?________ Model?________
    b. Where is it installed: Organization?________
    Address?________
    c. Is your access: Batch? ( ) Time-Shared? ( ) Other? ( ) Please explain________
    d. Any remarks?________
13. In which volume or volumes of the Who's Who —

	(a) Have you been included?	(b) Do you think you should be included?
Vol. 1 — Systems Analysts and Programmers	( )	( )
Vol. 2 — Data Processing Managers and Directors	( )	( )
Vol. 3 — Other Computer Professionals	( )	( )

14. Do you subscribe to Computers and Automation? ( ) Yes ( ) No — to The New York Times? ( ) Yes ( ) No
15. Associates or colleagues who should be sent Who's Who entry forms?

Name and Address

____
____
____
____
(attach paper if needed)

When completed, please send promptly to: Who's Who Editor, *Computers and Automation and People,* RFD 1, No. Grosvenordale, CT 06255

The New Orleans Portion of the Conspiracy to Assassinate President John F. Kennedy — II

Article 3. Opening Statement to the Jury, Trial of Clay Shaw, February 1969, by F. Irving Dymond, Attorney for the Defendant

Article 4. Statement by Jim Garrison, District Attorney, Orleans Parish, La., November 21, 1972, after the U.S. Supreme Court, by its decision on November 20, 1972, prevented the prosecution of Clay L. Shaw for perjury.

Article 3. Abridged Opening Statement to the Jury, in the Trial of Clay L. Shaw

by F. Irving Dymond, Chief Defense Counsel for Clay L. Shaw

(Source: *The Times-Picayune,* New Orleans, La., Feb. 7, 1969)

"Your honor, the defense knows that it is not necessary for it to respond with an opening statement but we wish to do so.

"We are not here to defend the findings of the Warren Commission; this is not the case at all. The defense has neither the inclination, the desire, or the money to do so. The Warren Commission interviewed 25,000 witnesses.

"It is the defense's judgment to strike at the very core of the state's case — the alleged conspiratorial meeting between Shaw, David Ferrie and Lee Harvey Oswald. We will show you that this alleged meeting was not conceived until David Ferrie's death. That's when the roaches came out of the woodwork.

"The Defense has two courses of action to take. One, we can prove that Mr. Shaw was elsewhere at the time of the alleged meeting. But this would be impossible since the state has never seen fit to set forth a precise time. And even if the state had set a time, Mr. Shaw couldn't be called on to go back three and one-half years and account for this time.

"Secondly, the defense could prove who says this meeting took place lies. Perry Raymond Russo is a liar — a notoriety-seeking liar whose very name does not deserve to be mentioned among honest and just people. We can prove this.

"We will begin with Russo's first entrance into this case. It was a few days after Dave Ferrie's death that Russo wrote the district attorney and said he would be willing to tell him what he knew of Dave Ferrie, a fairly close friend of his.

"The next day, Feb. 24, 1967, Russo was interviewed by Bill Bankston of the Baton Rouge State-Times. Russo told Bankston that he wanted to get down all he knew of the case and talked with Bankston for about 45 minutes.

Note: Article 1, "Introduction, April, 1973", by Edmund C. Berkeley, and Article 2, "Opening Statement to the Jury, Trial of Clay Shaw, February, 1969, by Jim Garrison, Prosecutor", appeared in the April 1973 issue of *Computers and Automation.*

"Russo did not mention Clay Bertrand, Clay Shaw, Clem Bertrand or any principals in the conspiracy. We will show this.

"After this interview, three more newsmen interviewed Russo and he didn't mention Shaw, Oswald, Bertrand, or a word of the conspiracy.

"Then on Feb. 25, 1967, Andrew Sciambra, an assistant district attorney in Orleans Parish, went to Baton Rouge to interview Russo. This lasted for three and one-half hours.

"Three days later, Sciambra wrote a 3,500 word memo to the district attorney. We will show you that nowhere in it was there mention of Bertrand, Shaw, or a conspiracy.

"We will show you that Russo was asked by Sciambra if he had ever seen Shaw; Russo's reply was that he had seen him twice — once at Ferrie's service station and a second time at the Nashville Ave. wharf.

"But shortly after, during the preliminary hearing for Mr. Shaw, Russo placed three meetings with Mr. Shaw, including the conspiratorial meeting.

"Russo had many conversations with a reporter for a national magazine and at one time the reporter set up a meeting with Shaw for Russo. But Russo cancelled out after the meeting had been arranged.

"Russo told the reporter that he was afraid to go to the meeting for fear of Garrison finding out about it. Russo said he was afraid to get with Mr. Shaw and find out he was mistaken.

"Then on May 28, 1967, this reporter said he noted to Russo the many inconsistencies in his testimony and replies. The reporter said Russo replied, 'I can't argue with any of that.'

"But Russo said there is no way out for him without being caught. He told the reporter that if he sticks to his story, Shaw's lawyers will get him. And if he changes the testimony, Garrison will get him.

"We will prove that another witness is totally unworthy. And we will present witnesses to whom Russo said he lied.

"Concerning the overt acts referred to in the prosecution's opening statement, we will not try to dispute that Mr. Shaw took a trip to the West Coast. But we will present evidence that the trip was taken in the course of his employment and at the solicitation of the person who obtained speakers for a world trade conference there.

"And we will talk on the trip to Houston taken by Dave Ferrie. We will show that if Ferrie wanted an alibi, as contended by the state, that he went from a good one to one not so good.

"We will show that Dave Ferrie at the time was on the staff of Attorney G. Wray Gill, who was defending Carlos Marcello. We will show that the case was prolonged and did not end until the day of the assassination. And we will show you that there is no way of telling when the case would end.

"In closing, I want to remind you jurors that we are not trying the Warren Commission Report. I ask you not to let what happened at Dealey Plaza in Dallas obscure your view of this conspiracy case."

Article 4. Statement November 21, 1972 (The U.S. Supreme Court Prevented by its Decision on November 20, 1972, the Prosecution of Clay L. Shaw for Perjury)

by Jim Garrison, District Attorney, Orleans Parish, La.

Almost 9 years ago to the day, the United States government began an historic experiment in deception of the people. The above described decision of the Federal Supreme Court — bringing to an end the only honest official inquiry concerning the assassination of President John Kennedy — completes the government's circle of deception.

Up to this time, I have refrained from stating publicly exactly how, why, and by whom President Kennedy was assassinated. I did this because my office for years has had in an active status at least one open case related to the assassination — although from the outset, up to the very present, we have suffered from continual interference and obstruction from the Federal government. It was particularly difficult to refrain from publicly describing the exact nature and meaning of the assassination because the national press — aware only of what had been disseminated to it by the government and possessing no independent understanding whatsoever of the circumstances and meaning of the President's murder — added greatly to the public's confusion concerning the assassination in Dallas and the related prior events in New Orleans. The Federal government, in order to continue to conceal its involvement in the President's murder, encouraged and contributed generously to the befuddlement of the national news media.

However, now that the government has succeeded in crushing the last open case in my office related to the assassination, there no longer is any reason for me to refrain from publicly stating precisely how President Kennedy was assassinated — any why and by whom he was assassinated.

On November 22, 1963, the President of the United States was murdered in a professionally executed guerilla ambush at Dealey Plaza in Dallas, Texas. He was killed by riflemen located on the grassy knoll in front of the limousine and in two buildings located behind the limousine. The first shot, fired by riflemen in the front, went through the knot of his tie and entered his neck. The following two shots, fired by two riflemen at the rear, struck President Kennedy and Governor Connolly each in the back. The fourth shot — fired once more from the grassy knoll in front of the limousine — fatally wounded the President in the head. The Cause of Death Certificate, made out by a civilian doctor at Parkland Hospital, is still recorded in Dallas and certifies that the President died from a gunshot wound of the temple — which customarily is located in the <u>front</u> of the head.

However, the Federal government of the United States — elements of which were actively involved in the ambush and murder of the President — had its cover story in operation, even as the President lay dying in Parkland Hospital. A "scapegoat" named Lee Harvey Oswald had been planted in the Texas School Book Depository — and he became the instrument by which the government drew the eyes of the world away from its professional assassins.

Oswald had been conditioned and carefully nurtured, during the summer of 1963 in New Orleans, to appear to be a pro-Castro Communist. In actuality, Lee Harvey Oswald was a low-level intelligence employee of the United States government. The government itself had taught him Russian, as testimony before the Warren Commission inadvertently revealed, while he was serving in the Marines at Atsugi in Japan and at Toro Marine Base in California.

The entire operation — from the prior setting-up of the scapegoat in Louisiana to the ultimate assassination in Texas — was carried out by the domestic espionage apparatus of the United States government. Most Americans are unaware that their taxes pay for a tremendous domestic espionage operation just as they are unaware that intelligence agencies of their government have been in the business of assassination — both foreign and domestic — for a number of years.

Inasmuch as the domestic intelligence apparatus accomplishing the operation was invisible to American eyes, all that ever became perceptible to surface observation was the sudden explosion of shots during the parade in Dallas. Almost immediately, attention was directed to the pre-selected scapegoat — while the riflemen made their departure — and around this hapless decoy, a young man who was utterly irrelevant to the President's murder, the fiction of the "lone assassin" was built up by the government and sent out to the world. Within several days, before he could reveal the small part of the monstrosity known to him, Oswald himself was murdered.

Oswald's murder also was effected by a member of the government's espionage apparatus. It accomplished the desired effect of making it appear that the whole affair was ended, that justice had come full circle and that there was no need to search any farther. In actuality, the need to search farther had just begun, but the duplicity of the government and the apathy of most of the national news media effectively obscured this fact from the American citizens — and, indeed from the entire world.

It should be noted that the use of a "scapegoat" is virtually a standard procedure in assassinations conducted by government intelligence operatives within the continental limits of the United States. The resulting distraction of attention away from the actual killers accomplishes the objective of concealing the motivation for the murders and of concealing the involvement of the Federal government. Consequently, such decoys have been used to good effect in assassinations accomplished subsequent to that of President Kennedy. In every instance, the attention of most of our national media has fixed upon the decoy and gone no farther. Any individual who happened to perceive that much more was afoot could expect to be described as "conspiracy-minded" by an apathetic national press and, furthermore, could expect to become the objective of a highly effective discreditation operation by such powerful agencies of the Federal government as the "Justice" Department.

Because the American people have not been permitted to learn of the existence of a complex and highly organized domestic espionage operation within this country, it has been impossible for them to conceive of innocuous individuals — wearing neither black capes nor villain's mustaches — as being effective participants in an assassination conspiracy. Actually, a career employee of the government's domestic intelligence is quite likely to be an individual with no surface signs of government connection, engaged in a "cover" civilian occupation and, quite well regarded in his community as a harmless and very pleasant individual. Similarly — to persons unaware of the hydrogen bombs stored in earth bunkers at Carswell Air Force Base, near Dallas — it is difficult to conceive of a "night club operator" as being a professional operative for government intelligence. In fact, however, control of night clubs near Strategic Air Command bases, such as the nuclear air base near Dallas, is standard operating procedure for the domestic espionage operation — just as protection of the security of such bases is one of its constant concerns.

The major machinery used to deceive the American people and to make one of the most significant political assassinations in history appear "meaningless" was the Warren Commission. Inasmuch as President Kennedy's murder — or "termination", to use the phraseology of American intelligence — was the product of the top level military and intelligence sector of the government, President Lyndon Johnson selected a Commission dominated by men with long-standing allegiance to the high brass of the Pentagon and to the stratospheric echelons of the U.S. intelligence and espionage machinery.

Here are a few examples of the make-up of the Warren Commission: Allan Dulles was the former Chief of the Central Intelligence Agency, and had been fired by President Kennedy. Senator Richard Russell was the long-time Chairman of the Senate Armed Services Committee. John J. McCloy was a former Assitant Secretary of War and was the former High Commissioner for the Allied Forces during the occupation of Germany. These are but a few examples, but they suffice to show that the Warren Commission was set up at the outset to protect the government's powerful Pentagon-C.I.A. complex.

And now here is why this powerful complex — which has become virtually the central core of the United States government — had to be protected by a carefully selected Commission of men, pre-disposed by their backgrounds to be more concerned with preserving the interests of the government complex than with seeking and communicating the truth to the people at large.

President Kennedy's murder was instigated by the powerful military chieftains of the Pentagon — with the notable exception of the Marine Commandant, General David Shoup, who remained loyal to him — in concert with dominant elements of the Central Intelligence Agency. By 1963, the thrust of the Pentagon and the C.I.A. toward deep involvement in the Vietnam War had become irresistible. Nevertheless, by 1963 President Kennedy had begun to resist this thrust — and had changed his earlier decisions, recommended to him by the military, permitting the U.S. to have limited involvement in Vietnam. In early June of 1963 — having begun to encounter increasing resistance from his own military leaders — he required Secretary of Defense MacNamara and Chairman of the Joint Chiefs of Staff Maxwell Taylor to announce from the White House steps that all American forces were going to be withdrawn from Vietnam by 1965.

President Kennedy had become convinced by the advice of Senator Mike Mansfield and — most particularly — by warnings to him by retired General of the Armies Douglas MacArthur against allowing American troops to become involved in a land war in Asia. By the summer of 1963, he had made his final decision against involvement in Asia — and ordered total withdrawal of all U.S. Forces from Southeast Asia. This decision was his undoing because the thrust of the American warfare machine toward involvement in Southeast Asia now had too much momentum to be reversed.

Nevertheless, one of President Kennedy's last orders to the military was to have the first 1,000 troops returned from Vietnam by December, 1963.

Within 72 hours after his death, the new President — Lyndon Johnson — completely reversed President Kennedy's new foreign policy with regard to Southeast Asia. Immediately after the eulogy for President Kennedy was conducted at the Rotunda of the nation's Capitol, Johnson met with the U.S. Ambassador to Vietnam, Henry Cabot Lodge, and instructed him to return to Vietnam and inform the Saigon government that we now were going to give South Vietnam strong military support. Within months after President Kennedy's death, the secret build-up in Vietnam — of what was to become more than half a million American troops — was underway.

The rest is history: the 55,000 American dead, the 300,000 Americans wounded — and the continuing guile and deception by the federal government concerning the real reasons for John Kennedy's assassination and real reasons for our capricious and unnecessary plunge into disaster in Vietnam. Nor can we forget the many American prisoners of war who are still suffering in Vietnam as hostages to the catastrophic adventure — which began with the assassination of a President of the United States by his own government.

When it became apparent to me that there was more to the President's assassination than had been revealed to the public — and that some of the preliminary activities had taken place in New Orleans, within the jurisdiction of my office — I decided to act, not in the interest of publicity but because it was clearly my duty as District Attorney elected by the people of my city. In fact, rather than publicize our inquiry into the assassination I sought to keep it secret until the news media stumbled across it and spread it to the four winds.

After the Federal government's deep involvement in the President's murder became apparent — and this developed at an early stage in our inquiry — it was quite clear to me that I had nothing to gain and everything to lose by continuing to press ahead. Nevertheless, no other elected official in the country was attempting to bring out the truth about one of the most critical and far-reaching events ever to occur in America — and, meanwhile, the Federal government actively was working to conceal the truth — so I concluded that I had no other alterna-

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Investigative Reporting

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"... a press restricted to official sources would be unable to provide the public with the information a democracy needs to function."

Outline

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Mr. Chairman, members of the subcommittee, my thanks first of all for giving me your time.

To introduce myself, I am A. M. Rosenthal and I've been a newspaperman on The New York Times all my working life, twenty-eight years. I was a reporter for eighteen of those years, most of them spent covering diplomacy and foreign affairs. I served in India, Poland, Japan and other countries and for ten years I've been an editor. I am now managing editor.

Statement before Subcommittee No. Three, Committee on the Judiciary, U.S. House of Representatives, March 5, 1973

The Division Between News and Opinion

That means you can blame me for anything you don't like that appears in the news columns of The Times. If you do not like our editorials or columnists, I am happy to say you can blame somebody else. A fundamental principle of our paper is the division between the news side and the opinion side and we are determined to keep it that way. The people who run the news and editorial parts of The Times meet at lunch when the publisher has a guest and then we part company and find out what the other is doing when we pick up the paper.

This is the very first time I have appeared before any legislative group or any other governmental body. The reason I have never appeared before is that by personal choice I am a professional non-advocate. I believe that people who gather or edit news should not take part in political action or become the champions of causes, publicly or privately.

Newspaper people, like everybody else, have opinions and motivations but I think it is the obligation of news reporters and editors to set aside those opinions and motivations in their work and activities insofar as humanly possible. This does not make us pallid people, but simply men and women quite passionately convinced that the collecting and disseminating of information is in itself an essential, positive social value and a worthwhile way of spending a lifetime.

The Protection of the First Amendment

And yet, outside the news columns of The Times, I have written as strongly as I could in favor of a cause — a law most newspapermen think is necessary to protect the First Amendment. And I am now appearing before a Congressional group in the same cause.

I admit the contradiction and accept it. I can say only that I would not be here if I did not think the issue was worthy of the inconsistency. I believe that if the erosion of the First Amendment continues, in time there may not be a press worth being philosophically consistent about.

I've thought for a long time about what I could possibly contribute to this subcommittee that would be new. You have heard many qualified witnesses. Most of you are lawyers and know far more about the legal intricacies than I. Obviously, I cannot possibly tell you anything about the political or legislative problems involved.

All I can tell you are the reasons that so many journalists are so concerned, what we think the issues are and how the whole process of providing information to the public is being affected and may be affected further.

Urgent Concern

I think the sense of urgent concern has to do with three things. First, the ways information reaches the public. Second, the significance of confidentiality, not simply as a journalistic tool, but as it affects what the public knows or does not know. And finally, the pragmatic, day to day meaning of a constitutional guarantee as distinct from what is written down on paper.

There is no great mystery about the news gathering process. Other than events that reporters see for themselves, the public, through the intermediary of the press, gets information from two kinds of sources and only two.

Official News

One kind of source might be called the official and I do not use this word pejoratively. This is the person in government or politics or business who wants certain kinds of information disseminated — often valid information and important; and he has the authority, status, power or access to the press to do so and be identified as the source.

Because of the traditions of American democracy, the people of this country get far more information of this kind than the people of any other nation. There is a vast body of information going to the people through public hearings such as this one, through news conferences, commission reports, open trials, political statements, interviews, corporation reports, legislative debates and the like.

This part of the information flow, which the American public generally takes for granted, is an important part of the information process. I have lived in societies where you could get arrested for simply asking questions that some of our governmental bodies and other institutions routinely answer.

Obsessiveness about Secrecy

I am sad to say that I believe that too often even this official kind of information is to a dangerous degree being withheld and that an obsessiveness about secrecy is taking hold on all levels of government. Too many documents are classified, too many appointed officials regard information gathered at public expense as their private property, too many civil servants who once felt they had a duty to speak up are being threatened with punishment if they do. In Washington, a civil servant was removed from office for giving Congress information; in New York a local school board threatened disciplinary action against teachers who discussed bad conditions in the schools.

A Press Restricted to Official Sources

But even if this trend toward secrecy were reversed, and I see no signs it will be, I think every American who put his mind to it would agree that a press restricted to official sources would be unable to provide the public with the information a democracy needs to function.

The Confidential Source

The second kind of source, absolutely vital to a free press, is the so-called confidential source. There has been a lot of talk about confidentiality and a certain amount of double-talk and play-acting.

For one thing, as we all know, all levels of government quite happily and regularly employ the techniques of confidentiality to their own ends. Every day in the year in Washington and every other major city in the country appointed officials and elected political figures hold briefings at which they give out information or opinions but refuse to allow themselves to be identified. Sometimes the motivations are important — a government believes a piece of information should be known but feels an official imprimatur would give it too much weight or distort its significance.

Trial Balloons

But much more often the press and officials allow this sort of confidentiality to be used as a convenient way of masking the source, manipulating news or sending up trial balloons. On The Times we do not have a blanket rule against accepting this kind of information; but more and more we try to move away from it and ask for as close an identification as possible. The movement is away from pseudo-confidentiality, but it is still just a movement.

But all of this aside, the vital confidential sources, the ones I am talking about, are those men and women or even institutions that have information they feel should be made public but are afraid to allow their names to be attached to it.

These sources are as varied as the news itself. Every single day in the year the public through the press gets some of its most important information from these sources.

Investigative Reporting

The most dramatic examples, of course, come from the area of investigative reporting. I say flatly that without the guarantee of confidentiality, investigative reporting will disappear. The erosion of confidentiality will mean the end of the exposure of corruption.

Every newspaper has its examples and I will cite some of our own. A couple of years ago a Times reporter, David Burnham, wrote a series of articles on police corruption. The extent of corruption that was revealed startled not only his editors but shook the city. The Mayor of New York, judges, and other officials have stated that those articles led to the Knapp Commission investigation of the police department, to the appointment of special prosecutors, and to inquiries still taking place.

There is a young man who has been reporting these hearings, David Shipler, who spent months investigating and proving corruption in the construction industry of New York. The examples are endless. Not one of these reporters could have gathered his information unless his sources took for granted that he would never endanger their careers and perhaps even their lives by revealing his sources.

Thinner News

But the importance of confidentiality goes far beyond investigative reporting. It is part of the entire stream of information the public gets.

Sometimes confidentiality is imposed simply by matters of rank and protocol. I have never visited an American or foreign embassy but that I have received and been able to convey to readers important information or insight into what was taking place. It would have been impossible for these ambassadors or attachés to speak frankly to me had they believed that I would ever reveal their names. To that extent, information reaching Americans about foreign nations would have been the thinner.

Dissidents

Very often confidential sources are among dissidents. Dissidents need not be demonstrators with placards. A lieutenant general can be a dissident, or an executive vice president of a steel company, or an official of a trade union. They think something they know should be known to the public but they don't feel strongly enough to put their nametag on it. Should this information be denied to the public? Need the price of disclosure be martyrdom? If so, how many martyrs would there be and how much information would the public lose?

Sometimes the need for confidentiality is the result of different backgrounds and social attitudes. I daresay there is nobody in this room who is really afraid of dealing with authority, government authority or police authority or business authority. We regard them as part of our own lives, in a sense arms of ourselves, our own servants.

People Who Do Not Trust the Government

But there are millions of people in this country who do not have that sense of confidence, who regard authority as menacing, who do not trust it. They will sometimes talk of even the most innocuous matters only if they are not named. Are they to be denied access to the public through the press; is access to the press to be permitted only to the confident and powerful?

It is sometimes said that if the public does not know the source, it cannot judge the validity of the information and to an extent this is true. That is why every reporter, every editor, prefers to print stories where the source is clearly stated and to use the confidential source only when nobody will speak up in his own name. But this is the world we live in and to deny the press the right to protect its sources and confidential information would be to make it an official press.

Constitutional Guarantees

I come finally to how this relates to Constitutional guarantees. Forgive me if I am obvious, but a Constitutional guarantee is meaningless unless the conditions for exercising it exist day in and day out. Virtually every Communist or other authoritarian society I visited had lovely constitutional guarantees about religion, speech, press and so on. The only trouble was that the conditions for exercising them, to put it politely, did not exist. Try and do it and you wound up dead or in jail.

My point here is that if the conditions for exercise of a free press do not exist, then the guarantee does not exist and the public loses its constitutional rights. I believe that the press reference in the First Amendment was essentially a guarantee to the people, not simply to the press.

The Right to Maintain Confidential Sources

Most journalists believe that the right to maintain confidential sources and information is an essential condition for the exercise of the First Amendment. We also believe that the very process of subpoenaing reporters, trying to get them to testify, attempting to use them as branches of government investigation by examining them even on published material — has created an atmosphere in which sources of news are losing confidence in reporters' pledges, not because of the reporters but because the sources are aware of increasing court pressures on the press. We fear that wells of information are drying up, that we are not hearing all we should and that therefore the public is not hearing either. You always know when the phone rings but you never know when it might have rung and was silent.

The First Amendment is in Danger

Like many other newspapermen, I have always been hesitant about supporting any Congressional action in relation to the press. But I do believe, most deeply, that the First Amendment is in danger and that the best interests of the country will be served by an act of Congress protecting the First Amendment, guaranteeing that the conditions for its existence survive, making it again a day to day unquestioned reality.

I am urging passage of legislation prohibiting the use of subpoena powers in all matters relating to the free press provisions of the First Amendment. I realize that absolutism of any kind goes against the grain of many people. But I think that to introduce qualifications would be to introduce the concept of varying degrees of information freedom depending on the kind of information and I do not really think that was the intent of the First Amendment.

I Was Expelled from Poland for Refusal to Reveal Confidential Sources

One final personal word. In 1959, after a year and a half in Poland, I was expelled on the charge of probing too deeply into the internal affairs of the government, the party and the leadership. Believe me, every bit of information I received came from Poles who trusted my word that I would protect them. I was lucky. The Polish Communists did not put me on trial; they just threw me out. If I had been called into a Polish court and asked to reveal who told me what, I believe that every member of Congress would have supported my refusal to testify had I had the strength to do so.

And I was by no means the only foreign correspondent who found himself in this kind of situation. It happens all the time. Henry Raymont, a former foreign correspondent for The New York Times, was arrested in Cuba and grilled as to the sources of some of his information having to do with the Bay of Pigs. Mr. Raymont was even threatened with execution but he did not reveal his sources.

I Never Dreamed in Warsaw that I Would be Defending this Right in the United States

And now, fourteen years later, we have a debate in our country on whether an American newsman has the right to do and act in our own society as I did in a Communist society — to inquire, to write, to protect his sources and information and thus his existence as a conveyor of information to the public.

I never dreamed in Warsaw that the day would come when I would be arguing this point in Washington. But since the day has come, I am grateful for the opportunity to state my views and hope with all my heart that this Congress will make sure that this sudden challenge to the First Amendment is properly met. □

The People's Need to Know — II

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"The American people's right to know is under the heaviest attack in our history."

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JURIES, GUIDELINES, AND CODES

The Caldwell case and other such court decisions are merely the tip of the iceberg that is so chilling toward the right of the people to be told what is going on. The rest of the iceberg is largely hidden, but it is here that a once proud vessel could be sunk forever.

For a long time, lawyers and others have been concerned, and rightly so, about how to assure the kind of fair trial that is guaranteed by Articles VI, VII and VIII of the Bill of Rights. It was said, and sometimes with justification, that the press was prejudicial to a fair trial.

Three years ago the American Bar Assn. after long study approved a new code empowering judges to bar attorneys and others from releasing information about pending cases outside the courtroom. This code resulted from the Reardon Report, drawn up by a commission headed by Massachusetts Supreme Judicial Court Justice Paul Reardon.

Two present members of the US Supreme Court majority in the Caldwell case played key roles in this report: Justice Powell was president of the American Bar Assn. when Justice Reardon's commission was set in motion, and Chief Justice Warren Burger was chairman of the parent group, the bar's Special Committee on Minimum Standards for Criminal Justice.

Many editors and publishers had objected to the original Reardon Report, fearing an attempt to limit press freedom. When the ABA debated its new code, the press was solemnly assured that it was not being attacked; the bar was merely putting its own house in order, and the new rules would govern only the conduct of witnesses, lawyers and court officers and would not limit the freedom of newsmen.

But ever since, a confrontation has been building up between government and the press, particularly after the Nixon Administration took over in 1969. To the Justice Department "law and order" meant not merely a drive against organized crime and drugs (a drive whose effectiveness is questioned by many experts in the field), but a battle as well against some forms of dissent.

This dissent was news and the press had to cover it. It frequently involved what US Supreme Court Justice White in Caldwell said were "minority cultural and political groups of dissident organizations suspicious of the law and public officials."

Prosecutors at all levels began to increase the use of Grand Juries as a tool of investigation. And newspapers by the summer of 1970 began to complain against "dragnet subpoenas," such as one in Chicago calling for their private files and photos.

The complaints were recognized by Atty. Gen. John Mitchell Aug. 10, 1970. He announced a set of guidelines for the Justice Department before the American Bar Assn.'s House of Delegates. They follow:

Negotiations with the press should be attempted when a subpoena is contemplated. The Attorney General must authorize each subpoena. A request for it must show the information sought is essential and cannot be obtained from non-press sources. Subpoenas normally should be limited to verification of published information. Great caution should be observed in requesting unpublished information or information where a serious claim of confidentiality is alleged.

Justice White in Caldwell referred to these guidelines when he said they "may prove wholly sufficient to resolve the bulk of disagreements . . . between press and Federal officials." But this is precisely what they have not done. The disagreements have multiplied.

Mr. Mitchell justified the guidelines by saying, "We will not permit an innocent man to be convicted or a guilty man to be freed because we declined to subpoena a newsman who had information vital to the case."

This was a most persuasive statement. Yet in the light of later developments he could be said to have framed it wrongly. For he might have acknowledged that convicted men have been proved innocent, and guilty men have been sent to prison, only because the press was free to dig out the facts from sources both secret and non-secret.

The Mitchell guidelines had other defects also. They were not at all binding on state and county prosecutors. They could be changed, for better or worse, at any time by any incumbent Attorney General. And they can be and have been abused. They need not restrict any lawyer's motion, nor a judge's whim.

It is cold comfort that under them, until last Sept. 21, US Attorneys had sought 15 Federal subpoenas involving confidential press information and obtained approval for seven. Other prosecutors and judges were subpoenaing all over the country in spite of the guidelines.

Just two months after they were issued, Congress passed and President Nixon signed the Organized Crime Control Act of 1970. It reinforced and expanded the investigatory powers of the Grand Jury, authorizing such special bodies to sit wherever designated by the Attorney General and for up to 36 months. Even before it cleared Congress, the New York City Bar Assn. warned that it contained "the seeds of oppression."

The Justice Department used the new law to revive its Internal Security Division, dormant since the demise of McCarthyism. It was now headed by Robert Mardian, a conser-

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vative-minded Californian and close friend of Mitchell's successor, Atty. Gen. Richard Kleindienst. Mardian also got control of the department's Interdivisional Intelligence Unit with its computerized storehouse of information.

In the last two years at least 20 Federal Grand Juries have been used to investigate radical or anti-war dissent. With the power of subpoena, the proceedings secret, and not bound by the rules of evidence required in open court, they have a lot more leverage than, for example, the old House Un-American Activities Committee.

And despite the rhetoric about combatting crime, the Grand Jury process has seldom been used against the big crime syndicates. It has been directed instead against the Berrigans, the Ellsbergs, the Vietnam Veterans Against the War, supporters of the Irish Republican Army, the Weatherpeople, the Black Panthers — and the newspapers.

For the press has had to cover these various stories, and a curious and two- edged governmental sword has been wielded against it. One edge, in cases involving government secrecy, is the feeling of public officials that somehow the nation's security is threatened if the public gets full access to information on the government's business, whereas what is really being undermined is merely secrecy itself.

The other edge of the sword concerns dissenting groups and movements and what some prosecutors see as a clear threat of subversion. Here it is not the government's secrets but the secret sources of the press which they want to use to obtain indictments and convictions. In reality what is being undermined here is press freedom itself.

The evidence suggests, moreover, that unless Congress acts to prevent it, a concerted movement will succeed in freezing the current policy into the entire Federal judicial system.

Early this month Congress received from the US Supreme Court a sweeping new judicial code that will become law automatically in 90 days unless both houses reject it. Technical in nature, it codifies the rules of evidence for the 93 Federal District Courts, and can be of immense value in standardizing procedure.

It was instituted by former Chief Justice Earl Warren, who named a drafting committee that has worked eight years under the Judicial Conference of the United States, the judiciary's administrative arm, now presided over by Chief Justice Warren Burger.

The new code, by and large, represents a long needed and monumental reform. But in two most vital respects, it would expand the right of the government to mark material "secret," and it pointedly omits any special privilege for newsmen to protect their confidential sources.

It affirms the privilege not to reveal confidences in the lawyer-client and husband-wife relationship, which is settled law, and it affirms the privilege of a clergyman in spiritual counseling and a psychiatrist in consultations with a patient. But it omits the problem of journalists.

On the other hand it lists broad privileges for the Justice Department against disclosure of confidential material on foreign relations, defense, investigations, and government informers.

The new code does not require the President's signature, and he may not veto it. But Congress may want to take a long, hard look at it, as well as examine the various proposals for a national press shield law.

THE CASE FOR A SHIELD LAW

The Bill of Rights was written into the Constitution in 1791 to protect the rights of the people, not of any special group or the government, against any encroachment by government. It is most important to keep this in mind.

For it has been asserted that in seeking a privilege of immunity under the First Amendment, the press is guilty of elitism, of wanting, as one writer has put it, to "be set apart as a privileged caste exempt from the obligations of lesser folk."

This is the same note struck by US Supreme Court Justice Byron White in his Caldwell ruling that "newsmen are not exempt from the normal duty . . ." and that they want "a testimonial privilege that other citizens do not enjoy . . ."

Such words hide the fact that, as usual, it is the people themselves who are being cheated of their right to know.

The First Amendment was written to protect the people's freedom to worship, freedom of speech, freedom of the press, and the right to assemble peaceably and "to petition the government for a redress of grievances." The very sequence is significant: free speech for all, and a free press so everyone could exercise free speech with knowledge.

It was known that some newspapers would print error. This has always been so. But it was also known that error can only be corrected if there is freedom for the truth to find its way. A free press does not mean, cannot mean, a press that is all good, but a press in which the good has more than a fighting chance to correct the bad.

In his very first case after being sworn in, U.S. District Court Judge Murray Gurfein summed it up in his 1971 Pentagon Papers ruling: "A cantankerous press, an obstinate press, an ubiquitous press, must be suffered by those in authority in order to preserve the even greater values of freedom of expression and the right of the people to know . . ."

Newspapers enjoy no special exemption from the laws of the land. They can be, have been and should be held accountable in court for what they publish. And they are also accountable to their readers, who should know better than anyone in government what to do about an elitist newspaper.

Unlike government, the press has no subpoena power. It must depend for much and sometimes the most important of its news on its sources. Ever since the Caldwell decision of last June, a lot of those sources have been drying up. This has happened, quite literally and specifically, to sources of The Globe's Spotlight Team, which before Caldwell won a Pulitzer Prize for exposing corruption.

We state quite frankly that if some of this team's sources were publicly identified, human lives would be in jeopardy. And also, there would be in the end no more exposure of governmental corruption. The people would be shafted more and more.

Far from being elitist, editors and reporters have to take a lot of pressure. They take a risk, small or large, every time they print a story. They get a lot of criticism, sometimes deserved, from public officials, community figures, readers. And now they are taking it from the courts and prosecutors.

The result is what the lawyers call "a chilling effect." Stories with elements of risk tend to be avoided. Editors can still go home and sleep soundly, perhaps — but in the end it is the public that is cheated.

Perhaps Paul Branzburg summed it up best when he said on a recent TV show, "I've heard of a lot of governments that took over the press, but I never heard of a press that took over the government."

The people's access to information is gravely endangered today, and there now seems small likelihood of the US Supreme Court's reversing Caldwell. The only possible solution of the problem lies in the enactment of Federal and state shield laws, which the high court explicitly invited if the Congress and states so wish.

They very much ought to. Yet the search for an adequate law will not be easy. Already the courts have shot holes in a number of the 18 state laws on the subject, since all but two of them protect newsmen only from disclosure of a "source" of information. Only two states protect the information ifself.

The official historian of the US Supreme Court itself, Prof. Paul Freund of the Harvard Law School, has summed up the matter: "It is impossible to write a qualified newsman's privilege. Any qualification creates loopholes which will destroy the privilege."

For this very reason, the American Newspaper Publishers Assn., the American Society of Newspaper Editors and the American Newspaper Guild all favor an absolute guarantee. So, we think, do the American people.

A Gallup poll last Dec. 3 said the view that a newsman should not be required in court to reveal confidential sources was supported by 57 percent to 34 percent. The percentage in favor ranged from 48 for those with only a grade school education to 68 for those with a college background. And such public figures as Govs. Rockefeller of New York and Reagan of California have come out for a strong shield law.

Two such bills are pending in the Massachusetts Legislature, one filed by Sen. John M. Quinlan (R-Norwood) and supported by the New England Press Association, and the other filed by Rep. James Segel (D-Brookline) and supported by the Civil Liberties Union of Massachusetts.

We prefer the latter measure, since it contains an absolute protection of sources, is broader in coverage and protects confidential information also except for that concerning certain specific felonies and then only if it is relevant and unobtainable in any other way.

But state shield laws do not bind the Federal government, and hence the enactment of a strong shield law by Congress this year is essential if the free press is not eventually to be muzzled. Some two dozen bills have already been filed.

Framing the best possible law will not be easy. But The Globe strongly believes that the law's protection should be absolute and not qualified, both as to the identity of sources, the information gained from them, and as to the entire field of the printed and electronic word. There should be no elitism in the free flow of ideas and facts.

Nor should the college and so-called underground press be excluded from the privilege. They probably need it even more than the established or commercial press. (In 1970-71 some 60 college newspapers were censored; the Internal Revenue Service probed the tax exempt status of the Columbia Daily Spectator to the point where its continued existence is threatened, and in Palo Alto the police raided the Stanford Daily looking for photos so they could make arrests.)

An all-inclusive, national shield law is vital to protect not merely the newspaperman's rights, but the public's right to the open kind of knowledge and information it needs.

For without it, a long-suffering people, deprived of this basic liberty, will have to make its decisions on public affairs under orders, or in the dark, while those in the seat of power rob them blind. □

Testa – *Continued from page 12*

perceiving does not easily change and represents an engrained feature of his psychological being — his perceptual style. Individuals can be classified on a continuum from field-dependent to field-independent depending upon their ability to extract a figure from an embedding context. Field-independent people are better able to perform this task.

It has been demonstrated that an individual's performance in this embedded figures test (EFT) represents the nature of his functioning in other areas of life, i.e., his dealings with symbolic representations. Thus, Testa hypothesized that performance on the perceptual test would predict programmer aptitude. Since the EFT is based upon the universal perceptual function of disembedding, it is amenable for testing people of widely different mental levels and socioeducational backgrounds. Study results indicated a significant correlation between EFT scores and class grades. It is interesting that a test, in this case EFT, not purposely designed to measure specific programming capacities had such a high correlation with class grades. Clearly, the EFT must have tapped some of the characteristics of the programming task. However, I would caution that further validation is required before the EFT can be used as a screening technique for programmer aptitude.

Man-Computer-Logic

A slightly expanded form of Licklider's symbiotic concept was introduced by Grace (1970), who noted that information systems are characterized by three components — man, machine, and logic. Thus, a triad exists in which man interacts simultaneously with machine and logic.

The idea of man-logic interaction was further explained by Schwartz (1972) who defined the logic component "as a bridge between man and machine (computer) — a change in the logic design of one component (man or machine) can require concomitant changes in the other component..." (Schwartz, 1972, p. 391). As a result, the once static process of allocating functions to man or machine becomes dynamic and iterative. In addition, system designers must continuously match human capabilities with machine logic during the design of data bases and programs or else certain problems will arise. For example, the amount of information processable as a unit by humans may be much smaller than the designer's definition of content, and may adversely affect human performance.

Another potential problem lies in the difficulty humans may experience in accessing and retrieving information from the data base because of its poor logical structure. Finally, the logic of the program itself (data base manipulation) may cause a deteriorated performance of human tasks. Consideration of these facts indicates that the emphasis has shifted from man-computer interface design to the design of computer core. This "new" concept is certain to evince a myriad of problems. However, the potential now exists to develop systems which will be indeed "symbiotic".

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New Orleans – *Continued from page 32*

tive but to push ahead regardless of the predictable obstacles and regardless of the predictable misunderstandings. I adopted as my guideline an ancient but rarely followed legal maxim: "Let justice be done, though the heavens fall".

Since then, the heavens indeed have fallen. Obstacles and misunderstandings indeed have occurred beyond accounting. I will not attempt here to delineate the viciousness of the many counter-efforts of the Federal government — fighting to preserve its now artificial facade as a government of the people. Nor will I attempt to describe the varied smears which I have had to read about myself in some sectors of the American press. Suffice it to say, that if I had to do it over again — I once again would conduct our entire inquiry as deeply and aggressively as I did. To do any less would be to fail to do my duty as District Attorney of New Orleans.

The Federal judiciary, not too surprisingly, took the position — in ending the investigation conducted by my office into the assassination — that our inquiry had been conducted in "bad faith". Inasmuch as the Warren Commission concocted one of history's greatest lies in order to fool the people and inasmuch as the Justice Department and the Federal judiciary have actively worked to obstruct and block the only honest official investigation into the assassination — I think it is all too clear where the "bad faith" really lies.

On November 22, 1963, agents of the United States government launched their deadly ambush against the President of the United States. The afore-described Supreme Court decision of November 20, 1972 — almost exactly nine years later — puts the final nail in John Kennedy's coffin. □

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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PEOPLE

Cover Story –

STROKE VICTIM "SPEAKS" THROUGH ELECTRONIC AID DEVELOPED BY COLLEGE STUDENTS

Robert Griffith
Public Relations Dept.
University of Vermont
Burlington, Vt. 05401

Several University of Vermont Electrical Engineering majors recently undertook a project to help Lloyd A. Lavigne of South Burlington. Mr. Lavigne, age 48, was the victim in July 1971 of a type of stroke that affected his motor functions and left him totally unable to communicate by speech or writing. The usual medical device to permit such patients to make their wants known is a pointer, placed in the mouth, which the patient directs to one of a series of messages or letters on a printed sheet.

The Electrical Engineering Department at UVM was approached by a graduate student in Speech Therapy, Ms. Christine Cleppe, who requested assistance in giving Mr. Lavigne a reasonable ability to communicate. Four seniors, Michael E. Grant of Vernon, Gary Hazard of Rutland, John G. Lang of South Burlington, and Romaine N. Tomlinson of Richmond, volunteered their time and effort to undertake to help the patient by providing a new electronic communication aid.

In conjunction with Gary Hazard's wife, Mary, a registered nurse, the students designed a system utilizing a television-screen computer terminal to display messages in printed form. At the students' initiative, the terminal was provided free of charge by the manufacturer.

To enable the patient to "speak" to the terminal, the students took advantage of a small degree of motion remaining in one hand. They used an electromechanical Morse code sending device, called a key by ham operators, which automatically converts small movements of a switch to electronic dot or dash pulses. The students' major problem then was the designing of an "interface" system to convert every combination of dots and dashes, which form a Morse code letter, into a "language" which the television device could interpret. What appears on the screen looks very much like a television picture of a printed sign, but the operator can transmit his message letter by letter as on a typewriter. He has the advantages, however, of instant erase of the total message, automatic spacing between words, and an erase-and-correct facility for individual letters.

Mr. Lavigne had been practicing Morse code for several months in anticipation of receiving his gift. His first deliberate message was to thank the four young men who made this possible. He used the device during its shakedown period of operation, and has used it enthusiastically.

It is too early to determine the long term utility of the students' contribution, but they have great confidence in a successful outcome, based largely on Mr. Lavigne's cooperation, enthusiasm, and determination. It is hoped that this device, or those of similar design, will be useful to other persons who have similar disabilities.

APPLICATIONS

TELL THE COMPUTER YOU'RE HOME

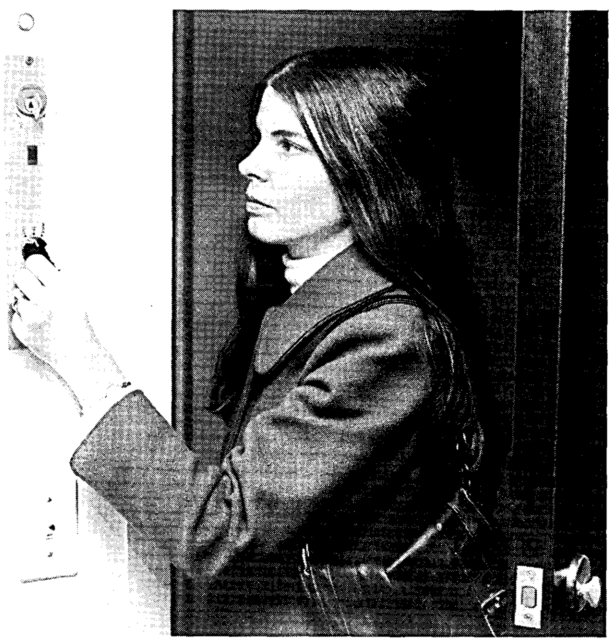
Waterview Apts.
a division of Robsham Industries
P.O. Box 151
Cochituate, Mass. 01778

When a resident of Waterview Apartments, Framingham, Mass., opens the door to enter his apartment, he uses an ordinary key in an ordinary lock. But what happens next isn't so ordinary. The resident must also inform an IBM computer that he's home. If he fails to do so within a certain time, a security guard is alerted. The "electronic check-in" is a simple matter that takes just a few seconds. But it's a significant feature of a computer-based system that is making Waterview one of the safest and most convenient apartment complexes in the country.

"When we initially surveyed prospective tenants," said Paul Robsham, president of Robsham Industries, builder of the 1,020-unit complex, "we found something called 'peace of mind' high on the list of things people wanted. We believe the computer, through the new levels of security and convenience it provides, can help us meet this requirement."

The computer itself is small, not much larger than one of the refrigerators found in any of the apartments, but it is capable of measuring, analyzing and controlling a wide variety of events as they happen. It can take as many as a quarter-million readings a second and analyze them almost as quickly. This capability is used at Waterview to provide round-the-clock monitoring of the sensing devices which, in turn, are assigned specific tasks.

Take the case of the "electronic check-in," the security feature for individual apartments. When a resident enters his apartment, he must also insert his key into a nearby security control panel. If he doesn't, the computer prints out the message "apartment entry," along with the apartment number and the exact time. A security guard can then use



an intercom to ask the resident for his code, which is a series of numbers. If the response is not correct, the guard would then check out the situation.

Once inside the apartment, the resident has several options. For one thing, he may not feel the need to re-activate the system. If he does turn it back on, however, he inserts his key and puts a switch into the "in" position. If he wants to open the door for short periods of time, such as when admitting visitors, he puts the switch into a "hold" position. If an expected visitor were to turn out to be an intruder, all the resident has to do is release the spring-loaded "hold" switch. The computer would then print out an alert.

An additional feature of the computer-based system is a medical alert button, which resembles a door buzzer. Located near the control panel in an apartment, it permits the resident to call for medical assistance. "This feature is especially popular with middle-aged and older residents as well as expectant mothers," said Mr. Robsham. "They realize that when seconds count, it's much easier to push a button than to dial a telephone."

In addition to the computer's current tasks ("electronic check-in", providing prompt medical assistance, and monitoring for fires and smoke) and those planned for the future, the IBM System/7 also has time to regularly check out the operation of the entire network. Each hour it polls all circuits, control panels and sensors. If any problems or malfunctions are detected, they can be corrected almost immediately. Among the tasks considered for the future — regulating elevator operation, insuring there's enough hot water for bathing, even watering the spacious lawns that green Waterview's 22-acre site.

NEW MEXICO'S NEWEST CRIMEFIGHTER

Western Electric
195 Broadway
New York, N.Y. 10007

For the New Mexico State Police, getting an answer to a teletypewriter message used to be a laborious process, with time-consuming delays built into an overworked and outmoded system. Now, using a new system developed by Teletype Corporation, a subsidiary of Western Electric, messages hum across the network almost instantly, with a monthly volume almost triple that of the old system.

The new, computer-directed network provides fast, efficient telecommunications over the varied terrain of America's sixth largest state. From the mountains of Taos to the desert of White Sands, the system can, in minutes, put a cruising patrol car in contact with FBI headquarters in Washington, or the National Law Enforcement Teletype Service in Phoenix. The 150-word-a-minute teletypewriters that form the heart of the system have been specifically designed by Teletype Corporation to be adaptable to the diverse needs of police work; they are compatible with all other relevant networks, so messages need not be translated from one computer language to another, and each station can, in effect, act as its own "headquarters".

The new system has drawn the interest of other police departments throughout the country. Some have even requested to see the New Mexico operation first hand. "They're always amazed," says Communications Captain Richard CdeBaca, "at how calm everything is in our communications department. One man even suggested that he had come at a bad time, when traffic was slow. When I showed him the volume of traffic that our units were handling, he was impressed."

The Captain expects the call volume on the network to exceed 100,000 calls per month sometime in 1973. "As our troopers in the field become accustomed to efficient service, they are more likely to use the system," he says. "And even with that many calls, this system isn't breathing hard."

FURNITURE MAKERS USE COMPUTER TO GET MORE USABLE WOOD FROM HARDWOOD PLANKS

Public Relations
Data General Corp.
Southboro, Mass. 01772

A minicomputer is making calculations that will help furniture manufacturers get more usable wood from the hardwood planks they cut into furniture parts. A Data General Corporation Nova 800 minicomputer is part of a lumber scanning system developed jointly by North Carolina State University's School of Forestry, and Technology Unlimited Inc., a Raleigh-based engineering firm. The work was done under a grant from the International Research Institute of the National Furniture Manufacturer's Association.

"The goal of the system is to get more defect-free furniture parts out of each board," said A.G. Mullins, of N.C. State, who directed development of the system. Saving lumber is important because roughly half the wood received is unusable because of defects. "When hardwood comes into a furniture company's rough cutting mill, a cutter looks at each board and, in a few seconds, tries to determine the best way to cut it to get the greatest number of defect free pieces," Mr. Mullins said. "Because he has so little time, he probably does not get the maximum yield from that piece."

David Cox, president of Technology Unlimited, the company that developed the hardware for the system, says the scanning system not only gives a greater yield, but places an automatic priority on larger pieces because they are harder to get. "With the computerized systems, an inspector circles defects in the wood with fluorescent paint," Mr. Cox said, "and clamps it into a scanning bench. A scanning head with 128 photocells travels the length of the board and transmits an image of the board and the location of the defects into the Nova 800."

When the scanning head reaches the end of the board, the Nova 800 computes the cuts that will get the most usable wood from the plank. The computer considers only sizes previously entered by the mill foreman. The company using the system makes up a cutting list and enters it into the system. After computations are done, the scanning head returns to its original position, spraying the cutting lines as it travels. When the plank is marked, it is cut manually. Mr. Mullins said the system can give furniture companies a significant cost saving — "...if a company is cutting 20,000 board feet of wood per day [about $6000 daily], ... up to a saving of $156,000 per year."

WEIGH-IN-MOTION (WIM-1) SYSTEM USED TO HELP PLAN ROAD RESURFACING REQUIREMENTS

June Fanazick
Public Relations
Data General Corp.
Southboro, Mass. 01772

A small computer system mounted in a truck is helping several Southern states plan highway resurfacing projects by measuring the dynamic forces a truck exerts on a road. The Weigh-In-Motion (WIM-1) system, incorporating Data General's NOVA minicomputer, was developed by UNITECH, Inc., of Austin, Texas. WIM-1 replaces a crew of men that flagged down trucks at a prepared turnoff and weighed them. The trucks no longer have to slow down or stop; the NOVA-based system weighs them in motion.

A small truck transports the system, which includes a NOVA 1200 computer, teletypewriter, line printer, visual display, and a magnetic tape unit, to the job site. The equipment at the site includes strain gauge wheel load transducers, a speed trap, and vehicle presence detector. The small van with the NOVA-based system parks beside the roadway and plugs into the sensors.

An operator manually calibrates the system on site and sets a mimimum threshold weight that excludes measuring smaller vehicles, such as cars or motorcycles. When a vehicle passes over the sensors, the time between tire impacts is measured and used with the measured speed to calculate axle spacing. The wheel load transducers give axle weight for each wheel by deflecting a series of load cells and generating analog electrical signals proportional to the dynamic weight of each wheel. The system samples these analog weight signals, converts them to digital format, and inputs the data to the NOVA.

As the vehicle leaves the measurement area, the NOVA calculates an estimate of its gross weight and stores it with the vehicle length, axle spacing, and speed, as well as the date and time of day. The operator can classify the truck visually and enter the identification (van, flatbed, semi) into the system.

The readings help highway planners determine which type of paving material would hold up best under the traffic load the road bears, and how thick the material should be to minimize repairs.

'COLD STORAGE' COMPUTER HELPS FREEZE PIES

L. H. Gerow, Production Vice President
Chef Pierre, Inc.
Box 1009
Traverse City, Mich. 49684

A small computer has been "placed in cold storage" to help meet a growing demand for frozen foods. Chef Pierre, producer of frozen desserts, has installed an IBM System/7 to ensure that Mrs. Jones' favorite store in Texas will have the cherry and pecan pies she needs for her bridge group next week.

"We package three dozen varieties of desserts under six brand names in addition to our own," says production vice-president Leonard H. Gerow. " ... keeping track of our 250 different labels would be an almost impossible task without the computer's help." Customers include frozen food brokers and distributors in 40 states who in turn sell to supermarkets, institutions such as universities and hospitals, and other retail outlets.

The computer is programmed to direct the daily storage of 160,000 pies, cakes and apple dumplings in the company's new, three-story freezer building. Roughly 90% of the desserts are packed into cartons and shipping cases for freezing right off the production line. The remainder (cakes, pecan and custard pies) are baked to keep them intact during shipment, and then frozen. Packed desserts are stored on pallets, 36 to 72 cases on each, depending on package size.

Chef Pierre freezermen move a loaded pallet from the production line into the freezer area. They pull a pre-punched computer card containing brand name and dessert name, and insert it into the computer along with the quantity stored. The computer automatically types out storage location labels. The labels are attached to the shipping cases and the pallets are stored according to the computer's instructions. When an order comes in, the same pre-punched cards are usedand quantity again is keyed into the computer — which then indicates the best freezer location from which to fill the order.

The computer also considers volume and frequency of use when it picks a storage location; high turnover items are stored in the most accessible areas. Length of storage is another factor considered by the computer program. This prevents the various desserts from being released for shipment until they have been in freezer storage from 5 to 48 hours, depending on the particular item.

NEW PRODUCTS

MIMIC — FOR MINICOMPUTER USERS

First Data Corporation
400 Totten Pond Rd.
Waltham, Mass. 02154

First Data Corporation of Waltham, Mass., an East Coast time-sharing service, is currently offering MIMIC — a system of program preparation aids for minicomputer users. This system offers on-line editing for creating and updating source programs, assembling, loading, and interactive debugging under simulation for most of the popular minicomputers such as the Nova line, the PDP-11 and PDP-8 families, and the GRI-909 and -99.

The service enables programmers to move their software projects to a powerful, multi-user time-shared computer away from the limited environment of the minicomputer. Software work can now be done prior to taking delivery of the minicomputer hardware. Also a production system's software can be updated using MIMIC when the minicomputer is unavailable to the programmers. After development, all programs can be moved directly to the minicomputer for final testing.

IBM INTRODUCES A TYPEWRITER THAT ERASES

F. J. Steinberg
IBM Corporation
Office Products Division
Parson's Pond Drive
Franklin Lakes, N.J. 07417

A new typewriter which can make typing errors disappear on original copies was introduced recently by the Office Products Division of IBM Corp. Called the IBM Correcting "Selectric" Typewriter, this new machine enables secretaries to type most work at "rough draft" speeds, since all errors on originals can be corrected quickly at the keyboard without time-consuming erasures.

When the secretary makes an error, she simply backspaces to the incorrect character (or characters) by depressing the correcting key. This key activates a special tape which removes the error when the incorrect character is struck again. Then, the secretary types the correct letter, number or punctuation mark and continues typing. Equipped with the new IBM Correctable Film Ribbon and Lift-off Tape, the IBM Correcting "Selectric" Typewriter actually lifts typing errors off the paper.

RESEARCH FRONTIER

NEW METHOD OF PROCESSING VISUAL DATA MAY SIMPLIFY AND REVOLUTIONIZE COMMUNICATIONS AND COMPUTER HARDWARE SYSTEMS

Joel Schwartz, News Service
Carnegie-Mellon University
Schenley Park
Pittsburgh, Pa. 15213

Electrical engineers at Carnegie-Mellon University, report progress in developing a new method of processing visual data that will eventually simplify communications systems and revolutionize computer hardware. The method, known as either optical computing or optical data processing, can refocus pictures and images that have been blurred by multiple exposures, movement and poor resolution. The work, directed by Professor Sing Lee and funded by the National Science Foundation (NSF) and NASA, involves the use of laser beams, lenses and a special light filtering element. According to Professor Lee the attractive features of the new technology are information capacity, processing speed and system cost.

Analyzing visual data presently involves the use of digital computers that are programmed to sequentially identify, label and process thousands and sometimes hundreds of thousands of pieces of information that make up an image. By computing optically, Professor Lee asserts, even more information can be processed, costly processing time can be reduced, and the same results can be achieved.

The key to optical computing has been the development of a light filtering element called a spatial filter. The filter itself can take on many different forms. Crude filters are simply photographic films with patterns on them, and more complicated and sophisticated filters are sometimes electro-optical crystals or organic dye materials. Laser beams are used as monochromatic and coherent light sources to illuminate the images, and the lenses focus the laser beams on to the spatial filters. Professor Lee explains, "The faster we can change the filter or the faster the filter can change itself, the faster we can process different images".

Although optical computing is still in the development stage, several uses have been found for the new system. One use, described by Professor Lee as "solid as a rock" is microwave photography. By using lasers and optical systems to process the data received from microwave radars, the Air Force and NASA can photograph the earth through clouds, fog and other natural interferences. In another application, optical computing already has succeeded in increasing the sharpness of images obtained from the most powerful electron microscope. Western Electric, the research and development division of Bell Telephone, is toying also with the idea of computing optically to improve quality control in the production of miniature electronic circuits. Presently, the circuits are examined in most large electronic companies by employees peering through microscopes. A new system utilizing spatial filters would be able to separate the good circuits automatically from the defective ones with ease.

Looking into the future, engineers see optical computing as a promising method of simplifying the information sent through communications channels. They envision using an optical system to subtract visual information that is changing from visual information that is constant. By sending only the information that is changing and adding it to the visual image known to be constant, a considerable amount of unnecessary communication can be eliminated. Another area being investigated is the use of optical systems in medical technology. Doctors and medical technicians might someday be able to run images of tissue and cells through an optical processor that would identify diseases and infected areas.

While digital computers are now the primary tools used in data processing, Professor Lee is quite positive about the future of optical systems. "Digital computers can handle about a half a million pieces of information, and in the future we want to be able to handle a hundred times that, maybe a thousand times that at a reasonable cost. An optical system promises to do that.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Sanders Associates, Inc., Nashua, N.H.	Lockheed California Co., Calif.	Producing second production lot of airborne acoustic data processors for U.S. Navy's S-3A carrier based anti-submarine warfare aircraft; processors receive buoy-detected underwater sounds, analyze them and display information on television screens for S-3A crewmembers	$20 million
ITT Creed, Great Britain	British Post Office	9,000 teleprinters and associated equipment	$17 million (approximate)
PRC Information Sciences Co., Los Angeles, Calif.	Air Force Systems Command, Air Development Center, Griffiss A.F.B., Rome, N.Y.	Providing software support to PACER (Program Assisted Console Evaluation and Review) system	$3+ million
Unidata, Ltd. (Datapoint Corp.), United Kingdom	British Railways Board	Datapoint 2000 Dispersed Data Processing Systems to serve as key element in a system called TOPS, which permits control and monitoring of every freight shipment within 11,000 mile rail system	$3+ million
GTE Sylvania, Inc., Mountain View, Calif.	U. S. Army	Design and development of a signal processing system	$2.6 million
Raytheon Data Systems, Norwood, Mass.	Midwest Stock Exchange	Supplying PTS-100 programmable terminals for use in Exchange's nationwide SIGNET 80 order processing and communications network	$2.6 million
Computer Sciences Corp., San Diego, Calif.	U. S. Navy, San Diego, Calif.	Analysis and programming services to the Fleet Combat Direction System Support Activity at San Diego	$2.5 million (approximate)
Computing & Software, Inc., Los Angeles, Calif.	California Dept. of Human Resources Development, Los Angeles, Calif.	Supplying data processing services for the Los Angeles County Job Bank program administered by HRD California	$1.8 million
Comten, Inc., St. Paul, Minn.	Federal Reserve Bank, Richmond, Va.	Dual COMTEN 45 computer communications system for on-line transfer of funds and securities	$850,000+
Litton Industries, Beverly Hills, Calif.	Laker Airways, United Kingdom	LTN-72 inertial navigation systems for 2 new DC-10 jets which will be used in low-fare "Skytrain" transatlantic service	$700,000
Raytheon Co., Waltham, Mass.	Lawrence Livermore Labs., (AEC), University of California, Livermore, Calif.	Laser power charging modules to be used in high energy laser systems for experimental work in controlled nuclear fusion	$497,000
Data Technology Corp., Santa Ana, Calif.	Kraus Elektronik KG Frankfurt, West Germany	5,000 digital panel meters, Model 3312, specifically designed for use throughout Europe and Scandanavia	$400,000 (approximate)
Logicon, Inc., Torrance, Calif.	Sea World, Orlando, Fla.	Development, integration and installation of entertainment system for Fountain Fantasy to control all show equipment elements	$337,000
University of Chicago, Center for Health Administration Studies, Chicago, Ill.	U.S. Department of Health, Education and Welfare, Washington, D.C.	Continuing development of research programs in quality, costs, distribution, financing and administration of health services; a $1 million additional grant has been pledged to support work	$243,654
Telefile Computer Products, Inc., Irvine, Calif.	ITT Defense Communications, Nutley, N.J.	Subcontract covering purchase of 2 DC-18 Disc File Controllers and 8 Telefile DD-215 Dual Density Disc Storage Units (16 Disc Pack Drives), plus a specially designed Dual Access Switching Unit; equipment to be interfaced to 2 Digital Equipment Corp. PDP-15s	$200,000+
Logicon, Inc., Torrance, Calif.	Naval Ship Weapons Systems Engineering Station, Port Hueneme, Calif.	Engineering services in connection with ship missile defense research	$192,000
Westat Research, Inc. and Aspen Systems Corp., Rockville, Md.	National Science Foundation (NSF)	Joint study on the feasibility of establishing Editorial Processing Centers (ECPs) to advance the use of computer technology in publication of scientific journals	$154,865
Alston Division, Conrac Corp., Duarte, Calif.	Michigan Bell Telephone Co., Detroit, Mich.	Two computerized telephone traffic data systems known as ATEMIS (Automatic Traffic Engineering and Management Information System), for use in the greater Detroit area	—
Computer Products, Inc., Fort Lauderdale, Fla.	Bailey Meter, Canada	RTP standard product interfacing equipment which will connect a SPC-16 computer to monitoring and sensing devices within a Power Station complex in Far East	—
Control Data Corp., Minneapolis, Minn.	Commonwealth Edison Co. Chicago, Ill.	Developing computerized system for accountability of nuclear reactor fuel assemblies	—
Documation, Inc., Melbourne, Fla.	General Automation, Inc., Anaheim, Calif.	500 punched card readers (varied models) to be delivered during next two years	—
Honeywell, Inc., Wellesley Hills, Mass.	British Steel Corp., Newport, England	Two identical Model 716 configurations to provide full fail-safe capability; system will act as "front end" of advanced production control system for Llanwern strip mills	—
SYSTEMS Engineering Laboratories, Inc., Fort Lauderdale, Fla.	Combustion Div. of Combustion Engineering Inc., Windsor, Conn.	Several nuclear power plant monitoring and supervisory computer systems built around 32-bit SYSTEMS 85 computer	—

NEW INSTALLATIONS

OF	AT	FOR
Control Data 7600 system	Compagnie Internationale de Services Informatique (CISI), Saclay, France	Very complex computations, and general data processing purposes for the CISI users
Control Data Cyber 70, Model 72 system	Automated Building Components, Inc., Miami, Fla.	All in-house computer functions, as well as design work presently being done by an outside time-sharing network
	National Institute for Nuclear and Particles Physics, University of Paris, Paris, France (2 systems)	Supporting data processing gathered from scanning devices which photograph vapor paths in bubble chambers; to be installed at Institute's two nuclear research laboratories in Paris and Orsay (systems valued at $1.5 million)
DECsystem-10	Cyphernetics Corp., Ann Arbor, Mich. (4 systems)	Fulfilling increased demand for time-sharing services; each will supply 50% more computing capacity than previous single-processor systems
DECsystem-1070	The First Church of Christ, Scientist, Boston, Mass.	Performing all data processing tasks for both The Mother Church and The Christian Science Publishing Society (publisher of The Christian Science Monitor) and 37 other periodicals (system valued at $1.2 million)
Honeywell 6060 system	Norwegian State Computer Center, Oslo, Norway	Serving central, regional and local government units; aim is to have coordinated computerized system for use of all departments in government (system valued at more than $3 million)
IBM System/7	Friendship International Airport, Friendship, Md.	A 24-hour electronic surveillance security system monitoring and controlling airport's entrances, passenger gates, tunnels, maintenance areas, freight elevators, fire exits
NCR Century 50 system	ARC Construction, Essex, Conn.	Accounts payable processing, job-costing, estimating, payroll and inventory
	F. H. Brewer Construction Co., Lancaster, Ohio	Job-costing, accounts payable and receivable, general ledger accounting and payroll
	Guaranty Bank & Trust Co., Cedar Rapids, Iowa	Monitoring checking and savings accounts
	Justus Contracting Co., Indianapolis, Ind.	Management of rental accounts, labor distribution, payroll and job-costing
	Orthopedic Equipment Co., Bourbon, Ind.	Accounts receivable and payable, sales analyses, inventory control, and payroll
	Systech, Inc., Champaign, Ill.	Materials requirements, production control and cost variance determinations; payroll preparation for itself and several other companies
	World Gospel Mission, Marion, Ind.	Fund-raising, keeping track of donations, and total financial reporting involving disbursements for missionary work
NCR Century 100 system	Damart Thermawear (Bradford) Ltd., Bingley, Yorks, GB	Meeting data processing needs
	York Trailer Group, Corby, Northants, GB	A variety of accounting applications; will place stock control system on computer at later date
NCR Century 200 system	Basha's, Chandler, Ariz.	Order billing, general ledger accounting, payroll, and processing employee credit union records
	Harris Pine Mills, Pendleton, Ore.	Processing accounts payable and receivable and preparing payroll for 500 employees
	Products Research and Chemical Corp., Burbank, Calif.	Maintaining all its financial records, including payroll for 350 employees
Univac 1106 system	Banco Espanol de Credito (BANESTO), Madrid, Spain	Use primarily in Stock Exchange recording; BANESTO is currently using eight UNIVAC computers
	Central Computer Agency, United Kingdom	Use by Central Statistical Office (CSO) which is responsible for computer support of British Treasury's economic forecasting and research; system will be used with IDIIOM II graphics terminal
	Keio University, Tokyo, Japan	Research programs, administration, and education in computer science
Univac 9200 system	Club Computer Corp., Tarzana, Calif.	General accounting chores and payroll processing; plans include extending services to other areas in addition to the four country clubs firm now serves
Univac 9211 C system	Gabberts, Inc., Dallas, Texas	Inventory control, payroll processing, general accounting, billing and sales reports
Univac 9211 D system	Gloucester County College, Sewell, N.J.	Student instruction and administration applications
Univac 9214 D system	Robert Cornwell Associates, River-edge, N.J.	Direct mail and publishing industries
Univac 9314 C system	Prestige Insurance Group, Skokie, Ill.	A number of applications related to processing automobile casualty insurance
Xerox Sigma 3 system	St. John Fisher College, Rochester, N.Y.	Increased administrative and student data-processing needs; will also be used to expand student participation program in computer science
Xerox Sigma 8 system	Pratt & Whitney Aircraft, East Hartford, Conn.	Testing jet engines and their components, and serve a large number of test stands; new system is upgrade from the currently installed Sigma 5 (system valued at $1.1 million)

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

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

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

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

The following abbreviations apply:

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

SUMMARY AS OF APRIL 15, 1973

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)		NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part 1. United States Manufacturers								
Adage, Inc.	AGT 10 Series	4/68	X		32	3	35	X
Brighton, Mass.	AGT 100 Series	1/72	100-300	(S)	11	7	18	1
(A) (Mar. 1973)								
Autonetics	RECOMP II	11/58	X		30	0	30	X
Anaheim, Calif.	RECOMP III	6/61	X		6	0	6	X
(R) (Jan. 1969)								
Bailey Meter Co.	Metrotype	10/57	40-200	(S)	8	0	8	0
Wickliffe, Ohio	Bailey 750	6/60	40-250	(S)	37	15	52	0
(A) (June 1972)	Bailey 755	11/61	200-600	(S)	7	0	7	0
	Bailey 756	2/65	60-400	(S)	15	12	27	2
	Bailey 855/15	12/72	50-400	(S)	0	0	0	2
	Bailey 855/25	4/68	100-1000	(S)	16	0	16	0
	Bailey 855/50	3/72	100-1000	(S)	0	0	0	12
Bunker-Ramo Corp.	BR-130	10/61	X		160	-	-	X
Westlake Village, Calif.	BR-133	5/64	X		79	-	-	X
(A) (Mar. 1973)	BR-230	8/63	X		15	-	-	X
	BR-300	3/59	X		18	-	-	X
	BR-330	12/60	X		19	-	-	X
	BR-340	12/63	X		19	-	-	X
	BR-1018	6/71	23.0	(S)	-	-	-	-
	BR-1018C	9/72	-		-	-	-	-
Burroughs	B100/500	7/65	2.8-10.0		1141	677	1818	25
Detroit, Mich.	B200	11/61	5.0		-	-	500	-
(N) (R) (April 1973)	B205	1/54	X		19	2	21	X
	B220	10/58	X		23	2	25	X
	B300	7/65	7.0		-	-	600	-
	B1700	8/72	-		2	-	-	-
	B2500	2/67	4.0		277	123	400	30
	B2700	8/72	-		-	-	-	-
	B3500	5/67	12-14		572	285	857	110
	B3700	11/72	-		-	-	-	-
	B4700	10/71	-		4	-	-	-
	B5500	3/63	23.5		154	47	201	-
	B5700	12/70	32.0		27	8	35	22
	B6500	2/68	33.0		-	-	60	2
	B6700	8/72	30.0		5	4	9	60
	B7500	4/69	44.0		-	-	-	13
	B7700	2/72	85.0		-	-	2	4
	B8500	8/67	200.0		1	-	-	-
Computer Automation, Inc.	108/208/808	6/68	5.0	(S)	165	10	175	110
Newport, Calif.	116/216/816	3/69	8.0	(S)	215	20	235	225
(A) (April 1971)								
Consultronics, Inc.	DCT-132	5/69	0.7		75	65	135	-
Dallas, Texas								
(A) (April 1973)								
Control Data Corp.	G15	7/55	X		-	-	295	X
Minneapolis, Minn.	G20	4/61	X		-	-	20	X
(R) (April 1973)	LGP-21	12/62	X		-	-	165	X
	LGP-30	9/56	X		-	-	322	X
	M1000	-	-		1	-	-	-
	RPC4000	1/61	X		-	-	75	X
	636/136/046 Series	-	-		-	-	29	-
	160/8090 Series	5/60	X		-	-	610	X
	921/924-A	8/61	X		-	-	29	X
	1604/A/B	1/60	X		-	-	59	X
	1700/SC	5/66	3.8		-	-	428-478	0
	3100/3150/3170	5/64	10-16		-	-	93-120	C
	3200	5/64	13.0		-	-	55-60	C
	3300	9/65	20-38		-	-	205	C
	3400	11/64	18.0		-	-	17	C
	3500	8/68	25.0		-	-	15	C
	3600	6/63	52.0		-	-	40	C
	3800	2/66	53.0		-	-	20	C
	6200/6400/6500	8/64	58.0		-	-	117	C
	6600	8/64	115.0		-	-	88	C
	6700	6/67	130.9		-	-	5	C

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Control Data (cont'd)	7600	12/68	235.0	-	-	12	C
	Cyber 70/72	-	-	2	8	10	-
	Cyber 70/73	-	-	1	3	4	-
Data General Corp.	Nova	2/69	9.2 (S)	-	-	925	-
Southboro, Mass.	Supernova	5/70	9.6 (S)	-	-	210	-
(A) (Dec. 1972)	Nova 1200	12/71	5.4 (S)	-	-	2430	-
	Nova 800	3/71	6.9 (S)	-	-	385	-
	Nova 820	4/72	6.4 (S)	-	-	140	-
	Nova 1210/1220	2/72	4.2;5.2 (S)	-	-	1025	-
Datacraft Corp.	6024/1	5/69	52-300 (S)	18	0	18	4
Ft. Lauderdale, Fla.	6024/3	2/70	33-200 (S)	100	25	125	4
(A) (April 1973)	6024/5	12/71	11-80 (S)	50	0	50	33
	6024/5R	2/73	30-60 (S)	1	0	1	2
Datapoint Corp.	Datapoint 2200	2/71	151-292	-	-	1200	-
San Antonio, Texas							
(A) (Mar. 1973)							
Digiac Corp.	Digiac 3060	1/70	9.0 (S)	78	-	-	8
Plainview, N.Y.	Digiac CT-10	-	9.0	20	-	-	1
(A) (May 1972)							
Digital Computer Controls, Inc.	D-112	8/70	10.0 (S)	721	113	770	-
Fairfield, N.J.	D-116	1/72	10.0 (S)	726	57	783	-
(A) (April 1973)							
Digital Equipment Corp.	PDP-1	11/60	X	48	2	50	X
Maynard, Mass.	PDP-4	8/62	X	40	5	45	X
(A) (May 1972)	PDP-5	9/63	X	90	10	100	X
	PDP-6	10/64	X	-	-	23	X
	PDP-7	11/64	X	-	-	100	X
	PDP-8	4/65	X	-	-	1402	X
	PDP-8/I	3/68	X	-	-	3127	X
	PDP-8/S	9/66	X	-	-	918	X
	PDP-8/L	11/68	X	-	-	3699	X
	PDP-8/E	-	4.9 (S)	-	-	3787	-
	PDP-8/M	-	3.9 (S)	-	-	365	-
	PDP-8/F	5/72	3.9 (S)	-	-	2	-
	PDP-9	12/66	X	-	-	436	X
	PDP-9L	11/68	X	-	-	40	X
	DECSystem-10	12/67	700-3000 (S)	-	-	243	-
	PDP-11/20	-	10.8 (S)	-	-	2740	-
	PDP-11R20	-	13.8 (S)	-	-	14	-
	PDP-11/05	-	10.8 (S)	0	0	0	-
	PDP-11/45	-	-	0	0	0	-
	PDP-12	9/69	-	-	-	620	-
	PDP-15	2/61	17.0 (S)	-	-	545	-
	LINC-8	9/66	X	-	-	200	X
Electronic Associates Inc.	640	4/67	1.2	109	61	170	1
West Long Branch, N.J.	8400	7/67	12.0	21	8	29	0
(A) (Feb. 1973)	PACER 100	7/72	1.0	20	30	50	20
EMR Computer	EMR 6020	4/65	5.4	15	1	16	0
Minneapolis, Minn.	EMR 6040	7/65	6.6	6	0	6	0
(A) (Nov. 1972)	EMR 6050	2/66	9.0	15	2	17	0
	EMR 6070	10/66	15.0	7	8	15	0
	EMR 6130	8/67	5.0	34	13	47	0
	EMR 6135	-	2.6	36	5	41	4
	EMR 6145	-	7.2	-	-	-	8
	EMR 6140	-	-	-	-	-	0
General Automation, Inc.	SPC-12	1/68	-	-	-	1700	-
Anaheim, Calif.	SPC-16	5/70	-	-	-	1050	-
(A) (Mar. 1973)	System 18/30	7/69	-	-	-	275	-
General Electric	GE-PAC 3010	5/70	2.0	25	1	26	35
West Lynn, Mass.	GE-PAC 4010	10/70	6.0	30	4	34	32
(Process Control Computers)	GE-PAC 4020	2/67	6.0	200	60	260	32
(A) (Oct. 1972)	GE-PAC 4040	8/64	X	45	20	65	X
	GE-PAC 4050	12/66	7.0	23	2	25	1
	GE-PAC 4060	6/65	X	18	2	20	1
Hewlett Packard	2114A, 2114B	10/68	0.25	-	-	1182	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	333	-
(A) (July 1972)	2116A, 2116B, 2116C	11/66	0.6	-	-	1171	-
Honeywell Information Systems	G58	5/70	1.0	-	-	4	-
Wellesley Hills, Mass.	G105A	6/69	1.3	-	-	6	-
(R) (April 1973)	G105B	6/69	1.4	-	-	-	-
	G105RTS	7/69	1.2	-	-	-	-
	G115	4/66	2.2	200-400	420-680	620-1080	-
	G120	3/69	2.9	-	-	-	-
	G130	12/68	4.5	-	-	-	-
	G205	6/64	X	11	0	11	X
	G210	7/60	X	35	0	35	X
	G215	9/63	X	15	1	16	X
	G225	4/61	X	145	15	160	X
	G235	4/64	X	40-60	17	57-77	X
	G245	11/68	X	3	-	-	X
	G255 T/S	10/67	X	15-20	-	-	X
	G265 T/S	10/65	X	45-60	15-30	60-90	X
	G275 T/S	11/68	X	-	-	10	X
	G405	2/68	6.8	10-40	5	15-45	-
	G410 T/S	11/69	1.0	-	-	-	-
	G415	5/64	7.3	70-100	240-400	310-500	-
	G420 T/S	6/67	23.0	-	-	-	-
	G425	6/64	9.6	50-100	20-30	70-130	-
	G430 T/S	6/69	17.0	-	-	-	-
	G435	9/65	14.0	20	6	26	-
	G440 T/S	7/69	25.0	-	-	-	-
	G615	3/68	32.0	-	-	-	-
	G625	4/65	X	23	3	26	X
	G635	5/65	47.0	20-40	3	23-43	-
	H-110	8/68	2.7	180	7	187	0

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Honeywell (cont'd)	H-115	6/70	3.5	30	-	-	-
	H-120	1/66	4.8	800	160	960	-
	H-125	12/67	7.0	150	220	370	-
	H-200	3/64	7.5	800	275	1075	-
	H-400	12/61	10.5	46	40	86	X
	H-800	12/60	30.0	57	15	72	X
	H-1200	2/66	9.8	230	90	320	-
	H-1250	7/68	12.0	130	55	185	-
	H-1400	1/64	14.0	4	6	10	X
	H-1800	1/64	50.0	15	5	20	X
	H-2015	-	-	2	-	-	-
	H-2040	-	-	3	-	-	-
	H-2050	-	-	1	-	-	-
	H-2200	1/66	18.0	125	60	185	-
	H-3200	2/70	24.0	20	2	22	-
	H-4200	8/68	32.5	18	2	20	-
	H-6030	-	-	-	2	-	-
	H-6040	-	-	-	3	-	-
	H-6060	-	-	-	3	-	-
	H-8200	12/68	50.0	10	3	13	-
	DDP-24	5/63	2.65	-	-	90	X
	DDP-116	4/65	X	-	-	250	X
	DDP-124	3/66	X	-	-	250	X
	DDP-224	3/65	X	-	-	60	X
	DDP-316	6/69	0.6	-	-	452	-
	DDP-416	-	X	-	-	350	X
	DDP-516	9/66	1.2	-	-	900	-
	H112	10/69	-	-	-	75	-
	H632	12/68	3.2	-	-	12	-
	H1602	-	-	-	-	-	-
	H1642	-	-	-	-	-	-
	H1644	-	-	-	-	-	-
	H1646	-	-	-	-	-	-
	H1648	11/68	12.0	-	-	20	-
	H1648A	-	-	-	-	-	-
IBM White Plains, N.Y. (N) (D) (Mar. 1973)	305	12/57	3.6	40	15	55	-
	650	10/67	4.8	50	18	68	-
	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	17	84	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	62	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7020, 2	3/60	27.0	10	3	13	-
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-
	System/3 Model 6	3/71	1.0	5	-	-	-
	System/3 Model 10	1/70	1.1	2	-	-	-
	System/7	11/71	0.35 and up	10	-	-	-
	360/20	12/65	2.7	7161	6075	13236	1780
	360/25	1/68	5.1	1112	759	1871	1287
	360/30	5/65	10.3	5487	2535	8022	-
	360/40	4/65	19.3	2454	1524	3978	1363
	360/44	7/66	11.8	109	57	166	39
	360/50	8/65	29.1	1135	445	1580	662
	360/65	11/65	57.2	604	144	748	562
	360/67	10/65	133.8	57	6	63	99
	360/75	2/66	66.9	50	17	67	12
	360/85	12/69	150.3	11	1	12	55
	360/90	11/67	-	5	-	-	-
	360/190	-	-	13	2	15	-
	360/195	4/71	232.0	-	-	9	48
	370/115	-	-	-	-	-	-
	370/125	4/73	8.2-13.8	-	-	-	-
	370/135	5/72	14.4	11	-	-	-
	370/145	9/71	23.3	1	-	-	-
	370/155	2/71	48.0	1	-	-	-
	370/158	-/73	49.5-85.0	-	-	-	-
	370/165	5/71	98.7	3	-	-	-
	370/168	-/73	93.0-170.0	-	-	-	-
	370/195	6/73	190.0-270.0	-	-	-	-
Interdata Oceanport, N.J. (A) (Jan. 1973)	Model 1	12/70	3.7	244	75	319	-
	Model 3	5/67	-	-	-	200	X
	Model 4	8/68	8.5	274	115	389	32
	Model 5	11/70	X	70	20	90	X
	Model 15	1/69	20.0	40	24	64	X
	Model 16	5/71	X	1	6	7	X
	Model 18	6/71	X	2	7	9	X
	Model 50/55	5/72	6.8	22	3	25	3
	Model 70	10/71	6.8	268	55	323	75
	Model 74	2/73	-	2	0	2	50
	Model 80	10/72	14.9	6	0	6	15

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Microdata Corp.	Micro 400/10	12/70	0.1-0.5	132	0	132	-
Irvine, Calif.	Micro 800	12/68	0.2-3.0	1993	810	2803	-
(A) (Mar. 1973)	Micro 1600	12/71	0.2-3.0	364	95	459	-
NCR	304	1/60	X	5	2	7	X
Dayton, Ohio	310	5/61	X	8	0	8	X
(A) (Dec. 1972)	315	5/62	7.0	255	200	455	-
	315 RMC	9/65	9.0	55	35	90	-
	390	5/61	0.7	160	325	485	-
	500	10/65	1.0	1100	1750	2850	-
	Century 50	2/71	1.6	580	0	580	-
	Century 100	9/68	2.6	1175	780	1955	-
	Century 101	12/72	3.7	50	-	-	-
	Century 200	6/69	7.0	575	330	905	-
	Century 300	2/72	21.0	5	5	10	-
Philco	1000	6/63	X	16	-	-	X
Willow Grove, Pa.	200-210,211	10/58	X	16	-	-	X
(N) (Jan. 1969)	2000-212	1/63	X	12	-	-	X
Raytheon Data Systems Co.	250	12/60	X	115	20	135	X
Norwood, Mass.	440	3/64	X	20	-	-	X
(A) (Jan. 1973)	520	10/65	X	26	1	27	X
	703	10/67	12.5	(S) 177	33	210	2
	704	3/70	7.2	(S) 260	70	330	40
	706	5/69	19.0	(S) 75	17	92	0
Standard Computer Corp.	IC 4000	12/68	9.0	9	0	9	2
Los Angeles, Calif.	IC 6000-6000/E	5/67	16.0	3	0	3	-
(A) (June 1972)	IC 7000	8/70	17.0	4	0	4	1
	IC-9000	5/71	400.0	(S) 1	0	1	-
Systems Engineering Laboratories	SYSTEMS 810B	9/68	2.6	168	10	178	-
Ft. Lauderdale, Fla.	SYSTEMS 71	8/72	0.9	-	-	-	-
(A) (Dec. 1972)	SYSTEMS 72	9/71	1.0	14	3	17	-
	SYSTEMS 85	7/72	6.0	3	1	4	-
	SYSTEMS 86	6/70	10.0	31	1	32	-
UNIVAC Div. of Sperry Rand	I & II	3/51 & 11/57	X	23	-	-	X
New York, N.Y.	III	8/62	X	25	6	31	X
(A) (April 1972)	File Computers	8/56	X	13	-	-	X
	Solid-State 80 I,II, 90, I, II, & Step	8/58	X	210	-	-	X
	418	6/63	11.0	80	39	119	23 E
	490 Series	12/61	30.0	76	14	90	15
	1004	2/63	1.9	1522	610	2132	-
	1005	4/66	2.4	617	248	865	72
	1050	9/63	8.5	136	59	195	-
	1100 Series (except 1107, 1108)	12/50	X	9	0	9	X
	1107	10/62	X	8	3	11	X
	1108	9/65	68.0	103	129	232	58 E
	9200	6/67	1.5	1106	835	1941	725
	9300	9/67	3.4	412	62	474	510 E
	9400	5/69	7.0	82	41	123	83 E
	LARC	5/60	135.0	2	0	2	-
UNIVAC - Series 70	301	2/61	7.0	143	-	-	-
Blue Bell, Pa.	501	6/59	14.0-18.0	17	-	-	-
(A) (Feb. 1973)	601	11/62	14.0-35.0	0	-	-	-
	3301	7/64	17.0-35.0	74	-	-	-
	Spectra 70/15, 25	9/65	4.3	18	-	-	-
	Spectra 70/35	1/67	9.2	95	-	-	-
	Spectra 70/45	11/65	22.5	265	-	-	-
	Spectra 70/46	11/68	33.5	30	-	-	-
	Spectra 70/55	11/66	34.0	10	-	-	-
	Spectra 70/60	11/70	32.0	18	-	-	-
	Spectra 70/61	4/70	42.0	7	-	-	-
	70/2	5/71	16.0	63	-	-	-
	70/3	9/71	25.0	7	-	-	-
	70/6	9/71	25.0	25	-	-	-
	70/7	12/71	35.0	7	-	-	-
Varian Data Machines	620	11/65	X	-	-	75	X
Newport Beach, Calif.	620i	6/67	X	-	-	1300	X
(A) (Mar. 1973)	R-620i	4/69	-	-	-	80	-
	520/DC, 520i	12/69;10/68	-	-	-	500	150
	620/f	11/70	X	-	-	207	X
	620/L, 620/L-00C	4/71;9/72	-	-	-	740	101
	620/f-100	6/72	-	-	-	100	43
	620/L-100	5/72	-	-	-	200	235
	Varian 73	11/72	-	-	-	40	39
Xerox Data Systems	XDS-92	4/65	1.5	43	4	47	-
El Segundo, Calif.	XDS-910	8/62	2.0	170	10	180	-
(N) (R) (April 1973)	XDS-920	9/62	2.9	120	12	132	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	32	3	35	-
	XDS-9300	11/64	8.5	25-30	4	29-34	-
	Sigma 2	12/66	1.8	163	36	199	-
	Sigma 3	12/69	2.0	15	0	15	-
	Sigma 5	8/67	6.0	30	14	44	-
	Sigma 6	6/70	12.0	2	-	-	-
	Sigma 7	12/66	12.0	30	7	37	-
	Sigma 8	2/72	-	4	-	-	-
	Sigma 9	-	35.0	2	-	-	-

NOTICE: Beginning with the July issue of *Computers and Automation,* the Monthly Computer Census will be published in three parts as follows:

Part 1 — U.S. manufacturers, A to H, in January, April, July and October

Part 2 — U.S. manufacturers, I to Z, in February, May, August, and November

Part 3 — Mfrs. outside the U.S., in March, June, September, and December

Updating sheets will, henceforth, be mailed quarterly to manufacturers.

All manufacturers of digital computers are invited to submit information for this census.

CALENDAR OF COMING EVENTS

May 13-16, 1973: 1973 International Systems Meeting, Hilton Hotel, Denver, Colo. / contact: R. B. McCaffrey, Association for Systems Management, 24587 Bagley Rd., Cleveland, OH 44138

May 14-16, 1973: DPSA International Meeting, Aperghi Hotel, Athens, Greece / contact: C. A. Greathouse, DPSA, P.O. Box 1333, Stamford, Ct. 06904

May 14-16, 1973: 3rd Annual NCR Users International Meeting, Sheraton Harbor Island Hotel, San Diego, Calif. / contact: Public Relations Dept., National Cash Register Co., Dayton, OH 45409

May 23-25, 1973: AIIE Annual Conference, Conrad Hilton Hotel, Chicago, Ill. / contact: Technical Services, AIIE, 25 Technology Park/Atlanta, Norcross, GA 30071

May 24-25, 1973: International Symposium on Multiple Valued Logic, University of Toronto, Toronto, Canada / contact: Z. G. Vranesic, Dept. of Electrical Engineering, University of Toronto, Toronto, Ontario, Canada

May 29-30, 1973: Workshop on Computer Description Languages, Rutgers University, New Brunswick, N.J. / contact: Saul Levy, Dept. of Computer Science, Rutgers University, New Brunswick, NJ 08903

June 4-6, 1973: 1973 8th PICA Conference, Radisson Hotel, Minneapolis, Minn. / contact: IEEE Hdqs., Tech. Svcs., 345 E. 47th St., New York, NY 10017

June 4-7, 1973: Power Industry Computer Applications Conference, Radisson Hotel, Minneapolis, Minn. / contact: K. K. Dols, Power Systems Control, Northern States Power, 414 Nicollet Mall, Minneapolis, MN 55401

June 4-8, 1973: National Computer Conference and Exposition, Coliseum, New York, N.Y. / contact: AFIPS Hdqs., 210 Summit Ave., Montvale, NJ 07645

June 18-21, 1973: SIAM 1973 National Meeting, Sheraton Conference Center, Hampton, Va. / contact: SIAM, 33 S. 17th St., Philadelphia, PA 19103

June 20-22, 1973: Canadian Computer Conference, Hotel Macdonald, Edmonton, Alberta / contact: Mr. Jim Wilcox, P.O. Box 1881, Edmonton, Alberta, Canada T5J ZP3

June 20-22, 1973: International Symposium on Fault Tolerant Computing, Ricky's Hyatt House, Palo Alto, Calif. / contact: E. J. McCluskey, Digital Systems Lab., Stanford University, Stanford, CA 94305

June 22-23, 1973: 11th Annual Computer Personnel Conference, Univ. of Maryland Conference Center, College Park, Md. / contact: Prof. A. W. Stalnaker, College of Industrial Management, Georgia Institute of Technology, Atlanta, GA 30332

June 24-29, 1973: 20th International Meeting, The Institute of Management Sciences, Tel Aviv, Israel / contact: TIMS XX, Box U, Brookline, MA 02146; OR TIMS XX, P.O.B. 16271, Tel Aviv, Israel

June 25-27, 1973: Design Automation Workshop, Sheraton-Portland Hotel, Portland, Ore. / contact: J. M. Galey, IBM Corp., Dept. G90, Bldg. 14, Monterey & Cottle Rds., San Jose, CA 95114

June 26-28, 1973: Workshop of Computer Architecture, Université de Grenoble, Grenoble, France / contact: Grenoble Accueil, 9, Boulevard Jean-Pain, 38000, Grenoble, France

June 26-29, 1973: DPMA 1973 International Data Processing Conference & Business Exposition, Conrad Hilton Hotel, Chicago, Ill. / contact: Richard H. Torp, DPMA International Hdqs., 505 Busse Highway, Park Ridge, IL 60068

July 17-19, 1973: Summer Computer Simulation Conference, Queen Elizabeth Hotel, Montreal, Canada / contact: Stuart Trask, Sun Life Assurance Co. of Canada, P.O. Box 6075, Montreal 101, P.Q., Canada

July 20-22, 1973: 1973 International Conference of Computers in the Humanities, University of Minnesota, Minneapolis, Minn. / contact: Prof. Jay Leavitt, 114 Main Engineering Bldg., University of Minnesota, Minneapolis, MN 55455

July 23-27, 1973: 3rd Annual International Computer Exposition for Latin America, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins and Associates, 273 Merrison St., Box 566, Teaneck, NJ 07666

Aug. 5-8, 1973: 7th Annual Mathematical Programming Seminar and Meeting, Breakers Hotel, Palm Beach, Fla. / contact: George M. Lowell, Haverly Systems Inc., 4 Second Ave., Denville, NJ 07834

Aug. 13-17, 1973: SHARE Meeting, Miami Beach, Fla. / contact: D. M. Smith, SHARE, Inc., Suite 750, 25 Broadway, New York, NY 10004

Aug. 20-24, 1973: 3rd International Joint Conference on Artificial Intelligence, Stanford University, Stanford, Calif. / contact: Dr. Max B. Clowes, Laboratory of Experimental Psychology, University of Sussex, Brighton, Sussex BN1 9QY, England

Aug. 27-29, 1973: ACM '73, Atlanta, Ga. / contact: Dr. Irwin E. Perlin, Georgia Institute of Technology, 225 North Ave., N.W., Atlanta, GA 30332

Aug. 27-Sept. 1, 1973: Computer Arts Society, 1973 Edinburgh International Festival, Edinburgh, Scotland / contact: R. John Lansdown, Secretary, Computer Arts Society, 50-51 Russell Square, London WC1B 4JX, England

Aug. 30-Sept. 1, 1973: International Conference on Systems and Control, PSG College of Technology, Coimbatore, India / contact: Dr. R. Subbayyan, PSG College of Technology, Coimbatore 641004, Tamil Nadu, India

Sept. 4-7, 1973: International Computing Symposium 1973, Davos, Switzerland / contact: Dr. H. Lipps, International Computing Symposium 1973, c/o CERN, CH-1211 Geneva 23, Switzerland

Sept. 17-19, 1973: 7th Annual Intergovernmental Council for ADP Conference, Ottawa, Canada / contact: ICA Secretariat, 18 Keren Hayessod St., Jerusalem, Israel

Sept. 25-27, 1973: Conference on 'Hybrid Microelectronics,' University of Kent at Canterbury, England / contact: Registrar, Institution of Electronic and Radio Engineers, 8-9 Bedford Sq., London WC1B 3RG, England

Sept. 25-28, 1973: Engineering in the Ocean Environment Conference, Washington Plaza Hotel, Seattle, Wash. / contact: Ted Hueter, Honeywell Inc., Marine Sys. Ctr., 5303 Shilshole Ave., N.W., Seattle, WA 98107

Oct. 2-4, 1973: 2nd International Computer-Aided Design and Computer-Aided Manufacturing Conf., Detroit Hilton Hotel, Detroit, Mich. / contact: Public Relations Dept., Society of Manufacturing Engineers, 20501 Ford Rd., Dearborn, MI 48128

Oct. 8-12, 1973: Business Equipment Show, Coliseum, New York, N.Y. / contact: Rudy Lang, Prestige Expositions, Inc., 60 E. 42nd St., New York, NY 10017

Oct. 15-17, 1973: 14th Annual Switching and Automata Theory Symposium, University of Iowa, Iowa City, Ia. / contact: Prof. Gerard Weeg, Computer Science Dept., University of Iowa, Iowa City, IA 52240

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