[redacted]

March, 1974
Vol. 23, No. 3

computers and people

formerly *Computers and Automation*

TRANSIT EXPRESSWAY

People-Moving With New Technology
– P. E. Norton

ALSO
IN THIS ISSUE:

"WHO'S WHO IN COMPUTERS AND DATA PROCESSING"

EDITION 5.3 = 5th EDITION + 3 SUPPLEMENTS ALREADY ISSUED

THE MOST ESSENTIAL COMPONENTS IN COMPUTERS AND DATA PROCESSING ARE

PEOPLE

Who are they?
What do they do?
Where do they do it?

Consult
"Who's Who In Computers And Data Processing"

jointly published by *Computers and People* (Berkeley Enterprises, Inc.) and Quadrangle / New York Times Book Co.

"Who's Who in Computers and Data Processing" has been changed to a periodic subscription basis as follows:

1. The latest Cumulative Edition (the 5th edition published 1971, containing over 15,000 capsule biographies, over 1,000 pages long, 3 volumes, hardbound) **PLUS**
2. Three Updating Supplements per period totaling over 3,000 entries

Both for $34.50 in any period when a cumulative edition is supplied . . . and $15.00 per period when a cumulative edition is not supplied.

BASED ON continual data gathering from computer professionals carried out by *Computers and People* (formerly *Computers and Automation*).

This reference is particularly useful for:

Personnel managers
Libraries
Conference planners
Directors of computer installations
Suppliers to the computer industry
Executive search organizations
Prospective authors
Prospective speakers . . .

anyone who needs to keep up with the important people in the field.

Each computer professional has a capsule biography detailing: last name; first name and middle initial (if any); occupation; year of birth; university education and degrees; year entered the computer field; main interests; job title; organization and its address; publications, honors and memberships; home address.

We are confident that you will find the subscription will repay you many times over. In fact, one day when this wealth of material gives you the inside track with someone important to you, you'll find the information PRICELESS: the most essential component in EDP is CAPABLE PEOPLE.

RETURNABLE IN 10 DAYS FOR FULL REFUND
(if not satisfactory)

(may be copied on any piece of paper)

WHO'S WHO IN COMPUTERS AND DATA PROCESSING
815 Washington St., Newtonville, Mass. 02160

( ) YES, please enroll me as a subscriber to *Who's Who in Computers and Data Processing* at the following rate:

( ) $34.50 including the last cumulative edition

OR

( ) $15.00 since I already have access to the last cumulative edition

I understand that for each period of subscription I shall receive three updating supplements, totaling over 3,000 entries.

( ) Payment enclosed ( ) Please bill me.
( ) Please bill my organization

RETURNABLE IN 10 DAYS FOR FULL REFUND
(if not satisfactory)

Name
Title
Organization
Address
City State & Zip
Your Signature P.O. No. (if company order)

Vol. 23, No. 3
March, 1974

Editorial Offices — Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160, 617-332-5453

Advertising Contact — The Publisher, Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160, 617-332-5453

"Computers and People," formerly "Computers and Automation," is published monthly, 12 issues per year, at 815 Washington St., Newtonville, MA 02160, by Berkeley Enterprises, Inc. Printed in U.S.A. Second Class Postage paid at Boston, MA, and additional mailing points.

Subscription rates: United States, $11.50 for one year, $22.00 for two years. Canada: add $1 a year; foreign, add $6 a year.

NOTE: The above rates do not include our publication "The Computer Directory and Buyers' Guide". If you elect to receive "The Computer Directory and Buyers' Guide," please add $12.00 per year to your subscription rate in U.S. and Canada, and $15.00 per year elsewhere.

Please address all mail to: Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160.

Postmaster: Please send all forms 3579 to Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160.

Change of address: If your address changes, please send us both your new address and your old address (as it appears on the magazine address imprint), and allow three weeks for the change to be made.

computers and people
formerly *Computers and Automation*

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.

Unsettling, Disturbing, Critical . . .

Computers and People (formerly *Computers and Automation)*, believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for: the reliability and social significance of pertinent input data; the social value 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 People* 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 planet in which our children and later generations may have a future, instead of facing extinction.

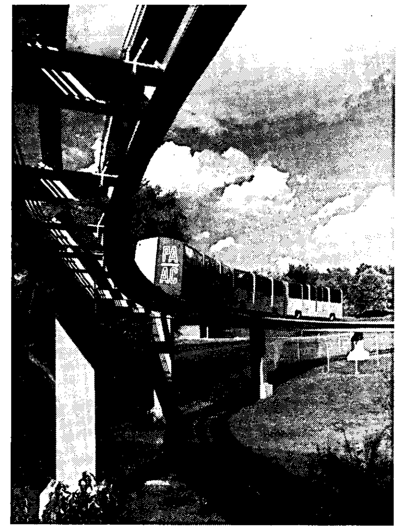
The professional information engineer needs to relate his engineering to the most important and most serious problems in the world today: war, nuclear weapons, pollution, the population explosion, and many more.

CORRECTIONS

In the February, 1974, issue of *Computers and People:*

Page 5, left column, line 19, replace "opponet" by "opponent".
Page 18, line 1 (title), replace "Social and" by "Social Force and".
Page 20, left column, last section heading, replace "Euthansia" by "Euthanasia".
Page 36, left column, line 5, replace "Phildo-Ford" by "Philco-Ford".
Page 37, right column, line 16 from bottom, replace "Brooks Roberst" by "Brooks Roberts".

We much regret these stupid mistakes, and have altered our procedure to make such mistakes less likely in the future.



Front Cover Picture

This two-mile Transit Expressway in South Park, near Pittsburgh, Pa., is one example of the development of new systems and new equipment to ease the burden on the commuting public. For more about moving people with new technology, see the lead article, page 8.

Departments

Key

[A] – Article
[C] – Monthly Column
[E] – Editorial
[F] – Forum

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.

EDITORIAL

Computers, Puzzles, and Games

It is fun to use one's mind.

One of the subjects that we continually cover in *Computers and People* is the material that challenges people's minds; and an important way to lead a person who has little knowledge of a computer into the comfortable understanding of it, is for him to play games with the computer – and to solve puzzles with the computer at his elbow helping him.

New machines make possible new ways of playing. On one occasion more than 40 years ago, I was assigned the use of a desk calculator possessing automatic long division, and I found a little time to just play with it. So, with all the work of long division vanished, I did a little experimenting with recurring decimal fractions. I found out that the prime number 11111 was exactly divisible by 41 and by 271 (both prime numbers) and so each of 1/41 and 1/271 was a recurring decimal that repeated in periods of five digits:

1/41 = .024390243902439 . . . .

1/271 = .003690036900369 . . . .

Some new games or puzzles related to computer game playing and computer puzzle solving that have been described and published in *Computers and People* (formerly *Computers and Automation*) are:

– Numbles, played with letters and digits – a series of puzzles published since 1968;
– Zingo, played with 21 dice – see the February 1972 issue of *Computers and Automation*;
– Naymandij, played with a series of 200 digits – see the January 1974 issue of *Computers and People.*

We have also embarked on some games, puzzles, and exercises related to some of the great tasks that still lie in front of computer programmers. One of these is teaching a computer to understand free and unconstrained natural language.

In this area, we have published:

– "Computer Programming Using Natural Language" – three articles in the June, July, and August 1973 issues of *Computers and Automation* (reprints available);
– "'Do What I Mean' (DWIM): the Programmer's Assistant" – an article by Warren Teitelman in the April 1972 issue of *Computers and Automation*;
– Wunsillabo and Sixwordo, puzzles played with words – published for the first time in this issue of *Computers and People.*

We expect to expand our coverage of games, puzzles, and exercises that can be played with or aided by a computer, especially an interactive computer – because the computer has many virtues as a partner in games and puzzles:

1. It can be very patient.
2. It never gets angry but always stays calm.
3. It never gets tired or weary.
4. It can be unfailingly polite and courteous.
5. It can be adaptable, friendly, even sympathetic.
6. It can crack jokes.
7. It can read, look up, report, sketch, draw, calculate, reason, analyze, learn, remember, forget, and act randomly.
8. It can ask questions, accept answers, supply answers, accept many kinds of commands, and respond to many kinds of commands.
9. It can play the roles of: teacher, drill sergeant, dictionary, table of figures, library, tutor, colleague, calculating prodigy, file of records, scorekeeper, timer, umpire, guide, philosopher, playmate, and friend.

It is fun to use the artificial mind of a computer.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

WORD PUZZLES FOR NIMBLE MINDS – AND COMPUTERS

Edmund C. Berkeley
Editor

WUNSILLABO

The day is sure to come when words will be understandable by computers not only in limited contexts but much more widely. In the meantime, it will be good to practice with several kinds of exercises. One kind of exercise is getting computers to understand sequences of words in natural language but in limited contexts. See for example in the August 1973 issue of *Computers and Automation* (in Appendix 1 in the article "Computer Programming Using Natural Language, Part 3") the 65 examples there given of plain ordinary free natural English translated by a computer program (GENIE) into a programming language acceptable to a computer. Another kind of exercise is getting people to translate from more difficult English linguistic expressions into easier expressions, for there is a great deal of English written and spoken which only a few people understand.

This second kind of exercise finds one expression in the following kind of word puzzle or word game (which we here and now name WUNSILLABO), the problem of taking passages in ordinary natural English and converting them entirely into one-syllable words, the meaning to be just the same. The requirement of one syllable has some exceptions: (1) additional syllables produced by one of the endings "s, es, d, ed, ing" are allowed; (2) figures in digits and symbols such as $25 are allowed. Example:

Problem: Jones intends to suppress all varieties of worship in this religious edifice.

A satisfactory answer (though perhaps not the best and perhaps not completely accurate) is as follows:

One Proposed Answer: Jones aims to put a stop to all forms of praying in this church.

Note that the concept of religious edifice in the original sentence includes the concept of mosque, while the paraphrase does not; but this is probably a quite unimportant objection.

WUNSILLABO PUZZLE 743

1. I mistrust the governmental system of monarchy, and always have.
2. In his monotonous harangue there were many misconceptions.
3. Brown is transmitting to Smith a consignment of condiments.
4. Smith reported that the earth tremors in Maine were serious and ubiquitous.
5. These old Scotch manufacturers have a hereditary monopoly in many varieties of excellent marmalade.
6. The icy precipice in the great valley glacier constituted such a tremendous obstacle for Clark that he could not overcome it and proceed on his journey.
7. Your invoice indicates that your company has a credit of $179. Please transmit this amount to us at your earliest opportunity so as to settle the accounts between us.
8. Please indicate to me if you are interested in examining the incoming letters for any particular kinds of correspondence, and as soon as the incoming mail is opened, I shall be happy to inspect it promptly, and refer to you any correspondence that you are perhaps interested in.

SIXWORDO

Another way to make difficult English linguistic expressions easier is to make sentences shorter. Short sentences can usually be understood more easily than long ones, both by persons and by computers. Hence we have two questions:

> Is it possible to express any desired meaning as a sequence of short sentences, each no longer than x words? What is the best value of x for a computer? for a person?

Some exploration of these questions is contained in the following puzzle or game (which we here and now name SIXWORDO). The puzzle is to paraphrase a passage (a set of sentences), making every new sentence no longer than six words, the meaning to be just the same. Example:

Problem: This is the problem of making every sentence no longer than six words.

One Proposed Answer: This problem is the following. Make every sentence short. "Short" means six words or less.

SIXWORDO PUZZLE 743

(1) It was a fascinating place to work. (2) There was the graceful old hacienda, now falling into picturesque disrepair. (3) There was the immense volcanic cone of Popocatepetl, close at hand, dominating the western sky line. (4) In the orchard, really a series of orchards, there were old avocados in long straight rows. (5) The Rodiles family had been interested in avocados through several generations. (6) For years they made it a practice to bring home the best ones from the local markets, and to sprout the seeds and plant the seedlings in their orchard. (7) The resulting collection is a botany professor's paradise, literally several thousands of avocados, grown to maturity, no two of them exactly alike. (8) If one wants to study variation in avocados, this is it.

(From page 103 of *Plants, Man and Life* by Edgar Anderson)

For these puzzles, we invite our readers to send us solutions together with human programs or computer programs which will produce the solutions. A proposed solution (there is no such thing as "the" solution) will be published in the next issue.

"All major city transit agencies building new systems or modernizing existing ones are turning to automation . . . automated rail systems are able to do a better job of competing with the automobile and of bringing relief from traffic congestion on streets and highways."

PEOPLE-MOVING With New Technology

Phillip E. Norton
Manager, Public Relations
Westinghouse Electric Corp.
Pittsburgh, Pa. 15222

Every day, in cities throughout the world, thousands of commuters travel part of their way to work on a nearly ideal mass transit system — quiet, safe, direct, inexpensive and dependable in all kinds of weather.

The system, of course, is the elevator. Its only real drawback is that it goes only up and down. And those same commuters find that moving horizontally in a city during a morning or evening rush hour is a much more frustrating challenge than vertical travel.

In the U.S. alone, planning experts have calculated that about 45 urban transit systems costing nearly 11 billion dollars should be built by 1980. This crisis in urban mobility has brought industry and government together in the development of new systems and new equipment to ease the burden on the commuting public.

One example of industry's involvement in mass transportation is the work of Westinghouse Electric Corporation. Westinghouse has been supplying transportation equipment for more than 80 years. Today its products range from total urban transit systems to motors for subway cars.

Transit Expressway

One achievement in this field was the development of "Transit Expressway", an innovative system of transportation designed specifically for medium-density cities.

This system features lightweight rubber-tired vehicles operating under computer control on their own guideways. The electrically propelled cars are quiet, give off no fumes, and can offer commuters virtually continuous service at all hours, in all seasons.

More than 300,000 people rode a two-mile Transit Expressway demonstration loop in South Park, near Pittsburgh. The loop was opened in 1965 as part of a development program conducted by Westinghouse for the Port Authority of Allegheny County.

Although developed by Westinghouse, Transit Expressway is not a proprietary system. The demonstration project was financed by funds from Westinghouse and other industries as well as Federal, state and county governments.

Instead of having an operator, Transit Expressway vehicles are controlled by an electronic system linked to a central computer. The computer supervises the entire system, while wayside controls see to it that the vehicles operate at the proper speed, maintain the specified intervals, and stop and start as programmed. Doors open and close automatically, as on an elevator.

Two 60-horsepower motors propel each car. The vehicles are locked to the roadway by rubber-tired wheels positioned along the side of an I-shaped center guidebeam.

Transit Expressway can operate at ground level, underground, or elevated. It can climb grades as steep as 10 per cent, compared to a maximum of about four per cent for steel wheel-steel rail systems. The vehicles also have a much smaller turning radius than the typical steel-wheel car.

At South Park, each Transit Expressway vehicle weighs 18,000 pounds, or less than one-third the weight of a typical subway car. Thus, it requires a much smaller, lighter, supporting structure than the old-fashioned "els".

Because of its quiet, pollution-free operation, Transit Expressway can be used unobtrusively even in residential neighborhoods.

The Port Authority of Allegheny County has begun construction of a 10.5 mile Transit Expressway system from downtown Pittsburgh to the South Hills suburbs. Other independent engineering consultants have recommended the same technology for a 45-mile transit system serving the Greater Miami area and for an eight-mile system linking downtown Honolulu with the airport.

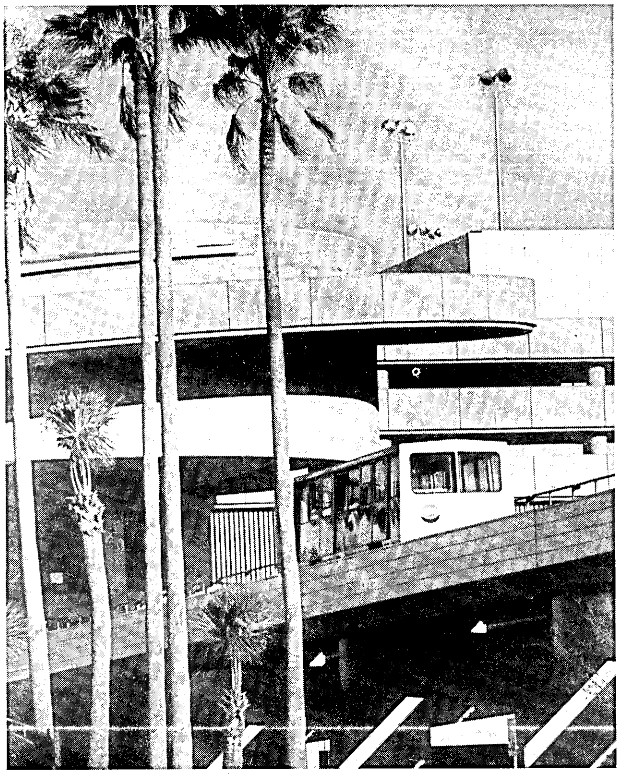
Besides medium-density cities, the Transit Expressway technology can be designed to serve spread-out college campuses, large shopping-office complexes and other activity centers. To date, however, the most important application has been for the country's new and expanding airports.

Taking the Walking Out of Flying

In 1971, the Hillsborough County Aviation Authority in Florida opened a $60-million terminal complex at the new Tampa International Airport. The airport features a new design concept: a central Landside terminal surrounded by four satellite Airside terminals.

Linking the main terminal with each of the satellites is a Westinghouse passenger transfer system designed to take the walking out of flying. The system is the first commercial application of Transit Expressway technology.

To eliminate an aggravating facet of modern air travel — the long, tiring, time-consuming terminal trek from car to boarding gate — the designers of the Tampa Airport included the shuttle as an integral part of the terminal.



TAMPA AIRPORT SHUTTLE

Travelers at Tampa never need walk more than 700 feet from car to plane. From the main terminal — where baggage is checked, cars are parked, and tickets are issued — a traveler takes a short, comfortable ride on an automated, air-conditioned vehicle and steps into one of the four airside terminals.

The system includes two cars on each of the four legs. Four additional cars will serve two future airside buildings, making a total of 12 vehicles on two-and-one-fourth miles of elevated roadway.

The cars shuttle back and fourth between the satellites and main terminal, reaching speeds of 30 miles an hour on the 40-second ride. With a 30-second dwell time at each stop, cars are available for boarding every 70 seconds.

Because the ride is brief, no seats are needed. Each car can comfortably carry 100 passengers, giving the shuttle the capacity to move 3360 passengers every ten minutes. Making over 1000 trips a day, each car travels about 50,000 miles a year — more than a New York subway vehicle.

Another airport designed for the era of the great Jets is the new Sea-Tac (Seattle-Tacoma) International Airport. There, a computer-controlled transit system links the main terminal with two satellite terminals. (See "People Mover Automatic System at Seattle-Tacoma International Airport", by J. N. Dravillas, Computers and Automation, April, 1973.)

The most recent airport to adopt a similar passenger shuttle system is Miami International. In July 1973, the Dade County Port Authority selected this system to link the main terminal with a new satellite international complex that will begin operation in mid-1975.

The system will consist of two trains, each with two rubber-tired cars, operating on a quarter-mile aerial roadway. Since each train will comfortably carry 128 passengers, the system will be able to handle 3000 passengers every hour. Traveling at about 30 miles an hour, the air-conditioned cars will make the run between terminals in less than a minute — and passenger waiting time will seldom be more than 38 seconds.

The Miami Airport installation will be specially designed to make international travel as painless as possible. For instance, the lobby areas in both the main and satellite terminals are divided into zones — "free" zones for departing passengers, airport employees and other nontravelers and "sterile" zones for those passengers arriving from overseas who must go through customs.

By having two cars connected, a train can stop at each station with one car in the free zone and the other in the sterile zone — saving passengers, their guests, and airport workers a lot of time and inconvenience.

The Tampa, Sea-Tac and Miami Airports give strong indication of the growing acceptance of driverless, computer-controlled transit systems to move passengers more efficiently throughout today's expanding air-travel complexes. But in Williamsburg, Va., another important application of Transit Expressway technology will soon be evidenced.

Busch Gardens Family Entertainment Complex

In Williamsburg, a passenger transfer system will carry visitors between the new $30 million Busch Gardens and the Anheuser-Busch Hospitality Center when the huge family entertainment complex opens in the spring of 1975. The electronically controlled system will be capable of handling 2000 passengers an hour along 7000 feet of concrete guideway. At a top speed of 30 miles an hour, a complete loop on the mile-and-a-half track will take five minutes including stops. Half the loop is elevated on steel superstructures with concrete columns. The other half is at ground level.

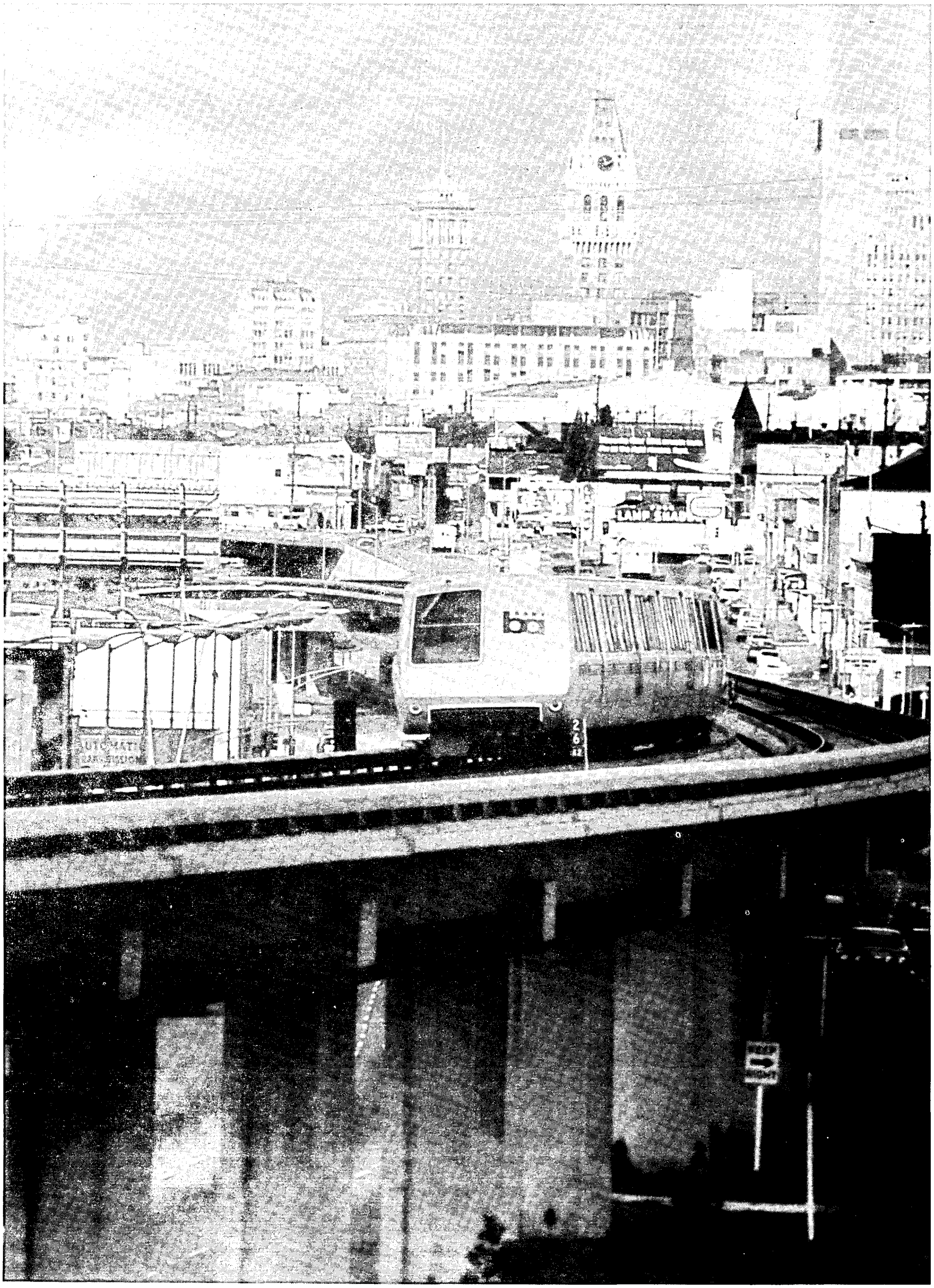
The system is a convenience feature of the 300-acre site that includes the Busch Gardens Bird Circus, the noted Anheuser-Busch Clydesdale horses, trained animal shows, and a 60-acre lake, in addition to rides, shops and eating facilities.

Such transit expressways will help ease the burden of "footwork" in medium-density cities, airports and entertainment complexes. But larger metropolitan areas require a somewhat different approach to handle the greater number of passengers.

Automated Rail Systems For Metropolitan Areas

All major city transit agencies building new systems or modernizing existing ones are turning to automation — including New York, Washington, Baltimore, Boston, Montreal, Sao Paulo and Atlanta. The reason for this trend is obvious. Automation helps modern transit systems provide passengers with a level of service never before possible; service that is not only safer, but also faster, more convenient, more comfortable, and more economical than that provided by any of the traditional, manually operated transit systems.

With this level of service, automated rail systems are able to do a better job of competing with the automobile and of bringing relief from traffic congestion on streets and highways. A major activity in this field centers on the Bay Area Rapid Transit



BART TRAIN

(BART) District system in San Francisco-Oakland and the Sao Paulo Metro system in Brazil.

Bay Area Rapid Transit District

The new 75-mile BART network, the first in the world to be fully computerized and automated, also is the first completely new metropolitan rapid transit system in the nation in 60 years. Built as an integral part of the total transportation facilities of the San Francisco Bay Area, the system serves San Francisco, Alameda and Contra Costa counties.

The communications and control equipment includes a central processing unit installed at the BART headquarters building in Oakland; secondary control facilities at each of the 33 BART passenger stations; wayside communications and data transmission equipment; and control units for the 150 lead cars on the trains.

The control system makes it possible to operate trains safely only 90 seconds apart at speeds of 80 miles an hour. The average speed of the trains is 50 miles an hour, including 20-second station stops.

The central computer for BART is a Westinghouse Prodac 250 system which supervises train scheduling and routing. If a train is delayed for any reason, the computer automatically adjusts other trains so that they maintain safe intervals and yet keep delays to a minimum.

What the Computer Does

The basic function of the computer is to "optimize" the system — and to help trains get back on schedule if for some reason they are delayed, and to determine how to cope with unexpected situations that affect scheduled service. The computer cannot override local station, wayside and train-carried equipment on questions of safety. It can make "suggestions" on how service can be improved. If the local equipment determines that the suggestion can be carried out safely, it will act accordingly.

The computer has a number of other major functions in the automated BART system. It dispatches trains from the yards and, working through station and wayside equipment, aligns various switches so the trains can be routed safely to their proper destinations. The computer also operates a large display board in the BART central control room. The board has a graphic representation of the various routes of the transit system. The computer lights various portions of the board to indicate the progress of all the trains in operation. The computer-operated board also displays the condition of the system's electrification equipment, as well as that of auxiliary equipment such as fans and pumps. All of these functions can be carried out by computer faster, more reliably, and more economically than would be possible manually.

BART also features the most advanced propulsion system of any transit network in the world. Four 150-horsepower drive motors propel each car. The propulsion equipment features a solid-state "chopper" system, an assembly of electronic equipment that takes power from the 1000-volt third rail and feeds it to the traction motors.

The equipment can accelerate a 700-foot-long train from stand-still to 50 miles an hour in 20 seconds and decelerate from 80 miles an hour to a stop in 40 seconds — with a smoothness approaching that of a modern high-speed elevator. As many as 105 BART trains will be in operation during peak hours, some containing as many as 10 72-passenger cars.

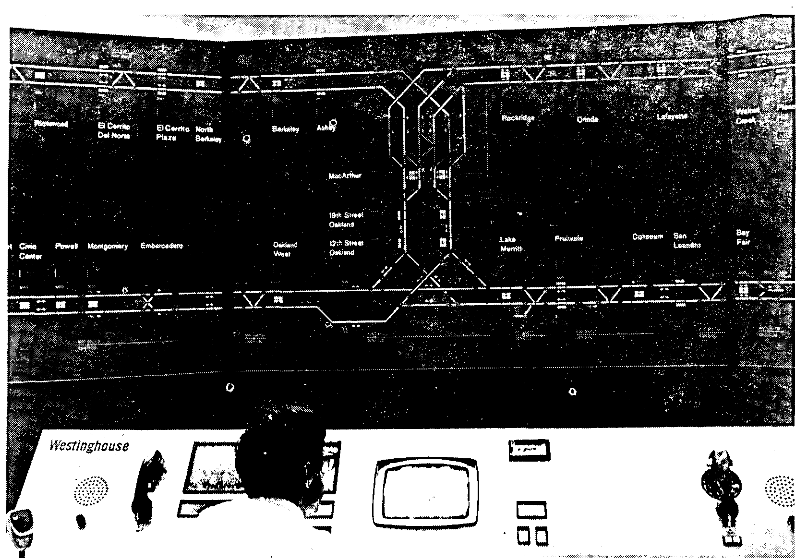
Three of the four lines that make up the BART system are already carrying passengers. These are all on the East Bay section of the Bay Area. Service to San Francisco through a tube beneath the Bay will begin this year.

120-Mile Sao Paulo Metro System

In South America, the first leg of what will eventually be a 120-mile network is being constructed in Sao Paulo, the world's eleventh largest city. Scheduled to begin initial service this year, the 10.5-mile section will run north to south through the city. The North-South line will have 20 passenger stations and the capacity to move one million persons a day. Right now, it takes two hours to travel the North-South line by car. Total metro transit time — about 40 minutes.

The trains will operate automatically at 90-second intervals and speeds up to 62 miles an hour. Each stainless-steel car will hold up to 333 passengers. Such speed and efficiency is a result of coordination of the Metro trains by an automated transit control system which ensures optimal scheduling. The train control system includes a central control complex, local units at each station, and the train yard, wayside equipment, car-mounted control packages, and the communications equipment needed to link the system together.

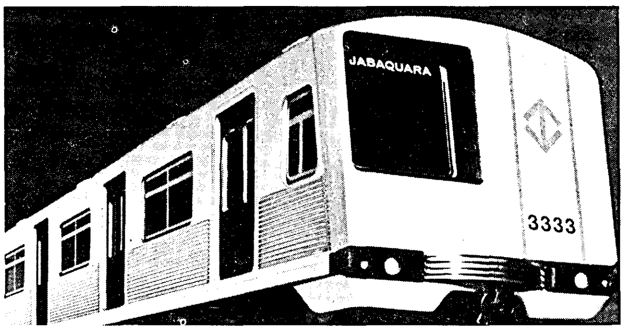
The automatic train control system provides three general functions: train protection, train operation, and line supervision. The Automatic Train Protection (ATP) is the safety system centered around each station or station control zone and involves only the trains within the area. The ATP detects trains within its zone and maintains safe separation of trains, preventing them from exceeding civil and



BART CENTRAL DISPLAY BOARD

traffic speed limits. It also controls track intersections so that trains move through them safely. The ATP system is fail-safe, and cannot be overruled by either the train operation or the line supervision functions.

Automatic Train Operation (ATO) is also a local control function which operates the trains from start to stop within the safety envelope provided by the train protection system. ATO closes the doors, accelerates the trains at the appropriate programmed rate, controls their speed based on schedule performance, decelerates the trains to a precise station stop, opens the doors, controls the train's dwell time at the station and, at predetermined points, reverses the train's direction.



SAO PAULO CAR

The Automatic Line Supervision (ALS) function is subdivided into local and central supervision. Local line supervision, located at stations, includes train identification decoding, route request, route designation, passenger station sign control, and dwell control. All of these functions are automatic.

Central line supervision, as the name implies, is located at the central control complex. It monitors the position and adjusts the performance of all trains. The train schedule is stored in a computer that controls and supervises a number of functions, including train routing, station dwell times, train performance adjustments, train dispatching, and corrective strategies.

Although central line supervision provides recorders, visual displays, and manual input devices for use by central operations personnel, many of the functions are programmed to function automatically without human intervention. The design is such that any degradation in service is detected while it is still a minor deviation from the schedule and not a complete breakdown in performance.

System Optimization

Probably the most important and valuable function of the Metro central computer control is its unique ability to supervise operation of the network to see that daily train schedules are maintained as closely as possible.

The control strategy that performs these optimizing functions describes the real-life system. It includes a model, which is essentially a tabular representation of the Metro system corresponding to the discrete locations where information for control is obtained and where control adjustments can be made. The simulation program can be used to test proposed changes in the system, especially as passenger load demands change in the future. □

Computerizing Production Data Increases Plant's Operation Efficiency

Edward F. Sylvain
General Products Division
IBM Corporation
San Jose, Calif. 95114

"THE CENTRAL DATA BASE IS STRUCTURED LIKE A PYRAMID."

Production control and operational economy are significantly increased by a real-time batch-oriented system at IBM's plant in San Jose, California. The Data Information and Manufacturing System (DIMS) computes production requirements, reports machine and operation performance and provides for inventory control and control of parts movement through manufacturing phases in the production of magnetic disk packs. DIMS handles over 2,000 terminal inquiries and some 40,000 testing transactions a day.

Direct manufacturing personnel — engineers and managers — can readily retrieve data using any of the system's 32 video display terminals or a graphic display terminal. Each user retrieves only information suited to his particular needs, as defined by DIMS' internal hierarchial security structure.

DIMS also turns out several hard-copy reports, such as a Batch Matrix report that lists all batch yields and quantities against operations and a Production Scheduler report that notes the required starts and operations based on current yields, schedules, and inventories.

E. F. Sylvain is Manager of Circuit Technology Engineering Administration at the IBM San Jose General Products Division plant. He was previously Manager of Manufacturing Engineering. Mr. Sylvain has also held several key positions at IBM related to storage product file development, and been associated with test methods in manufacturing over the past decade. He has a BSEE 1949 and MSEE 1950 from Montana State College, Bozeman, Montana.

System Configuration

The DIMS hardware configuration (Figure 1) includes an IBM System/360 Model 40 computer servicing video display stations. The stations are used for process data input and for results and performance output. The stations are strategically located throughout the manufacturing process and in engineering and administrative areas. Testing operations in the process are monitored by special control units. Data gathered by these testers is transmitted to the computer for inclusion in the central data base via a transmission control unit.

Additional hardware includes remote printer/keyboard units for label output and exception report-

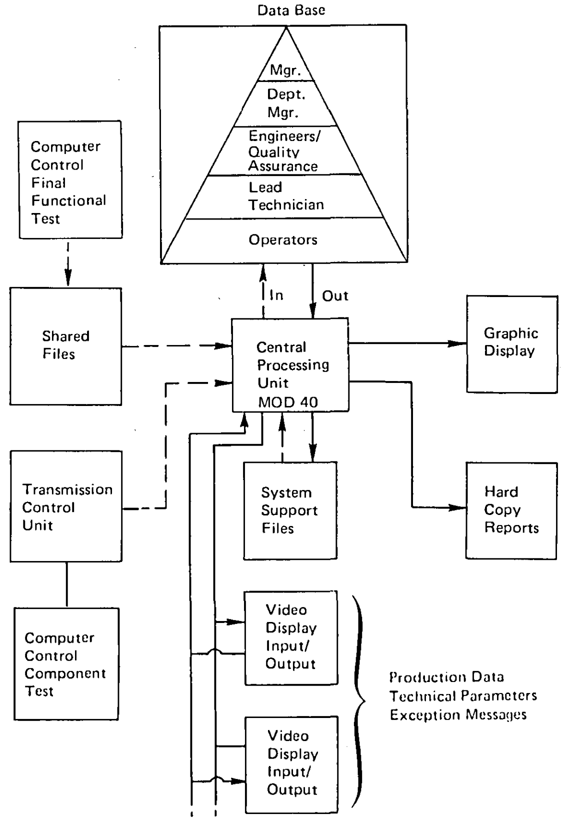


Figure 1. DIMS Data Configuration and Flow

PRODUCTION & DEFECT CLAIM
TOTAL CLAIM = 100
BATCH = QV51 MACH = 0200
TOTAL GOOD = 50 TOTAL REJECT = 50
10/452 20/453 20/454

Figure 2. Typical Video Display Outputs Used by Operators

ing, disk storage units for the data base, and the graphic display terminal for statistical analysis.

DIMS operating system is DOS, selected because of its low core overhead, flexibility, and relative ease with which nonstandard devices can be supported.

Included in the DIMS software is a communications simulator that allows testing of new application programs without impacting the online system. Every transaction received through the communications system is logged, enabling DIMS to maintain data base integrity through restart procedures.

Conceptually, the central data base is structured like a pyramid, as shown in Figure 1. Raw data, oriented to the operator, serves as the base of the pyramid. A greater degree of summarization of the data takes place as the tip of the pyramid is approached, until the most summarized data is available for strategic planning by management. The search structure is such that a person at a given hierarchial level can seek out lower level detail but he cannot seek information summaries above his level.

DATE/TIME 09/18/71 14.15.13

BATCH MATRIX REPORT PAGE 2-

BATCH NO.	QTY	OP1 GOOD	OP1 YLD	OP2 GOOD	OP2 YLD	LAST YLD	NUMBER REMAIN
1294	200						
1402*	190	174	91	154	88	81	154
1403*	190	176	92	166	94	85	163
1405*	190	168	88	161	95	84	160
1406*	190	190	100	166	87	86	165
1407	190	174	91	160	91	33	64
1408	190	185	97	175	94	92	175
1409*	190	174	91	160	91	84	160
1410=	190	188	98	171	90	89	170
1411	190	179	94	171	95	87	167
1412	190	182	95	175	96	92	175
1413	190	187	98	177	94	93	177
1414	190	176	92	153	86	80	153
1415	190	163	85	143	87	75	143
1416	190	184	96	161	87	84	161
1417	190	176	92	156	88	82	156
1418	190	173	91	158	91	83	158
1419	190	181	95			95	181
1420	190	181	95	167	92	87	167
1421	190	181	95	174	96	91	174
1422	190	184	97	178	96	93	178
1423	190	184	96			96	184
1424	190	24	12			12	24
1425	190					100	190
1426	190					98	188
1427	190					100	190
1428	190					100	190
1429	190					100	190
1430	190					100	190
1431	190					100	190
1432	190					100	190
9203	195					21	179
9216	190						
TOTALS		6,277		5,390			

= DENOTES REDTAG AND DIARY ENTRY

Figure 3. Batch Matrix Report

Controls

The primary control or monitoring technique built into DIMS involves batching of parts. Each batch must be completely accounted for at each operation before the system allows the batch to proceed to the next operation. Figure 2 shows a typical video display input used by the operator to account for parts processed and defects found. The three pairs of numbers at the bottom of the figure refer to defect type and quantity. Another control technique prevents the batch from being worked in the event Quality Assurance people should place a hold on it.

	BATCH 2505	AT OPERATION DEC 72		
OP	#1	#2	#3	#4
GOOD	130	130	130	127
YIELD	100.0	100.0	100.0	97.6
MACH	054	065	073	003,004
MO/DAY	12/10	12/10	12/19	12/26
DEFECT	NONE	NONE	NONE	3/179
A015-00	BATCH 2505	AT OPERATION DEC 72		
OP	#5	#6	#7	#8
GOOD	126	126	125	121
YIELD	99.2	100.0	99.2	96.8
MACH	101	304	408	502
MO/DAY	12/27	01/05	01/08	01/20
DEFECT	1/227	NONE	1/931	4/901
A015-00	BATCH 2505	AT OPERATION DEC 72		
OP	#9	#10	#11	
GOOD	121	115	N/C	
YIELD	100.00	95.0		
MACH	603	702		
MO/DAY	01/22	01/22		
DEFECT	NONE	6/501		

Figure 4. Output for Batch Analysis

Still another technique involves notifying an operator of potential problems detected earlier in the manufacturing process by linking messages to a batch of parts.

An offshoot of batch control is scheduling and inventory control, based upon the operator's batch inputs to the system. Inventory control also encompasses the various other materials making up the finished product.

Collection of variable data about key parameters provides yet another means of monitoring manufacturing operations. An operator keys in variable process readings. If any exceed one of a number of control limits (fixed or statistical), the system alerts the operator and instructs him as to the proper action to take. The data base also includes variable data which is linked to production data for convenient engineering analysis of problems related to costs or production efficiency.

Cost information, perhaps the most sophisticated of all DIMS reports, draws together nearly every piece of information in the data base to arrive at where and what cost deviations and fluctuations are occurring.

The computer control testers automatically input raw data to the data bank for such uses as feedback information to operations, preventive analysis, and correlation studies. Study results are used to optimize specification and operation limits.

The controls provided by DIMS usually require human involvement, in that information from the data base alerts someone to take some appropriate action. Human involvement is important. When, for instance, an operator receives feedback from a manager or an engineer, he realizes that someone is indeed looking at the data he entered and taking appropriate ac-
This in turn prompts him to make more valid inputs.

Applications

Examples of how DIMS is used follow:

1. At the beginning of each work day, manufacturing lead technicians receive a Batch Matrix Report (Figure 3) which shows all the active batches in a matrix form. This enables the technician to maintain a smooth flow of his batches through the process, picking up stragglers and tracking "hot" batches. If the technician notes any batches that are out of place or are "unusual," he may immediately obtain a complete analysis of that batch (Figure 4) by going to the nearest video display terminal.

2. A daily Production Scheduler Report (Figure 5) shows what has taken place and where bottlenecks are appearing. The report tells manufacturing how many parts are scheduled to be started, based on current yields and inventories. Actual, scheduled, and projected disk starts are compared, showing management what the process has been doing and whether it looks like the process can handle the advancing schedules.

PRODUCT TYPE 231 CENTER NEW PRODUCTION SCHEDULER			
09/29/71 12.48			
COMPUTATIONS BASED ON LAST 3000 UNITS			
DESCRIPTION	OP1	OP2	OP3
	015	035	045
OPERATION YIELD	100.0	100.0	98.5
TARGET YIELD	98.0	100.0	98.0
CUMULATIVE YIELD	100.0	100.0	98.5
START FACTOR	18.80	18.80	18.80
AVG. LEAD TIME			
ACTIVE	14	13	12
FINAL ASSEMBLY SCHEDULE PER DAY FOR			
NEXT DAY	49	49	49
NEXT WEEK	49	49	49
NEXT MONTH	45	45	45
AVERAGE STARTS PER DAY FOR			
NEXT DAY	921	921	921
NEXT WEEK	921	921	921
NEXT MONTH	846	846	846
DESIRED OUTPUT INVENTORY	00	00	2,500
ACTUAL OUTPUT INVENTORY	00	2,280	570
*REDTAGGED OUTPUT INVENTORY	00	00	00
OPTIMAL UNIT STARTS	-1,068	-1,068	1,211
ACTUAL UNIT STARTED	1,140	1,140	00
FIRST RUN DAILY YIELDS	100.0	100.0	00.0
REWORK DAILY YIELDS	00.0	00.0	00.0

Figure 5. Sample Page from Production Schedule Report

OPERATION #11	PERFORMANCE	WK	1/19			
	PERIOD	30 DAY	DEFECT	#	%	MACH
WKD	3,298	10,969	TYPE 900	400	84%	01,03
YLD	85.6	78	TYPE 400	27	06	01,03
TGT YLD	90		TYPE 600	18	04	03,02
			TYPE 300	11	02	03,02

	BATCH	REJ/TOT	YLD	MACH	#/DEF	CODE
	2552	35/110	68	01	32/900	2/400
	2514	32/114	72	03	29/900	1/450
	2506	29/113	74	01	23/900	3/400
	2528	27/109	75	01	23/900	4/200

Figure 6. Performance by Operation

3. Each operation in the process is summarized at the end of the shift, enabling an engineer to assess the performance of the specific operation he is responsible for by simply going to a terminal. The display (Figure 6) lists the throughput, yields, a breakdown of the most significant rejects and a list of the poorest performing batches. Information is stored to allow the user to look at not only the shift, but the current day, week, and month, as well as historically by day, week, and month with equal ease.

4. Frequently, something unusual will occur in the process. To prevent this from going unnoticed, the users are encouraged to enter a DIARY note into the data bank. (Figure 7) Perhaps an entry will never be referred to; but as history has proven, many of those entries have helped solve problems that arose days or weeks later. Diary messages are associated with a batch, machine, or operation as dictated by the author of the message. The author may be an operator, engineer, or manager.

5. Traceability provided by the system enables engineers to observe "cause and effect" occurrences more readily, thus increasing engineers' effectiveness in solving problems.

DIARY ACTIVITY	ENTRY DATE 73/09/06
BATCH 0-0170 BY MAN # TIME 02/13/12	THE 409 RAN WELL UNTIL ABOUT 2200 WHEN HUB FINGERS OCCASIONALLY FAILED TO GRAB DISK AND ALLOWED SOME SLIPPAGE UPON ACCELERATION. PROBLEM WAS RESOLVED BY CLEANING INSIDE TOP OF HUB.

Figure 7. A Typical Diary Entry

Conclusion

In designing DIMS, highest priority was given to making the system responsive to the needs of diverse users; and, very important, DIMS is sufficiently flexible to meet changing requirements.

DIMS provides instantaneous access to information concerning a batch process, thereby eliminating hours of paper work for lead technicians. It allows engineering people to track specific batches of interest. It assures operators that their batches have been properly accounted for. And Quality Assurance has rigid control of any batches they put on hold, thus providing QA with permanent records of actions that were applied.

DIMS has enabled Manufacturing to maintain better inventory levels at the various operations. Production requirements are accurately computed based on current real process performances. Operation summaries allow management and engineering personnel to more carefully assess the performance of the various operations and machines.

The net result is an improved process performance now and the necessary control to maintain improved performance in the future.

□

Effective Program Design *

David W. Packer
Digital Equipment Corp.
146 Main Street
Maynard, Mass. 01754

"The tendency of many programmers is to just start drawing a detailed flowchart, solving each problem as it occurs. This is analogous to building a house without a plan – one brick at a time. The result in either case is likely to be the creation of a monster."

This discussion of computer program design promotes the idea that the success and ultimately the cost of any computer program is critically related to its design; that is, that the design, is, by far, the most critical aspect of program development. The EDP community often talks of design and the concepts of modularity, generality, flexibility, and maintainability; yet many programs are not well designed, and others are not designed at all, but simply written. It is my belief that the design of a program is much different from its coding, and is a creative task involving many – if not all – of the same elements as systems design.

Good Program Design Results in Good Systems Design

A further extension of this view is that one who learns to design programs well gains valuable training in systems designing as well. The only basic difference between the program and the system is that the program is a smaller unit, and consequently there is less risk from bad design of it. A system is nothing more or less than a set of programs with logical and physical inter-connections, in much the same way as a program is a set of routines with the same sort of connections. I believe that program design is, over the long run, a most essential ingredient of an effective systems job, for well-designed programs are fairly insensitive to the inadequacies of the particular coding techniques used and tend to make the system flexible and easy to modify.

David W. Packer is Manager of Information Systems and Data Processing at Digital Equipment Corporation. He joined DEC in 1964 and has most recently been responsible for developing and building its systems and data processing function. Prior to this, he was a Research Associate at M.I.T.'s Sloan School, working on simulation of industrial enterprises. He has authored material on management of the EDP function, corporate growth dynamics, and management science techniques. He received a B.S. in both electrical engineering and humanities in 1960 and an M.S. in industrial management in 1963, all from M.I.T.

The lip-service paid to program design manifests itself in a number of misconceptions about what constitutes good design. This, coupled with the fact that the computer can do "anything" (i.e., that even the most poorly designed program can be made to work), detracts from the importance of program design today. Why should programs be designed well – or maybe more practically, why should programs be designed at all and not just coded?

I think it is clear to anybody who has worked with large numbers of programs that have existed for a long time that well-designed programs are easier to write, to document, to review, to control, to understand, to debug, to test, and to maintain.

Today, many programmers are being thrust into their jobs with only a brief indoctrination into programming techniques (a course that more often than not has nothing or little to do with design), with a manual that answers only the technical questions of the specific language being used. Very little education or emphasis has been or is being given to effective design of computer programs. Thus, the development of programmers' creative skills (which in turn would provide a solid base for future systems work) is being minimized.

Another important consideration is that EDP installations are operating at an unnecessarily high cost level, and they are often unresponsive to users' needs because of the time required to change, revise, and write new programs. The EDP business today is characterized by a tremendous shortage of programming and technical talent so it is highly desirable to educate the available talent in an organized way and to develop at the earliest time the creative and technical requisites for high productivity, fast response, and advancement in the organization for people currently in programming jobs.

It is my intention in this article to discuss program design, to show concrete examples of what constitutes good – and poor – design, and to show how fundamental the design process is to the whole programming job, and in effect to the whole systems job. My comments derive from COBOL-oriented business-data-processing operations; but I do not believe they are restricted to COBOL users nor to business applications programmers. The following sections focus on concepts of modularity and program structure. From these elements, I will seek to outline the straightforward approach to program design that results.

Modularity

The concept of modularity is at the heart of effective program design. It is also the concept most often not carried through to a meaningful end, although the programmer thinks that it is.

A rather theoretical definition of a program module is that it is a set of instructions that perform a clear-cut function that can be described largely independent of other program steps. Essentially, a module is a set of instructions that is meaningful within itself.

The degree of modularity that a program achieves relates to how close it comes to consisting of a number of independent modules, each with a meaningful function and with no interactions with other modules. In other words, the output of one module is in no way dependent upon what is happening or has happened in other modules. It depends only on the input to the module and the function of that module. As a result of logical independence, any program error can be traced to a malfunction in a single module, and by correcting the module the program malfunction will be completely corrected.

"A good test of modularity is independence among modules."

Using Subroutines

Modularity implies the use of common routines (or subroutines). However, heavy use of subroutines by itself does not mean that one has a modular program. To be truly modular, two key points are required:

1. Each module of the program has a *small* number of interactions with other modules.
2. Each module has clearly defined functions, which are related specifically to the *logical* function of the program.

For example, consider a program that is updating a master file with transactions from three transaction files. When the program was first laid out, it looked very complex, because the updating functions were different for each transaction type and because the process of reading the transaction files to determine which transaction type should be updated next was inherently complicated.

The program was redesigned with the following key modules:

1. A section that processed the transaction files to find the next transaction to be processed and delivered it to a common working storage location.
2. A section that received each transaction and updated the master file accordingly.

Now each module could be written independently – when working on the transaction matching one did not need to think *at all* about the updating functions; when working on the updating, problems of matching multiple transaction inputs could be completely forgotten – the problem was

> *
> **This article, originally published in the July 1970 issue of *Computers and Automation*, is one of the most reprinted articles that we have ever published. Its good sense is as applicable now as it was when published.**

simply to post one transaction at a time. Thus overall complexity was considerably reduced.

Maintenance was also easier. If, for example, a new transaction file was added, it was clear where to make changes and what changes to make, The chance of "subtle" problems emerging was reduced; we knew that a new type of transaction would appear as input to the update, and it was clear how to accommodate it. For the update module itself was modular, i.e. it contained a set of simple sections that provided for the processing differences between transaction types.

A good test of modularity is independence among modules. The test involves the following questions:

1. Can each module be reviewed and specified in detail without regard to other modules?
2. Can each module be coded by a different person (this is not desirable but may be necessary) based on a simple set of specs, and that very little (ideally, no) communication need take place between the programmers?

Program Structure

Conceptually, a well designed program consists of two types of routines. They are:

1. "Mainstream" or control modules.
2. Subroutines, each a module with a function that is only a part of what the entire program does.

Mainstreams

The "mainstream" modules direct the program's operation. They are the basic control sections, calling various subroutines to do detailed jobs. By reading the mainstream code, one can get an overview of the entire logical function of the program.

For example, consider a typical sequential update. Below is the COBOL Mainstream section. The update is sequentially matching a transaction file to a master file, updating the master when a match occurs (by adding to totals in the master), and rejecting transactions (printing an error message) when a transaction has no matching master. The matching is done on fields within the records called TRANS-KEY and MAST-KEY.

```
MAINSTREAM SECTION.
COMPARE-TRANS-TO-MAST.
    IF TRANS-KEY EQUALS MAST-KEY GO TO UP-
    DATE.
    IF TRANS-KEY GREATER THAN MAST-KEY
        PERFORM WRITE-NEW-MASTER THRU
        WNM-EXIT
        PERFORM READ-OLD-MASTER THRU ROM-
        EXIT
        GO TO COMPARE-TRANS-TO-MAST.
TRANS-LESS-THAN-MAST.
    PERFORM ERRONEOUS-TRANS THRU ET-EXIT.
```

```
READ-TRANS.
    PERFORM READ-NEXT-TRANS THRU RNT-EXIT.
    GO TO COMPARE-TRANS-TO-MASTER.
UPDATE.
    IF TRANS-KEY EQUALS HI-VALUE GO TO END-
    ING.
    PERFORM ADD-TO-MASTER THRU ATM-EXIT.
    GO TO READ-TRANS.
```

As exemplified above, the mainstream section consists mainly of decision logic (IF's, GO TO's) and calls of subroutines (PERFORM's). This section, surprisingly enough, is often quite short; yet it provides a clear description of the entire logical function of the program.

Subroutines

Each subroutine is a program module with a smaller function than the entire program. Each is essentially a small program, and will itself consist of a mainstream and may use other, lower level subroutines.

Referring to the example, note that every routine that is PERFORMed is a closed subroutine. For example, the ERRONEOUS TRANSACTION routine is a program whose input is a transaction in an input area and whose output is, in this case, an error printout. The routine might look like this:

```
ERRONEOUS-TRANS
    MOVES SPACES TO PRINT-LINE.
    MOVE "NO MASTER FOR THIS TRANSACTION"
    TO PRINT-LINE.
    PERFORM WRITE-PRINT-LINE.
    PERFORM MOVE-TRANS-TO-PRINT-LINE.
    PERFORM WRITE-PRINT-LINE.
ERRONEOUS-TRANSACTION-EXIT. EXIT.
```

The statements above are the "mainstream" of the subroutine. It, in turn, calls other simple routines for output and for formatting. But its operational functions are clear from the mainstream section alone.

Subroutines can be overused – often to the point where documentation and clarity degrade. This happens when key logical functions appear in a subroutine rather than in the mainstream, where they logically belong, or when subroutines are written for tasks that are short enough to be included in the mainstream.

For example, in the update program, if certain transactions are being selected or deleted from the input file, this logic (or at minimum a PERFORM of the logic) belongs in the mainstream, not in the READ-NEXT-TRANS subroutine, because it is an important function of the program.

"Subroutines can be overused – often to the point where documentation and clarity degrade."

Thus, it is critical that the designer not be carried away by subroutine usage. A common misconception is that *any* use of subroutines is good because it means modularity. A program that overuses subroutines – reducing mainstreams to meaningless levels – is as bad as an undesigned program where everything is included in a long, complex mainstream section.

Subroutines are a tool to break a program into a set of meaningful building blocks with a minimum of interactions among them. Like a program itself, each should do a job that is related to the logical breakdown of tasks of the entire programming system.

Conceptually, both mainstream and subroutine modules are a set of "building block" programs that can be written, tested, and maintained by themselves – they are highly independent.

Overall Program Structure

The block diagram shown in Figure 1 is a convenient way to represent the heirarchical structure of a program. Each box indicates a program module. Along the top are mainstream modules, which are always in control of the program's operations. Note that there may be several mainstreams; typically there is an initial section (initialization, setup, etc.), followed by the main processing section or sections (if the program is doing a series of sequential jobs), and an ending section (wrap up, final totals, closes of files, etc.).

At the next level are what I call first level routines, the major subroutines referred to in the mainstream. Since these are in fact programs, they may use more detailed routines, creating a structure several levels deep. As one goes deeper into the structure, one normally finds that routines have functions of increasingly limited scope. For example, at the lowest level are subroutines that do such things as write print lines, read tape, read disk files, etc.

The block diagram representation of a program is a useful tool for teaching and for stimulating good design concepts. It shows every module of the program and will quickly bring to light fallacious design concepts (for example, an undesigned program will show up as one monstrous block), excessive use of subroutines, etc.

Design Considerations – An Example

Here, let me discuss a representative example of program design consideration. It is typical of a wide variety of rather general design questions that come up in a broad range of programs.

The design consideration is how to handle the several possible outcomes of a modular subroutine. For example, the mainstream may say, "PERFORM READ-CUSTOMER-RECORD." Then the question is, how can we account for the possibility that the customer record will not be found by the subroutine that is "performed"?

There are two approaches: First, to have the subroutine handle the error condition, i.e., go to an error routine that returns to the mainstream section. Second, to have an indicator set at the end of the subroutine that will *tell* the mainstream logic whether the record has or has not been found. If the error indicator is set or "on," then the mainstream logic can handle the error condition. I believe that the indicator is usually the better method, because it puts back into the mainstream logic for a condition that is in fact a part of the broad function of the program – what to do when an error is found. Thus the mainstream may read:

```
PERFORM FIND-CUSTOMER-RECORD
    IF ERROR INDICATOR IS ON, PERFORM CANT-
        FIND CUSTOMER.
```

"CANT-FIND-CUSTOMER" is another program module that would print the program messages and take appropriate action. Thus again the reader of the program knows, from the mainstream alone, that errors can occur and how they are handled.

In most programs, there are many such design considerations. The good programmer will find the opportunity for creativity, innovation, and personal satisfaction if he recognizes such opportunities and exploits them.

Generality and Flexibility

An important design consideration that does not relate directly to program structure is that of generality. Essentially, this means setting up a program to do a general task, rather than a series of highly specific jobs. Generality buys flexibility, for it creates programs that are adaptive, without modification, to the normally changing business environment.

Almost every program of any substance contains opportunities for generality. For example:

Don't include today's specific numbers in programs (like stockrooms, parts, orders). They may (and usually will) change. Include them as parameters, or data, that is an input to the program and can be changed at run time.

Make dates printed by programs in the format "N week period ending MM-DD-YY" so that the same program can be used for weekly, monthly, quarterly, or yearly reports as a function of the input data. Allow for full dates (decades do change, about once every 10 years).

Format reports in a way that allows expansion. Normally a vertical arrangement is best; printing summary items across the page limits expandability and means program changes whenever a new item is added or changed.

"A program should be designed to do a general task, rather than a series of highly specific jobs."

Don't cut corners based on *current* requirements. *Always* design for the general case. For example, if there is a four-digit account number, where the first two digits are constants (today), don't set up records and programs to use only two digits ("But, the other two don't matter!" – today). Use the whole number. Avoid the crises of "But, that means revising 30 programs!" by designing it for the general case the first time. Also, in fixed records, allow extra spaces – you will need them sometime. Don't lump items together unnecessarily ("They say they only need the total, so why keep an extra field in the master file?"). The keynote is:

Think Ahead
Understand Why
Design Systems that Live in a World of Change (Remember Heraclitus)
Avoid Future Crises

Of course, there are tradeoffs. A *highly* generalized system is expensive to build and operate. In many cases, however, a general approach is as easy to implement as a

(please turn to page 41)

TYPICAL PROGRAM STRUCTURE

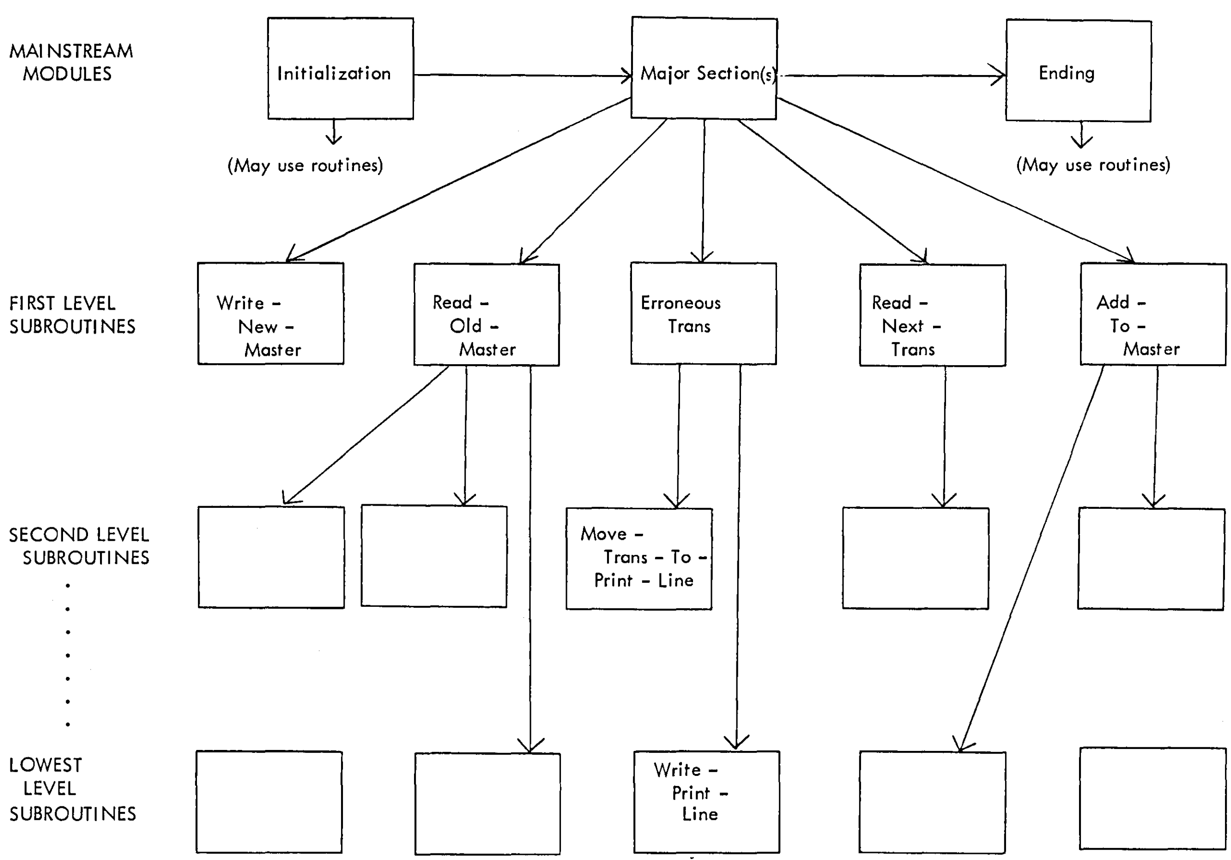


FIGURE 1

Privacy and Security in Data Systems

Ruth M. Davis, Director
Institute for Computer Sciences and Technology
National Bureau of Standards
Bethesda, Md. 20234

Table of Contents

The Problem

There is a societal problem today that signals a major confrontation between the individual in modern society and modern technology. It is the problem variously referred to as that of "Invasion of Individual Privacy," "Data Security," "Computer Crime" or "Computer Security."

As a problem it may perhaps be a singular occurrence or, on the other hand, it may be a tell-tale of the future in which the interaction between people and technology will become much more personalized and intense.

Certainly, the problem area which encompasses the privacy of individuals, the confidentiality of data and the security of computer systems is highly explosive and could, if not dealt with properly, trigger off negative chain-reactions as well as possibly damaging restrictive controls on many applications of technology.

At the same time, if the problem is treated lightly by the executive, judicial or legislative branches, if industry does not carry out its obligations to the public and if the scientific community disassociates itself from the technological underpinnings of the problem, then computer and communications technology could indeed victimize individuals and intrude upon their rights as citizens and consumers.

It is of little use to the public to simply highlight the vastness and complexity of the problem which will be described as the problem of "Security in Automation". What is needed is a sufficient understanding of the problem to describe its component parts, to assign responsibilities and to recognize a satisfactory solution when it is presented.

Components of the Problem

The problem of "Security in Automation" is multidimensional in scope. Its several components can be characterized along the axes of:

- Protection of the privacy of the individual: a responsibility of the judiciary and legislative branches.
- Management of information in automated record-keeping systems: a responsibility of management and information management technologists.
- Assessment and assignment of the costs of Security in Automation: a responsibility of the service industries and government.
- Establishment of procedures, guidelines and standards to assure information management is in compliance with legislative and judicial requirements for privacy: a responsibility of government, management, industry, and the public.
- Development and application of the needed automation and information management technologies and products: a responsibility of industry, information services and the government.

Resolution of the problem of Security in Automation will result from the derivation of solutions that will satisfy all the individual problem components. It is an empty exercise to pass legislation that is technologically impossible to implement. Similarly, it is just a technological tour-de-force to design equipment or procedures that are too costly to use.

Progress towards resolving the problems of Security in Automation is thus dependent upon coordinated, in-step efforts of the judiciary, Congressional and state legislatures, Federal, state and local government management, information service industries and the automation and information technology industries.

Successful resolution of the problem also depends upon an understanding of the differences between its very important separable aspects of privacy, confidentiality and security. Table 1 assists in that understanding.

"THIS PROBLEM OF SECURITY IN DATA AUTOMATION MAY BE A TELL-TALE OF THE FUTURE IN WHICH THE INTERACTION BETWEEN PEOPLE AND TECHNOLOGY WILL BECOME MUCH MORE PERSONALIZED AND INTENSE."

TABLE 1: Problem Terminology

Privacy is a Concept
Which Applies to Individuals

It is the right of an individual to decide what information about himself he wishes to share with others and also what information he is willing to accept from others; i.e., he is freed from observation by others when he so wishes and he is free to select from the universe the information he wishes to assimilate unto himself. This concept is in direct conflict with the present trend toward collecting and storing a large amount of information about everyone and then using it for a number of different purposes. The resolution of such matters will have to be achieved through legal channels and is not within the purview of controlled accessibility. The privacy issue has not resulted from the development of computers, but the heightened interest in it can be laid to the capability of computers for storing vast amounts of readily usable data.

Confidentiality is a Concept
Which Applies to Data

It is the status accorded to data which has been agreed upon between the person or organization furnishing the data and the organization receiving it and which describes the degree of protection which will be provided. It is the confidentiality of data that requires protection, not the privacy.

Security is the Protection of Hardware,
Software and Data Through the Imposition
of Appropriate Safeguards

Security comprises:

Data security is the protection of data against accidental or intentional destruction, disclosure or modification using both physical security measures and controlled accessibility.

Physical security as it pertains to computers, does not differ from physical security for other installations. It is achieved through the use of locks, guards, badges, personnel security clearances and administratively controlled measures outside the computer as well as measures required for the protection of the structures housing the computer and related equipment against damage from accident, fire and environmental hazard, thus ensuring the protection of their contents.

Controlled accessibility is the set of technological measures of hardware and software available in a computer system for the protection of data.

Privacy of the Individual

The issue of individual privacy is no more a modern phenomenon than is record-keeping. Both are as old as society itself. They have, however, become of far greater concern to individuals and government as (1) computer technology has made record-keeping more effective and thus more widely employed, (2) service industries — both public and private — have become more dependent upon records about individuals for success in their operation and (3) the public has demanded more accountability by government and public enterprises.

As a result, the principal concerns about individual privacy today center around:

- The desires of the individual to exercise control over the collection of information about himself, and
- The desires of the individual to exercise some measure of control over the use of information about himself once it is collected.

The Judicial Process and Individual Privacy

The judicial system in this country provides protection to the individual and his rights. It is the judicial process which must address and interpret the law concerned with the rights of the individual to privacy. The Constitution of the United States and court-precedent law are primary sources for this protection. So also is Congressional and state legislation.

Although the Supreme Court has not accorded the right to privacy the status of a Constitutional right, it has recognized elements of this right. In a landmark case involving a state statute restricting the use of birth control, Justice Douglas, writing for the Court found the right of privacy to be implicit in rights afforded by the first, third, fourth and fifth amendments to the Constitution. In a more recent case, the Court indicated that a person may have the protection of due process, the right to a fair hearing and appeal to a higher authority with regard to the circulation of information about him.

Legislative Actions and Individual Privacy

One of the most significant legislative actions, while not directly aimed at protecting individual privacy, has been the Fair Credit Reporting Act of 1970. This Act, among its provisions, gives the individual the right to be informed of what information is maintained about him by a credit bureau or investigatory reporting agency. Items which are challenged as inaccurate by the person about whom the information is maintained must be reinvestigated by the maintainer of the file and corrected. If after reinvestigation the dispute is not settled, the agency must include a brief statement from the subject describing the dispute. While the enactment of this statute has been the most significant Federal action, state and local governments have also been active in this area. The city of Wichita Falls, Texas, has enacted an ordinance designed to protect computerized personal data, and the National Association of State Information Systems (NASIS) has been active in seeking to formulate model legislation in this area.

On September 5, 1973, a bill was introduced into Congress entitled "Code of Fair Information Practices of 1973". The intent of the Bill is to establish a Code of Fair Information Practice for automated data systems. The Code defines fair information practice as adherence to specified safeguard requirements, prohibits violation of the requirement, provides for civil liability and criminal sanctions against violators and provides temporary or permanent injunctions to stop violations.

In 1973, some seventy bills concerned with protection of individual privacy were pending in the fifty state legislatures. Passage of any significant number of these bills along with passage of some of the bills introduced into Congress could easily result in an unacceptable morass of conflicting requirements on service industries, technology and regulatory or judicial organizations. Some national coherence must exist for any realism to be present in arriving at security in automation adequate to protect individual privacy.

Legislative and judicial activity then is intense and increasing in its goal of providing adequate protection to the individual by allowing him measures of control over information about him which is collected and used through the medium of automated record-keeping systems.

The Process of Information Management

Information management is an essential component of the generalized management process which occurs in all organizational units of society. This has always been so. In recent decades, however — particularly since the 1950's — there has been an increased concern with and an increased emphasis on information management.

The principal factors leading to the new emphasis on information management are identifiable. First of all, in the 1950's the United States transitioned from an industrial nation to a post-industrial nation.[1] It was the first nation to so do with over half of its labor forces concentrated in the service industries. The change to a post-industrial nation was not just a theoretical "paper-change". It meant, in practical terms, that success for organizations was dependent upon the proper use of information as the basis for control in their complex action mechanisms and intricate organizational structures.

This is in contradistinction to pre-industrial and industrial societies, societal states through which the United States has progressed in becoming a post-industrial society or service economy. Success in pre-industrial societies is based on management of raw materials: success in industrial societies is based on management of energy and production processes: but success in post-industrial societies is based on the management of information resources.

KEY TO SUCCESS IN	IS BASED ON MANAGEMENT OF
Pre-industrial societies	Raw materials
Industrial societies	Energy and production processes
Post-industrial societies or service economics	Information

Information management is just one component of the management process. To try to make it inseparable from management in its entirety is to hinder progress in both information management and the generalized process of management.

Information management is a process which involves the many operations performed <u>on</u> information to accomplish a predetermined objective. It is helpful <u>not</u> to include the uses of information or decisions <u>about</u> its substantive content in information management. These latter type steps are better incorporated in other steps of the management process supported by other technologies and disciplines than that of information management.

To illustrate the extent of information management, it begins once the step is completed of deciding what information is desired for the management process in question. It does not include the use of the information by managers or the actions taken as a result of the information presented.

Information management does include the operations of:

1. Data collection,
2. Data validation,
3. Information processing or information handling,
4. Data transformation,
5. Record-keeping,
6. Information control including the operations associated with:
   Freedom of information
   Confidentiality of information
   Integrity of information,
7. Information display and presentation, and
8. Standardization of information management operations.

The adequate performance of information management as thus described is an integral and essential part of the entire management process.

"Security" as a Component of Information Management

The problems of data confidentiality and computer security cannot be dealt with in the abstract or out of context with the other components of the information management process. There are, for example, two other current public concerns which directly affect other aspects of information management. These coupled with the concern with security form a potentially conflicting triad, namely:

<u>Public Concern Over</u>:

Confidentiality of Information
Freedom of Information
Integrity of Information

Actions undertaken to meet public concerns with protection of individual privacy must not run counter to these other demands on information handling currently being made. Guarantees of freedom of information already have been made by Congress under the Freedom of Information Act of 1967 (81 Stat. 54). This Act establishes procedures to expedite the freedom of information by setting up means for any citizen to obtain access to identifiable Federal records (with certain identified exceptions).

Congress has also legislated procedures to expedite the integrity or accuracy of information maintained about individuals. An example here is the right of citizens, under the Fair Credit Reporting Act of 1971 (84 Stat. 1136), to interrogate credit files in order to assess the accuracy of information maintained about them and to demand correction of inaccurate information.

Here, in Information Management then, major current concerns are:

- The feasibility of design of Information Systems that simultaneously meet legislative and judicial requirements for:
  - Confidentiality of Information,
  - Freedom of Information, and
  - Integrity of Information;

and

- The costs to the service industries, government and the public of Information Systems that satisfactorily meet these three potentially conflicting public demands.

The Linkage Between Privacy, Confidentiality and Security

The linkage between privacy, confidentiality and security rests on the tenets cited earlier, namely:

- Privacy is a property of individuals,
- Confidentiality is a property of data,
- Security is a property possessed by hardware and software systems and facilities.

Although each of these properties are distinct, they are interrelated. Privacy is usually defined in terms of the controls an individual may exercise over the collection and use of information about himself or in absolute terms of forbidden collection and disclosure of information about individuals. One has, for example, the statements that:

- Certain national defense information can only be disclosed to specified individuals.
- A wife may not be forced to testify about her husband.
- In some states a psychiatrist may not be forced to testify about information provided by a patient.
- An individual must be allowed access to his credit record under the Fair Credit Reporting Act.
- An individual may request that his phone number be unlisted.
- A private company (a corporate person) may classify certain information about itself as proprietary and subject to trade secret protection.
- A person may specify that certain information is not accessible until after a certain time, e.g., as in wills.

Privacy of individuals when proscribed as in the above instances immediately translates itself into confidentiality characteristics of data. Confidentiality characteristics of data may be generally defined in terms of:

- The source of the data,
- Allowable recipients of the data,
- Listings of those who have had access to the data, and
- Time periods for which the data is valid.

Compliance with protective rights afforded to privacy of individuals normally then is dependent upon a proper translation of these rights of privacy into confidentiality characteristics of data. Each datum or piece of data will carry along with it a set of tags defining its confidentiality.

Information management must include established procedures for collecting, storing and interpreting for accessibility purposes these confidentiality tags. Compliance with these confidentiality conditions is an important function of information management. It is also costly in terms of obtaining and verifying the confidentiality conditions, of storing them and of accessing the conditions each time information is requested from the information system.

Once privacy rights have been established by judiciary and legislative processes and once these rights have been translated into confidentiality conditions for the collection and use of information, safeguards and procedures must be established for handling the information in accord with the required conditions of confidentiality. The set of established safeguards and procedures defines the security of the information systems and its facilities.

The security of an automated information system or facility, defined in terms of safeguards or procedures, is implemented through:

- Administrative procedures,
- Equipment features and configurations,
- Communications safeguards, and
- Program or software features.

The least expensive and most effective way of providing the necessary security is to know the confidentiality conditions in time to reflect them in the design and development of the system and the facility. This is not, obviously, the typical case today. There are over 110,000 computers being utilized in the United States. The overwhelming majority of these do not possess the security to meet the data confidentiality conditions required by laws recently passed or pending which state the privacy rights which must be afforded to individuals.

Everyone, then, whether a private citizen, a government manager, a supplier of information services, or a supplier of computer equipment and software is faced with the problem of retrofitting automated information systems to meet the new conditions of data confidentiality and the protection accorded to individual privacy rights.

The Costs of Privacy and Security

Paying for privacy and security is not new to the American public. Some 15% of the 100 million telephones in the United States have unlisted phone numbers. To obtain this privacy, customers must apply to their telephone company and make a one-time payment of $9.00. The American public is currently paying $135M for this right of privacy.

Airlines now publicly advertise their passenger rates by stating the fare "plus a nominal security charge". The United States has more private "backyard" swimming pools than any other country. We are paying for this recreational privacy far more than any other society. The overwhelming majority of working Americans commute in private automobiles rather than use public transportation. There is a nationwide willingness to pay for privacy in transportation.

Apartment buildings find it a valuable asset in gaining tenants to have security guards, TV monitors in halls and garages, and building doors able to be opened only when triggered by an occupant. These security and privacy costs are openly reflected in rental costs. Banks, stores and offices are increasingly making use of TV monitors both for security and to prevent invasion of privacy.

Individuals who select the services of a private physician as opposed to a clinic or other publicly available medical services pay a known price for "private" attention and care. Private education facilities have always been an accepted symbol of individually financed privacy in education.

Executive placement services provide for the prevention of disclosure that an individual is seeking a change in employment. Individuals who have filed their credentials with such a service are compared with the needs of hiring firms. When a match occurs, the individual is notified and requested whether or not he wishes his name forwarded to the hiring firm. The individual is given control over the release of the information that he is seeking employment.

Advertisements for real estate place great emphasis on the privacy afforded in the properties offered for sale. There is a measurable and direct correlation between price and the degree of privacy.

Already and knowingly then the American public is voluntarily paying for many types of privacy and security, representative of which are:

Privacy or Security In:

- Phone listings
- Airline travel
- Recreation
- Housing
- Commuting travel
- Health
- Education

The economics of information management and hence the costs of confidentiality and security of information in automated information systems, unfortunately, are neither well-understood, well-documented nor well-quantified.

Some of the costs of system and facility security are fairly easy to derive. These include, as discussed earlier, the costs of (1) administrative security procedures, (2) equipment security features and (3) communications safeguards. Costs of program or software security safeguards still need to be derived on a case-by-case basis as do certain of the costs of changes to computer system architecture required by security safeguards.

The costs of injecting data confidentiality tags into an information system and storing and retrieving the information so that it meets the safeguards imposed on these data confidentiality tags have to be determined on a case-by-case, system-by-system basis. An example may help to illustrate the factors involved.

An Example of Costs of Data Confidentiality

In order to respond to the privacy concerns which are embodied in part in the current proposed legislation before Congress, significant changes will have to be made in the way current personal data systems are designed and operated. File sizes will grow and processing and security capabilities of existing computer systems will have to be augmented. Organizations will incur additional administrative costs such as those of corresponding with the individuals about whom they maintain information as well as costs of educating their staff concerning security procedures and its responsibility for individual privacy.

As a concrete example, one might consider the impact of responding to these concerns in a hypothetical credit reporting agency's system. Such an operation may have a file of 1,000,000 records, each of which typically contains 220 characters of truncated data. These same records contain an average of 330 additional characters representing the six most current transactions on postings to the record. Turning to the specific impact which privacy safeguards

TABLE 2: Examples of Existing Files Maintained in Information Systems

FILE MAINTENANCE AGENCY	NO. OF FILE SUBJECTS
Defense Department files	
Names of persons exposed to radiation	150,000
Family housing information system	465,000
Civilian personnel data bank	55,000
Defense industrial security programs	1,600,000
Navy manpower and personnel management information system	1,400,000
Justice Department files	
Civil disturbance file	13,000
Organized crime intelligence unit	200,000
FBI's National Crime Information Center	95,000
Other Government Agencies files	
National Driver Registration Service	2,600,000
Passport applicants of law enforcement interest	240,000
Banking Industry	
Bank of America individual accounts	14,000,000
Bank of America personnel files	41,000
Commercial Reporting Agencies	
TRW Credit Data	30,000,000
Insurance Companies	
Mutual of Omaha — applicant health records	8,500,000
Mutual of Omaha — benefit history files	5,000,000
Mailing List Companies	
R. L. Polk & Company — names and addresses on file	200,000,000
Colleges and Universities	
University of Maryland	
Personal & demographic records	158,000
Admission records	131,000
Accounts receivable from students	60,000

would impose, we must first consider that the 220 characters of truncated data are not sufficient to provide for unambiguous identification of an individual. This size will have to be significantly increased, say to about 440 characters since personal identification numbers are not presently used. Likewise, one must provide additional information in each record such as a complete history of all accesses to the record, any access limitation which may be imposed on data within that record, and tags to indicate the age of the information, when it may or must be deleted and when it may be given out in answer to an inquiry.

In this hypothetical model such changes would result in an average file growth of 10% per year, i.e., 33 million additional characters would be added each year so that in seven years the size of the file would double. This growth is due totally to requirements for data confidentiality and does not reflect any file growth due to increases in substantive material. Such growth will clearly affect the operations of the data system. As file size increases and as additional checking procedures are implemented in the software, a price will have to be paid in increased processing time for each query. Larger files will also mean additional hardware. One can thus envision a significant cost for safeguarding data confidentiality.

Allocation of Privacy and Security Costs

The question of allocation of these costs between the supplier industries, the service industries, the consumer public and the government has rarely been directly addressed. In the examples cited earlier of privacy and security already accepted or desired, the cost allocation schema vary widely.

The Federal government, for example, shares with the consumer the costs of privacy in education, health and travel. The consumer generally bears the entire costs of privacy and security in recreation, housing and phone listings.

The allocation of costs to guarantee individual privacy in information systems maintained by the credit and banking industry should presumably be handled differently than the costs of ensuring privacy through security and confidentiality safeguards imposed on government information systems.

Under any circumstance, an important action that needs strong support now is the determination, service-by-service, of the costs of individual privacy and decistions on how to allocate these costs.

Information Systems, Security Incidents, and Existing Threats

In resolving the problems of confidentiality and security, any approach taken is dictated by the facts that (1) large numbers of information systems already exist in which the necessary safeguards are not present, (2) the technologies on which rest the resolution of the many components of the problem are in widely varying states of readiness and (3) the threats to information systems differ markedly in their popularity of use.

Some idea of presently existing files and their contents maintained by public and private organizations can be gained from Table 2.

A picture of the numbers and types of security incidents involving automated information systems

TABLE 3

CATEGORY OF INCIDENT	NO. OF INCIDENTS
National risks	—
Sabotage	15
Theft	23
Copying (data)	8
Tampering 1/	23
Masquerading	2
Browsing/snooping	—
Fraudulent activites 2/	5
	76

1/ Example: An individual replaces a bank's regular deposit slips with slips that have been "doctored" to show the individual's own account number: walk-in depositors using the "doctored" slips are actually depositing money in the interloper's account.

2/ Example: A "computer dating firm" that has no computer. A "computer training school" that has no computer.

during the period 1964-1972 has been compiled by Stanford Research Institute, and is shown in Table 3.

In more technical terms the breadth of the threat spectrum is presented in Table 4. The countermeasure spectrum is just as extensive: partly hardware, partly software and partly administrative procedures.

It is only when armed with these types of data and knowledge that an appropriate approach to the problems of data confidentiality and security can be formulated.

An Approach to the Problems of Confidentiality and Security

Any realistic approach taken to meet the problems of data confidentiality and computer system security

TABLE 4
Threats and Countermeasures

Counter-Measures / Threats	National catastrophe	Sabotage, hardware, and software	Data theft	Copying, browsing, snooping	Bugging	Electromagnetic eavesdropping	Accidental revelation or destruction	Remote terminal assault
Physical barriers	x	x	x	x		x	x	
Guards, badges		x	x	x			x	x
Passwords, finger-prints, voice, signature, etc.			x					x
Encrypting of data			x	x	x	x	x	
EM filters, shields						x	x	
Auditing, checks and balances		x	x				x	x
Threat monitoring		x	x					x
Quality software, data protection, bounds controls		x	x	x			x	x
Personnel screening, motivation		x	x	x				x
Terminal access controls		x	x	x			x	x
File access controls		x	x	x			x	x
Data copies in safe storage	x	x						
Back-up support equipment	x	x						

will be multi-pronged in nature. Minimally, it will be comprised of parallel efforts to:

1. Introduce uniform operating practices and procedures where the supporting technology is adequate,
2. Conduct coordinated research and development efforts where the necessary science and technology does not exist so that nationwide benefits will result from non-duplicative and widely needed R&D efforts, and
3. Apply available technology in systems and procedures in innovative ways which will result in widespread use of these new techniques.

The establishment within government as well as in the private sector of uniform administrative and physical security procedures is an example of the first type of effort listed. Here, for instance, the National Bureau of Standards intends to provide by the first quarter of FY 1975 a set of guidelines for achieving physical security within Federal automated information systems. An initial survey of feasible physical security procedures and guidelines to be used as a basis for these Federal-wide guidelines has been completed and will be published this year.

A number of very obviously needed safeguards for data confidentiality and system security cannot be presently implemented because the supporting science and technology is not adequately developed. These problems must be handled as coordinated R&D programs as cited in the second type effort above. One example is that of operating system software which can effectively control access to the information resident in automated files and the equipment units making up an automated information system.

Another example is that of combating with technology the greatest threat to computer systems — human ingenuity. One way of reducing this threat is through the development of means of uniquely identifying individuals accessing an automated information system in ways that still meet all the judicial and legislative actions prescribed for protection of the individual rights. Technology has yet to produce such acceptable identification procedures.

Examples of means for unique identification which generally appear to rely on identification through personal characteristics can be listed as follows:

MEANS OF UNIQUE IDENTIFICATION THROUGH PERSONAL CHARACTERISTICS

Memory:	Passwords Catechetical Sequences	In use
Neuromuscular:	Dynamic Signature	Promising, in research
Genetic:	Body Geometry	Finger lengths in use
	Fingerprints	Off-line; early research for on-line
	Voiceprints	High interest, limited R&D
	Facial Appearance	High interest, lacking research
	Eyes iris fundus (blood vessels) retina (rods and cones)	Early research
Media:	Picture badges with punched or magnetic patterns	In use
	Magnetic stripe credit cards	In use
	Optical ID cards	

An instance of the innovative applications of existing technology which illustrates the third type effort listed earlier in any realistic approach to the confidentiality problem is that of combating the most dangerous external threat to a computer system. This is the remote terminal operated by a clever, computer-knowledgeable individual. Outside the computer's physical barrier and without fear of surveillance, this individual can plan and execute sophisticated probes of the system to discover and later retrieve or modify information in the system. In a computer network, one computer can be used to subvert another. The possibilities are endless, and, to some, intellectually challenging.

Data Encryption as a Safeguard for Confidentiality and Security

The application of encryption techniques is an instance of innovative application of technology in civilian information systems. Data encryption will protect data during transmission between a computer and its terminals or other computers. Passwords can be encrypted: so also can be data in storage although the economics of this latter procedure are highly questionable.

The introduction of encryption will necessitate modifications to terminals, to software, to communications procedures and to system equipment itself. It presently appears, nevertheless, to be the best way to achieve certain necessary confidentiality safeguards.

Data encryption, also called enciphering, scrambling and privacy transformation, is achieved through the use of encryption algorithms. A computer data encryption algorithm can be thought of as a function which translates data into a form which has no resemblance to its original form. For most applications, an inverse function must exist to convert this encrypted form back to the original. A perfect algorithm is one which is very simple, can be known by everyone, is its own inverse, is based on a simple key known to its authorized users, and requires an infinite amount of work to read the scrambled form without the key. No such perfect algorithm exists. Some examples will bear this out.

An algorithm with perfect security is one in which a purely random key is "added" to the message producing a purely random cipher. The receiver "subtracts" the purely random key in order to obtain the original message. The problem is that such a key must be as long as the sum of all the messages transmitted. This becomes an impossible key distribution problem.

A simple computer algorithm which may be used is a pseudo-random number generator based on multiplying a fixed initial number (the "seed") by the key and taking the result modulo some number 2^N. If $N = 72$, for example, a brute force attack on this algorithm making one test per micro-second on one million of the fastest CDC 7600's available would require 150 years to "break" the key and subvert the system. However, simple analyses of this kind of algorithm by noting the statistical patterns of the results can produce the seed of the generator and hence the key in a much shorter time.

Some commercially available crypto generators are said to use a random code generator of more complexity than the previous example: one such device is said to allow generation of pseudo-random streams in excess of 66 billion bits before repeating. These streams are based on 25 billion different possible key combinations. A brute force attack by an individual to obtain a single key of this machine using the same CDC 7600 at one test per microsecond would take a full shift of computer time given that the necessary input and output existed and the algorithm were known. Not having all the necessary materials changes the task from very difficult to impossible.

Thus, simple algorithms and equipment can be developed to provide protection against intentional subversion of computer systems. NBS is in the process of making such algorithms generally available in order to achieve required protection and a balance between simplicity, economy, and security. NBS is working with and will need the assistance of both industry and government to achieve this goal.

Summary: Problems, Responsibilities, and Approaches

Experience seems to indicate that the many problems of individual privacy, data confidentiality and computer security can, in most instances, be tackled simultaneously and resolved in a reasonable scheduled manner.

Privacy Problems

The problems of settling the problems of individual privacy, namely:

- The desires of the individual to exercise control over the collection of information about himself, and
- The desires of the individual to exercise some measure of control over the use of information about himself, once it is collected,

are the responsibility of courts, Congress and state legislatures. So also is the associated problem of stating penalties for non-conformance. National coherence in legislation and court decisions should be achieved as soon as possible.

Data Confidentiality Problems

Translation of the privacy rights of individuals into conditions of data confidentiality is a joint responsibility of each special interest service community, and computer and information technologists. Even without passage of privacy legislation or additional court decisions, useful anticipatory translation is eminently practical.

The confidentiality tags which must be associated with information, such as:

Data source
Allowable recipients of the data
Listings of those who have had access to the data
Date of validity of the data, etc.

will be differently interpreted by the medical community than by the law enforcement community or the credit service industry.

These different interpretations will result in different file structures, file sizes and access procedures which must be delineated and costed by technologists.

Technological alternatives for retrofitting the existing system and specifying new systems must be reviewed and mutually agreed upon as acceptable by involved information service suppliers, the legal community and technologists.

Innovative applications of data encryption techniques with governmental sponsorhip and support and within as many information service areas as possible can begin during the next year.

Computer System Security Problems

Widespread agreement among large groupings of information service suppliers and by managers of large record-keeping segments will ease the adoption of administrative and physical security procedures. Adoption of such security procedures and subsequent compliance with them will be a tremendous aid since these are documented now and since there has been considerable experience with their use in specific communities.

Government agencies and private sector groups such as the American Banking Association, the American Hospital Association and the American National Standards Institute can adopt such procedures as guidelines or standards.

Research and Development Problems

A general consensus can be reached by government agencies and by private sector service groups on their most important needs which existing science and technology cannot fulfill. This will allow for separate but coordinated R&D efforts with nationwide benefits.

Examples presently seem to include means of unique identification of individuals, redesign of operation system software and computer network protocol development.

Federal, state and local governments have much to gain by coordinating R&D efforts; so also do private sector groups. This is especially true since some of the research, such as that for unique individual identification will be long term, expensive and not profitable enough for any single company to warrant total industry funding.

Concluding Comments

The privacy problem has already introduced serious stresses between society and technology. The best that can be striven for now is to allay present tensions and reduce the follow-on problems of the future. The visible assumption of relevant responsibilities by government and service industries and correlative progress in protection of individual privacy by the courts, Congress and legislative bodies in the country is perhaps the only first step that will permit subsequent resolution of the privacy problem.

That first step is what we are all striving for today.

Footnote

1. Bell, Daniel, "The Management of Information and Knowledge", The Management of Information and Knowledge, Committee on Science and Astronautics, U.S. House of Representatives, 1970, pg. 13-15.

□

The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part 2

Wayne Chastain, Jr.
810 Washington Ave., Apt. 408
Memphis, Tenn. 38105

"When this writer suggested a tentative identity of the eggs and sausage man, Holloman's face ... beamed as if he had suddenly recognized the name ... but he said, 'We picked him up for the FBI who wanted to check him out on something completely different from the King slaying'."

The "Eggs and Sausage Man" Returns

The next morning, April 5, the temperature had dropped to the low 40s. The afternoon before, when the "eggs and sausage man" came into Jim's Cafe, it had been a warm spring day, although the temperature was plummeting at that very moment — hence, probably the reason for the sweater he wore.

About 8:30 a.m. on April 5, the "eggs and sausage man" returned. At first, Jowers was not sure it was him. He entered the cafe. He wore a large ski-type coat with hood, and had a pair of dark glasses on. He carried a large suitcase. He sat at the same table. A different waitress took his order. Again, it was "eggs and sausage".

Jowers immediately called the police and told them: "He's here again ... the eggs and sausage man ... they told me to call if he returned." Jowers said his call was switched several times, and several of the voices at the police station couldn't understand the significance of "eggs and sausage man".

Jowers said: "I finally talked to someone in homicide ... it wasn't Inspector Zachary, but one of his top men. He knew about the 'eggs and sausage' man. He said he would get a uniform detail to bring him right in. I asked him to arrest the man outside my cafe after he had paid his bill and had left. I didn't want him to think I had tipped the police. The officer understood and assured me he would do just that."

The man finished his meal. He paid his bill, picked up a suitcase and stepped outside. He walked only a few feet north of the cafe, when a squad car pulled over to the curb and two policemen got out. They approached the man. One officer took the suitcase, and the second policeman whisked the man over to the side of the squad car. The "eggs and sausage man" leaned on the squad car, his body at an angle, as the second patrolman frisked him for weapons. It appeared from the window, that they had found none on his person, but Jowers said he could not tell what the other policeman might have found in the suitcase. They put the man in the back of the squad car, and the two policemen got in the front, with one carrying the suitcase. They drove away. That was approximately 9:10 a.m. April 5.

Ramsey Clark's Statement

"All day long, I listened to the news reports on my radio. The crime seemed unsolved," Jowers said. "The attorney general — Mr. Ramsey Clark — had arrived in Memphis and I heard Mr. Ramsay's voice over a local radio station saying there was no evidence of conspiracy. He said it in a way that suggested that they knew for sure there was no conspiracy. Other news commentators picked the statement up, and one news commentator must have gotten it mixed up or something, because he flat out said the attorney general said 'there was no conspiracy behind King's death'. I couldn't understand why they kept saying that they did not believe it was a conspiracy until they knew who actually did the shooting. I kept thinking about the man who ordered eggs and sausage. I kept wondering if they might have already solved the murder with his arrest, and they just were not telling the news media at this time, until they could confirm what they thought they knew. I said to myself, this is why they don't believe it is a conspiracy. They have already solved the murder with the 'eggs and sausage man'."

"Some Real Connections"

That night, the same police captain who had questioned him right after King was shot came to his cafe and asked for coffee in paper cups to go. Jowers told him of the arrest of the "eggs and sausage man" that morning.

"Yeah, I know all about it," the captain said. He seemed disgusted, Jowers recalls.

"That eggs and sausage guy you put us on must have had some real connections. One phone call, and he was gone less than an hour after the boys brought him in. He wasn't in the station more than an hour they tell me."

The captain was off duty when the "eggs and sausage man" was arrested and released. He said, however, the man's arrest had been "whispered about and talked about all over the police station."

Memphis Police Interviewed

This writer spent many manhours interviewing many members of the Memphis police department including Inspector Zachary, detectives, and uniformed policemen. With the exception of one high-ranking officer, not one ever acknowledged knowing about the arrest of the "eggs and sausage man" the day after King was killed. In many instances, this writer could not help but feel that he had touched a raw and sensitive nerve in many of these officials. One high ranking officer seemed highly nervous when pressed for details of the incident. This writer then decided to go to the top officials.

Henry Lux, then police chief and now professor of law enforcement administration at Memphis State University, was approached by this writer. "Where did you hear such a wild tale as that? ... I can assure you that no such incident occurred."

Arrest of the "Eggs and Sausage Man"

This writer, however, then approached his superior: Frank Holloman, then director of the Memphis Police and Fire Departments. Holloman was also a retired FBI agent with 20 years in the bureau. At one point in his FBI career, he was one of Hoover's top assistants in Washington, D.C. Holloman, now an executive director of Future Memphis Inc., a private organization which is working behind the scenes to upgrade the image of Memphis, was interviewed by this reporter before he resigned as director of the Memphis Police three years ago.

Holloman reluctantly acknowledged the arrest of the "eggs and sausage man". He contended that this writer, however, was on the wrong track if he was trying to connect the "eggs and sausage man" to the King assassination. When the writer tried to broach a second report, concerning the involvement of a purportedly respectable Memphis businessman[1] in an alleged conspiracy plot to kill King, Holloman admonished this writer: "You had better watch yourself. Time magazine knows all about that incident and they were threatened with a libel suit if they ran the story."[2]

When this writer suggested a tentative identity of the "eggs and sausage man," Holloman did not appear to be familiar with the name. Later in the conversation, his face beamed as if he suddenly recognized the name, but never conceded that he actually had heard the name before.

"Believe me," Holloman concluded the conversation as saying: "There was no conspiracy behind Dr. King's death. Forget the "eggs and sausage man". We have checked him out. We picked him up for the FBI who wanted to check him out on something completely different from the King slaying."

When pressed to at least identify the "eggs and sausage man," Holloman declined: "If I were to reveal his identity, this would violate the confidentiality that we must accord to persons we question in the course of an investigation. It could also libel the person involved and damage his reputation."

Memphis FBI Questioned

This writer then approached William Lawrence, FBI agent in charge of counter-intelligence and subversive surveillance in the Memphis area. (He has been retired from the bureau several years now.) Lawrence, at the time, seemed genuinely interested — and surprised — when this writer told him about the "eggs and sausage man" and when I presented him with clues to his real identity, and other information not related here. Lawrence said before he could respond to my questions, I would have to repeat my information in the presence of his superior, Robert Jensen, special-agent-in-charge of the Memphis FBI office. Jensen quickly conceded that he knew "all about the eggs and sausage man," but repeated Holloman's assurance that the mysterious customer at Jim's Cafe one hour and a half before the shooting had "absolutely nothing to do with King's assassination".

This writer reminded Jensen that Holloman had told him that Memphis Police picked him up for the FBI.

Jensen said the "eggs and sausage man" was released by Memphis police on the okay of the FBI because "his story checked out," but Jensen declined either to identify him or why he was picked up. Unlike Holloman, Jensen concedes that the "eggs and sausage man" was picked up in connection with the King assassination. (One high ranking Memphis police official told this reporter in confidence that the "eggs and sausage man" was both an undercover FBI informer and Army intelligence agent, but this story was never confirmed by his superiors and later the inspector denied making the statement although this writer never divulged his identity in print or to any other person.)

Rare Gun Collector

When I pressed him about a tentative identity, Jensen blurted out: "What is so unusual for a gun collector coming to Memphis to buy a rare gun? We are on the crossroads here. There's nothing in the man's ("eggs and sausage man" presumably) story to connect him in any way to King's death." Jensen, when making this statement, looked at the writer, who sensed Jensen was pretending to make a slip, but actually was trying to give a hint to the newsman.

If Jensen's explanation is correct — namely, the "eggs and sausage man" was only a gun collector — would it not be coincidental that he would select a cafe in a blighted area to eat breakfast at 4:30 p.m. in the afternoon? Nor did Jensen seem to find it coincidental that Dr. King was killed less than a block away about an hour after he left the cafe. If Jensen's seemingly inadvertent statement about buying a "rare gun" is the "eggs and sausage man's" story, where did he go to buy the rare gun? Who was the prospective seller? Did he buy the gun? What kind of gun was it? Was the seller in the neighborhood of Jim's Cafe? Could he have resided upstairs in the rooming house?

And where did the "eggs and sausage man" go after leaving Jim's Cafe? Did he have a rendevouz with the seller during the time span of 5 and 6:10 p.m.?

Non-Conspiracy Theory

If the answers to these questions were known, the "eggs and sausage man" might prove to be the fly in the ointment of the "non-conspiracy" theory upon which the official version is predicated.

The non-conspiracy version must rest on these four assumptions:

1) James Earl Ray killed King from the bathroom window of the rooming house above Jim's Cafe.
2) The rifle left below on the sidewalk was the murder weapon.
3) Ray had no assistance and no ally (Ray contends a mysterious Raoul had masterminded King's slaying and the FBI and Memphis police have gone to exhaustive length to prove that Raoul never existed).
4) Ray was a professional robber[3] and had possession of a pistol and therefore supported himself by committing robberies to finance his travels between the time he escaped from the Missouri Prison in March 1967 until he was caught in June 1968.

As will be discussed later, the "eggs and sausage man" was tentatively identified by Jowers, his waitress, and at least two other persons from photographs obtained by a Memphis private detective, Renfro Hayes, and Bernard Fensterwald, until recently the attorney of record for Ray.

For the present time, we will name the "eggs and sausage man" by a code-name: "Jack Armstrong". Later, a psychological profile will be given of Armstrong.

Five days after Dr. King was killed, and four days after police released from custody the "eggs and sausage man," two significant events occurred in Memphis. That was on April 9, 1968.

A Model for Conspiracy of the Left

Before delving further into the mysteries of the "eggs and sausage man," it is necessary to put into proper perspective this time-frame. On April 9, 1968, the world was still waiting in suspense for answers to such perplexing questions as: Who killed Dr. King? Did the FBI and Memphis police have any tangible clues as to the identity or identities of the killer or killers? Of course, the answer to the latter question would determine whether King was the victim of a murder conspiracy.

If it were a conspiracy, the question would naturally emerge: Was it a conspiracy of the left? Or was it a conspiracy of the right?

If it were the former, three logical possibilities prevailed:

- A foreign Communist power, which wanted to exacerbate the racial problem in the U.S. for propaganda purposes.
- A domestic left-wing group with anti-Vietnam war objectives. Domestic turmoil might divert the U.S. from its course in Vietnam.
- Militant blacks who opposed Dr. King's peaceful and nonviolent protest tactics, which they deemed passé and ineffectual. Motive: to give a more violent direction to the civil rights movement in America and set the stage for black guerilla warfare in urban centers of America.

Of the three, the latter would appear the most plausible when the motives, opportunities, and power to carry out a successful conspiracy and a subsequent cover-up are thoroughly analyzed. Why? In the first two possibilities, one would have to ascribe to the culprits a total lack of perspicacity and a myopic view of the dynamics of American voter psychology. A foreign Communist power — already facing a bellicose U.S. policy in Southeast Asia — would hestitate before fomenting domestic discord if the obvious result would be to tilt American public opinion further to the right. America's military might could certainly crush such domestic turbulence and the resulting martial climate would tend to foster a "man on a white horse" syndrome in the American white voter six months before a Presidential election. If President Johnson were deemed a dangerous man by the Communist world (assuming for a second there is such a monolith) because of his Vietnam policy, wouldn't Richard Milhaus Nixon be deemed even more dangerous? As Vice President under Eisenhower, Nixon had been one of the earliest proponents of an interventionist policy in Indo-China, especially during the crucial days of 1954 after the Vietminh (nucleus of the present day infrastructure of the National Liberation Front and the Viet Cong) had defeated the French Colonial Army at Dienbienphu. (Ironically enough, Johnson[4] — then Senator Johnson, minority leader of the Senate Democrats — and his longtime mentor, conservative Senator Richard Russell — then senior ranking minority leader on the Senate Armed Forces Committee — were credited with trimming the sails of Nixon and the other early Indo-China interventionists.)

Conspiracy by Black Militants

Thus, if one would explore conspiracy possibilities among the left, the black militants would be deemed the most logical plotters. Their motives, of course, like those of most revolutionaries, appear paradoxical and even contradictory to the nonbelievers. True believers of an ideology are often willing to make deals with true believers of a diametrically opposing ideology to eliminate those who hold power in the middle, as true believers in both camps assume that the power vacuum in the middle would give them a chance to move in and take control. Why wouldn't black extremists be willing to deal with white racists extremists in a turbulent atmosphere in much the same way that Communists of the Stalinist orientation were willing to make deals with Nazis in Germany, Russia, and the U.S. during the late 1930's? In these power plays, there will always be a risk that the opposing ideology might turn on you before you can turn on them, but the benefit-risk ratio is such that the prospective benefits — tactically speaking — out-weigh the risks. King's assassination could serve three purposes for the radical black militants.

First: it would eliminate King as leader of the black civil rights movement in America. Second: the militants could quickly fill the gaps. Third: King's death itself could be exploited to engender even more hatred toward the white establishment. (The assassination, of course, would have to have been plotted whereby it would appear that a white racist or racists killed him, a modus operandi made imperative from the lessons of Malcolm X's murder.)[5] Dr. King's murder could trigger black urban warfare in America. It could unleash the restless but resilent rage in America's black ghettos. A massive hostility seethed beneath the surface of Black America, but it was a paradoxical phenomenon — an apparent animus that simmered in the winter, smouldered in the spring, and sizzled in the summer. Sometimes, despite potential provocations, these seasonal smoulderings never exploded. Other times, the least likely provocation[6] could ignite these human combustibles and detonate a social explosion of mushrooming proportions. If one could ignore the tragic aspects, an almost zany quality could be detected in the dynamics of these human passions. They sometimes resembled the old Laurel-Hardy scenario in which a dispute between the two comedians on a public street would accidentally ensnare an innocent bystander. The feud would escalate by encompassing a third, fourth, and fifth bystander until the madness sweeps over entire city blocks in the manner of a forest fire raging out of control.

Racial Unrest

It was no laughing matter, however, when this summer madness spawned sniper-slayings, fires, riots, looting and devastation in Detroit, Newark, and Patterson, N.J., the year before. This monumental madness of racial rage laid waste to inner urban areas of those particular cities, but they were only the egregious examples of its destructive potential. In at least 50 other cities, the racial rage manifested itself in lesser confrontations, but public officials had detected its foreboding presence in the air and swiftly acted to contain it.[7]

If spontaneous combustion could wreak such widespread damage and elicit concessions from the white establishment, what destructive potential could it have if it were programmed and given human direction? This thought could have prompted the radical black militants (or radical white racists) to use this critical mass of hostility as the human kindling for a much more sweeping explosion: one that could be channelized into urban guerilla warfare — not too dissimilar to the kind of warfare waged by the Viet Cong in Vietnam, the kind Castro and his Sixth of July Movement used to topple Batista, and the kind that was being waged in 1968 in at least two South American nations. The more massive the destruction, the more effective the concessions that could be wrung out of the white establishment — that is, if one accepts the thesis that the only real political power is that which comes out of the muzzle of a gun.[8] The thesis presumes that the level of violence is in direct proportion to the benefits or concessions that can be elicited from a war-weary white establishment.

Dismissal of Black Militant Theory

The "black militant" theory of conspiracy and a variation of the "black militant-white racist" temporary alliance were the only two conspiracy theories considered by the FBI and the Memphis police in the first days after King's death. Considering Hoover's reputed vanity for the moment, the first theory had to be quickly dismissed if no tangible evidence — and suspects — could readily be found, because the serious consideration of such a thesis for any length of time would suggest the FBI was ineffectual in penetrating and prosecuting a strong criminal organization in the nation. The second theory was a variation of the black militant thesis. It goes like this: a seemingly, incongruous coalition of black militants, left-wing black subversives in Dr. King's entourage, conspired with white racists hired by a black Mafia-like organization which obtained a murder contract from a Los Angeles black businessman. The latter was a cuckold of many of Dr. King's amorous exploits. According to this theory, this was the reason James Earl Ray went to Los Angeles. This theory had to be also dismissed lest Hoover concede that the invincible FBI could not cope with certain criminal organizations in America.

A Model for Conspiracy on the Right

Then there are possibilities of conspiracies on the right. They could conceivably include:

- Radical racists such as the Ku Klux Klan or National States Rights Party.
- An agency within the Federal government.
- Paramilitary professional organizations with links to both private organizations and key policy makers inside the Federal government.

Radical right-wing racists hate Negroes, Jews and Catholics, although to a lesser extent, Catholics may not rank so high on their hate lists as they formerly did. (The militant anti-Communist stance of many prominent Catholics such as the late Cardinal Spellman and Senator Joseph McCarthy has somewhat diluted and assuaged the virulence of that particular prejudice, which has been traditionally rooted in KKK demonology.) Hatred of Negroes seem to be the number one bete noire in the KKK's panoply of prejudices. Thus a sufficient motive could be easily established.

Weakness of the theory: the motive — even the man-endangering capabilities — exist, but racist-rooted rightists seem to lack the requisite power inside the Federal establishment to cover up evidence of conspiracy once the crime is complete and a fall guy has been caught. A "cover-up" is a sine qua non of a successful conspiracy. Also, J. Edgar Hoover — the nemesis of the KKK — is included in the litany of demons cited in the average KKK tirade, which denounces Hoover as a "tool of the Communists" for persecuting Klansmen.

Conspiracy by Federal Government

The number two possibility approaches credible proportions upon superficial review of events which have occurred over the past decade. Of course, any such agency must be possessed with right-wing predilections, and an anti-King animus. The FBI might fit such a description upon cursory examination. The feud between Hoover and King was legend.[9] Thus, a sufficient motive might be argued. Added to this is the fact that the FBI had the power not only to kill King, but to cover up evidence of a conspiracy.

However, one would have to weigh Hoover's personal animosity toward King against his "image consciousness". The evidence would suggest the latter would prevail. Hoover's vanity and his inordinate preoccupation with the FBI's image as the number one law enforcement agency in the nation would be severely damaged if King were killed amid the "massive and electronic surveillance".[9] It would have the effect of making the FBI appear to be as inept as the Keystone Cops — especially if the supposed fall guy got completely away from the scene after King was killed. After all, King's criticism of Hoover's lack of "vigorous investigation of civil rights violations in the South" had the effect of making Hoover so self-conscious about the civil rights situation that after that incident he bent over backwards in ferreting out subsequent violators — especially in the KKK — so he could not be accused ever again of being soft on civil rights. He had the FBI catch the culprits responsible for the murders of the three Mississippi workers (including a deputy sheriff), but also the killers responsible for the Penn murder case in Georgia, and a woman civil rights worker near Selma.

Hoover then zeroed in on one of the better known paramilitary organizations on the right — the Minutemen. Headed by Robert DePugh, the Minutemen had four prominent Americans marked for assassination, including Dr. King. Of course, one does not have to assume that Hoover was a late convert to the cause of civil rights.[10] On the contrary, his reinvigorated pursuit of facists and rightists could again be ascribed to his excessive preoccupation with his image as number one law enforcer in the nation.

(In the next installment —
Conspiracy by Paramilitary Organizations)

Footnotes

1. Gerold Frank. An American Death (New York: Doubleday & Co.), pp. 147-149.
2. Time carried the story without the businessman's name, but was never sued. According to the story, the Memphis businessman — easily confused with four other Memphians with the same name, including another prominent businessman — has a brother with Mafia connections living in New Orleans. It has been confirmed that John McFerren, a black grocery man and active West Tennessee civil rights leader, gave a signed statement to the FBI that he overheard the Memphis businessman talking over a telephone the day before King was killed and heard him say: "Get that black bastard on the balcony of the Lorraine and my brother will pay you off in New Orleans". McFerren said he offered to take a polygraph test.
3. William Bradford Huie. He Slew the Dreamer (New York: Delacourt Press). Huie is the opposite of Bishop. He now accepts the official non-conspiracy theory, but he disputes some of the premises the official non-conspiracy theory is based upon. Huie concedes the existence of Raoul, and quotes none other than Ray's own attorney Percy Foreman, that Raoul was probably a runner for the Mafia who paid Ray to smuggle contraband across the Canadian and Mexican borders, but that Raoul was not in any way connected to the King slaying.

4. David Halberstam. The Best and the Brightest (New York: Random House), pp. 139-141. In a bipartisan conference of Senators and state department officials in 1954, President Johnson, in effect, shattered intervention plans when he elicited an admission from Secretary of State John Foster Dulles that a majority of the Joint Chiefs of Staff — including Chariman Matthew B. Ridgeway — opposed intervention.
5. Two close advisors of Dr. King have related a theory in vogue with many black intellectuals concerning Malcolm X's assassination. According to the theory, the murder of Malcolm in a Harlem auditorium in 1965 was the culmination of a CIA plot. Malcolm had been deemed a "national security threat" because of his growing stature in the underdeveloped nations of Africa. Neither advisor said he accepted the theory in toto. The two advisors are: Chauncey Eskridge, general counsel to the SCLC in Chicago; and the Reverend Mose Pleasure, a Memphis minister and an early protege of Dr. King in the formation of the SCLC in the early and middle 1950's. The rationale behind the theory that the CIA had Malcolm murdered goes like this: first, the gunmen who killed him were hard-core criminals, not Black Muslim idealogues. Second, the assassination was propitiously timed at a point where there was a split between two Black Muslim factions. Third, the CIA believed Malcolm X was dangerous because of his shrill and strident speeches against the U.S. foreign policies in underdeveloped nations — especially in Africa and Asia. What made him even more dangerous was the fact he had reached an accord with Dr. King — via emissaries — that he was ready to merge his Black Muslim faction with the SCLC on domestic black civil rights issues. Malcolm would temper his black power slogans, but the quid pro quo, however, would require Dr. King to get the SCLC to take more militant positions on international questions. This meant that Dr. King would have to join Malcolm in denouncing the growing escalation of the Vietnam War, as President Johnson had just ordered the bombing of North Vietnam a few months before Malcolm's death. Several weeks before, Malcolm had toured Africa where he vehemently denounced the U.S. role in Vietnam. Malcolm capped his tour with a visit to Nasser in Egypt. According to the theory, the CIA had penetrated Nasser's menage. A cyanide pill was planted in Malcolm's food at Nasser's table. Nasser's private physician pumped Malcolm's stomach and saved him. Nasser suppressed news accounts of the event, but it was leaked through the international intelligence grapevine. After Malcolm left Egypt, his private plane landed at Orly Field outside Paris, but French officials refused to let Malcolm deplane. It was apparent the assassination attempt in Cairo had reached French Intelligence. Thus, French officials feared Malcolm would be assassinated in France.
6. A hose held by a white merchant apparently proved to be a more effective fuse than a policeman's nightstick in Harlem in the summer of 1964. The merchant splashed two black teenagers and sparked a riot that required Mayor Wagner to call for National Guard units.
7. Ironically enough, Memphis, Tenn., was one of the fortunate cities in the summer of 1967. Specter of riots hovered over the city, but Mayor William Ingram was credited for defusing the explosive atmosphere. He disciplined several policemen for alleged brutality complaints and kept the lines of communication open to the black community. Ingram, however, was defeated for reelection in the fall by a white backlash electorate who assailed Ingram for playing up to the "nigger vote".
8. A counter-thesis can be constructed to the Mao thesis based on observation of American politics since 1968 — namely, the election of a conservative Republican administration that feels that it does not have to make any concessions to the black community. Instead, it feels more obligated to a white backlash electorate to attempt abolition of War on Poverty programs and other urban reforms, concessions gained from a Democratic administration, which was the target of most of the more massive black protest tactics.
9. William Turner. The New York Times (May 21, 1973). Turner interviewed Arthur Murtagh, 51, retired FBI agent, who worked for many years in the Atlanta FBI bureau. Now a New York attorney, Murtagh said when he was in the Atlanta bureau, he headed a labyrinthian underground of black informers. The intelligence he received indicated there were no black subversives in Dr. King's entourage as the late FBI Director J. Edgar Hoover had insisted to then Attorney General Robert F. Kennedy. The phantom subversives, of course, created the raison d'etre for Hoover's electronic surveillance of King. Hoover, Murtagh tells Turner, consistently ignored his intelligence reports and in 1964, after Kennedy left office, and the imbroglio between Hoover and King over the investigation of the three slain civil rights workers in Mississippi (this was the incident which culminated with Hoover calling King the "most notorious liar," etc.), Hoover ordered a beefed-up contingent of FBI agents to monitor every movement of Dr. King. Turner quotes Murtage as saying: "The surveillance was massive and complete. He [King] could not wriggle" without the FBI knowing about it. Concomitant with the surveillance was a comprehensive campaign to "smear Dr. King's reputation" by the special FBI squad. Agents visited newspaper editors (including the late Ralph McGill) and urged them to assign photographers to follow King to certain hotels and motels where the black civil rights leader had love trysts with several women. Agents also visited many prominent businessmen — both in the Atlanta community and elsewhere — urging them to not attend a banquet in King's honor after he had won the Nobel Peace Prize.
10. William Turner. Power on the Right (New York: Ramparts Press), pp. 89-90. To show that Hoover had not been converted to any scrupulous concern for civil rights of suspects or victims, this author — an FBI agent for 12 years and now author-critic of Hoover — said Hoover was so concerned with eliminating the doubt in the public mind that he was soft on right-wing organizations that he went after the Minutemen with such a fanatic zeal that he used Gestapo-like tactics. Turner said he testified at the trial of DePugh, the founder, who had been indicted of bank robbery and illegal possession of unregistered firearms by a Federal grand jury. He said DePugh was innocent of the bank robbery charge and had been framed by FBI agents as an expedient means of breaking up the Minutemen. Turner is no friend of right-wing organizations as he left the FBI in the late 1950's because he felt Hoover was ignoring the threat of growing right-wing, paramilitary organizations which were collecting firearms and recruiting private armies of fanatics. □

Neil Macdonald
Assistant Editor

NAYMANDIJ

A "Naymandij" puzzle is a problem in which an array of random (or pseudo-random) digits produced by the first player, "Nature," has been subjected by Nature to a "Definite Systematic Operation" — and the problem for Man is to discover what Nature did.

Certain rules apply to Nature's Definite Systematic Operations:

a. The operation must be performed on all the digits of a definite class which can be designated; for example, "all central 6's".

b. The entire operation has to be expressible in not more than four English words: for example, "replace 2's by 7's".

c. The operation must produce a result that displays some kind of evident, systematic, rational order, and completely removes some kind of randomness.

d. The operation must change at least 6 digits from their original random value.

e. The value and the position of all digits not in that definite class must remain unchanged.

The second player, "Man," studies the puzzle so produced, and tries to figure out what Nature did. Can you figure it out? (Man is not required to express the operation in no more than four words; only Nature is so required.)

For more information about Naymandij as a puzzle and as a game for two players (one or both of whom is aided by a computer), see the two articles in the January and February 1974 issues of *Computers and People.*

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

NAYMANDIJ PUZZLE 743

5	9	8	9	6	7	4	9	8	8	3	2	2	7	6	0	5	2	2	0
0	9	9	6	0	8	5	1	9	6	5	9	7	1	0	7	0	1	2	1
6	9	0	9	4	9	7	1	4	0	8	7	4	7	8	3	9	6	9	4
7	8	4	1	5	9	3	0	8	1	5	7	0	1	3	0	8	8	1	8
4	8	9	1	6	2	2	3	9	2	5	2	9	2	5	9	2	1	7	4
1	0	3	6	9	1	3	3	5	4	0	7	1	7	3	4	5	1	1	4
9	1	4	0	7	8	9	6	0	8	8	1	7	0	6	4	5	8	6	2
1	2	8	1	8	6	1	3	3	4	3	1	0	1	0	4	0	6	8	9
9	4	2	6	3	8	0	1	1	1	5	6	7	8	9	9	3	6	3	7
9	1	5	6	4	8	6	7	9	2	6	9	6	1	4	9	4	4	7	1

The solution for **Naymandij Puzzle 742** in the February issue is: Next 8, make 9.

NUMBLES

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 deliberate (but evident) misspellings, or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

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

NUMBLE 743

```
          R A I N
      x     I C Y
        ---------
        N E E E A
      E Y Z G G
    N E E E A
    -------------
  = N C G F E C A        IS = YZ
+ F D Y A I S D N
  ---------------
= F R E E Z I N G
```

and it all 74351 86166 16370 0742

The solution for **Numble Puzzle 742** in the February issue is: V = 0; Y = 1; N = 2; T = 3; B,M = 4; E = 5; O = 6; L = 7; A = 8; U = 9.

The message is: You times me equals love; I want you to be my valentine.

Our thanks to the following individuals for submitting their solutions — **to Numble 741**: Edward A. Bruno, Cliffside Park, N.J.; John A. Koziol, Addison, Ill.; Abraham Schwartz, Jamaica, N.Y.; Randy Templeman, Vestal, N.Y. — **to Numble 7312**: Richard R. Cutler, Reisterstown, Md.; Randy Templeman, Vestal, N.Y.

— **to Naymandij Puzzle 741-1**: Russell Chauvenet, Silver Spring, Md.; Leon Davidson, White Plains, Plains, N.Y. — **to Naymandij Puzzles 741-2 thru 6**: Gertrude Coates, Chicago, Ill.

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

Table of Contents

APPLICATIONS

"CONVERSION FILE" DATA BANK – A SOLUTION TO CAR RENTAL "THEFT"

Peter Bryan, Director
TRW Validata
12911 Simms Ave.
Hawthorne, Calif. 90049

A solution to one of the most difficult crimes has been devised by TRW Validata. The crime is auto conversion, which results when an individual rents a car and doesn't return it. Eventually it might become theft — but not without the passage of considerable time and lots of legal maneuvers. The solution rests in a bank of computer information at the Validata headquarters in Hawthorne, Calif.

To the layman, auto conversion would appear to be car theft from a car rental agency. An individual rents a car — and then doesn't return it on the promised day! The legal question of car theft isn't as important, however, as the revenue and cost problems associated with cars that are missing and unaccounted for. To solve this dilemma, which costs car rental firms estimated millions of dollars per year, Validata has added driver's license and other information about "converters" to its nationwide central credit and check authorization system.

Now, when an individual presents his driver's license at the counter of a Validata subscriber firm, an automatic check of the license number indicates whether the proposed transaction is unacceptable because the customer has converted a car in the past, or has otherwise violated previous rental agreements.

The system includes built-in safeguards to protect an individual whose driver's license and credit cards have been stolen and are being misused. Like credit or check verification, this transaction takes only seconds.

In creating the "conversion file" data bank, the TRW Data Systems' service includes police agency and warrant outstanding information. However, each subscriber determines what action should be taken and what agency should be notified when a "converter" is standing at the counter. In some cases the car rental's security force is brought in and in others, law enforcement agencies are advised.

The Validata network currently extends from coast to coast and encompasses 25 of the major metropolitan areas in the U.S. Approximately 20,000 inquiries into the system are made each day and these result in an average of 200 "hits" daily. A "hit" results when a transaction is stopped as a result of information on the file. It is estimated that Validata's subscribers have been able to cut their losses from uncollectable transactions by more than 50 percent.

INSURANCE COMPANY BUILDING WILL BE HEATED BY COMPUTERS

Robert P. Jursch and
Douglas Eglinton
The Hartford Insurance Group
Hartford, Conn. 06115

Computers can do some amazing things, and now The Hartford Insurance Group is planning to use its data processing machines to heat a building.

The company will use a special heat recovery system to circulate the heat generated by its computers through a nine-story building now under construction. The 350,000 square-foot structure is on Hartford Plaza and abuts the 22-story tower near the corner of Garden and Collins Streets.

In 1975, the first full-year of occupancy, the fuel savings are estimated at the equivalent of 81,000 gallons of oil. Due to planned expansion of the data processing facilities, The Hartford expects to heat the entire building in this fashion by 1980, saving the equivalent of 120,000 gallons of oil per year.

The system is being installed as part of a new concept in building design called "architectural energy conservation". This concept places increased stress on ways to make more efficient use of heating and lighting.

RECONSTRUCTION OF CAR ACCIDENTS GETS ASSIST FROM COMPUTER

Dean Richmond, Editor
Calspan News
Calspan Corporation
P.O. Box 235
Buffalo, N.Y. 14221

A new system, in which a scientific computer "investigates" and reconstructs highway accidents from information fed to it via radio by a minicomputer at the scene, has been developed by Calspan.

Calspan designed, built and successfully tested prototype units of the new system during the past two years under contracts totaling $200,000 from the National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation. The NHTSA has awarded Calspan a $150,000 contract to further refine the system.

Calspan also is developing and building a special motorized van, which will be equipped with a Calspan-designed system using a minicomputer and other electronic equipment to field test the "new concept in accident reconstruction". The accident investigation van, with its electronic gear, will be turned over to a Buffalo-area police unit for field testing in 1974.

The minicomputer in the van will automatically process accident information at the scene and, at the push of a button, transmit it in computer language by radio directly to a large computer. This base computer then will make repeated attempts to reconstruct the accident.

CHILTON'S COMPUTER TAKES PUBLIC PULSE

Eleanor S. Hargrave
Public Relations Director
Chilton Company
Radnor, Pa. 19089

Most Americans have opinions they are willing to share — a fact upon which industry is placing greater emphasis as it seeks to provide better products and services. At Chilton Research Services, one of the world's largest commercial, social and scientific survey organizations, a computer-based system is helping to speed up and fine tune that feedback. Chiltons takes advantage of the speed and power of an IBM System/370 Model 145 and the country's network of telephones.

The computer is used in all aspects of the surveys: preparation of questions, selection of persons to be called, error-free recording of answers, and a rapid but thorough analysis of results. In fact, it gives Chilton the ability to come up with a statistically accurate fix on a nationwide question in the course of just one evening. This speed and accuracy lends itself not only to surveys requiring rapid response, but also to more lengthy and detailed efforts conducted over longer periods of time. Surveys can range from studies on the type of candy preferred by 10-year-olds ... to reaction about a switch in U.S. foreign policy ... to the problems of the elderly on Medicare.

"Approximately 92 percent of U.S. households can be reached by telephone," points out John H. Kofron, Senior Vice President of Chilton Company and Director of Chilton Research Services. "A telephone interview is much faster and much less expensive than the door-to-door method and far more accurate than surveys conducted by mail."

Survey questions, drafted by research specialists are translated through Chilton's "Survey Processor" package based on an IBM-developed programming language called Coursewriter, and fed into the computer. Coursewriter, which consists of a series of simple, fill-in-the-blanks statements that can be completed by persons with little knowledge of data processing, was originally designed for use in teaching.

In picking persons to be called, the Model 145 handles a job that once involved leafing through more than 500 telephone directories that are quickly out-of-date and usually miss about 20 percent of all households. With 55 million households and 28,000 central offices to choose from, the Chilton computer randomly generates the last four digits of phone numbers, avoiding in most cases large businesses and phone booths. These numbers, which represent a statistical cross-section, are printed by Model 145 and assigned to interviewers.

During an interview, questions are presented in sequence on the screen of a TV-like terminal device. Answers are keyed in and displayed on the screen to check their accuracy. With the touch of another button, answers are recorded in the computer's electronic files. These answers, analyzed and printed as complete reports, are available almost as soon as the final interview has ended.

EDUCATION NEWS

INFORMATION SCIENCES PROGRAM WILL BE OFFERED AT HARVARD UNIVERSITY

University News Office
Harvard University
Cambridge, Mass. 02138

Harvard University will offer a new professional program in Information Sciences in the Fall of 1974 as announced by Harvey Brooks, Dean of the Division of Engineering and Applied Physics. The program, leading to the degree of Master of Engineering, has been developed in response to a strongly felt need to provide advanced training for people interested in acquiring a deeper understanding of advanced computing technology and employing it to meet the needs of business, industry and government.

Presently the typical graduate of a master's program in business administration lacks the technical depth needed to guide the development of advanced computer systems, while those trained in Ph.D. programs in computer science are often too technically specialized to appreciate the over-all operation of organizations or to fully anticipate the effects their decisions might have on aspects of the organization not immediately related to the problem at hand. Harvard's new Information Sciences Program is designed to provide sound training in both these areas — technical and managerial.

Approximately one-third of the program is devoted to developing basic management skills — acquiring an understanding of the problems peculiar to complex organizations, for example, or the functions and responsibilities of a manager. The student will be exposed to a variety of practical management problems and be expected to resolve them and analyze the concepts which underlie proposed solutions.

On the technical side, the student will be exposed to concepts of programming language design, both the fundamentals and the most advanced ideas in the development of operating systems, to state-of-the-art advances in hardware design and computer architecture, and issues involved in developing complex information systems and data bases. A professional approach to the evaluation of technical proposals is stressed as well as the ability to deliver oral and written presentations. The student will be expected to devote the equivalent of a full-year course to the design and execution of a significant project for which design proposals and progress reports will be prepared and a written report will be required at the conclusion. The project, which can be undertaken either at the University or in the field, will entail tackling a significant problem of a company or other institution.

For additional information about the program, write to: MIS Program, Harvard University, 33 Oxford St., Cambridge, MA 02138. Applications for admission may be obtained from: Admissions Office, Graduate School of Arts & Sciences, Harvard University, Byerly Hall, 8 Garden St., Cambridge, MA 02138.

NEW PRODUCTS

"OPERATION ENERGY" – COMPUTERIZED CAR-POOLING SYSTEM

Corporate Public Relations
Burroughs Corporation
Burroughs Place
Detroit, Mich. 48232

Burroughs Corporation has announced the development of a computerized car-pooling system which it calls "Operation Energy". The Detroit-based computer maker offered, as a public service, to give its program without charge "to any organization, any company, any government that wishes to use it, throughout the world". The offer was made at a news conference in Detroit by Ben L. Rouse, Burroughs Executive Vice President for Marketing Operations.

Rouse described "Operation Energy" as a "very complete computerized program for organizations wishing to establish a car-pooling system for employees, or any government unit seeking to encourage the general public to make use of car pools". A consulting firm retained by the Federal Department of Transportation and the Urban Mass Transportation Administration has reviewed "Operation Energy," Rouse said, and reported that the Burroughs program was "a very well documented" program and a "second-generation approach" to computerized car-pooling.

"All car-pooling systems," Rouse said, "have certain common elements. They all seek to establish for as many people as possible concise lists of other commuters who live near them and travel to and from the same destination area at about the same time each day. The difficulty which organizers of car pools face is the need to correlate their data easily and efficiently. Here, the computer can play a vital role as the tool for car pool organization."

The Burroughs program is written in a higher level computer language called COBOL, and it conforms to the standards set by the American National Standards Institute (ANSI). Because it is written in ANSI COBOL and is relatively small, the computer program can be run on any medium or large-size computer system for which an ANSI COBOL compiler is available, regardless of the manufacturer of the system. Rouse added that it can be run even on some small systems such as the Burroughs B 1700.

Rouse said the 2,000 employees at Burroughs World Headquarters in Detroit have been car-pooled through "Operation Energy," and that the program is being expanded to include Burroughs employees in plants all over the world.

"Operation Energy" uses a simple grid map to enable participants to locate their residences in a form which the computer will recognize. The participants indicate the times at which they normally travel, and their work destination. The computer searches all the information furnished by participants, and creates a printout for each, which contains a listing of other commuters with whom car pools might logically be formed.

The computer program provides for as many as 99 distant destination areas within one geographic region. This flexibility permits very large organizations with many plants in a single area to pool all their employees, and by designating each plant as a distinct destination, match those employees with others working at the same location. The program contains features which also would allow larger organizations to invite their smaller neighbors to participate with them in an area car-pooling program.

Rouse said transportation authorities will find the Burroughs program of use in conducting area-wide studies for the planning of new service of the modification of existing service. "The data base is established," he said. "Each individual transportation authority need only adapt the program to obtain from that data base the specialized information required."

PROPERTY APPRAISAL BY COMPUTER OFFERS SPEED AND ACCURACY

Mary Ann West
University News and Publications Service
University of Wisconsin-Madison
Bascom Hall
Madison, Wis. 53706

A computerized property appraisal system, developed at the University of Wisconsin-Madison School of Business, may help solve growing tax assessment problems, according to real estate professor James A. Graaskamp.

In a Bayside, Wisc. property appraisal study, graduate student Keven Hansen and Prof. Graaskamp found that a computer program was able to cut appraisal costs per residence from $30 to $1.37 while reducing appraised error by two-thirds. Written by Robert Knitter, director of the University's computing center, the program was designed to provide yearly valuation of individual properties with speed and accuracy.

Many Wisconsin tax assessors in recent years have lagged five to six years behind in property tax assessments, actually appraising only a fraction of properties in their municipalities each year. The program can be used to value properties annually, thus eliminating a large jump in taxpayers' assessments every three or four years. "Under the present system," explained Graaskamp, "if the market value of the community is understated, it will receive less than its share of state aid and individual taxpayers will carry unequal tax burdens."

The program is different from other computerized appraisal programs in its use of the traditional market comparison method of assessment in which assessors assign a value to a property based on what properties with similar characteristics have sold for.

The program, named MKTCOMP, is accessed via teletype to the GE Mark III Information System. Data on properties already sold, including the number of rooms, design, and quality of the houses are stored by the assessor. He then stores in the computer the data on those properties to be valued. MKTCOMP finds the closest matches between the two sets of properties, making adjustments for differences, and thus assigns a market value to the properties under consideration. "MKTCOMP actually simulates the method an appraiser uses," Graaskamp said. "It permits an assessor to exercise his judgment and experience."

MKTCOMP, in comparing a sample of 16 test properties sold in 1973 to 100 other property sales, estimated selling prices for individual properties more accurately than either an assessor or a previously-tested computer program using regression analysis. MKTCOMP's average dollar error per property was $7,000 less than the error of the assessment on record. Further, MKTCOMP processed one property per minute and would be able to value all 1,127 properties in Bayside in less than 20 hours of computer and analyst time.

MKTCOMP is now part of the Educare computer network. Educare, a non-profit corporation owned by the professional appraisal societies, offers educational courses and a library of real estate programs to real estate professionals.

This study was sponsored by the UW-Madison Graduate School Research Committee.

OPTICAL LENSES PROCESSED BY HONEYWELL MINICOMPUTER

Brooks Roberts
Carl Byoir & Associates, Inc.
800 Second Ave.
New York, N.Y. 10017

COPP Inc. (Computerized Optical Prescription Processing) of Dallas, Tex. has developed a complete software system for processing prescription optical lenses. A Honeywell System 700 computer handles everything from input from prescriptions to management reports. It provides complete mathematical computations and gives all equipment settings for optometrists.

According to COPP president Lyle Ratner, this computer program gives any optical laboratory the accuracy and speed of a computer plus economy in processing prescription optical lenses — as little as nine cents of computer time per prescription, depending on volume. The Honeywell computer has been programmed, and is constantly updated, with a complete universe of lenses and more than 3,000 frames by manufacturer, color and size.

The operations performed by the computer are: selection of glass or plastic blank by bin number after determining the minimum size needed by cut-out formula; giving generator setting, accomodating for elliptical error; supplying spotting information for bench department, as well as layout for edger details; giving time settings for heat treating; supplying checkout information; printing tolerances for P.D.; indicating proper frame size by bin location, and printing shipping label and billing the job from information supplied on doctor's or optician's order form.

In addition, the COPP system provides management reports such as inventory usage of lenses by size, base curve, color, segment, etc.; frames by manufacturer, color, eye size, bridge size etc.; breakage analysis; production reports; payroll and labor cost analysis; production cost analysis, and accounts receivable.

COPP will lease the hardware, software and Honeywell maintenance to optical laboratories. Ratner said that the entire system is designed to be operated by non-technical optical people, primarily typists — not computer experts.

RESEARCH FRONTIER

"BUBBLE" MEMORY DEVICE UNDERGOING TEST AND EVALUATION

John B. Lawrence, Jr.
Public Affairs Department
General Telephone & Electronics
One Stamford Forum
Stamford, Conn. 06904

GTE Laboratories Inc., Waltham, Mass., recently announced the development of a memory-storage device containing microscopic "bubbles" that can store vast amounts of information in a tiny wafer of magnetic material. This is the first time such a device, known as a magnetic domain memory, has been developed to the point where it has been turned over to a manufacturing organization (GTE Automatic Electric Inc.) for testing and evaluation. GTE Automatic Electric, a GTE communications equipment manufacturing subsidiary, will test and evaluate the prototype as part of the memory unit of an electronic telephone switching system.

Dr. Lee L. Davenport, President of GTE Laboratories, said, "We anticipate that magnetic bubble devices will be used in a wide range of systems requiring large-capacity memories capable of operating at high speeds. Because of these characteristics, as well as small size, low cost, and reliability of operation, the devices will offer significant promise for future application in electronic telephone switching systems, computers, and other kinds of electronic equipment."

Magnetic domain memories consist of extremely thin films of magnetic material — in this case from yttrium gadolinium thulium garnet family — deposited on specially-grown garnet crystals. The garnet film, which is no thicker than a human hair, contains minuscule cylinder-shaped magnetic domains — called bubbles — which can be moved at high speeds within the material. Movements of the bubbles are controlled by "tracks" of magnetic material placed on the garnet chip. The presence or absence of bubbles provides digital information which can be read by a detection device.

A wafer of garnet the size of a postage stamp can store one million binary digits — "bits" — of information. The small size and large capacity give bubble memories great potential as future replacements for the disc and tape memories used in computers. Present estimates indicate that where bubble memories can be used these types of memories also offer a thousand-fold increase in capacity for the same price.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Advanced Memory Systems, Inc., Sunnyvale, Calif.	Control Data Corp. (CDC), Minneapolis, Minn.	Add-on memory systems	$11 million
Litton Industries, Guidance & Control Systems Div., New York, N.Y.	U.S. Air Force	Production of additional LN-12D inertial navigation systems for F-4 Phantom jet fighter aircraft	$7.1 million
Computer Sciences Corp. (CSC), El Segundo, Calif.	Navy Regional Procurement Office, Long Beach, Calif.	Computer programming support to Naval Undersea Center (NUC) in Pasadena and San Diego	$4.9 million
Xynetics, Inc., Canoga Park, Calif.	DHJ Industries, Inc., New York, N.Y.	Model 2000 automatic digital plotters to be used in a marker making system which produces pattern markers and performs pattern grading for apparel industry	$2+ million
GTE Sylvania Inc., Stamford, Conn.	Space & Missile Systems Org., U.S. Air Force Systems Command	Providing input-output data processing equipment for Minuteman intercontinental ballistic missile system	$1.6 million
Computer Automation, Inc., Irvine, Calif.	FACIT AB, Solna, Sweden	NAKED MINI and ALPHA/LSI computers to be delivered over a two-year period	$1+ million
Sanders Associates, Inc., Nashua, N.H.	CAE Electronics, Montreal, Canada	Situation display subsystem which will be used to train controllers at Air Traffic Control Center in Ottawa	$1 million (approximate)
Applied Devices Corp., Hauppauge, L.I., N.Y.	Redstone Arsenal, Army Missile Command	Refurbishing and converting HAWK missile system simulators	$971,800
Peripheral Equipment Div., Pertec Corp. (ASE), Chatsworth, Calif.	Redifon Electronic Systems, Crawley, England	Digital magnetic tape transports and formatters to be used with Seecheck, a computer controlled key-to-disk data preparation system	$750,000 (approximate)
Harris Communication Systems, Inc., Dallas, Texas	State of Tennessee, Nashville, Tenn.	COPE Remote Batch Terminals to be used to transmit business data for Department of Transportation, Department of Welfare, and Department of Mental Health	$683,800
INCOTERM Corp., Natick, Mass.	Midland National Bank, Milwaukee, Wisc.	100 additional intelligent CRT computer terminals	$400,000+
Pitney Bowes, Stamford, Conn.	U.S. Postal Service	Providing 1,000 postage meter mailing machines to print and record postage paid by customers utilizing post office window service for parcel post	$379,000
Peripheral Equipment Div., Pertec Corp. (ASE), Chatsworth, Calif.	Plessey Telecommunications Limited, Poole, Dorset, England	Digital magnetic tape transports and formatters to be used with several products including an automatic library system and stock control system which are marketed in the U.S.	$375,000 (approximate)
Energy Conversion Devices, Inc. (ECD), Troy, Mich.	Burroughs Corp., Detroit, Mich	Development of semi-conductor memory devices designed to Burroughs' specifications	$304,000
DATUM, Inc., Anaheim, Calif.	JPL, Pasadena, Calif.	Several Model 5091 Magnetic Tape Systems; used for recording critical real-time engineering and scientific T.V. image data MVM73 (Mariner-Venus-Mercury) spacecraft	$300,000+
Sanders Data Systems, Ltd., Nashua, N.H.	Esso-Europe, London, England	Programmable computer terminals to be used in national computerized management information system throughout the United Kingdom	$194,000
Auto-Trol Corp., Denver, Colo.	Phillips Petroleum Co., Bartlesville, Okla.	A graphic product, known as "Auto-Draft" system, which produces finished drawings from rough sketches or other input media	$150,400+
Lehigh University, Center for Information Science (CIS), Bethlehem, Pa.	National Science Foundation (NSF)	The eleventh grant supporting further refinement of LEADERMART, a computerized information storage-and-retrieval system	$93,800
Atlantic Research Corp., Alexandria, Va.	Dearborn Heights Police Dept., Dearborn Heights, Mich.	A pilot installation of ARCOM® Mobile Digital Communication System providing miniature mobile terminals in 15 department patrol cars; grant funded by Law Enforcement Assistance Administration (LEAA)	——
Control Data Corp., Minneapolis, Minn.	Southern California Edison Co., Downey, Calif.	A multi-computer energy management system for electrical power service network; two Cyber 70 Model 73 and four SC 1700 computers will control the "Digital Dispatch Security Monitoring System" (DDSMS)	——
Datatrol Inc., Hudson, Mass.	J. L. Hudson Co., Detroit, Mich.	Totally automated credit authorization system which replaces voice response system; new system includes 15 minicomputers and over 1300 compact credit terminals at cash register locations in all 12 stores	——
ECRM, Inc., Bedford, Mass.	Scripps-Howard Newspapers	Twelve Model 1200 AUTOREADER Optical Character Recognition (OCR) systems	——
INFONATIONAL, Inc. (OTC), San Diego, Calif.	Equity Funding Corp. of America, Los Angeles, Calif.	A data processing Facilities Management agreement to provide computer services; will manage computer software systems, data preparation, and computer operations	——
Interdata Inc., Oceanport, N.J.	Scotty's, Inc., Winter Haven, Fla.	15 Model 7/16 minicomputers to be used in point-of-sale network involving 45 retail outlets in 38 cities	——
Photon, Inc., Wilmington, Mass.	South China Morning Post, Hong Kong	Three Chinese-language phototypesetting machines	——

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B 6700 system	Consolidated City of Jacksonville/ Duval County, Jacksonville, Fla.	Fiscal Information System; will provide full financial and budget services for all city departments (system valued at $3.6 million)
	Time Sharing System Inc., Milwaukee, Wisc.	Expanding services to customers (system valued at $2 million)
	University of the Pacific, Stockton, Calif.	Broadening direct usability of the computer in the classroom and in research; system replaces a B3500 (system valued at more than $1.25 million)
Data General Nova 1220 system	South Boston Savings Bank, Boston, Mass.	General ledger system; on-line personal loans system; and in near future, a securities management system for bank's portfolio
Digital Equipment DEC System 10	National Chaio Tung University, Taiwan	On-line analyses and designs; a major task is computerized highway supervision system in Taiwan, including all administrative functions; each of Taiwan's 18 highway supervision stations will be connected to the system (system valued at approximately $400,000)
Honeywell Model 2020 system	Palmer G. Lewis Co., Inc., Auburn, Wash.	Financial applications and inventory reporting (system valued at approximately $105,000)
Honeywell Model 6060 system	Standard Telephones and Cables Ltd. (STC), London, England (2 systems)	Management information system and for expanding current applications (system valued at approximately $3 million)
Honeywell Model 6080 system	Seattle-First National Bank, Seattle, Wash.	Batch processing, time sharing, an interbank credit authorization system and remote MICR processing (system valued at $2 million)
IBM System/7	Gulf Life Insurance Co., Jacksonville, Fla.	Energy conservation; system controls the heating and air conditioning systems for the building; future plans include controlling other sources of power demand such as lighting and elevators
NCR Century 50 system	Williams Energy Co., Tulsa, Okla.	Computerizing customer and dealer billing procedures; encoders will be located in district sales offices nationwide and will communicate with computer located in one of firm's regional offices
NCR Century 101 system	American National Bank & Trust Co., Danville, Va.	Nucleus of Central Information File system giving service to 47,000 accounts
	Lozier Corporation, Omaha, Neb.	Office applications including bill of materials, inventory and production control and general accounting
	Southern Constructions (Holdings) Ltd., Waterlooville, England	Preparing financial ledgers, integrated costings, interim valuations, and payrolls and to process plant rentals
	Stratford of Texas, Stratford, Texas	Billing and keeping track of cattle feed provided and the weight gained by animals it feeds for others
NCR Century 200 system	First National Bank of Martinsville and Henry County, Va.	Nucleus of Central Information File system providing services to 70,500 accounts
	Stichting Gemeenschappelijke Informatieverwerking voor de Rundveehouderij, Amsterdam, Holland	Supporting nationwide effort to maintain and upgrade quality of Dutch milk cattle; keeping track of day-by-day production and tri-weekly protein-fat content of milk from 1.600,000 horned cattle, along with breeding data for herds (system valued at $650,000)
NCR Century 350 system	Sumitomo Bank, Osaka, Japan (3 systems)	Expansion of on-line, real-time computerized banking network
	Sumitomo Bank, Tokyo, Japan (2 systems)	Expansion of on-line, real-time computerized banking network
Univac 1106 system	Lutheran Hospital Society of Southern California, Los Angeles, Calif.	Core of an information system serving seven hospitals affiliated with the Society (system valued at approximately $1 million)
	Nissan Motors Company, Tokyo, Japan	Allowing mold designers of Datsun automobiles and trucks to rapidly draw, check and modify designs; a graphic display terminal, capable of three dimensional representation, to be connected to UNIVAC 1106 (system valued at $1.9 million)
Univac 1110 system	Real Time Center A.G., Bern, Switzerland	Real-time computing services for on-line processing of banking transactions; system will eventually be able to handle 18,000 transactions per hour (system initially valued at approximately $3 million)
Univac 9400 system	Portuguese Postal, Telephone and Telegraph Service, Lisbon, Portugal	Telephone invoicing, personnel management and inventory control
Univac 9480 system	Spanish Ministry of Finance	Public expense accounting, control and development of Government's general budget, and payments control
Xerox Sigma 6 system	Intermediate School District 109, Data Processing Cooperative, Everett, Wash.	Administrative data processing in an on-line, terminal-oriented manner in 19 local districts
Xerox Sigma 530 system	G. D. Searle & Co., Skokie, Ill.	Pharmaceutical research applications, and handling overflow from a Sigma 3 (system valued at approximately $105,000)
	TRW Systems, Space Vehicles Div., Redondo Beach, Calif.	Environmental testing of new spacecraft, including a global network of satellite (FLTSATCOM) to provide instant communications between U.S. Navy ships anywhere in the world

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND PEOPLE

The following is a summary made by COMPUTERS AND PEOPLE of reports and estimates of the number of general purpose digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers quarterly 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. A few manufacturers refuse to give out, confirm, or comment on any figures.

Part 1 of the Monthly Computer Census contains reports for United States manufacturers, A to H, and is published in January, April, July, and October. Part 2 contains reports for United States manufacturers, I to Z, and is published in February, May, August, and November. Part 3 contains reports for manufacturers outside of the United States and is published in March, June, September, and December.

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

The following abbreviations apply:

(A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND PEOPLE
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 PEOPLE
(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 and/or not released by manufacturer

SUMMARY AS OF FEBRUARY 15, 1974

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 3. Manufacturers Outside United States							
A/S Norsk Data Elektronikk	NORD-1	8/68	2.0	0	135	135	24
Oslo, Norway	NORD-2B	8/69	4.0 (S)	0	20	20	X
(A) (Jan. 1974)	NORD-5	2/72	-	0	1	1	1
	NORD-10	5/73	2.0	0	17	17	38
	NORD-20	1/72	3.5 (S)	0	36	36	8
A/S Regnecentralen	GIER	12/60	2.3-7.5	0	57	57	0
Copenhagen, Denmark	RC 4000	6/67	3.0-20.0	0	23	23	3
(A) (Aug. 1973)							
Elbit Computers Ltd.	Elbit-100	10/67	4.9 (S)	-	-	325	10
Haifa, Israel							
(R) (Nov. 1973)							
GEC Computers Ltd.	902	5/68	-	0	17	17	0
Borehamwood, Hertfordshire	903, 920B	12/65	-	1	464	465	19
England	GEC 905	5/69	-	0	77	77	1
(R) (Nov. 1973)	GEC 920M	7/67	-	0	130	130	103
	GEC 920C	7/68	-	0	19	19	0
	Myriad I	1/66	-	0	47	47	0
	Myriad II	11/67	-	0	32	32	0
	GEC M2140	10/69	-	9	21	30	0
	GEC 2050	6/72	-	0	5	5	32
Hitachi, Ltd.	301	5/59	X	-	-	-	X
Tokyo, Japan	101	9/60	X	-	-	-	X
(A) (Jan. 1974)	102	8/59	X	-	-	-	X
	103	12/61	X	-	-	-	X
	201	4/62	X	-	-	-	X
	3010	11/62	X	-	-	-	X
	5020	3/65	X	-	-	-	X
	4010	5/65	X	-	-	-	X
	8400	2/67	10.0-50.0	-	-	-	-
	8200	2/67	3.3-8.3	-	-	-	-
	8300	4/67	8.3-15.3	-	-	-	-
	8100	5/67	1.3-4.0	-	-	-	-
	8500	8/68	16.7-66.7	-	-	-	-
	8210	12/68	2.6-10.0	-	-	-	-
	8350	2/71	11.7-40.0	-	-	-	-
	8700	3/72	60.0-167.0	-	-	-	-
	8450	6/72	23.3-66.7	-	-	-	-
	8150	11/72	1.7-5.0	-	-	-	-
	8800	12/72	13.0 and up	-	-	-	-
	8250	4/73	5.0-13.0	-	-	-	-
International Computers, Ltd. (ICL)	Atlas 1 & 2	1/62	65.0	0	6	6	X
London, England	Deuce	4/55	-	0	2	2	X
(R) (Sept. 1972)	KDF 6-10	9/61	10-36	0	34	34	X
	KDN 2	4/63	-	0	1	1	X
	Leo 1, 2, 3	-/53	10-24	0	43	43	X
	Mercury	-/57	-	0	4	4	X
	Orion 1 & 2	1/63	20.0	0	10	10	X
	Pegasus	4/55	-	0	9	9	X
	Sirius	-/61	-	0	8	8	X
	503	-/64	-	0	18	18	X
	803 A, B, C	12/60	-	0	107	107	X
	1100/1	-/60	5.0	0	13	13	X
	1200/1/2	-/55	3.9	0	11	11	X
	1300/1/2	-/62	4.0	0	82	82	X
	1500	7/62	6.0	0	35	35	X
	2400	12/61	23.0	0	3	3	X
	1900-1909	12/64	3-54	2	2200	2202	-
	Elliott 4120/4130	10/65	2.4-11.4	0	100	100	X
	System 4-30 to 4-75	10/67	5.2-54	0	200	200	-
Japanese Mfrs.	(Other manufacturers of various models include: Fijitsu, Ltd.; Matsushita Electric Co. of America; Mitsubishi Electric Corp.; Nippon Electric Co., Ltd.; Oki Electric Industry Co.; Tokyo Shibaura Electric Co., Ltd.; Toshiba.)				12,980		800E
Philips Electrologica BV	P1000	8/68	7.2-35.8	-	-	128	50
Apeldoorn, Netherlands	P9200	3/68	-	-	-	298	2
(A) (June 1973)	P9200 t.s.	3/70	-	-	-	5	1

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
Philips Electrologica BV (cont.)	P880	9/70	-	-	-	52	8
	P850/55/60 (OEM)	9/70	-	-	-	200	500
	ELX	5/58	6-21	-	-	27	-
	PR 8000	1/66	-	-	-	23	-
Philips' Telecommunicatie Industrie BV Hilversum, Netherlands (A) (Jan. 1974)	DS 714	-/67	-	13	34	47	10
	DS 18	9/72	-	0	9	9	4
Redifon Electronic Systems, Ltd. Crawley, Sussex, England (A) (Aug. 1973)	R2000	7/70	-	1	26	27	2
	R2000A	6/73	-	-	2	2	12
Saab-Scania Aktiebolag Linkoping, Sweden (A) (Dec. 1973)	D21	12/62	7.0	0	25	25	-
	D22	11/68	15.0	0	39	39	2
	D220	4/69	10.0	0	15	15	0
	D23	-/73	25.0	0	0	0	7
	D5/30	12/71	1.0	0	23	23	12
	D5/20	5/71	0.6	18	312	330	2360
Selenia S.p.A. Roma, Italy (A) (Oct. 1973)	GP-16	7/69	10.9 (S)	0	230	230	265
	GP-160	-	5.6 (S)	-	-	-	23
Siemens Munich, Germany (A) (Jan. 1974)	300 Series	4/65-4/72	0.9-7.9	-	-	680	160
	2002	6/59	16.4	-	-	41	X
	3003	12/63	15.8	-	-	29	X
	4004/15/16	10/65	6.1	-	-	83	1
	4004/25/26	1/66	10.0	1	-	96	4
	4004/35	2/67	14.2	-	-	212	7
	4004/127	4/73	14.0	-	-	57	42
	4004/135	10/71	20.5	-	-	164	25
	4004/45	7/66	27.3	-	-	334	20
	4004/46	4/69	41.0	-	-	10	X
	4004/55/60	7/66	35.0	-	-	23	X
	4004/150	2/72	49.0	-	-	139	33
	4004/151	3/72	61.0	-	-	29	17
	4004/220	1/75	-	-	-	-	51
	4004/230	1/75	-	-	-	-	41
	404/2	11/73	3.0	-	-	-	71
	404/3	4/71	2.1	-	-	101	35
	404/6	10/71	4.5	-	-	105	16
Telefunken Computer GmbH Konstanz, Germany (A) (Jan. 1974)	TR 4	10/61	X	-	-	35	X
	TR 440	6/70	60.0	-	-	29	-
USSR (N) (May 1969)	BESM 4	-	-	-	-	C	C
	BESM 6	-	-	-	-	C	C
	MINSK 2	-	-	-	-	C	C
	MINSK 22	-	-	-	-	C	C
	MIE	-	-	-	-	C	C
	NAIR 1	-	-	-	-	C	C
	ONEGA 1	-	-	-	-	C	C
	URAL 11/14/16 and others	-	-	-	-	C	C

PACKER — *Continued from page 19*

specific one. It just requires more thought in the design stage. Sometimes (often) it's even easier, because the extra thought results in generality that avoids programming specifically all the oddities of the way things work now.

The Design Process

How does one really set to work to design a program? I think the answer to this question is relatively simple, and it takes the form of evaluating various alternatives to good program design. The first step normally is to start drawing flowcharts. These should not be detailed flowcharts; and in fact, even in the case of relatively complex programs it should not take more than ten to twenty blocks to show what is really being done. In other words, the flowchart blocks should all fit on a single piece of 8½ x 11″ paper, if the designer is thinking broadly about the function of the program and is really starting at the highest level before becoming enmeshed in detailed design of individual portions of the program.

The basic approach here is to think in terms of alternatives and to draw flow diagrams at a general enough level so that it is possible to re-think and re-draw until one finds a design that is satisfactory. The process one goes through here is like many other creative processes. One starts with some assumption of how the total program should be structured and starts to diagram it. In the process, one will often see difficulties and objections with that particular method. From these objections one will get ideas for another way that will make the logic look simpler and more easily implemented.

Because of this process, it is important to start at a fairly general level. By "general" I do not mean vague. It is important to be precise but not to worry about too many of the details. If one starts drawing a detailed flowchart, one thing that often happens is that the effort to revise it evokes a normal emotional bias against really examining alternatives.

The flow diagram at this stage will normally be a detailed diagram of the key mainstream section, showing all of its decision logic and showing all first level subroutine modules, each with a brief description.

Many programmers do not begin design at this level, an indication of a nonmodular approach to the problem. Instead, the tendency is to just start drawing a detailed flowchart, solving each problem as it occurs. This is analogous to building a house without a plan -- one brick at a time. The result in either case is likely to be the creation of a monster.

If we are to have well designed programs, the concept of design as a discipline must be accepted, taught, and developed. The concept of design is essentially unrelated to the material in the programming manuals; the information there provides only the raw materials that design converts to reality. □

CALENDAR OF COMING EVENTS

May 5-8, 1974: Offshore Technology Conference, Astrohall, Houston, Tex. / contact: Offshore Tech. Conf., 6200 N. Central Expressway, Dallas, TX 75206

May 6-10, 1974: 1974 National Computer Conference & Exposition, McCormick Place, Chicago, Ill. / contact: Dr. Stephen S. Yau, Computer Sciences Dept., Northwestern University, Evanston, IL 60201

May 7-10, 1974: 12th Annual Assoc. for Educational Data Systems Convention, New York Hilton Hotel, New York, N.Y. / contact: Thomas A. Corr, Nassau Community College, Stewart Ave., Garden City, NY 11530

May 13-17, 1974: European Computing Congress (EUROCOMP), Brunel Univ., Uxbridge, Middlesex, England / contact: Online, Brunel Univ., Uxbridge, Middlesex, England

May 13-17, 1974: International Instruments, Electronic and Automation Exhibition, Olympia, London, England / contact: Industrial Exhibitions Ltd., Commonwealth House, New Oxford St., London WC1A 1PB, England

May 14-17, 1974: 6th Annual APL International Users Conference, Sheraton Hotel, Anaheim, Calif. / contact: John R. Clark, Orange Coast College, 2701 Fairview Rd., Costa Mesa, CA 92626

May 20-24, 1974: Computer Week IV: DPMA, ASM, ACM, TIMS, SCYL, Statler Hilton Hotel, Buffalo, N.Y. / contact: William P. Hanley, Erie County Department of Health, Buffalo, NY 14202

June 4-6, 1974: Symposium: Simulation of Computer Systems, National Bureau of Standards, Gaithersburg, Md. / contact: Paul F. Roth, National Bureau of Standards, U.S. Dept. of Commerce, Room A265—Technology Bldg., Washington, DC 20234

June 11-13, 1974: 1st Annual Automotive Electronics Conference and Exposition, Cobo Hall, Detroit, Mich. / contact: Robert D. Rankin, Rankin Exposition Management, 5544 E. La Palma Ave., Anaheim, CA 92807

June 23-26, 1974: 1974 DPMA INFO/EXPO (22nd Annual Data Processing Conference and Business Exposition), Auditorium & Convention Hall, Minneapolis, Minn. / contact: Data Processing Management Assoc., 505 Busse Highway, Park Ridge, IL 60068

June 24-26, 1974: Design Automation Workshop, Brown Palace Hotel, Denver, Colo. / contact: ACM, 1133 Ave. of the Americas, New York, NY 10036

June 24-26, 1974: 5th Conference on Computers in the Undergraduate Curricula, Washington State Univ., Pullman, Wash. / contact: Dr. Ottis W. Rechard, Computer Science Dept., Washington State Univ., Pullman, WA 99163

July 9-11, 1974: Summer Computer Simulation Conference, Hyatt Regency Hotel, Houston, Tex. / contact: M. E. McCoy, Martin Marietta Data Systems, Mail MP-198, P.O. Box 5837, Orlando, FL 32805

July 15-19, 1974: 1974 Conference on Frontiers in Education, City University, London, England / contact: Conf. Dept., Institution of Electrical Engineers, Savoy Place, London, England WC2R 0BL

July 23-26, 1974: Circuit Theory & Design, IEE, London, England / contact: IEE, Savoy Pl., London WC2R 0BL, England

July 23-26, 1974: International Computer Exposition for Latin America, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins, National Expositions Co., Inc., 14 W. 40th St., New York, NY 10018

July 29-Aug. 1, 1974: 2nd Jerusalem Conference on Information Technology, Jerusalem, Israel / contact: Prof. C. C. Gotlieb, Dept. of Computer Science, University of Toronto, Toronto, Toronto, Canada M5S1A7

Aug. 5-10, 1974: IFIP Congress 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: U.S. Committee for IFIP Congress 74, Box 426, New Canaan, CT 06840

Aug. 5-10, 1974: Medinfo 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: Frank E. Heart, Bolt Beranek and Newman, Inc., 50 Moulton St., Cambridge, MA 02138

Aug. 21-23, 1974: Engineering in the Ocean Environment International Conf., Nova Scotian Hotel, Halifax, Nova Scotia / contact: O. K. Gashus, EE Dept., Nova Scotia Tech. Coll., POB 100, Halifax, N.S., Canada

Sept., 1974: 2nd Symposium IFAC/IFIP/IFORS, Cote d'Azur, France / contact: AFCET, Secretariat des Congres, Universite Paris IX, Dauphine 75775 Paris Cedex 16, France

Sept. 8-10, 1974: 6th International Conference on Urban Transportation, Pittsburgh, Penna. / contact: John W. Besanceney, Pittsburgh Convention & Visitors Bureau, P.O. Box 2[illegible]49, Pittsburgh, PA 15230

Sept. 9-12, 1974: INFO 74, Coliseum, New York, N.Y. / contact: Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017

Oct. 14-16, 1974: 15th Annual Symposium on Switching and Automata Theory, New Orleans, La. / contact: Prof. Fred Hosch, Dept. of Computer Science, Louisiana State Univ. at New Orleans, Lake Front, New Orleans, LA 70122

Oct. 31-Nov. 1, 1974: Canadian Symposium on Communications, Queen Elizabeth Hotel, Montreal, Quebec / contact: George Armitage, IEEE Canadian Region Office, 7061 Yonge St., Thornhill, Ontario L3T 2A6, Canada

ADVERTISING INDEX

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

WILL YOU HELP?

Yes, *you.* It may come as a surprise that you'd be asked . . . but as a reader of *Computers and People* (formerly *Computers and Automation*) you are in a unique position to help us.

NAMES . . . people, institutions, companies who should be interested in 1) the computer industry and/or 2) seeking truth in information are very much needed to join you as readers of *Computers and People.*

Will you tell us who they are? And perhaps even more, will you let us use your name in writing to them? But with or without your name (we'll only use it if you grant permission) we need to know those *you* think might be interested in also reading *Computers and People.*

*** * * *** ***reprint from***
computers and automation

Science and the Advanced Society, by C. P. Snow, Ministry of Technology, London, England (April 1966)
The Information Revolution and the Bill of Rights, by Dr. Jerome B. Wiesner, M.I.T. (May 1971)
Employment, Education, and the Industrial System, by Prof. John Kenneth Galbraith, Harvard Univ. (Aug. 1965)
Computers and the Consumer, by Ralph Nader, Washington, D.C. (Oct. 1970)

Please give us their names and addresses on the form below or add another sheet of paper. Trim out the card with scissors and drop it in the mail. We'll gladly pay the postage to learn of possible new friends. And many thanks for your help! As a token of our appreciation we'll send you our ****Reprint.

P.S. If you like you may mail your list separately to:
R. A. Sykes, Circulation Mgr.
Computers and People
815 Washington Street
Newtonville, MA 02160

cut here and tuck in flap

cut here

TO: R. A. Sykes, Circulation Mgr.
Computers and People

I suggest you send information on *Computers and People* to . . .(attach list if you like)

(1) Name ______________________
Address ______________________
City ______________ State ________ ZIP ________

(2) Name ______________________
Address ______________________
City ______________ State ________ ZIP ________

May we use your name? ☐ YES ☐ NO

Please give us your name and address on the form below so we can send you your ****Reprint. Just cross out the subscription request — unless you also want to enter your new or renewal order.

cut here

Fold here — do not cut

cut here

B — staple or glue to A

BUSINESS REPLY MAIL

FIRST CLASS
PERMIT NO. 33531
BOSTON, MASS.

No postage stamp necessary if mailed in the United States

POSTAGE WILL BE PAID BY BERKELEY ENTERPRISES, INC.

COMPUTERS AND PEOPLE
formerly Computers and Automation
815 Washington Street
Newtonville, MA 02160

bend here and fold

YES, **start my subscription to**
COMPUTERS AND PEOPLE
according to the instructions checked below.

One Year (including the Computer Directory and Buyers' Guide — 13 issues) U.S. only. ☐ $23.50

One Year (excluding the Computer Directory and Buyers' Guide — 12 issues) U.S. only. ☐ $11.50

Name: ______________ Title: ________
Organization: ______________________
Address: ______________________
City: ______________ State: ________ Zip: ________
Country if not U.S.: ______________________
Signature: ______________ P.O. No.: ________

☐ Payment enclosed ☐ Renewal
☐ Bill me ☐ New subscription

To SPEED the processing of your order, please check the one best descriptor in each of the two categories below. (This information will be used for statistical purposes only.)

BUSINESS TYPE	JOB FUNCTION
01—Computer Manufacturer	1—Technical Management; (computer installation management, program management, or engineering mgmt.)
02—Aerospace / Aircraft Manufacturer	2—Computer Center Personnel; (methods & procedure analysts, and operators)
03—Other Manufacturing	3—Programming Personnel; (systems, application & research programmers)
04—Raw Materials Processing; (chemical, primary metal, petroleum, food, etc.)	4—Professional: (systems analysts, mathematicians, operations researchers, and professors)
05—Mining and Construction	5—General Management Executives; (corporate officers, owners, and partners)
06—Computing & Consulting	6—Engineering Personnel; (systems engineers, research & development engineers)
07—Finance, Insurance, Publ., and Service Organizations	7—Research Personnel
08—Transportation Companies	8—Students
09—Public Utilities	9—Library Subscription
10—Research	10—Subscription in Company Name Only
11—Wholesale, Retail, Sales, and Marketing Firms	
12—Educational; (College, University, or School)	
13—Government and Military	
14—Libraries	

A — staple or glue to B

cut here