DATAMATION® 75
May

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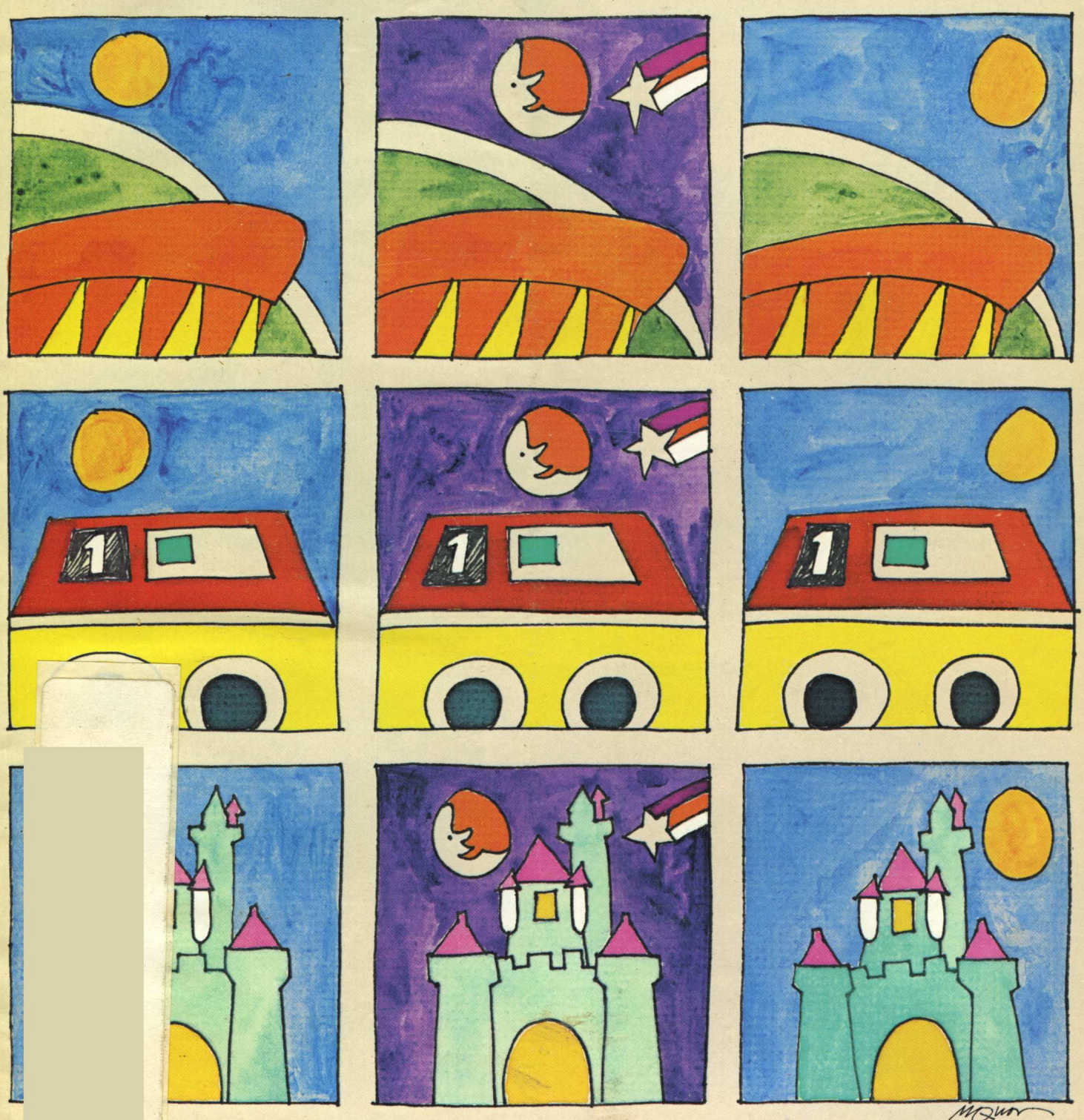

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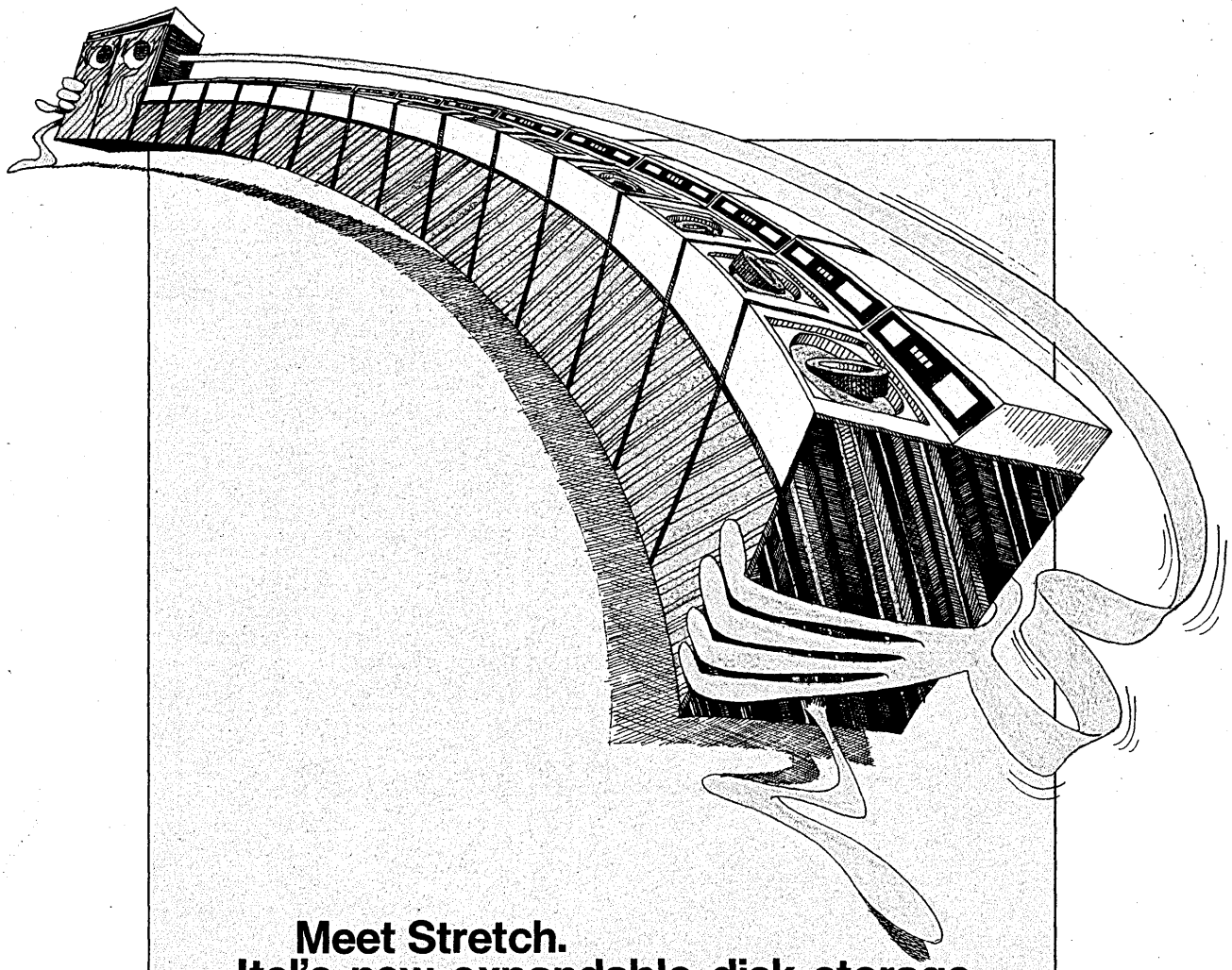

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DATAMATION 75®

VOLUME 21 NUMBER 5 This issue 126,100 copies **MAY 1975**

FEATURES

National Computer Conference
Here's an analysis of the program and a rundown on products to be introduced by some of the 270 companies exhibiting at the National Computer Conference, May 19-22 at the Anaheim Convention Center. This is the third annual NCC, successor to the semiannual Spring and Fall Joint Computer Conferences which have been held in one form or another since 1951.

44 "WHAT SHOULD BE BROUGHT TO NATIONAL ATTENTION"
Interviews with NCC program chairman Stephen Miller and many session organizers on how NCC will address "challenges in a new era," theme of the four-day conference

50 NCC PRODUCT PREVIEW
The accent is on microprocessor applications, terminals, special purpose systems, and auxiliary equipment

63 BAR CODES FOR DATA ENTRY
Edward K. Yasaki. From trains and cereal boxes they are moving toward dp departments

73 UPGRADING TO A SMALLER MACHINE
Victor Matthews and Joanna V. Pomeranz. The way up from an IBM 1130 was to a minicomputer with more power at less cost

80 STRUCTURED TOP-DOWN FLOWCHARTING
John B. Holton and Bill Bryan. The old templates still work, but the old rules do not

88 MANAGING THE TRANSITION TO STRUCTURED PROGRAMMING
Lawrence Peters. If not properly charted, the transition could be painful

101 A DATA BASE FOR NON-PROGRAMMERS
Andrew B. Whinston and Wm. D. Haseman. This system performs data retrieval and manipulation for users who don't want to know about computers

111 PERSONAL COMPUTERS
Berthold K. P. Horn and Patrick H. Winston. Who needs time-sharing?

123 THE "ELSE" MUST GO, TOO
Allan M. Bloom. Will "functional" programming replace "structured" programming?

137 PSYCHOLOGY AND PROGRAM DESIGN
David Frost. By "Chunking" concepts, program designs become more manageable

143 IBM AND THE INDUSTRY
More provocative ideas on restructuring the computer industry and dealing with the Jolly Gray Giant

202 THE FORUM
Stephen R. Levine, III. Don't look to black boxes, encryption, or sophisticated software to make an installation secure
Ben W. Shelton. Memory technology is the key to Future Systems; let's tell the vendors what we want

NEWS IN PERSPECTIVE

146 TECHNOLOGY
Bell Telephone Laboratories' 10-second laser facsimile system

147 THE ENVIRONMENT
"Kludge" device keeps energy tabs on Robert Schlesinger's home in California

148 ANTITRUST
Computer, communications competition in the 1980s: must it be regulated? The government vs. the giants

153 COMPANIES
Memorex works its way out of accounting suits

157 MICROFILM
Paper vs. film: it's all in how you view it

158 COMMUNICATIONS
Latest network in Canada won't fix on a protocol Interconnection

163 BANKING
From zero dp to on-line in six months

165 WALL STREET
Central market bills are moving

166 PRIVACY
Questions on legislation: who pays for added privacy?

170 GOVERNMENT PROCUREMENT
A big teleprocessing procurement plan is considered

171 ELECTRONICS
Catching up with microprocessors

173 BENCHMARKS

DEPARTMENTS

9 LETTERS
Various rules, a rebuttal, future bets, significant answers, hospital dp, and more

13 PEOPLE
DR. KENNETH E. IVERSON: an acceptance of APL. . . DR. RONALD P. CHRISTMAN: a nuclear scientist concerns himself with beer distribution. . . DR. ROBERT R. JOHNSON: an engineer in management

17 LOOK AHEAD

23 CALENDAR
The industry looks at UPC, Semicon/West, & personnel

29 SOURCE DATA
The first volume in an IBM-sponsored Systems Programming Series reviewed, plus Program Style, book briefs, reports, periodicals, and vendor literature

43 EDITOR'S READOUT
Massive cuts in the Commerce Department's foreign trade promotion budget despite a whopping trade deficit and rising unemployment, prove once again that truth is stranger than fiction

176 HARDWARE
Univac modernizes its 1100 series; Data General starts showing the direction it will take with its new minis

184 SOFTWARE AND SERVICES
An independent brings up IBM's time-sharing option on VS/1 systems; users of 3330-type discs can now recover the use of flagged tracks using a new utility program

198 ADVERTISERS' INDEX

ABOUT THE COVER
For five days this month, Disney's giant Anaheim playground will be joined by a new attraction, Computerland, created by our cover artist, Mike Quon.

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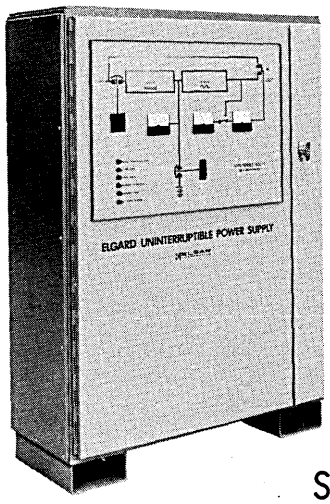

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Publisher	James M. Morris
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GRAPHIC DESIGN & PRODUCTION

Art & Production Director	Cleve Marie Boutell
Advertising Production Manager	Marilee Pitman
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CIRCULATION

35 Mason Street, Greenwich, CT 06830

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Circulation audited by Business Publications Audit

BPA

Member ☆ABP American Business Press, Inc.

DATAMATION is published monthly on or about the first day of every month by Technical Publishing Company, 1301 South Grove Ave., Barrington, Illinois 60010; Arthur L. Rice, Jr., Chairman of the Board; James B. Tafel, President; Gardner F. Landon, Executive Vice President. Executive, Circulation and Advertising offices, 35 Mason Street, Greenwich, CT 06830, (203) 661-5400. Editorial offices, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Published at Chicago, Ill.

DATAMATION is circulated without charge by name and title to certain qualified individuals who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $24; $40 Air Mail annually in the U.S. and Canada. Reduced rate for qualified students, $14. Foreign subscriptions are available for £16.80 or for the equivalent of $40 U.S. in most West European currencies. Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA13QT, England. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulations paid at Columbus, OH and Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000. Greenwich, CT 06830.

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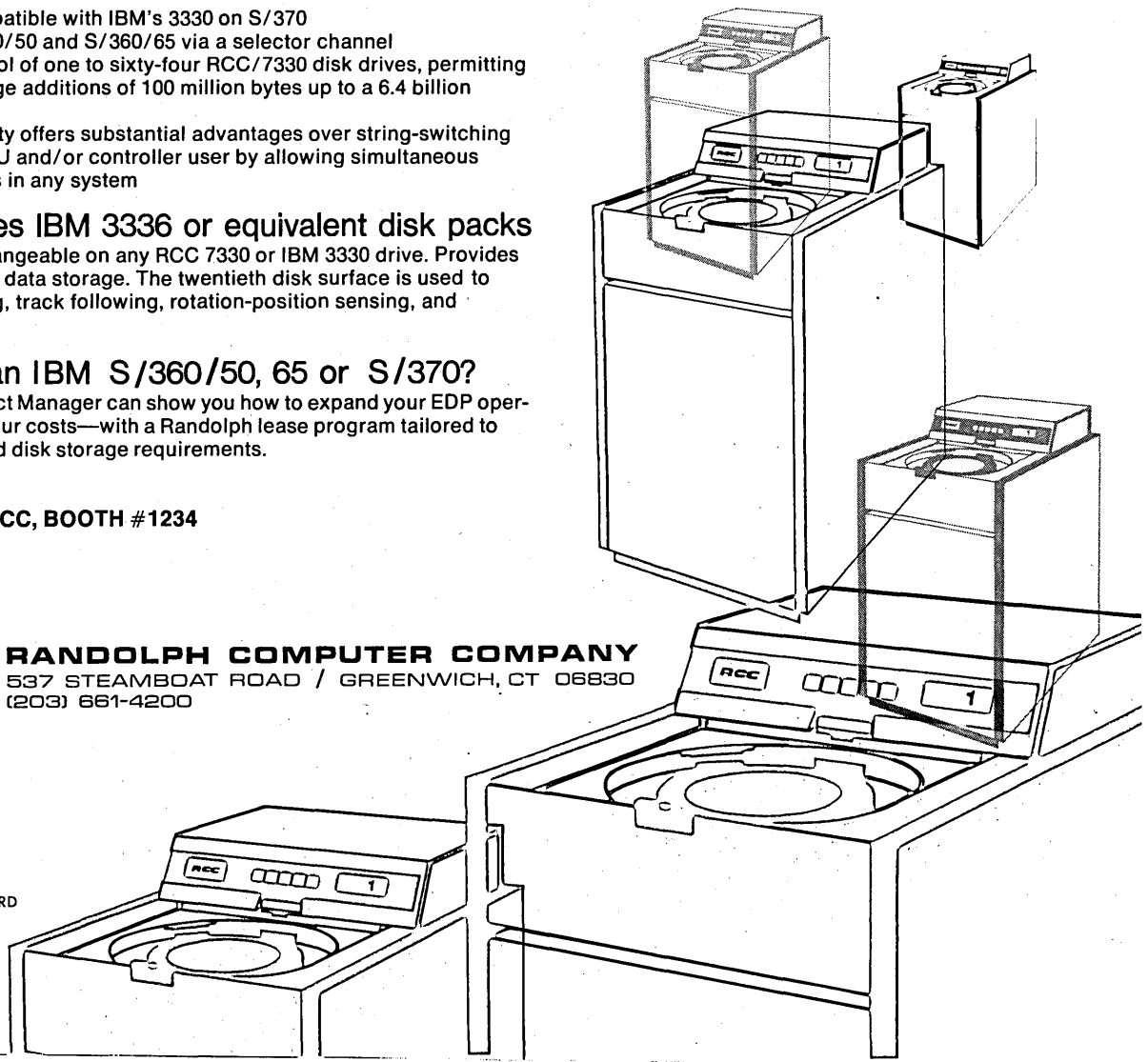

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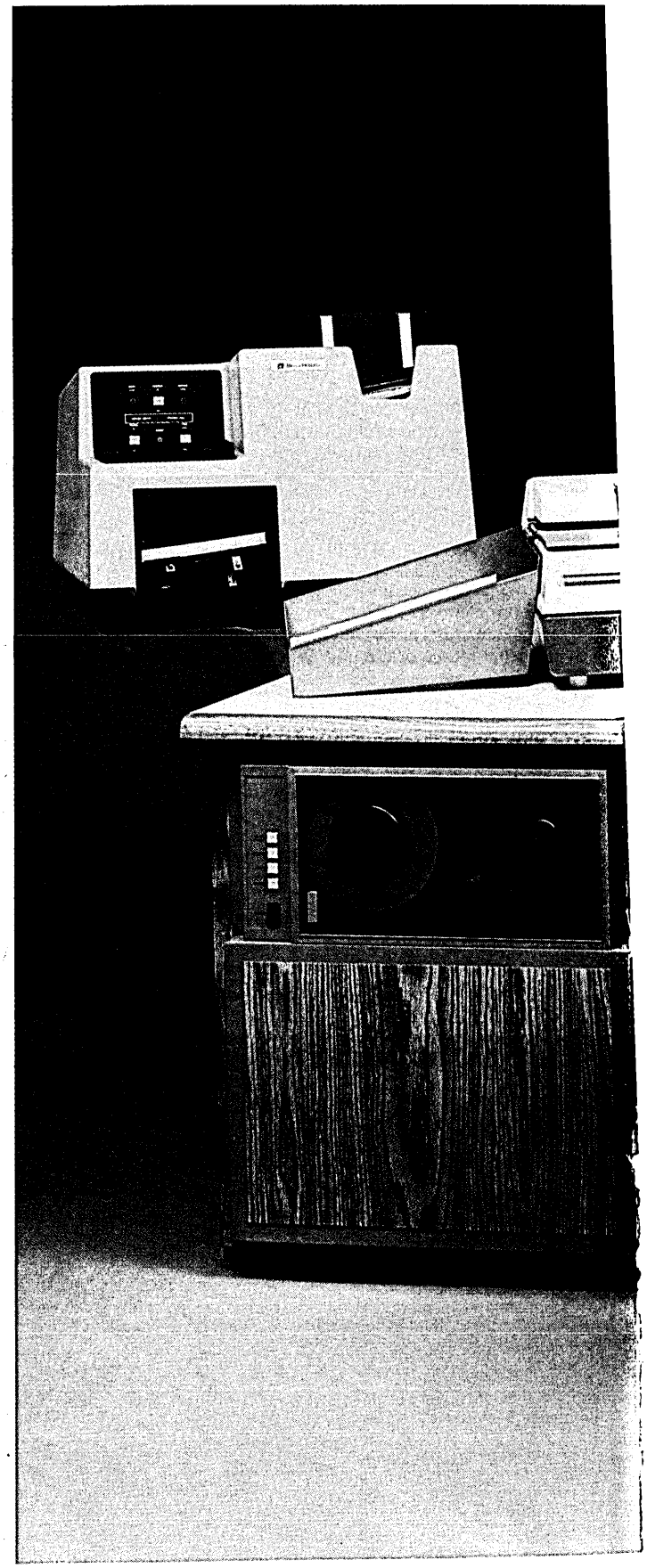

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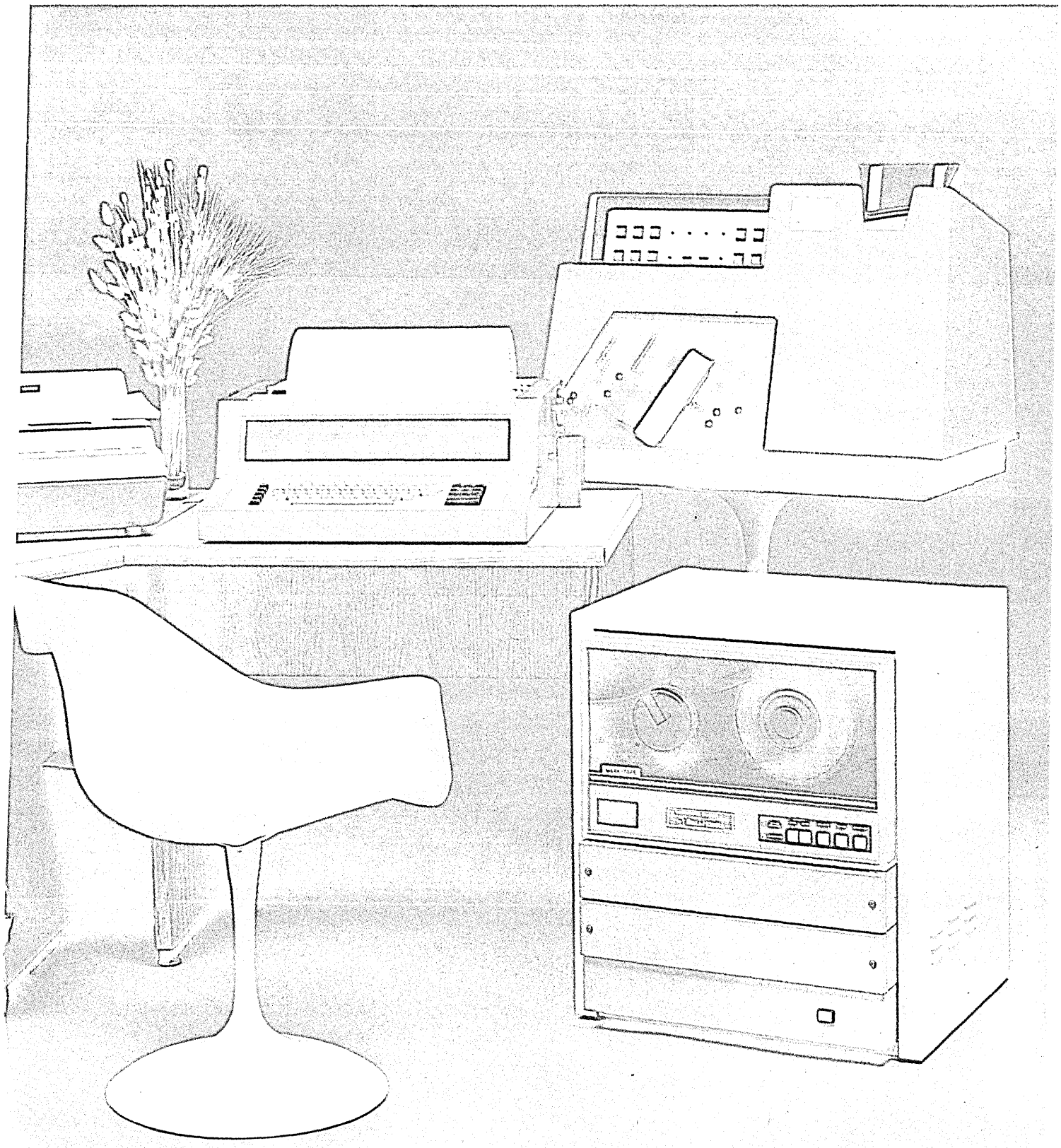

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letters

Roehm's Rule & Zusman's Errors

As a positive alternative to Tom Gilb's first two Laws of Unreliability (March, p. 81), and acknowledging SHARE's note (SSD #249) of our 1980 to 1985 anticipated people problems, I offer Roehm's Rule:

> The most useful and reliable system attainable is a wary man-machine symbiosis utilizing the greatest strengths of each.

I am presumptive of course; these are not new thoughts. The simple fact, as recognized by SSD #249, is that in order to accomplish the work ahead we must optimize the relationship, and soon.

GEORGE H. ROEHM
Technical Acquisition Office
State Department of Management and Budget
Lansing, Michigan

. . . The laws listed in Mr. Gilb's article . . . are all good, but one was better (more useful) than the others. Law 8 ("All real programs contain errors. . . .") is closely related to the following definition for "debugged," which I have found to be useful: "The remaining errors will be found in the production runs."

More from Mr. Gilb.

FRED S. ZUSMAN
Principal Computer Scientist
Operations Research, Inc.
Silver Spring, Maryland

Rebuttal rebutted

I think I have made it abundantly clear in two published letters to DATAMATION (January and March) that you were absolutely wrong to report ". . . when Control Data signed its antitrust settlement with IBM last year, IBM stipulated that CDC not be permitted to join the CIA." It is regrettable that DATAMATION chooses to continue to mislead its readers with an erroneous interpretation of an affidavit in the U.S. vs. IBM case by a person who was not a party to the settlement, a Mr. Miller.

In your latest rebuttal (March, p. 7) you claim a "press gag order" in the U.S. vs. IBM case "prevented DATAMATION from obtaining complete clarification on the issue" from IBM. I'm afraid you are misleading your readers once again.

Despite Mr. Miller's affidavit, Pretrial Order #4 in the U.S. vs. IBM case does not prevent IBM from commenting on the CDC vs. IBM case. You might have checked with us on that but you obviously preferred not to do so. I might add that your rebuttal neglected to mention that DATAMATION could also have asked CDC for the true facts without concern for court orders. It seems you didn't see fit to do that either.

FRANK T. CARY
Chairman
IBM Corporation
Armonk, New York

The 32-bit bet

Regarding your March Look Ahead which indicates that Systems Engineering Laboratories "is betting its future on the idea that its 32-bit machines will be more attractive to users than the popular 16-bit minicomputers." A Data General salesman once told me that the 16-bit mini would replace the 12-bitters. Four years and 25,000 PDP-8s later, I question his and SEL's reasoning.

I would venture to guess that the PDP-8 has a good five years of life left and the era of the 16-bit mini has just begun. I'm sure that there must be a market for a 32-bit computer somewhere; but not as a mini.

HAROLD R. BERENSON
Syosset, New York

How significant an answer?

In his fine article "Calculators in the Classroom" (March, p. 90), Mr. Grosswirth attempted the following long division problem to demonstrate the ease of using calculators: 417.4 divided by 61.331. He then stated the answer was 6.8056936 . . . Well, of course, 6.8056936 is not *the* answer. It is not even an answer accurate to seven decimal places; that answer would be 6.8056937.

To quote Mr. Grosswirth, "The question remains, however, whether or not students will now learn the basics when *answers* are a pushbutton away."

PHILIP E. LOITERSTEIN
President
Group Operations, Inc.
Washington, D. C.

. . . Anybody familiar with significant figures realizes that the long string of digits at the end of the "answer" is meaningless. Will the use of calculators make it more difficult for teachers to convince science students that they *cannot* measure a quantity to three significant digits, perform an operation using that quantity, and come out with an answer that has more significant digits than their least precise measurement?

BERNARD WALL
Northfield, New Jersey

Hospital dp

Considering the complexity of the hospital-medical dp field, I found Edward Yasaki's article, "Wide Variety of Computer Based Systems Available to Hospitals," (March, p. 115) an interesting thumbnail sketch of certain state of the art aspects. However, the descriptions and projections related to peer review, i.e., PSRO data processing needs, demonstrate either an appalling lack of knowledge in this area by those interviewed, or a vested interest in frightening every hospital in the country into purchasing or installing "very responsive computer system(s)."

(The "new federal regulations" referred to in the article are not PSRO regulations—they are new Medicare/Medicaid requirements which apply to Conditions of Participation in the Program by hospitals and nursing homes.)

The suggestion that automated audits of acute hospital care involving clinical elements, i.e., "did he need the x-ray and all those blood tests?" is feasible in the average hospital setting, grossly overestimates the state of the art of proceduralized medicine. These elements of diagnostic and therapeutic process are still largely judgmental aspects of medical care (and should perhaps remain that way).

I would concede that there may be minor applications of computer technology which could be implemented as additions to existing in-house systems or out-of-the-hospital services in support of PSRO requirements, but they will certainly not cost justify the introduction of computer systems where they do not presently exist.

RICHARD C. JAMIESON
Vice President
Information Services
Hospital Research and Educational Trust of New Jersey
Princeton, New Jersey

The story was never meant to intimate that the computer would make judgmental decisions, and we, of course, would not favor such a situation.

Supporting the ALGOL family

IBM has recently agreed at a very high level to investigate the current level of support for the ALGOL family of languages on 360/370 hardware. This covers ALGOL 60, ALGOL 68, PASCAL, SIMULA and others, and is the result of sustained pressure by the ALGOL Committee of SEAS (the SHARE European Association).

letters

As Chairman of the ALGOL Committee, I have agreed to investigate the potential interest in increased IBM support, and I would be most grateful if any of your readers who have views on this would write to me. In particular I would like to know:

1. Are you aware that two new ALGOL 60 compilers (the Delft ALGOL compilers) are available through your IBM SE?

2. Would you use a good ALGOL 68 Compiler if it were available?

3. What are your views on the current level of IBM support for ALGOL-like languages?

MARTYN THOMAS
Chairman, SEAS Algol Committee
22 Grantbridge Street
London N1 8JN
England

Bugged about debugging

Dr. Gordon's letter (March, p. 7) with reference to Ted Withington's article has me overwhelmed. Perhaps the view from down under is different, but a gigasecond figures out to be 32 years up here, which strikes me as too long for error correction.

I have advocated maximum programmer debugging time of eight hours before going for help. Even assuming that an entire week is required, that is still only 600 kiloseconds—already far beyond reason.

DICK H. BRANDON
Brandon Applied Systems, Inc.
New York, New York

Budgets: firing & freezing?

I read your article "1975 DP Budgets" (March, p. 63) with interest and dismay. Can it be true that the only thing a beleaguered Director of Data Processing can do in the face of financial retrenchment is to fire his staff, put a freeze on hardware, and prepare himself for an obstructionist posture to all new requests for dp services?

Whatever happened to that infinitely postponable notion: optimization? Perhaps its time has indeed come. Rarely do work loads diminish when budgets are cut. Major results can and have been achieved by sites across the country in increasing throughput and decreasing response time, diminishing major program run time and improving programmer efficiency. This has been accomplished by the use of monitoring and analysis combined with good judgment, an open mind and the will to do it.

An installation is as victimized by this economy as it lets itself be.

WILLIAM J. GANZ
Executive Director
People Machine Interface
New York, New York

. . . Since February 1974 I have used your article on "A Survey of 1974 DP Budgets." We have found it to be amazingly accurate as a projection of what the actual cost of a hospital's data processing department is, or would be—sometimes to the chagrin of the hardware salesmen.

JOSEPH E. NADEAU
President
COMPUTERx
Miami, Florida

Costs go down the tubes

If Mr. Shelton (Letters, March, p. 7, taking issue with Lias' December article: "On-line vs. Batch Costs," p. 69) is not aware that computers are now used as part of a total information system he should study up on the subject. Tubes *are* cost effective devices for data entry, and instantaneous verification in situations where the data is composed of something other than the patient's temperature is significant in cost analysis.

At Riverside City College we have had our student data base on-line for three years. During that time our enrollment has increased from 10,126 to 13,272. Despite this 30% increase in enrollment, the number of clerks required to process the records in the Admissions Office has decreased by one.

The savings resulting from the increased efficiency of the Admissions Office clerks will more than pay for the Four-Phase terminal system over the estimated ten year life of the equipment.

MICHAEL C. MILLER, CDP
Director of Computer Services
Riverside City College
Riverside, California

Where to now?

Further to the COME FROM controversy (December 1973, p. 62), Professor Carpenter's DONT COME FROM (OR GO BACK TO?) discussion (November 1974, p. 23) and Robert E. May's DONT loop (January, p. 136), I suggest the .WAS. and .WILL.BE. logical operations.

(Continued on page 194)

"Miss Ambrose, send in the sales force for a debriefing on my trip to the National Computer Conference."

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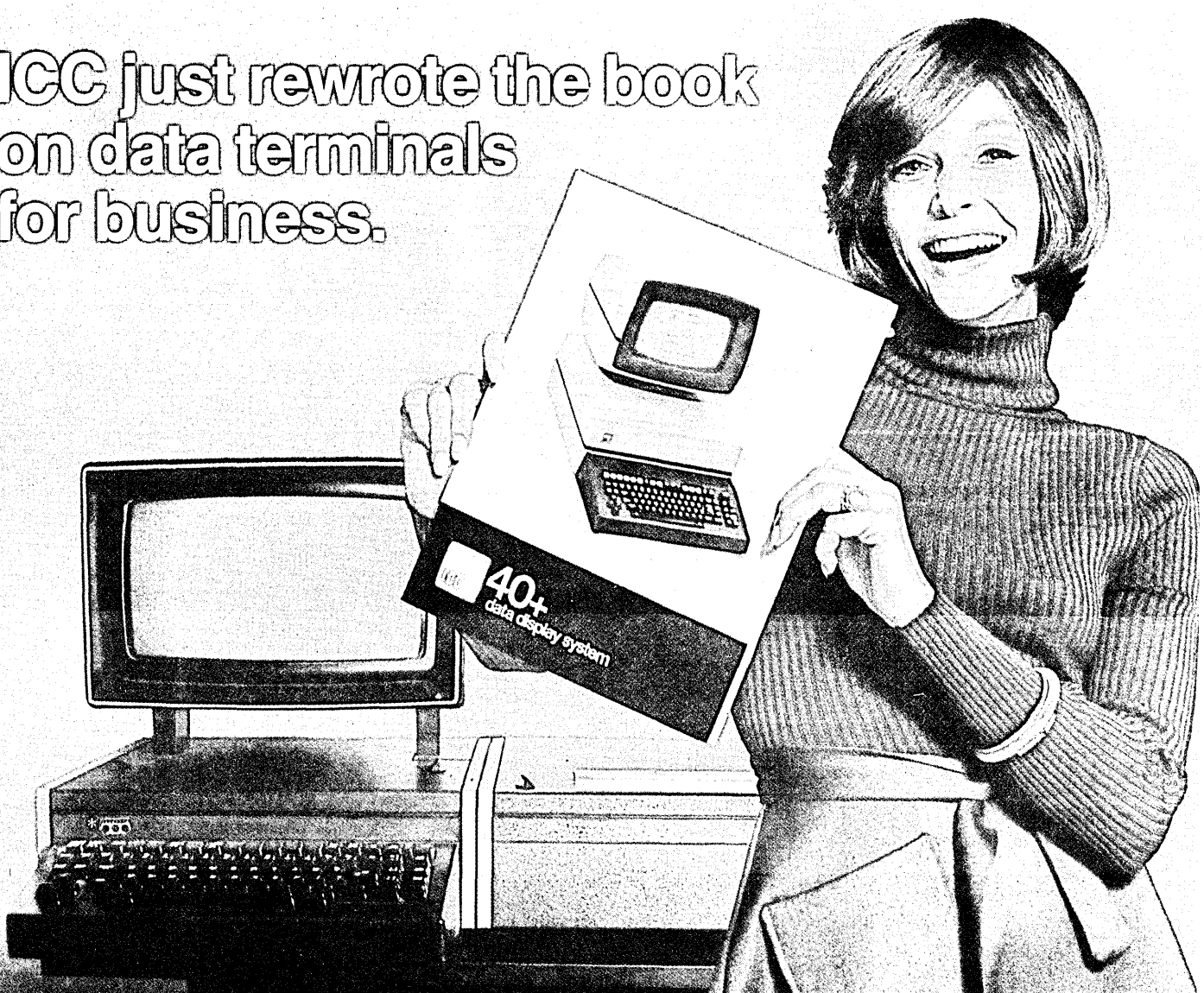
ICC just rewrote the book on data terminals for business.



Finally, big things are happening to data terminal systems for business applications. And, why not? Business users have been neglected long enough, operating with outdated equipment that pecks away at your growing load of data traffic. Now, that you have a choice of advanced equipment from leading manufacturers — don't go only part of the way.

ICC developed the 40+ Data Display System *specifically* to meet today's business communications needs, with plenty of capacity for the future. What about system features? It takes our 12-page brochure to describe them all. Price? Competitive. Delivery? We're building them now. Customer support? Ask any ICC modem user.

There are other terminals with "40" in their name. Check them out first. Then find out why ICC rewrote the book. We'll rush you a copy.

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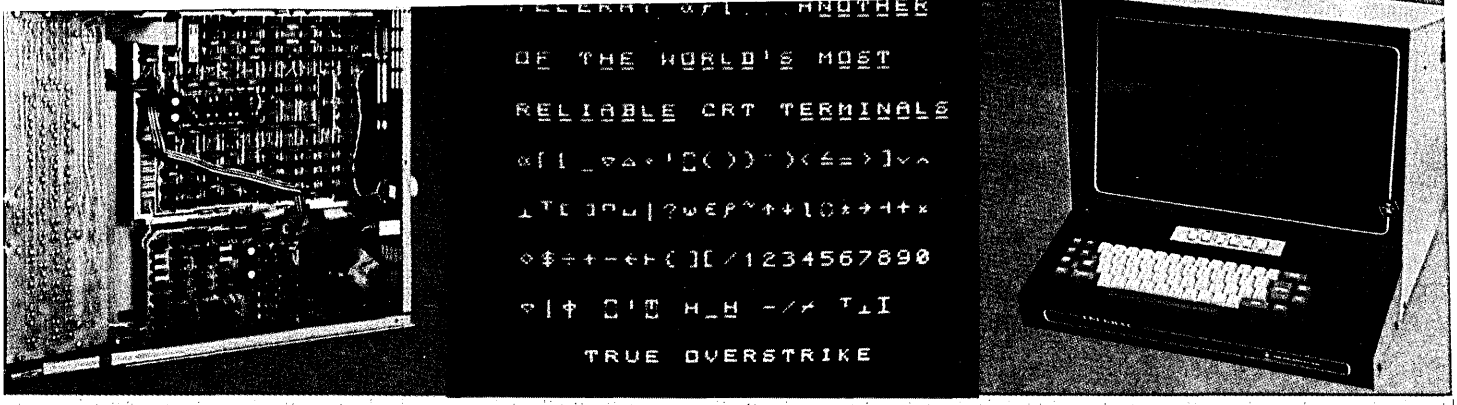
CIRCLE 41 ON READER CARD



The "Fewer Belly Aches" CRT Goes APL

Here's the newest addition to the growing TELERAY family of "gutless wonders" . . . the Series 3900 . . . following in the same tradition that produced the Series 3300 TTY replacement and the full-ASCII Series 3700 with single-logic-board, plug-in-chip simplicity.

The 3900 is really three terminals in one—APL, full ASCII, and upper-case TTY. Its display clarity is unusually sharp—the result of several interacting features: a high resolution monitor, 15-inch CRT, and TELERAY's switchable wide-character format (over ¼ inch high and wide).

The 3900 displays TRUE APL overstrike characters, with ASCII mode overstrike optional. It operates scroll-up, with bottom-line data entry and bottom-line cursor controls. And, except for the bell tone, it gives you totally quiet operation—no fan.

Best of all, it is priced lower by far than any APL terminal in the world . . . like under $2500—for one.

Standard Features:
APL/ASCII Typewriter-Pairing Keyboard
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True APL Overstrike and Underlining
15-Inch, High-Resolution CRT
1920 Characters (24 x 80)
Wide Character Format (24 x 40), Switchable
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Dual Data Rates, to 9600 Baud
All Standard Interfaces—RS-232, Current Loop and TTL

Optional Features:
Printer Output—RS-232 Serial and Parallel TTL and Current Loop
Composite Video Output
Numeric Keypad
Detachable Keyboard and Receive-Only Models
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Nationwide Service By RCA Service Company.

Call collect (612) 941-3300. That's the hot line to the "gutless wonders" 3300, 3700, and now APL 3900. We're called the *Uptime* terminal TELERAY!

CIRCLE 63 ON READER CARD

people

APL: POLITIC TO MENTION NOW

Since it first emerged in 1962, APL has attracted considerable interest—if minimal implementation—as a clean and tight notational language. Those who use it like it very much and many who don't think it's horrid.

"Nobody is more fanatic about a language than an APL nut," a longtime student of computer languages said recently. On the other hand a pioneer enthusiast, Allen Rose, talks of the times when detractors called it, "that funny little language that does things backwards," and expressed their reluctance "to have to learn Greek." Although a considerable education effort lies ahead, it is now "more politic" to mention APL, says Rose, of Scientific Time Sharing, which, behind IBM and Xerox, is considered the largest user of the language.

This month, in a sense, the computer community lends a little more than political acceptance to the language by honoring the man who devised it—Dr. Kenneth E. Iverson, an IBM Fellow and manager of the APL design group in IBM's System Development Div. in Philadelphia. The name of the language comes from A Programming Language, the title of a 1962 Wiley book written by Iverson who devised the language while teaching at Harvard. For his development and for his subsequent work with APL and in "developing a unifying conception of the role of executable languages" Iverson May 20 will receive the Harry Goode Memorial Award from the American Federation of Information Processing Societies during the National Computer Conference in Anaheim (page 44). AFIPS established the award in 1964 to honor persons for pioneering contributions to computer science. Interestingly, when Iverson invented the language, he was more interested in finding a clear and concise way to describe algorithms than in its execution on a computer. Author Dan McCracken noted that one of the landmarks in APL history was an article in 1964 in the *IBM Systems Journal* in which the operation of the IBM 360 computer was described in APL (DATAMATION, Sept. 15, 1970).

Many APL users say that the efficiency of APL today is due to Iverson's tight control of enhancements and to his insistence on "bending only to what was right, not what would sell." Associates talk of Iverson as a "highly moral and genuine person" who appealed to people's sense of good taste, and convincingly so. Adin D. Falkoff who joined Iverson when he left Harvard in 1960 to go to IBM's Thomas J. Watson Research Center in Yorktown Heights and has worked closely with him ever since, admits that "we disagreed a lot, but I couldn't have stood around here with him for 15 years if I hadn't liked him a lot."

KENNETH E. IVERSON
Bends to what was right

In discussing his AFIPS award, the Canadian born mathematician, mused to a reporter: "It's too bad they could only pick the guy who invented APL. Make sure you mention Adin. For 15 years we've been working together equally and his contributions should be recognized as much as mine."

Though friendly and mild-mannered, Iverson is not beyond blunt directness in making a point. Asked by a reporter about his opinion of today's programming, he answered: "My comments would be unprintable." But then he ventured the term "appalling." Ever the realist, though, he admits that the large investment in software may be holding up conversion to more efficiency. Falkoff, however, thinks "there are too many good things about APL for people to keep their eyes closed." He thinks another five years will pass before "we know the extent to which APL will be accepted."

Whatever the schedule, Iverson—described by friends as having a way with youngsters (his home has been a halfway house for troubled youths in the Philadelphia area and he has had as many as six living with the family)—has convinced his children of APL's acceptance. His sons Eric and Keith and daughter Janet all have found jobs with I. P. Sharp, a prominent Canadian APL time-sharing bureau.

FROM NUCLEAR SCIENCE TO BEER

"For years, most service bureau people have, in a general sense, waited for business to come to them. My responsibility at MSC will be almost 100% marketing oriented. We are analyzing specific industries, isolating their problems, and approaching them with data management systems which will help solve their problems."

That's how a former nuclear scientist plans to put additional profitability into a 30-year-old Dallas based data processing organization. And, for openers, Dr. Ronald P. Christman is attacking some of the problems of beer distributors in New York City.

It is easy to understand how the Beer/Manage program of Dr. Christman's Management Systems Corp. could help in producing truck load inventory reports, driver reports, accounts receivable statements, and a host of other brew related data. But why New York City?

"That's part of our philosophy of isolating markets . . . New York City is

DR. RONALD P. CHRISTMAN
The water's warmer this time

people

the biggest beer drinking market in the nation."

Isolating beer drinking markets is a far cry from Dr. Christman's earlier work in isolating isotopes. A graduate of North Carolina State University, the 35-year-old Ph.D. worked first for DuPont at its Savannah River Research Laboratory, dabbling in such things as Californium 252, an isotope used in nuclear weapon material production.

After two and one-half years Christman, who had been heavily influenced by his research scientist father, decided the sterile environment of a laboratory was not his style. In the course of his DuPont research, he had used computers to a great degree and had become entranced with the possibility of smaller companies using computers on a time-share basis.

In 1969, with several partners, he formed a time-sharing company in Cincinnati and dove into the dp waters. They were deep and cold.

"I came out of that venture with my Ph.D. intact and with a third grade education in finance," says MSC's president with a smile.

He followed his ill fated entrepreneurial effort with a five year tour at Computer Sciences Corp. and was a branch manager for CSC in Houston when he took over the presidency of MSC last February.

Management Systems Corp., with $1.5 million in 1974 sales, is a subsidiary of American Biomedical Corp. ABC, with total 1974 earnings of $16,400,000, is said to be the second largest clinical laboratory service in the nation.

"ABC is a user of our on-line and remote batch services, but we derive only about 15% of our income from our parent," said Christman. "Our primary customers are savings and loan associations and other financial institutions, the retail industry, and medium sized manufacturers."

MSC began operations in 1945, said Christman, as sort of a Ma and Pa tab service . . . cards in the front door and hardcopy out the back door. He indicated MSC still does some of this for certain customers, but it is fast transferring most of its clients to on-line operation, via crt's, leased phone lines, and microwave links with their IBM 360/50 in Dallas.

"The terminal can become a tool for these people, just like the typewriter . . . once they get over their fear of it. However, they need access in plain language and we're approaching our on-line service with a data base and data management concepts that can provide a variety of reports without the need for major programming revisions."

Christman is trying to put more of "service" meaning into service bureau.

"One of my competitor's customers came in yesterday, hollering that his service bureau said they needed six weeks to get him some sales data he needed immediately to make an expensive decision. That man knows the information is there in his data base and with on-line service he could get it out in minutes. Later today, I'm going to try to convince him that's what we do, provide on-line service."

He grins when he says it. That's a former nuclear scientist, taking another dive into the marketing end of dp . . . but the water seems a bit warmer this time around.

A SIMPLE NOTION AND HE MAKES IT HAPPEN

If an engineer doesn't like what management is doing with his ideas, he had better get into management and make sure his ideas come out as planned. This is a simple notion. Many scientists and engineers have been aware of it for years but few can make it happen. One who has, with outstanding success, is Dr. Robert R. Johnson, a 1956 Ph.D. from Cal Tech who is now vice president of engineering for Burroughs Corp.

Johnson started as a research physicist for the Airborne Digital Computers Div. of Hughes Aircraft Corp. He spent a hitch with GE during the ERMA days and joined Burroughs 11 years ago. As top engineer at Burroughs it is his responsibility to translate the needs and ideas of the field into the cost/benefit equations that will unloosen corporate purse strings. He also has a reverse responsibility, ensuring that available R&D funding is not wasted on dead end, unmarketable or unproductive projects.

The Burroughs approach is strongly influenced by the bundle of ideas known collectively as the "B-5000 concept." As Johnson put it, the "secret of the B-5000 is that it is a carefully engineered system, a collection of pieces in which no individual piece by itself was that great, but they fit together with a structure under the whole. You don't put in a stack without associated, very powerful descriptor technology and you must use segmentation to parse the software world into its natural elements."

Johnson noted that software technology has lagged. We went through three generations in the '50s, absolute, symbolic assembler, and compilers, but since that time the most constructive development has been the use of interactive techniques. He mused that although the leaders of programming thought, perhaps an indirect reference to Prof. Edsger W. Dijkstra of Burroughs Corp. in The Netherlands, have discovered that they must use safe structures, an idea that logic designers uncovered 20 years ago to do worst

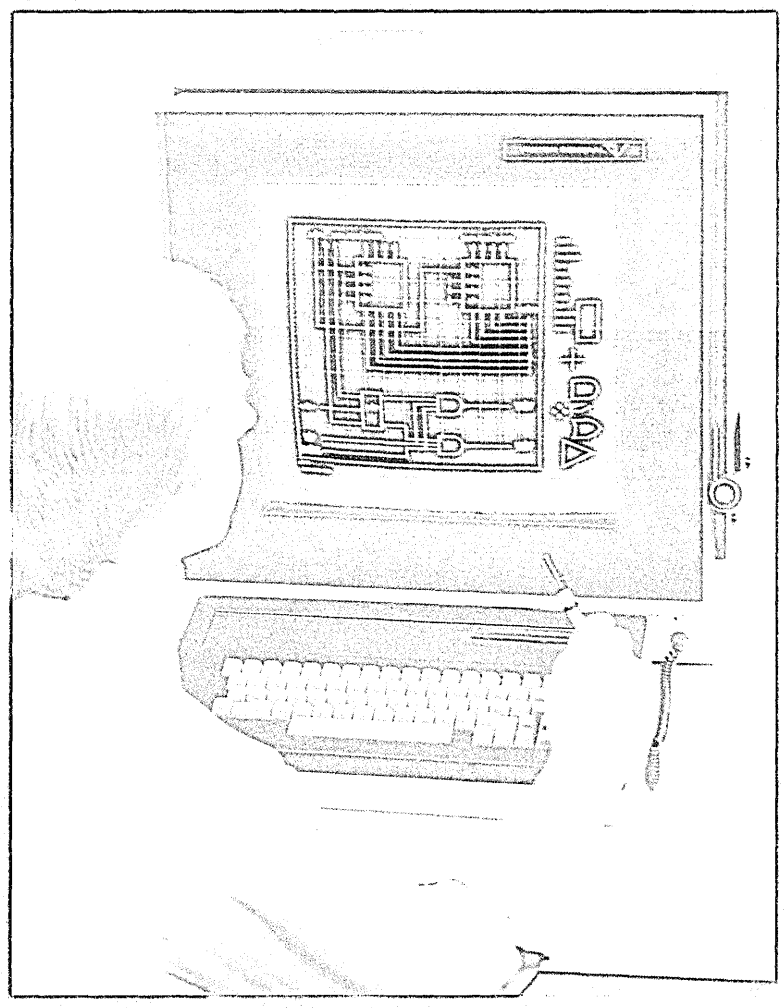
DR. ROBERT R. JOHNSON
An engineer in management

case design, the idea of structured programming has not yet been adopted. "Our Burroughs feeling when we go out into the world is that we are assaulted for our ideas in programming when we have been practicing them for 15 years while the rest of the world is still debating."

The recurrent theme in Johnson's thinking is the notion of finding the structure of a problem, parsing it to collections of manageable elements, and then fitting the technology to the problem solution. But, "it is absolutely imperative to first understand the problem." He predicted that "15 years from now we will have major complex networks of chips somehow working harmoniously together. Somehow is the thing we don't know too well."

Johnson's philosophy of getting into management extends to local township politics. He is a village trustee of Franklin Village, a suburb of Detroit, and he is a long time supporter of the Detroit Science Fair. He is active in engineering circles and, in his spare time, teaches at the Univ. of Detroit and gives advice to four separate engineering faculties. □

Quick!
Name the company whose Graphics Terminals have off-the-shelf interfaces for minicomputers like H/P, Xerox, Data General, Honeywell, DEC, etc.



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Operating as a high-speed peripheral, Series 3 offers high-performance graphics as an add-on to your present mini, or as a component in a system still on your drawing boards.

But there's more to Series 3 than interface flexibility. It can display 21,000 inches of vectors and 4700 characters at a flicker-free 30 FPS. Its modularity allows on-site expansion from a basic line-drawing system to a full 3D, real-time display. It can support four, full-color monitors and a host of interactive controls and peripherals. And, it has the best price/performance you can find.

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CIRCLE 57 ON READER CARD

BASF announces its own "Winchester" Data Module.

You've undoubtedly been following the progress of the 3348, or "Winchester," Data Module in the computer press. You know it's a completely self-contained unit, incorporating heads, spindles, and recording surfaces in a protective factory-sealed pack. You've heard of the advantages of this new technology . . . complete security from environmental contamination, improved high-density storage, and incredibly fast access. And now, you can order the "Winchester" Data Module from BASF, with all the quality and error-free performance that the name implies, and a competitive price.

Here are the facts, in brief:

- Complete compatibility with 3340 drives.
- BASF-guaranteed Zero-Error performance.
- Now available in two configurations for early 2nd-quarter delivery . . . The 1335 Module, with 35 million-byte capacity, and the 1370 Module, with 70-million byte capacity.
- Our 1370F Module, with fixed head and quicker access, will be available in 1975.

For complete details on the BASF "Winchester" Data Module, write: BASF Systems, Crosby Drive, Bedford, MA 01730 or contact your local BASF representative.

You're already paying for BASF quality. . .you might as well have it.

BASF

CIRCLE 12 ON READER CARD

LOOK AHEAD

FUNCTIONAL PRICING TALK REVIVED

IBM found an easy way to revive the talk about functional pricing: the company announced a product with functional pricing. Buried in the announcement of IBM's 3800 laser-electrophotographic printer was the revelation that IBM will levy a "usage" charge on customers in addition to IBM's traditional product charges. The printer isn't slated for delivery until the third quarter of 1976 and there are some who are predicting there will be other products with "usage" charges announced before the printer is ever delivered. Some believe functional charges will become a standard in the dp industry in coming years. IBM is charging $2.30 per 1,000 feet of paper processed for the high speed printer.

HIGH SPEED PAPER SAVER

IBM's April announcement that it will have a 13,360 lines per minute printer within a year from next July has stirred considerable interest among large system users concerned with conserving paper. IBM said the model 3800 laser printer, which can print reports on 8-1/2x11" forms, could help a typical user cut its monthly printing bill to $5,460 from $18,390. Its high speed also could chop away at rental charges some users now pay for slower impact printers. A large oil company, thinking of replacing three IBM 3211 printers with the 3800, figures it could save $125,000 a year--not counting the savings in paper.

First to benefit from the IBM announcement was Xerox Corp. which sells a 4,000 lpm non-impact printer--the 1200--which operates off-line from tapes from IBM, Univac, Burroughs and Honeywell systems. Xerox says that the week following the announcement was, "in terms of serious inquiries, letters of intent and signed orders, the strongest for the 1200 since it was introduced in May 1973." The company declined to release any figures, however. Although the IBM 3800 is more than three times the speed of the 1200, it also is three times the monthly rental. And while the IBM product will run only on VS machines from the 370/145 up, the Xerox offering will run on the lower end, including the 360 models.

IBM'S ENCRYPTOR: FREE TO ALL IF...

An IBM data encryption algorithm proposed by the National Bureau of Standards as a federal standard will be made available free to anyone if the Dept. of Commerce establishes it as a standard by Sept. 1, 1976. The NBS proposed the algorithm as a standard in a notice in the March 17 Federal Register which solicited comments by May 16. IBM has said that should its Sept. 1, 1976 deadline not be met, its royalty free license offer will be withdrawn at that time. Industry concern seems not to be with the algorithm itself, which allows an encryptor to be built on a single chip, but with its implementation. Independent suppliers want more assurance that they really could use such a device in a practical way. Some see IBM's setting of the Sept. 1, '76 deadline, as the giant's way of "getting the government to get off the dime."

BIG USERS DISCOVER THE 360

Many big and sophisticated dp users have discovered an exciting new IBM product --the 360 line. One computer broker, Harry E. Goetzmann, Jr., of Continental Information Systems Corp., of Syracuse, says that the sales prices of 50s have jumped 50% in recent months. "I could place 20 model 50s in two months," says Goetzmann, "but I just can't get them."

The reason for the renewed interest in the 360s? More than anything, it's the tight economy, which has made users more conscious than ever about saving on their computing. Goetzmann cited the situation of a big midwestern hospital that made a "lateral movement" from a 370/145 to a 65 and the user got more throughput for less money. The 65s have also been selling well--up probably 30% in recent months. While the lower end of the 360 line hasn't moved up yet, there is some expectation that it will soon. The price of 40s is beginning to increase slightly.

IBM: EXPANSION AT THE TOP AND BOTTOM

Meanwhile, production runs of the great sales flagships of the 370 line--the 158 and 168--may be slipping faster than generally had been anticipated. IBM

has been informing customers that the 158 or 168 they order may be a "normal mix" machine, which is the computer company's way of saying that it will no longer guarantee that 158s and 168s ordered now will be new production line models.

The feeling is that production lines of the 158s and 168s peaked before Christmas and that production is being gradually braked by IBM. The 135 and 145 have been in limited new production for several months. While the 115 and the new System/32 are said to be hot selling products still, IBM nevertheless is in the uncomfortable situation of running out of new high revenue producing products to peddle. While most models of the 370 line are slated to be souped up, IBM is also understood to be considering expanding the range of its equipment.

On the high end a super computer--a 178?--is expected by some to plug the sales hole that the sluggish selling 195 never filled. On the low end, General Systems Div. has been looking at new equipment too--an even cheaper small commercial dp system below the 32 and, as well, a desk top calculator called Scamper internally.

PRIVACY GUIDELINES DUE THIS MONTH

Computer security guidelines, to be finalized this month and offered to federal agencies to help them comply with provisions of the Privacy Act of 1974 (February, p. 71) are "relevant and applicable to the private sector," says Seymour Jeffrey of the National Bureau of Standards.

Legislation similar to the privacy act which would affect the private sector has been introduced into the House of Representatives by Rep. Edward Koch and Rep. Barry Goldwater, Jr. NBS compiled a draft of privacy guidelines for federal agencies at the request of the Office of Management and Budget and circulated it in mid-April for comment. Other privacy guidelines were submitted at the same time to OMB by the Civil Service Commission and the General Services Administration.

The NBS standards coordinating committee (called FIPSCAC) now is reviewing the NBS draft guidelines and will send its comments to NBS by May 15. These comments will be incorporated into a final version to go through OMB May 30 for publication.

Jeffrey (who is with the NBS Institute for Computer Sciences and Technology, System and Software division) and officials at OMB think federal agencies will "in the large" meet the privacy act's Sept. 27 deadline for compliance with major provisions to prevent misuse of information about individuals and assure its confidentiality and security. But one OMB source admits, however, that "it will be quite an effort for the big record keeping agencies."

The NBS guidelines--a 32-page list of them--concern the use of technical procedures for safeguarding personal data in automated information systems. The report accompanying the guidelines suggests that if they're put together in a well balanced set of safeguards, "significant levels of protection can usually be attained at a reasonable cost."

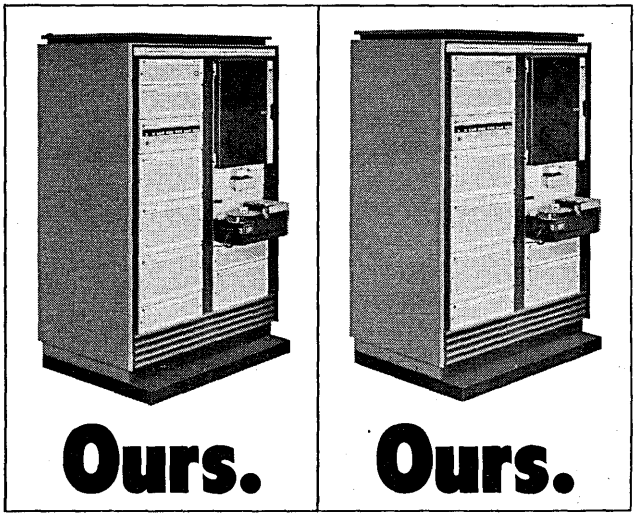
TOWARD NETWORKS OF SUPER COMPUTERS

Users of multiple massive computers would like to hook them in a sort of local interconnect scheme to, among other things, share large data bases. But with today's conventional channels and controllers, it's difficult to get such computers and their large number of peripherals close enough together to do this and such other things as on-line maintenance. Some dp centers have rigged one-of-a-kind networks, but there's nothing off the shelf for the rest. A fledgling company in St. Paul, Minn., has been mulling this problem for the last year and a half under the direction of Jim Thornton, architect of Control Data Corp.'s Star computer.

Its first product--yet to be installed, but attracting interest in large government agencies--is a $25,000 network adaptor. The device would adapt signals to or from the channels of large computers and coaxial cables. In one pending application, as many as 16 computers, including a CDC 7600, could talk to each other and several hundred storage and I/O devices at 50 million bits per

(Continued on page 174)

The new V-75 leaves us competing against ourselves.



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Fully compatible with previous V-70 computers, the V-75's new capabilities make it the most powerful member of the high performance V-70 family.

The CPU's instruction set is a significant expansion of previous V-70 computers. New instructions operate on 8 general purpose registers and handle 8-, 16- and 32-bit operands. Plus, up to 512K bytes of 330 nanosecond memory which is directly accessible via 1024 mapping and protection registers. And I/O transfers at up to 3 million 32-bit words per second are possible through dual memory buses.

The V-75 widens the competitive gap even further with the Writable Control Store package. New firmware modules include byte and stack manipulation and accelerated FORTRAN functions.

The new, fast FORTRAN included in the V-75 package is comparable to large machine compilers. With double precision integer data, compiler overlays, seven dimensional arrays, and direct access I/O.

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Everybody knows what tomorrow's computer system will be like.

It will serve all kinds of commercial and scientific users (local and remote batch, time-sharing, real-time, transaction processing) concurrently and interactively with no discernible delays.

It will handle a great variety of unscheduled jobs in the most efficient, cost/effective way possible.

It will be able to manage a very large shared data base.

It will allow each kind of user to communicate with it in the simplest and easiest language suited to his task and his level of expertise, and it will let programmers develop and debug on-line, then immediately put their completed programs into production.

It will automatically keep track of priorities, shifting them about as deadlines approach or if real-time urgencies preempt segments of the system.

It will have self-scheduling hardware to dramatically reduce software overhead and speed up execution.

It will have a control processor to manage the entire system, another processor dedicated to computing, and multiple processors for input/output.

It will have an operating system that is completely transparent to the user and which will see to it that all units are kept as busy as the workload demands, up to nearly 100% system efficiency.

It will have independent memory management with virtual addressing.

It will converse with other manufacturers' computers and with intelligent remote terminals.

It will have close to 100% availability, diagnosing and isolating its own ailments and working around them until they are corrected.

It will be modular so that capacity can be precisely fitted to current needs and can later be expanded simply by adding more units under the control of the original operating system.

Not many know that such a computer system now exists.
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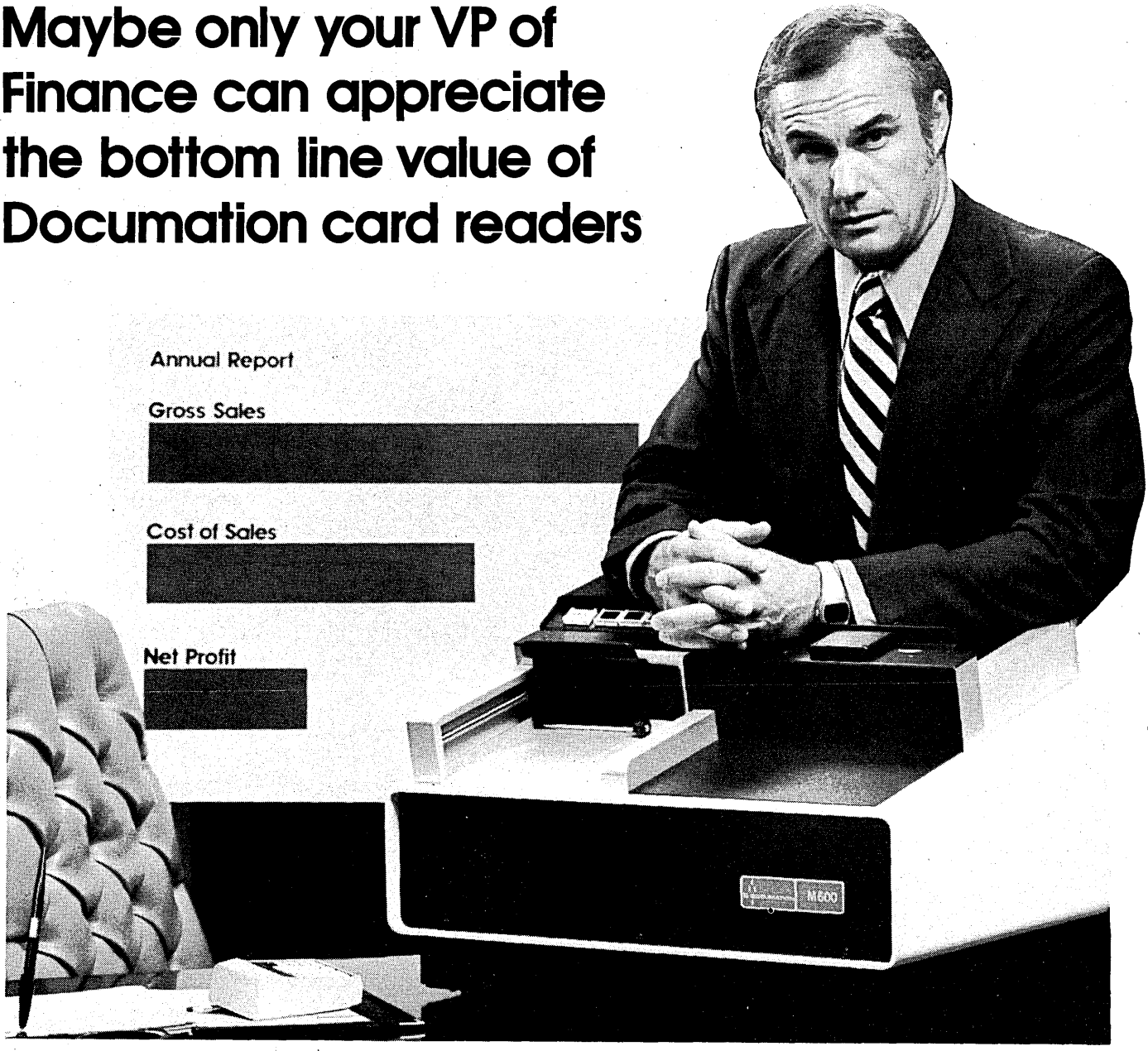

Figuring the cost of data processing is easy. Simply calculate a constant monthly figure. But ask your Vice President of Finance if you want to know how much your computer system contributes to the corporate bottom line.

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CIRCLE 38 ON READER CARD

calendar

MAY

Universal Product Code Conference: Engineering for Productivity, May 20, Stony Brook, N.Y. Corporate and government representatives involved with UPC will take part in sessions on technology and implementation. Sponsors are Public Systems Research, Inc. and the State Univ. of New York. Fee of $100 covers all sessions, luncheon and proceedings. Contact: Shelley A. Harrison, PSRI, 1320 Stony Brook Rd., Stony Brook, N.Y. 11790, (516) 751-4515.

SEMICON/West '75, May 20-22, San Mateo. More than 500 exhibits of semiconductor equipment and materials are combined with a technical program for this show sponsored by Semiconductor Equipment & Materials Institute(SEMI). Sessions will cover wafer processing, interconnection packaging and assembly, and new developments in semiconductor technology. Fees: $1, advance; $3, at the door. Contact: Golden Gate Enterprises, Inc., 1333 Lawrence Expwy., Santa Clara, Calif., 95051, (408) 241-7400.

Los Angeles Chapter, EDP Auditors Assn., Annual Conference, May 21, Santa Monica. This one-day meeting, of interest to public accountants, internal auditors and data processing management, centers on the theme "EDP Auditing—How I Did It." Fee (includes lunch): $30, members; $40, nonmembers ($10 can be applied toward membership dues). Contact: Gary Keefe, P.O. Box 29366, Los Angeles, Ca. 90029, (213) 972-4186.

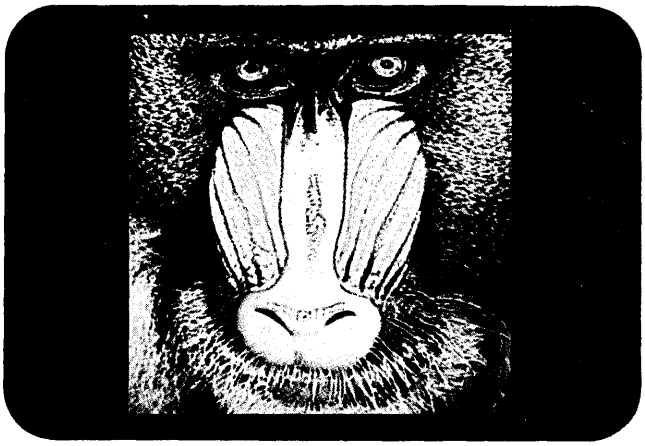
Society for Information Display, May 21, New York. The Mid-Atlantic chapter of SID hosts a technical panel discussing "Recent Developments in Display Technology." The evening program is free to members, $5 for the public. Contact: I. F. Chang, P.O. Box 218, Yorktown Heights, N.Y. 10598.

JUNE

U.S. Dept. of Commerce Exhibition, Minicomputers, Terminals and Peripherals, June 3-7, Milan, Italy. More than 35 American manufacturers will display their latest technological advances in the minicomputer market. Contact: Mara Yachnin, U.S. Dept. of Commerce, DIBA, Rm. 1014, Washington, D.C. 20230, (202) 967-2762.

13th Annual Conference, Computer Personnel Research, June 19-20, Toronto. Representatives from industry, education and government throughout North America will concentrate their discussions on programmer productivity and programmer certification. Sponsored by SIG/CPR of the Association for Computing Machinery (ACM), fees are: $55, members; $65, nonmembers; $10, students. Contact: Daniel P. Freedman, SUNY, Binghamton, N.Y. 13901, (607) 798-2480.

National Conference, Canadian Information Processing Society, June 24-26, Regina, Saskatchewan. This conference, intended for the general computing and data processing audience, will cover the relationship of computers to society, science, and communications. Fees (includes proceedings): $75, CIPS members; $85, nonmembers; after June 11 add $10. Contact: Pow-Wow '75, Box 3343, Regina, Saskatchewan, S4P 3H1.



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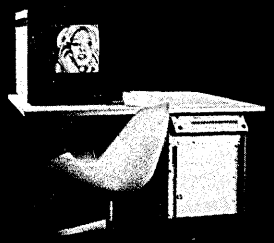

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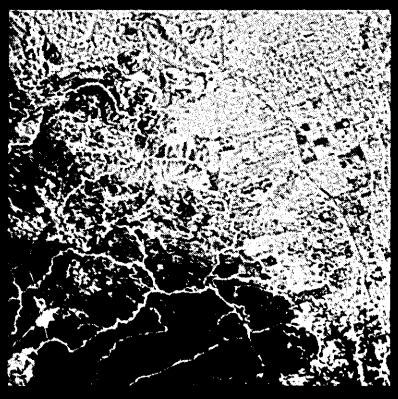

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CIRCLE 104 ON READER CARD

calendar

JULY

Summer Computer Simulation Conference, July 21-23, San Francisco. The program will emphasize the application of simulation to solve problems in the technical, management and social sciences. Sponsors are AICHE, AMS, ISA, SCS, and SHARE. Fees (advance): $55, members; $70, nonmembers; add $15 for on-site registration; $175, five-person group (minimum). Contact: Lawrence Sashkin, P.O. Box 92957, Los Angeles, Calif. 90009, (213) 648-5934.

Special Symposium on Advanced Hybrid Computing, July 23-24, San Francisco. Held in conjunction with the SCSC (see above), the symposium will focus on recent advances in hardware and software technology which have made possible the development of the advanced hybrid computing system (AHCS). There will be no fees for either the symposium or the published papers; registration at the SCSC is not required. Contact: Aldric Saucier, Dept. of the Army, 5001 Eisenhower Ave., Alexandria, Va. 22304.

Semiannual Conference, Optical Character Recognition Users Assn., July 21-23, Boston. Theme for the meeting will be "Centralized and Decentralized Applications," focusing on advancements in ocr as a means of capturing data. Fee: $150, first company representative, $100 each additional person. Contact: T. David McFarland, OCR Users Assn., 505 Busse Hwy., Park Ridge, Ill. 60068, (312) 825-8124.

AUGUST

ADCIS Summer Conference, August 5-7, Portland, Maine. Hardware and software exhibits and demonstrations will augment technical sessions on computer-based applications to education. Sponsor of the conference is the Assn. for Development of Computer-Based Instructional Systems. Fee: $15, members; $20, nonmembers; $5, students. Contact: Dr. Martin Kamp, Office of Info. Systems 76-U, Univ. of California, San Francisco, Calif. 94143.

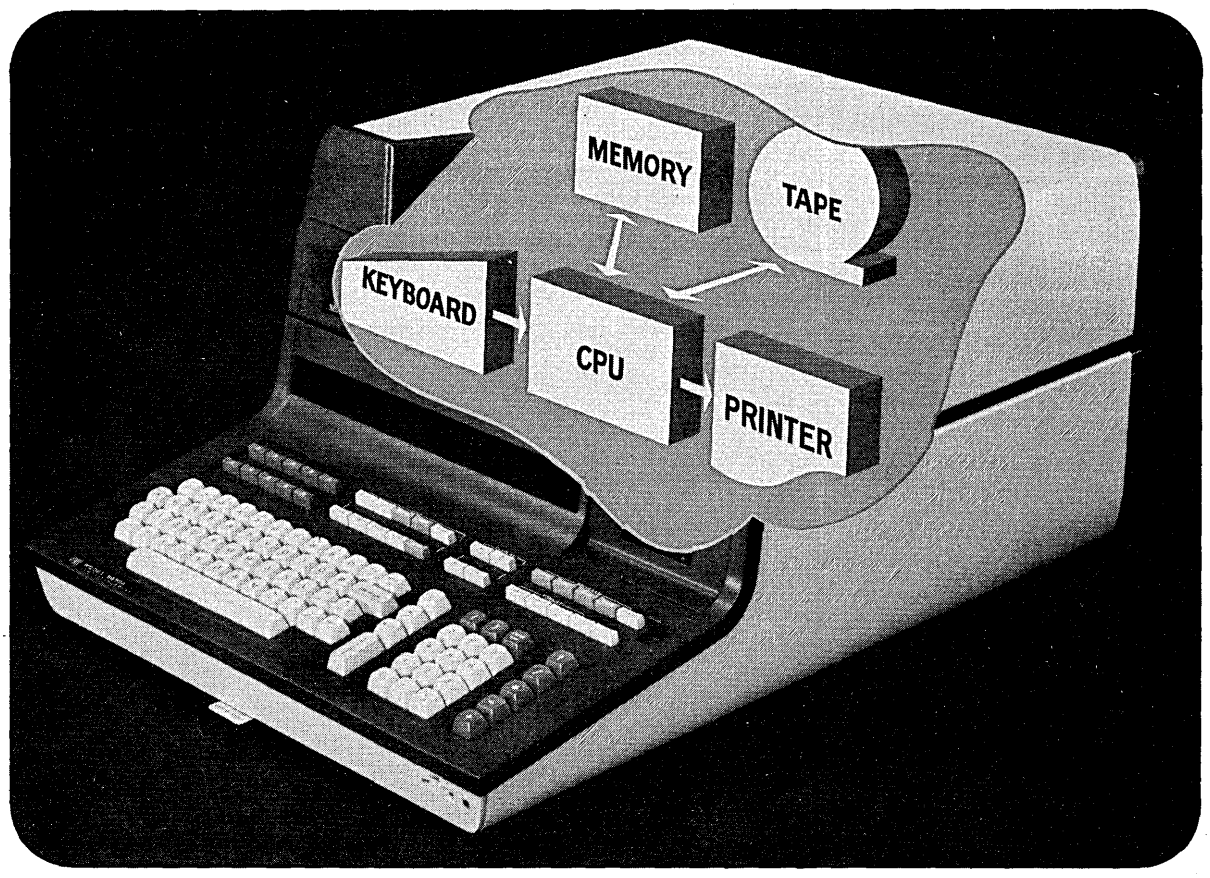
10th International Logistics Symposium, August 12-14, Lake Buena Vista. Sponsored by the Society of Logistics Engineers (SOLE) the conference has as a theme "Total Logistics Resource Management." Fees: $55, members; $65, nonmembers. Registration can be sent to SOLE Symposium Registrar, 2490 Lauder Dr., Maitland, Fla. 32751. Contact: James L. Carpenter, (305) 352-2656.

Urban and Regional Information Systems Assn., 13th Annual Conference, August 24-28, Seattle. "The Role of Information Systems Technology in Community Management" will be discussed by more than 500 government officials, consultants, computer specialists, and university professors. Exhibits will include graphic display devices, minicomputers, and software packages. Registration of $65 includes URISA membership fee. Contact: Sidney Brounstein, 1125 Fifteenth St., N.W., Washington, D.C. 20005.

ON THE AGENDA...

Compcon Fall '75, Sept. 9-11, Washington, D.C.
Wescon, Sept. 16-19, San Francisco. **American Bankers** Assn., Oct. 4-8, New York. **Instrumentation** and Computer Fair, Oct. 7-8, Washington, D.C. **ACM '75,** Oct. 20-22, Minneapolis.

Conferences are generally listed only once. Please check recent issues of DATAMATION for additional meetings scheduled during these months.



Today this could be your best computer investment.

Before you make a heavy capital investment in a new computer system—or an expensive upgrade of your present equipment—take another close look at your computing work load. You may find that most jobs don't require the capabilities of a large computer. Unless your applications call for high-speed execution and many computer languages, there's a good chance you can do them more efficiently and economically on a programmable calculator.

Take a programmable calculator like the HP 9830, for example. In many respects it is a powerful computer—complete with BASIC language and up to 16K bytes of read/write memory. This can be dramatically extended with a Mass Memory that provides another 4.8 million bytes of rapid-access storage. The 9830 not only accommodates a complete range of input/output peripherals, it even converts to a remote batch or timeshare terminal. And the 9830 also provides easy interfacing for instrument control, data acquisition, and processing.

Even more important, the 9830 combines all this power and convenience with calculator simplicity. Take it out of the box, set it on your desk, and it's ready to go. The BASIC language is already hardwired into the CPU, so it doesn't use any read/write memory. The 9830 can start solving problems the moment you turn it on. In fact, a lot of the input, output, and storage you need is also built in: the alphanumeric keyboard and display, the thermal printer, and the magnetic tape cassette (for both input and storage). What you have, then, is a powerful computation system that's simple to operate, immediately accessible and reasonably priced. Leases for the HP 9830 with printer start at approximately $300* per month.

So if you're exploring alternative solutions to your computation problems, ask your local HP Sales Office about the HP 9830 Programmable Calculator. Or send us the coupon for more information.

*Domestic U.S.A. Price only. Leases, where available, includes service contract.

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Ford improves dealers' parts control "Silent 700" data terminals

Recently, Ford Motor Company decided to upgrade the communications network used to communicate parts inventory and management accounting data between its Dearborn, Michigan Computer Center and the nationwide network of Ford and Lincoln-Mercury dealerships.

This network is a crucial part of two services that Ford offers to its dealerships . . . Automated Inventory Management (AIM) and Computerized Management Accounting (CMA). Dealers subscribing to these two services receive extensive parts inventory control reports and a wide spectrum of accounting and management information reports.

Striving to improve service to its dealers, Ford wanted more efficient data entry, simpler operating procedures, and greater accuracy than was offered by the existing mechanical teletypewriters. For this purpose, TI data terminals operating with fast, accurate magnetic tape cassettes offered the best alternative.

"Silent 700*" Automatic Send-Receive and Programmable Data Terminals from Texas Instruments provided the answers. According to a spokesman for Ford's Dealer Computer Services, "These terminals will provide major advancements through increased equipment reliability, data preparation efficiency, and improved data transmission integrity."

Improving man's effectiveness through electronics

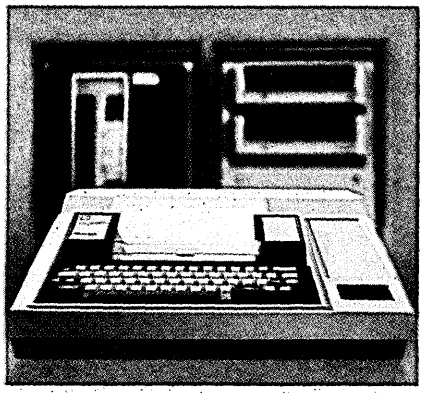
and management accounting with from Texas Instruments.

Operating Simplicity

Reusable magnetic tape cassettes — easily edited, corrected and retransmitted — along with proven reliability, place the "Silent 700" ASR and Programmable Terminals far above those of conventional paper tape terminals in capturing inventory, management and accounting data. Built-in intelligence enables these "Silent 700" terminals to guide operators in their data entry procedures, check the data for correctness and format before recording it on tape . . . and later monitor data transmission to Ford's Dearborn computer facility.

And, all this is done with powerful performance features at a reasonable cost per unit . . . which means continued cost-effective communications for Ford and its dealers.

Data communications applications, like this challenging one at Ford, call for a wide range of capabilities in devising solutions. Texas Instruments has this capability . . . to serve you.



"Silent 700" data terminals combine with "EMS II" to form powerful data communication systems . . . for cost-effective applications

Other models from the Texas Instruments line of "Silent 700" data terminals

Is your problem different?

No matter whether your data communications requirements involve only a few pieces of equipment, several hundred units, or even a complete systems network . . . TI can provide the depth of application experience to obtain an effective solution.

A popular family of "Silent 700" Electronic Data Terminals backed by EMS* II Electronic Message Switching Systems, a host of peripherals and software . . . and a network of sales and service offices backed by TI-CARE† . . . enables us to give you complete service from design through support.

What's more, we can do it efficiently . . . just as we did it for Ford. And, we think you'll be completely satisfied with the results . . . just as satisfied as our current customers are.

Dispatcher at "TI CARE" center initiates service ticket via CRT to computer and transfers call to "TI CARE" technician

For more information, contact your nearest TI office listed below. Or, write Texas Instruments Incorporated, P. O. Box 1444, M/S 784, Houston, Texas 77001. Or, call (713) 494-5115, ext. 2126.

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CIRCLE 39 ON READER CARD

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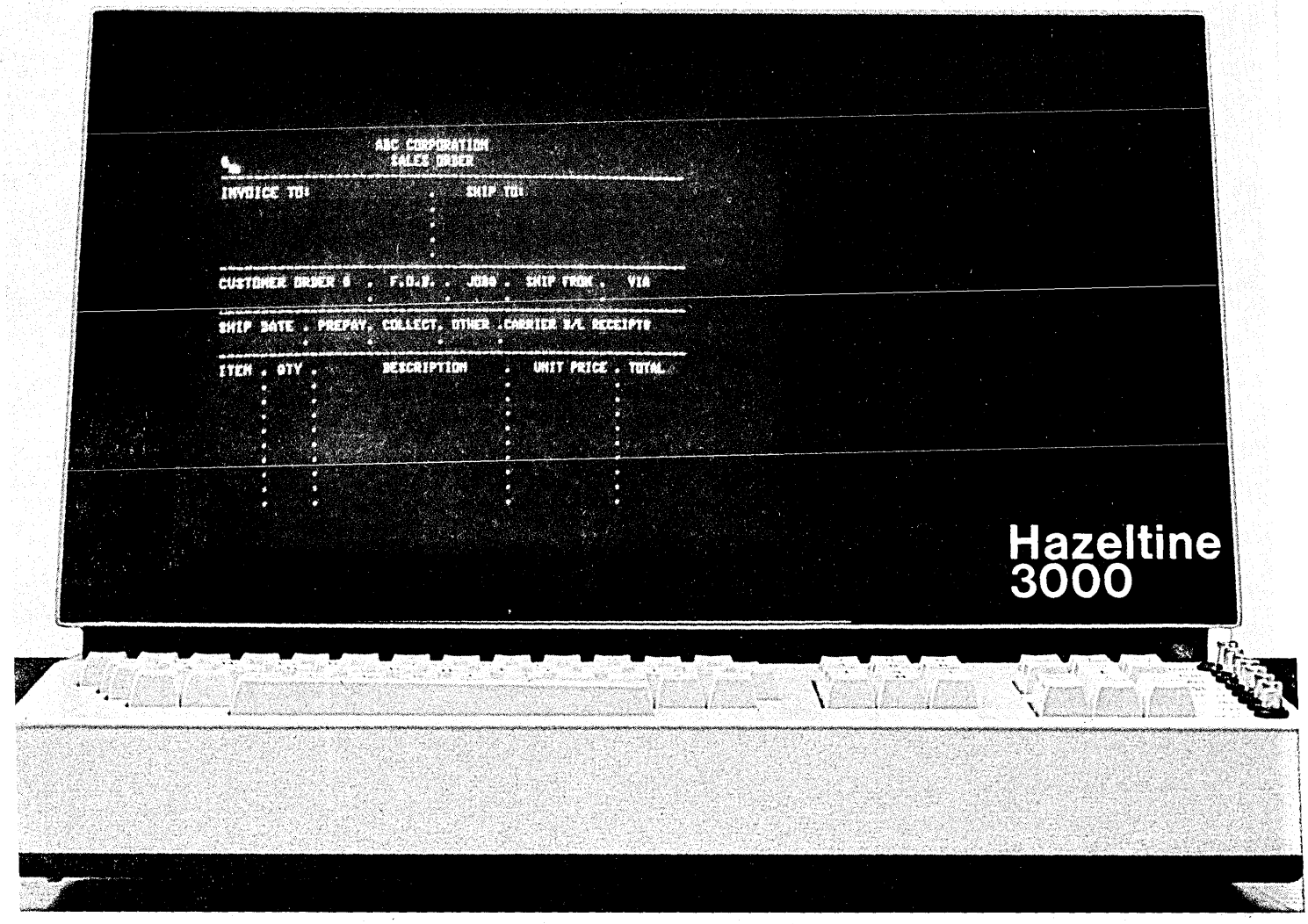

YOU'LL CALL IT FANTASTIC!

The Hazeltine 3000 terminal has a programmable microprocessor-based communications interface that makes it compatible with communications disciplines of most computer manufacturers. It has the features that make communicating so much easier—powerful local editing capability, protected formatting with dual-intensity video, full-size 1998-character display, uncluttered moveable keyboard, and a full range of options. It's a "custom" terminal at an "off-the-shelf" price . . . and it's backed by worldwide sales, service and technical support from the Company with a half-century of leadership in electronics and displays! Fantastic!

CIRCLE 35 ON READER CARD

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Houston (713) 783-1760 ☐ Orlando (305) 628-0132. *West:* San Mateo (S.F.) (415) 574-4800 ☐ L.A. (213) 553-1811 ☐ Denver (303) 770-6330 ☐ Seattle (206) 242-0505
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source data

SOURCE DATA provides information on books, courses, references, reports, periodicals, and vendor publications.

books

The Program Development Process: Part I, The Individual Programmer

By Joel D. Aron
Addison-Wesley, 1974
264 pages, $12.95

This book, the first in the new "Systems Programming Series" sponsored by IBM, addresses the program development process from the viewpoint of the individual programmer with a single "work unit" of code to produce. The second in the series, also by Aron, will address "The Programming Team" and systems projects.

As a book, *The Individual Programmer* strikes the middle ground between the extreme generality of how to manage program development and the kind of detail found in recent books on programming style. But it seems definitely of the new wave, structured programming genre. Although the series is about systems programs, Aron's remarks are equally applicable to applications programmers. In fact, aside from occasional lip service to systems programs, Aron seems to address all programmers. In his first chapter, Aron does devote himself (sometimes amusingly) to showing how systems programs have evolved over the years into the commanding role they play in software technology today.

Some nice rules of thumb, backed by occasional statistics, are put forth for programmer guidance:

1. *Work Units.*, Divide assignments into manageable units suited to the individual programmer's capabilities.
2. *Attention Span.* Organize work into a small number of classes (about seven); concentrate on a few things at a time.
3. *Complexity.* Manage the task *and* the program to minimize complexity.
4. *Design Refinement.* Design completely before starting implementation; there is no hardware-type "learning curve" for software production.
5. *Documentation.* Software exists only in its documentation; document so someone else can use and maintain it.
6. *Change.* Change is inevitable; be flexible, plan for change, and design for easy modification.

Chapters on concepts and on analysis and planning, discuss the impact of the first three principles on work planning with several nomographs for computing work unit costs (400-1000 lines of source code in 4-6 man weeks as a basic work unit) reflecting program complexity and programmer experience. Aron has drawn on quite a number of sources in working these costing algorithms up, and, for the sort of programs considered (i.e., those small enough to be done by a single programmer or small team) certainly appear to be as good as any around.

The chapters on design, code and debug present the top-down approach to design and implementation in an easy, informal manner. Step-wise refinement of designs is covered simply and rules for forming modules (functional, sequential, and control flow groupings) are given, but more sophisticated material (such as Stevens and Myers modularization rules) is largely ignored. Similarly, the elements of programming style in coding is sponsored at an introductory level, but not in any great detail a la Plauger and Kernighan. Top-down integration of program elements is hinted at but integration and validation of systems produced by several programmers is left to Part II.

The coverage of programming tools, after the emphasis on systems programs in the introduction, is rather disappointing. More could have been said about the sort of support the programmer may expect from his standard tools today and something of tomorrow's promise.

Somewhat tangential to the rest of the book but appealing to my particular bent is the chapter on interaction with the computer. Aron compares batch, interactive, and RJE as data entry methods, covering the somewhat tenuous evidence offered by Sackman, Gold and others concerning their relative efficiency. Aron himself seems to prefer RJE, citing the greater computer efficiency of batch combined with the turnaround advantages of remote terminals. He admits the debugging and editing power of interactive programming, deplores its operating overhead, and says little about the programmer's fascination with his computer symbiosis that leads him to sit for hours at his terminal with only after the fact designs to guide him. He does discuss workspace and display requirements for programmers and alternative symbol sets for keyboards, but goes no further into what would really be the most effective set of terminal devices and facilities than he does into an effective set of programming tools.

In all, Aron holds to his middle ground, never really superficial or greatly penetrating. The tone is practical; reasonable advice is given; no flights of fancy are taken. Although the tone is new wave, the orientation is not really all-out structured programming. To some this may be a disappointment since we are really waiting for a good description of how the total programming process proceeds under the new concepts. On the other hand, while little technical minutiae on programming are given, the book does present the best advice I've seen on how the programmer should run his individual programming project. A good, if not a great book.

—N. E. "Gus" Willmorth

Dr. Willmorth has performed a myriad of functions at System Development Corp. since 1955. He is well known in military and aerospace circles as author of "System Programming Management," a massive internal SDC document which covers on the system level much the same grounds Aron does for the individual programmer. He is currently principal architect of a project management system called IMPACT specifically designed to support structured programming projects.

Program Style, Design, Efficiency, Debugging, and Testing

by Dennie Van Tassel
Prentice-Hall, 1974
256 pp. $10.50

This little book attempts to cover all of the topics listed in the title in relatively few pages. In addition, it contains a short section on programming problems (exercises) and three appendices: Program Rewriting, a FORTRAN Execution Time Estimator, and Optimization of Tape Operations. These later sections are reminiscent of how our federal representatives attach inappropriate riders to bills assured of passage.

However let me first set some things straight. This book is a good book rather than a bad one. Size alone neither confirms nor denies value. The author has attempted a monumental task and has provided some very useful information.

He has also made some huge assumptions. The first is that this book is valuable only to experienced programmers. On the contrary, it is, in the majority of the truths and guidelines

source data

offered, quite basic. For example, "Blanks should be left in all places that will improve readability of the program," "Subscripts are very costly . . . but they are also very useful," and "Keypunch errors in source programs can cause bugs that are very difficult to locate."

Throughout the text there is the implication that one must plan ahead in order to achieve a higher level of effectiveness in the various activities associated with program development. Thus, the tips given in this book, when used, will produce the desired result. In a like manner, good programmers must be planned for, and this planning is called training. And what better way to train a novice than to make him aware of these time-tested tips on how to program with style, to design for simplicity, and to code, debug, and test efficiently? I would recommend this book as required reading for all new programmers. And I might just fire those "experienced" programmers who have to read it.

The second assumption the author makes is that this collection of homilies will have any meaningful effect on the game of programming. If we put all of these tips, hints, guidelines, suggestions, etc., into a big basket and offered them free to any programmer, at the end of a year hardly a handful will have been taken. And this is because it is not easy, and maybe not possible, to change one's style, philosophy, and habit. My point is that without some type of enforcement, standards just don't work! In our highly labor-intensive craft of programming, particularly in business data processing, we have never learned how to increase, much less measure, our productivity. We know what to do (as this book tells us), but not how.

—**Howard Bromberg**

Well known in the industry for his work in COBOL standardization, Mr. Bromberg is president and founder of International Computer Trading Corp., and a contributing editor of DATAMATION.

periodicals

Information Times

News of the world of information, from copyright legislation to conference highlights to photocopying problems, are featured in the first issue of *Information Times,* a quarterly in newspaper format published by the Information Industry Assn. According to publisher Paul Zurkowski, "nobody really thinks about information in . . . larger terms" of how it is having a "profound impact on all our lives"; *Information Times* will provide its readers with "a slice of life viewed from an information perspective." The editor is David Carvey and the subscription is free—so far. INFORMATION INDUSTRY ASSN., 4720 Montgomery Lane, Bethesda, Md. 20014.

System/32 Users Periodicals

The *I.S.U. Bulletin* of the International System/32 Users is an instructive, educational, and informative monthly journal for System/32 users at all stages of their development. The first issue (March) contained information on minimum standards for the S/32, a systems library, a feature article on measuring the success of a computer installation, an announcement of a new I.S.U. System/32 software quarterly, and more. There is also a hot line service for subscribers to phone or write in requests for immediate assistance. Subscriptions are $39/yr., including a free systems design kit, or $10 for three months. The *System/32 Software Quarterly* is $10/issue or $29/yr., and to subscribe to both the bulletin and the quarterly, the price is $59/yr. INTERNATIONAL SYSTEM/32 USERS, 1700 E. Desert Inn Rd., Las Vegas, Nev. 89109.

Special Programming Issue

A special issue of the ACM quarterly, *Computing Surveys* (December '74), was devoted exclusively to computer programming. Featured were five papers on the topic: "Programming Methodology/Programming Style"; authors such as Donald Knuth and Niklaus Wirth are represented on structured programming, software programming and documentation projects, programming practices and composition, and programming style. Prices: $3 to ACM members, $8, others, and special rates for bulk orders. ASSOC. FOR COMPUTING MACHINERY, Box 12105, Church Street Station, New York, N.Y. 10249.

reports & references

Top Computer Executives

The convenient, useful *Directory of Top Computer Executives* lists vice presidents, directors, and dp managers in corporate staff positions at more than 2,600 of the largest companies in the U.S., including *Fortune* magazine's "Double 500" list of industrial firms. This semiannual publication is organized alphabetically by company name within eight industry classifications: manufacturing and service, commercial banks, diversified financial, insurance, retail chains, transportation, utilities, and educational institutions. The information supplied includes company name and address, subsidiary or division name, phone number, major systems installed, and the names and titles of the top dp executives. Published in February and August, single copies are $50, annual subscriptions, $80. APPLIED COMPUTER RESEARCH, Phoenix, Ariz.

FOR DATA CIRCLE 200 ON READER CARD

Minicomputer Software

The *Minicomputer Software Directory,* in loose leaf format for easy update, provides instant access to information on hundreds of minicomputer software packages and services. Suppliers, their company descriptions, locations and services offered, are covered, and are cross-indexed with applications/services. There is also a geographic locator listing. Price: $45/yr., including two updates. MINICOMPUTER DATA SERVICES, 20 Coventry Lane, Riverside, Conn. 06878.

A/N Display Terminals

Recent technological advances have created new applications for alphanumeric display terminals, and the revised *AUERBACH Guide to A/N Display Terminals* provides facts to help in selecting the right model for the user. Of more than 250 terminals reviewed, reports on the 30 most significant are given in detail, including comments from current users as well as technical and background information. Price: $19.95. AUERBACH PUBLISHERS INC., 121 N. Broad St., Philadelphia, Pa. 19107.

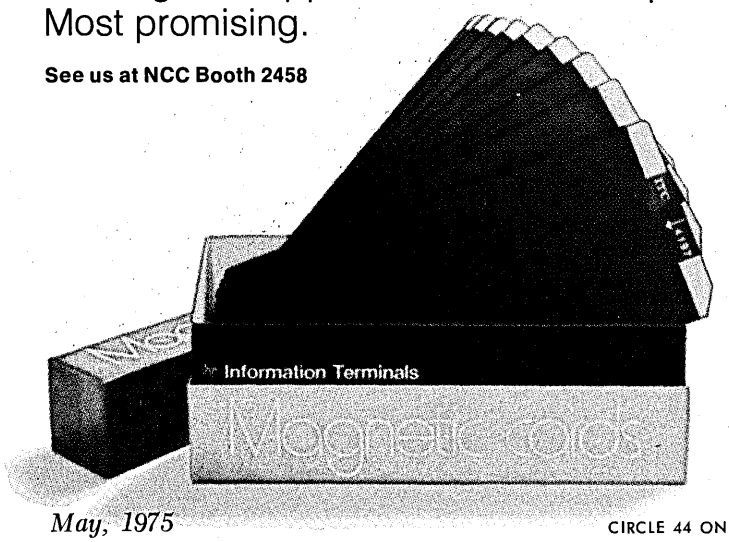
Mini/Microcomputer Market

Between 1974 and 1984, two million minicomputers and 15 million microcomputer systems worth more than $30 billion ($15 billion in peripherals) will be sold. Minicomputer prices will

How we got ahead of the pack in data storage media.

Six short years ago, we weren't number one in digital cassettes. ☐ We weren't industry innovators in floppy disks. ☐ We weren't first in certified word processing cassettes. ☐ Fact is. We weren't. Period. But then a lot can happen in six short years. ☐ Our first digital cassettes were winners. So much so that they set the standards (ANSI and ECMA) against which the performance of all other cassettes are measured. ☐ Comforting, but not enough. ☐ So, with a little help from a friend named Gus we found and filled still another customer need—certified flexible disks. Certified flexible disks with the same stringent dedication to quality as our data cassettes. ☐ And then we became the first company to introduce the "flippy", the world's first two-sided, double-capacity flexible disk initialized on both sides. ☐ Even more comforting but still not enough. ☐ We've just announced a line of magnetic cards for the growing world of word processing. ☐ So despite the fact that we're number one in digital cassettes and word processing cassettes ... and the innovators in floppy/flippy disks, we're still seeking new opportunities for our expertise. ☐ The next six years? Most promising.

See us at NCC Booth 2458



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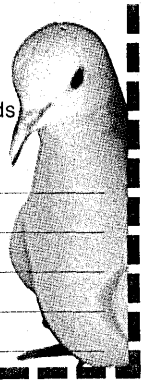


For the computer still questioning, "Paper, terminals, or COM?"

Bell & Howell presents the compatible COM.

experts who are

You have been through all the pros and cons a hundred times about the various options for utilizing computer output to the fullest. However, to the information you already have about COM *per se,* we would like to add a few things about the Bell & Howell COM which you might find comforting.

Bell & Howell's COM is compatible with most computers now in use. It speaks virtually any computer language. It requires a minimum of alteration to your own programming. Job setup is inputted through universal punched cards, so human error is substantially reduced. And our COM's throughput time is up there with the best of them, including some COM systems that are far more expensive.

When it comes to COM retrieval, we have one of the broadest ranges anywhere of computer-compatible readers and reader printers. Software and back-up programs? When you do business with Bell & Howell, you are dealing with one of the giants in the microfilm industry.

Think about it...and, if you would like more information, write to:
Bell & Howell, Inc. Business Equipment Group
1451 Quail Street, Newport Beach, California 92660
Or call Pat Flynn, collect, (714) 752-1940.

BUSINESS EQUIPMENT GROUP

BELL & HOWELL

source data

drop with the inroads into the oem market made by microcomputer products. End users will be the major minicomputer market in the future, and suppliers will have to develop extensive peripherals and software capabilities to meet competition from major computer manufacturers. So finds a 250-page report, *The Minicomputer and Microcomputer Markets,* which analyzes and forecasts the nature, size, opportunities, and competitive structure of the markets, based in large part on a survey of end users. Price: $595. FROST & SULLIVAN, INC., New York, N.Y.

FOR DATA CIRCLE 201 ON READER CARD

Savings with COM

A 30-page Report to the Congress by the U.S. Comptroller General, *Increased Use of Computer-Output-Microfilm By Federal Agencies Could Result in Savings,* describes the advantages of COM and microforms, and compares methods of providing COM services. A number of COM applications with various Federal agencies are also described. Price for a reprint of the report: $3.50. DATAFLOW SYSTEMS INC., 7758 Wisconsin Ave., Bethesda, Md. 20014.

User Surveys

Three Datapro reports analyze user responses in different areas. In an updated 62-page report, *IBM System/370: an Independent Appraisal,* users show some dissatisfaction in the areas of technical support, ease of conversion, and software. However, a resounding 93% rated System/370 as either good or excellent in overall satisfaction. Detailed descriptions, analyses, and prices of all the current System/370 equipment and software, as well as their ratings by users, are included.

All About Small Business Computers, a 43-page report, finds users satisfied with the overall performance, ease of programming, ease of operation, reliability of equipment, and with the maintenance service. They are less pleased, however, with the associated technical support and software. Detailed comparison charts describing characteristics and prices of 132 low cost business dp systems from 46 vendors are included.

In the 39-page report, *All About Remote Computing Services,* four suppliers of interactive time-sharing and/or remote batch processing services receive high user ratings (On-Line Systems, Inc., General Electric Co., Universal Computing Co., and Computer Sciences Corp.). The report also summarizes the services offered by 98 commercial remote computing companies and provides guidelines for prospective users.

These reports are reprints from *DATAPRO 70* and are $15, $10, and $10 respectively. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

Programming Management

The *AUERBACH Computer Programming Management,* the second in the *AUERBACH INFORMATION MANAGEMENT SERIES,* is a new service in which individual portfolios of in-depth intelligence reports on specific programming problems are sent to subscribers. The copies are in loose leaf format and are organized into five sections: Management, Environment, Methodology, Data Base Management, and Standard Practices and Documentation. (The first in the series, *AUERBACH Data Processing Management,* has about 3,000 subscribers.) Subscription is $95 and includes continual updates. AUERBACH PUBLISHERS INC., 121 N. Broad St., Philadelphia, Pa. 19107.

Computers in Mexico

A 72-page computer printout lists about 425 Mexican business and industry computer installations, plus the exact type of computer equipment used and the names of principals. Price: $500. VERITAS INTERNATIONAL, INC., 196 Main St., Nashua, N. H. 03060.

DATAMATION Subject Index

There are still some copies of the subject index of 1974 DATAMATION, Vol. 20, Nos. 1-12, which includes references to feature articles, conference reports, book reviews, News in Perspective, Editor's Readout, and the Forum. DATAMATION, Los Angeles, Calif.

FOR COPY CIRCLE 210 ON READER CARD

Guide to Exporting

To help American manufacturers obtain more business abroad, the U.S. Dept. of Commerce has published "A Basic Guide to Exporting," a 52-page report. Listed is the wide range of assistance available from both government and private sources, and steps are outlined for the businessman to take. On the premise that "exporting is neither mysterious nor difficult, the guide covers market research, sales and distribution, pricing, collections, financing, shipping, documentation, and product promotion. Price: 70¢. Superintendent of Documents, U.S. GOVERNMENT PRINTING OFFICE, Wash., D. C. 20402.

vendor literature

Microfilm Products

A 32-page illustrated catalog, "Kodak Microfilm Products, 1975," presents the company's full microfilm products

line, giving features and specifications. Products range from micrographics equipment to information and storage and retrieval equipment. EASTMAN KODAK CO., Rochester, N.Y.

FOR COPY CIRCLE 202 ON READER CARD

Business Products

An illustrated description of business products including disc cartridges and packs for IBM, NCR, and CDC drives; floppy discs; magnetic tape; magnetic tape cleaner; continuous, tab, snap out, and OCR forms; fabric or film printer ribbons; and credit card imprinters is available. CONTROL DATA CORP., Minneapolis, Minn.

FOR COPY CIRCLE 203 ON READER CARD

Bank Data System

A literature package describes this vendor's complete retail banking software, which features an integrated data base/data communications system with "plug in" demand deposit, savings, and loan applications. On-line inquiry and maintenance through video terminals are featured, and each

FOR GENERAL ELECTRIC CIRCLE 40 ON READER CARD →

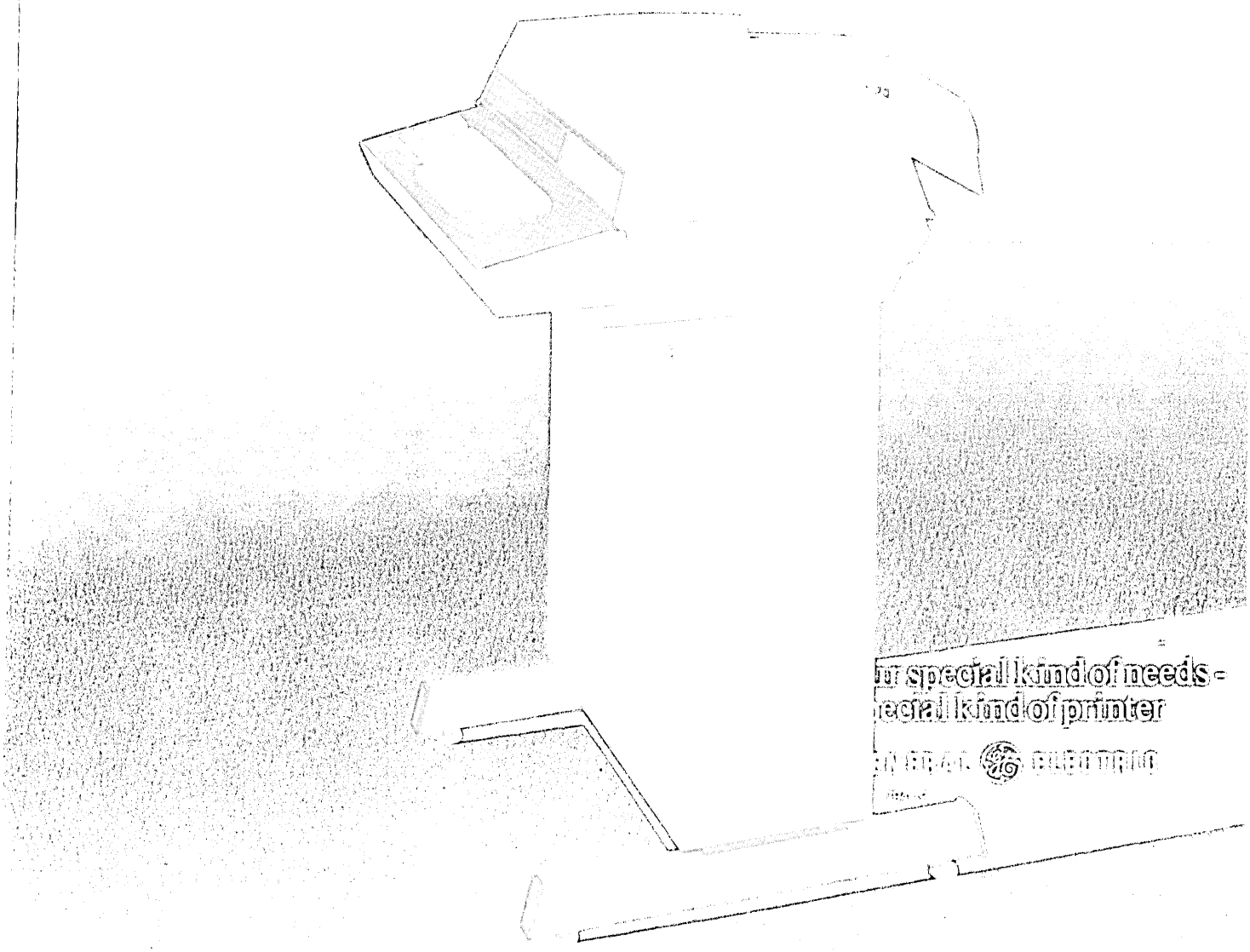
Stylish, compact, and cost-conscious, the TermiNet 30 printer adds expanded dimension to GE's line of high performance printers. GE technological breakthroughs combine to make this all new 30 CPS matrix printer one of the best values available anywhere. Breakthroughs like consolidating the electronics into two circuit boards that perform the basic printer functions with outstanding reliability and simplified maintenance. Breakthroughs like the rugged printhead that's built for extra long life of trouble free service.

Ease of operation breakthroughs offer customers the option of convenient handling of 132 column printing on 9½ inch wide paper that substantially reduces paper costs, or the standard 80 print column on the same size paper. And, like the convenient ribbon "mobius" loop cartridge that extends ribbon life, and makes ribbon replacement clean and simple.

All of these and more, backed by nationwide service in 92 locations, add up to a 30 CPS matrix printer that is designed to fill your needs for an efficient, highly reliable printer at an attractive low price.

For more information on the new TermiNet 30 printer, write General Electric, Data Communication Products Department, Waynesboro, Virginia, 22980 or call your nearest GE sales office listed on the left.

General Electric introduces the TermiNet® 30 Matrix Impact Printer



Why Datamation, the best magazine to reach the End User Market, is also the best magazine to reach the OEM Market.

It's measurable.

At DATAMATION, we watch every development in the EDP marketplace, because that's where we live, too.

We've seen the trend—the shift in marketing and product strategies. The sharp lines between OEM and End User accounts are dissolving, marketing efforts are being redirected, and the new term in production is vertical integration.

With this shift, advertisers are asking new questions about old media choices. They're measuring.

Two such firms recently asked their customers: "If you could read only one magazine, which would it be?"

They carefully measured responses by type of customer.

First choice of End Users? DATAMATION.

First Choice of OEM's? DATAMATION.

For obvious reasons, we can't print the names of those companies, but we can show you the results, and—more to the point—help you plan your own analysis.

We know that when you do it, DATAMATION will measure up.

tp Technical Publishing Company

DATAMATION®

First in market coverage—worldwide.

New economic picture!

The $3995 E4010-1: a graphic example of great new prices.

Tektronix presents a new terminal, free options, and a great 4023 lease plan. You'll save up to 22%!

We're calling it our All in the Family Sale, because price savings can be found up and down the Tektronix family of graphic and alphanumeric terminals.

Take our new E4010-1. It's very similar to our standard 11″ hard copy-compatible graphic terminal, with the same high quality graphics we're famous for.

The E is for Economy. Designed without a cross-hair cursor, it still allows all graphic input from the keyboard itself. It's a small distinction, but a very distinctive price difference: at $3995*, it's $700 cheaper than the 4010-1. And at $3795, our E4010 is a full $400 cheaper than the 4010.

The easy copier. Copy compatibility comes a whole lot easier with our new 4631 hard copy unit . . . designed to deliver superior performance and easier maintenance, while saving you $400 to $900 over any of our previous models.

New standards. We're attaching the usually optional $350 rulings character set to our 4023 alphanumeric terminal. Now you can quickly format standard forms at no additional cost.

Lease for less. We've also made a $50 reduction—to $140—in the monthly lease for the 4023 with rulings character set. That's a savings of over 22%.

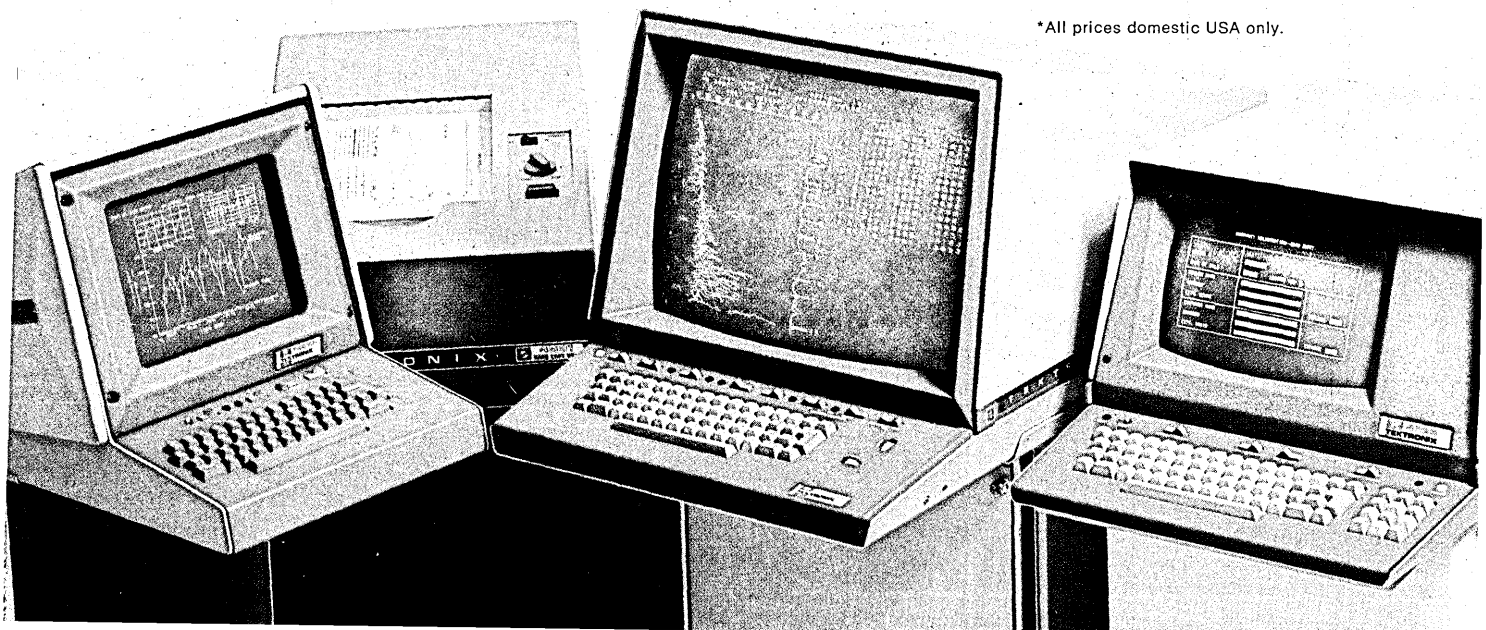
Right now our terminal family can solve your budget problems—and do a lot more problem-solving every day. Talk to your Tektronix Sales Engineer soon. Or write:

Tektronix, Inc.
Information Display Division
P.O. Box 500
Beaverton, Oregon 97077

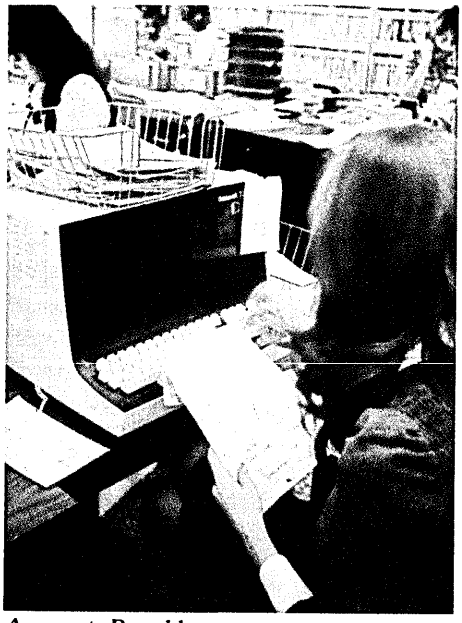
TEKTRONIX®

CIRCLE 61 ON READER CARD

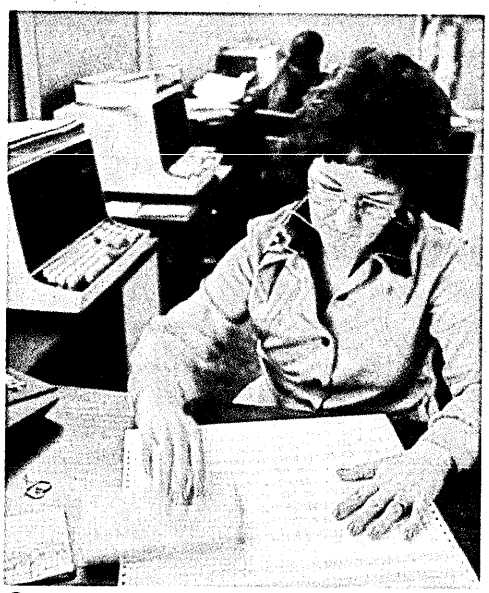
*All prices domestic USA only.



For your total business



Accounts Payable



General Ledger

Under Datashare control

- *The Datapoint 5500*
- *300 lpm printer*
- *2 large disk units*

Inventory Control

Accounts Receivable

Sales Order Entry

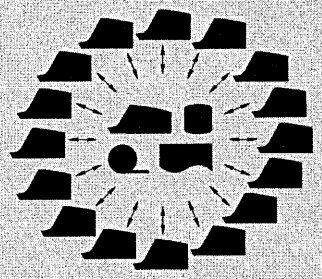
data processing needs: Datapoint's New, Expanded Datashare System

- ***Datapoint 5500 Central Processor/Mass Storage Disk Units***
- ***Datapoint 3600 Remote Terminal/Hardcopy Terminal Printers***
- ***Datashare III***

The new Datashare system, from Datapoint, builds on the success of the initial Datashare based on the Datapoint 2200 processor. The concept remains the same—a compact central computer with associated peripherals providing the people who need it most compute power at remote work stations for a variety of business data entry and processing needs—but capacity for work throughput and diversity of applications have expanded greatly with the new version. For businesses whose workload has outgrown both available equipment and available budget, Datashare represents a real breakthrough. Nowhere else can you get such a total business data processing capability at such a modest cost. Let's take a closer look at these new elements and what they can do for you.

The Datapoint 5500—a compact but powerful business processor that incorporates the very latest integrated circuit technology. Physically the same size as the Datapoint 2200 and 1100, the 5500 offers 64K high-speed internal memory and an advanced processor architecture with a wide variety of printers, tape units and disk systems (see list). It can supply up to 16 work stations simultaneously with compute power. In one typewriter-sized unit the 5500 provides the basis for an independent "computer utility" operation (even while it serves optionally as a highly efficient data communications link to a central computer complex.) Fully compatible with software created for the Datapoint 1100 and 2200 systems.

The new Datashare—supporting up to 16 remote work stations



Each remote unit may be equipped with a printer unit for hard copy capability.

The Datapoint 3600—a low-cost video terminal with upper case/lower case capability, a unit designed for efficient satellite use with a Datashare configuration. (Datashare also works efficiently with other Datapoint units such as the 1100 and 2200 and all TTY-compatible terminals.) The optional 120 CPS belt printer serves as a hard copy outlet for work stations where printer information is desirable.

Datashare III—the enhanced master control system that extends Datashare capability to 16 remote stations, allows users at these stations access to the expanded number of peripheral units that may be associated with the 5500. Version III offers greatly improved file creation and handling capability, including advanced file protection/security and virtual memory techniques.

Additional Datashare components have been added but the Datashare philosophy remains the same—to provide the business user a low-cost, highly productive way to disperse a powerful data entry and data processing capability among departments and field offices. Either as an independent system or as part of a larger computer/communications network, the new, expanded Datashare is available now to help your organization. For further information contact the Datapoint sales office nearest you or write or call Datapoint Corporation, attention: Marketing Department, 9725 Datapoint Drive, San Antonio, Texas 78284 (512) 690-7151.

Datashare Central Processors and Peripherals

Processors
Datapoint 2200 with 16K memory
Datapoint 5500 with up to 64K memory

Data storage
Cartridge disk (2.4 mil. char. storage on replaceable disks), 4 max. 2.4-9.6 mil. char. storage on 2200 or 5500
Mass storage disk 20-40 mil. char. storage on 2200
25-200 mil. char. storage on 5500

System Printers:
300 LPM Drum Printer
60-120 LPM Matrix Printer
60-120 LPM Belt Printer
30-60 CPS High quality print servo printer

Communications to terminals
Direct wire, 1200 Baud
Leased line, 1200 Baud
Dial up, 300 Baud

Card Reader
300 cpm

Magnetic tape drives
556,800 and 1600 bpi
7 and 9 track

Cassette tapes
Integral to 2200 and 5500 processors

User terminals
Datastation 3600 terminal
Datapoint 1100 intelligent terminal
Any TTY-compatible terminal

Terminal printers
120 cps Belt Printer
Any Datapoint/System printer used with Datapoint 1100 and 2200

DATAPOINT CORPORATION

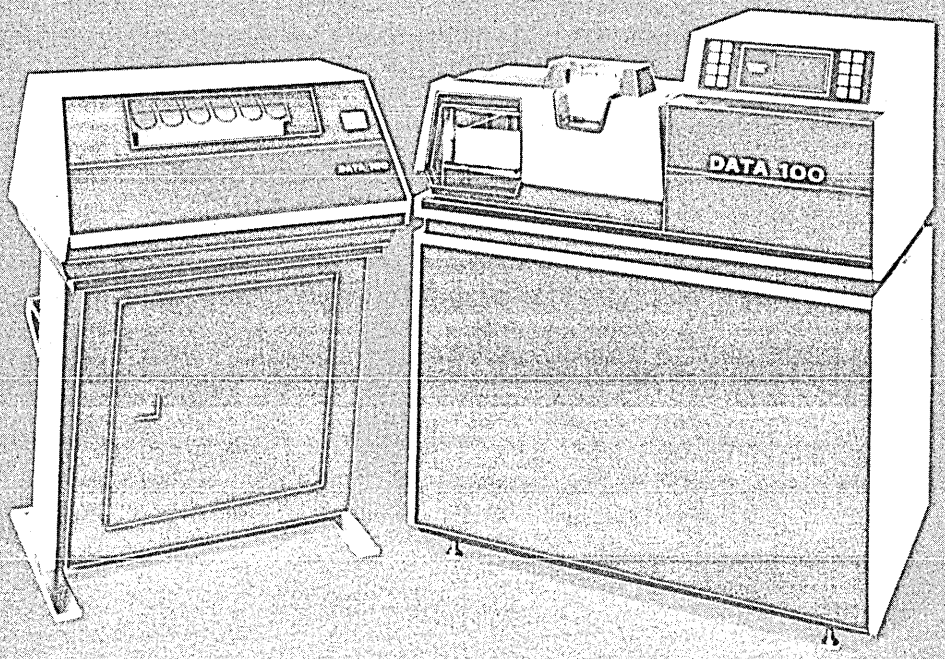
The leader in dispersed data processing

See the new Datashare in action—Booth 1649-51, NCC

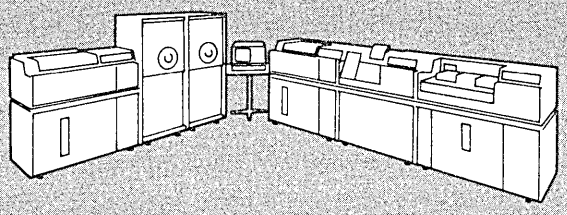
Home Office: 9725 Datapoint Drive, San Antonio, Texas 78284 (512) 690-7151 • **Sales Offices:** Atlanta/(404) 458-6423 • Austin/(512) 452-9424 • Baton Rouge/(504) 926-3700 • Boston/(617) 890-0440 • Chicago/(312) 298-1240 • Cincinnati/(513) 421-6122 • Cleveland/(216) 831-0550 • Dallas/(214) 661-5536 • Denver/(303) 770-3921 • Des Moines/(515) 225-9070 • Detroit/(313) 478-6070 • Greensboro/(919) 299-8401 • Hartford/(203) 677-4551 • Honolulu/(808) 524-3719 • Houston/(713) 688-5791 • Los Angeles/(213) 645-5400 • Milwaukee/(414) 453-1425 • Minneapolis/(612) 854-4054 • Nashville/(615) 385-3014 • Newark/(201) 376-1311 • New York/(212) 759-4656 • Orlando/(305) 896-1940 • Philadelphia/(215) 667-9477 • Phoenix/(602) 265-3909 • Pittsburgh/(412) 391-7213 • Portland/(503) 761-2250 • Puerto Rico/(809) 783-5320 • Salt Lake City/(801) 272-6441 • San Diego/(714) 460-2020 • San Francisco/(415) 968-7020 • Seattle/(206) 455-2044 • Stamford/(203) 359-4175 • St. Louis/(314) 291-1430 • Tulsa/(918) 664-2295 • Washington, D.C./(703) 790-0555 • **International:** TRW/Datacom—International/Los Angeles, California, TELEX 691286 (213) 475-6777 • Sydney, Australia/(2) 922-3100 • Vienna, Austria/0222/36 21 41 • Brussels/3762030 • Rio de Janeiro, Brazil/222-4611 • Copenhagen/(01) 965-366 • Guayaquil, Ecuador/394844 • London/903-6261 • Helsinki/90-661 991 • Paris/(1) 657-13-31 • Hanover Germany/(0511) 634-011 • Rotterdam/(10) 216244 • Hong Kong/(526) 4111 • Tel Aviv, Israel/(03) .410565 • Milan/316 333 • Tokyo/264 6131 • Beirut/348 340/1/2 • Kuala Lumpur, Malaysia/73901 • Oslo/15 34 90 • Makati Rizal, The Philippines/877 294 • Singapore 92765 • Tehran, Iran/8538857 • Johannesburg/724 9301 • Stockholm/(8) 188295 • Lyss/Byrne/(32) 844240 • Taipei, Taiwan/(361) 7241

NOW $551 Per Month Buys You DATA 100 Batch Terminal Performance

NEW MODEL 76



The new DATA 100 Model 76 is a low-cost, general purpose remote batch terminal with IBM 2780 and 3780 plug compatibility. Standard versions include 150 to 1250 LPM printers, 150 to 1000 CPM card readers and optional card punch. The above five year lease price includes a 150 CPM card reader and a 210 LPM, 132 print position line printer. The Model 76 is the newest member of DATA 100's growing family of low-cost terminal products. These include, with a wide variety of optional choices, the programmed Model 78 and Model 74, and Keybatch with exclusive editing capabilities for remote batch and data entry. Each DATA 100 product is supported by a sales and service network operating from over 230 locations world-wide.



DATA 100
CORPORATION

7725 Washington Avenue South, Edina, Minnesota 55435 • 612/941-6500

CIRCLE 21 ON READER CARD

Editor's Readout

John L. Kirkley, Editor

In Restraint of Trade

Governments are funny things.

Particularly when it comes to money. More often than not they're incredibly sloppy, wasting taxpayer dollars with mad abandon; and then, as if to counteract this fiscal wantoness, important budgets are slashed on the basis of some obscure and bizarre logic. It's like cutting off your leg to lose weight.

Take the matter of the $6 million lopped from the Commerce Department's foreign trade promotion budget. To the Pentagon, $6 million is coffee money. To Commerce it's a 50% cut in overseas trade promotion events—events designed to improve our position in a fiercely competitive world market.

Add to that a "full cost recovery" plan: another monetary nightmare from the same source that trimmed the budget—the White House's Office of Management and Budget (OMB). Commerce will still be allowed to subsidize part of the cost of missions and shows for brand new U.S. exporters and for companies that are attempting to open up a new overseas market. But the price of admission to Commerce's shows for "established" companies is a full share of all support costs. (The precise definition of an established company is not yet clear.)

Trade missions and other Commerce activities in the Eastern Bloc countries are unaffected by the budget cuts. Although this is an interesting and developing market, it represents only a tiny fraction of the existing Free World market.

The immediate effect of the $6 million slice has been the cancellation of U.S. participation in a number of important overseas shows; many, such as Munich '75 in October, are big computer industry trade fairs where U.S. companies have done good business in the past. Also cancelled are computer-related trade missions to South America, Africa and Saudi Arabia.

Commerce officials also expect a 10% RIF (reduction in force) among their U.S.-based field staff.

One might argue that a little frugality is certainly called for during these hard times. But it's the long range implications of the OMB actions that give these directives their Kafkaesque quality.

We are faced with a continuing $3-5 billion trade deficit. Our unemployment rate is creeping up toward the 8% mark. Other countries of the world, especially Japan and West Germany, are stepping up their already high level of promotional activity in order to offset a balance of trade injured by high oil import prices. Most of our high technology competitors rely heavily on export trade: they know how to play the game. Our sluggish attitude toward developing international markets is no longer appropriate in a world where oil cartels significantly impact our economy.

OMB's answer? Two dollar devaluations and a floating world currency make the price of American products so attractive that promotion really isn't necessary.

But how, asks Commerce, can you compete against the offerings of other nations if the customer doesn't even know your product exists? And even if he has heard of you, how can you expect to disrupt old buying patterns and edge out aggressive competitors without skillful promotion? Commerce's point: price competition alone has never been enough, whether you're selling toothpaste or tape drives.

A president of what must be considered a very "established" computer equipment company commented that the missions are one of the best services Commerce has to offer. His company has been actively involved in the shows for years and has built a thriving overseas business. "It's a great way for a U.S. businessman to determine, at a low cost, whether or not a promising market exists. And it's a nice platform —the shows are well done and you're in good company."

Terming the cut "short-sighted," he commented that his firm would be less interested in participation now that OMB wants to recover a prorated share of the costs. He's not alone. Other large companies may pull out under these conditions, leaving the trade shows to the small and the unknown. Without the drawing card of the big firms, customers may stay away in droves. And the shows will slowly wither and die. The small and medium sized companies will bear the brunt of this senseless blue-penciling.

The pending 10% layoff of Commerce's domestic field personnel will seriously hamper their efforts to interest the small and medium sized U.S. firm in marketing their products abroad. Less than 5% of the firms that have the potential to export their products are doing so—and most of these are Fortune 500 companies.

Congress should rectify the Ford Administration's mistake. Congress should restore the $6 million so that Commerce can get on with the business of helping to improve our competitive position in world trade. The "full cost recovery" plan should be dropped and the RIF cancelled.

But even more needs to be done. Both the White House and Congress should join together in a determined effort to substantially increase the U.S. presence in the world marketplace. This means even more missions, even more trade shows. . . and more subsidy money for big and small firms alike. And the grass roots missionary work to get small firms to look toward overseas markets should be intensified.

What can you, the individual reader, do? Write your trade association expressing your views, whether it's CBEMA, ADAPSO, or the Electronic Industries Association. And drop a carbon copy of your letter to the new Secretary of Commerce, Rogers Morton, Washington, D.C. 20230. And to Sen. Daniel K. Inouye (Washington D.C. 20515), whose commerce committee held open hearings on this matter late last month.

We think this is one instance when increased government spending makes sense. □

'75 NCC

"What Should be Brought to National Attention?"

by Tom McCusker, Senior Associate Editor

That's the question NCC program planners have asked in putting together an 89-session program addressing "challenges in a new era."

It's an eventful week for the computer community.

On Monday, May 19, in a sedate federal courtroom in New York City, a massively complex six-year-old antitrust case finally goes to trial. On May 19, across the continent and amid the hotel/motel lined streets and the make-believe of Disneyland, some 25,000 people begin filing into the Anaheim, Calif., convention center for a four-day conference and exposition.

The oft-postponed trial of the Justice Dept.'s antitrust suit against giant IBM, which likely could be deferred again, and the third National Computer Conference come at a time of much change for the computer community and its increasing visibility within society. The American Federation of Information Processing Societies (AFIPS), which stages NCC, calls it a "New Era." It will address its four-day program of 18 computer topics to "Challenges in a New Era."

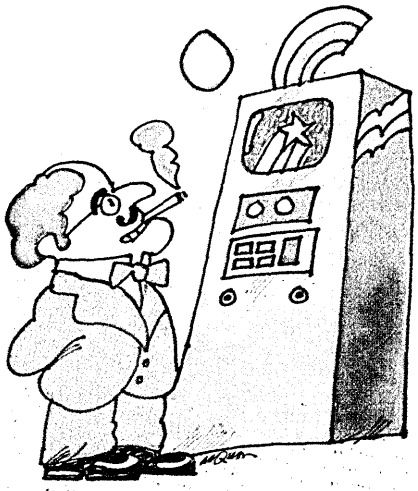
Says Stephen W. Miller, the technical program chairman, "A decade ago, our industry still focused prime attention on basic technology. But now, technology must be evaluated in terms of its impact on, and interaction with, society as a whole. As it faces these broader concerns, the data processing industry is entering a new era.

"It's an era when information will be transmitted over larger geographical areas, when new forms of data transmission will compete with traditional business communications channels, and when economical, decentralized data processing will come to the fore. And it's an era of growing social pressures to regulate the data processing industry."

It's a time, too, when the computer industry seeks a more active voice in the halls of legislation. This spring, the 45-company Computer Industry Assn. (CIA) packed up and moved its San Fernando Valley headquarters in Encino, Calif., to new headquarters in Washington, D.C. The association, a vigorous advocate of competition in an IBM-dominated industry, also will pursue such other issues as regulation of the communications industries and privacy legislation.

And AFIPS, despite its tax exempt status that precludes it from lobbying activity, this month opened a Washington office with a full-time director, Philip Nyborg. The federation also has nominated the candidates it wants appointed to the federal Privacy Protection Commission set up by the Privacy Act of 1974 and to the Commission on Electronic Funds Transfer. The findings and recommendations of these commissions are expected to influence any future legislation concerning the way records are kept on individuals and the way banks and other financial institutions do business with each other and the public in an age of computer convenience.

Conference Particulars



Dates: May 19-22

Place: Anaheim Convention Center, Anaheim, Calif.

Technical Program: Monday, 2 p.m.-5:30 p.m. Tuesday, Wednesday and Thursday, 8:15 a.m.-5:30 p.m.

Exhibits: Monday, 11 a.m.-7 p.m. Tuesday, Wednesday and Thursday, 10 a.m.-6 p.m.

Fees: Conference, exhibits and proceedings for entire conference, $75. Exhibits only for one day, $10. Exhibits and conference one day, $25. Students, $10 for entire conference and exhibits.

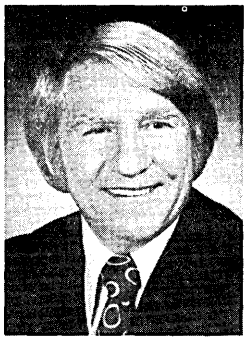
Sponsor: American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645. Toll free number: (800) 631-7070

Third conference

The NCC in Anaheim, May 19-22, is the third once-a-year conference to be staged by AFIPS, as a successor to the semiannual Spring and Fall Joint Computer Conferences held in the east and west respectively since 1951. An earlier recession in 1972 precipitated a move by exhibitors to have the event changed to a once-a-year event, the first of which was held in New York in June 1973. It moved to Chicago in 1974 in May and to the west this year. It will return to New York in 1976. As with most "national" conventions, however, it remains essentially regional, drawing at least 70% of its attendance from within a 500-mile radius of its location.

The conference is a major source of revenue for activities of the AFIPS, a super society of 15 computer-related professional societies claiming a total membership of 100,000. It consists of that conference program of 89 sessions on 18 topics, an exhibit by 270 companies and many special events. Among the special events:

- A keynote address May 19 by computer science pioneer Jay W. Forrester, discussing computer modeling of social systems. Forrester, of MIT, authored the book *World Dynamics* which is said to have stirred a group of international thinkers called the Club of Rome to sponsor a long range study on the predicament of mankind that led to a widely discussed report, "The Limits to Growth."
- Luncheon talks by Univac's product strategy vp Neil Gorchow, Georgia's former governor Jimmy Carter, and the Federal Reserve System's Gov. John E. Sheehan.



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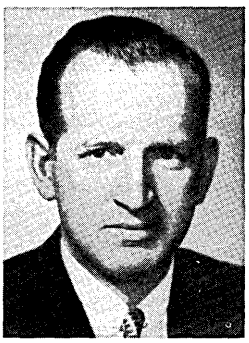
JAY W. FORRESTER

NEIL GORCHOW



JOHN E. SHEEHAN

Donal A. Meier is general chairman of the 1975 NCC. Stephen W. Miller is the program chairman. Jay W. Forrester of MIT will deliver NCC keynote address Monday. Neil Gorchow, vice president for product strategy and requirements at Sperry Univac, and John E. Sheehan, member of the board of governors of the Federal Reserve System, will address NCC luncheons Tuesday and Thursday respectively. Former governor Jimmy Carter of Georgia will address the conference at 1 p.m. on Wednesday.

• A massive cocktail party on opening night.

• A day at Disneyland at cut rate on Wednesday, May 21.

• The high school computer science fair; a science film theatre, and an art show entitled "The Silicon Age."

Turnout of 25,000

AFIPS officials think they'll be able to draw about 25,000 to the Anaheim convention center, some 40 miles south of Los Angeles. That would be about the same as turned out in Chicago last year, but 7,000 fewer than the turnout at the first NCC in New York. But AFIPS president George Glaser admits "we have no way of predicting what the exact turnout will be" in a year of economic uncertainty. One thing going for the conference is its turnout of exhibitors, higher by 20 companies than in Chicago and five who cancelled in December and January because of the recession have since renewed. But economic conditions still are a gloomy factor, particularly in anticipating a turnout of representatives from overseas companies. Miller said that some overseas participants in the technical program have cancelled; others who had planned to send several authors of papers have since advised that only one author will turn up.

In fact, a day-long program May 21, entitled "International Dialogue" turns out to be very much a U. S. dialogue. In the four sessions, the only paper to be delivered is one on standard interfaces for medium speed printers by Gary E. Jones of Odec Computer Systems, of Warwick, R. I. All other participants are listed as "panelists"—one from Japan, one from Switzerland, five from France (of which one is doubtful to attend) and three from the U. K. (with one of them expected to be a no-show). Seven other panelists are from the U. S. Topics to be covered in the four sessions: Public Packet Switching; International Data Communications Policy; Impact of Computer Interface Standards; and Interface and Software Standards—Japanese and European Viewpoints. An unfortunate sidelight: the chairman of this last session was to have been Dr. Toshio Ikeda, managing director of Fujitsu's Information Processing Systems Group, who died last summer after committing to Miller, who began organizing the program a month before the 1974 NCC opened in Chicago last May.

Nevertheless, Miller and his associates have assembled an admirably topical program that adequately addresses the issues of challenge in a new era, issues that "are a lot more than just somebody updating last year's work."

"What we wanted," Miller said, "are people with something to say that should be brought to national attention." In doing so, Miller's group sought topics that would appeal to three general types of attendees: the technically oriented people looking for innovations in system design; the problem solving users interested in methods and applications; and the persons concerned—directly or otherwise—with computer technology and its impact with society.

But there is a little for all three groups in nearly all of the topics covered, regardless of their label—and mercifully, the number of sessions has been reduced to 89 from the more than 110 presented last year in Chicago's massive McCormick Hall. Among them:

Microprocessors: A day-long program on microprocessors tries to answer four questions: what are microprocessors, where are they being used, what are the future applications, and what about the software problems?

The advent of the microprocessor has spawned a whole new cast of computer vendors and consultants—the new vendors being the semiconductor manufacturers who have traditionally shunned the minicomputer market because they were that market's prime component supplier; the consultants being those providing software support because the new vendors, the semiconductor houses, generally are deficient in this regard. Some aspects of the software questions, although not enough according to some critics, will be addressed in a session called microprogramming and microcomputer programming. Among the papers is a discussion of a project at Stanford Univ. to develop an emulation system for user microprogramming. Called "Emmy," and discussed by Michael J. Flynn, it is said to exemplify dynamically microprogrammable "soft" architecture for emulation of various target machines and the development of specialized language processors.

An introductory session, microprocessor basics, will review developments at Signetics, National Semiconductor and Motorola Semiconductor. It will be followed by talks by representatives from Hewlett-Packard, Warner & Swasey the machine tool manufacturer, Beehive Medical Electronics and NCR on some current applications of microprocessors. For the designers of high performance large systems, a four-paper session on bipolar microprocessors has been organized.

Computer-Communications Networks: Fourteen papers are to be presented on four subjects: a tutorial on computer communications, advances in packet switching, advances in packet radio communication, and the future impact of packet radio (a major benefit of this being a convenient and flexible organization of terminals, computers and data bases and low power transmission for personal computing).

A paper by Ivan T. Frisch and Howard Frank of Network Analysis Corp., entitled "Computer Communications: How We Got Where We Are," is expected to provide an excellent update on computer communications. Critics note, however, a lack of attention to IBM's announced Systems Network Architecture (SNA) in any of the papers discussing current and future trends in data communications. The four-paper session on packet radio should intrigue the multitudes in data processing who've never heard of the term.

Computer Software: Eight sessions will cover software with 19 panelists and 16 formal papers. Some titles are deceiving. One entitled, "An Anglo-

'75 NCC "What should be brought to national attention?"

French Study of Software Portability" by P. J. Brown, turns out to be a report on the feasibility of such a study. Another, "Better Manpower Utilization Using Automatic Restructuring," by Guy de Balbine, concerns a technique not now in use. A winner, according to critics, could be a session Tuesday morning, "Programming—Art, Science or En-

gineering?" It's all about how programming can be improved and the speakers bring excellent credentials. They are: Edward Yourdan ("Structured Programming and Structured Design as Art Forms"); Stephen N. Zilles ("Modularization Around a Suitable Abstraction"); P. J. Plauger ("Minicompilers, Preprocessors and Other Tools"); and Peter J. Denning ("On Being One's Programming Self").

A session Wednesday on Operating Systems Theory features a paper by SDC's Richard R. Linde with the intriguing title, "Operating Systems Penetration."

Data Base Management: Four of seven sessions on data base management deal with the concept of "relational" data base management, considered by some as a wave of the future, by others as yet to be proved and by most as worthy of close examination. "There is a blue sky aspect to it," says IBM's Dr. Edgar F. Codd, "but more than one company is keenly interested in it . . . and its concepts can be applied to the simplification of network data base management." Dr. Codd, who is chairman of a tutorial and panel discussion on the topic and technical director of the entire seven session program on DBM, thinks that users will find the relational model to be a "much simpler way of looking at data." It's first and foremost a method of structuring formatted data in large data bases. It requires that all the formatted data be represented in tabular form. In contrast to network-oriented models, such as the model advocated by the CODASYL data base task group, there are no access paths linking one table to another. As a result, the historical and artificial distinction between data on the one hand and relations on the other is obliterated. Users retrieve any data they desire by specifying its properties instead of specifying which access paths are to be followed to find that data.

As yet to be proved, and its performance question still an open issue, the subject should be of interest, says Dr. Codd, if only to allow people to think about adopting certain kinds of disciplines in their DB systems so that if relational data base concepts become the way of the future they can be adopted without serious disruption in existing systems.

Actual implementations on a machine of the concept will be discussed

Banking Made Exciting

"We want to make banking exciting to the technical guys. . . to let them know it's more than green eyeshades and quill pens," said Bill Stritzler, AT&T, organizer of a day-long series of NCC sessions on the banking industry and electronics funds transfer (EFT).

"Data processing people should understand that banking, as an industry, has moved into an era of understanding and using technology as a part of basic business."

All of the four banking sessions are panel sessions. "We're hoping informality will generate audience participation and bring out opposing points of view," said Stritzler, who formerly was a data processing officer with Wells Fargo Bank in San Francisco.

This is most likely to be achieved in the opening session on "Electronic Funds Transfer Systems—What's In It For You?"

"This (EFTS) is an opinion oriented activity rather than a factually oriented activity," said Stritzler. "There are more people around with opinions than there are with facts." Although legislation is a big part of EFTS progress today, he doesn't expect the session will touch much on this but rather will concentrate more on the hardware, software and communications requirements for today and the future. He hopes discussion "will zero in on funds transfer technology of the future. . . where technology is leading us."

Stritzler feels the appeal of the banking sessions is "not restricted to bankers. We have tried to make the subject matter generically interesting to everyone in a systems sense and a technical sense." In the funds transfer area in particular, he noted, "the importance goes well outside the banking community, to any activity that touches the consumer."

Chairman of the EFTS session is B. Ray Traweek, a senior director of systems activities for National BankAmericard Inc. Panelists are Barry Wessler, Telenet Communications Corp.; James F. DeRose, IBM; and Traweek.

Second session in the series is on "Implications & Applications of Communications Based Systems Technology on Banking Operations," chaired by Larry Dorf, manager of the technology group at Security Pacific National Bank, Glendale, Calif. Stritzler sees this as the kind of a session people will leave "with specific answers to their specific problems." He described it as a session that should "interest anyone facing problems of applying communications technology to large data bases."

Panelists and their topics are David Harris, IBM, "Remote Devices in Banking Offices;" Leo J. Cohen, Performance Development Corp., "Data Base in Banking Operations;" and Robert M. Wainwright, Robert Wainwright Assoc., "Networks and Money Transfer Operations."

A session on "Banking's Back Office Paper Problems and Approaches to Solutions," is one Stritzler feels should interest anyone involved with systems problems. Its chairman is Watson M. McKee, Jr., Wells Fargo Bank, described by Stritzler as a man "whose entire career has been devoted to back office automation." Panelists are Roy F. Bonner, IBM; Don Lewis, Burroughs Corp.; and Leonard J. Nunley, Recognition Equipment, Inc.

'More of a tutorial,' is the way Stritzler describes the final session in the banking series on "Data Base Technology in the Banking Industry." Chairman Bernard K. Plagman, a consultant on data base systems, has focused the session on current and future data base technology in banking but the technology to be covered, said Stritzler, is applicable in nonbanking areas as well. Panelists are Gene Altshuler, Stanford Research Institute, and Joseph Judenberg, Chase Manhattan Bank. □

in another session, entitled Data Base Machines.

In another session on the more traditional topics in data management, to be held Thursday afternoon, two papers on data compression and performance evaluation are given high marks by those reviewing the NCC program. One, "A Classification of Compression Methods and Their Usefulness in a Large Data Processing Center," is being given by four authors from Fireman's Fund Insurance Co., Oakland. Three authors from Japan's Hitachi will discuss "A Simulation Model for Data Base Performance Evaluation."

Another Thursday afternoon session is a must for anyone following trends in distributed data bases—shared data bases that are comprised of logically related but physically separate files. Dr. Codd notes however, that the papers discuss investigation that is at an early stage. The papers and authors: "Optimizing Distributed Data Bases: A Framework for Research," by K. D. Levin and H. L. Morgan, The Wharton School; "Structured Organization of Clinical Data Bases," by Gio Wiederhold, J. F. Fries and S. Weyl, Stanford Univ.; and "Integrated Data Bases for Municipal Decision-Making," P. E. Mantey, IBM, San Jose.

The Conference at a Glance

Monday, May 19
Morning:
Keynote Address

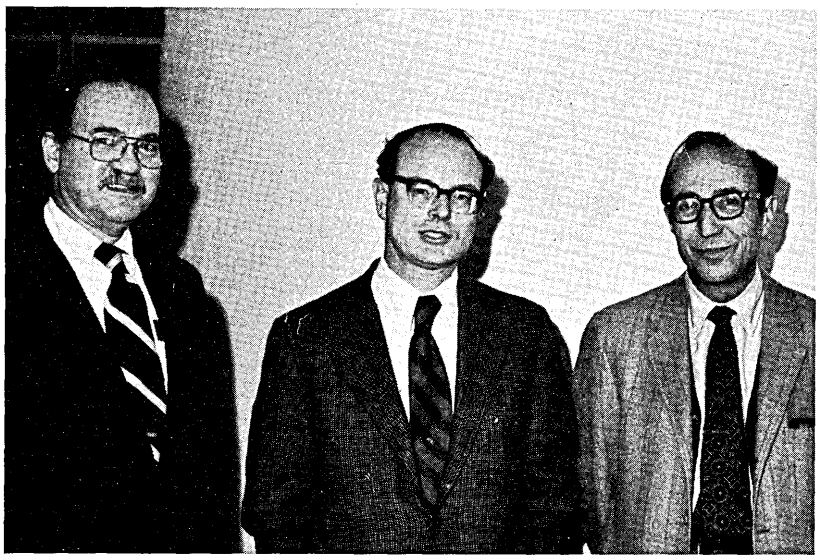
Afternoon:
Program Funding
Interactive Graphics
User Requirements
Social Impact

Tuesday, May 20
Morning & Afternoon:
Microprocessors
Computer Software
Banking
Making Computers Safer
Education, Curricula, Training

Evening:
The Editors Speak Out
Data Processing in 1980-1985

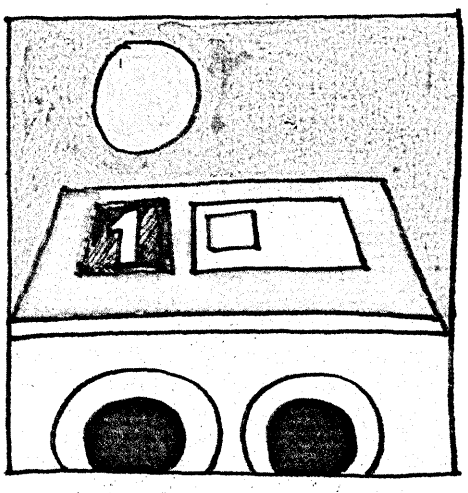
Wednesday, May 21
Data Base Management
Program Funding
Computer Software
Design Measures
Users' Viewpoint on EDP
Legal Aspects of Computer Management
Storage Technology
International Dialogue
Health Care and Computers
Pioneer Day

Thursday, May 22
Data Base Management
Computer-Communications Networks
Management and Computers
Applications
Interaction of Technology & Architecture
Innovative Applications of Computer Science



PIONEER DAY: A three and a half hour program will be held May 21 during NCC to honor the scientists, philosophers, mathematicians, engineers and meteorologists who worked with Dr. John von Neumann on the Electronic Computer Project at the Institute for Advanced Study, Princeton, N.J. Talks discussing the work of these groups will be given in panel form during the session to be called Pioneer Day. Principal organizers are, from left, James Pomerene of IBM Corp., Dr. Bruce Gilchrist, Columbia Univ. and Dr. Herman Goldstine, an IBM Fellow at the institute. A fourth organizer is Dr. Willis Ware of Rand Corp.

Storage Technology: As could be expected, the announcement last fall of IBM's 3850 mass storage system has sent users scurrying to survey the need for peripheral systems that give them low-priced on-line storage up to a trillion bits without manual intervention. The suppliers and would-be suppliers will be there to discuss their systems. There will be papers on bubble domain and superconductive memories employing Josephson devices as well as holographic



memories. One of the questions to be asked in a panel discussion on "System Implications of Advancing Storage Technology," is: Does the megabyte memory serve to make the intelligent memory terminal the site of most computing, while the centralized system serves only as a library and data sharing medium?

Interaction of Technology and System Architecture: Eight papers and four panelists. A paper by Ugo Gagliardi, formerly of Honeywell and now of Harvard, "The Impact of New Technology on Data Management Architecture," looks at the cost and density trends in main, disc and archival memories and how they affect system architecture and operating concepts for files, data bases and library systems. Charles Bachman of Honeywell brings it all together in a paper, "Trends in Data Base Management—1975." Richard P. Case, IBM-Poughkeepsie, leads a panel on the future wherein there may be hints of what the mainframers are thinking to offer in tomorrow's systems.

Forecasting EDP: Four sessions look at the state of data processing tomorrow. One four-paper session examines future technology transfer from R&D into aerospace requirements. Two Tuesday morning sessions will feature

'75 NCC "What should be brought to national attention?"

four papers on future prospects for data processing and be followed after lunch with a panel discussion on the papers. Critics give high marks to a paper, "Innovations in the Operation of Future Computers," by Frederick G. Withington, Arthur D. Little, Inc., who also will be a panelist in the afternoon session.

Interactive Graphics: Finally, say the critics, attention is being given to the economics of this discipline. How do you justify these systems on an economic basis, asks S. H. Chasen of Lockheed Aircraft, in a paper, "Economic Principles for Interactive Graphic Applications."

Users Viewpoint on EDP: Four sessions of panel discussions, one of which discusses the highly topical issue of privacy legislation and features Rand Corp.'s Willis H. Ware and the White House's Douglas Metz. That session, "Issues and Answers—Data Security and Personal Privacy," is a must for anyone who keeps personal information files.

Management and Computers: This is a four-session program on Thursday in which one session examines the evolution and future of data processing from the data processing management's viewpoint and a second session in which the user management speaks out. Two papers receive high marks in a session on Management Issues in Computers: "Practical Guidelines for EDP Long Range Planning," by John V. Soden and George M. Crandell, Jr., McKinsey & Co., Los Angeles, and "Cost Benefit Evaluation of Interactive Systems," Henry C. Stern and George C. Holt, Technology Management, Washington, D. C.

User Requirements: Two sessions on Monday afternoon concern the technology needs of users and how they can address these needs to the technology developers. Systems are developed for use by many. Who's to make up for the non economy-of-scale when the vendor must supply systems on a onesy-twosy basis? The subject could be vague, except for the cast of characters in a panel on technology transfer: Lewis M. Branscomb, IBM's chief scientist, Stanford Provost William F. Miller and Richard Mills of First National City Bank of New York.

Education-Curricula-Training: The technical director of this four-session

Artificial Intelligence in the Real World

Four NCC sessions on "Innovative Applications of Computer Science" have been designed to show how artificial intelligence techniques are being put to practical use in the real world.

"From time to time, critics have looked upon artificial intelligence as an ivory tower activity," said Bertram Raphael, Stanford Research Institute, session coordinator. "We want to show them how intelligent computers are moving into vital, practical roles."

ANTHONY W. CONNOLE
It isn't wise to rush into total automation

The first three sessions cover use of AI ideas in medicine, education, and automation and should appeal to people in these fields. The fourth is a kind of summary session. "Our general theme should be exciting to anybody," said Raphael. "How are computers really becoming smarter?"

Most of the participants in the session are involved in advanced work using AI techniques but not all of them. One of the panelists in the automation session is Anthony W. Connole, administrative assistant to the vice president of United Auto Workers in Detroit.

Connole sees as his mission, "to warn this group that in times like these it isn't wise to rush into total automation... not until the economy can absorb the existing work force." He hopes to identify the socioeconomic effects of automation.

He said he will urge the use of attrition to reduce work forces and will suggest a national, tax supported training program under which companies would give employees leaves of absence to take training to upgrade existing skills or learn new ones and the government would provide them an allowance while training. He also will suggest use of computer technology to forecast what the job market will be "a decade hence."

Others on this panel will cover conventional automation including numerical control and direct computer control and the potential and work force impact of the latest developments in artificial intelligence. They are Eugene Merchant, Cincinnati Milacron Inc.; James L. Nevins, Charles Stark Draper Laboratory; Charles A. Rosen, Stanford Research Institute; Robert H. Anderson, The Rand Corp.; and Thomas O. Binford, Stanford Univ.

The medical session is chaired by G. Anthony Gorry, MIT, who is involved in a project modeling humanistic and heuristic knowledge of kidney disease. One of the panelists, Saul Amerel, Rutgers Univ., has developed a computer system said to perform as well or better than humans in the diagnosis and treatment of glaucoma. He currently is working on adapting the system for other disorders including hypertension. Also participating in this session will be Harry Pople, Univ. of Pittsburgh, and David West, Lawrence Livermore Laboratory.

Alan Kay of Xerox Palo Alto Research Center is chairman of the education session in this series. Kay is involved in development of an inexpensive terminal for use with a new kind of Computer Assisted Instruction (CAI). Raphael said a common theme of this session's panelists will be movement away from the "spoon feeding" of traditional CAI toward use of computers as tools with which students experiment. Panelists are John Seely Brown, Bolt Beranek and Newman Inc.; Seymour Papert, MIT; Tom Dwyer, Univ. of Pittsburgh; Kent Wilson, Univ. of California, San Diego; and Adele Goldberg, Xerox Palo Alto Research Center.

The summary session, titled "Knowledge-Based Expert Systems," will have the same technical basis as all the other sessions, Raphael said. Norton R. Greenfeld, USC Information Sciences Institute, is chairman. Panelists are Robert M. Balzer, USC Information Sciences Institute; Richard E. Fikes, Stanford Research Institute; Edward A. Feigenbaum, Stanford Univ.; W. Gerry Howe, IBM; and William A. Martin, MIT. They will cover knowledge-based computer systems being built now and methodology questions facing the artificial intelligence field. □

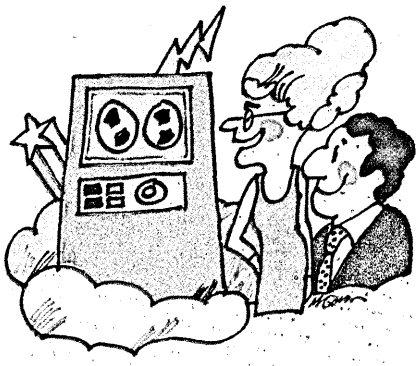
program (with six papers and 18 panelists), Gopal Kapur, refers to an oftenmentioned quote that "if 50% of the people in data processing were to drop out, the effect on productivity would be nil." Kapur hopes that if that is true, data processing users will flock to a session, "Graduate and Undergraduate Programs in Computer Science," and "shout and be hostile" over the quality of the people which the universities are training for the data processing world. People in the business have yet to tell the colleges whether they are right or wrong in the curricula they offer. When will the business managers step forward and say what they find good or bad, asks Kapur.

That session on Tuesday morning will consist of panelists from four universities telling of graduate and undergraduate programs in Computer Science. But special emphasis will be placed on interactions with industry—if people from industry show up.

Another session, "Data Processing Education—A View from Education—a Reaction From Industry," will also touch on the subject, but the industry people will be there as chosen panelists. Kapur would like some noise from the audience—if anyone cares.

Making Computers Safer: An opportunity for attendees at NCC to see a confrontation between proponents and opponents of licensing computer professionals as a way to make computers safe. The emotional topics may overshadow more meaningful sessions on this program such as a review of the recently-published AFIPS manual on security, and programs similar to this by the British Computer Society and the National Bureau of Standards. A panel on the role of auditing also will be included in this program. The chairman is William E. Perry, of the Institute of Internal Auditors. A provocative issue also will be addressed in another session by Jerome Lobel of Honeywell, "The Cost of Computer Privacy."

Legal Aspects of Computer Management: One of the sessions on this program "Future Trends in the Law of Computers," might interest management of computer using organizations as well as those who report to management. Susan H. Nycum, of the law firm of MacLeod, Guller, Muir & Godwin, heads a panel of three attorneys (Roy N. Freed, Robert P. Bigelow and F. Sherwood Lewis) who discuss future directions laws may take to cope with computer-driven changes such as: international business transactions, transnational transfers of information, privacy, and EFTS. Although a critic observes that it is "the same old crowd saying the same old thing."



The NCC program lists other sessions, such as a projection of demands the computer users want to be satisfied in the 1980s; a pioneer day program honoring people involved with Dr. John Von Neumann at the Institute for Advanced Study; and an evening session Tuesday at 8 p.m. in which computer trade publication editors express their editorial policies. (That event may be preceded by an organizational meeting of a proposed Computer Writers Association of computer trade publication journalists and of general media writers whose interest is the computer industry.)

The program fails to include such highly topical fields as point of sale, terminals and minicomputers. Miller was aware of the gap. He said the program committee "waited to see what would come in" on point of sale. Nothing did—an indication that the subject has been talked out. "I called up 20 people whom I was told could discuss computers and transportation, another hot subject, but nobody wanted to offer a paper," he said. Terminals and minicomputers aren't among the subjects on the program, but their presence in almost every subject is implied.

Particularly so in the product exhibition previewed in the following pages.□

Health Care: Minis Pave the Way

The use of computers in clinical applications is becoming more practical. "Part of this, I think, is due to the increasing presence of the minicomputer," says Vaughn Alexander, organizer of an all-day session on computers in health care. He says one of the systems that will be discussed, a clinical records system for ambulatory care, runs on a PDP-11/45.

"So the changes we're seeing are related to the miniaturization" and an accompanying drop in hardware prices.

Alexander, who is executive director of the Texas Medical Foundation, Austin, which he recently joined, says the sessions have been directed at both physicians and dp types. "We think that medical applications have reached the stage where they require more involvement and require a forum where these two professional groups can talk about these things." Accordingly, the sessions are to be chaired by three physicians and a member of the Canadian Medical Assn., people who are physician-oriented but also are knowledgeable about computing.

The opening session will feature a discussion by Canadian physicians who are working on their medical information system. In the clinical applications session—referring here to applications that relate to actual patient care—presentations are to be made on systems that are up and running rather than imagined and hoped for. And a third session will deal with the modular approach to applications, focusing on the MUMPS system at Massachusetts General Hospital.

Increasingly, computers are being applied to the solution of problems in medicine, but it's been a slow process. Many observers see a significant pickup in this activity, a broadening of this market, and a chance for computer professionals to tackle something that's sort of new, if not exactly to get in on the ground floor. A number of vendors have business office systems to handle the billing and accounting, and several are offering records keeping and information handling systems, some that operate on-line and incorporate a common data base.

Among technologists, applications for the computer in medicine and the delivery of health care might be obvious. . . a natural. Even among some physicians and nurses, there is no disagreement. Nevertheless, there exists a large number of physicians who, for example, want no part of the data entry process, whether that means using a keyboard or a light pen. A pencil and paper have sufficed in the past, and they see no need to change things now.

"I think that's a matter of education," says Alexander, "but there certainly is a growing acceptance" of computers. He cites new publications in the medical community on this technology that didn't exist five years ago. For example, Alexander started one while he was employed at the American Medical Assn. This publication, called *Computers in Medicine,* has some 2,000 paid subscribers, Alexander estimates, of which perhaps half are physicians. □

'75 NCC

Product Preview

Manufacturers from around the world will display the results of considerable new product activity, belying that a recession exists outside the door.

Peripherals

FACIT-ADDO, INC.

Secaucus, N.J. **Booth 2734, 36, 38**

80-column Printer

The 4554 is an attractive looking 80-column page printer that operates at asynchronous rates up to 60 cps. A 5x7 dot matrix impact mechanism is used to generate up to four copies on fanfold or roll paper. The unit is said to be quiet enough for office operation. It's available with bit parallel and serial (RS232) interfaces and a 20 ma current loop. Orders of 100 and up bring the price down under $2K.

FOR DATA CIRCLE 160 ON READER CARD

SHINSHU SEIKI CO., LTD.

Torrance, Calif. **Booth 2660, 62**

Miniature Drum Storage

The Japanese reputation for designing small products won't be tarnished by this manufacturer, as it's going to show up with a drum memory that weighs only four pounds. It measures only 5.59 x 2.63 inches, but that's room enough to store 200 kilobits of information. The average access time is 10 msec. The Epson 7110 uses 24 ± 2 volt DC power. In quantities of 100 it's priced at $400. The interface logic is TTL. Controllers are available, however, for approximately $150 in 100 lot orders.

FOR DATA CIRCLE 161 ON READER CARD

TOKYO JUKI INDUSTRIAL CO., LTD.

Tokyo, Japan **Booth 2345, 47**

Serial Printer

If all goes as planned, this firm will show up with a 165 cps serial printer that will sell to oem's for less than $2K for orders of 100. The 132-character unit uses a 7 x 9 dot matrix print head and contains a 132-character buffer. The data transmission speed is 7,500 cps; the data input parallel; the code ASCII. Production models are planned for September.

FOR DATA CIRCLE 136 ON READER CARD

PERIPHERAL DYNAMICS INC.

Norristown, Pa. **Booth 2250**

Single Feed Card Reader

There will be at least three of these devices at the show for oem's and users to compare features against. This unit, the model 1000 comes in three basic configurations: The 1100 is a straight-through feed system; the 1200 uses a card return to insertion slot feeding system, and the model 1300 uses a turn around and card return via an exit slot feed system. The drive mechanism is activated when the card is inserted into the read station. The modular unit is constructed so that various size cards and RS232 data transmission capability can be contained within it. Single unit pricing is approximately $600.

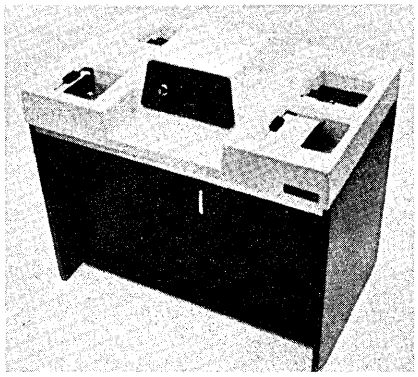
FOR DATA CIRCLE 162 ON READER CARD

DOCUMATION INC.

Melbourne, Fla. **Booth 1342, 44, 46, 48**

Multi Function Card Unit

The LC50 card processing subsystem is designed for small business systems users who need to process turnaround documents. The machine is capable of



punching, reading, and printing multiple lines on either 80- or 51-column card. Individual modules for punch, read, single-line printer, are field installable, and a multi-line print device is available at the factory. The punch is rated at 50 cpm, while in the read-only mode, the LC50 operates at 300 cpm. As a printer/reader/punch, the speed of the subsystem increases inversely with the number of columns punched or printed. The oem device is priced between $5-10K depending on quantity and specific options chosen.

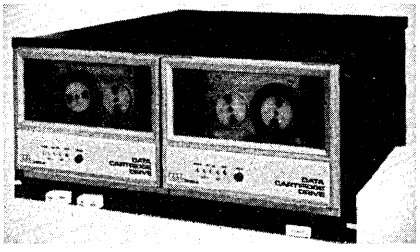
FOR DATA CIRCLE 163 ON READER CARD

WILSON LABORATORIES, INC.

Fullerton, Calif. **Booth 1720**

Cartridge Storage

The WL300 uses two 3M-type cartridge drives to provide up to five million characters of on-line storage accessible



through an RS232 interface. A microprogrammed formatter is used to conform to the proposed ANSI format. The buyer has a choice of two baud rates up to 9600. Incoming characters are stored in a 256 position buffer and then written to the modules. A single drive, dual baud rate unit is priced at $2,650.

FOR DATA CIRCLE 140 ON READER CARD

PERSCI, INC.

Pacific Palisades, Calif. **Booth 2658**

Flexible Disc Drive

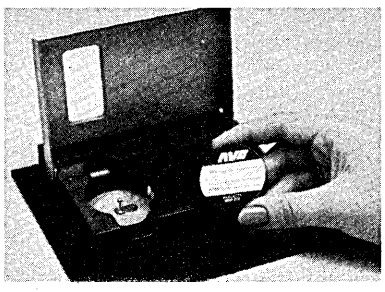
There are a number of impressive claims made for this floppy disc version, dubbed the model 75. Among them are head positioning times 5-10 times faster than its competition, with a maximum of 100 msec for a 76-track seek; lowest power consumption at 25 watts—something manufacturers are getting conscious about—the smallest size packaging for both single and dual drives, with

AMERICAN VIDEONETICS CORP.

Sunnyvale, Calif. **Booth 2714, 16**

Cassette Storage

In addition to displaying the latest model from this firm's comprehen-



sive cassette line, it will introduce what it hopes will become a contender to cassettes. The MDR-212 comes in two models that store 750,000 and 1.5 megabits of information, respectively, in a container smaller than a typewriter ribbon spool. The Reelette weighs one-half ounce but contains 80 feet of quarter-inch magnetic tape. The 212 operates at 10 ips read/write and searches at 30 ips. Prices for the drive in quantities of 100 start under $140/each; under $300 for drive, read/write and motion control electronics.

FOR DATA CIRCLE 139 ON READER CARD

the single unit measuring 13 3/4 x 8 9/16 x 3 3/8-inches; a safer loading design to virtually eliminate damage to discs, etc. Options include IBM-compatible format or oem-specified format; a phase-locked data separator; choice of electronic physical or electronic sectoring, and a PDP-11 interface. Single units are priced at $800; $645 for orders between 100 and 250.

FOR DATA CIRCLE 165 ON READER CARD

KENNEDY COMPANY

Altadena, Calif. **Booth 2117**

Oem Tape Drive

The 9100 is a 10.5-inch, 75-ips vacuum-column tape drive that uses a capacitive tape location detector to reduce tape wear and improve recording accuracy. The unit reads and writes IBM and ANSI compatible formats. Data transfer rates are 60 KHZ at 800 bpi, 120 KHZ at 1,600 bpi. The rewind speed is 200 ips. Unit prices range from $4,750 to $5,450 depending on options.

FOR DATA CIRCLE 164 ON READER CARD

REMEX

Santa Ana, Calif. **Booth 1128**

Floppy Disc

This manufacturer is primarily known for its punched paper tape equipment—which will be prominently displayed—but in addition, a floppy disc system and cassette peripheral will also be shown. The floppy is set up for DEC PDP-11 users and comes in three flavors: a complete operating system, an "I/O enhancement" package for systems with less than 8K of memory, and basic driver/diagnostic programs. The complete operating system, ROS-11, is priced at $1K; the RFS-7400 disc drive is $3,150.

FOR DATA CIRCLE 166 ON READER CARD

DECITEK

Worcester, Mass. **Booth 2647**

Paper Tape Reader

The paper tape equipment market is still growing and here's just one of the manufacturers that will be showing such equipment at the show. The 560 series reader/spooler operates at 300 cps using a velocity control feedback system. The bidirectional unit also features 1,500 cps high-speed forward/rewind operations. Reel sizes can range from 5 1/4 to 7-inches. The reader-spooler is priced at $838/each in orders of 100.

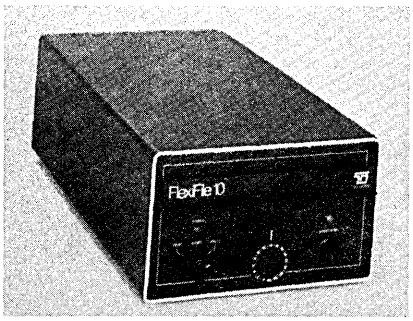
FOR DATA CIRCLE 167 ON READER CARD

TRI-DATA CORP.

Mountain View, Calif. **Booth 2200, 02**

Paper Tape Emulation

The FlexiFile 10 is a floppy disc-based paper tape emulator that is plug compatible with most current readers and



punches. The unit is available as a stand-alone or rack-mounted configuration, one or two drives, side by side. The capacity is just under 100,000 bytes and the transfer rate is 1-40K bytes/second from a rotational speed of 100 rpm. A read/write configuration is priced at $1,600 for users. Interfaces if required are priced at $850.

FOR DATA CIRCLE 168 ON READER CARD

BÜRO UND DATENTECHNIK

GMBH, West Germany **Booth 2649, 51**

Forms Guides

Adjustable motorized tractor forms guides and "programmable" forms front feed devices will be displayed for the first time in the U.S. The FT 212 forms tractor can accommodate almost any reasonable width business form generated from typewriters, billing/accounting systems, terminals, and ocr printers. A program tape similar to a line printer's controls the 212's operation and holds two "programs". Prices are quoted in Deutsch Marks since their currency doesn't fluctuate as much as ours but runs around $400 for a single unit.

FOR DATA CIRCLE 138 ON READER CARD

TEC, INC.

Tucson, Ariz. **Booth 2712**

Mini Peripherals

Two items of interest to mini users and systems houses will be on display here. One is a floppy disc peripheral equipped with two serial asynchronous RS-232C interfaces for selectable operation at 110-9,600 baud rates. The storage capacity is 308,600 characters which can be the full eight-bit ASCII code. Also featured is automatic record stepping for cassette emulation. The DISCO-TEC memory is priced at approximately $3K.

Also on display will be an 80 cps printer intended for hard copy output for the manufacturer's line of crt terminals. A full 80 x 24 screen can be copied in 24 seconds. Characters are formed by 5 x 7 dot-matrix on electrostatic paper. Depending on quantity, the model 24 printer price ranges from $1,095 to $1,350.

FOR DATA CIRCLE 169 ON READER CARD

DATA ELECTRONICS INC.

Pasadena, Calif. **Booth 1354, 56**

Ruggedized Cartridge

Three versions of a ruggedized cartridge storage system based on the 3M cartridge will be displayed for military or commercial applications where hard usage can be expected. The drives are ANSI/ECMA compatible and record at 1600 bpi. The storage capacity is just over 23 megabits and the transfer rates are 192 kilobits/second. Interface connections are bussed so that up to eight drives can be connected together. There are a variety of options that include long-life heads (guaranteed to 3,000 hours), integral tape cleaner to enhance error rate performance; one- or four-track format; 15 or 25 ips operation, etc. Pricing begins at $566 for basic drive configurations in quantities of 100.

FOR DATA CIRCLE 170 ON READER CARD

TELEFILE COMPUTER PRODUCTS, INC.

Irvine, Calif. **Booth 1111, 13**

Disc Controller

There aren't many 16-bit minicomputers that the DC-16 C disc controller can't hook up to to provide interfacing between moving head, removable media drives. The product features simultaneous seek, selectable record lengths, and multiple record seeks. The words per record can vary from 128 to over 3,000. Up to eight disc drives can be accommodated. The unit is priced at $5,500 in quantities of 10-49. Complete disc storage systems are also offered.

FOR DATA CIRCLE 171 ON READER CARD

MDB SYSTEMS, INC.

Orange, Calif. **Booth 2553**

Peripheral Interface

The MDB Universal Logic Interface Module provides interfacing between any model Interdata minicomputer using 15-inch pc boards (including the 7/16 and 7/32 models) and multiple peripherals. The board provides complete device handshaking logic, device addressing and interrupt control as well as data channel and I/O register options. The wirewrap portion of the board provides space for 92 positions of user designed logic. The logic can be in 18, 22, 24, and 40-pin configurations as well as the standard 14 or 16 pin. The basic board price is $425. Also on display will be a direct memory access interface for Digital Equipment Corp. PDP-11 minis.

FOR DATA CIRCLE 172 ON READER CARD

'75 NCC Product Preview

Computers/Systems

INFOREX, INC.
Burlington, Mass. **Booth 1513**

Data Entry System
The System 3300 is a multistation, shared-processor data entry system billed as being able to perform the most sophisticated editing upon incoming data. The system is aimed at the heart of most data entry configurations, and a one-year lease for a 16 keystation system runs $2,883/month.
FOR DATA CIRCLE 141 ON READER CARD

HAMILTON COMMUNICATIONS, INC.
Naperville, Ill. **Booth 2448, 50**

Word Processing
ZZIPCOM is the name of this word processing system which consists of a Selectric typewriter, cassette peripheral, and acoustic coupler. Information stored on the cassette can be sent over the phone at up to 1,200 words per minute. A dual-cassette model can both send and receive at 110 through 1,200 wpm rates. A 200 character buffer allows complete editing capabilities. The ZZIPCOM is priced at $8,500 and rents for $214/month on a lease. A battery operated portable ZZIPCOM system will also be displayed.
FOR DATA CIRCLE 142 ON READER CARD

HEWLETT-PACKARD CO.
Palo Alto, Calif. **Booth 1437**

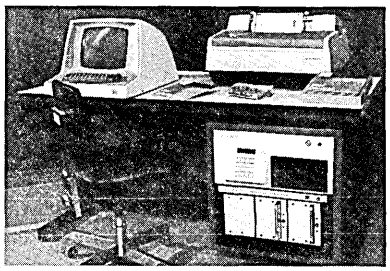
Minicomputer
Gracing H-P's stand will be the most powerful member of the 21MX 16-bit oem minicomputer series so far, the M/30. Half the system's maximum memory complement of 256K words can be contained in same cabinet as the cpu together with 14 powered I/O channels, thanks in part to the use of 4K bit/chips. Standard features include a 128 instruction repertoire, floating point firmware, memory parity, extended arithmetic unit, bootstrap loader, and operator panel. The user microprogrammable mini is priced at $8,382 with 32K of memory for oem orders of 50 units.
FOR DATA CIRCLE 131 ON READER CARD

SORD COMPUTER SYSTEMS, INC.
Tokyo, Japan **Booth 1742**

Microcomputers
Several different flavors of microprocessors will be on display here. The MCPU module is offered to oem's using an Intel 8080 "or equivalent" chips on a module board. The SMP-80/10 is a more powerful standard design, while the SMP-80/20 module is a complete microcomputer for general-purpose applications. All SMP-80 family members are furnished with necessary support software. The SMP-80/20 system is priced at approximately $600 for orders of 30-50.
FOR DATA CIRCLE 133 ON READER CARD

APPLIED DATA COMMUNICATIONS
Santa Ana, Calif. **Booth 2342**

Microprocessor/Peripherals
The series 70 microcomputer is based on the recently announced

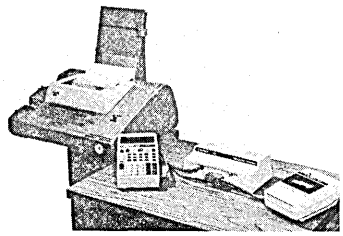


Intel 8080 series and is offered as a one board system to oem's or as complete hardware systems for sophisticated end users. The basic board contains the terminal controller (crt or tty), 4K bytes of RAM, 1K bytes of PROM, auto-start bootstrap, and floppy disc controller. This configuration, priced at $1,300, is expandable up to 16K of RAM, 4K PROM. Peripherals that can be used with the 70 series will be shown and include IBM compatible floppy discs, 3M tape cartridges, printers 9-track tape drives, non-intelligent crt, graphic devices, etc.
FOR DATA CIRCLE 137 ON READER CARD

Communications

MONROE, THE CALCULATOR CO.
Orange, N.J. **Booth 2718, 20**

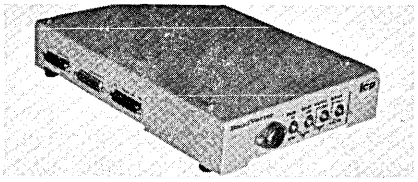
Peripheral Interface
The 395 interface allows attaching many relatively low-speed RS232-compatible device to this manufacturer's 325, 326, or 1800 series programmable calculators. Numerical



data, alpha of variable length, and software program I/O are accepted. The character code is ASCII at any two rates from a choice of 110, 150, 300, 600, and 1200 baud, half- or full-duplex. Devices using the 20 ma. current loop and the European CCITT V. 24 interface standards are also accommodated. The price is $550.
FOR DATA CIRCLE 134 ON READER CARD

INTERNATIONAL COMPUTER PRODUCTS, INC.
Dallas, Texas **Booth 1133**

Baud Rate Converter
In addition to two cassette units, one a ruggedized oem deck and the other set up for mobile point-of-sale applications, this manufacturer will display a device called the BaudVerter. Its purpose in life is to convert baud rates of 110-300 to 1200 baud and up. Programs



and data can be stored indefinitely for immediate replay either on-line or locally thanks to the cassette. The RS232 compatible device is priced at $144.
FOR DATA CIRCLE 143 ON READER CARD

UNIVERSAL DATA SYSTEMS
Huntsville, Ala. **Booth 2267**

Line Monitor
The Data Trap is used to diagnose communications problems by triggering on any character or series of characters up to 70 Hexadecimal characters in length and will trap up to 256 characters both sides of the trigger pattern. The device can be used on synchronous or asynchronous lines at rates up to 9600 baud. A crt and RS232 interface capability are optional. The data trap is priced at $4K. Also on Display will be several models of Bell 201-type modems.
FOR DATA CIRCLE 130 ON READER CARD

Services

TELENET COMMUNICATIONS CORP.
Washington, D.C. **Bootn 1205**

Packet Switching
Experts will be on hand to discuss the operation of a nationwide packet-switching network that will begin operation next month. Founded by Bolt,

Beranek and Newman, a communications company with considerable experience, the service will initially be available in Washington, D.C., New York, Boston, Chicago, Dallas, San Francisco, and Los Angeles. Packet switching can be utilized to reduce the costs of time-sharing, teleprocessing, and batch data transmission. Technical support will continue to be provided by BBN for the network.

FOR DATA CIRCLE 144 ON READER CARD

DELTAK, INC.
Schiller Park, Ill. **Booth 1744**

Programming Course

A comprehensive training course series in multimedia (video, text, audio and "reinforcement"), designed to train analysts, designers, programmers and managers in the techniques and skills of structured programming and structured design will be discussed at this booth. Ten courses are available now; 19 are scheduled for introduction later this year. The price of $750/course is based on signing up for 10 or more course plans.

FOR DATA CIRCLE 132 ON READER CARD

INCOTERM CORP.
Natick, Mass. **Booth 1157, 59**

Data Entry Software

INCOFORM is the name given to this forms-oriented source data entry software package for use with the manufacturer's diskette-based 20/20 multistation intelligent terminal system. INCOFORM provides users with a set of applications-oriented, general purpose software modules for custom forms design and data entry control.INCOFORM also allows the system to be operated in inquiry/response mode concurrently with data entry operation.

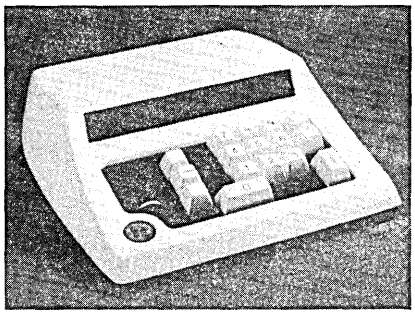
FOR DATA CIRCLE 145 ON READER CARD

Terminals

INTERFACE TECHNOLOGY, INC.
St. Louis, Mo. **Booth 2360**

Touch-Tone Terminal

The 731 is a 16-key, desktop, Touch-tone data entry terminal. It features up to 16 digits of light-emitting diode (LED) display for data verification. A built-in



amplifier with volume control enables operation without holding the handset to hear computer responses. The 731 can be connected directly to the telephone through a data access arrangement. A single, 8-digit display is priced at $605.

FOR DATA CIRCLE 146 ON READER CARD

INTERTEC DATA SYSTEMS CORP.
Charlotte, N.C. **Booth 1554, 56**

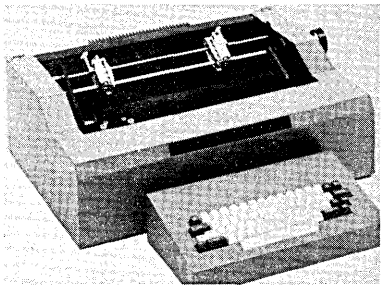
Low-speed Terminal

Terminals using the Diablo HyType printer and a microprocessor inside seem to be inheriting the earth, but this one, the SPINTRONIC seems to have a new twist. The manufacturer has gone to great lengths to reduce the weight of the power supply down to four pounds making the unit, at 97 pounds, easier to push around than its competition, we're told. The 4-6K byte microprocessor is responsible for super and subscripting, programmable forms feed, forward/reverse horizontal and vertical tabbing, selectable pitch printing, switch selectable baud rates of 110, 134.8 (IBM 2741

APPLIED COMPUTING TECHNOLOGY, INC.
Irvine, Calif. **Booth 2500**

High-speed Terminal

Our insatiable demand for more and more information means products like the 900 may one day become commonplace. The terminal prints bi-directionally at 120 ASCII cps across 132 columns using a 7 x 9 dot-matrix



print head. Standard features include multiple copy capability, horizontal tab, vertical formatting and forward/reverse line feed. The standard character set of 64 can be raised to 96 for UPPER/lower case printing. An incremental speed feature allows for keyboard input and send/receive speeds of 10, 30, and 120 cps. Orders for 25 units drop the price to $1,945 for the printer; the keyboard and an RS232 interface are optional.

FOR DATA CIRCLE 135 ON READER CARD

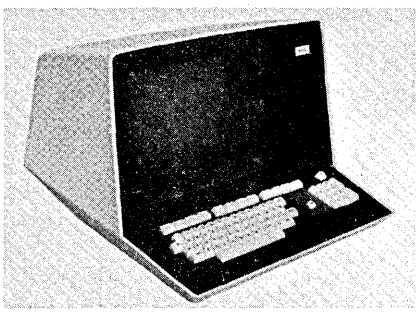
firmware selected), 150 and 300 baud. Prices start at $3,995 in quantities of 10. The SPINTRONIC is also available without a portable stand.

FOR DATA CIRCLE 147 ON READER CARD

ONTEL CORP.
Plainview, N.Y. **Booth 2744, 46**

Crt Terminal

Not just one, but *three* microprocessors are inside the OP-1 programmable intelligent terminal. One is the cpu, to be used for user applications such as typesetting, text editing, reservation, inventory and other applications; a second unit performs display functions such as video reversal, blinking, half intensity and underlining; and a third is responsible for I/O activity between up to four



high speed devices. Communications with various computer systems are possible since I/O disciplines are under program control. The following features can be either field or factory installed: 50 kilobit/second operation, a 3M tape cartridge controller capable of supporting up to four transports, a disc controller with four ports, a controller for an 80- or 132-column printer, a byte string controller for word wrap-around capability at 25 usec/byte, and a multiprocessor controller for clustered OP-1 systems. Pricing hovers around $2,285/unit in orders of 100.

FOR DATA CIRCLE 148 ON READER CARD

DATA TERMINALS AND COMMUNICATIONS
Campbell, Calif. **Boo 1449**

Low-speed Terminal

The 300/T is a tabletop, 30 cps blo printer-based terminal incorpora ; a microprocessor. Read-only memory is used to control margins, vertical tab set and reset, bi-directional printing, graphics capabilities, two-color ribbon, subscript/superscript, addressable horizon-

tal and vertical tabbing, and variable pitch and line feed spacing. The features may be controlled from the Selectric style keyboard or the communications line using standard ASCII escape and control codes. The 300/T is priced at $4,500 or can be leased for $134/month. A wide carriage version, the 300/S, will also be on display.
FOR DATA CIRCLE 149 ON READER CARD

MEGADATA COMPUTER & COMMUNICATIONS CORP.
Bohemia, N.Y. **Booth 1115, 17**

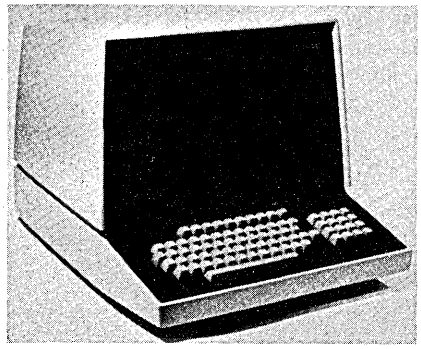
Crt Terminal

The initial installations of the SIR-1000 touch pad screen terminal are in the medical applications. Instead of having a doctor or other medical personnel play with a keyboard to describe to the host system what is required, the user need only touch the 1000's screen to tell the system what information is needed. For example, if the doctor touches the arm of a torso displayed on the screen as being a pain point, the system responds by listing possible causes on the other portion of the screen. The terminal can operate in high-speed communication environments (up to 30,000 characters per second) and can be interfaced to virtually every computer on the market, says the builder.
FOR DATA CIRCLE 150 ON READER CARD

CONRAC CORP.
Covina, Calif. **Booth 1267**

Crt Terminal

The 480/25 tty-compatible crt terminal will use a combination of good features and low pricing to attract oem's to this booth. The unit displays 25 lines of 80 characters and operates at line rates up to 9600 baud, with higher rates optional. Up to four peripheral devices, such as floppy discs and printers, can be supported. Full editing capability, performed by an integral microprocessor is available, and one nice thing the 480/25 is billed as being capable of is holding up well under worst case conditions, i.e., line rate of 9600 baud while an operator is performing extensive interactive edit routines involving peripherals. A variety of keyboards is available. Prices start at approximately $1,700/unit for orders of 500.
FOR DATA CIRCLE 151 ON READER CARD



LEAR SIEGLER, INC.
Anaheim, Calif. **Booth 2348**

Crt Terminal

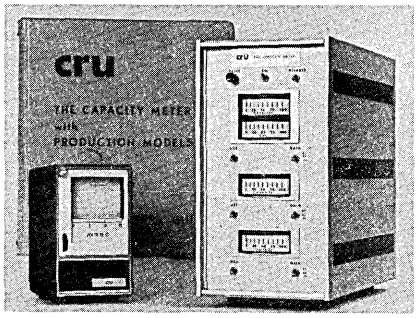
The ADM-3 is the most compact member of the ADM crt series announced so far and features an integrated keyboard/screen design. Even the power consumption has been reduced from its siblings, down to 80 watts. A 12-inch (diagonal) screen displays either 12 or 24 lines of 80 5 x 7 dot matrix characters. In addition to the normal complement of 53 keys, the ADM-3 has a special shift key that enables it to generate up to 128 ASCII codes. Baud rates are switch selectable from 75-19,200 baud, half- or full-duplex. Another switch sets the terminal up for RS232 or current loop interfacing. All these features in a terminal for under $1K, single quantity, seems almost too good to be true. LSI sells both to oem's and end users.
FOR DATA CIRCLE 152 ON READER CARD

Auxiliary Equipment

CRU, SUBSIDIARY OF COMPUTER RESOURCES, INC.
Cleveland, Ohio **Booth 2263**

Performance Measurement

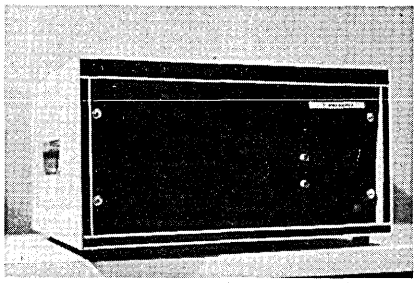
Maybe the most interesting thing about "The Capacity Meter" isn't the product itself but the information supplied with it: five years of comparative production history and enforcing standards for multiprogramming computers above the class of an IBM 370/125. This information allows an installation to take a broader view of the meaning of computer productivity, including the people aspect. The meter itself is a compact unit that can be placed on the system console or in a supervisor's office. It sounds an audible alarm when the cpu falls below predetermined loading levels. Pricing for "The Capacity Meter" starts at $4,500 including installation instructions.
FOR DATA CIRCLE 153 ON READER CARD



MOTOROLA INC.,
Carol Stream, Ill. **Booth 1347A**

Microprocessor Diagnostics

The MPA-1 logic analyzer was specifically designed to analyze both the hardware and software operations of microprocessors. Thirty-two words of 24-bits each are displayed in hexadecimal characters on a 9-inch crt screen. The characters are arranged in groups of four and two, representing a 16-bit address and eight data bits. Any location within 64K addresses may be selected as the trigger address by presetting hex switches. Up to 32 consecutive addresses are displayed with associated data.
FOR DATA CIRCLE 154 ON READER CARD



DELTEC
San Diego, Calif. **Booth 2555**

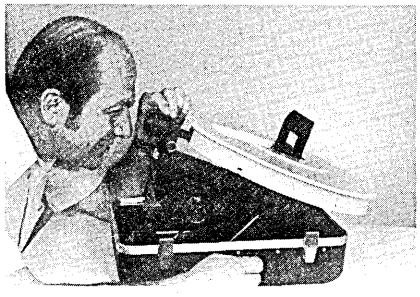
Uninterruptible Power

The 5250 is a 7.5 KVA uninterruptible power system suitable for use with small scale systems about the size of an IBM System/3 or a Data General mini. The customer can specify how much reserve power, supplied by batteries, he wants, ranging from five minutes to several hours. The use of MSI and other advanced circuit techniques has cut the component count by 50% in the 5250 which should enhance reliability figures. The unit itself is priced at $10, 450 less batteries. Batteries sufficient for one hour's operation would add an additional $3K.
FOR DATA CIRCLE 155 ON READER CARD

DATA MAINTENANCE, INC.
Rolling Hills Estates, Calif. **Booth 1453**

Disc Inspection

No more plastic chips on disc surfaces that can virtually destroy the information on a disc cartridge that has been disassembled for cleaning. The model 450 disc cartridge inspector provides



(Continued on page 191)

Bar Codes For Data Entry

by Edward K. Yasaki, Sr. Associate Editor

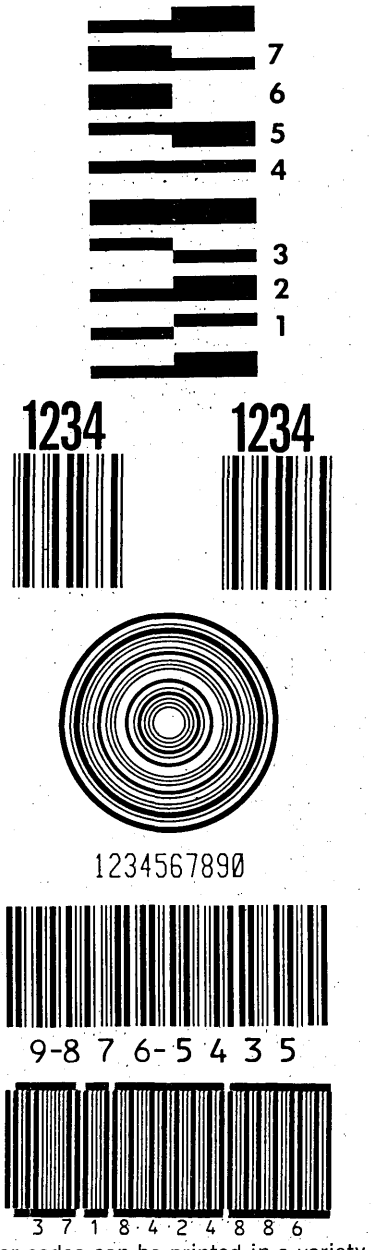
Born on the side of a freight car, bar code labels are now finding more conventional applications and displacing some older forms of data collection.

At the Buick Motor Div. of General Motors Corp. in Flint, Mich., assembly line foremen and materials control personnel are using bar-coded labels with scanners in an integrated and real-time scheduling/production control system. At the head of the assembly line, where automatic transmissions are made for Buicks, Oldsmobiles, Pontiacs, and Chevrolets, an operator applies to the transmission case a pressure-sensitive bar-coded label that identifies the transmission type; the label also bears alpha characters for human reading.

The system not only provides an accurate count by type of transmission built before the completed product reaches the shipping department, but also makes possible the generation of production profiles (hourly, by shift, or on demand) for such purposes as the evaluation of assembly line performance, and improved planning, scheduling, and tracking. And, obviously, it does these things with a reduction in the direct labor involvement in such tasks. The success of this system, developed by Computer Identics Corp., Westwood, Mass., has led Buick to adopt it also for monitoring rear axle and engine production.

The bar code, with its accompanying contact reader (the "wand") and/or remote scanning equipment, is being used for data entry purposes in a variety of material handling applications in factories and warehouses. But it has also begun to appear outside of those environments.

There are parking lot control systems at such places as hospitals in which a bar code label, attached to a window on the side of a car, identifies a staff member. A remote scanner reads this label to activate entry and exit gates. A similar system is being used at a few toll booths on expressways. It enables a commuter who has purchased a 30-day pass to drive in lanes equipped with scanners, which become express lanes; the logic in the system checks to see that the driver is in the proper commuter zone. If the label is valid, the system permits the coin hopper to accept a reduced toll. And the car numbers of Boston commuter trains are similarly identified in this manner; this information, along with arrival and departure times, is used for scheduling and routing.



Bar codes can be printed in a variety of sizes and shapes, have differing code formats, and usually have man-readable characters alongside.

Bar codes appear on storage bins and shelves as part of an inventory control system. A large manufacturer uses them for checking out tools to employees. And an electronics company is in the pilot stage of a work-in-process system that calls for a bar code label to be attached to the back of each of its circuit boards as they go through the assembly process. Libraries are using them too, for circulation control.

Sales of bar code scanning equipment last year came to less than $10 million, according to Jim Baldinger of Identicon Corp., a Franklin, Mass., systems house. But Baldinger sees this doubling each year. "I think within the next five years this market is going to skyrocket," he says. He adds, "We're at the point where the minicomputer industry was 10 years ago." Identicon, which until now had concentrated on material handling systems, has begun looking at other markets and is tending toward identifying itself more broadly as a manufactuer of computer peripheral equipment.

The technology catches on

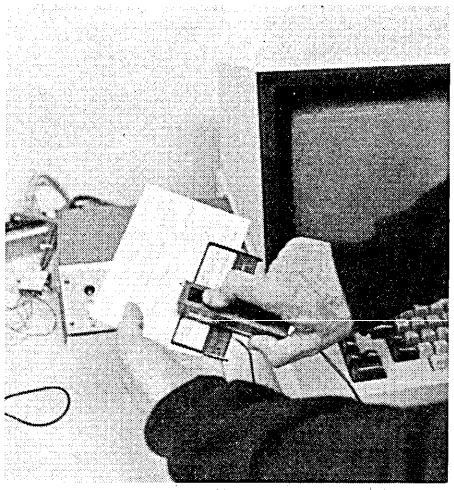
A spokesman for Computer Identics observes that only a couple of years ago the bar code as an input medium was relatively unknown. But with all the Universal Product Code publicity by the supermarket crowd, many people have become familiar with scanning. "Somehow people believe that if it's in the grocery store, it must be real," he says.

Indeed, the bar code is for real. And its use for data entry purposes appears to be limited mainly by the imagina-

1. DataCopy's device reads alphanumeric characters in OCR-A font. It's still in the development phase.

2. NCR's hospital system uses bar codes to build messages rather than simply identify items.

3. As a twist, the label can be stationary, as on these parked trailers, and the scanner can be portable.



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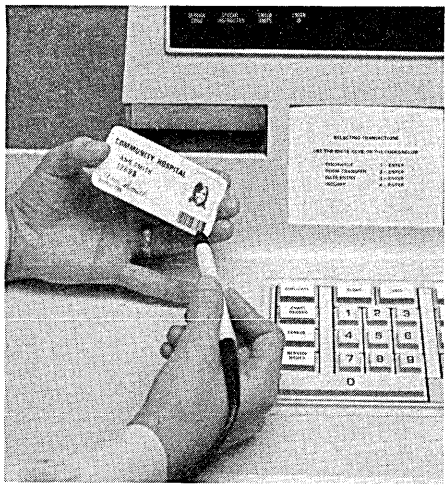

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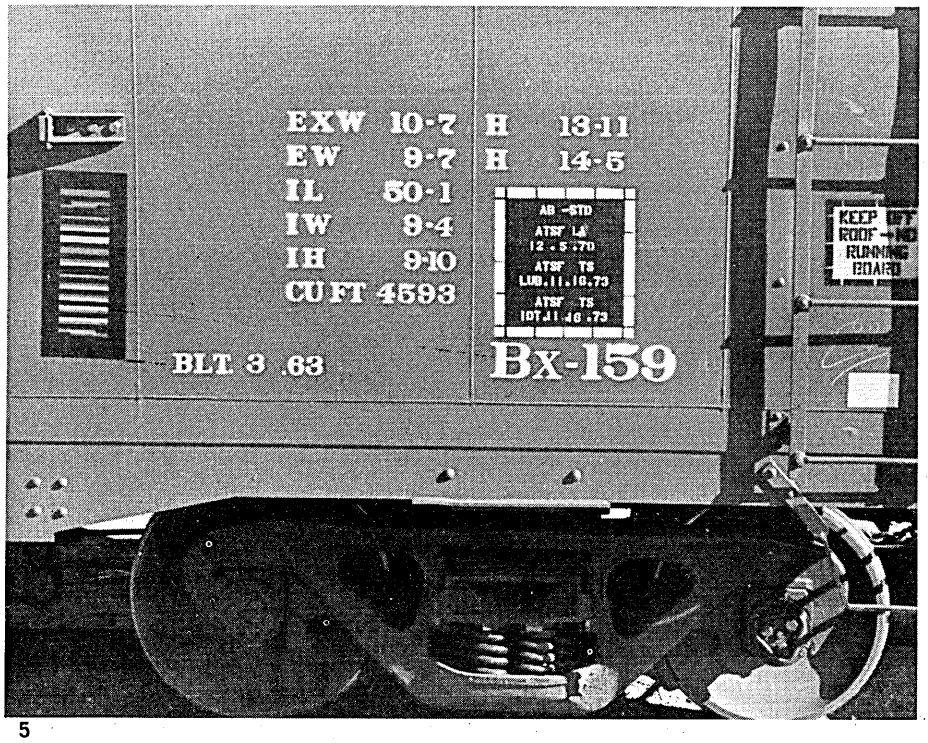
4. In an application not much different from freightcar tracking, the scanner on the left reads the label on the side of the truck to record the truck's passing or to control access to a parking lot.

5. The origins of the bar code's popularity are traced to its use by the Assn. of American Railroads to identify freightcars. Labels like the one on the left can be read by trackside scanners while cars speed by at up to 80 mph.

6. General Motors uses bar code labels to track transmissions on its assembly line. The labels are stuck onto the transmission cases, and read by the scanner in the box on the left.

7. Hand-held scanning devices such as this one made by Computer Identics Corp. have already found a variety of uses, including inventory control. Input from the scanner or from the small keyboard is recorded on cassette tape.



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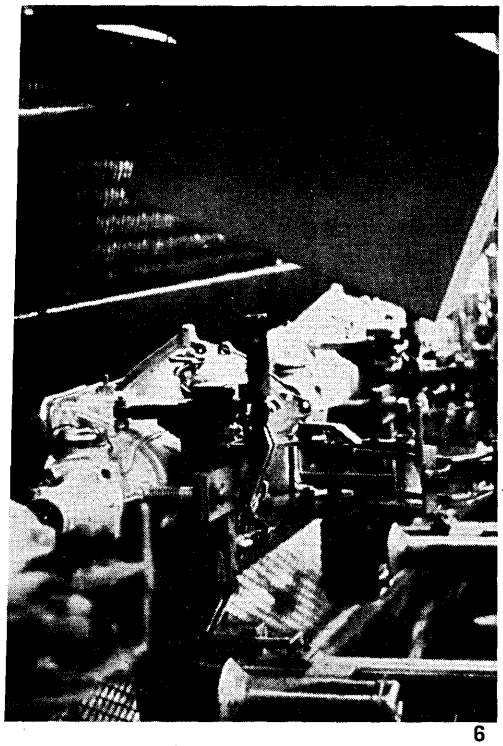

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7

Bar Codes...

tion of systems designers. By looking at some of these applications, perhaps some vistas can be opened.

NCR's proprietary color bar code is being used to control the issuance of office supplies by Coca-Cola in Atlanta. Normally, in a corporate home office setting, a department administrator might have to sign for a ream of bond paper and two boxes of envelopes, generating paperwork in the process. Coca-Cola, instead, uses bar codes to identify its office supplies and reads the code in an operation much like a retail environment to charge the proper department.

In its hospital information system, NCR also uses its bar code to facilitate and speed the entry from a terminal of such basic items of information as the patient's identification (each patient is assigned a code), a service requested, and the operator's identification. Services ordered for a patient are listed in a catalog alongside the bar code for that service. And these items are used to indicate schedules and routes of medication, to enter the number of days or medication doses, and the day or time the medication is to begin. Units are also coded in the catalog for ordering quantities greater than one, or for indicating numbers when that is necessary.

A Boston research hospital keeps track of x-ray folders, using a pen system from Identicon. Folder labels, carrying patient ID numbers in bar code, are stroked with the pen to log them out when they leave one area and to log them in when they've arrived.

Bar codes can do more than play a role in document control. In the hospital environment, they obviate the need to key in some commonly used codes, as to order some aspirin for a patient or specify that medication be given four times daily. For inventory control purposes, data can be captured at the source with a portable device that reads bar codes on a storage shelf and allows the variable quantity data to be keyed in, storing this information on cassette tape.

But the bar code, which, in a particular configuration, is also used as the Universal Product Code on boxes of corn flakes and bottles of catsup in the nation's supermarkets, is not the only scheme devised to get around the input bottleneck.

A California firm, Xebec Systems Inc., is preparing to start delivery of a ballpoint pen that converts handwritten data to computer code. Requiring no stylized characters, such as are imposed by ocr systems that read handwritten numerals, the Alphabec-75 system being marketed by the Sunnyvale, Calif., company recognizes the numerals and a limited set of alphabetic characters. Each pen is linked to a microcomputer system, the entire electronics housed in a desktop unit. In the box, too, is a 96-character display.

This pen system recognizes characters by the direction of travel of the pen's tip. Thus a character that looks like this Z, as noncomputer-types write it, would be recognized as a 2. Theoretically a numeral 1 could be a straight vertical line a mile long and still be recognized. Obviously, then, the user need not write the character within a box or follow any restrictive, prescribed form. Error notification is by both a visual and audible alarm, and there are facilities for line erase, rubout of last character, and field deletion and replacement.

Cheaper than keypunching

In Palo Alto, Calif., another data entry company, DataCopy Corp., still in the r&d stage, has developed a handheld optical scanner that, to date, reads only numerics in the OCR-A font. But the firm's president, Armin Miller, who was also the founder of Data Disc, foresees no problem in developing the electronics to read alphabetic characters in a number of type fonts.

"With the inflation problem and the cost of keypunching, I think that's going to force optical character recognition to move ahead a lot faster," he says optimistically. Miller observes that the traditional ocr systems, held back until now primarily by their high cost, are being used in greater numbers. Gesturing at a prototype scanner in his hand, he says that something that would sell for $3-4,000 could be rented for $100 a month, adding, "You don't have to realize much savings in labor time to make that up." He foresees a scanner such as his becoming an integral part of a crt terminal and being used initially to read, say, the numerics off a turnaround document.

Perhaps a device like DataCopy's scanner or a bar code reader could be made a part of AzurData's data collector, increasing its versatility. A handheld bar code reader, called a Ruby Wand, is available from Interface Mechanisms in Seattle for $45-100, depending on quantity ordered.

Bar-coded labels vary in size, code format, the stock on which they are printed, and printing methods. Doing without the label, they can also be printed directly on a carton at the same time the manufacturer's name and his product are being printed. The size of a label is usually a function of the number of digits, the reading resolution, and the type of scanner to be used. If a remote scanner is used, the width of a label is determined by the

speed at which the label is passing the scanner, the amount of skew off vertical the label has, as well as the number of digits. In applications where a handheld contact reader is used, label width is of less significance.

Code format stems from an application's requirements. A bar code usually contains a number of self-checking features and certain characters to determine the direction of the code. They can be designed to be read in one direction only or in either direction. And they can be produced on standard printing presses, on special machines for printing bar codes, and on impact and nonimpact line printers.

They can be read by pen readers that must be stroked across, and in contact with, the code, as well as by remote scanners. There are both static and dynamic scanners, the former consisting of a photoelectric cell and being used for sorting. With a dynamic scanner, however, numbers can be decoded and data collected. Further, there are two types of dynamic remote scanners, those that project an incandescent light and those using a low-power, harmless laser as a light source. The former is used outdoors where rain and snow will not degrade its performance; it is cheaper but requires the use of more expensive retroreflective labels. For indoor applications, the laser scanner with cheaper paper labels and codes printed on cartons is found.

It began on a train

The ancestry of the bar code is usually traced to its adoption by the Assn. of American Railroads as the standard North American system to monitor and control the movement of railcars. The automatic car identification (ACI) label, adopted by the AAR in 1967, measures 10½ x 22-inches and holds 13 digits that identify the equipment type, owner, and serial number. As a freight car moves past the trackside scanner at speeds up to 80mph, light rays from the scanner read the label in a vertical direction, starting at the bottom, at a rate of 240 times per second.

It is believed that some 5-10,000 trackside scanners are required to achieve a national freightcar control system, but there was said to be only slightly more than 300 installed through the end of 1974. Still, of the estimated 1.8 million freight cars in the U.S., all but a small fraction now bear the ACI label, the exception being primarily privately owned cars.

This dearth of scanner installations means carriers still don't know where all their freight cars are at any given moment. But the technology is being applied profitably at specific rail terminals. The Illinois Central railroad, for example, installed the nation's first fully automatic transportation terminal management system. Using both rail and roadside scanners, this system monitors the movement of freight cars and piggyback trailers (which also bear the ACI labels) as they move to, from, and within the IC's primary terminal in Chicago. The carrier's officials credit this system with increasing equipment utilization by 9%, dropping drayage costs by 30%, and personnel by 11%.

With some modification, the developers of that system, again Computer Identics, are now working on a new marine terminal control system for American Export Lines at Howland Hook, Staten Island, in the Port of New York. It is an attempt by the U.S. Maritime Administration to do something about the poor service and high transfer costs at American container ports. This prototype system, again using the ACI labels and scanners at the terminal's entrances and exits, tracks container movement into and out of the terminal, as well as within the terminal, and provides information on equipment inventory and locations. It also uses weigh-in-motion electronic scales at the terminal's entrance gates that are integrated with the scanners, and correlates the identification of the container with its weight.

In a few months, CI will be installing scanners on gantry cranes to monitor vessel loading and unloading operations, prevent misroutings, and ensure that loading/unloading plans are carried out properly. It will also warn work crews when they are handling dangerous cargo. These scanners, functioning much like those at the gates of the terminal yard, will travel vertically on elevators synchronized to the movement of the container being handled. Following an evaluation period, CI is contracted to build a mathematical model of marine terminals and make this available, along with all system documentation and software, to all U.S. shipping companies. The U.S. flagships will be free to adopt it in their terminal operations if they wish.

To facilitate the handling and control of those containers when they reach overseas ports, the ACI label has been recommended for adoption as a world standard for freight containers. It is now in the hands of a working committee of Technical Committee 104 on freight containers of the International Standards Organization, which is expected to recommend its adoption later this year.

Finding conventional jobs

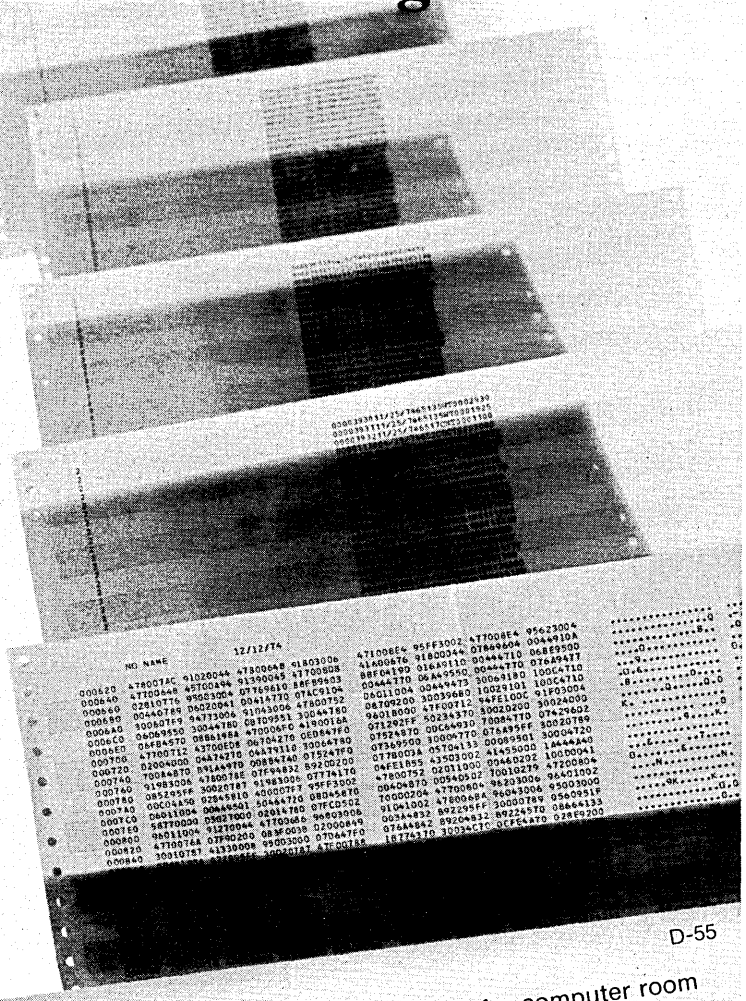
There's a logical transition from freight cars and containerized cargo to the use of bar codes in the tracking of parts, subassemblies, and finished products as they move from the receiving dock to the warehouse, thence to the assembly plant and back to the warehouse, and finally to the shipping dock.

Taking this technology, more than one company is using the bar code in a system that controls the circulation of books in libraries. Checkpoint Systems Inc., Barrington, N.J., is marketing such a system developed by the Plessey Co. in the U.K. and reportedly installed by the latter in more than 150 library systems world-wide. It calls for bar code labels to be applied to all loan items, books and phonograph records and the like, as well as to the borrower's library card.

Checkpoint has installed four systems in the U.S., the largest at the Milwaukee county federated library system. All the 24 branches are linked to a central Interdata minicomputer, which is supporting some 60 terminals. It's essentially an off-line data collection system, with a few things performed on-line. For example, there's an on-line book reservation file which indicates that a recently returned book has been reserved by someone else. Also, the librarian can check to see whether a borrower owes money for overdue books.

There are three types of terminals, all made by Plessey. One is strictly a charge terminal, for checking out books, while one is a discharge terminal, and the third is a composite, having both a pen to scan the code and a keyboard, plus a digital display. The keyboard is used to enter reservation data and delinquent patron informa-

If your computer's talking gibberish, take two aspirin and call us in the morning.



Chances are, your computer's being harassed by its environment. High or low humidity, wide temperature swings and insufficient air circulation all cause gibberish. And worse, they *can* cause a complete system failure.

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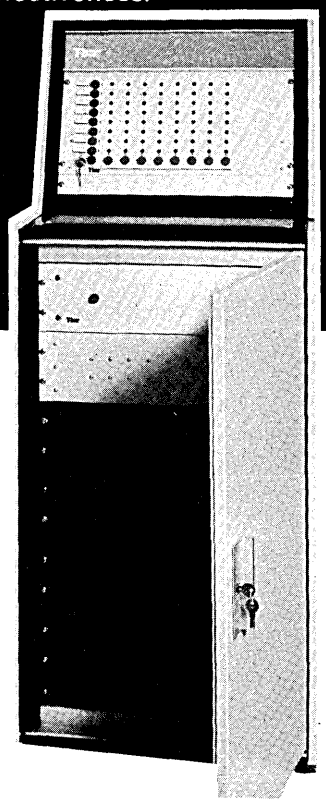

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Bar Codes...

tion. The latter would be used at a small branch, while a large branch might have a variety of all three types of terminals.

Replacing multi-part forms

Finally, there's an application in which bar code labels are used in a manner much like a multi-part form. This is in a ginning operation out in cotton fields. As the cotton is baled, a numerically sequenced label of NCR's color bar code is attached to each bale. It can hold 28 numeric digits on a block; there are two blocks on a label, so its capacity is 56 digits. It can also store alpha characters, but this drops the capacity from 56 to 28.

The bar code attached to a bale identifies not only the field where the cotton in that bale was picked, but also the owner of that field, if necessary. The bales are then taken to a central processing operation, equipped with NCR 280 terminals that can be polled by a Century computer. Here, a number of identical labels are attached to the bale for identification purposes, the label is scanned, and the weight of the bale is keyed.

At this point, too, a sample of the cotton is taken and a label from the bale is torn off and attached to the sample. The sample is used for grading purposes, but a buyer will also inspect that sample and scan the code to specify that this is the bale he wants to purchase. And when the bale is shipped, another label can be removed to record its shipment. At this installation they average about a half-million reads per year, and reportedly have had no detectable errors in their two years of using bar codes! Having captured all this information, it's a small step to producing management reports that analyze the growing conditions of the land where the cotton was grown and comparing the field's yield with the watering and feeding care it received.

Conclusion

Thus it appears that bar code systems are being used in a growing variety of data entry applications. From the factory environment, where these codes have become familiar graphic elements to people in the material handling field, they have begun moving into office and hospital settings. Through the efforts of the Super Market Institute, their appearance in grocery stores and even in the cupboard at home has become commonplace, if not too popular. They may next appear on product tags in department stores.

All that remains is for some bureaucrat in Washington to suggest that each citizen be issued his own. □

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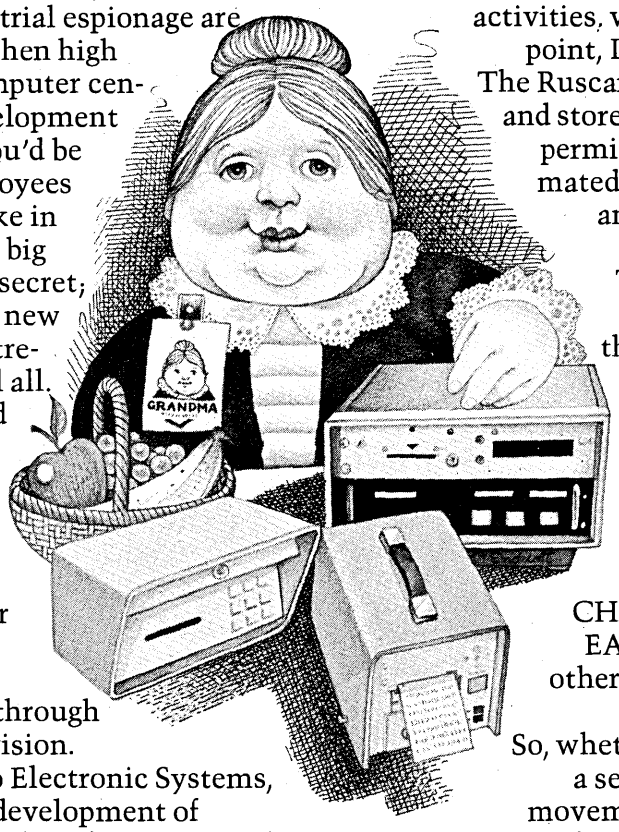

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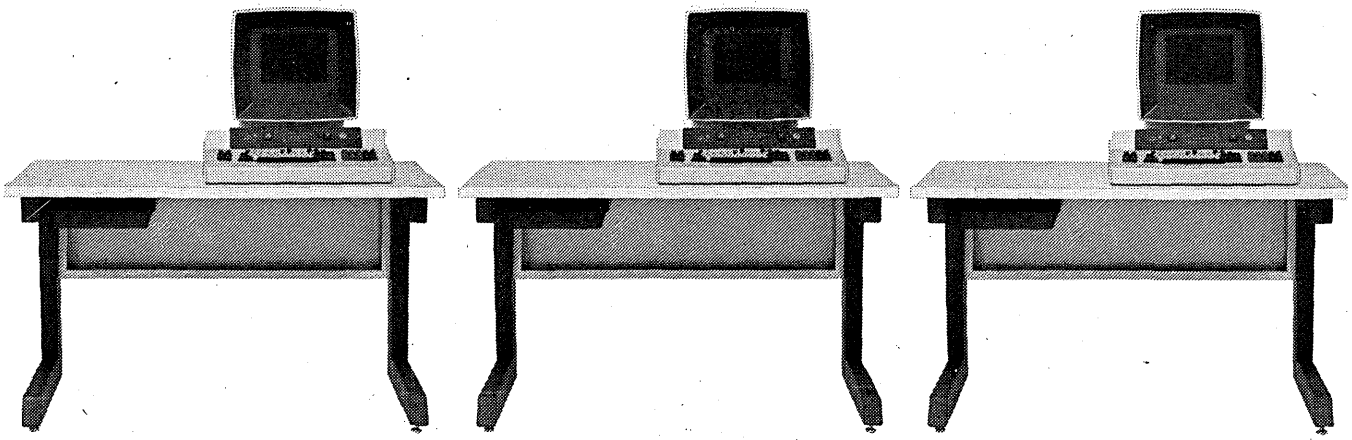

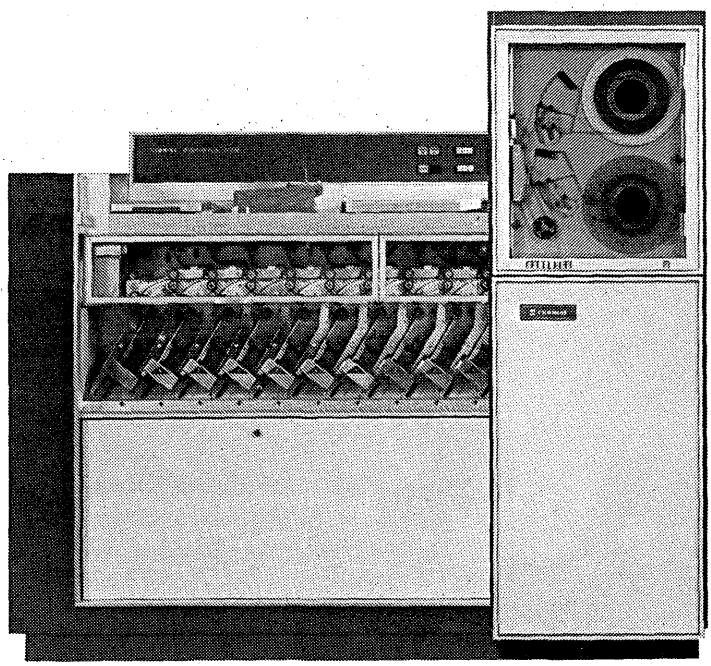

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Going "backwards" to an open shop, single-stream environment and "down" in scale to a minicomputer can yield higher throughput, increased flexibility, and easier operation.

UPGRADING TO A SMALLER MACHINE

by Victor Matthews and Joanna V. Pomeranz

Computers have made it feasible for research workers to routinely perform complex analyses on large volumes of statistical, engineering, scientific, and other data. However, in many quarters data processing centers have gained unenviable reputations as barriers rather than bridges between end users and analytical tools. Much of the schism results from the hardware and software complexity. Fortunately for broad classes of research oriented applications, systems based on minicomputer central processors now offer viable alternatives to this complexity. The hardware speed and software simplicity of these machines permit upgrading many existing systems, expanding direct user involvement and increasing overall throughput, by going down rather than up in scale and cost.

Older traditional data processing centers use equipment which has been optimized for closed shop single-stream batch operation. This is ideal for workloads dominated by accounting, payroll, and other commercial functions, and by standard production runs of data base manipulations. However the long turnaround time and lack of interactive program development are detrimental in research oriented activities because they preclude intimate communication between the worker and the computer. Similarly, systems programmers and other personnel required to service complex systems introduce extra links in the chain between the user and his program in execution, while adding to operating expenses.

Avoiding the dp center

The cult of the computer center has been somewhat self-defeating because users are looking elsewhere for data processing functions, capabilities, and performance. Management often expresses serious doubts when augmented computer capabilities are requested, and internal conflicts can be created if either the end users or dp specialists have strong influence within an organization.

Interactive time-sharing is employed to supplement internal computer services. Time-sharing utilities offer fast enough access for most applications, some specialized software packages or services, and small capital investment and overhead. Liabilities include costs which increase sharply with numbers of users, and nontransferability of programs if the system or the supplier is changed.

Another widely accepted path around data center problems is the purchase of individual minicomputers for use in specialized applications. Benefits are high availability and well developed BASIC and FORTRAN programming aids, as well as an increasing array of suitable terminals, high speed I/O devices, discs, and peripheral processors. Disadvantages include costs to purchase and maintain extra hardware and software, need for personnel to coordinate and perform limited system functions, and data formats which are incompatible with those of larger machines.

Time-sharing service bureaus and decentralized dedicated minicomputers are often only stopgap solutions to problems of unresponsive data processing systems. A more viable alternative is the development of a central resource optimized for open shop end user involvement, throughput, expandability, and economy.

Until recently the best means of balancing these factors appeared to be through acquiring increasingly large central processors, taking care that the family contained at least one more upward compatible member for growth. However, the surprising power of present minicomputers permits a radically different solution.

The characteristics of minicomputer-based systems which favor their use in upgrading older medium-scale installations include well developed multiprogramming executives for mixing batch and time-shared interactive terminals; program creation and debugging aids that permit a high degree of direct involvement by end users with no particular computer background; addressing schemes which access reasonably large memories (in spite of short word lengths); short enough cycle times to provide satisfactory number crunching; low cost parallel processors to implement features such as floating-point or commercial arithmetic overlapping central processor operations; a widening variety of I/O and storage devices, such as high capacity multi-ported discs with swapping priorities to optimize usage; expanding hardware and software support; well documented, easily used, reliable software; and inherent expandability through such features as provision for multiprocessors.

Experience in the dp center at The Population Council illustrates how upgrading to a mini-based system can provide optimal utilization of limited funds. The council is a nonprofit foundation established in 1952 for scientific training and study in the field of population. It endeavors to advance knowledge in the broad field of population by fostering research, training, and technical consultation and assistance in the social and biomedical sciences.

A midi was too small

The council's original involvement with data processing began in the late 1960s with a number of international surveys. These data were analyzed at various universities as well as at a service bureau in New York City. Use of the service bureau expanded rapidly as other large-scale projects were undertaken and awareness of data processing as a statistical tool spread

through the organization. By early 1971, costs were in excess of $12,000 per month and still climbing, but turnaround was discouragingly slow and staff members were dissatisfied with the inflexibility of the system.

An evaluation during 1971 indicated that the establishment of a computer facility would raise performance and simultaneously decrease costs by a factor of three relative to the outside source. An IBM 1130 with tape drives was selected, largely on the strength of a similar system operating at Brown Univ. The Brown Univ. computer was in a social science department and used for demographic applications like those of the council. It was run in a batch mode on an open shop basis, with users responsible for much of the operation. Moreover, the director of the facility offered to provide consultation as well as software and programs. Further, the 1130 could serve as a remote job entry station if required.

The 1130 was installed in July 1971 and a manager was hired to head the data processing unit. Because existing application programs had been developed and used at a local service bureau with a large IBM 360/65, little attention had been paid either to core size or the number and size of disc files. These programs had to be completely rewritten to recognize the differences in word size, to reduce core requirements to 16K (words), to operate within the limitations of 1130 FORTRAN and to substitute tape for disc files when the requirements exceeded the capacity of the IBM 2310 disc. The guiding principle during the 500-odd man-hours dedicated to program conversion was to make the revised programs as machine independent as possible.

As the application programs were converted and general statistical routines implemented, the use of computer time increased to 10-12 hours/day, 6 days/week. Because of increasing demands, it became apparent by fall 1971 that an upgrade would be necessary. This posed a problem in that the configuration of the 1130 left little room for expansion. This was a very serious limitation, for while all past computer applications were being performed inhouse, the required new activities would increase the workload to 24 hours/day, 6 days/week and would severely restrict turnaround time. Use of the 1130 as a remote job entry station would not significantly alleviate the situation because of the high use and limitations of peripherals.

A set of functional specifications was written. This involved an assessment of needs, computational priorities, and direction of growth. For example, it was clear that statistical analysis would constitute a major portion of the requirements. This work would involve using survey data to produce frequencies, cross tabulations, regressions and correlations; to perform curve fittings and multivariate analyses; and to develop and verify models. Data bases varied in size and frequency of updating; for example, an evaluation of intrauterine devices involved over 150,000 records established and maintained by 98 field investigators with bimonthly updates of about 10,000 new records.

Many of the studies involved large data bases, so high processing speeds and large disc capacity would be essential. The large volume of reports emphasized the need for a fast line printer. The past rate of increase in computer applications made the capability for incremental expansion imperative. Because of the large number of studies in the data base and the necessity of transferring programs and survey data between university research centers and the council, magnetic tape drives were required. A card reader was included for batch processing. The open shop environment, where each user was responsible for his own data processing, dictated a system which could be easily operated. Also, the ability to interact with other cpus was considered.

The "smaller" system

A grant of approximately $200,000 was made available for the purchase of a system. Proposals within this price range were solicited from various manufacturers representing a variety of system philosophies.

An upgraded IBM 1130 processor with more core, larger discs and a faster printer was considered, as were several 1130 replacement systems. These would provide greater throughput and would entail little conversion effort. However, the operation would continue in a single batch environment and flexibility as well as growth potential would be limited.

Systems based on larger mainframes which met most performance and expandability requirements were also considered, but exceeded the price range. In addition, these systems would require additional staff for operation and maintenance.

The only systems which satisfied the established functional and economic goals were those built around minicomputer central processors. Since this approach was away from the IBM family and the other large mainframe vendors, some questions were raised by management. The major concerns were the availability of system support, application software, and the capability of dealing with EBCDIC tape files. Detailed inquiries indicated that although this had been problematic in the past, a directed effort was being made to meet these requirements of the end user market place.

A PDP-11/45 was purchased from Digital Equipment Corp. The components and prices are listed in Table 1. For future expansion, the system could be upgraded to a multiprocessor configuration with nearly double capacity for an added investment of about $70,000; the number of terminals

ITEM	CODE	COST
Central Processor	PDP11/45	$ 12,050
Core Controller & Core (32K)	MF11LP	22,500
Core (Additional 64K)	MM11LP	62,000
Bootstrap Loader	MR11DB	500
Memory Management	KT11C	3,900
Floating Point Processor	FP11B	4,900
Disc Controller & Drive	RP11CE	36,000
Disc Drive	RPO3AS	25,000
Tape Controller & Drive	TM11EA	9,950
Tape Drive	TU10EE	6,950
Unibus Repeater	DB11A	1,000
DECwriter	LA30P	2,795
Line Printer	LP11RA	30,000
Card Reader	CR11	4,500
Line Clock	KW11L	250
Expander Cabinet	H960EA	4,400
Line Interface	KL11A	2,000
Peripheral System Unit	DD11A	525
Original Cost*		$229,220
Multiplexor	DH11AA	4,400
Modem Control	DM11BB	1,295
Line Adapter	DM11DA	340
Line Conditioner	DM11DC	860
Beehive Model III Terminals (5)**		13,440
Communication Equipment ordered later		20,335
Total Cost		$249,555

*Internal funds were used to supplement the external grant. These monies were used to expand from 64K to 96K of Core.

**The Beehive Model III terminals have been replaced by nine new terminals consisting of the DECwriter II and the DEC VT50.

Table 1. Components and prices of the minicomputer-based system installed at The Population Council.

could be increased to 48 for the cost of the terminals and communication devices alone; and memory capacity could be increased to 128K words with no changes in existing software.

The system has exceeded throughput expectations, while operating at a substantially lower cost per program than was anticipated. An additional advantage resulted from the availability of time-sharing software. This has proved to be a significant factor for applications with heavy emphasis on end user involvement.

Installation and conversion

Startup problems are inevitable in any installation because each computer configuration is somewhat unique. For example, the original 1130 was to be very similar to the configuration at Brown Univ., yet some of the software had to be modified before it could be run. Some difficulties were encountered when the PDP-11/45 was installed, mainly because it was a recently announced system. Strong support was obtained from the vendor in making the system operational. Furthermore, during the shakedown period before the system was formally accepted, the workload of the 1130 was successfully transferred. During this time, the normal data processing requirements were satisfied in spite of concurrent debugging operations.

Conversion of software is a major concern in any upgrade, and more than a few dp installations have encountered disasters even when remaining within the same computer family. The council's conversion problems were faced when the change was made from the IBM 360/65 at the service bureau to the 1130. In addition, since the council had provided programs to other institutions, conversion pitfalls were well understood. Existing programs, therefore, had been written in a low level of FORTRAN that proved easy to convert.

The average program conversion consisted of changing the "control language," changing the DATA statement which assigned logical numbers to peripherals, and recompiling. During the earlier conversion, the decision had been made to reference peripherals symbolically within the program and define the corresponding logical number within a DATA statement. Less than 50 man-hours were required for the conversion. Since an application program for translating 360-type EBCDIC tapes into ASCII was available from the vendor, the entire data base was available for analysis and sharing with other institutions.

Implementing time-sharing was relatively easy. For example, existing programs to perform sophisticated demographic analysis had to be converted from FORTRAN into BASIC PLUS (an enhanced version of BASIC available under the time-sharing system) and from a batch oriented to an interactive operation. Within three weeks of installing the time-sharing system, remote terminals were stationed at the annual meetings of the Population Association of America and these programs were successfully used by demographers who had no prior knowledge of the system.

As presently configured, the minicomputer-based system is equivalent in cost to the original IBM 1130, but exhibits a run time throughput gain of about 10, a compile-time reduction of about 3, and an on-line storage capacity increase of over 45. As presently operated, less than 50% of prime time is spent under DOS/BATCH with programs written in FORTRAN. Some of the system development work and most of the large-scale statistical applications are run in this mode. During most of the day, the time-sharing system is available through programs written in BASIC PLUS. The applications for which the time-sharing environment is most popular include administrative work, data base handling, matrix manipulations, quick calculations to test theories, consistency checks, and data editing.

Production runs for analyzing or updating large volumes of data are performed unattended at night under DOS/BATCH, with the two disc packs providing spooling and storage of both program and data files. This use of the computer has significantly increased available processor time and has, therefore, reduced costs to individual users. An example of the gain is provided by a continuing study involving about 75,000 records with 20,000 periodic additions and changes. The data base update required over 40 consecutive hours on the 1130; the first run on the PDP-11/45 was completed in 4 hours, and the program is now executed unattended at night when the system would otherwise be idle.

Conclusion: it works

The recent change in minicomputer vendor orientation from solely supplying components to the oem market to also providing systems (with peripherals, software, customer training and maintenance) to the end user has provided a new alternative to the former midicomputer user. The minicomputer-based system appears to be ideal for applications with heavy emphasis on individual user involvement. The systems offer such high inherent throughput that inefficiencies of interactive computation do not penalize workload. Further, the system hardware and software are designed to require only minimal computer skills of end users.

The minicomputer system which replaced the IBM 1130 was installed at a cost of approximately $230,000. Time-sharing was implemented almost as an afterthought, but is now accounting for a greatly increasing portion of the machine time.

Minicomputer-based systems also offer considerable economy in purchase or lease price. This economy is magnified in the cost of individual jobs due to greatly expanded use in the terminal environment, extremely fast program run time, and the practicality of running production work at night in an unattended mode.

The lack of standard program packages supplied or sold by the vendor has not proved to be a major hindrance. Most such packages must be customized for each application, a task which can easily approach that of writing software from scratch. Further, most available statistical packages require a great deal of core, and are therefore only marginally effective on medium- or small-scale systems. Experience here indicated that some proprietary applications programs would have to be written regardless of which computer system was selected. In addition, the council and other sophisticated end users are developing well documented application packages designed for minicomputer-based systems. Much of this user-developed software is becoming readily available.

For quick calculations and testing, users have become adept at creating their own programs. Since run time is not critical, no real penalties are imposed by trading operational efficiency for programming ease.

Use of the system is growing faster than originally expected but capacity is still far from being fully utilized. The

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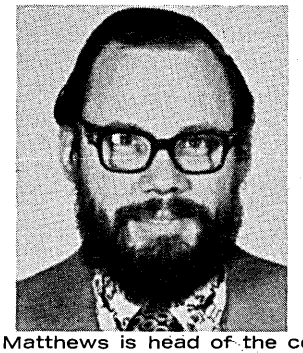
UPGRADING

ease and convenience of operation have encouraged users, who think of the computer more as a statistical tool than as a data processing system. Further, researchers have not had to become involved in the intricacies of computation. As a result, the system proves comfortable to the end user and, simultaneously, powerful to the professionals responsible for the data processing center.

Finally, a staff is responsible for the computer but there is no dp department in the traditional sense. Though the work has escalated over the past three years, the size of the staff has remained constant. A primary reason, aside from the assumption of responsibility by the end users, is that the hardware and software are virtually foolproof. As a result, $250,000 in computer equipment is shared by users throughout the organization with minimal staff hours dedicated to its care or feeding. □



Dr. Matthews is head of the computer center at The Population Council. His introduction to computers came as a graduate student at Washington State Univ. during the mid-'60s. Prior to joining the Council, he was an associate professor at the Univ. of Alberta.

Ms. Pomeranz is the manager of the computer center at The Population Council. She received her education at London School of Economics and the Univ. of Michigan. Prior to her present position, she worked at IBM World Trade and Columbia Presbyterian Hospital.

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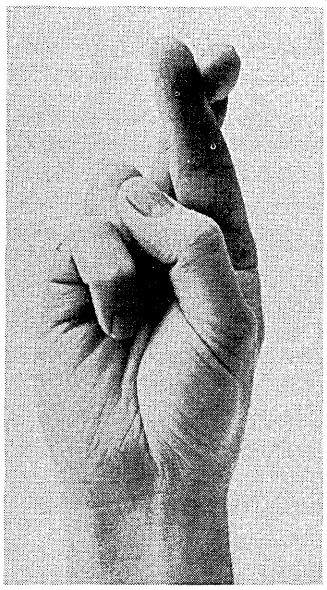
You're one of the lucky ones.

Unfortunately too many companies last year did suffer major business interruptions due to fires in or near their computer rooms.

What's even more unfortunate is the fact that a lot of the damage, clean-up and downtime could have been avoided.



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The system that snuffs out fires dry. Just seconds after they start.

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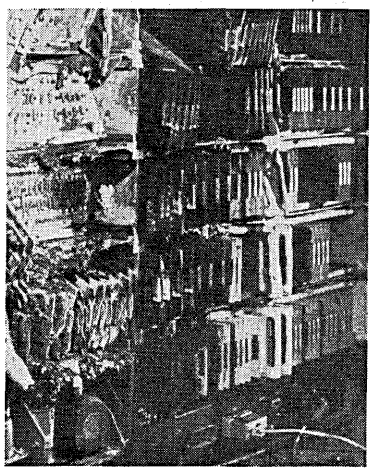

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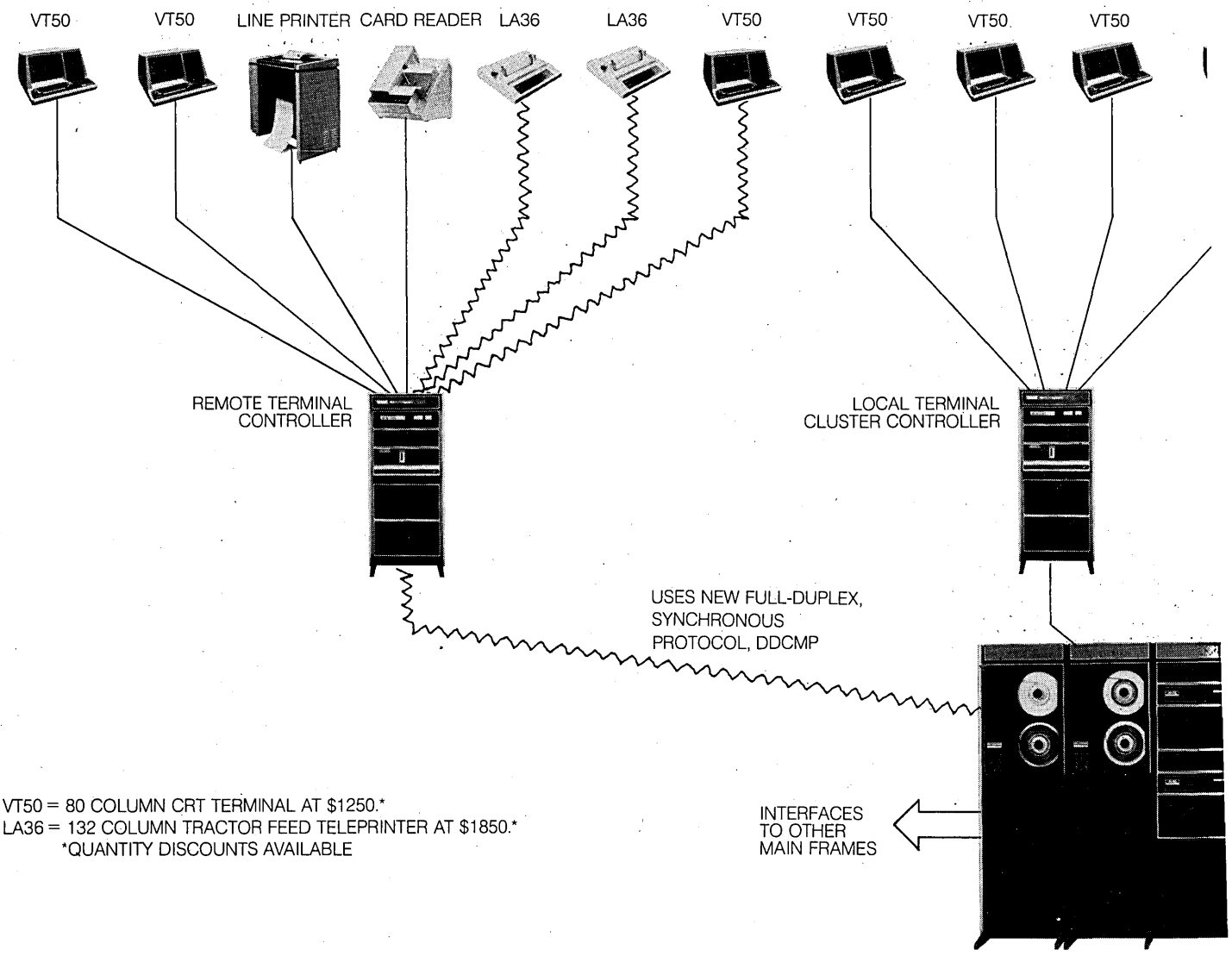

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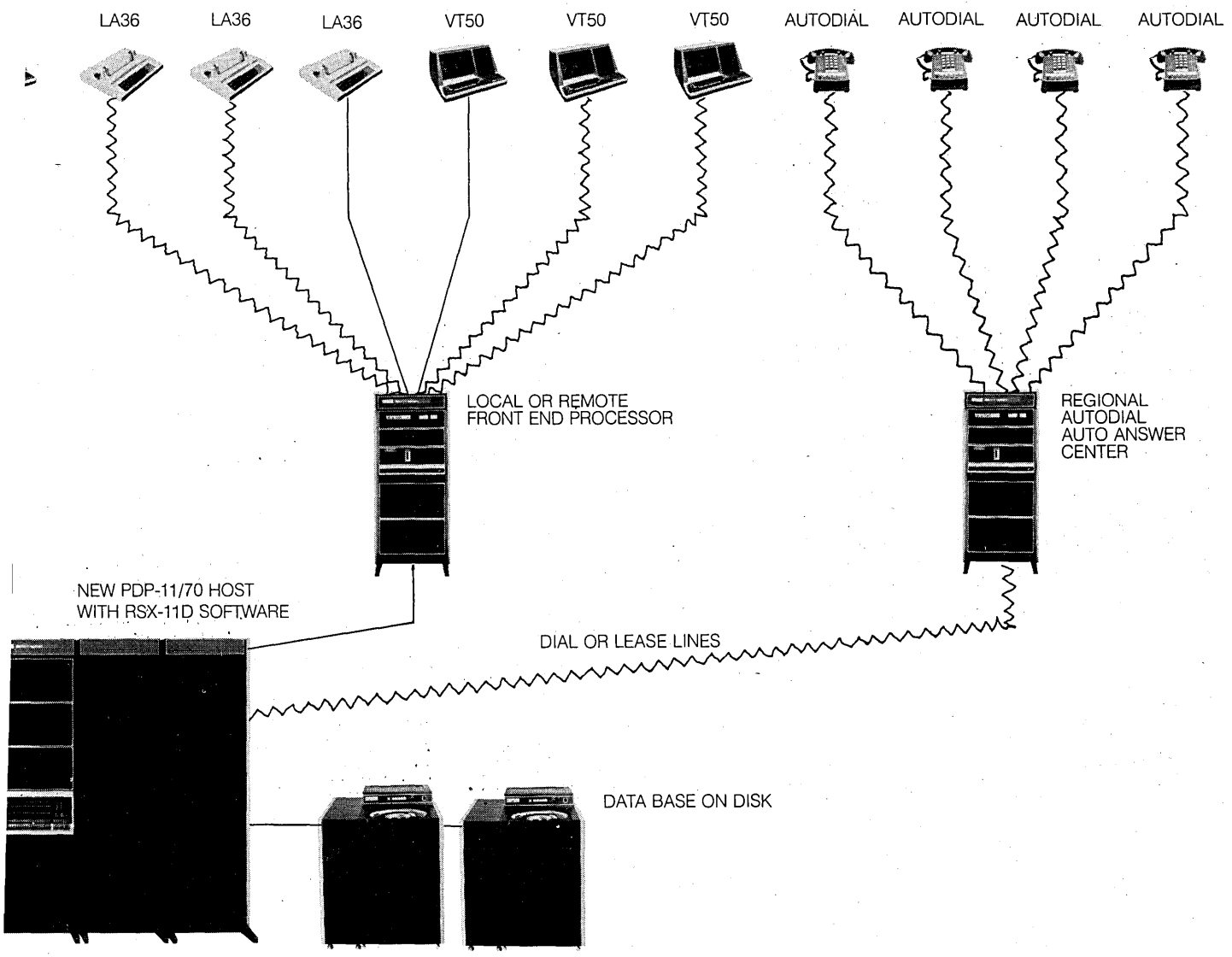

This technique produces
a set of linear, single-path flowcharts
which are very well suited to
the new programming techniques.

STRUCTURED TOP-DOWN

Spurred by the increasing costs of computer software, much attention is presently given to the creation and exercise of better programming system development and maintenance techniques. Two recently popularized approaches to solving this problem are the top-down and structured programming techniques.

With the top-down approach to programming, the first order of procedure is to describe a generalized structure or set of modules to solve the programming problem. These first level modules may then be divided into succeeding levels of modules to form a tree-like pattern for the design and development process. Given modules are expanded to as detailed a level of functional definition as is necessary to produce a relatively easily understood and manageable work breakdown structure.

Structured programming is generally characterized by the use of control structures consisting of three basic programming progressions: the linear sequence, the selection process, and the iteration or loop. Use of these basic constructions enhances both a program's readability and maintainability.

Top-down programming is easily combined with the use of structured programming. Use of this combination tends to generate a highly modularized, clearly organized description and development of a computer programming system.

There is a technique for flowcharting programming systems that is compatible with both the top-down and structured approaches to programming. The technique also: (1) is simple in concept and presentation, (2) describes a readily intelligible control flow of the programming process, (3) is clear and concise in defining processing modules and their control flow at each level of activity, (4) is easily translated to computer code, and (5) provides effective facilities for making coding assignments.

Other techniques have recently been developed that promise to improve programming systems documentation technology. Hierarchy plus Input-Process-Output (HIPO) developed by IBM as a method of programming system documentation is one active solution to the problem. The essence of this approach is to segment a program into input-process-output blocks and then build the hierarchy of a given function with them. Although a major improvement over the conventional flowchart and reasonably consistent with top-down design, the HIPO diagram describes the functions to be performed and not the internal control-flow of the programming process.

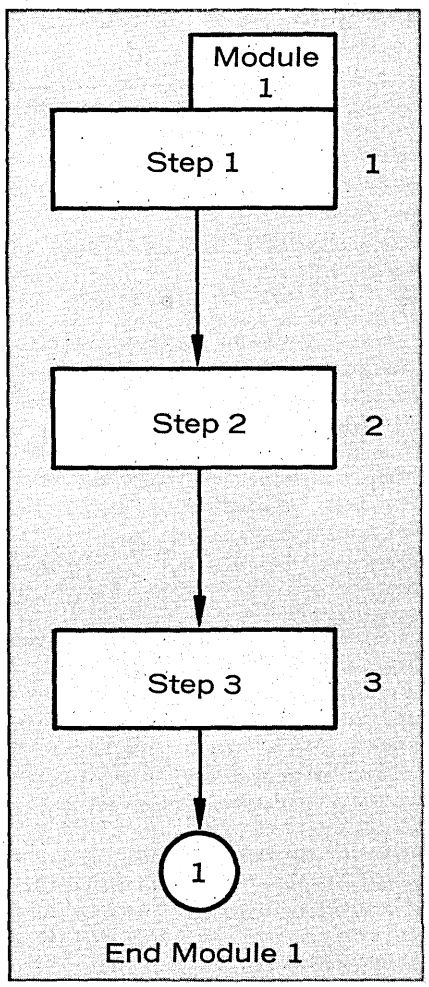

Fig. 1.

The structures

The SCAT flowcharting technique introduced here incorporates the use of both the Structured Control-flow And Top-down programming structures. The essence of SCAT is to display control flow and functional performance at successive levels of activity. Consistent with top-down programming, the first level is defined as the most general or highest level of control flow that connects the major activities of a programming system. The control flow at any level then takes the form of three basic patterns to directly support those used in structured programming. These basic patterns are: the simple linear sequence, the condition-action sequence, and the repetitive sequence.

The most basic pattern, the simple linear sequence, is exemplified in Fig.

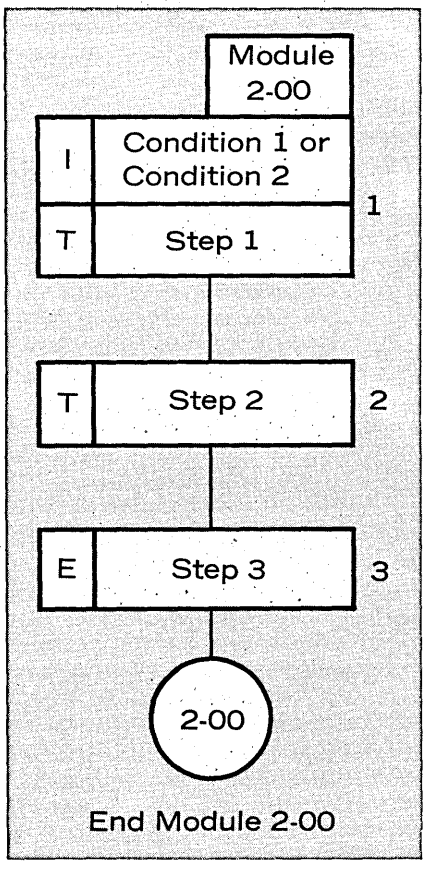

Fig. 2.

FLOWCHARTING

by John B. Holton and Bill Bryan.

1. The number "1" in the upper right corner identifies this particular linear sequence of steps or module. The final node marks the end of the sequence.

The condition-action (CA) sequence is the second type of structure used with the SCAT technique. It is patterned after the standard selection statement: "IF . . . THEN . . . ELSE." It is described in Fig. 2.

The "I" in the upper left column of the first process given in Fig. 2 identifies the condition or conditions to be tested. The "Ts" in the first and second block identify the steps to be executed if the compound condition associated with the "I" test identifier is true. Otherwise (ELSE) step 3 will be executed.

Each conditional expression and each of the resulting set of activities may require the use of more than one process block. The latter possibility implies that a simple sequence of steps can be naturally embedded in the con-

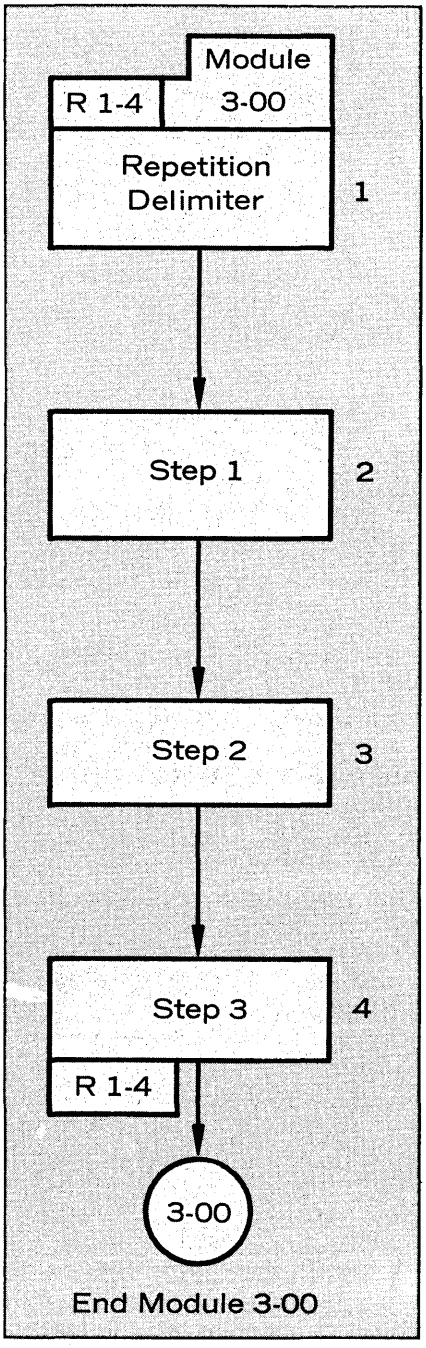

Fig. 4.

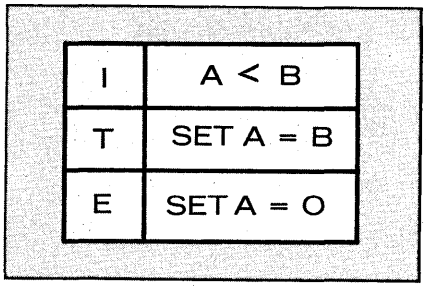

Fig. 3.

```
PROCEDURE DIVISION.

1-MAIN-LINE-PROCESS SECTION.

     OPEN INPUT ACCTS-REC-FILE.
     OPEN OUTPUT PRINT-FILE.
     PERFORM S2-02-HEADING-LINE-ROUTINE.


103-CUSTOMER-PROCESSING.

     READ ACCTS-REC-FILE
        AT END GO TO 110-END-ROUTINE.
     IF AR-CUST-NO NOT EQUAL WS-CUST-NO AND
        IN-REC-NO NOT EQUAL FIRST-ONE
        PERFORM S2-06-CUSTOMER-TOTAL-ROUTINE.
     IF LINE-COUNT NOT < 20
        PERFORM S2-02-HEADING LINE-ROUTINE.
     IF AR-CUST-NO EQUAL WS-CUST-NO
        PERFORM S2-08-PRINT-OUT-ROUTINE
     ELSE PERFORM S2-09-NEW-CUSTOMER-ROUTINE.
     GO TO 103-CUSTOMER-PROCESSING.


110-END-ROUTINE.

     PERFORM S2-06-CUSTOMER-TOTAL-ROUTINE.
     PERFORM S2-11-GRAND-TOTAL-ROUTINE.
     CLOSE ACCTS-REC-FILE, PRINT-FILE.
     STOP RUN.


2-SUBROUTINE SECTION.

S2-02-HEADING-LINE-ROUTINE.

     WRITE PRINT-LINE FROM HEAD-LINE-1 AFTER
        TOP-OF-PAGE.
     WRITE PRINT-LINE FROM HEAD-LINE-2 AFTER 2.
     MOVE SPACES TO PRINT-LINE. WRITE PRINT-LINE
        AFTER 1.
     COMPUTE LINE-COUNT = 0.

END-MODULE-S2-02.
```

Fig. 5. Excerpt from a COBOL program to list and accumulate customer invoices.

dition-action sequence. It is not necessary that every condition-action sequence have an "E" act of steps associated with it.

An example of the condition-action sequence is shown in Fig. 3. It simply states that: IF A < B THEN SET A=B ELSE SET A=0.

The third and final control structure, the repetitive sequence is illustrated in Fig. 4. The "R 1-4" in the upper left corner of the first process block marks the beginning of the sequence and defines its range of activities. The first process block also contains the repetition delimiter or exit condition for this repetitive sequence of activities. The "DO . . . UNTIL . . ." statement is one example of a delimiting function that may be entered in this first block. The remaining blocks in the sequence define a simple linear sequence of steps to be executed repeatedly until the condition stated in the delimiting function is satisfied. The "R 1-4" in the lower left corner of process block 4 marks the end of the sequence.

A very simple set of flowcharting symbols is used in implementing the SCAT procedure. The rectangle is used as a description for any computation or control function. This is consistent with the standards set forth by the International Organization for Standardization (ISO).

However, the circle is not used in the standard manner as a connector symbol. Instead, it becomes a special type of terminal symbol representing the end of a module of activities at a given level of process control flow. The ellipse is used to represent all other terminal points in a program network.

Line segments are used to define the sequence or flow of processing. And finally, the hexagon is used to contain module descriptive information and normally marks the beginning of a program module.

An example should help clarify the essentials of the technique. Consider the following program abstract:

This program reads a file of customer records—with each record containing a customer's name, number, and invoice amount—and reports the results. The input file is organized sequentially in ascending order by customer number. Each input record triggers a detail line of print on the report describing the customer's name, number, and invoice amount. An additional line is printed for each customer showing the total of all invoice amounts for that customer. A grand total or invoice summary amount is printed at the end of the report. Heading lines are printed at the top of each page and each page is limited to 20 printed lines of detailed information.

Fig. 5 is an excerpt from the Procedure Division of a COBOL program designed to accomplish this task. It illustrates the MAIN-LINE-PROCESS or first level of programming code used to solve the problem. Also included is a second level module, the HEADING-LINE ROUTINE, which is called into execution by this MAIN-LINE-PROCESS.

Fig. 6 is a SCAT flowchart of the program segment shown in Fig. 5. This flowchart is sequenced and read column by column starting from the left side of the chart. Individual steps or activities in a given module are numbered sequentially. These numbers appear to the right of the flowcharting symbol being used to describe the particular step in the process.

The information symbol used in block 5 of module 1 contains the conditions to be tested in steps 6 through 9. The individual conditions are numbered and these numbers are then used in the Boolean expressions to represent the particular conditions to be tested

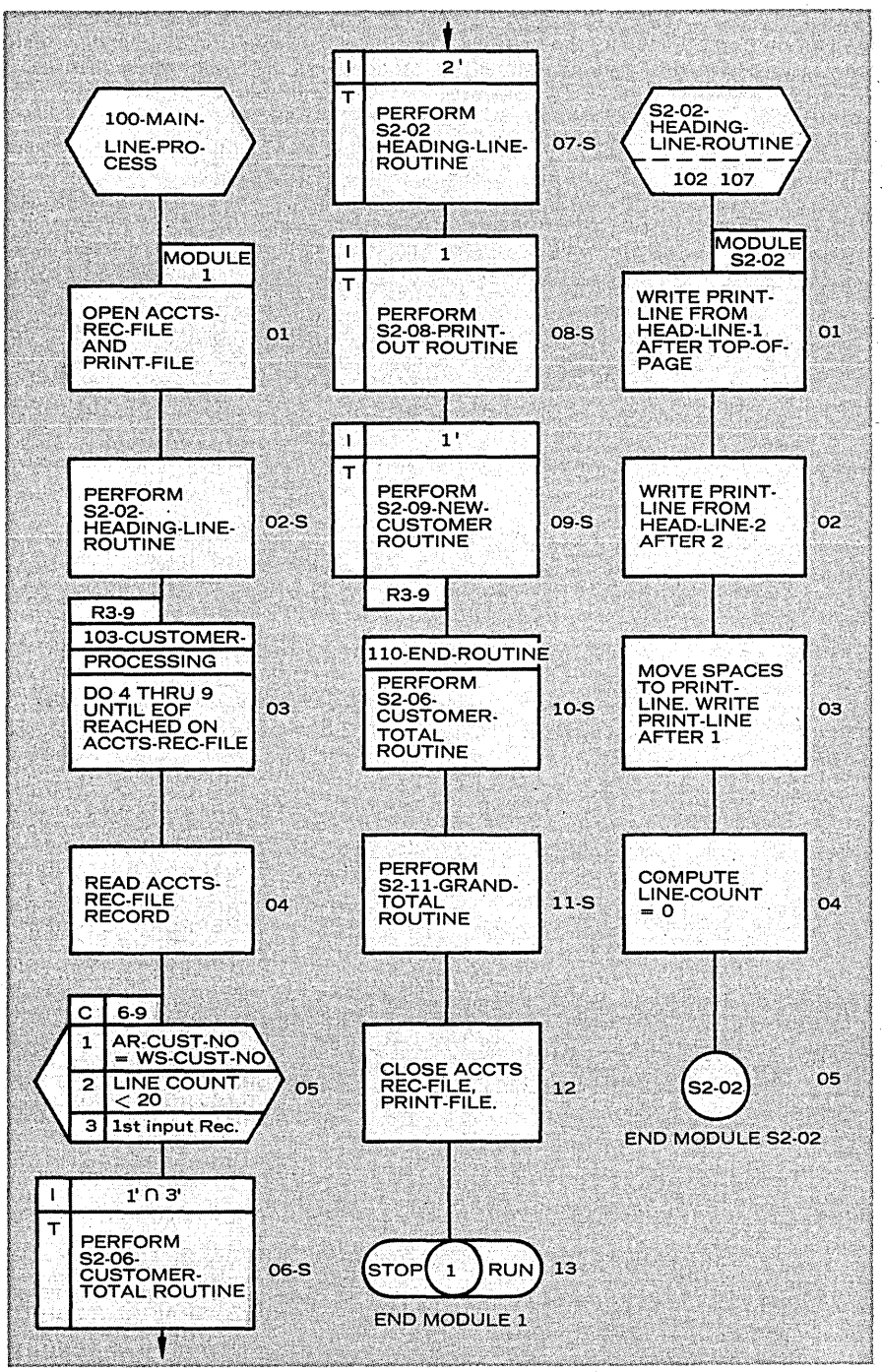

Fig. 6. Flowchart for code shown in Fig. 5, as produced through the SCAT flowcharting technique. The chart is read column by column starting at the left. This example illustrates the use of the closed subroutine in expanding modules at lower levels.

when these steps are executed.

It is not necessary to use this "shorthand" notation. However, when the Boolean expressions are used, the "∩" symbol defines the logical product of two conditions. This in turn means that the logical product is true if and only if each of the conditions in the product is true. The single apostrophe is used to represent the complement or negation of a condition.

Step 6 in module 1 exemplifies the use of these symbols. Step 6 will be executed when AR-CUST-NO does *not* equal WS-CUST-NO and the input record is *not* the first input record.

The hexagon or information symbol is also used in Fig. 6 to mark the beginning of each processing module. It contains the module's name and, where appropriate, references to other modules using or linked to this module from a higher level module.

Part of a module's name is its identification tag. The HEADING-LINE-ROUTINE identification tag (i.e., S2-02) starts with the letter "S" to identify the module as a closed subroutine. The first digit position "2" identifies the level of this module in the hierarchy. The last two digits complete the identity of this module by naming the step which first calls upon or uses this module at the next higher level of activity. For example, module S2-02 is first called into use by module 1 during step number 02. Lower than second level modules are identified by adding two digit positions to the module identifier for each successive level of processing involved.

The last step in module 1 (i.e., step 13) is pictured using a combination of flowcharting symbols. The ellipse identifies this step as a terminal or exit step in the process. The circular symbol identifies this step as the terminus of a program module.

Notice that module 1 contains more than one control flow (CF) structure. In particular, steps 3 through 9 define a repetitive sequence of functions to be performed. Embedded in this sequence is a series of condition-action sequences.

This raises the issue as to whether it is possible to embed any given type of CF structure within the same or any other type of CF structure. The answer to this question is "yes" and the appropriate flowchart entries are easily constructed. Minor additions to existing rules must be made in order to properly make these entries when embedding condition-action sequences in other condition-action sequences.

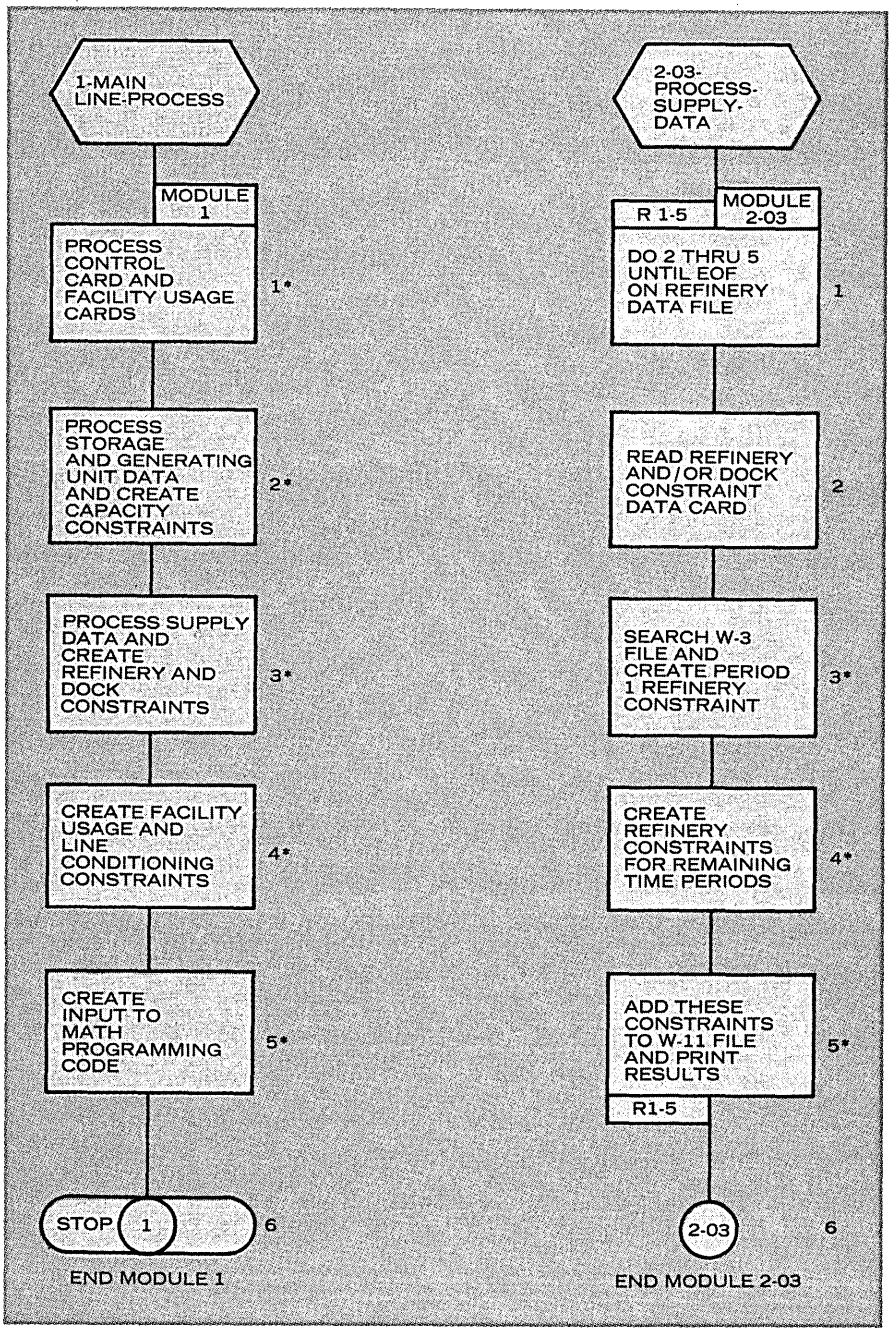

Fig. 7. Excerpt from a FORTRAN program which preprocesses data to be used by math routines. This example shows that SCAT is also compatible with the open subroutine approach to program design.

The top-down approach

The top-down approach to program flowcharting is easily implemented using SCAT. Control flow is analyzed and described at each level beginning with the first level of control flow, that is, the one among major program activities. From that point, a more detailed description of activities or functions may be developed and described at the next level of modular activity. This process is repeated until no lower level of processing activity is present. This results in a series of individual module flowcharts as exemplified in Fig. 6.

Fig. 6 shows only the use of the closed subroutine in expanding modules at lower levels. The question arises as to whether it is practical to use this same structure to describe open subroutine modules at these lower levels of activity.

Fig. 7 is an excerpt from a flowchart describing a FORTRAN program to preprocess a set of user data for input to a math program. The asterisk shown to the right of the step numbers in module 1 indicates that the particular step is expanded at the next level of activity. Module 2-03 is an open subroutine expansion of the activity or function defined in module 1 step number 03. From this example, it is easy to see that

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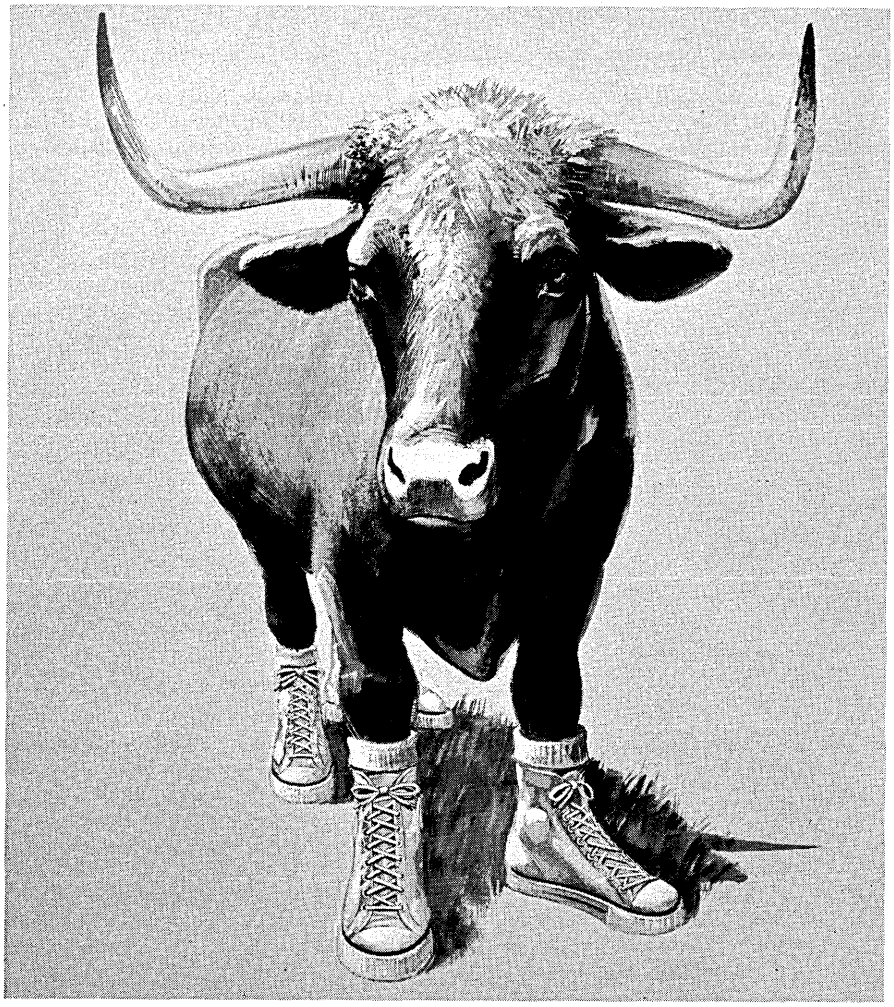

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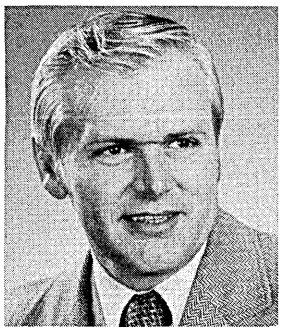
the open subroutine approach to program design is also compatible with the SCAT procedure.

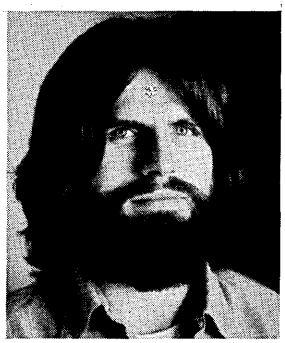
Summary

Because SCAT depicts program processing as a sequence of linear chains defined at successive levels of processing activity, it eliminates the conventional flow-charting need to establish muliple, often difficult to follow paths from the same program step. The minimum number of different programming symbols used further heighten its simplicity in concept and presentation.

SCAT's linear sequencing of activities and hierarchical ordering of activity modules also help the user to produce a clear, concise, readily intelligible description of the programming process. Furthermore, it helps the user develop distinct clearly defined program logic modules. This, in turn, facilitates the user's ability to make programmer coding assignments and subsequently translate a flowchart into comptuer code. □



Dr. Holton is an assistant professor of quantitative business analysis at USC and a partner in Management Science Associates. His research and business interests include the economics, design, and management of computer-based information systems.



Mr. Bryan is an assistant professor of management science at the Calif. State Univ. at Northridge. A doctoral candidate at USC, he has worked two years there as a research fellow.

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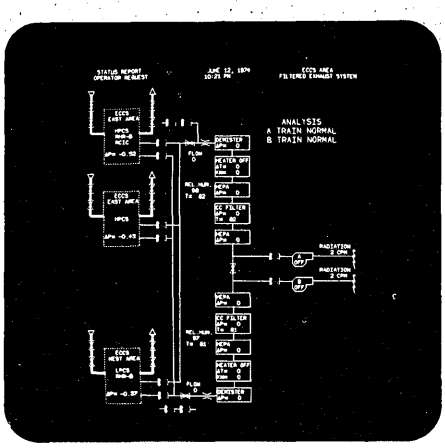

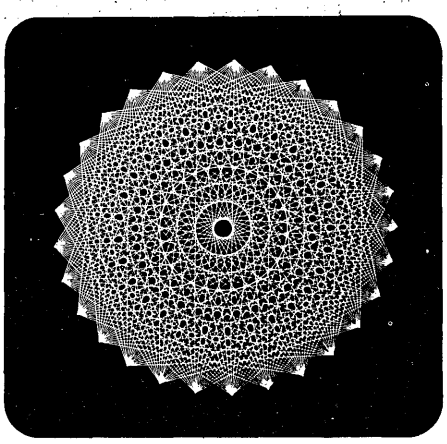

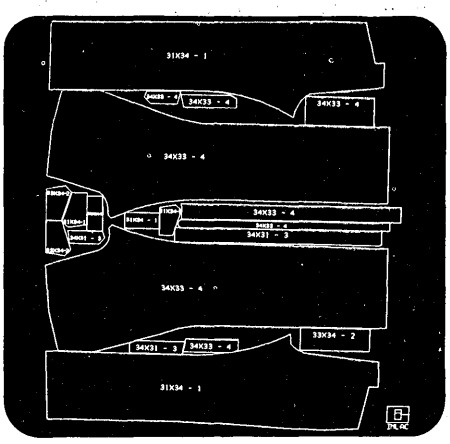

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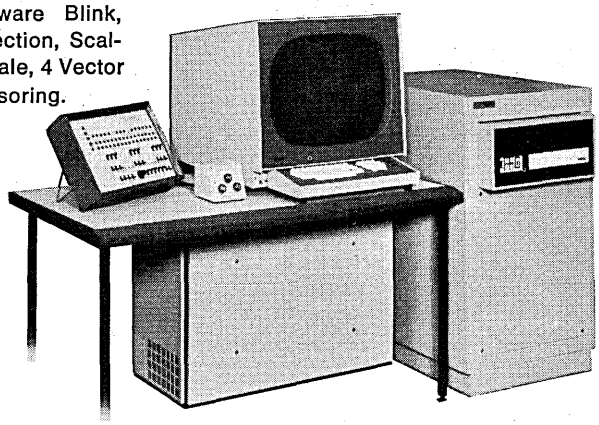

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MANAGING THE TRANSITION TO STRUCTURED PROGRAMMING

by Lawrence Peters

In the last few years, the subject of top-down structured programming has received an increasing amount of attention, and many firms with existing software development organizations are adopting the method. The decision to do so is an important first step, but what are some of the important factors which must be considered in planning for the transition? In what kind of environment would this approach flourish?

Intuitively it seems unlikely that the same environment which exists today would be conducive to structured programming, especially to the chief programmer approach to structured programming. And factors such as personnel selection and evaluation, motivation, promotions, costs and schedule estimating, simulation, timing and sizing estimating, job descriptions, and management practices—all these present problems.

The case for structured programming

Further, in the various texts and articles which discuss structured programming, no common agreement exists on just what it is. There does, however, seem to be general agreement on some of the properties structured programs possess, such as being

- easier to read and understand than other kinds of programs
- much less likely to contain unreachable code
- easier to debug and maintain
- more correct than other kinds of programs in that one can tell by inspection whether the requirements of the software have been addressed.

Other claims for structured programs exist, however, which are somewhat controversial in that there is either limited or no evidence to support them. Some of these claims are that they cost less to produce, are self-documenting, are more efficient, contain no GOTO statements, and are more reliable.

It is apparent then that once the decision to adopt this method has been made, the very next decision must be what specifically will be adopted. One should, at this point, assemble a complete, detailed description of structured programming as it will be practiced at his facility. This description may also include a plan to phase in structured programming in carefully defined steps. For example, top-down structured programming may be instituted prior to the adoption of the chief programmer team method, or the top-down approach may be utilized together with program structuring (a modular approach by coding in definable units or packets, and not as concerned with control structure as in structured programming), and later used with structured programming, etc.

Another area of concern must be programming experience. Although most software development personnel in an organization have heard or read about structured programming, many organizations—probably most—have no members with first hand experience using this approach. A problematic situation arises. Senior and more experienced individuals, including managers, can attribute their success to familiarity with, and ability to function in, the existing software environment. Since this new technique has not yet shown that it can definitely continue the pattern of success for these individuals, they may become defensive and resist such change. Less experienced, junior level people, on the other hand, who are less indoctrinated in the current methods used by their organization, are more likely to support, or at least, not to resist, a change.

It is more than just a problem of age versus youth. The experience, wisdom, sound judgment, and track record of senior people are necessary for the success of a chief programmer team environment. A well planned education and "public relations" program can go far in reducing the fears of

senior people while reinforcing the stature they have attained.

Management considerations

Management problems associated with adopting the structured programming technique are significant. They run the gamut of management activity from hiring to firing, and should prompt a reexamination of practices which have long gone unquestioned by the management "team." Questions that appear in the discussion here must be answered by the management of the organizations involved. In some cases, possible answers are suggested. Since ego problems, as related to software, will be present regardless of which method is used, I shall assume throughout this discussion that the chief programmer team approach is also being adopted.

1. *Personnel Selection.* Each programming organization has its own means of identifying those people it wishes to hire. These means often involve a "feel" the manager has about how this person would fit into the organization. This subjective approach was developed and fine tuned in a nonstructured programming environment. How much different must an individual be to contribute meaningfully in a structured environment?

In a way it may come down to assessing the degree of autonomy or creativity the individual possesses. For example, an individual who is independent may be quite effective on a research project or in the existing software development organization, but would he be a suitable team member? Are fellow workers now being asked about the advisability of hiring a prospective employee? A prospective member of a team may best be interviewed by his future teammates. Whose judgment should then take precedence, the manager of several programming organizations, or the team that needs another member?

Assembling and maintaining any sort of effective team is a delicate, almost indefinable process at best. Personnel departments normally equate money (salary) to experience via a series of two-dimensional plots with statistical footnotes. What makes an employee worth x dollars anyway?

2. *Personnel Evaluation.* Current methods of evaluating personnel for retention, promotion, and/or raise purposes involve management awareness of the contributions made by each individual. Often performance on specific assignments is the key to an individual's success or failure in these areas. A common complaint among managers and programmers alike in the conventional software development situation is that the individual's visibility is usually obscured, or, at best, dimmed. Since programming teams may logically be composed of people who possess complementary talents or skills, the performance of the team may be easier to judge than that of any specific team member. This is analogous to two societies—one competitive and one cooperative.

Current evaluation methods are geared toward competition among programmers/analysts for limited salary adjustments and promotions. Is it any wonder that a lack of "team spirit" is noted by most management personnel? Are employees currently asked to evaluate themselves? In the chief programmer team environment, would it be permissible for team members to evaluate themselves as well as each other? Would the results be accurate and honest?

Making the chief programmer a member of management is not the answer since this tends to inhibit the flow of information and member-to-member rapport. In fact, the characteristics of chief programmers should be established and reviewed to define how team members may become chief programmers, how chief programmers may become managers, etc. Are these lines of progression from one technical level to the next, and from technical levels to management, defined at your facility now? Do managers currently critique the designs and programs of their subordinates? What qualifies them to do this?

3. *Progress Monitoring/Reporting.* In the typical bottom-up or conventional software development effort, it is not uncommon to have a large number of software units coded at once with little or no regard for control structure or programming style until late in the game. Thus, a weekly or monthly progress report amounts to a glowing account of what percentage of the programs on a given project have been designed, coded, debugged, etc. The number and size of each of these tasks have been estimated based on experience, a good nose, and practically no data.

Experienced software managers have learned the hard way, in some cases, to subscribe to the theory that coding must begin as early in the development cycle as possible since budget and/or schedule are usually overrun. Think of how unnerving it would be for such a manager to receive progress reports that described what

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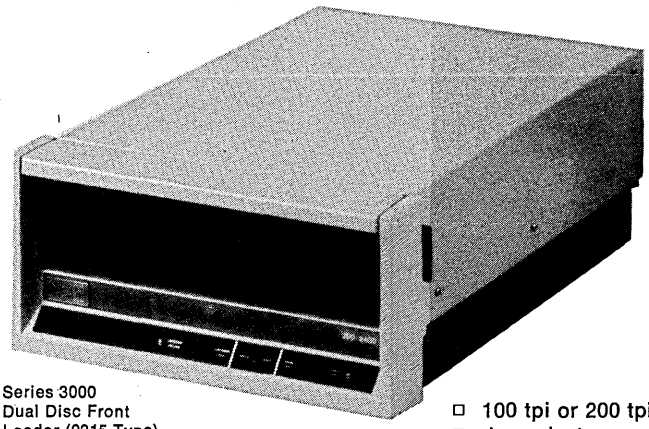

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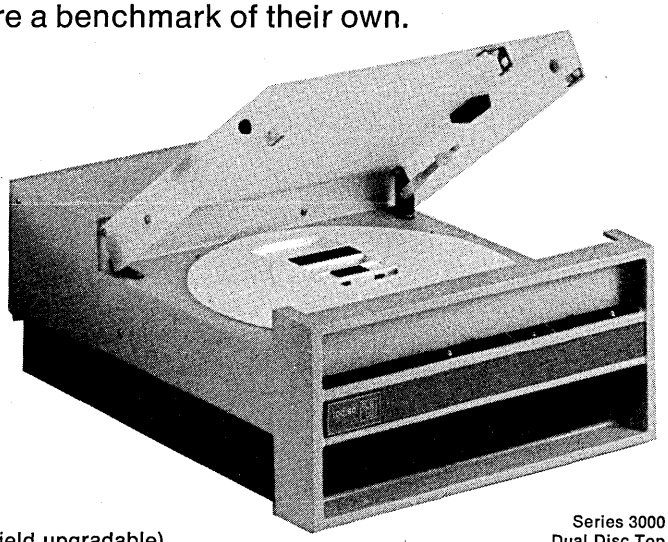

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level of abstraction had been defined or how much of an interface definition had been completed. This is especially troublesome in the structured programming case since the emphasis is on avoiding coding until the control structure and interface(s) have been defined. And this is in direct conflict with the adage subscribed to by many a successful software manager, "Forget the science, code it!"

What is needed, it would seem, is a means for measuring the state of completeness of the product which is not as heavily influenced by the kinds of considerations hardware manufacturing uses. One way of doing this is to define what a complete design is, in specific, checklist terms at each level within the system. This amounts to standardizing the definition of each software development step. Does your organization currently have a standardized way of measuring progress? If so, on what is it based? How often is it updated? How accurate is it? Most progress reporting schemes are an outgrowth of hardware efforts. The emphasis is on making target dates and meeting milestones, but do they really measure progress? In fact, it has been suggested that at least in the case of R&D projects, performing required customer techniques (for example, some military specifications) has little or no positive effect on the success of the project.

4. *Organizational Considerations.* Most large scale software projects have organizations which attack specific problems in the development process. Their organizational structure is derived, again, from the hardware technology, but is it compatible with the software development process? One carryover which is noticeably absent in the software situation is a quality control or quality assurance organization. In the hardware manufacturing environment, such organizations are responsible for the establishment and maintenance of standards against which each item is inspected, and then is either approved or rejected. These procedures are oriented toward the problem of reproducing an item a given number of times, each item meeting the same set of criteria.

In terms of software, the nature of the problem differs in that duplication is a trivial problem, but getting the first one "right" is the main problem. The renewed concern for factors such as efficiency, correctness, and reliability has contributed to the great amount of attention given to structured programming. The establishment of this new quality control organization to ensure that the established standards are adhered to or modified coherently should relieve some of these problems as well as emphasize the importance of these factors. The new department should be at the project level and may be called software quality control.

Another organizational factor is the cooperation (or lack of it) which exists among the various projects within a company. How helpful are these groups to each other now? How willing are they to accept direction from a central authority regarding what development methodology they will employ? Do projects voluntarily disseminate useful techniques to other projects? The quality control effort in the software case would go far beyond the scope of its hardware counterpart in this regard.

5. *Software Testing and Configuration Control.* Current methods of testing software have evolved from experience with both hardware prototype development and software development. In most efforts involving the development of large numbers of software units, formal testing is conducted after the programmer has completed coding and checking out his program. This formal testing is often broken down into a number of steps such as unit testing, string testing, integration testing, regression testing, etc.

What is the impact on this process, and on its associated method of identification of versions of a system, if a scheme of program "stubs" replacement is adopted? "Stubs" refers to stand-in symbols for pieces of executable code which are also portions of the control structure. Is integration testing necessary if stub replacement is used? What about regression testing? Are current testing methods and configuration control techniques defined at your facility now (not to be confused with compliance with customer demands such as military standards)?

6. *Costing and Scheduling.* Currently, there exists no foolproof way of estimating the dollar cost, amount of calendar time, or man hours required to develop a given software unit. In adopting a new software development methodology, caution is advised in estimating the resources required. There already exists pitifully little data on the effectiveness of current methods, and even less on this new technique. Thus, the cost and schedule estimates on the first few projects may be arrived at in a conventional way with sufficient data gathering to modify the estimation methods as more experience is acquired. What will the maintenance cost of such software be? What method is

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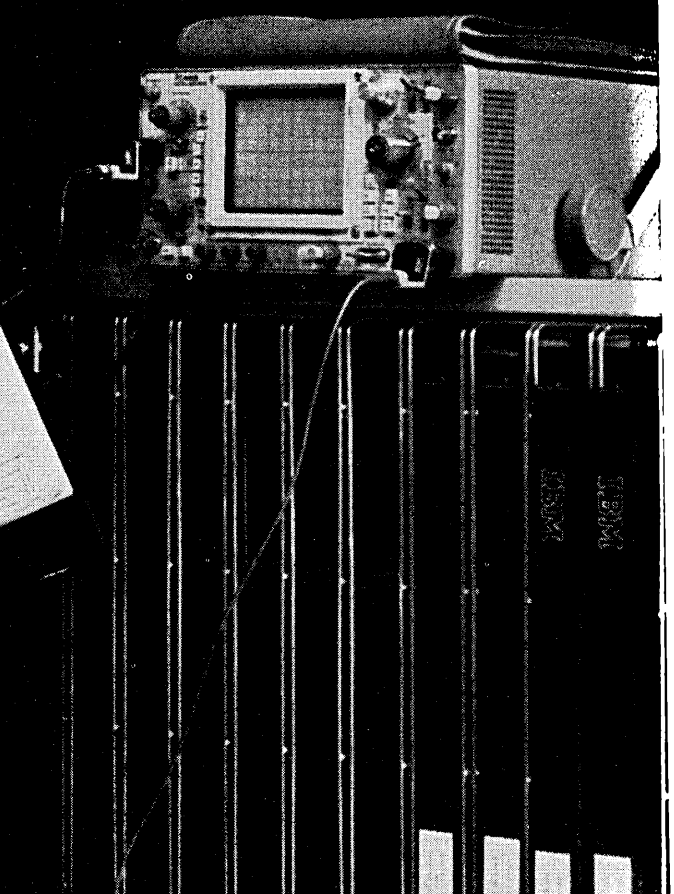

used to determine this now?

7. *Personnel Motivation.* In the bottom-up programming situation, software development personnel are nearly self-motivating. This is due to the fact that each individual possesses sole (or nearly sole) responsibility for a particular program or group of programs. His performance, as viewed by management, is synonymous with his ability to meet milestones and to get the job done, not necessarily upon how well his product performs.

Obviously, there are varying degrees of visibility of the individual's performance. However, the structured programming approach would require a more technically oriented form of personnel evaluation. The situation is somewhat complicated by the fact that most experienced, senior programming individuals are eventually promoted to management. Thus, the actual development of most software today is done by inexperienced or less proficient programmers. (In the New York Times project, which gained such great prominence for its early successful use of the new techniques, the programmers were unusually highly qualified.)

In dollar terms, this means that we are currently using comparatively cheap labor to produce software, but are converting to a new scheme which will utilize comparatively high priced help to produce better software. The full ramifications of this change cannot be judged until more experience is gained. However, the Cost Plus Award Fee (CPAF) type of contract normally is formulated in such a way that profits may be optimized by using the allowable large number of people. To reduce this number of people will reduce the award and hence the profitability unless CPAF formulas are reviewed and modified.

8. *The Goldfish Bowl Phenomenon.* Machiavelli observed in *The Prince* that those who attempt to bring a new order of things into the world will find resistance from unexpected sources and only half-hearted support from those in favor of the change. At best, making the transition from a conventional to a structured programming environment is an ambitious undertaking for any company. Hence, it is to be expected that the first undertaking which fervently employs structured programming, with or without the chief programmer team approach, is going to be closely "eyeballed" by supporters and potential enemies alike. However, in making the transition, more data will probably be gathered in a more accurate way than ever before. The temptation will be to examine this new information and compare it to the old. Precisely because there is more information on a new technique, the old technique should *not* be evaluated using it.

A plan of action

At this point in the discussion, the prospect of adopting structured programming using the chief programmer team approach may have lost some of its appeal. Though present methods may not provide satisfactory results for the increasingly complex types of software systems required today, at least they are comfortable in merely being familiar. More than one manager's bright future has been slowed or stopped altogether because he chose to break with the conventional to improve matters. Whether he was successful or not, the fact remained that he broke with accepted practice and as such was penalized by the system and/or his peers.

However, there are some things which can be done that may reduce the trauma of transition, may make it more orderly, and may reduce its hazards. These are to:

1. Obtain support for this transition from the highest levels of management and make sure managers and software development personnel at all levels are aware of it.
2. Define exactly what features of structured programming will be adopted.
3. Obtain a firm commitment from management that the transition will be one way and will not be abandoned in the event of setbacks such as contract cancellation or problems occurring due to this change.
4. Consider phasing in the features that will be adopted.
5. Develop a training program for programmers and a separate one for managers that would be coordinated with the transition process. These programs should include sessions in which both groups participate.
6. Identify individuals who would make good chief programmers based not only on technical, social, and managerial abilities as viewed by management, but on the preferences of technical persons as well. Of those identified, use only volunteers for chief programmers.
7. Review and revise organizational structure to make it more amenable to this method.
8. Establish a quality control organization with a well defined charter consisting of primary responsibility for the establishment, maintenance, and monitoring of the use of software de-

"Impartial judgments are confirming our own analysis – we have a Mass Storage System that outperforms the 3850 by a significant margin"

An interview with Arthur Hausman, President of Ampex Corporation

Q. Mr. Hausman, what's so new about the Ampex TBM Mass Storage System?

A. The TBM Mass Storage System isn't being announced as a "new product." We delivered our first system in July of 1972. It's been a very successful installation with better than 98% uptime.

Q. Then why haven't we heard more about the Ampex Mass Storage System until just recently?

A. We had two very good reasons for biding our time. First, we wanted to evaluate and test our first installed system under actual field conditions. This system has demonstrated high reliability and superior performance. Our second reason for waiting was related to market conditions. Now we think mass storage has reached maturity. IBM's announcement of the 3850 Mass Storage System has confirmed our judgment that the time is ripe for MSS.

Q. How does IBM's announcement of the 3850 Mass Storage System affect Ampex's position in the mass storage market?

A. Quite frankly, we are elated that IBM has joined us in the market. Interest in MSS technology has skyrocketed since they announced the 3850. IBM users are evaluating the performance of both the Ampex and the IBM systems. And from what we hear, the impartial judgments are confirming our own analysis—we have a system that outperforms the 3850 by a significant margin.

Q. Can you compare the two systems?

A. I'm not sure. IBM designed the 3850 to serve a very specific segment of their own equipment users. The 3850 is designed for a batch environment, operating under OS/VS. If you're in that category, you're a potential customer.

On the other hand, the Ampex TBM Mass Storage System satisfies a much broader range of user situations, such as interactive, OS/MVT and multi-host environments containing both IBM and non-IBM mainframes. TBM Mass Storage System users have a much wider range of operational and growth options.

Q. Speaking of other mainframes, how will those manufacturers meet the IBM challenge in the area of mass storage?

A. We hope they'll do it with the Ampex TBM Mass Storage System. We feel we offer OEMs better performance and field-proven hardware, which could place them ahead of the competition.

Q. What about interfacing the TBM Mass Storage System to other mainframes?

A. We have interfaces for CDC, DEC and IBM 360 and 370 OS/MVT. Others are under development.

Q. Let's talk about reliability and performance, since they seem to go hand-in-hand. Can you capsule the Ampex claims?

A. Reliability is a combination of our technology and our field experience. The TBM Mass Storage System uses a technology based on Ampex equipment that has been in the field for 19 years. In all that time, nobody has developed a better recording technology. The performance of the TBM Mass Storage System is the result of eleven years of MSS experience. Our mass storage people are experts.

Q. The word flexibility *keeps coming up in these discussions. What does it mean in relationship to a potential user of a TBM Mass Storage System?*

A. The TBM Mass Storage System is extremely modular. Basic capacity is 11 billion bytes on-line, and it can be expanded in increments of 11 billion bytes as required by the user. You can begin with fairly modest I/O capacity and some basic access times, and build to just about any performance rating you need. The competition only offers an incremental package of 67 billion bytes plus additional I/O channels every time the system is expanded. The cost is substantial.

Q. Who qualifies as a prospect for mass storage systems?

A. Anybody with large off-line computer tape libraries and a lot of on-line disk drives. The TBM Mass Storage System puts the tape library on-line and substantially reduces the number of disk drives required to support the CPUs.

Q. The idea of having your data base on-line is exciting. But is it cost-justified?

A. The labor for human intervention—mounting and demounting computer tapes—is costly. Delays in processing and job scheduling on the CPU are very important determinants in efficiently utilizing CPU time. Storing a million bytes on-line with a 3330 type disk drive costs approximately $6.50 per month; storing the same data on mass storage costs about 50¢ a month.

Q. Doesn't the integration of a mass storage system into a customer's operation imply substantial software modifications?

A. The Ampex TBM Mass Storage System was the first to offer disk staging and destaging of data from the mass storage system to the host computer. The IBM 3850 utilizes the same technique. Our user transparent interface makes the TBM Mass Storage System appear to the host computer as an infinite number of on-line 3330 type disk drives.

Q. What is your opinion regarding the future of mass storage systems?

A. We know there is a substantial market for on-line mass storage systems. Off-line tape and disk libraries are incongruous with the power available in today's computers. We believe that thousands of mass storage systems will be installed during the next several years. Those projections are substantiated by the number of 3850s which IBM has been reliably reported to have on order. Ampex is confident that the TBM Mass Storage System will gain a respectable share of this growing market.

Thank you, Mr. Hausman.

(Your letterhead inquiry will be answered with a free copy of our brochure titled *TBM The Ampex Mass Storage System.* It's important reading for executives with data processing responsibilities).

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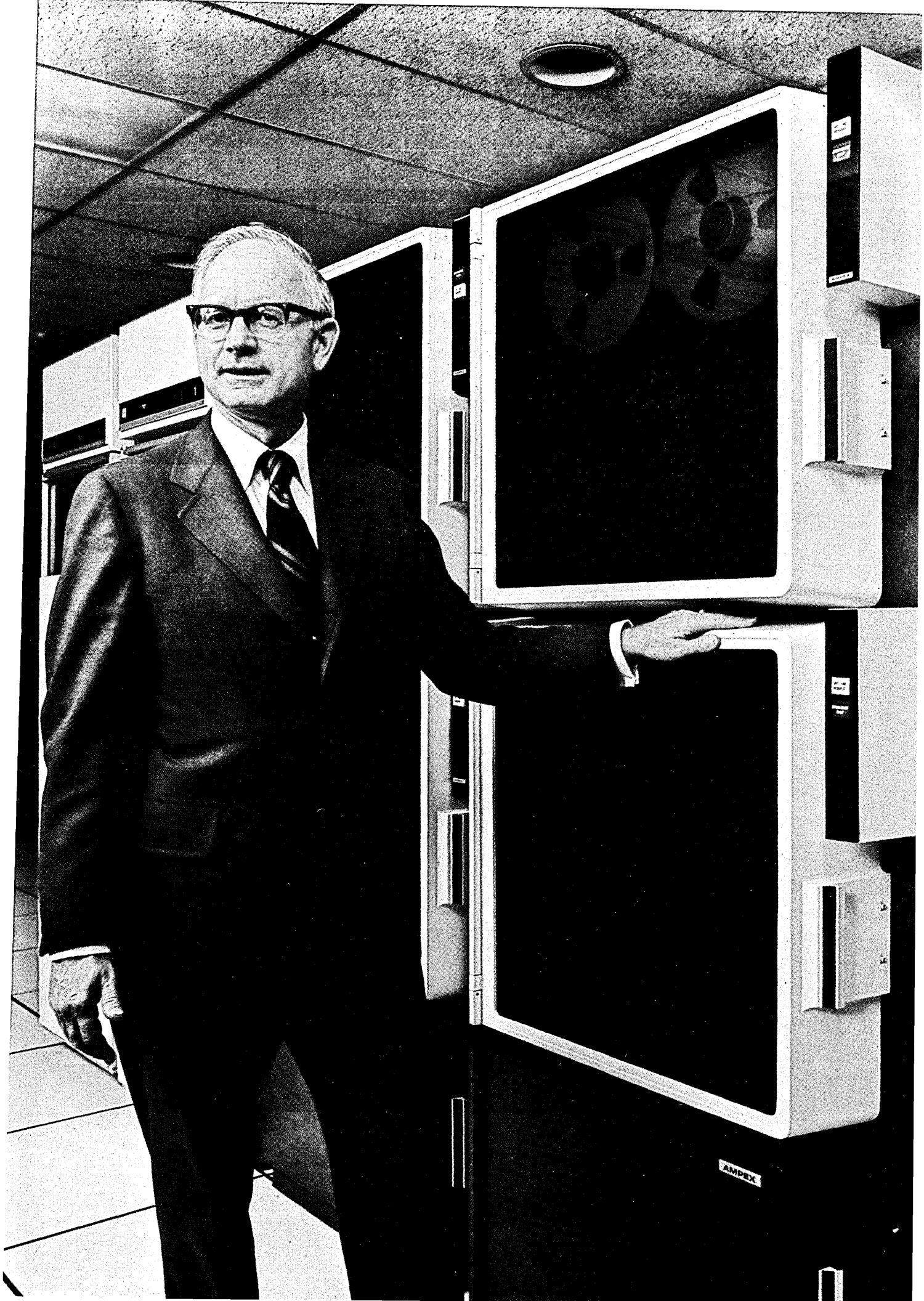
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velopment standards and methods. This includes the definition of test procedures, test plans, review of test results, configuration control methods, etc.

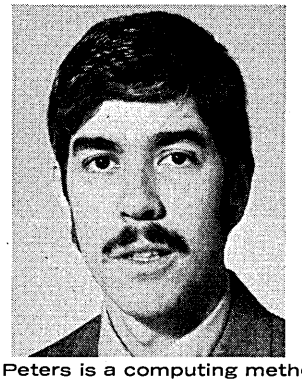
9. Monitor the costs associated with developing software in this way and use this information to assess the impact it will have on profitability.

10. Review and revise current methods of evaluating software personnel and managers.

11. Carefully select the first project or task to use this technique. This project should be of small to moderate size and not very complex. A dual purpose could be served in this way. The situation would be slanted toward success and valuable experience can be gained under less than critical conditions.

12. If available, obtain the services of several individuals who have been through this process successfully at firms similar to your own. A word of caution is in order here. It is unlikely that there are very many of these people around right now. And it would be better to have everyone involved fully aware of his own inexperience and need to learn. An alternative is the use of a reputable consulting firm.

Finally, note that what is occurring is a transition from a means of developing software which is, at best, poorly defined, to a means of developing software which has a clearer definition and procedural advantages. This alone should outweigh any reservations about adopting this technique. The exact path of this transition will depend on the composition of the personnel, their experiences, and the political and financial forces at work within the firm making the change. ☐



Mr. Peters is a computing methods analyst with Boeing Computer Services. He is currently a member of a group responsible both for training Boeing programmers in structured programming and for developing software tools to facilitate its use.

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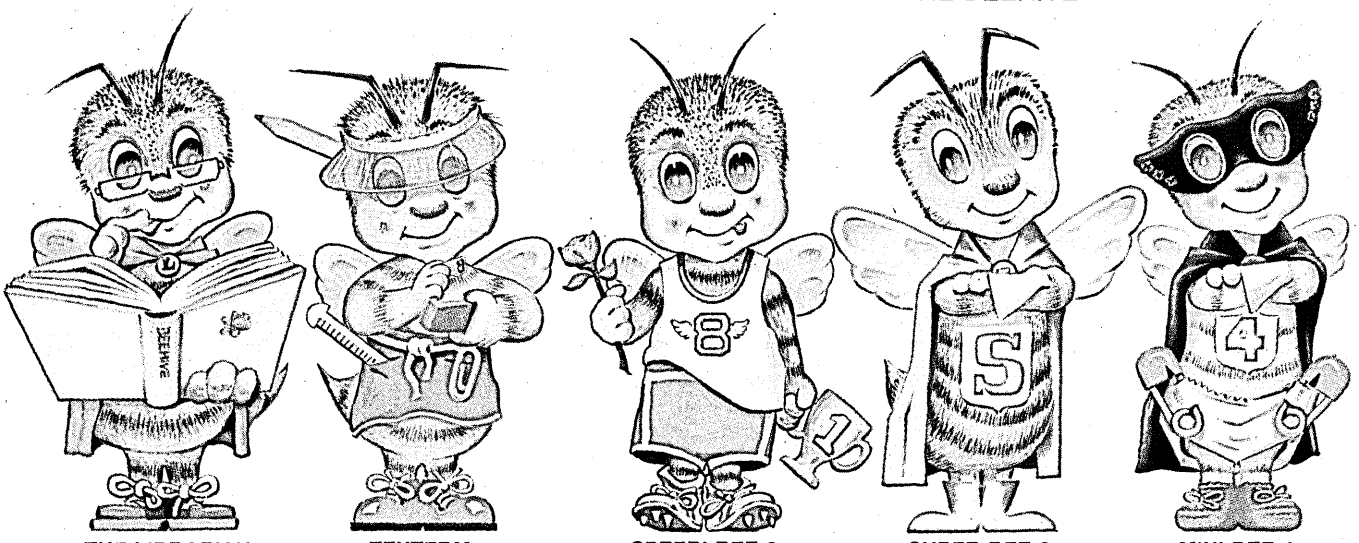

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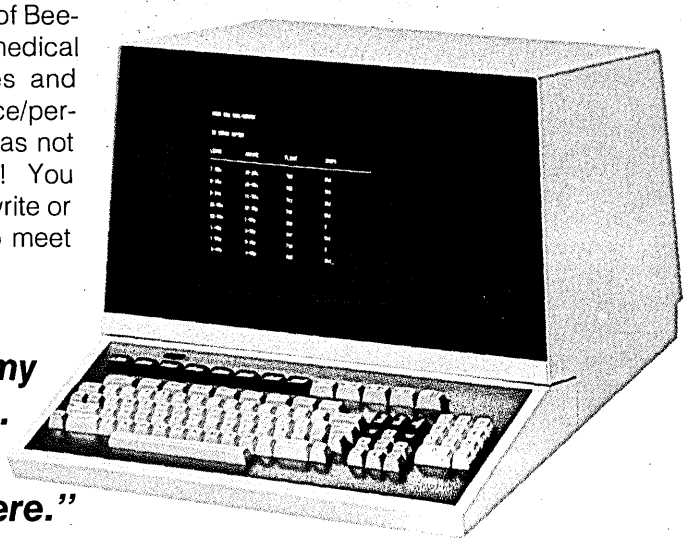

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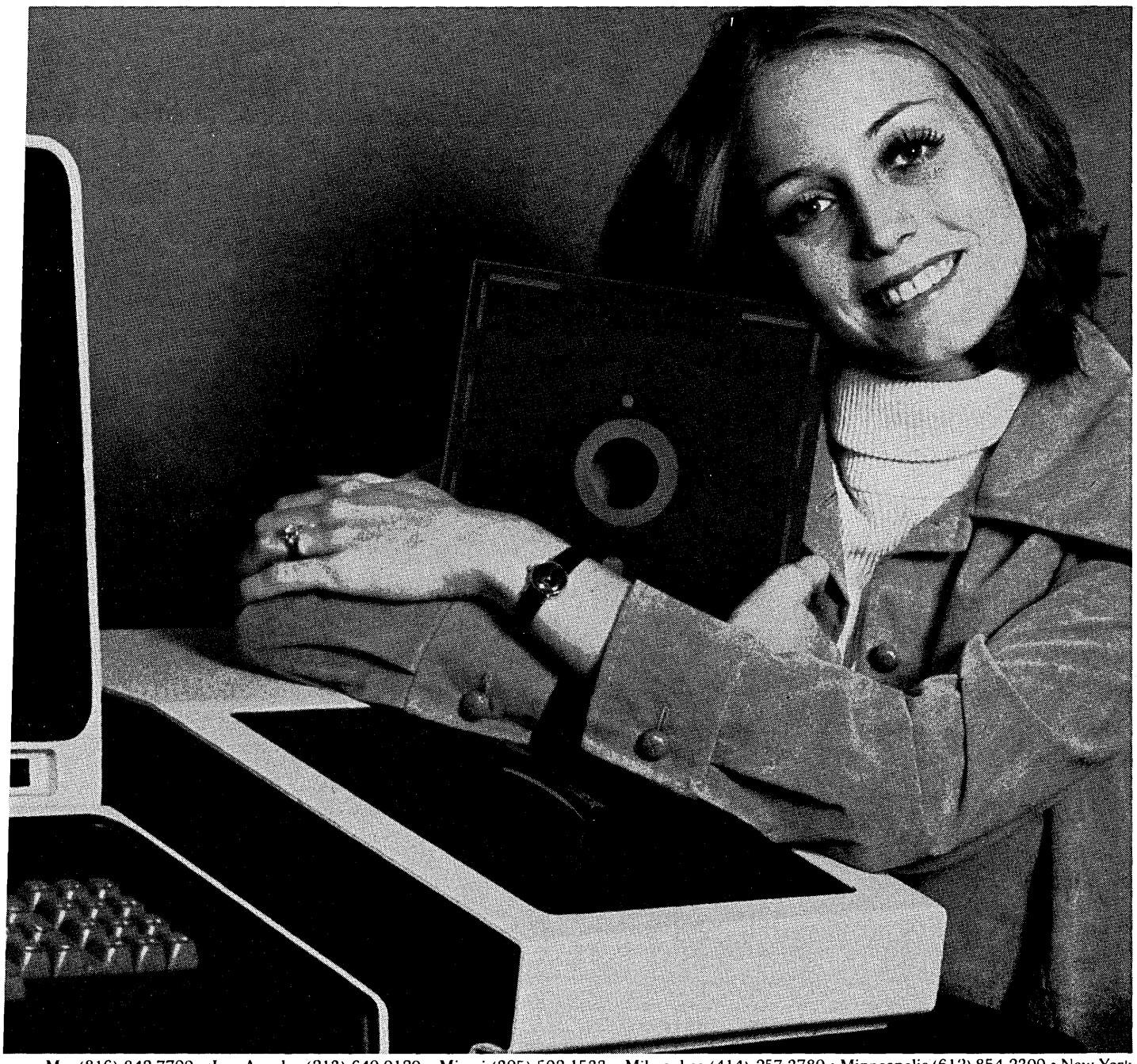

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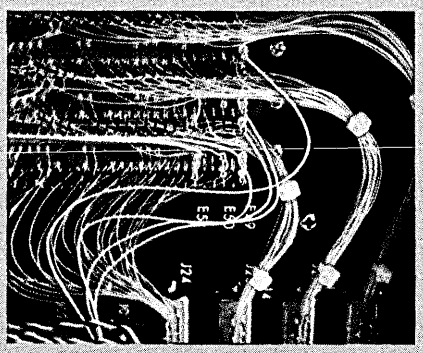

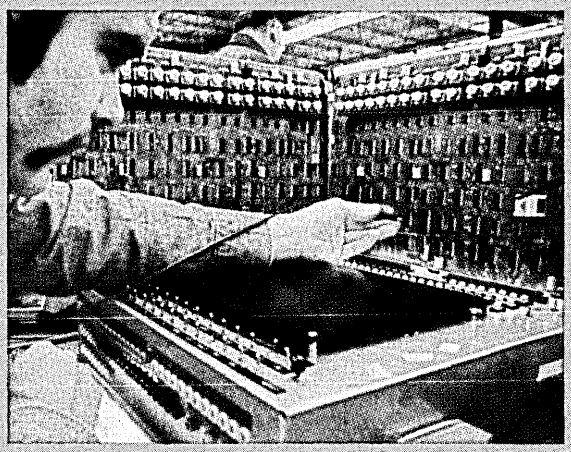

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Planners need to be able
to easily access a data base
without first having to become programmers.
This system seems to help them do that.

A DATA BASE FOR NONPROGRAMMERS

by Andrew B. Whinston and Wm. D. Haseman

People in all areas of management in industry and government have responsibilities for making complex decisions. Many decisions are repetitive or routine in that they arise in a predictable fashion and the various parameters can be anticipated. Examples are payroll and inventory systems. Other decisions, including planning decisions, involve nonroutine and possibly nonrepetitive problems. The general approach to making planning decisions is to collect past and current data, determine parameters that may affect the future, analyze this often voluminous data, and make decisions. The decisions are then sometimes tested through simulation.

Information storage and retrieval systems are available to help manage all the data used in the problem through the use of statistical packages and modeling routines, and sometimes through simulation. However, the planner is perplexed by the burdensome task of managing the many computer programs and manually preparing the data required by them. And even after this, all the actual decision-making is left to him.

If the planner is to expect aid from the computer, he must be given a system to perform decision-making duties. A planning system should tie together all the individual computer functions to be capable of providing answers for the planner. The computer should play a more active role in the decision-making process.

On the other hand, planners cannot afford to be tied down to the chores of data formatting, editing, and manipulation required by many application programs. Further, the task of handling all of the individual programs (selecting, loading, running, formatting results) should be done for him by some system.

The Generalized Planning System, called GPLAN, is such a system that is nearing completion of its development at Purdue Univ. The planner uses GPLAN by entering queries through a terminal. Two types of requests may be made. The user may ask for information to be retrieved from a data base and displayed. Alternatively, he may request that an application program be

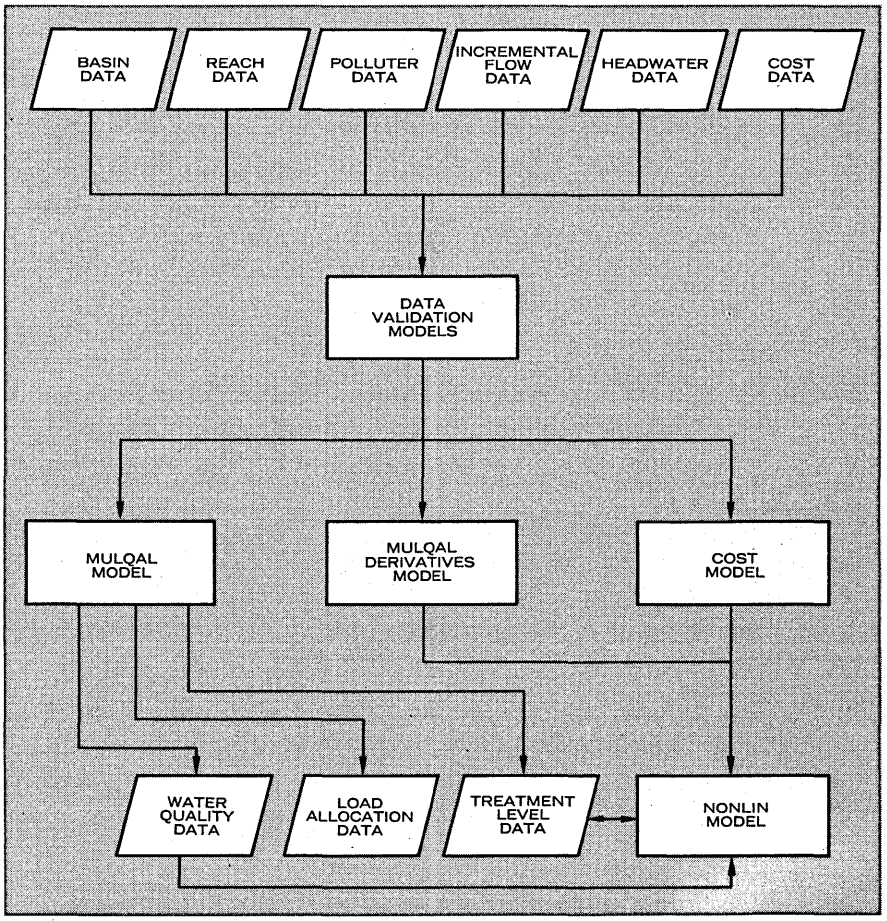


Fig. 1. The total information flow as it looks for the river modeling problem. By performing a flow analysis like this, starting with the output and working backwards to the models required to generate that output, the required inputs are determined.

The authors wish to acknowledge the assistance of Arthur Z. Lieberman, who was instrumental in the production of this article.

executed using the data base. Together, these two types of requests offer a planner strong decision-making capabilities.

A case study involving the Indiana Stream Pollution Control Board will illustrate problems encountered in the planning process and show how GPLAN will help solve them.

A sample problem

In recent years public interest in environmental management has increased significantly. One result is the 1972 Water Quality Act, which greatly increased the powers and obligations of the states to protect and enhance water quality. The general direction of the legislation has been to establish common federal guidelines with more specific control and enforcement delegated to the states.

Complying with the legislation has brought large scale difficulties for each state's stream pollution control board. In the past, the Indiana Stream Pollution Control Board (ISPCB) had coltected from polluters much data detailing effluent flow. Use of collected data was rather limited. Previous legislation had been less stringent, requiring the collection, but not much analysis. So, for the most part, data was collected and stored on paper forms in filing cabinets, occasionally to be referenced for specific problems. When detailed analysis was required on a portion of a stream, a separate effort was made to collect specific, detailed information. Integration of the data collected on a routine basis from the several types of polluters (industrial, municipal, agricultural, and semi-public) has not been needed, and therefore not performed.

To comply with the 1972 Water Quality Act, the ISPCB is being put into a situation where it is required to assign an allocation of waste loads among polluters in a manner which will guarantee that the minimum water quality standards will be maintained. The primary role of the ISPCB has been changed from that of data collection to long-range planning. The new task requires the collection of large amounts of data that must be complete and errorless.

The first step in designing a system

GPLAN STRUCTURE

GPLAN offers a system design and ease of operation which will minimize the efforts required of a planner in using the computer. Its three selling points are: 1) a data base structure; 2) a collection of applications programs; and 3) a query language through which the user controls the system by requesting data retrieval and program execution.

The data collected for all the planner's problem areas are stored in one data base. GPLAN's current implementation uses a data base designed around the CODASYL DBTG specifications. Its structure is that of a hierarchical set and is manipulated through a Data Manipulation Language similar to that proposed by CODASYL. However, GPLAN can be implemented with any structure. It is only necessary to describe that structure by writing a schema using a Data Description Language.

GPLAN has a collection of standard processing programs to which the user has access. The programs produce standard output and perform other functions. Some outputs and functions are: standard reports; X-Y plots with up to five variables on the Y-axis; histograms; regressions; statistics processing (number, minimum, maximum, average, standard deviation, variance); changes; additions; deletions. In addition, the user may add his own programs and request them for execution through the query language.

The general syntax of a query is:

<COMMAND><FIND clause><CONDITIONAL clause>

The FIND clause specifies which variables should be retrieved from the data base. The CONDITIONAL clause delimits the retrieval process by placing restrictions on the data being fetched. Once the data is retrieved, the COMMAND instructs GPLAN as to which application program should be executed. For example:

PLOT RIVER.MILE VERSUS DISSOLVED.OXYGEN FOR BASIN.NUMBER = 1, RIVER. NUMBER = 2, AND RIVER. MILE ≤ 100

will retrieve the values of RIVER-MILE and DISSOLVED-OXYGEN for the first 100 miles of the second river in the first basin, and then produce an X-Y plot. If the user supplies a program which performs its own data retrieval, then he need only type the program's name as the query.

An additional feature of the language is that the user may define synonyms and "noise" words to make a query easier and more natural to use. The user could define GRAPH to be a synonym for PLOT so that variations of the command name may be remembered. DO could be made a synonym of DISSOLVED-OXYGEN so that the user would have less to type. VERSUS is a noise word that is ignored by the interpreting system but typed to provide more meaning to the user and observers. The synonyms and noise words are stored in special tables in the data base. This allows a new set of synonyms to be initiated for different GPLAN applications.

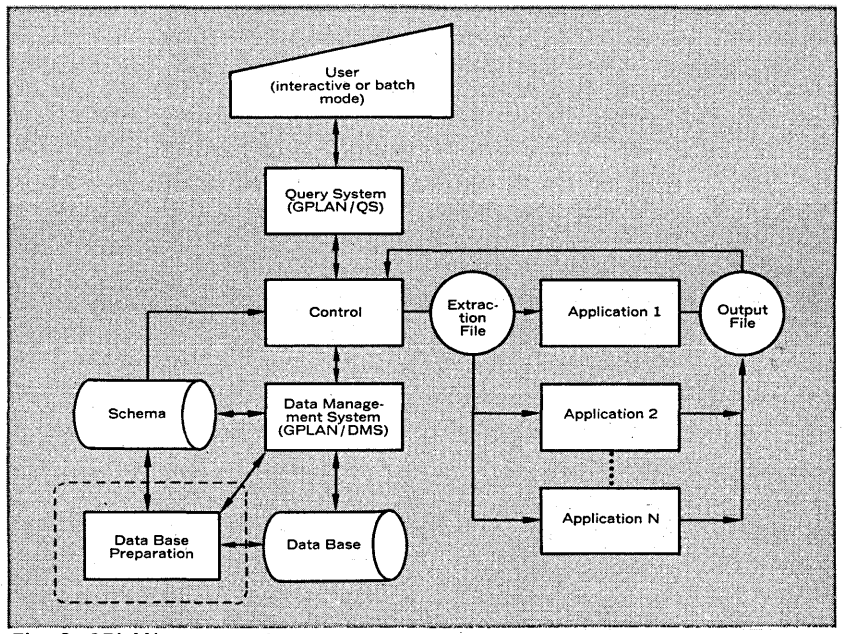


Fig. 2. GPLAN query system.

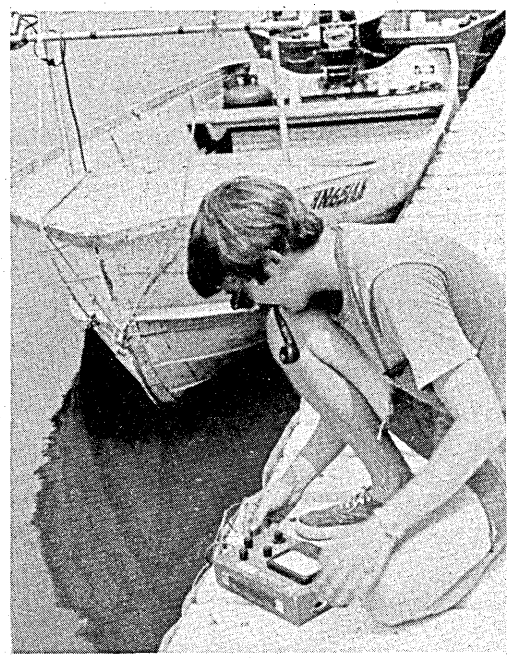
to meet the ISPCB's objectives involves defining specific goals and the information required to meet them. One specific goal is to determine a load allocation for each polluter for each of several "pollutants" including heat. When these are defined, the next step is to determine what kinds of models will be required to generate this information and what input data will be required to run these models.

In this case, the first requirement will be a model which can simulate a river basin and determine the water quality for a given set of treatment levels. A number of models are available which perform this task, including the MULQAL model, which allows for each pollution level to be analyzed individually. The types of data required by MULQAL can be grouped into the following categories;

- Description of the river basin structure (junctions, bypass-piping, etc.)
- River reach statistics (length, reaeration parameters, velocity parameters, etc.)
- Polluter statistics (pollutant concentration, temperature, flow rate, conservative minerals)
- Incremental flows statistics
- Headwater statistics
- Treatment levels of polluters

The outputs of MULQAL are water quality statistics and load allocations.

The second model required is an optimization package for determining a good solution of assigning waste load allocations to individual polluters. A planner may make many runs of the simulation program trying different combinations of treatment levels until a good solution is found. A much more economical method involves determining a criteria for the "goodness," and then trying to maximize (or minimize) that criteria given the constraints previously mentioned. This particular problem requires a nonlinear optimization routine which, when interfaced with the river quality model, can select from a choice of treatment levels which minimized the criterion function of cost of treatment. The data required for such a model, called NONLIN, are: 1) the water quality sta-



Data on water flow, polluters, and pollution levels has always been collected in Indiana, but prior to the development of the data base, the storage medium consisted of file cabinets and access was very slow.

The components and information flow are illustrated in Fig. 2. The GPLAN Query System prompts the user for a query. After the query is read and parsed, a set of routines initiate DML commands to retrieve data through the data management system from the data base, according to the FIND and CONDITIONAL clauses of the query. The collected data is written in a standard format on an extraction file that can be read by any of the application programs. After retrieval, execution is passed to the specified application program (which actually may have fetched its own data). The output then goes directly to the user's terminal, onto an auxiliary file, or into the data base. The user is then prompted for another query, at which time he has the option of either performing additional processing on the data collected by the previous query or retrieving and processing a new set of data.

GPLAN may be used in either interactive or batch mode. If in batch mode, the queries are entered on cards just as they would be if entered at a terminal. If in interactive mode, the user may at any time request that the output be diverted to a high-speed line printer rather than the terminal.

At present, GPLAN is in FORTRAN and running on the CDC 6500 at Purdue Univ. The Data Management System segment occupies approximately 20K words of central memory, and the Query System (including standard application programs) requires another 20K words of overlayed memory. Queries take less than one second of computing time in this configuration. □

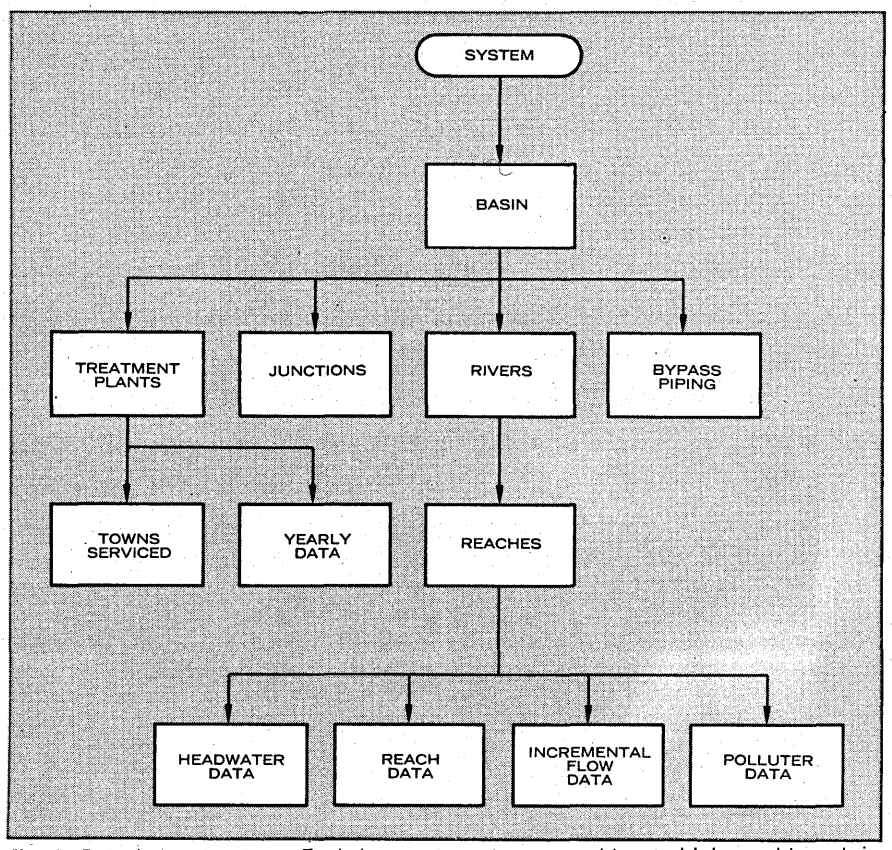
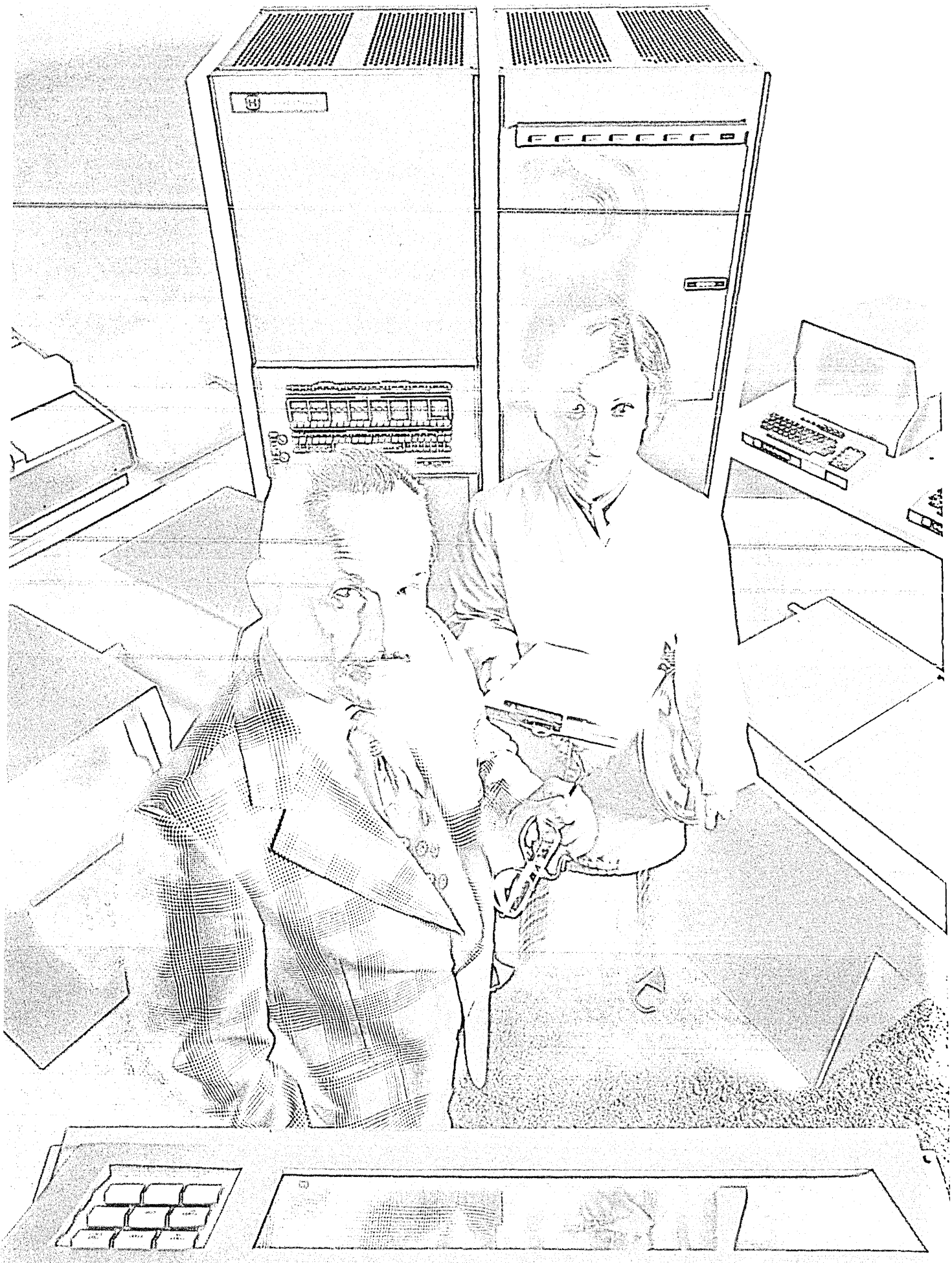


Fig. 3. Data base structure. Each box represents a record-type which would contain the item-types comprising the record. The arrows represent the owner-member set relationships.



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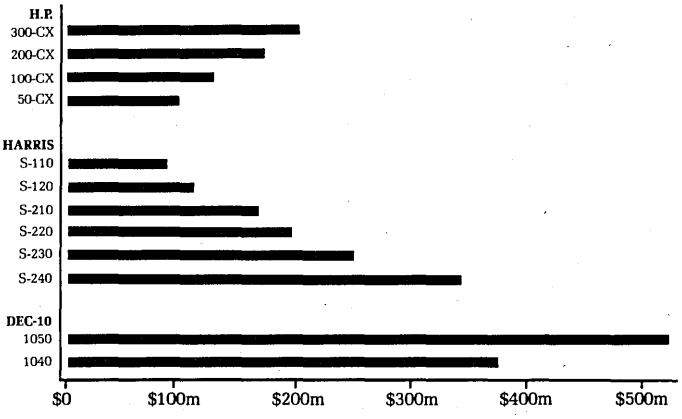

The above graph represents equally configured systems comparisons based upon currently available published information.

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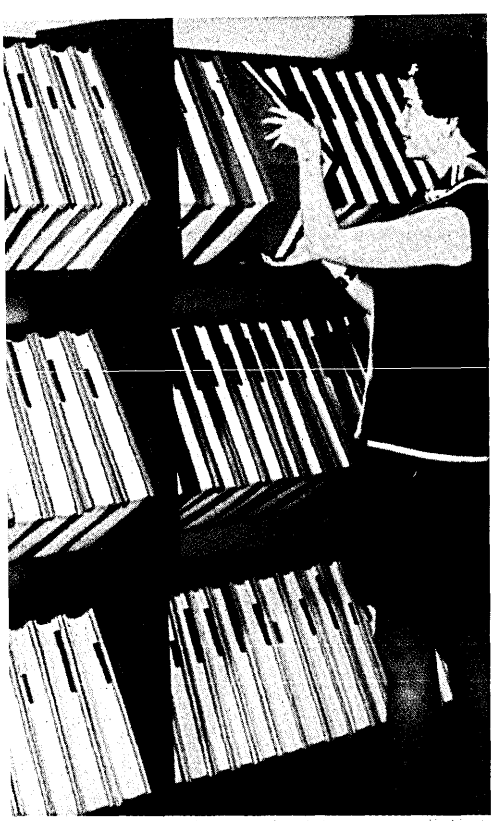
CIRCLE 42 ON READER CARD



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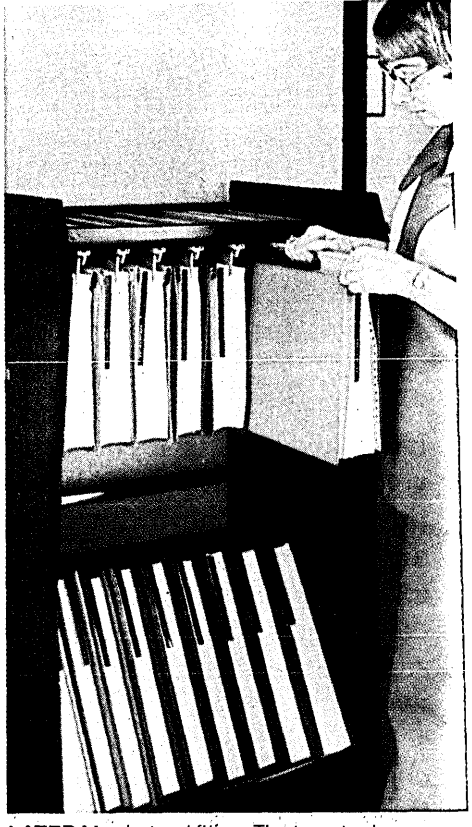

LATERAL Lateral filing. The two steel railings remain on top. Accodata Binder Handles and Channels permit quick lateral filing of all the most commonly used data binders.

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tistics, 2) load allocations generated by MULQAL, and 3) cost information about the various pollution removal rates. The output of NONLIN would then be the allocation of treatment levels.

Two additional models are needed in interfacing MULQAL and NONLIN. These models generate cost functions through the use of curve-fitting algorithms and the derivatives of these cost functions.

Before any of the data processing can be performed, the planners must be assured that the data is both accurate and complete. Various computer routines will be used to analyze the data and determine which values might be in error and which are missing. Techniques for this include the use of discriminant analysis and time series analysis. Another technique involves the checking of permissible bounds on each data type.

The sample solution

Fig. 1 (page 101) shows the total information flow as it looks for ISPCB's problem. The structure of ISPCB's water pollution data base is shown in Fig. 3 (page 103).

Indiana is divided (as any state would be) into several basins, and the data base contains a record-occurrence describing each of them. For each basin there is information about the treatment plants, rivers, river junctions, and bypass-piping. Information on the towns serviced and yearly data is stored for each treatment plant. Rivers are divided into segments called reaches. For each reach of each river, data stored describes headwater conditions, incremental flows, polluters, and other water characteristics.

The data and program resources are now literally at the planner's fingertips. The following queries illustrate some of the commands open to him:

LIST BASIN.NAME, RIVER.NAME AND REACH.ID

(will list all reaches in each river, all rivers in each basin, and all basins)

LIST REACH.ID, BOD AND DO FOR RIVER.ID = 3 & BASIN.ID = 1

(will list the reach number, biochemical oxygen demand, and the dissolved oxygen for all reaches in the third river of the first basin)

LIST BASIN.ID, RIVER.ID, REACH.ID, DO, BOD WHEN DO <DO.GOAL OR BOD>BOD.GOAL OR (DO < 5 AND BOD ≥ 7)

(this example is self-explanatory)

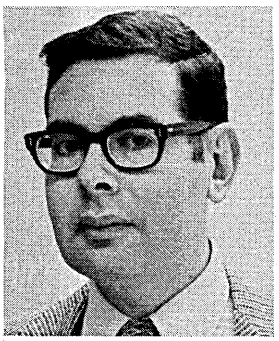
LIST AERATION.RATE AND 3* AERATION.RATE ↑ 2.5 FOR BASIN.ID = 2 AND RIVER.ID = 14

(for all reaches of the 14th river in basin number 2, compute and list 3 · (aeration rate)$^{2.5}$

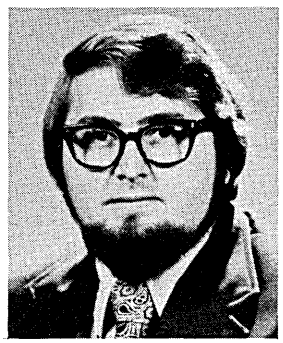
Also, to execute the MULQAL program, the planner would type RUN MULQAL (or just MULQAL). MULQAL, in turn, has been designed to expect the user to pass certain parameters to it; if none are entered, the user will be asked for them. A run request might look like:

RUN MULQAL FOR BASIN.ID = 1, DATE = '6/18/75', TREATMENT.PLAN = 2

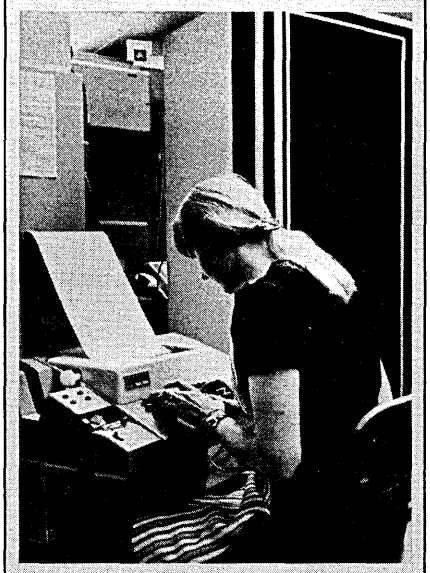
The query language is thus the planner's only contact with the computer system. Organizing the data and interfacing the applications programs are all finished beforehand, leaving the planner with no need for programming skills nor for detailed knowledge of computer operations. □



Dr. Whinston is a professor of industrial management and computer science at Purdue Univ. A principal investigator on the NSF project that has led to the development of GPLAN, he is also associate editor of "Management Science." Previously president of his own software firm, Combinatorics, he now also acts as a consultant for Mathematica, Inc.



Mr. Haseman is a doctoral candidate in management science at Purdue Univ. A member of ACM and IEEE, he has been in the computer field for eight years.



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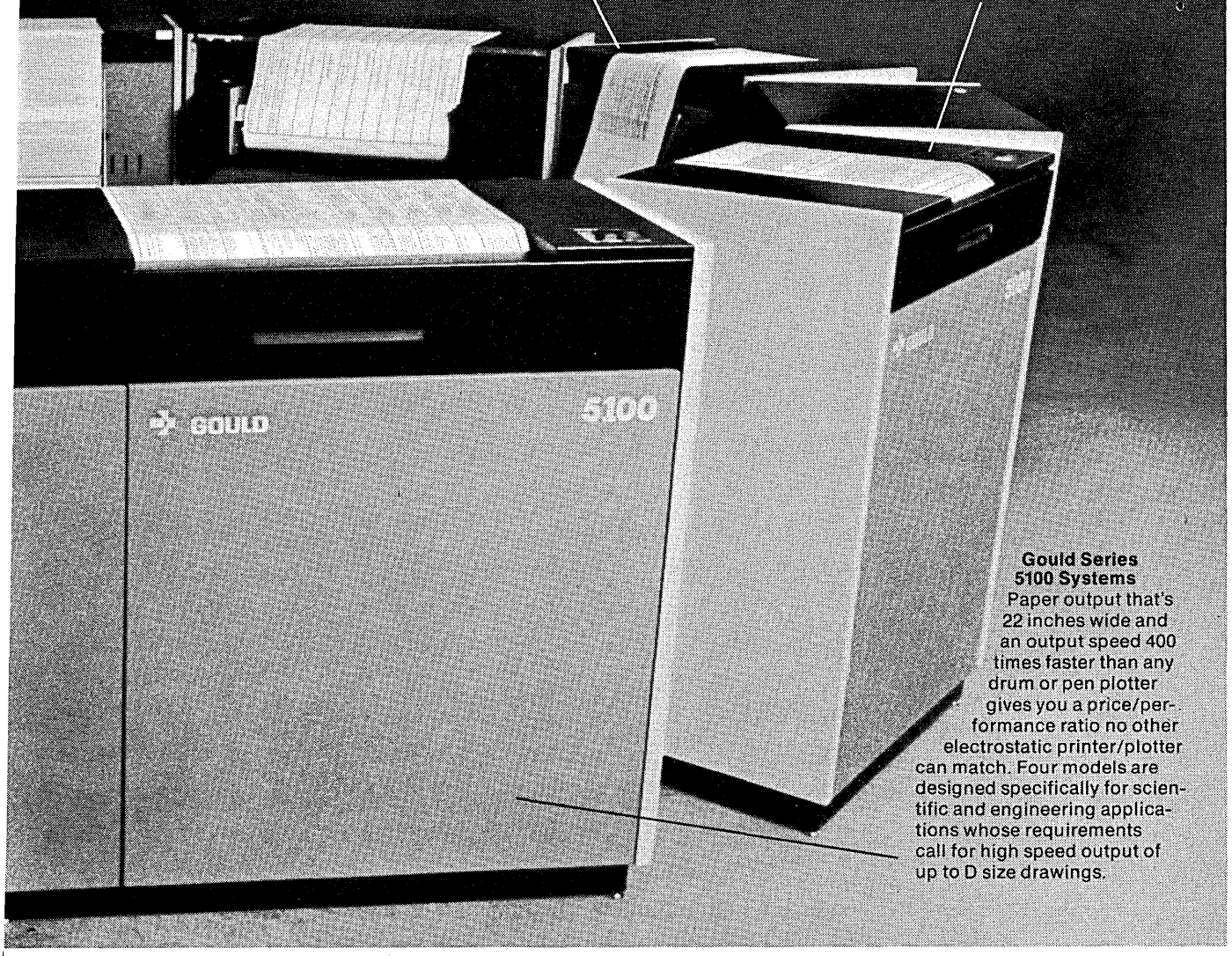

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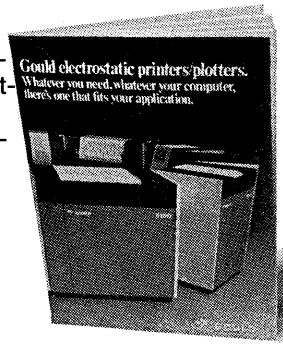

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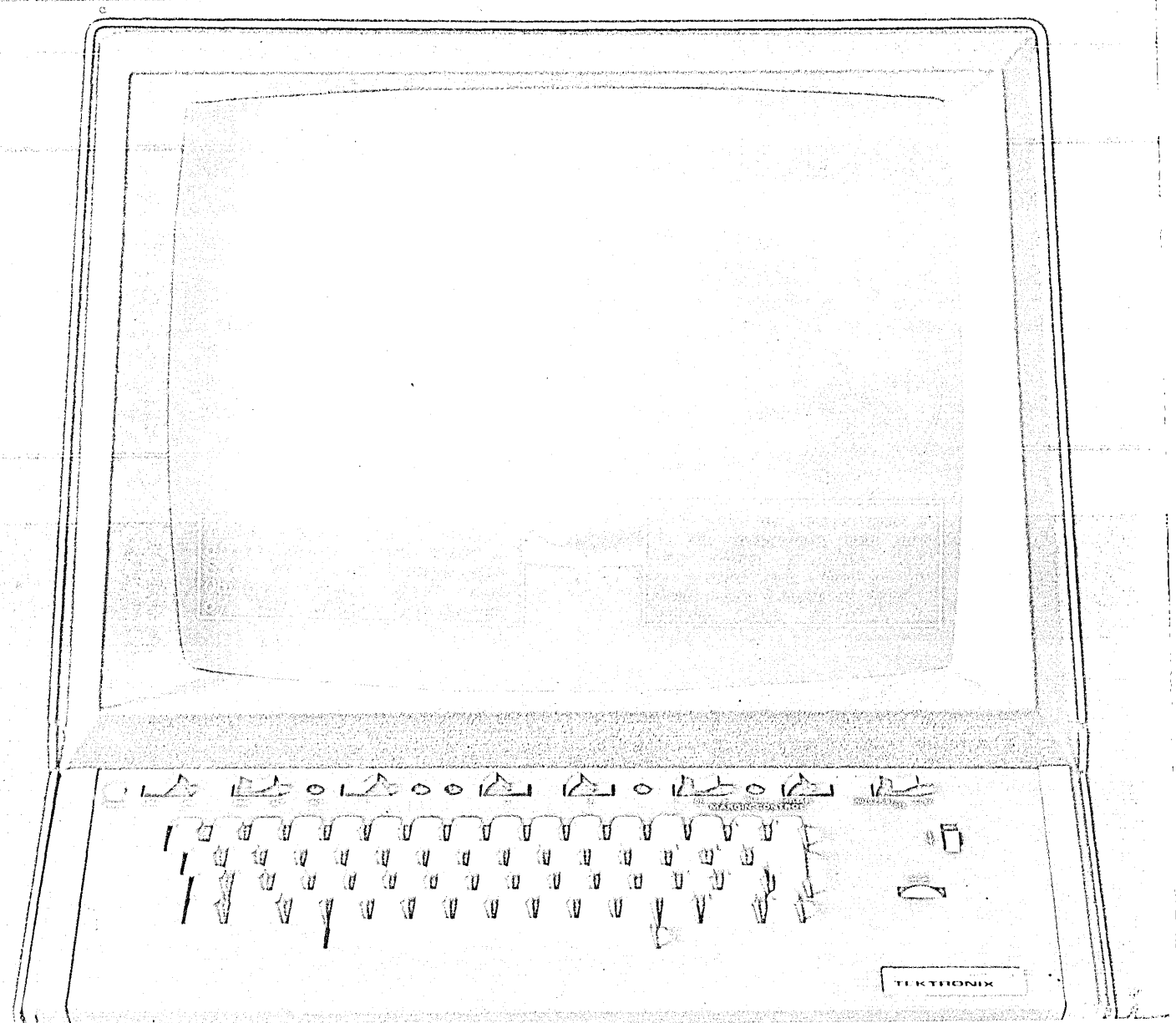

Economics once favored time-sharing;
it now may favor a different technology.

PERSONAL COMPUTERS

by Berthold K. P. Horn and Patrick H. Winston

When a resource is scarce, it makes sense to share it, even in the face of extra administrative cost. But ordinarily everyone in a household has his own knife and fork, and there may even be some sets for guests which lie unused most of the time. The economy realized by sharing simply would not be worth the extra hassle and time required for organizing meals. There are now good reasons to believe that processors should be like knives and forks—dedicated to individual users without sharing.

One reason why this is not just a dream about the way things ought to be is that costs are rapidly changing. One can anticipate crossing the threshold below which time-sharing ceases to be the only possible way sophisticated computing services can be supplied. It is time to reexamine the choices.

The evolution of time-sharing

Once upon a time, computer users had intimate contact with their computers on a one to one basis. Turnaround was fast, response predictable, and debugging immediate. But unfortunately there was too little computing power to go around. This lack of power, coupled with the fact that the computing machines were very costly, meant that it made no sense for them to stand idle at any time. This led to the introduction of multiprogramming, and user convenience suffered as a result. System software complexity necessarily increased and was accompanied by decreased comprehensibility, maintainability, and reliability. The user was removed from the theater of operations to wait impatiently elsewhere, fearing he might have committed one more trivial, but nevertheless fatal syntactic blunder.

The introduction of time-sharing can be viewed as an attempt to reverse this escalating alienation of the computer user. It succeeded only partially. Because of system complexity and integrity considerations, most time-sharing systems offer only very limited access to the capabilities inherent in the large machines they operate on. Some even restrict the user to a single language. The overhead due to frequent and careful task switching and memory management makes time-shared computing relatively expensive. Most irritating perhaps is the highly variable response characteristic of such systems.

Time-sharing is an idea which has dominated interactive computing for more than a decade. Its end may now be in sight.

Everyone knows that a time-sharing system's performance deteriorates rapidly with the number of users. *But curiously the perceived deterioration can depend almost totally on the number of users rather than on the machine's speed.* This is true because in interactive programming the user sooner or later uses the system in the middle of the night or at some other time when the system load is light. He will forever after be frustrated by any less responsive behavior.

When does he begin to get less? Let us look at the worst case by considering users working with difficult scientific computation problems. No matter how fast the machine is, these users seem to permit the complexity and size of their programs to expand according to a sort of inexorable Parkinson's law until program execution occupies about a fifth of the total time they spend at the console. With fractions larger than a fifth, frustration with debugging predominates. Consequently users interactively debugging complicated programs under dedicated machine conditions probably think about four-fifths of the time and ask the machine to think one-fifth of the time.

This means that any system will begin to appear sluggish whenever there are more than about five users. The exact number depends on what the users are doing: interactive debugging and editing require fast response, while a user may be quite prepared to go away and have coffee when a program is actually executing. The sluggishness is of course aggravated by thrashing—on a time-sharing system, trying to maximize processor utilization can result in a disastrous situation in which so many tasks are competing for resources that the system spends much of its time switching state and deciding what to do next. The result is faster-than-linear increases in response delay time with increase in the number of users.

Overall, the step-wise growth in system complexity made sense while hardware was expensive and software could be cheaply extracted from enthusiastic young people willing to learn. But today software costs are up and hardware costs are plummeting downwards. Is there then a way to make use of the availability of cheap processors and memories to avoid the software costs, inefficiencies, and frustrations of complicated systems? The answer is yes. There is a practical end of the spectrum opposite from where time-sharing lies. We

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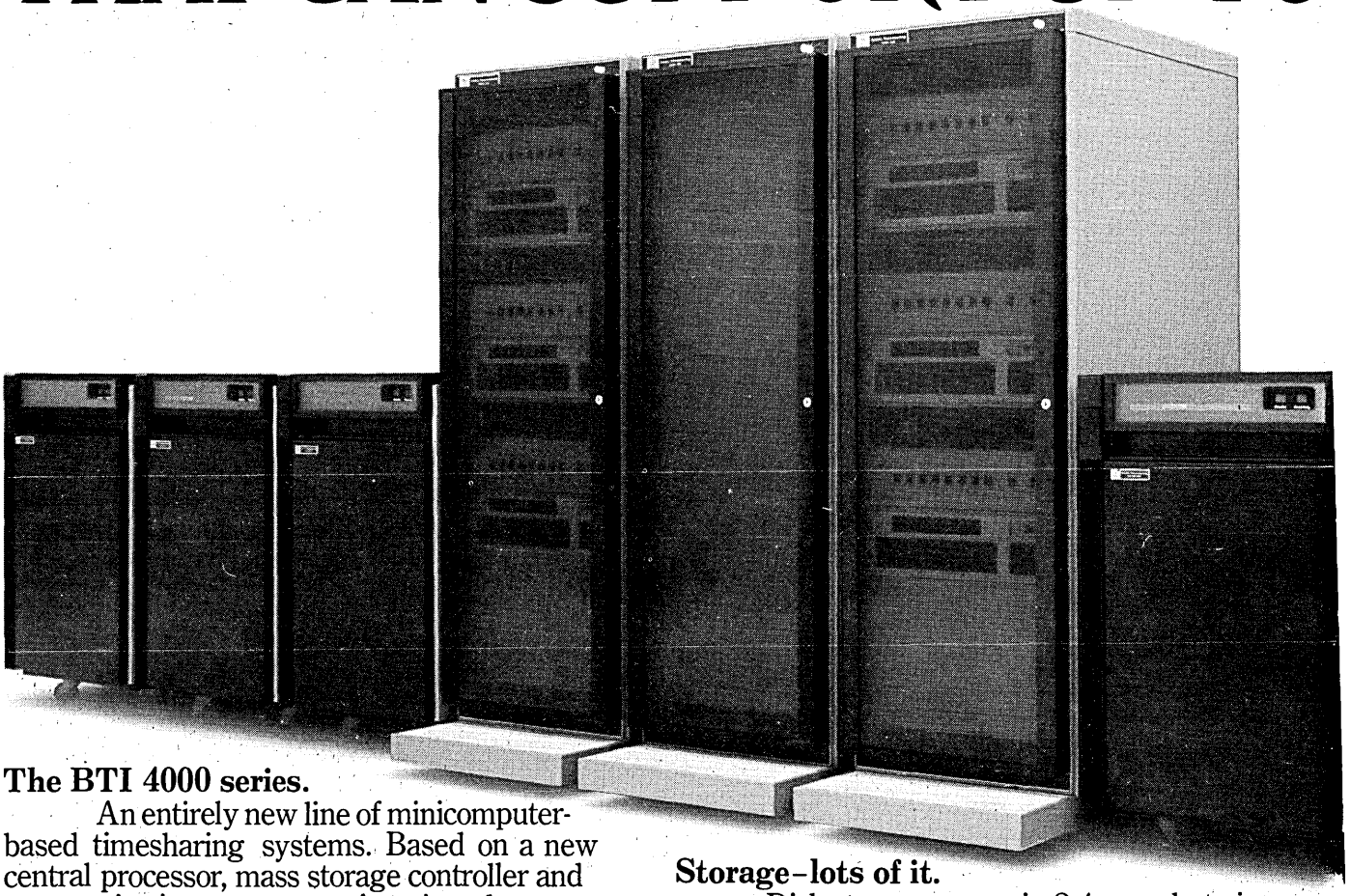

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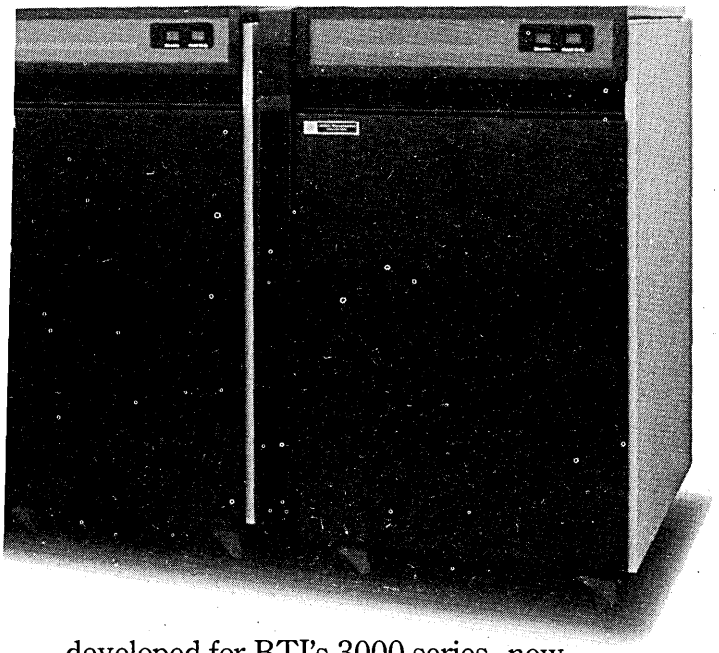

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seem about to go full circle back to the dedicated cpu!

The new economics

The personal computer provides the answer. A personal computer is a non-shared system containing sufficient processing power and storage capability to satisfy the computational needs of a single user in the style to which he has become accustomed. It makes sense today, because it is certainly superior to have 30 systems that give excellent steady service for $33K, than to have one central time-sharing system that cannot adequately support 30 users and costs $1M. The economics of scale in the past favored putting all one's eggs in one basket. The balance will now tip the other way.

While there are various possible intermediate scenarios in the decentralization of computing components such as processors, memories, and file systems, we will sketch out only the most advanced to illustrate how far things may be expected to go using available technology.

a. The new primitive modules

With the advent of large-scale-integration (LSI) and several new circuit technologies such as silicon-on-sapphire (SOS), the integrated circuit manufacturer must once again face the usual decisions about what kinds of circuits he should develop and manufacture. Since setup costs are very high and production costs very low, we can expect standardization on a small number of products with wide applicability. Memory is an obvious candidate, and so are processors. They will become as ubiquitous as transistors were a few years ago, and as transistor-transistor-logic (TTL) gates are now. Special purpose logic arrays on the other hand are definitely out. This has already had, and will continue to have, important implications for the whole field of electronics. Memories and processors will replace a large number of special purpose devices.

It is already cheaper to build a disc controller using a simple general purpose processor than specially designed circuits using only lower level modules such as flip-flops and gates. It also makes for a controller that is smarter, more compact, and more serviceable. Similarly, to build a high quality display terminal device, one can use a standard television monitor, one bit of memory for each point on the screen, and some logic to paint the data onto the screen at the usual tv scan rate. Such a device will be cheaper than those using special-purpose vector- and character-generators, D/A converters, and an addressable crt. At the same time it will be simpler to maintain since it contains fewer kinds of modules and parts.

b. Alterable machine structure

The trend toward standardization of LSI products on just memory and processor will be accompanied by a trend toward microcoding, again for the sake of simplicity and flexible uniformity. Lower cost and ease of debugging processor hardware are driving forces that favor microcoding. The variability in machine characteristics desired by the user is taken care of by providing different microcode memories. Many microprocessors consist of two dual-in-line packages (DIPS). One is the processor itself, the other its microcode memory. In the past this memory most frequently was read-only-memory (ROM), but more often than not it is now read-write random-access (RAM) and can be loaded by the user to emulate his favorite machine. Such user-loadable microcode allows tailoring the machine to suit a particular language, and this in turn makes it competitive with much larger and more expensive machines that cannot allow any modification of their basic structure because system security would be compromised. This at last allows machine structure to reflect software needs.

On the drawing boards

So far we have looked at the personal computer as a simplifying evolution of the larger computer systems. It can equally well be approached as a further sophistication of minicomputer systems. Some of these already provide quite acceptable single user software development facilities, often with better interactive editing, debugging, and utility services than the larger systems.

Fig. 1 is a diagram of a system that could be assembled now, largely out of commercially available modules. Notice the use of several memory modules of various sizes, speeds, and wordsize. These are not all shown to be connected to the common bus directly, but could be for added flexibility. The communication facility would still provide access to a repository of files—the user community interaction introduced as a byproduct of time-shared computing should surely be retained. Such a system has enough storage and processing power to satisfy the computational needs of most users now requiring access to a classical time-sharing system, and would cost around $33K to build. This is typical of what many proposed personal computers would cost to manufacture now, and purchase prices at the same level should be just around the corner.

At $33K, one can expect a group of systems to be used like a secretarial pool. Each would be totally dedicated to individual users on demand but would reside in a central pool otherwise. Login would connect the user to an idle system that would then serve that user and no other until logout.

At still lower prices the mode of use would no doubt change. Conceivably

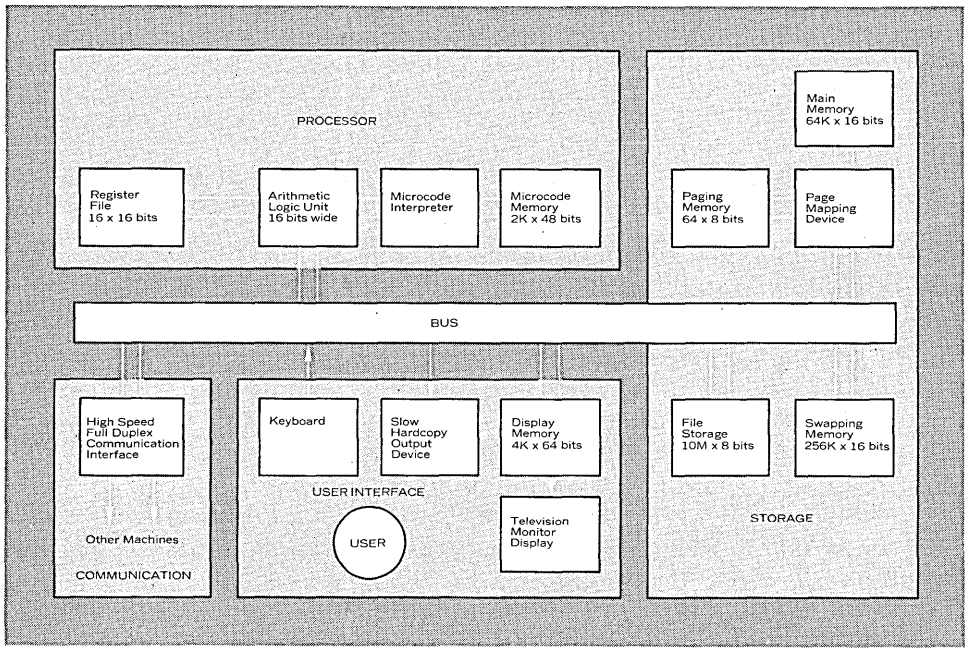

Fig. 1. A computer of this design might be built for $33K today, and prices keep falling. Such machines could obviate much of the need for larger shared systems.

the machines may eventually be distributed like pocket-calculators or pencils.

a. DYNABOOK and logo

One proposed personal computer system is Alan Kay's DYNABOOK, rumored to be under development at the Xerox Palo Alto Research Center. It is a display oriented system evidently intended for educational use. The display in this case is a slightly nonstandard television monitor, turned on its side, with enough resolution to present a full page of text with near book-print quality. It requires about twice the display memory as in our first example. A version of this system is believed to exist now and is reputed to cost around $10K to build. Its microprocessor emulates a machine much like the Data General Nova. There is serious talk about eventually packaging the system in a box about the size of an ordinary three-ring notebook.

Recognizing the need for good display features in education-oriented applications, Marvin Minsky at MIT has designed a still less expensive machine aimed at running LOGO, a language for teaching thinking. LOGO has been demonstrated on larger machines to be an effective way for children to learn about such subjects as geometry, physics, and music as side effects of learning to think by learning about programming. The LOGO machine will be a giant step toward general use of the concept.

b. The LISP Machine

Perhaps the most sophisticated personal computer system now under active development is one proposed by Richard Greenblatt and his colleague, Thomas Knight, at MIT. Their intention is to make possible the efficient execution of very large programs written in high level languages such as LISP, PLANNER, or CONNIVER. Such programs cause typical time-sharing systems to stagger and thrash since they require large virtual working sets of pages. Other problems are occasioned by the need for very large address spaces, the ability to handle sophisticated control structures, and multiple execution environments. Greenblatt has demonstrated that the proposed system will run large programs faster than the presently used time-sharing systems on Digital Equipment PDP-10s. Another interesting feature of his system is the planned integration of the editing, debugging, file-manipulation, utility, compiling, and interpreting facilities, with the user needing to learn only one common command language. This system requires relatively large main and swapping storage and is estimated to cost around $50K to build.

The more the merrier

After the heavy initial investment in design, layout, and debugging, turning out LSI devices is much like cutting cookies out of dough. If one remembers that the only impetus for sharing was of economic origin, then there is no reason to believe that there is any need for a central facility at all—not even for file storage. The personal systems should however be connected together in some kind of network, perhaps of the packet-switching kind, to allow sending messages and exchanging files and new software tools.

Perhaps in a number of special applications involving large amounts of number-crunching or processing of very large undistributed data bases, a big, conventional batch-oriented system will still have a role to fulfill—in such applications may lie the last stronghold of the breed whose thankless task it now is to make life difficult for computer users. □

Dr. Horn is an assistant professor of computer science at MIT. He has also taught at the Univ. of Witwatersrand, Johannesburg, South Africa, has worked in private industry, and has been active as a consultant.

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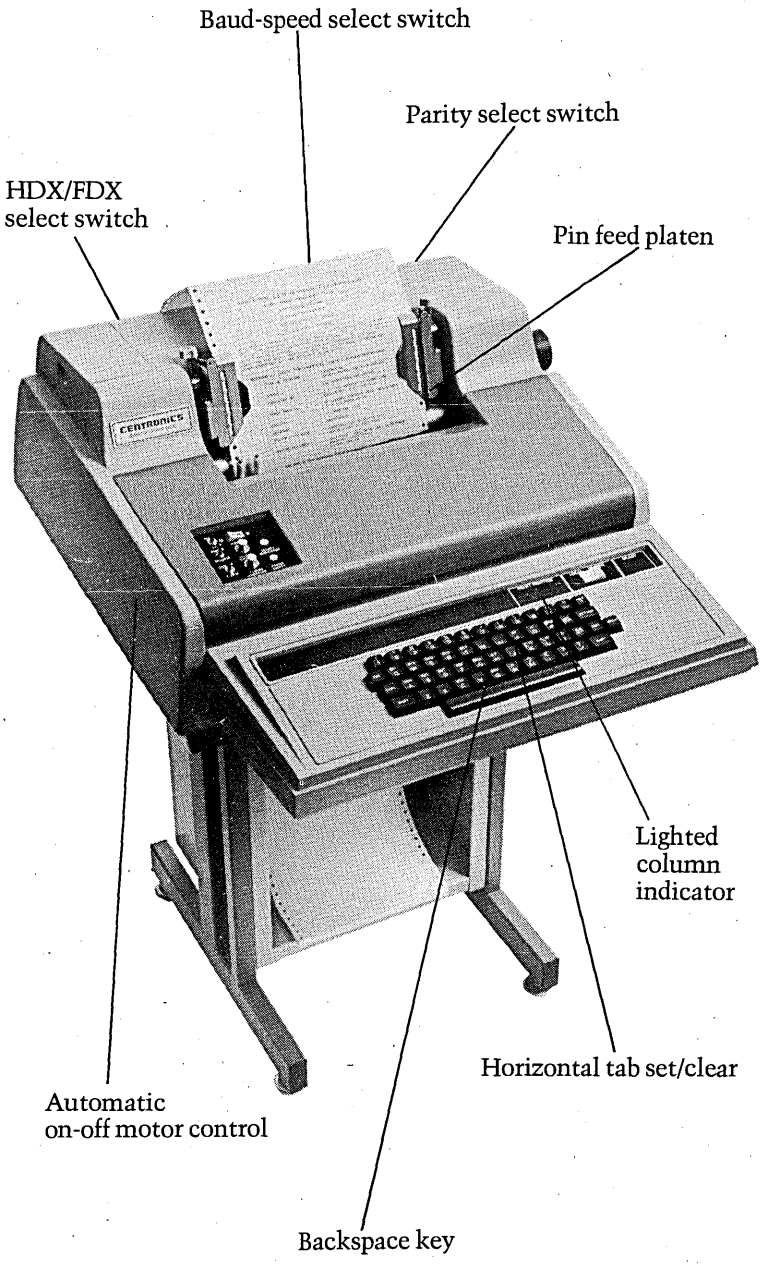

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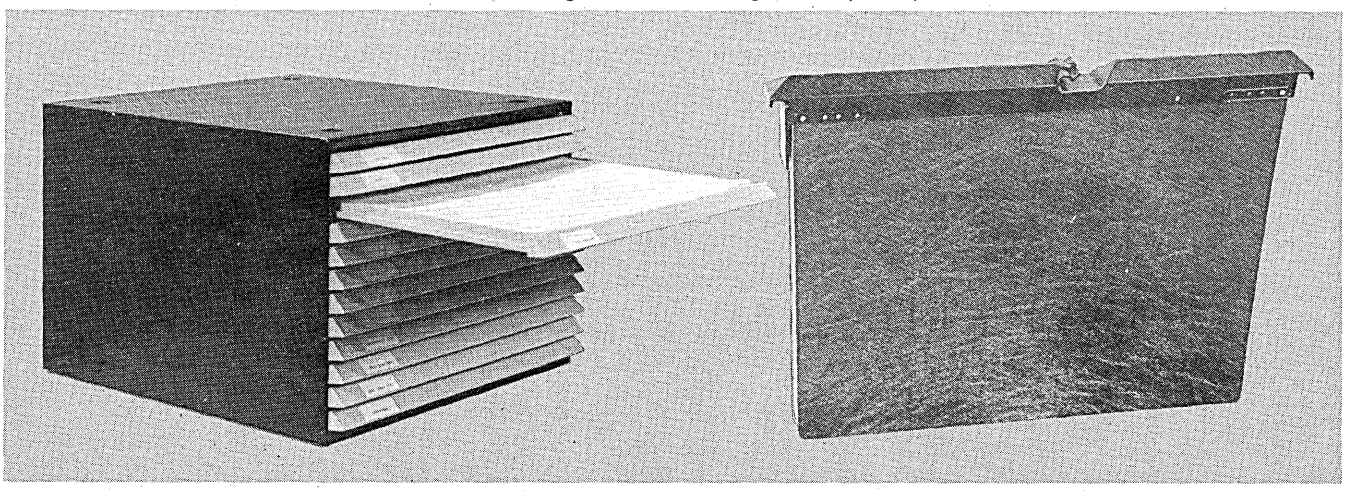

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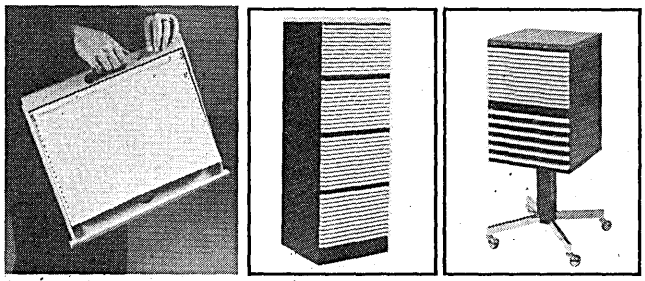

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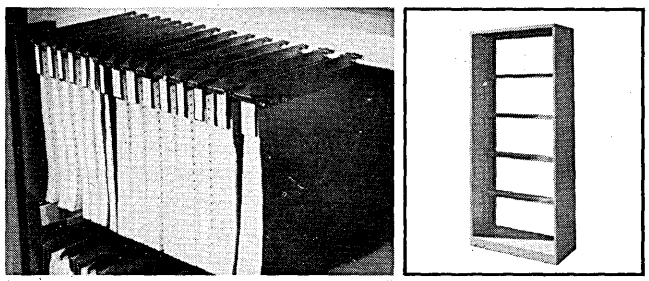
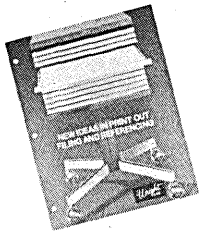


Complete details on the new CPS Computer Printout System are contained in our new brochure. For your copy circle the readers' service number or write today. Wright Line, a division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606



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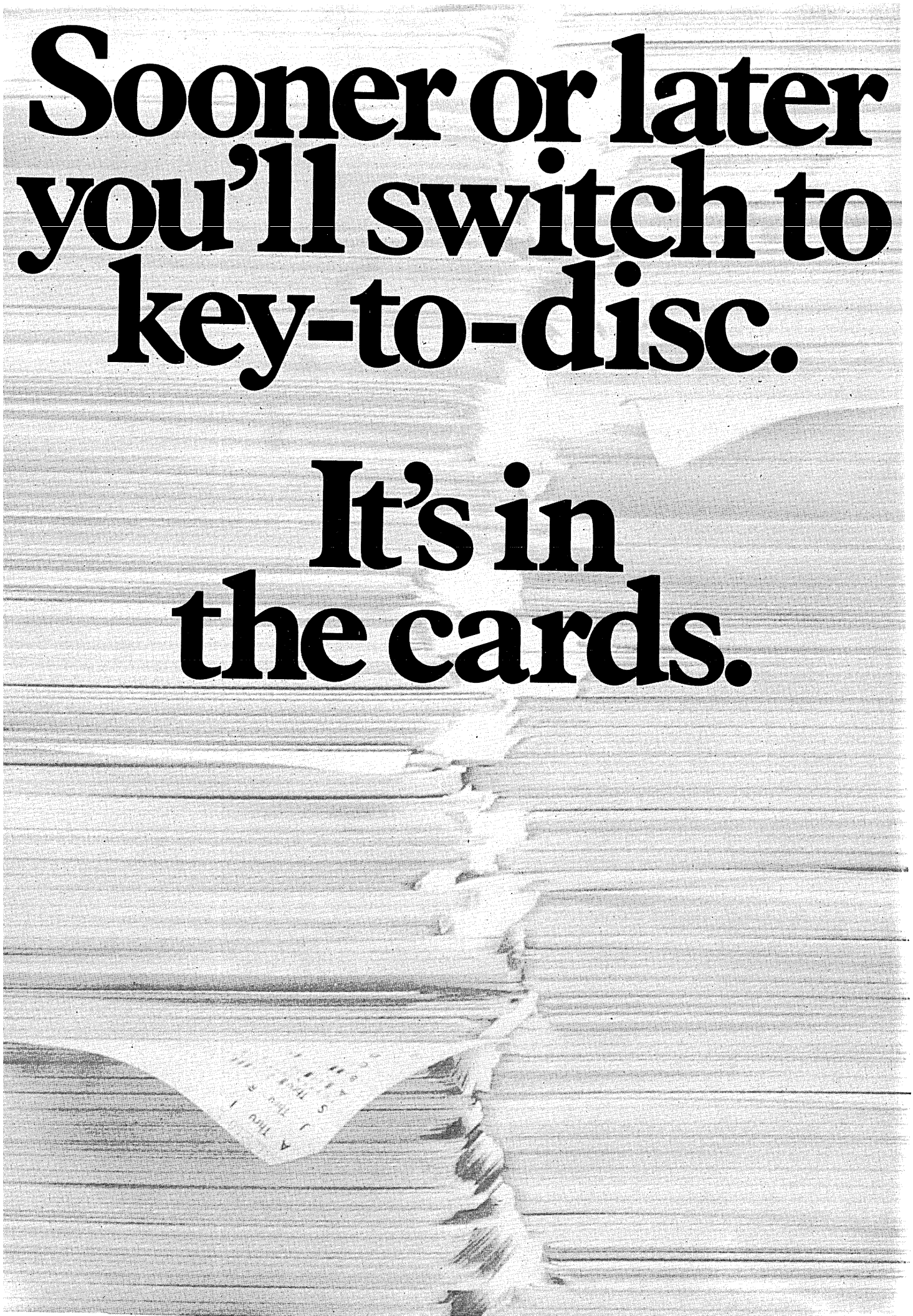

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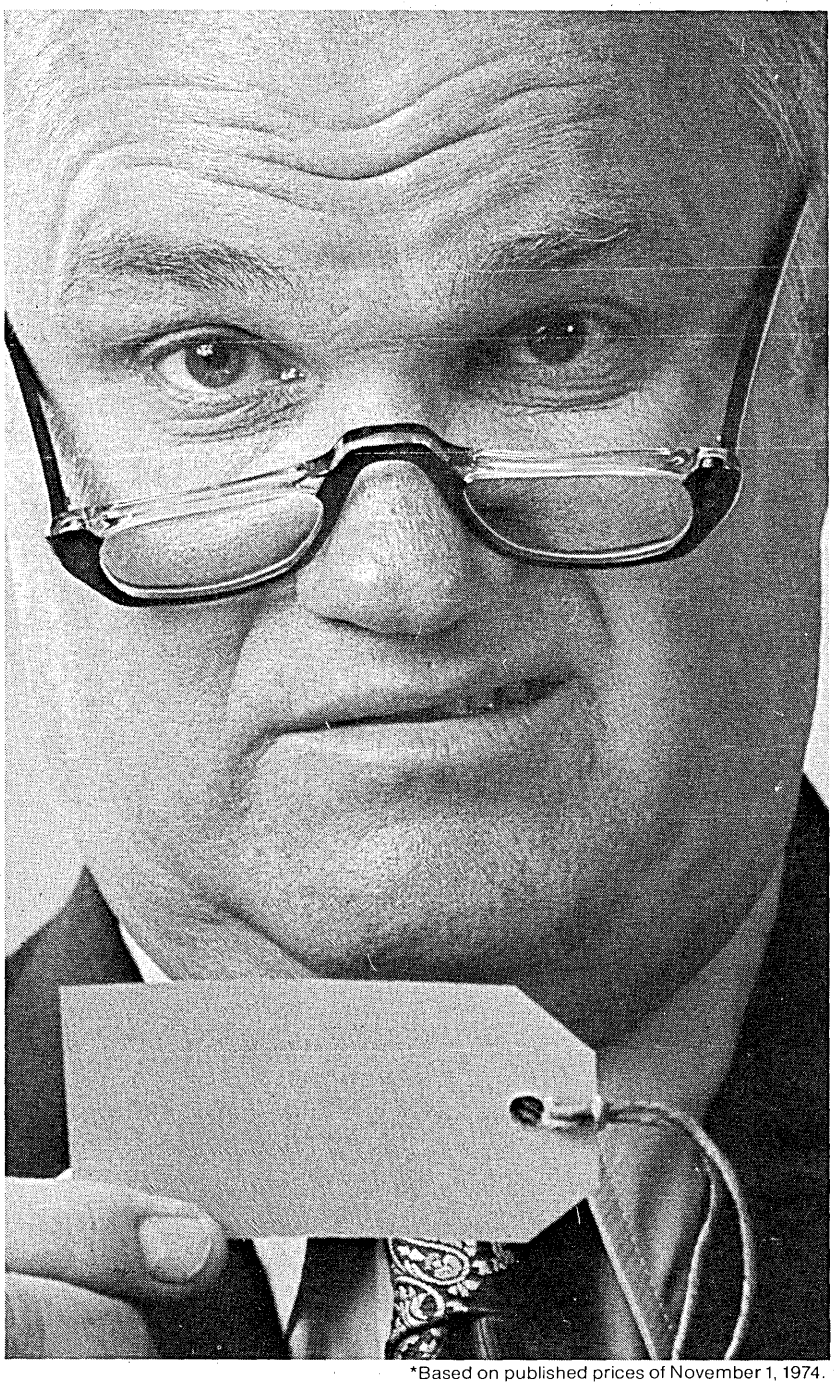

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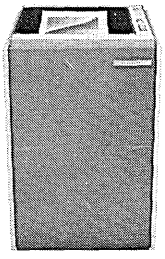

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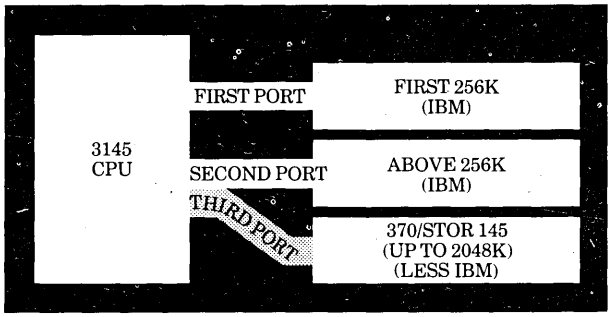

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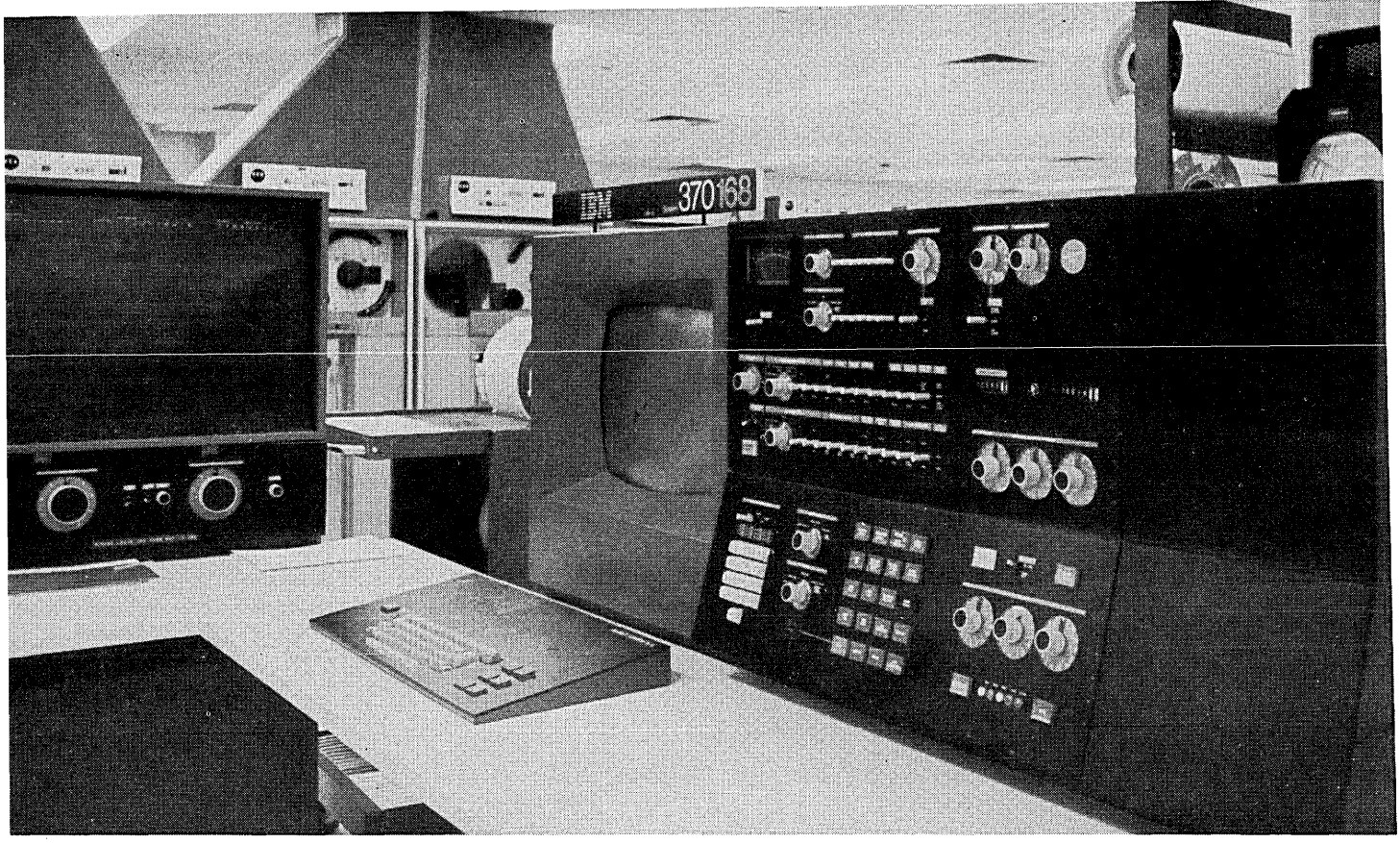

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This clause is
just as dangerous as a GOTO
and equally unnecessary.

THE "ELSE" MUST GO, TOO

by Allan M. Bloom

Structured Programming is the current "Idea whose time has come." Its premise is a start in the right direction—away from the rats' nests of code which are expensive to debug, which cause too many maintenance programmers to go prematurely gray, and which drive customers mad when their "simple" requests—and sometimes they really are simple—can't be implemented quickly or at all. However, the most noticeable characteristic of a "structured" program is that it is itself something of a rats' warren of nested IF-THEN-ELSE groups. Before anyone really started worrying about the GOTO, the nested IF (or nested IF-THEN-ELSE in the current nomenclature) was one of the things that programmers with any maintenance background avoided as a matter of course. In fact, much the same hazards were attributed to the multiple nest as are currently being attributed to the GOTO—unnecessary complexity, difficulty or debugging/maintenance. It's doubtful that any ruckus at all would have been raised had Dijkstra's letter been titled "Nested IF Statements Considered Harmful" (Dijkstra, E. W., "GOTO Statement Considered Harmful," *Communications of the ACM*, Mar. 1968, pp. 147-148). Yet "structured" programming has the IF-THEN-ELSE, with DO-WHILE, as its major control element (with "simple sequence" added to tie up loose ends). The ELSE, of the IF-THEN-ELSE control structure, not only implies nested IFs but also is the *only* way to get a multiply nested IF group ("IF a IF b IF c" is no different from "IF a AND b AND c").

Properly done, a program that is ELSEd to death (with many levels of IF-THEN-ELSE groups) can be just as complex and just as much a test of the programmer's skill as the overbranched program whose logic flow diagram looks like so much spaghetti. And *the ELSE is just as unnecessary as the GOTO*. Since the processing following the ELSE is equivalent to processing an IF (NOT)-THEN (the negation of the original IF condition), the ELSE is clearly unnecessary. Therefore, any program may be written using only the control elements

(1) Sequence
(2) IF-THEN
(3) DO-WHILE or DO-UNTIL

Elimination of both the GOTO and the ELSE results in what might be called "functional" programming. Functional programming reduces a program to its essence, a detailed procedure for performing a set of specific functions under specific conditions.

Comparative programming

As examples of "traditional," "structured," and "functional" programming, consider an extension of the "traditional"/"structured" comparison presented in the "Improved Programming Technologies: Management Overview."* Fig. 1 shows three pseudo-code program segments which do exactly the same thing. The "traditional" and "structured" pseudo-code segments are those used in the IBM publication, and the nomenclature is IBM's. The equivalence of those two segments can be shown by tracing the flow of control to determine which conditions apply to the execution of a function. As an example, in the "traditional" segment, function A is executed three times:

(1) when "p" is true and "q" is false, and
(2) when "p" is true and "q" is true and "t" is false, and
(3) when "p" is true and "q" is true and "t" is true.

In other words, Function A is executed whenever "p" is true, independent of "q" and "t," as seen in the "structured" code segment of Fig. 1.

Tracing the flow of control to each function in the two program segments

*Proceedings Manual of the Nineteenth Annual College and University Machine Records Conference, Baylor Univ., Waco, Texas, 1974, p. 100.

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results in the decision table, (Table 1). It would be close to impossible to re-create the "traditional" code segment from the decision table. It is, however, fairly easy to reconstruct the "structured" pseudo-code, and it can be done exactly from the table. Easier yet is the "functional" pseudo-code segment of Fig. 1, which was in fact written directly from the table. The condition for executing each module is explicitly stated, and functional modules, or IF-groups, may be written directly. For example, the table shows that Function E is executed when "p" is true and both "q" and "s" are false, or in pseudo-code

IF p AND (NOT q) AND (NOT s)
THEN E Function

The remaining functional modules, or IF-groups, were constructed in the same way.

Since the functions in the example are arbitrary, the IF-groups have been arranged arbitrarily (alphabetical order) in the "functional" pseudo-code segment of Fig. 1. If a functional group is indeed independent, it can indeed be placed arbitrarily in a program. Unless there is a specified and necessary sequence of operations, an IF-group can be placed *anywhere* in a "functional" program.

A comparison of "traditional," "structured," and "functional" programming methods may also be made via the three pseudo-code program segments of Fig. 1. The progressive decrease in complexity is visible from "traditional," through "structured," to "functional" programming methods. Reading the "traditional" code is close to impossible, and its flowchart (Fig. 2) doesn't really help much in understanding what it does. Designing a test procedure to check all control flow paths, determining the reason for a program crash, making a modification —all would be quite difficult and expensive.

The equivalent "structured" program segment in Fig. 1 seems to be a bit better. It reads from the top to the bottom, rather than skipping around the page. Its consistent indentation provides a "handle" on which structures are related. Its flowchart (Fig. 3) also reads top-down, and very graphically shows the functional hierarchy of the program segment. It is easier to see what the program does. Still, it is

Condition	p	q	s	t	v	w
Function						
A	T					
B	T					
C	T	F				
(while r) D	T	F				
E	T	F	F			
F	T	F	T			
G	T	T		T		
(while u) H	T	T		T		
I	T	T		T		
J	T				T	
K						
L	F					F
M	F					T

Table 1.

```
        IF p GOTO label q
        IF w GOTO label m
        L function
        GOTO label k
label m M function
        GOTO label k
label q IF q GOTO label t
        A function
        B function
        C function
label r IF NOT r GOTO label s
        D function
        GOTO label r
label s IF s GOTO label f
        E function
label v IF NOT v GOTO label k
        J function
label k K function
        END function
label f F function
        GOTO label v
label t IF t GOTO label a
        A function
        B function
        GOTO label w
label a A function
        B function
        G function
label u IF NOT u GOTO label w
        H function
        GOTO label u
label w IF NOT t GOTO label y
        I function
label y IF NOT v GOTO label k
        J function
        GOTO label k
```

TRADITIONAL

```
IF p THEN
   A function
   B function
   IF q THEN
      IF t THEN
         G function
         DOWHILE u
           H function
         ENDDO
         I function
      (ELSE)
      ENDIF
   ELSE
      C function
      DOWHILE r
        D function
      ENDDO
      IF s THEN
         F function
      ELSE
         E function
      ENDIF
   ENDIF
   IF v THEN
      J function
   (ELSE)
   ENDIF
ELSE
   IF w THEN
      M function
   ELSE
      L function
   ENDIF
ENDIF
K function
END function
```

STRUCTURED

```
IF p THEN
   A function
   B function
IF p AND (NOT q) THEN
   C function
   DOWHILE r
      D function
   ENDDO
IF p AND (NOT q) AND (NOT s) THEN
   E function
IF p AND (NOT q) AND s THEN
   F function
IF p AND q AND t THEN
   G function
   DOWHILE u
      H function
   ENDDO
   I function
IF p AND v THEN
   J function
K function
IF (NOT p) AND (NOT w) THEN
   L function
IF (NOT p) AND w THEN
   M function
END function
```

FUNCTIONAL

Fig. 1. The advantages of functional over traditional and structured coding are seen in this comparison of three pseudo-code segments that perform identical functions.

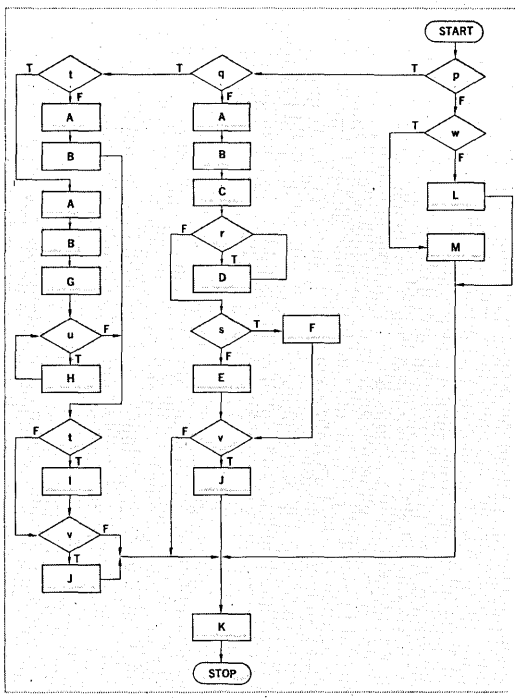

Fig. 2. The flowchart for the "traditional" code does not help much in understanding the program's function. This makes testing, debugging, and modifying the program difficult and expensive.

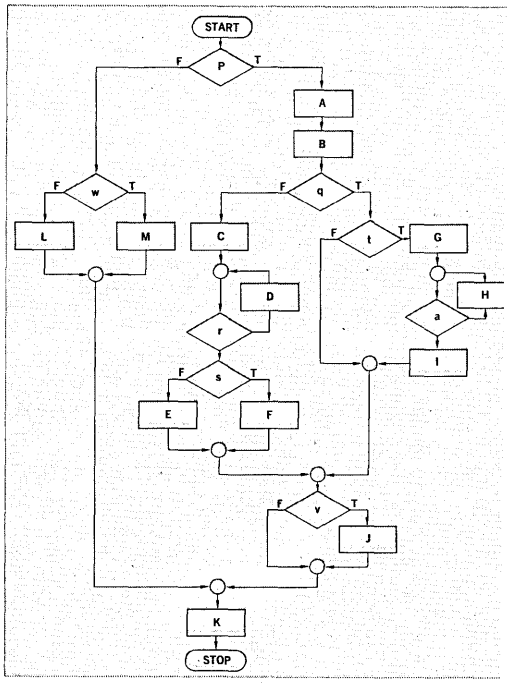

Fig. 3. The flowchart for the "structured" code reads from the top down and does show the functional hierarchy of the program. It does not make it easy to see under what conditions a specific function is performed, however.

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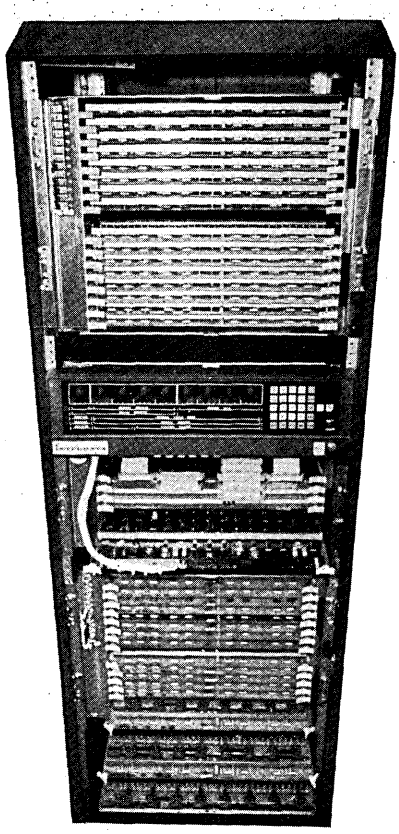

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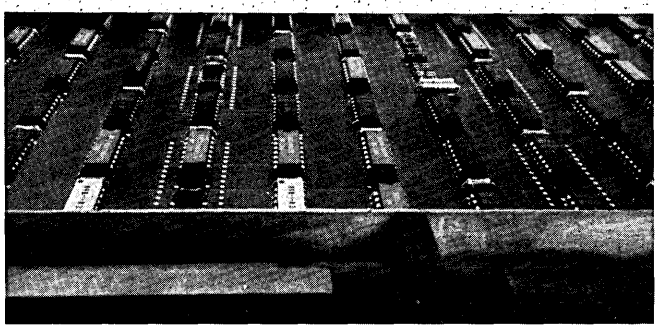

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Multiply	3.54	6.2	2.0	3.9	8.8
Divide	5.8	14.4	9.9	8.3	11.2
Floating Point Add	2.3	6.1	2.4	8.25	5.5
Multiply	3.0	9.1	2.3	11.25	7.2
Divide	5.35	23.3	8.9	12.25	7.9
HARDWARE I/O	Yes	Yes	Yes	No	No
MAX. DMA RATE/SECOND	6MB	4MB	6.7MB	4MB	2MB
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unnecessarily difficult to determine under what conditions a specific function is performed because of use of (1) the "IF filter" and (2) the separation of the conditions for a function's execution. Something has been "IF filtered" when an IF statement is used to forever deny its access by another IF. As the conditions for a function's execution are separated (part associated with each higher IF or ELSE in its hierarchy), it's that much easier for one to be missed or misinterpreted. The maintenance programmer would still have to exercise care to determine exactly where in the "structured" program's control path to make a modification.

"Functional" advantages

Fig. 1's "functional" coded program, on the other hand, is easy to understand and a maintenance dream. Each processing function and the conditions under which it is executed are intimately related and independent of any other function/condition set. It is very easy to see exactly what the program does and exactly when it does it. A flowchart for the program (Fig. 4) is actually superfluous—the program coding is self-explanatory. Since every set of conditions is queried in the program's control path, a modification can be placed *anywhere*. There are no IF-filters, and there is no danger of a modification affecting any other function's execution. *All* the conditions under which a function is executed are together in its associated IF, so there is minimal chance of misinterpreting and no need to look elsewhere than the module of interest. Additionally, it is quite easy to plan testing of such a program, since the control paths are explicitly stated. To test Function J in Fig. 1, for example, the "functional" pseudo-code states explicitly that the conditions "p" and "v" must be true. The unique sets of conditions needed to test each IF-group of the program are stated explicitly *in* the program.

A functional program, then, is easier to understand, debug, and maintain than either a "traditional" or a "structured" program. It's also easier to write correctly, because the programmer need concentrate only on the particular module he or she is working on—its processing and the specific conditions under which it is to be executed. It is *not* "efficient" in terms of machine execution, and duplication of some conditions adds a bit to the initial coding process. Execution and initial coding, however, are part of a multi-step process of code/debug/execute/maintain, and they are the two least costly elements of the process. Debugging and maintenance are the time, money, and resource eaters, and "functional" programming is the best that control logic can do to decrease those costs. Structured programming, with elimination of the GOTO, is claimed to be a step toward changing programming from an art to a cost-effective science, but the ELSE will have to go, too, before the promise is a reality. □

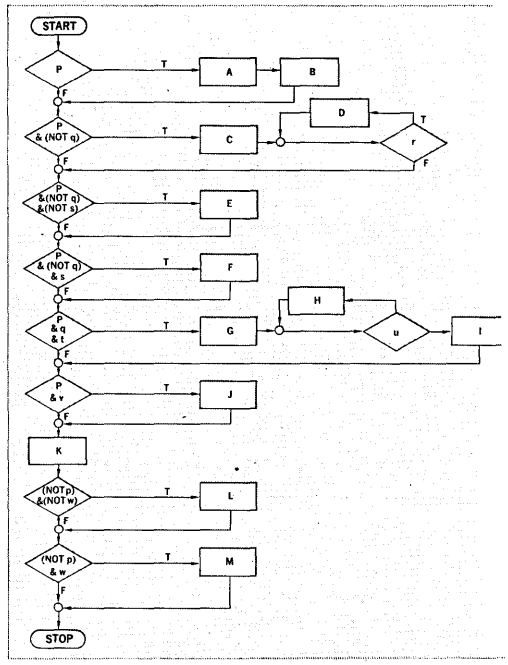

Fig. 4. A flowchart for a "functionally" coded program is claimed to be superfluous since the coding is self-explanatory.

Dr. Bloom is the Senior Programmer, Information Systems Div., Penn State Univ. His current interests involve increasing programmer productivity, by the development of coding by dictation and in the definition of a good program and how to produce one.

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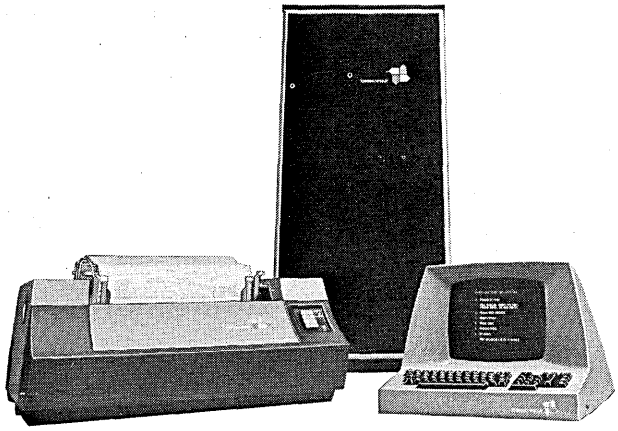

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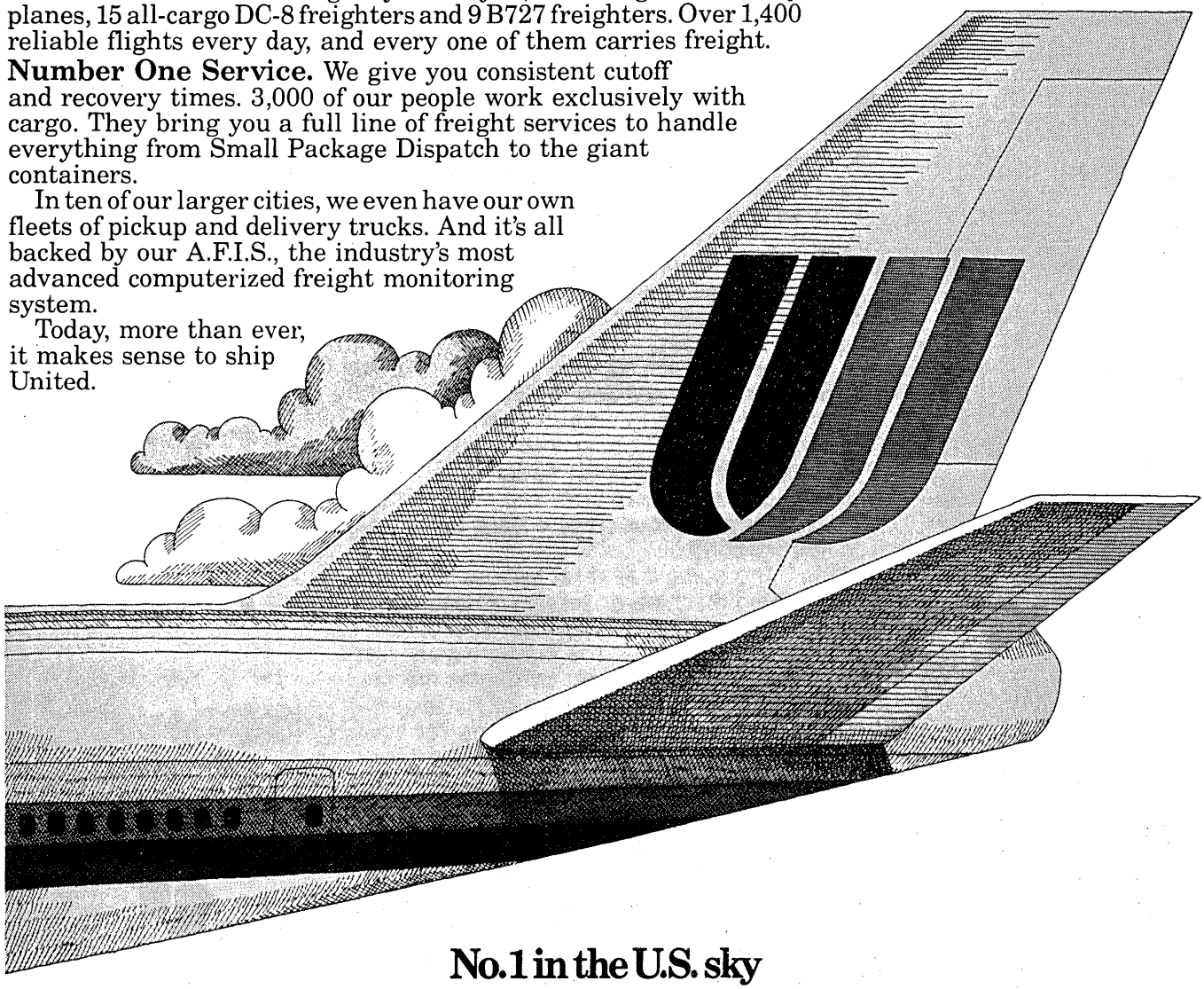

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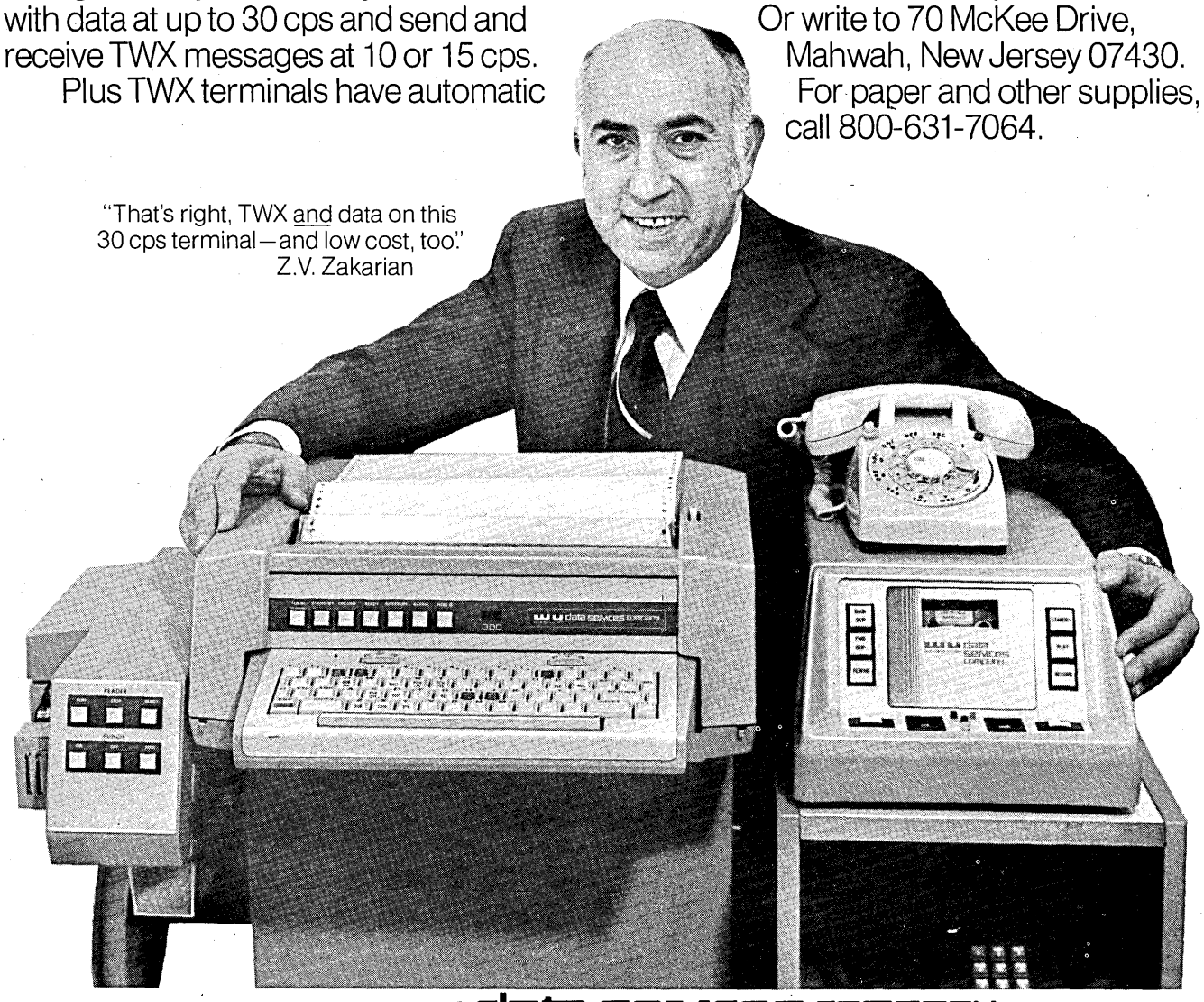

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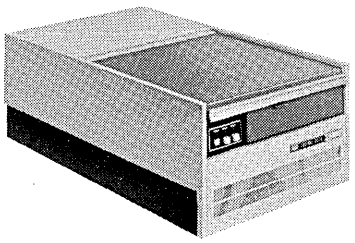

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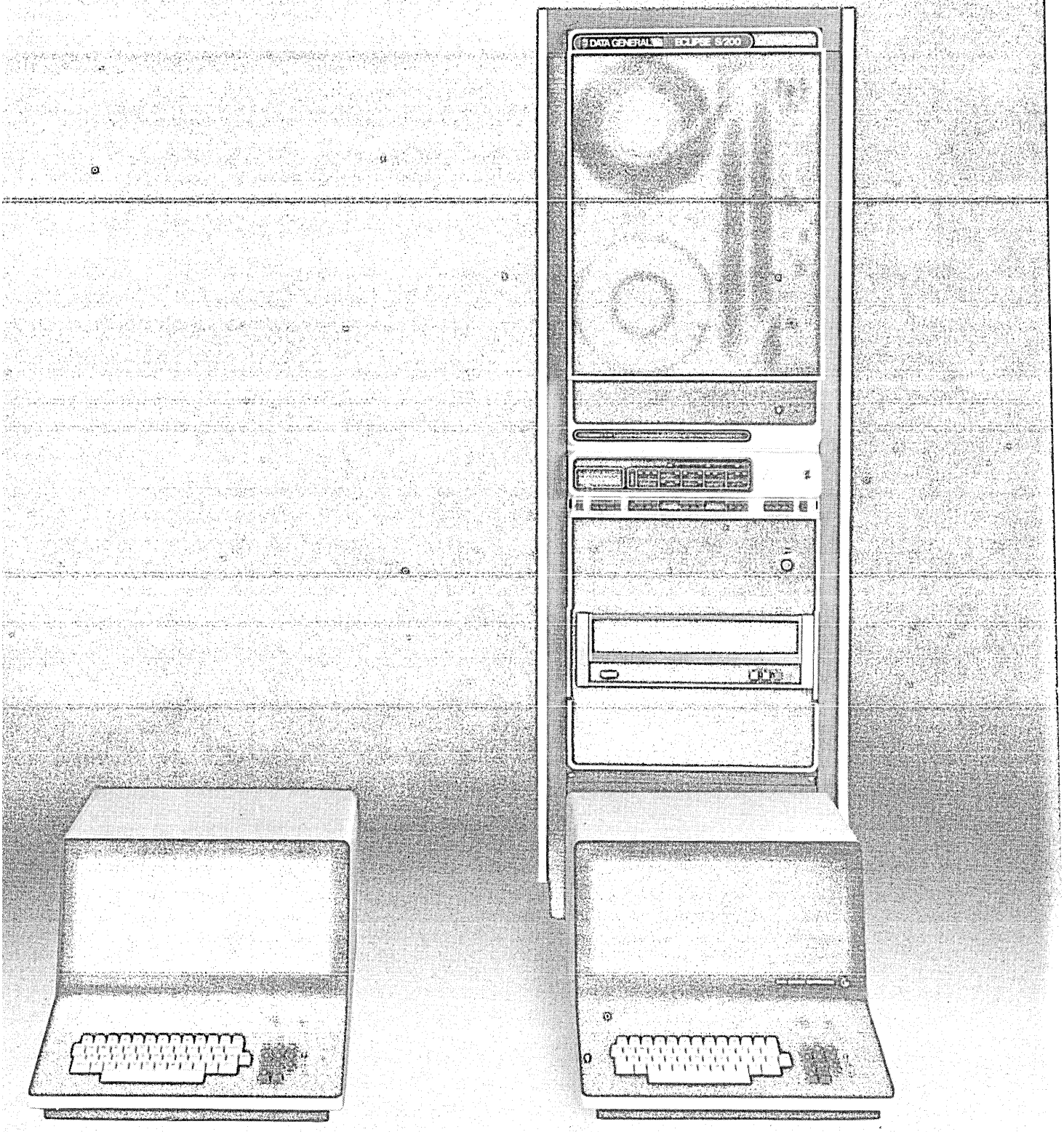
THE BUBBLE ON THE CHART

by Inez M. Kirby

'Twas a mild winters evening
And a goodly crowd had banned
To fill the local tavern
Leaving barely room to stand.
  As the songs and cheerful laughter
  Filled the room from walls to floor
  A bent and twisted figure
  Staggered through the open door.
A gasp, a shriek, a stammered "Look!"
Turned merriment to gloom
As all eyes turned to gaze upon
The presence in the room.
  Horror filled the gathered throng
  The crowd withdrew in fear.
  His sunken eyes and haggard face
  Was filled with ought but cheer.
An albatross, had he but worn,
Could not have wrought more fright
The red-rimmed eyes, the unkempt hair
He looked a ghastly sight.
  "The funeral parlors down the street"
  Spoke up a faceless voice.
  "The parlor wouldn't take that thing,
  Not if they had a choice."
"He looks as though he's just been through
A fight, a trial, or test."
"Yes!, and what is worse he looks as though
He came out second best."
  This humor did the poor wretch take
  In fact he gave a grin.
  He scratched his beard and then he spoke
  The room was still again.
"If you don't mind, I'd like to rest
I've not slept in many days."
"Then why don't you go get a job,
And change your wicked ways!"
He fixed his swollen, half shut eyes
Upon the voice that spoke.
He grinned, he chortled, then he laughed
As though he'd heard a joke.
  Walking slowly to the bar
  He ordered up a beer
  "I'll tell you a funny story
  One I know you'd like to hear."
Quaffing down his cooling drink
He turned to face the crowd.
"Once I was a clean cut youth,
Healthy. Happy. Proud.
  "Yes! I was once a decent man.
  'Tis hard to believe I know.
  But I was—some four or five months back,
  Even though it doesn't show.
"I was a programmer.
No, not a coder, tech or clerk.
But an analyst—an artist
Who knew how to do his work.
  "I programmed this and debugged that.
  Finished each task in time.
  And as my programs bugfree ran,
  My star began to climb.
"Then one day it happened.
My rising star did beam.
For I was asked to join the
Mighty Systems team.
  "Why don't you laugh? 'Tis funny
  When you think about it some.
  That such a task could ever use
  This dirty, wretched bum.
"But 'twas so and for an hour or two
My work progressed quite well.
'Til someone checked the perted chart
Then my schedule went to hell.
"I hadn't met a bubble that was
Due on June the 7
It mattered not that I came on
The job on June 11.
  "But they told me not to worry,
  They would help me do my chore.
  Instead of working just eight hours,
  They allowed me twenty-four.
"They didn't let me eat or sleep,
And yet they couldn't figure,
Why everytime they saw the pert
My bubble had grown bigger.
  "Hurry! Hurry! Get it done!
  Was all that they could say.
  My teeth grew weak, my body thin
  My hair began to gray.
"My voice went numb; my skin turned pale,
I started seeing double,
But they cared not—their prime concern—
That ever growing bubble.
  "One day I tried to run away.
  I used to be a sprinter.
  They caught me in the parking lot
  And chained me to the printer.
"And there I stayed for months on end,
'Til one day they said—Okay.
No sooner had my chains come off
Than I made my get-away."
  As he spoke this final sentence
  He was walking to the door.
  When suddenly he gripped his throat
  And fell, dead, upon the floor.
Around his neck they found a tag
Like diabetics wear.
Engraved upon this self same tag
This message written there:
  If you should find this wayward soul
  Whether he's safe or he's in trouble
  Send him back, he isn't through
  He's got another bubble.



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Borrowed psychological concepts can help in designing programs.

PSYCHOLOGY AND PROGRAM DESIGN

by David Frost

"As a slow-witted human being I have a very small head, and I had better learn to live with it and to respect my limitations, giving them full credit rather than trying to ignore them, for the latter vain effort will be punished by failure."

—E. W. Dijkstra
"Notes on Structured Programming"

Psychology is important to a programmer in four ways:

- In helping him deal with people (group dynamics).
- In human engineering—understanding of the limitations and requirements of the human component in automation systems.
- In the management of programming projects and programmers (including himself).
- In how the intellect works, and how the analysis of problems and the program design process relate to the intellect.

Although the first three topics are certainly important, the concern here will be with the fourth topic—our intellectual limitations as they relate to the work of programming. These limitations to the thinking processes have to do with speed, capacity, parallel processing (how much we can think about at once), and error rates.

"Chunking"

There is a theory that human memory capacity can be measured in "chunks," with a chunk defined as a unit of information or a single encoding of two or more units of information. "Chunking" is the process of combining related pieces of information into one concept, then giving the concept a name. Once the concept is named, we can handle it as one chunk. We then break it apart only when we need to. The chunking process helps us to gain insight into problems and to see structure in the world around us. More important, chunking permits the mind to keep track of a great deal of information simultaneously. Thus it is through chunking that we can hope to understand and remember large programs.

The number of pieces of information (chunks) we can think about at any one instant has been estimated to be approximately seven (7±2) and more recently to be between five and seven. The number 7±2 crops up in so many psychological experiments that it has been called a "magical number."

Obviously, the mind is able to store and retrieve more than about seven chunks, and chunking is the tool that makes this possible. For example, a telephone number is much more easily comprehended and remembered as (602) 555-2341 X441 (four chunks) rather than as 6025552341441 (one big chunk with thirteen units in it). Likewise, 526-40-1400 is easier than 526401400. Programmers talk in decimal, octal, or hexadecimal rather than in binary for the same reason. This process of chunking is as necessary to remembering and understanding programs as it is to remembering telephone numbers. Dijkstra called a well-chunked system "intellectually manageable," a very descriptive term.

Abstraction and function

Two bases for forming chunks are important to programmers: abstraction and function. We have seen that chunking can be a very powerful mechanism for organizing and remembering information in the world around us. "Abstracting" is a generalizing process in which one concentrates on similarities between things and gathers (i.e., chunks) them into a group based on those similarities, thus making up the "abstraction." For example, the abstraction "housing" is useful for people who want to discuss housing without having to enumerate all the possible different houses that the discussion might relate to. (Abstraction can also be a two-edged sword. Many communication problems result from people using terms of abstractions with the same name, but actually meaning different things.)

For any set of entities there can be as many abstractions as there are traits which might form a basis for grouping. The process of abstraction is very important in the study of data types and structures, and also in programming them.

Just as abstraction is important to the programmer for handling data types and structures, chunks based on function are important for handling procedures. A procedure's purpose is to do things (i.e., perform functions). A good functional chunk is an entity that (1) does one thing, (2) can be

named, and (3) its function can be described easily in one sentence without resorting to a great many if's, and's, and but's.

Decomposition is the opposite of chunking. It consists of breaking up a chunk into parts (which are themselves chunks). In the case where the chunk is based on an abstraction, decomposition consists of ignoring the similarities between its parts, and concentrating on their differences (e.g., differentiating green houses from blue houses). In the case where a chunk is functional, decomposition consists of breaking up the function into individual functions which will work together to do the original function (e.g., "get a character" may require chunks for "open file," "read a record," "test validity," etc.). All the functions, at both levels, are themselves chunks.

A function can usually be decomposed in many ways, selecting different subfunctions as the constituents of the function being decomposed. Decomposition is the cornerstone of Structured Programming and other "top-down" approaches to programming. Selecting a good decomposition is recognized as probably the most important aspect of the design process.

Chunking, abstraction, and decomposition are all iterative processes which usually result in something resembling a hierarchy. The levels of such a hierarchy are called "levels of abstraction," each level representing a well-chunked concept that can either be decomposed into those chunks beneath it in the hierarchy, or combined with other chunks from the next level above it in the hierarchy. Levels of abstraction can be made up of either functional chunks or abstractions.

A human's error rate when processing information goes up very rapidly when the number of chunks being processed in parallel exceeds the "magical number." *This is of crucial importance to programming.* It is undoubtedly the reason why programming is such an error-prone process. Programmers too frequently write monolithic programs that force their minds beyond their ability to do parallel processing.

We all know, at least intuitively, that the error rate appears to increase exponentially as the size of a module, program, or system increases. Dijkstra asserts (in other terms) that our failure to chunk large systems into intellectually manageable pieces is the cause of this, and if we chunked programs into intellectually manageable pieces, errors would increase only linearly with the size of a program.

What all this boils down to is that psychology provides a powerful argument for modularity in systems design. But it is also a powerful argument for the hierarchical design process called top-down decomposition, as well as for hierarchical program structures, because chunking results in essentially hierarchical structures in the mind. The very successful New York Times' information bank project used this approach.

Summary

The human mind appears to be able to process no more than about seven concepts in parallel. The mind overcomes this by the process of chunking, the recording of several concepts into one newly identified concept. Chunking can be based both on combining functions and on abstraction, which is the decision to concentrate on the similarities among objects. Through chunking and decomposition, concepts are stored and retrieved.

When the mind tries to conceive of more than about seven things in parallel, the error rate goes up at what appears to be an exponential rate. It seems to be no coincidence that the error rate in programs also appears to go up exponentially with a linear increase in size.

The problem is that programmers write programs that are not well chunked; its pieces are too large and complicated to be comprehended accurately—the programs are not "intellectually manageable." To write programs with fewer errors, programmers must design for intellectual manageability. □

Mr. Frost is a consultant in software development at Honeywell's Process Control Div./Phoenix. He has been programming for 18 years, primarily in systems software for real-time applications.

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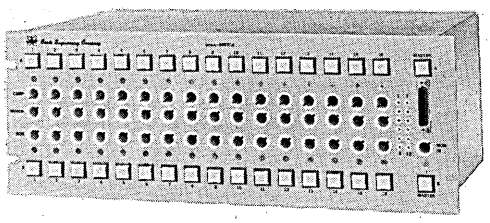

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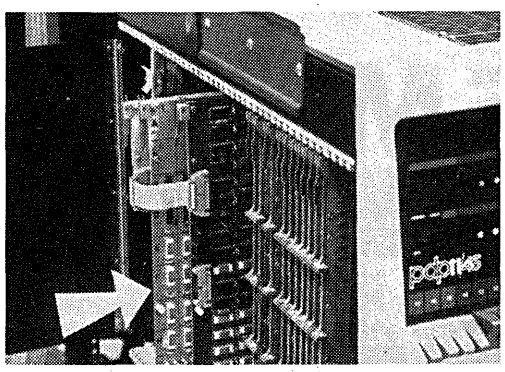

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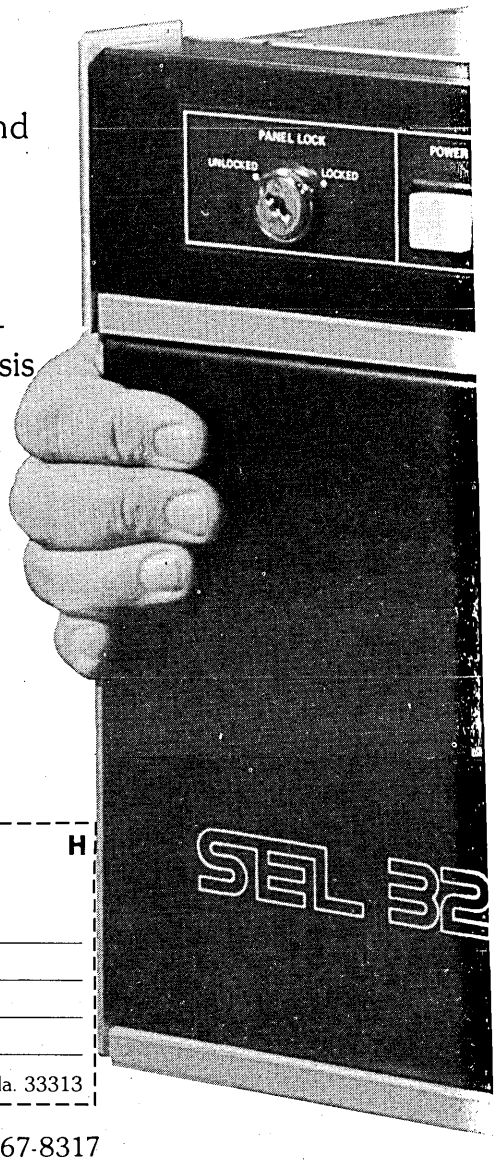

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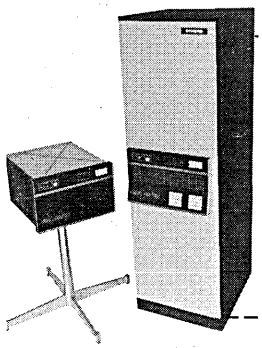

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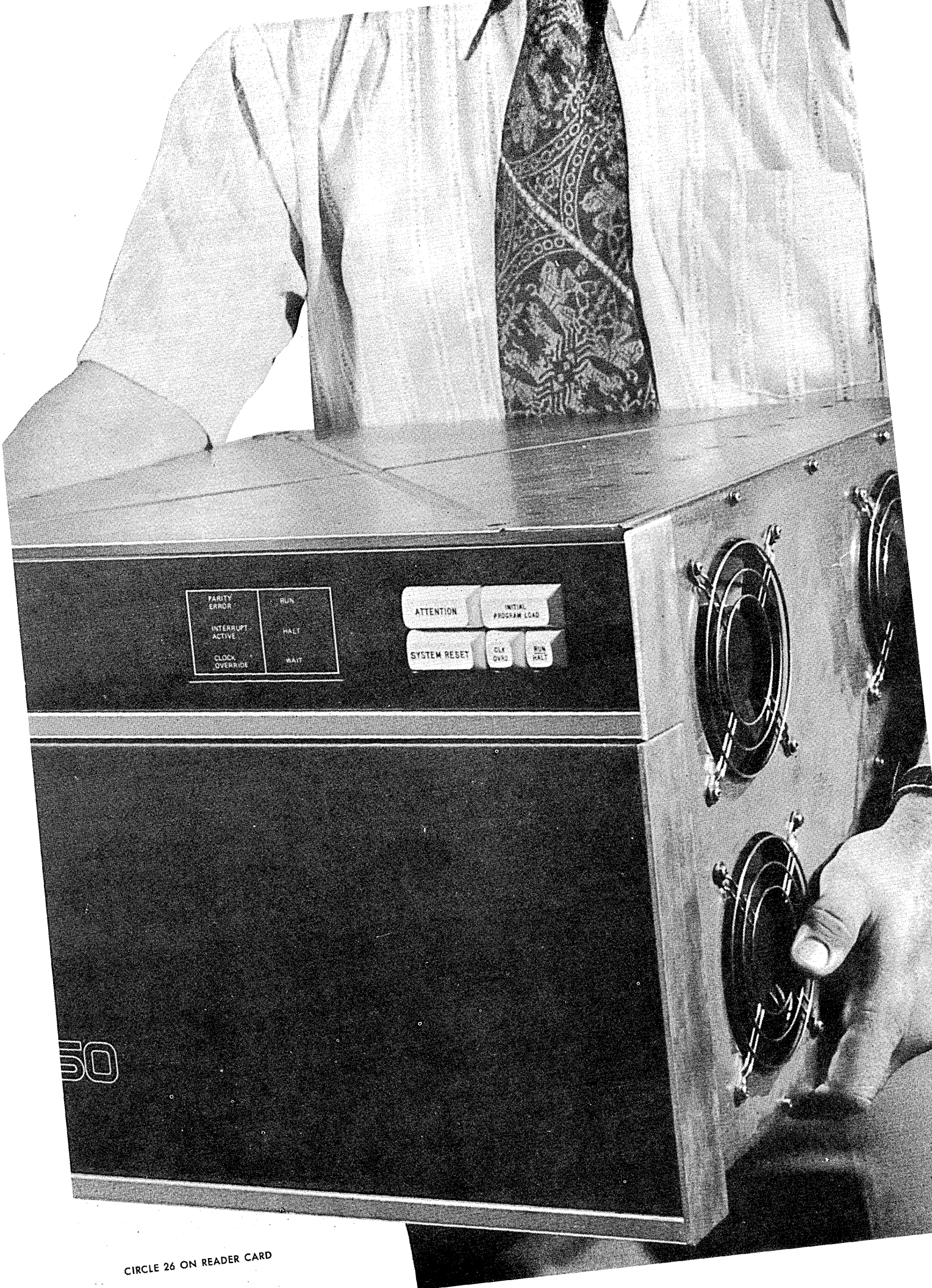

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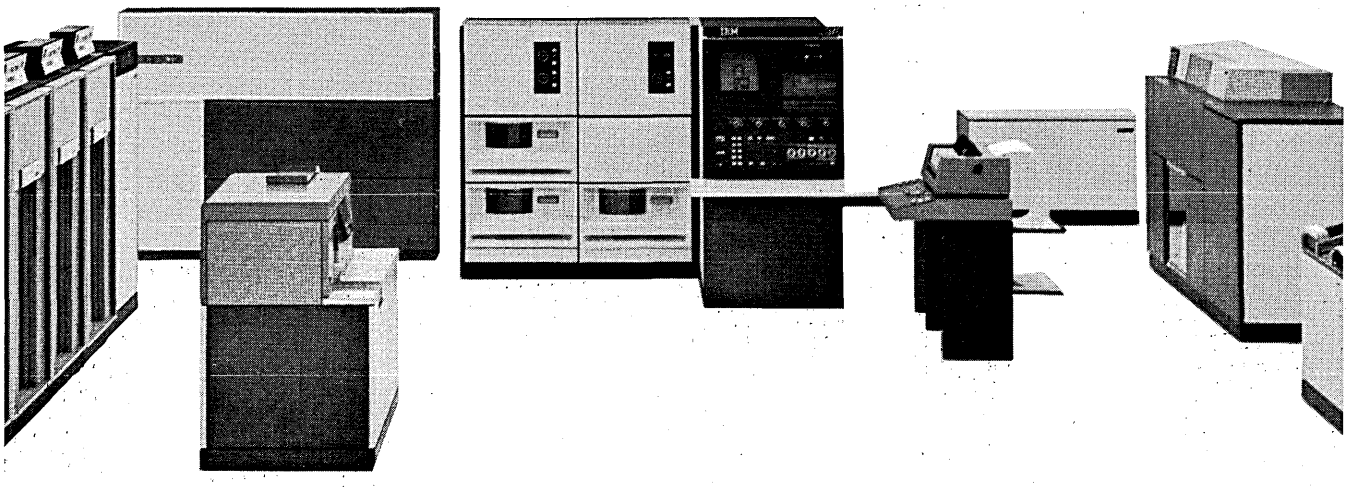

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IBM and the structure of the industry

Replies to our editorials requesting comment on the structure of our industry continue to come in. We decided to begin this month's selection with a rather bemused comment from a friend of ours in London:

Strange Chaps, Those Yanks

On the subject of the "Editor's Readout" I think that it is fair to say that the effect of any decisions about IBM by the U.S. legal authorities would be much less dramatic in Europe than in the U.S. The market is much less dominated by IBM (only 40% in the U.K., for example) and, therefore, there is not so much IBM-based activity (especially in the plug-to-plug market). I think that most Europeans will just wait and see, and watch with fascination while the United States goes through the peculiar practice of chopping up its most successful organisations.

—R.R. Fawcett

Bob Fawcett is the president of CMG (Computer Management Group) Ltd.

Limits to Growth

If anything, the *Telex* decision brings home dramatically the point that it is from the government, not private parties, that industry relief must be expected and ultimately obtained. Private parties cannot be expected singlehandedly to carry the enormous burden of trying to restructure this huge industry.

We cannot accept the thesis that IBM is not too big nor too powerful for the Government to cope with. Nor can we accept the specious arguments on how competitive the industry is or how small IBM's share of the "market" is. Anyone who has tried to compete with IBM (and many of these are no longer here to tell it) knows first hand the enormous strengths and overwhelming dominance possessed by IBM. We cannot believe that our judicial system will fail to survive any amount of obfuscation by lawyers seeking to prove otherwise.

Given that the Government will ultimately win its case, the important question is the form of relief. The 1956 consent decree with IBM was an inadequate, backward-looking solution and the industry can ill afford another similar solution. We have always believed that any relief should be non-punitive and should be aimed at benefitting competition and the user.

We strongly disagree with the Government-announced solution of splitting up IBM into a number of computer systems companies. We feel that this will stifle the industry and prevent technical advance, for with a number of "little" IBM's (each larger than its competitors) manufacturing and marketing products, users will gravitate toward the compatible IBM technologies and the non-IBM computer makers will eventually wither away. This solution also would leave the IBM companies with their huge resources and installed computer base relatively unfettered to move into and ultimately dominate the computer-related industries of data services, data communications, remote terminals, components, professional services and education activities, including programming, and office products. The FCC decision on IBM's efforts to enter the domestic satellite business confirms our views of what may be expected when IBM seeks to enter a computer-related business.

We strongly disagree with the Government-announced solution of splitting up IBM into a number of computer systems companies.

We and a number of others have proposed that IBM's largest activity, the computer systems business, be restricted so that IBM's growth in this area may be held to or below the growth of the overall market, with IBM's competitors able to fill the users' needs. This would be a gradual, non-punitive reduction of IBM's enormous market share, and both competitors and the user would benefit from the technical advances brought about by the opportunity to compete. This is an effective alternative to either split-up or Government regulation.

Moreover, IBM should not be permitted to enlarge its position therein and ultimately dominate the computer-related markets mentioned above. These markets generally are ones in which smaller companies are able to make effective contributions. They are a growing segment of the electronic data processing industry, and furthering competition in these areas is of great importance to our economy.

We have strongly urged, therefore, that the Department of Justice concentrate its structural relief plan on restricting IBM's growth in the computer systems area and divorcing it from these related markets. Control Data in its settlement with IBM effectively divorced IBM for a six-year period from the domestic commercial data processing business. We feel that as a result all of the companies in that business have benefitted, and the user has been well served. IBM's willingness as a part of our settlement to so restrict its activities suggests that the door may be open to pursue additional similar solutions.

—William C. Norris

Mr. Norris is Chairman of the Board of Control Data Corporation.

In Defense of IBM—Part 4

I think it is time we stopped picking on IBM.

It is an attractive hobby—shooting at a giant target makes it difficult to miss—but it does not solve the many problems of our industry.

In the first three parts (DATAMATION, April 1973, November 1973, and January 1974) I defined the negative of breaking up IBM, the components of a suggested consent decree, and the inevitability of government regulation in our industry.

Since that time the Court has overturned the Telex decision, which has resulted in raucous cries from the anti-IBM faction of our industry, and the professional gunslingers who try to make a living shooting at large targets.

However, a *dispassionate* examination of the *facts* does tend to indicate that the Appeals Court was correct, and that size and success alone are not sufficient cause for conviction under any doctrine of law. It is difficult to be dispassionate when envious—but let's face it, IBM is a brilliantly managed, successful company, albeit more from the view of their shareholders than their users.

It would be difficult to deny that

- IBM has made, and continues to make, a major contribution to our industry—far outweighing any advertent or inadvertent negatives.
- IBM is successful, *despite* some questionable marketing practices, product weaknesses, high prices, general arrogance, and refusal to define a reasonable contract. Thus they must be doing something right, if they maintain their market share, growth rate, and profitability!
- Despite IBM's success, the industry flourishes, there are more than 2,000 companies in it, and it is the greatest example of enterpreneurial initiative since automobiles.
- The computer industry is almost a national resource, spearheaded by IBM, contributing billions to our balance of payments—almost the only industry to continue to do so in the

face of a total reversal of global economics.

• IBM deserves credit for being a lot more competent than Penn Central, Lockheed, Rolls Royce, Pan Am—all companies with similar market shares or dominance at one point in their respective fields. If it is only success that attracts legal action, our system of Justice is badly warped.

I believe we should get back to running the computer business and concentrate on the key problems of our industry: invasion of privacy, social upheavals, and the lousy press which so-called 'computer errors' have generated for us in the minds of the public, to mention but a few.

No industry can survive if it rewards success by constant attack: No societal element has survived which destroyed its pioneers or its pioneering drives. The resources being spent on legal attacks and defenses, in the name of antitrust, could be infinitely better applied to our problems.

I therefore reiterate my proposal for a negotiated settlement—a consent decree—which will constrain IBM, and provide for continued competition and increased user benefits. The basic suggestions for such a decree have not changed significantly since November 1973:

1. IBM will provide specifications of new equipment to all vendors on and after initial delivery.
2. IBM will license, on a fair royalty basis, the rights to manufacture peripheral equipment after one year of installation experience.
3. IBM will grant the unconditional right to attach components and attachments to its equipment, provided that any damage done is reimbursed to the equipment's owner.
4. IBM will establish a firm trade-in schedule for all used equipment.
5. IBM will refrain from any anticompetitive marketing practices, such as 'knocking' competition, low-balling, and the like. An imaginative list of these is given in the December, 1968 Control Data complaint.
6. IBM will alter its standard contract to comply with basic practices in the industry. An industry body will be established to develop the initial contract, and to monitor its compliance. Principal terms relate to reliability, performance, acceptance testing, arbitration, and hundreds of less important ones.
7. IBM will refrain from any and all personnel efforts, formal or informal, on behalf of users. No employee of IBM will comment, positively or negatively about any employee or prospective employee of any customer or prospective customer.
8. IBM will participate pro-rata in a major funding of industry-wide standards to be developed by an independent body. This will include hardware, software, methodology and performance standards.
9. IBM will provide, at reasonable charges, to all users upon request: complete maintenance training, equal to that given internally; spare parts, blueprints, and engineering changes.
10. IBM will establish and adhere to mandatory pricing practices, for
    - purchase-rental ratio
    - maintenance as a fixed percentage of rental
    - maintenance separate from rental
    - warranty rebates on rental
    - quantity purchase discounts
    - software discounts for multiple cpu's
    - long-term leases at fixed rates
    - price protection on purchase options
    - installment purchases at realistic interest rates
    - etc., etc.
11. IBM will agree to maintain its equipment as long as it is installed, on a fixed schedule dependent solely on age of equipment. IBM further agrees to recondition all its equipment on resale, at a schedule solely dependent on age.
12. IBM will agree to sell reconditioned equipment at discounts.
13. IBM agrees not to discriminate against any users of its equipment, whether purchased, rented, first or subsequent, competitive or otherwise.
14. IBM will agree not to announce equipment earlier than 6 months prior to delivery, and not to announce equipment which totally obsoletes outstanding equipment until such outstanding equipment has been installed at least five years (cf 158 vs. 155), unless IBM is willing to upgrade at no further user cost.
15. IBM will agree to submit to binding arbitration whenever it is deemed to be in violation of its consent decree.

I am sure that the energy expended by certain industry 'leaders' on denouncing IBM could be profitably channeled into expanding this list.

Let's get back to the business of building our industry!

—Dick H. Brandon

Mr. Brandon is the chairman of Brandon Applied Systems, Inc.

Unlocking the Money Market

The Computer Lessors Association, concerned about the drying up of investment funds "primarily because of IBM's muscle in the marketplace . . ." advocates the "sales-no leasing" solution also offered by Robert Clawson in the April issue (p. 103). Here are some of the association's comments:

Force IBM to SELL its products rather than renting or leasing them!

Some of America's most innovative companies have gone down for the count simply because they were forced to slug it out with IBM financially . . . to lease or rent their equipment rather than offer it on a "purchase-only" basis.

Only a handful of financially oriented executives and enlightened marketeers seem to understand how seriously IBM's lock on the computer money market is eroding America's leadership of the industry.

The third-party leasing companies have helped cash-hungry companies in many cases, but they must make a profit too, and somehow, IBM seems to wind up in the dominant position. The giant can afford to wait for long-range returns because of its huge cash-producing rental base that provides profits to keep stockholders happy. IBM has time to "fine tune" new products and software until they perform the way they should. Unlimited money can buy almost unlimited time. Smaller firms just do not have this luxury.

We all know how IBM can adjust the rental vs. purchase spigots by altering lease-price ratios or offering discounts on special rental plans. The rest of the industry can only stand by, watch, and then respond the best they can.

It seems to us that IBM is destined to grow even stronger relative to the rest of the industry as the computer market expands. As IBM's rental base grows, so will its financial monopoly.

Our recommendation—to force IBM to sell its equipment—would set an industry precedent that would soon become an industry practice. Profit potential outside IBM would certainly be enhanced and the financial world may reach the conclusion that investments in our industry are worth the risk after all.

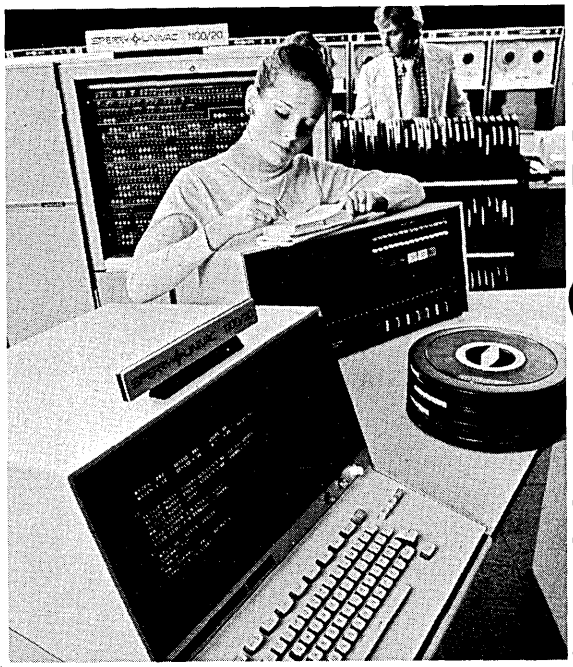
But there remains the looming question of IBM's unique cash position—that $4 billion nest egg. If some of IBM's cash were made available to others in the industry on an interest-free or equity basis, you can be sure that we would soon see some *real* competition—the kind that placed America on top of the computer world, and can keep us there.

We hope someone's listening. Because the "IBM Monopoly Game" is about to become the "IBM Solitaire Game". There just won't be anyone else around to play.

—James F. Benton

Mr. Benton is the executive director of the Computer Lessors Association, Inc.

From the field, two new Sperry Univac computers.



A computer evolution is taking place at Sperry Univac based on millions of hours of actual customer experience and a continually expanding customer base.

In time, this evolution will influence major changes in the character of medium to large-scale computer systems. And two products representative of these changes are the Sperry Univac™ 1100/20 and the 1100/40.

As you would expect, speed and capacity have been increased enormously in the new members of the 1100 family. But many more features have evolved out of changing usage patterns. For example, there is new memory storage, new communications and a new system of mass storage.

If your computer sophistication has grown with the increased use of terminals, the benefits can be seen almost immediately.

And if you worry about major investments in computer systems, we can ease your mind. We have expanded upward compatibility so that you can add to your system as fast or as slowly as you want. We've also made transitioning unbelievably easy. Since the 1100/20 and the 1100/40 evolved over a period of ten years, complete support is available through the 1100 Series Operating System Software.

The bottom line, of course, is cost. And the new price-to-performance ratio gives you more computer for your money than you've ever gotten before.

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Technology

Bell's Ten Second Laser Fax System

It's Been Used as a Computer Graphics Terminal in the Lab

A laser facsimile machine capable of scanning, transmitting and displaying a standard page of text in 10 seconds has been patented by Bell Telephone Laboratories. Plans for marketing the device are "being explored," said a BTL spokesman. Normally, when the laboratories develop a salable product, it is licensed to an outside firm or is added to the Bell product line. So far, BTL will say only that "facsimile is something AT&T can do but is not now doing."

The new system, besides being faster than present commercial fax equipment, also produces a better quality image, according to BTL. And the cost of the recording material—a bismuth-coated mylar film—is low. It amounts to "a small fraction of a cent" per page processed. Another advantage is that no chemicals, ink, wet processing or paper handling are required, and the recording medium is insensitive to light. The problems are eliminated by using the laser, which "burns" the image into film.

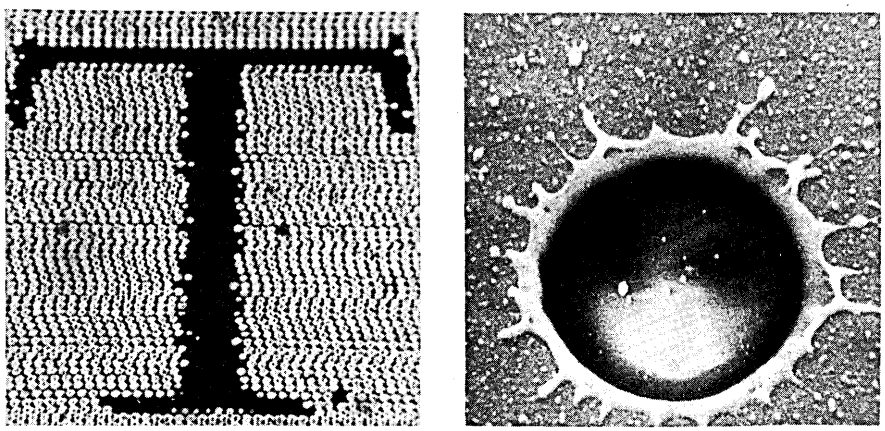
An article published in the March 1975 issue of the *Bell Laboratories Record* says printed material is input by laying it face down on a glass plate.

Needs 200 kHz bandwidth

Under this plate is a system of lights and mirrors, a lens and a charge-coupled device (CCD). The page is scanned from top to bottom in a series of equally-spaced horizontal lines (rasters). The lens forms a reduced image of each scan line on the CCD, which has some 1,500 light-sensing elements on its receiving surface. Each element generates a packet of electrons proportional to the amount of light being received at that point. The electrons are then converted into an analog signal which, after amplification, is transmitted to the receiver over a broadband circuit. A bandwidth of 200 kHz is needed to send an 8½ x 11 in. page image in 10 seconds.

At the receiving end, a laser whose output can be modulated is used to machine a miniature copy of the original page image on the bismuth-coated mylar film. Essentially, the laser burns a series of microscopic holes through the bismuth and exposes the mylar substrate, which is transparent to light. The pattern of these holes conforms to the shape of each character in the original image.

The laser emits about 400,000 pulses per second. These are amplitude-modulated by the signal coming across the line. A significant feature of the system is that the size of the holes burned in the bismuth is proportional to the strength of each pulse. This makes it possible to produce a continuous scale of gray as well as black and white tones in the film image.



A laser in the receiving unit of Bell Labs' new facsimile system "burns" a series of microscopic dots in a bismuth mylar film, producing a faithful reproduction of the original image. At left: an enlarged photo of the film image. The white area is bismuth coating, the dark area is the underlying mylar substrate. Since the substrate is transparent to light, the image can be viewed in a standard microfilm reader or transferred to paper by a standard microfilm printer. At right is a hole—about one tenth the diameter of a human hair—machined by one laser pulse.

The direct output of the system is a film containing a set of transparencies each measuring about 9 mm. wide and 11 mm. long. Within each transparency, the laser can record the contents of a single 8½ x 11 in. page. Without further processing, the film can be fed into standard microfilm viewers or printers.

In the laboratory experiments conducted so far, most of the images have been recorded with an yttrium aluminum garnet laser, which requires a water cooling system and an external modulator. "Preliminary experiments" have shown that "it is feasible to use a gallium arsenide laser instead," reports BTL. This is a simpler device, requiring less power and no water cooling. "With such a laser it has been possible to construct a relatively compact and simple receiver."

As a graphics terminal

Laboratory experiments have demonstrated that the receiver can also be used as a computer graphics terminal. Or, it can be used in displaying information received from computer storage. In still other trials, experimenters transmitted two stereo frames in succession and obtained a "three-dimensional" image by mounting the transparencies in a stereo viewer. Similarly, when three color-separation frames were transmitted in succession and projected simultaneously onto a common screen through appropriate filters, the result was a color image of the original document. "These trials all suggest areas for further research," according to BTL.

"Kludgey" Device Keeps Energy Tabs

The Tarzana, Calif., home of engineer Robert Schlesinger is probably the only home in the world to have the minutest details of its energy consumption and needs over a six months period of time stored in a computer.

The computer in question is an IBM 360/67 at a National CSS Inc. time-sharing service bureau in Sunnyvale, Calif. The data itself was collected right in the Schlesinger home via a data collection device Schlesinger developed as part of a one-year $25,000 research study funded by the National Science Foundation.

Schlesinger is the first to admit that his collection device is "kludgey looking" but notes that it is strictly an experimental prototype. His research report includes plans for a more compact, portable field unit model.

Schlesinger received his grant last spring when he responded to an NSF solicitation of ideas on solar energy. "They got 440 responses," he said.

The objective of his work was to develop a prototype hardware system capable of simulating solar heating, ventilating and air conditioning performance when associated with a residential building and to provide a test bed for computer solar system design model verification.

He explains there are three ways a solar house heating and cooling researcher can evaluate the effectiveness of a system. One, of course, would be to use a full scale solar heating system and retrofit it to a particular building. Schlesinger describes this approach as "desirable in the sense that the responses to the load and environment will be entirely realistic." But, he notes, the approach is costly and it is somewhat difficult to modify or change the system after the fact of installation.

Flexible approach

A second approach is to use total computer simulation to determine the effectiveness of the proposed system on a particular development. Schlesinger feels this approach is flexible and relatively inexpensive. And you can get results representative of a long period of time in a matter of minutes—assuming that adequate weather and load data for the location are available.

The predominant disadvantage of total computer modeling, said Schlesinger, is that multiple assumptions in the modeled environment are required. "It is difficult to model the impact of the life style of the inhabitants of the house on the energy demands and the effects of micro-climate characteristics may introduce significant variations from conditions that exist where the weather data was collected."

The third approach, the one Schlesinger has taken, is somewhere between the first two. He calls the approach "hybrid simulation." Its main advantages, he said, are that the loads, namely the house, the inhabitants, and the environment, including whatever micro-climate conditions exist in the immediate vicinity, are real.

The components of a solar heating, ventilating and air conditioning system, (HVAC) namely the collector, storage tank, and control system, are simulated. The loads and the simulated HVAC are coupled within the actual structure.

Real time problem

The equipment designed to simulate the solar HVAC system is quite inexpensive and relatively flexible, Schlesinger said. "The major disadvantage with this approach is that it does operate in real time. To collect a month's data takes one month and to collect a year's data takes one year. The equipment works extremely fast. It's the input data rate of the system which limits its response. The sun only comes up once every 24 hours unfortunately."

Basic components of the system in the Schlesinger house are the sensors, located atop a lattice structure called a ramada in the back yard, the solar system simulator, a channel scanner, clock and timing circuits, an analog to digital convertor, and a digital printer.

While the unit is monitoring conditions continuously, reacting as a true solar heating system would, using solar power when possible and reverting to back-up when necessary, data is printed out only once each hour.

The printouts are taken once a month to a keypunch service and punched cards are taken to the Los Angeles CSS office which transmits the data to the computer in Sunnyvale.

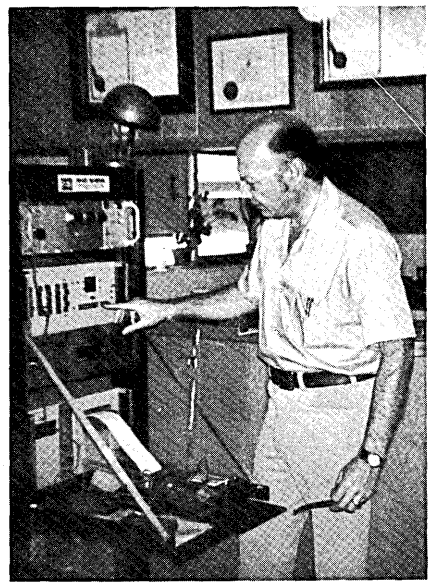
Schlesinger accesses his data via a teletype terminal in a small, cluttered office in his home, some 20 miles northwest of downtown Los Angeles.

Through a computer program developed for him by Bruce and Henry Kleine of Cal Tech/Jet Propulsion Laboratory where Schlesinger is on the technical staff, he can, for any given day, find out such things as the percentage of heating provided by solar power. Then he can change the size of the collector or storage tank or make other changes in the simulated solar HVAC system and see what the effects would have been.

A by-product of Schlesinger's research is a computer solar energy design program which he is offering to persons wanting to design a solar system for $37.50 a run. Actually this could be considered five runs. A user fills out a questionnaire giving details of the structure and suggests five different sizes of collector. Results of the run will show him which of the five would be most effective.

Right now, use of the program is restricted to California and parts of Arizona, Nevada and New Mexico because Schlesinger's data base includes weather statistics for those areas for the last 10 years.

Schlesinger believes there should be more interface than there is between data processing and solar energy. "We need more data bases, on climate, on performance of what's being done and we need to make more use of existing data bases like weather bureau tapes which are available for all parts of the country." These, he explained, do not include insolation (rate of penetration of the sun) data but this can be calculated from cloud cover data.



Robert Schlesinger makes an adjustment to a data collection device in his home which is continuously monitoring energy needs and consumption and simulating heating of the home by solar energy.

Incentives for the inventive

He also feels strongly that there is no solar industry in this country as yet and that one is needed. "It should respond to the energy crisis and to unemployment by creating jobs." He would like to see some kind of tax incentive offered such as allowance as a deduction from state and local taxes of the amount or a percentage of the amount spent on solar energy systems.

Even without tax incentives and an industry, interest in solar energy appears to be mushrooming. "I'm being asked to give lots of talks now," says Schle-

singer. Newspaper stories abound on single residence projects and in mid-April a Los Angeles builder announced plans for a seven-home development to be completed next fall, with all the homes having solar heating.

And technology is responding. Last month Stanmar, Inc. a Sudbury, Mass. builder, in a joint project with Raytheon Co. of Lexington, Mass., announced it will custom design and build a private residence utilizing an advanced type solar energy system.

Stanley W. Snider, president of Stanmar, said the home design will be personalized to suit the buyer's needs, budget and lifestyle and will be built in a community of the buyer's preference in Greater Boston or the outlying suburbs. The home will have its domestic tap water heated and its living space heated and cooled with an electronically controlled, solar augmented comfort system. Raytheon is developing the system.

Snider said Stanmar is looking for a "family concerned about ecology and energy conservation." He estimates the house will require a budget of $60,000 or more.

One of the features of the proposed system is billed as a "comfort computer." Bob Seaman, a vice president of Raytheon, said this is a control system with logic. He said Raytheon has been working on the concept for some time and has built a prototype for the Stanmar project. A second, more sophisticated version is expected to be completed this month.

Economy in quantity

Schlesinger estimates there are some 500 solar homes either planned or already constructed in the U.S. today. "Cost is a big inhibitor," he noted. Homes in the seven-home Los Angeles development are expected to cost from $142,500 up.

He thinks costs could be considerably reduced with quantity production. He has a small firm called Rho Sigma (Greek for his initials) which makes controllers for solar HVAC systems. These cost $70 a piece now and he says they would go to from $45 to $48 in quantities. Collectors, which cost $10 per square ft. now could go to half that, he said.

It used to be felt, Schlesinger noted, that collectors of 2-300 sq. ft. would be typical. He said his research project has indicated that collectors considerably smaller than that would be effective which would bring costs down. "It appears as if things are going to work out better than earlier research indicated. We have better collectors, better control, and better insulation."

Schlesinger's Rho Sigma has been making solar system controllers for two years. It's a bit of a switch from the purpose for which he formed the company six years ago. That was to produce the Rho Sigma-3 which he describes as a miniature management information system to help retail store managers schedule checkout clerks to avoid long lines.

"We had an algorithm and a piece of hardware which would predict how many clerks would be needed at a given time to achieve a specific line length," he explained. It had a real time display which would tell a manager to either add or take away so many clerks in, say 15 minutes. The manager could choose the time interval. These units are in use in a number of Los Angeles chains, including Akron, but Schlesinger isn't making them any more. He's too tied up in solar systems. He holds a patent on the store device and would like to sell the rights to it, possibly to a point-of-sale manufacturer who could incorporate it in his system.

When not running Rho Sigma, giving talks on solar energy, or working at Cal Tech/JPL, he is teaching systems management and systems analysis at West Coast University in Los Angeles.

He has held positions with General Electric in Syracuse, N.Y.; Ramo Wooldridge in Los Angeles; General Dynamics in San Diego; ITT-California, as vice president; and Packard Bell/Teledyne, Monrovia, Calif. as director of research and development.

"Sun is neat"

Schlesinger said as a result of his research project and of Rho Sigma literature getting around, he receives some 300 letters a week from people interested in solar energy systems. "I answer them all," he said, "even those from students who say, 'sun is neat. . . send me your sun stuff.' "

He feels solar energy is an international business and considers his an international firm. He has one unit in Sweden. In early April, a delegation of 14 professors from the Univ. of Stockholm visited his home to see his project. "They saw literature on the Rho Sigma controllers and bought one on the spot." Schlesinger said he learned there are five solar houses in Sweden "little as the sun shines there."

Earlier he had been visited by two groups of visiting Japanese who showed "considerable interest." Schlesinger said Israel and Australia are the furthest along in terms of having a solar industry.

Schlesinger is exhibit chairman for the Biannual Congress of the International Solar Energy Society which will be held at UCLA this year July 28-Aug. 1. He said the ISES expects a record attendance this year but he didn't know in mid-April how exhibit space would shape up. Could be he'll find out there is an industry here now.

And as for the "kludgey" looking device in his den, it was turned off the end of last month, the end of his one-year research project. But he was hoping for a follow-on grant. The one-year study covered only solar heating and he would like to look into air conditioning. Maybe his family will have to continue living with the constant hum, the blinking lights and the once-an-hour clacking of the printer for a while longer.

—Edith Myers

Antitrust

Computer, Communications Competition in the 1980s: Must it be Regulated?

Regulatory, legislative and judicial decisions made in the next five years concerning the computer and communications industries will determine the shape of their future 25 years from now.

If present regulatory practices continue into the year 2000, the results of the simple rule that "regulation tends to beget more regulation" will be seen and "everything in sight that has anything to do with any of the remotest kinds of fields of activities will be regulated," says Donald Baker, deputy assistant attorney general in the Justice Dept.'s antitrust division. Fortunately, he says, there is now some skepticism in Washington about whether endless new regulation really is the answer "to all the questions."

Baker offered some examples during a talk at a Washington meeting of the Computer Law Association looking at "Competition in the Year 2000." He said regulators tend to feel that "they have to do something" which leads to the very familiar phenomenon "of fitting new kinds of enterprises and new ways of doing things into old pigeonholes not designed for that purpose," as

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NETWORK

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CIRCLE 48 ON READER CARD

can be seen in the computer-communications field with the new value added carriers. The question was not one of "if" they would be regulated, but "how."

"So these value added carriers became regulated as carriers, although there were no known scale economies, almost no economic barriers to entry in the traditional sense, and no physical duplication of carrier facilities. To start with, the FCC didn't even have a name for them."

A guaranteed living

In theory, what the FCC decides to label a carrier should be as important as what the commission decides "to do to it, or for it, or what they let it do to or for the public," Baker told the CLA group. Bringing such firms into the "regulatory fold" creates a psychological problem—it makes them think that essentially the FCC has guaranteed them a living, Baker continued. "Indeed, if the history of their fellow regulatees is any guide, as for instance with the international record carriers, quite a handsome living." Another problem, Baker said, is that the regulators then begin to take on a spirit of wardship, that once having let these firms in, they're under some obligation to make sure the firms remain viable. "Western Union is a classic example, I think," Baker noted.

The FCC now has before it proposals on how best to deal with the value added carriers, and more specifically, specialized concepts of the brokerage and resale of communications services, Baker told CLA meeting attendees. The Office of Telecommunications Policy has proposed essentially that the FCC stay its regulatory hand, and if that type of message carries the day, "the year 2000 is going to be a lot better than many of us fear it will."

But even if the present FCC is willing to do as the OTP wants, "how can we be sure that future FCC's won't revert to what I would tend to think of as the regulatory norm," Baker asked. Probably the best way to quiet this problem would be to face it directly through legislation, eliminating the existing barriers on brokerage and sharing and permitting the value added carriers to offer their services free from the usual common carrier price entry regulations, Baker noted. "We're thinking about possible legislation along these lines now, but it's still in an early stage."

Policy of competition

"The movement toward greater competition cannot be stopped, in my view," the CLA's second speaker, Bernard Nash, assistant counsel, Senate Subcommittee on Antitrust and Monopoly, told attendees . (See accompanying story.) He said the courts have required regulatory agencies to consider competitive policies "and it is slowly but inevitably sinking in that competition is our fundament national policy." He pointed out that competition's advantages in the communications industry have been ev-

The Government Versus the Giants

Outcome of the government's antitrust suits against IBM and AT&T will have a critical effect on the shape of the computer and communications industries in the year 2000, says a special counsel to the Senate on antitrust and monopoly.

Bernard Nash, assistant counsel to the Senate Subcommittee on Antitrust and Monopoly, thinks the government will be successful in its cases against the two giants. He said he wouldn't be surprised to see Western Electric divided into a multiplicity of competitive entities.

The mood in Congress "is clearly supportive of the Dept. of Justice's antitrust endeavors," Nash told a meeting of the Computer Law Association looking into the future of the computer and communications industries 25 years hence.

Draft legislation is circulating concerning a legislatively mandated breakup of the AT&T system because structured cases have a propensity to drag on for years.

"It might be more expeditious for Congress to mandate the breakup so that the government can then spend the time figuring out the appropriate restructuring plan rather than litigating whether restructuring shoud take place," Nash said.

Nash, who said he was "greatly disheartened by the seeming inability or unwillingness of the Dept. of Justice to bring that case (against IBM) to trial," said he believes "it is a disgrace and a disservice to IBM, to IBM's competitors, to computer users and to the country for a case of such importance and magnitude to remain in a pretrial state for more than seven years." The government's case "is a good one" and the government should prevail "if it does get to trial," according to Nash. "The resultant restructuring should bring forth significant benefits and freer competition and its attendant benefits."

Telex appeal

Nash said he doesn't believe that the Tenth Circuit Court of Appeal's decision in the Telex case (see March, p. 99) will affect the government's case against IBM. "I believe the decision to be erroneous in a number of important respects," Nash commented. "The court's view of relative market and market share in my opinion bears no relation to the reality of the computer industry." Hearings before the Senate Antitrust Subcommittee last year demonstrated IBM's market share to be in the 60 and 70% range, he said. The hearings also did not support the court's conclusion that IBM derived its market position solely by superior skill, foresight and industry, Nash noted. "In my opinion, the court further erred in concluding that a firm with a dominant position, such as IBM's, can deliberately use practices with exclusionary effects if such practices would be permissible by companies not having a monopoly position in an industry," according to Nash. Hopefully this can be rectified by the Supreme Court, he said.

If it turns out that the legal principles enunciated by the court in the Telex case are upheld by the Supreme Court and that represents the judicial view of the Sherman Act, "I have no question but that legislation will quickly be introduced to redefine the parameters of the Sherman Act."

Sen. Phillip Hart currently is considering modifications to the Sherman Act to remove the element of deliberateness as an element of the monopoly offense and to broaden the offense to include oligopoly as well as monopoly power, Nash noted. He will reintroduce the Industrial Reorganization Act shortly, a bill designed to provide a mechanism to restructure concentrated industries and companies in those industries in a more effective and expeditious manner than has taken place under the Sherman Act. The computer and communications industries are specified in the bill. Sen. Hart intends to bring the bill up for consideration by the Senate Antitrust Subcommittee by the end of the year, Nash said. □

ident in the domestic satellite area and by the "tremendous growth" of the interconnect companies and in terminal equipment and PBX development. The telephone companies, he said, have responded by developing and offering more specialized and versatile equipment of their own, but in contrast, "the very same companies have shown little enthusiasm and equally little success in driving down the costs and prices of the interface devices required for customer supplied terminal equipment."

Another speaker, Walter Sutter, consultant to the FCC's Office of Plans and Policy, said to have true competition, "we must allow the market forces to flow freely, to react, implement, enter and withdraw according to the dictates and commitments of that company to its stockholders."Putting artificial restraints and imposing long delays on the stated desires of the company to enter, change or modify a particular service or tariff will not result in a rewarding competitive environment, he said. "Our regulatory laws must be revised to fit the new philosophy of some monopoly and some competition, and in some cases, one that straddles both."

Policies on new entry

"What will happen in the next five years will pretty much determine the shape of what we're going to look like in the year 2000," predicted another speaker, Bernard Strassburg, former chief of the FCC's Common Carrier Bureau. He pointed to a new body of national policies he said have largely emanated from the FCC over the past decade which encourage new entry and less concentrated control over market supply for telecommunications equipment and services. "I feel as a participating architect in shaping those policies that they are sound and in the long run will pay off in the form of a greater, more enriched source of supply of communications of all kinds for all types of users," he said, adding that the implications of these policies, however, is far from complete. Present issues involved at both federal and state levels and in the courts will probably be resolved within the next five years and greatly shape the future of structured communications and in the process prove the validity or invalidity of the policies which the commission has formulated, Strassburg said.

Concerning new entrants in the specialized common carrier field, Strassburg said there are questions of certification—will states willingly give certification for intrastate operations to the carriers that the FCC has authorized in the federal jurisdiction, for example. "Unfortunately, with certain exceptions, the state commissions are generally unrelenting in their opposition to the FCC's policies with respect to competition—if they are not unrelenting they are grudgingly accepting—and they certainly have not made it easy for the interconnect industry," Strassburg claimed. "Bell still has the upper hand in most of its state jurisdictions in writing its ticket and shaping the extent to which we will and will not have a competitive market in specific areas of communications, facilities and services."

Weak on implementation

Another discouraging aspect for those looking to see competition "get a fair shake," which Strassburg said means having adequate regulatory protection against such things as cross subsidization and predatory pricing, is the fact that "we see too often that regulators are not equipped to deal with the problems of regulation in a timely, effective and knowledgeable manner." It's not the fault of the Communications Act, which is "technically sound" and "doesn't need much refurbishing," according to Strassburg. "What it needs is implementation." The FCC doesn't have the tools, resources, manpower or funds to deal with the kind of jobs that come before it, he continued, "nor the depth of understanding of the market that it deals with, nor the industries."

There are some hopeful signs, according to Strassburg, such as the FCC is still giving "genuinely heartfelt support" to its policies of promoting new entry in the fields of data transmission. Another such sign concerns the Dept. of Justice's antitrust suit against the Bell System. While Strassburg declined to predict the outcome or comment otherwise, he did say "at least it gives you confidence that the government is willing to take on bigness." Strassburg said he was also encouraged that in recent months, because of the antitrust suit and certain rebuffs Bell had gotten in court, "Bell has taken a more conciliatory view towards certain aspects of competition and is adopting more of a live and let live policy, rather than kill off the competition before it even has a chance to gestate." Finally, he continued, "I'm heartened by the fact that there seems to be a groundswell of grass roots concern about the efficacy and adequacy of regulation to deal with the crucial public interest in major areas of economic activity." The regulatory apparatus is being revisited today by inquiries in and out of government as to its efficiency and relevance to contemporary problems and ability to deal with those problems, according to Strassburg. "I hope this will bear fruit in the form of strengthening regulation where it has to be strengthened and by bringing about a deregulation where regulation is no longer relevant," he noted.

Can't decree competition

Kenneth Cox, former FCC commissioner and now counsel to MCI, told CLA members he believes there is still a significant role for regulation, which probably is going to be around in some form for the next 25 years. He said he doesn't think it's a foregone conclusion that there will be competition in communications as it relates to computers in the year 2000. "I don't think you can simply decree competition in a new area, particularly one that's been long dominated by authorized, franchised monopolies and expect it to take place," Cox told the group. "You cannot expect the new entrants to spring full blown as it were from Zeus' brow and go about the business of competing just as if they had all the resources and experience of the Bell System, Western Union or the major independents." There are difficulties in handling predatory pricing and identifying costs so it can be determined if cross subsidy exists, Cox pointed out, adding that just defining cross subsidy will not prevent it.

"The mere effort to permit competitive response on the part of the established carriers will lead in the normal processes of competition to the elimination of the new competition and you will be right back full circle where you started," Cox predicted. "There may be some antitrust verdicts won in the process, but I guarantee you there will not be very many entrepreneurs ready and willing to make a try again to break down an existing monopoly even if the legal environment seems to favor it."

Cox said he doesn't believe a utility can engage in both monopoly and competitive service unless certain events occur, such as the FCC developing basic, adequate tools to deal with cross subsidy, or judges who apply antitrust law moving much more efficiently and rapidly than they have in the past to strike down anticompetitive conduct.

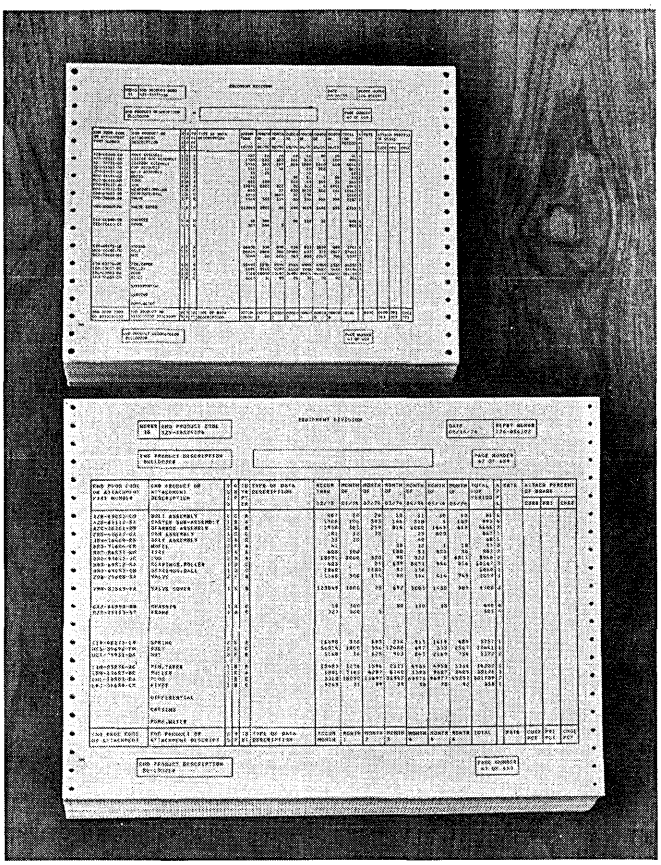
—Pamela Evans

Companies

Working its Way Out of Accounting Suits

In mid-1971 the Securities and Exchange Commission sued Memorex Corp., charging that the firm had violated the Securities Exchange Act by making false and misleading statements in its financial statements and press releases. The suit was settled soon after with the filing of a consent decree. Subsequently, however, a number of class action, derivative, and individual suits were also filed, charging the Santa Clara, Calif., peripherals company and

New IBM printer uses advanced technology to streamline computer output and reduce costs.



The new 11 x 8½" printout size offers convenience and cost savings compared with the unwieldy 14⅞ x 11" printout.

The efficiency with which a printer records the results of data processing helps determine the efficiency of an entire computer system. Now IBM announces the 3800 Printing Subsystem which can revolutionize the entire printout process.

Linked to a System/370 virtual storage computer, the 3800 is based on a new principle of non-impact printing. In place of the familiar method, which makes printed characters by striking a ribbon against paper, the 3800 uses

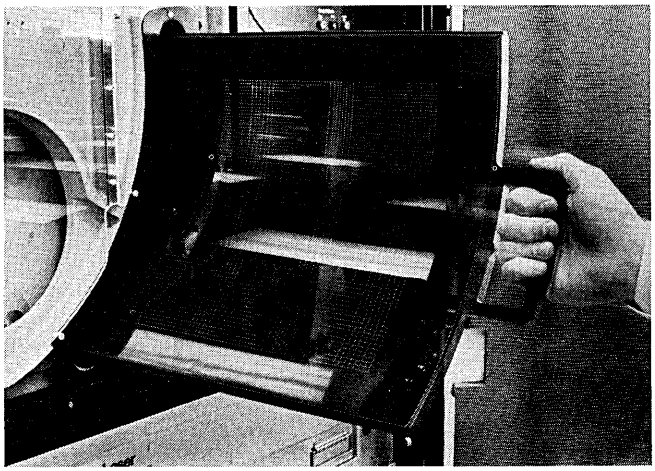
Single-copy speeds can be as high as 13,360 lines per minute.

laser and electrophotographic technology to create printed images.

The immediate result is quality printing with exceptionally high contrast and clarity. But that's not all.

Single-copy speeds can be as high as 13,360 lines per minute—*six times faster* than the fastest IBM printer now in use.

Since the 3800 employs non-impact printing technology, carbon copies are not made—which can result in a savings of from 25% to



To create a business form on plain paper, an overlay is inserted in the 3800.

nearly 50% of current form costs. When a duplicate copy is needed, the material is simply printed again at extremely high speed. The effective line-per-minute rate is reduced, but all copies are equally sharp from first to last.

At least 25% savings on current form costs possible.

And with carbon paper entirely eliminated, there is no time-consuming removal and disposal of carbon paper after use.

Using plain paper, the 3800 can create both the business form and its content *simultaneously*. This is done by inserting an overlay of the desired form in the 3800. The form as well as its content are then transferred onto the paper. By so doing, the expense of preprinted business forms can be greatly reduced. There is virtually no need for machine setup time for changing from one form to another.

Equally important, the 3800 has the flexibility to accommodate preprinted business forms in any of 50 common sizes.

```
THIS IS 10 CHARACTERS PER INCH PR
THIS IS 12 CHARACTERS PER INCH PRINTING.
THIS IS 15 CHARACTERS PER INCH PRINTING.
```

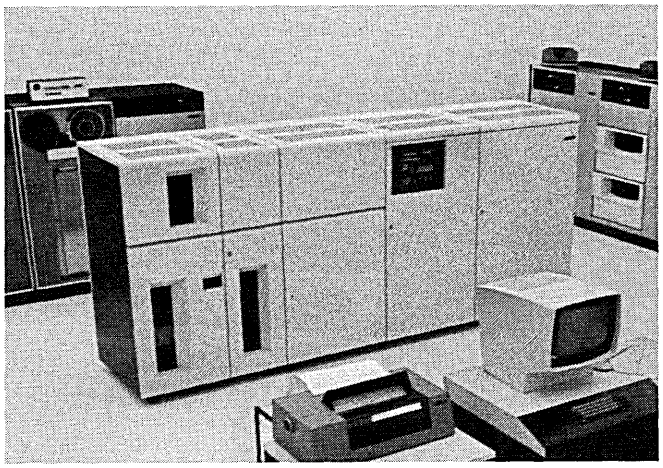
Three print sizes—10, 12 and 15 characters per inch—are standard with the 3800. The multiple sizes can be intermixed in a single form. All printing is done in a one-step process, under direct computer control.

Use of the 15 character size allows you to print the same amount of information on 11 x 8½" paper that would normally fill standard 14⅞ x 11" computer printout sheets. The convenient 11 x 8½" forms fit in files and briefcases just like regular correspondence, ending the handling of awkward, oversized computer reports.

The smaller size also cuts down on current forms costs by at least 25%—a substantial savings in the light of increased paper costs.

The 3800 can even individually address each copy of each report, to help speed it to its destination.

The 3800 offers improved data security. For example, confidential sections of a report may be withheld from selected copies on a "need to know" basis. And, of course, there is no carbon paper to worry about destroying.



The IBM 3800 Printing Subsystem employs laser and electrophotographic technology.

Through the use of the 3800, you can lower your total cost of printing. It can do your systems printing job—not just parts of it. This means, for example, that it can replace any off-line units you might be using to increase your overall printing capacity. And it can do it all while cutting costs through smaller size forms and the elimination of carbon paper.

IBM can help you evaluate cost savings and system advantages of the 3800 in comparison with your current impact printers. For further information, including cost comparisons as well as descriptive material and print samples, consult your local IBM Data Processing Division office. Or write IBM Corporation, Dept. 83F-D, 1133 Westchester Avenue, White Plains, N.Y. 10604.

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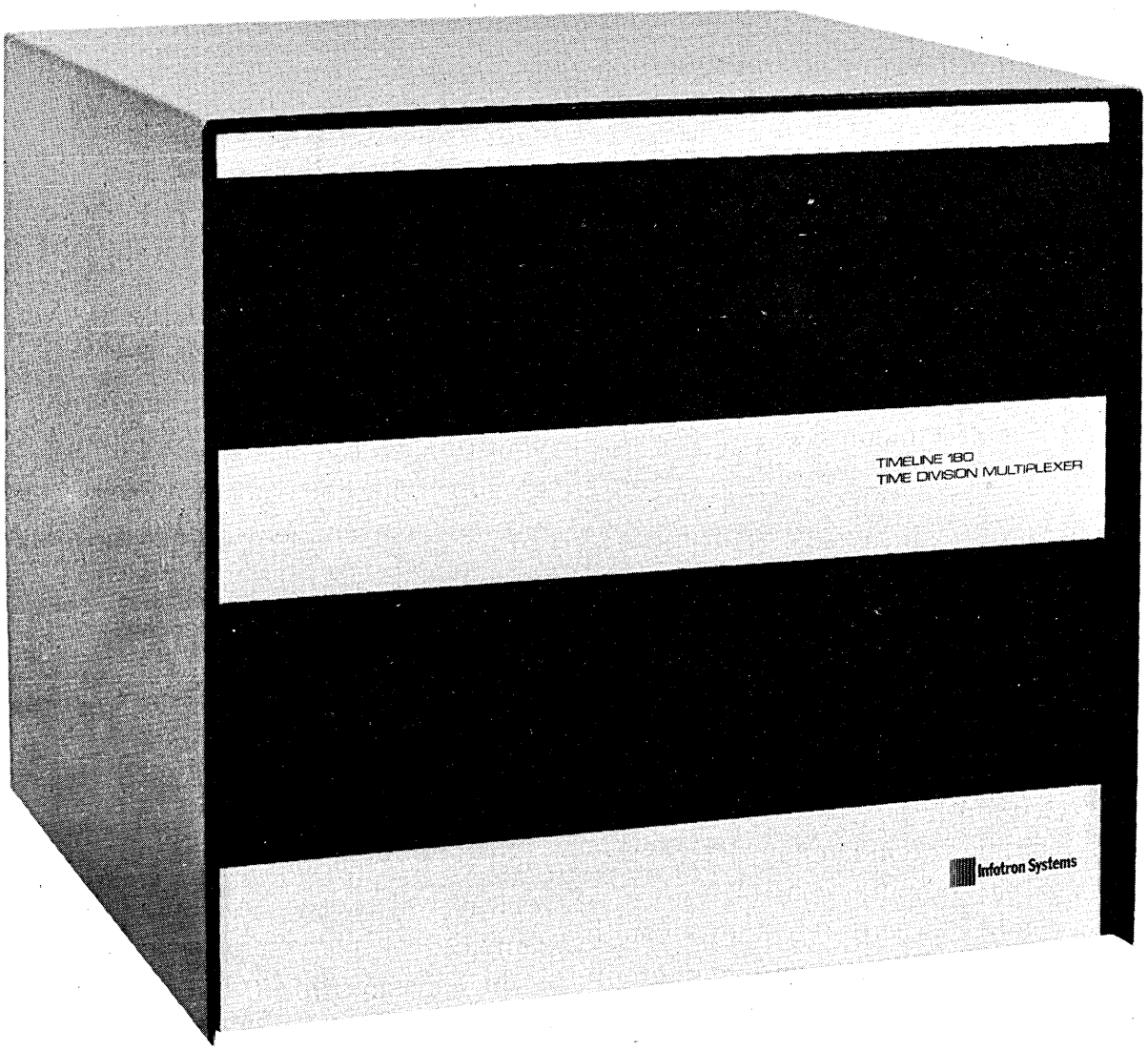

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others with the same violations and with employing accounting methods that allegedly overstated the firm's sales and income.

To get those suits out of the way, Memorex recently announced that the payment of $4 million to the plaintiffs has been proposed, $1 million of that to be paid by the company. Other defendants

WILSON OF MEMOREX
"The best interests of the company will be served"

in the suits include former Memorex president Laurence L. Spitters, ex-vp/-finance Gordon E. Pilcher, a number of former and current board members, and the former auditors, Arthur Andersen & Co.

Instant profits

The issue centered around the method by which companies accounted for equipment placed on lease. Memorex chose to establish a leasing company in which it held a minor equity position. It then sold the hardware to the leasing firm and recorded the full price of the leased equipment as a sale. The result: instant profits. Following the SEC suit, its accounting procedures were changed and lease revenues were recorded only as they were earned, lowering substantially the firm's sales and earnings picture.

Along about this time, and for a number of years, the accounting community had been debating the leasing issue. Most notably in the real estate industry, abuses in the manner in which leases were handled in financial reports were legion. As one industry source comments, "There were some creative things going on in leasing." Subsequently, the accounting profession established what it considered as acceptable procedures.

They provide for an "operating method" of accounting for leases, under which income is reported as it comes in. But they also allow certain long-term noncancellable leases to be reported under a "financing method" and treated like an outright sale.

Not the villain

Contrary to some people's belief, Memorex was not the villain who focused interest on this aspect of the computer industry. It obviously wasn't an angel either, being the subject of much publicity for its accounting practices at that time. In its latest announcement regarding its proposed settlement of these several lawsuits, the firm says, "Neither Memorex nor any of the other defendants admit any liability in connection with the suits or their settlement." The firm's chairman and president, Robert C. Wilson, who inherited all this, said, "The best interests of the company will be served by disposing of this burdensome, expensive, and protracted litigation."

Microfilm

Paper Vs. Film: It's All How You View It

These are good days for the suppliers of microfilm products and systems.

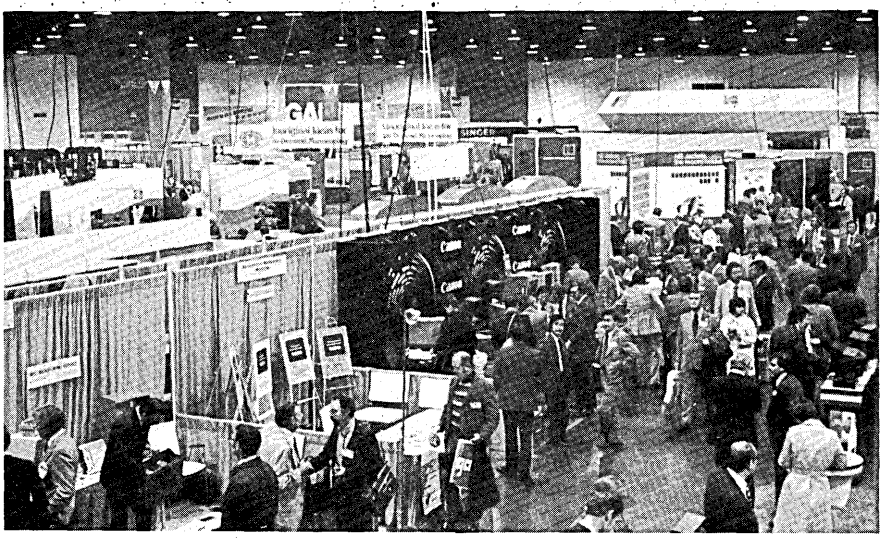
Revenues in that business, now generally called the micrographics industry, ran anywhere from $700 million to $900 million last year, according to a variety of surveys. And some surveys see it as a $3 billion industry by 1980 and a $6 billion business in 1985.

The lion's share will be divided among a handful of companies—the more prominent being Eastman Kodak, 3M, Bell & Howell and the Stromberg DatagraphiX Div. of General Dynamics. All four companies sell heavily in the Computer Output Microfilm (COM) market, generally considered to be the fastest-growing segment of micrographics. A study by the big film supplier, GAF, shows that COM revenues of $157 million last year will soar to $180 million in 1975 and go all the way up to $1.3 billion in 1980. A forecast by Predicasts, Inc., a Cleveland research organization, is that COM revenues in 1985 will pass $3 billion. Lumped with what Predicasts calls the microfilm automatic storage and retrieval systems (ASRS) field it's a business that will be growing 33% a year and eventually account for half of the $6.4 billion micrographics market it envisions in 1985.

Numbers, numbers. What do they mean?

Microfilm for the public

Vendors and customers attending a conference of the National Micrographics Association (formerly the National Microfilm Assn.) in Anaheim, Calif., last month admitted that the forecasts depend on that industry's technical ability to make that which is microfilmed available at the right price to John Q. Public. Sears would like to make the millions of catalogs it puts out each year available to a customer on microfilm and so would the telephone companies their directories and the Book-of-the-Month Club its selections—provided someone comes up with a microfilm reader that is as small as a book and can be sold for $5. The lowest-



ALL ABOUT MICROFILM: 24th annual conference of National Micrographics Assn. drew 7,000 to Anaheim convention center in April. Huge exhibit showed products of 112 companies in 100,000 sq. ft. exhibit hall.

priced viewers are about $100 today.

The proponents think the public is ready, provided the industry can bring down the price of viewers. Others question this optimism. "Given the choice of obtaining hardcopy or film, most users still prefer the hardcopy," says Edythe Moore, of Aerospace Corp.'s technical library. They want the hardcopy, she explained in a talk at the conference, because they can take it away and read it anywhere, "and on which they can make notes in the margins." However, she admitted, "given the choice of having that data, or having to wait several days or weeks for it, users are generally happy to have the film, but will invariably head directly to the reader-printers," to make a hardcopy.

Why use paper

COM, of course, is a different matter. Some vendors of COM recording systems now claim that data processing departments today are finding that they have to justify to their management the use of paper output rather than the other way around. The problem of having to buy viewers for their users is a problem of the past, according to some.

Recent soaring prices of paper—some users were being quoted 200% higher within the past two years—have caused dp users to take a long, hard look at microfilming computer output. "They looked and they liked what they saw," said 3M's product manager Donald G. Furlong whose company has installed 15 laser recording devices since the product first was available last December. In fact, many vendors interviewed at the conference said the question no longer is of selling the concept of recording computer output on film instead of paper, but of guiding users to an understanding of the systems approach to COM.

"Failure to recognize that there is a systems side to COM will soon lead the newly initiated COM user to the point where most of the easy paper conversions are accomplished, and he finds that his organization's interest and enthusiasm has waned," is the way Ralph J. Morrison of M. Lowenstein & Sons, Inc., put it during a talk on COM systems.

Speakers at the conference talked of COM indexing software developments as leading to the implementation of microfilm-based data bases. In some talks microfilm was suggested as being no less a computer-based storage medium than the magnetic mediums of tape, disc and core. "Today," said a speaker, "the microfilm medium has become established as a highly cost effective tool in the hands of the well trained systems analyst." Many analysts consider COM as an adjunct to large data base systems, cutting down transaction cycle times and making information retrieval better and cheaper.

Saving space, money

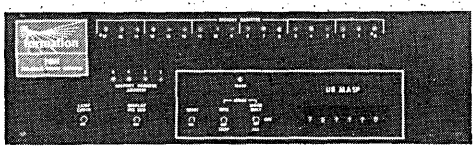
But the obvious is not being ignored in the vendors' pitches to prospects and the users' pitches to management. The testimonials are legion: Cleveland Trust's use of COM "has generated hundreds of thousands of dollars savings over paper reporting systems," said the bank's James Glueck at the Anaheim conference. The Greenville (S.C.) Hospital System which once had to use 85 double-column file drawers to maintain an index of more than 300,000 patients now has it all on thirty 4 x 6 inch sheets of microfiche, reported the hospital's Peggy J. Glass. What it saved in computer print time by going to COM has allowed City National Bank of Beverly Hills to begin generating some reports on a daily basis that before could be printed only once a week on paper, reported James W. Hoddle.

One of the more recent entrants to the COM recorder business, Bell & Howell which acquired Pertec Corp.'s COM line, issued the results of a survey concerning COM of dp managers at some 400 companies. Of 122 who weren't using COM, 40 said they'd make the move within the next six months. Two thirds will go the service bureau route, however. And to soften the doubts of those comtemplating having to buy viewers for their users, the survey also showed that almost 88% of today's users get along with fewer than 10 viewers. A little more than 10% used more than 100 viewers and just over 1% use more than 1,000.

—Tom McCusker

For PDP-11 Users

A New Program Debug Console. By Formation.



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From Formation. The people who deliver proven peripheral subsystems for RCA Spectra/Univac Series 70, RCA 3301, DEC PDP-11, Honeywell 200 and 2000 Series . . . and you.

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Communications

Latest Network Won't Fix on a Protocol

Unlike its competition, Canada's other major communications carrier isn't threatening to lock out IBM communications protocols from its new packet-switched system.

CNCP Telecommunications this spring unveiled Info-Switch, a circuit and packet-switched system which it hopes to start up in the second half of next

year. But it's emphasized in the announcement it won't be imposing a protocol on anyone. "There is no protocol universally acceptable to carriers, terminal/computer manufacturers, and users of data telecommunications facilities," was the way it was put by Guy F. Carleton, the Info-Switch project manager.

In contrast, late last year Trans Canada Telephone System (TCTS) announced its packet-switched network, called Datapac, that is based on a protocol called SNAP. Systems suppliers must implement SNAP before their customers can fully exploit the benefits of Datapac.

For data communications users in Canada, as well as elsewhere, the question of who specifies the protocol is important. If the carrier does it, most users can save money. For example, different makes of terminals can share common facilities like access lines and concentrators. If the system supplier specifies the protocol, these benefits are sharply curtailed or eliminated altogether. IBM, for one, would prefer the latter.

Adapting to a carrier-specified protocol means that IBM's recently-announced SNA (Systems Network Architecture) control scheme has to be altered, at an apparently significant although unspecified cost. Also it becomes easier for the user of terminals like the IBM series 3600 to migrate to competing systems. All of which helps to explain why IBM, at least initially, was reluctant to support the Trans Canada Telephone System's SNAP.

Some sources think the company is now more amenable. One noted that "further discussion with TCTS has established a basis for possible agreement."

International effort

This jockeying ordinarily would have only limited interest for datacom users outside Canada. However, an effort is now underway to develop an international protocol standard for packet-switched networks (April, p. 112). Canada is playing an important role in that project, which is centered in study group VII of CCITT. The membership of CCITT represents most of the world's telecommunications carriers. Any understandings TCTS works out with IBM on SNAP are quickly cranked into the international standard-development effort, and vice-versa.

Several overseas carriers involved in the international effort have criticized SNAP because of the way it implements "virtual call procedures." It looks now as if TCTS will retreat on this point, in the hope of getting an international standard that incorporates the other main feature of the SNAP protocol. If such a standard is adopted, and IBM doesn't go along, it risks loss of business to competing system suppliers. Those competitors have a far smaller share of the existing worldwide market and therefore stand to gain more than they lose by implementing a largely carrier-dictated protocol. Also, by modifying the SNAP scheme, TCTS counters any competitive advantage CNCP might gain from broadcasting that it doesn't intend to impose a protocol on anyone.

What has happened essentially, is that TCTS is now considering a network- as well as a user-implemented virtual call procedure. Under the former arrangement, message control functions transmitted across the link connecting the user with the network would be coded and formatted according to a protocol developed cooperatively by suppliers, large users, and TCTS.

Originally, SNAP prescribed a "host-to host" message control scheme, extending typically from a computer's front-end communications processor to a terminal's concentrator. The processor and concentrator each had to be capable of generating SNAP—i.e. TCTS-prescribed—codes and formats to transmit message control commands. These commands signal the beginning of communication with the other end, permit messages to be accepted from the other end, acknowledge receipt of messages, allow recovery from an error condition, and keep track of sequential blocks of message data among other functions.

May offer an option

Under the revised arrangement, TCTS still would like the customer's system to implement SNAP virtual call procedures on a host-to-host basis. But according to a key TCTS official, "we are thinking seriously of offering Datapac customers the option of interfacing with the network in a manner that would allow the virtual call function to be performed within the node." He added that this change will require development of a standard host-to-network protocol, and there is some question at the moment whether one can be developed. But reportedly the technicians who must do the work are optimistic.

Another source thinks this revised virtual call implementation scheme, if supported by IBM, would give 3600-series users greater ability than they now have to communicate with different makes of computers and terminals.

TCTS reportedly worked out the proposed revision in close collaboration with representatives of the British and French PTTs. The next step, basically, is to develop a statement that will describe the scheme in detail, and meanwhile seek support from additional PTTs. But even if the additional support doesn't materialize, the three countries probably will submit the protocol to a plenary CCITT meeting late in 1976. Under the rules, it can be adopted as a "preliminary recommendation" if no member objects. Several European PTTs adopt proposed standards automatically when they reach this "preliminary recommendation" stage.

ANSI leaning to TCTS

Meanwhile, there are indications that the American National Standards Institute (ANSI), chief developer of U.S. datacom standards, will support the kind of protocol now being discussed by TCTS and its overseas associates. ANSI's stamp of approval carries tremendous weight around the world, and thus may have an important bearing on the reception given to any proposed packet network standard submitted to the 1976 CCITT plenary meeting.

A report endorsing key features of the revised SNAP protocol scheme—although not referring to it by name—was prepared recently by a group within ANSI's X3S3.7 subcommittee. One of their key points is that the user-to-network interface represents "a prime candidate for standardization." Also, the standard should allow use of different control code algorithms. This is another feature implicit in a network-implemented virtual call scheme. It would allow terminal/computer manufacturers to continue using present proprietary control schemes, albeit with some changes.

The X3S3.7 group added that an ANSI position on packet network standards "should be developed and documented as soon as possible."

Three services

The CNCP Info-Switch offering will serve seven cities initially—Montreal, Toronto, Ottawa, Winnipeg, Edmonton, Calgary, and Vancouver—and consist of three distinct services:

Info-Exchange, which features circuit switching and charges the customer on the basis of the time he's connected. Transmission speeds up to 9600 bps will be available and "it will take somewhat less than one second for the connection to be established," said project manager Carleton.

Info-Call, which is intended primarily for users of low-speed, character oriented inquiry-response systems. Info-Call messages will be packetized at the network entry node and multiplexed onto a 50 Kbs trunk channel, then demultiplexed and depacketized at the exit node. The customer will be charged on the basis of the volume of data transmitted. "The Info-Call service provides a 'computer concentration' option to users, including time-sharing companies, who have many low-speed terminals connected to a central computer," explained Carleton. "By replacing sev-

The Hewlett-Packard 3000 is a minicomputer?

"The 3000 a minicomputer? I think calling the 3000 a mini is an abomination!"

When we asked Mr. Thomas Harbron, Director of the Computing Center, Anderson College, Anderson, Indiana, what he thought about the HP 3000, he had some very interesting things to say:

"We're using the 3000 for administrative processing, academic work and some commercial work. We have 27 terminals and we selected the 3000 because we wanted a system that would provide us with remote access and would do general purpose types of things from the terminals. The 3000 allows us to do many different things at different terminals. In fact, it does everything we expected it to do and was the only machine we could find in its price class that would. I'd recommend the 3000 to others. It's a powerful and versatile machine. And it's cost effective as well. It's half the price of anything that comes close to it."

"I don't think that Hewlett-Packard ought to call the 3000 a minicomputer. It is a complete medium-sized system."

That's what the EDP center manager of an aircraft manufacturer said about the 3000. He also had this to say:

"One primary reason we bought the 3000 was to collect and analyze radar development data. The problem is that we have to collect data fast enough, pipe it to a computer, analyze it, and then make the necessary instrument adjustments. HP's 3000CX was the answer. We also bought it for its interactive capability. Very significantly, in our acoustics department we had to have the ability to turn around data analysis fast. The 3000 has been a real cost saving computer for us. For the last two years I was the entire staff for the 3000. Not a great deal of detailed knowledge of the system is necessary. Technicians can use it without much training. I'm very much sold on the 3000. And it's definitely a complete system—not a minicomputer."

"It allowed us to run eight times the volume at a third the cost. No minicomputer could do that!"

The above statement was made by the corporate banking division EDP manager of a major California bank. He also said:

"We've had the 3000 for over nine months. A year ago we were on a time-sharing system and the cost became prohibitive. We contacted six different companies to look over and bid on a proposal that defined our needs. HP was the only one that could handle our total application of management information for the Corporate Banking Division. The 3000 is not just a mini—it's much more. We're constantly amazing people here with what we can do. It's not hard to operate, not hard to cope with. But our favorite topic is that we're paying less than one third of what we were paying and running four times the volume. And this year, we'll double our volume again. That's eight times greater and less than one third the cost.

That's really productivity!"

"We found the only thing mini about the 3000 was its price."

When we asked the EDP center manager of another major manufacturing company about the 3000, that was what he had to say. He also had this to say:

"Our computer needs include both scientific and commercial applications. We were phasing out our teleprocessing terminal and our Environmental Monitoring Division's computer. So we started looking. We spent several months studying computer systems, and rated them on speed, versatility and ease of operation. The result of our study showed that the HP 3000 provided these requirements and had the best cost/performance ratio. We didn't fully realize the potential of the 3000 until we started programming it. We have experienced a significant cost savings in the seven months we've had the 3000 and we expect a greater savings in the months ahead. We really like the interactive CRT for programming and data input. Being a multi-programming system we can have many users on at the same time. The power and speed of the 3000 is equal to a large machine. It's no mini. Calling it the Mini DataCenter is more accurate. I'd definitely recommend the 3000 to other potential users. In fact, we already have. We feel they would be money ahead."

We're glad these and other users of the HP 3000CX set us straight. We called it a minicomputer because we built it with the state-of-the-art technology that lets us sell it for a minicomputer price. From now on we'll call it a Mini DataCenter.

We want you to get the whole story. Write us and we will mail you a copy of our HP 3000CX Mini DataCenter booklet. We know you'll find it interesting, informative, and maybe a bit surprising.

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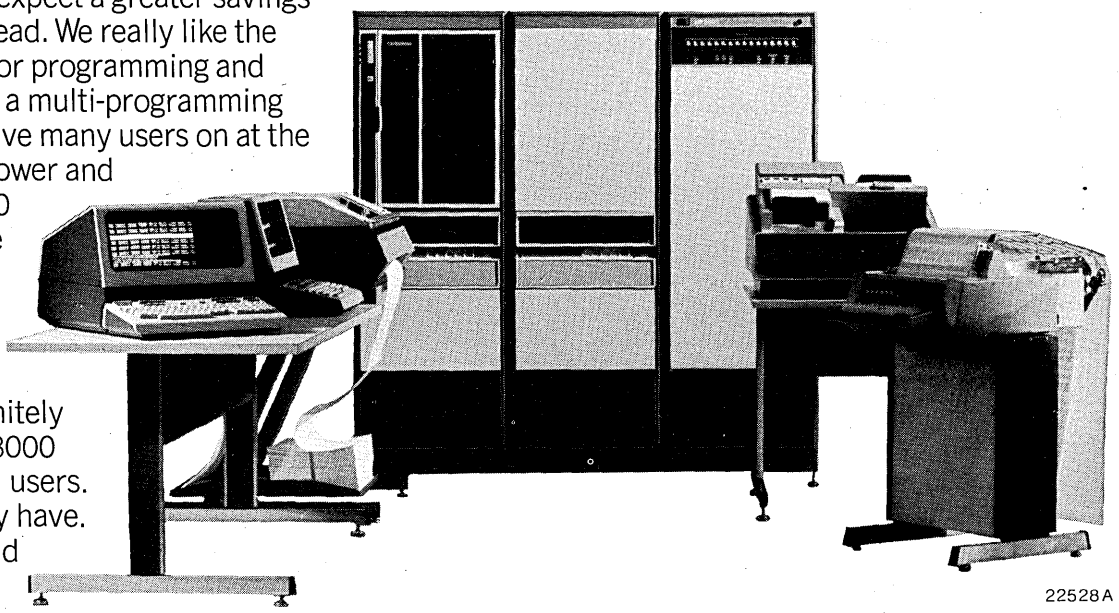

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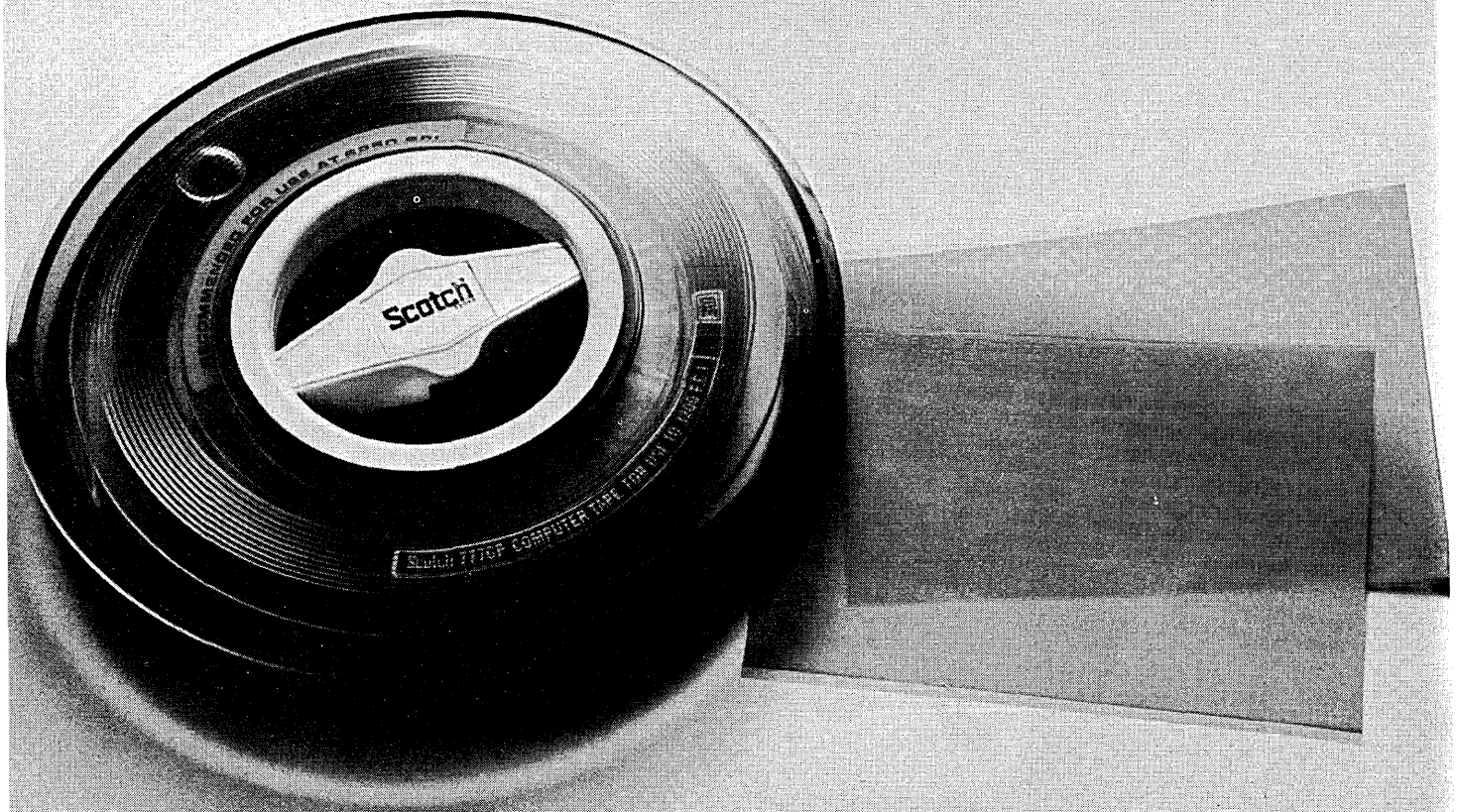

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eral low-speed circuits with one medium-speed circuit, the user can reduce the number of ports providing entry to the computer, and thus will likely reduce his communications costs."

Info-Gram service, providing "constant users, such as those with a large number of point-of-sale terminals, or credit card verification systems, with a permanent and active connection to the network." Initially, Info-Gram will support proprietary network protocols (like IBM's SDLC/SNA) exclusively, Carleton added. He reported that CNCP "expects" a standard Canadian access protocol to be developed by the time the Info-Switch network is operational next year. "But we are thoroughly committed to flexibility in meeting the needs of users, and will not become locked into any one standard that will impose a burden of adaptation on those customers who do not need it. Therefore, CNCP also plans to support any reasonable variations on this protocol."

—Phil Hirsch

Others Must Pay for What Some are Saving

The increasing connection of non telephone-company-made devices to telephone lines is causing New York Telephone Company's subscribers to "incur significant increases in the cost of communications service."

That's the major conclusion of a New York Public Service Commission study which also says, "our projections indicate that these cost increases will probably become more significant in future years." The report by the commission's communications staff seems likely to be cited frequently in coming months by foes of further interconnection.

One of the study's other conclusions is that elimination of a connecting arrangement, supplied by the telephone company, for "foreign attachments"—non-Bell terminals—would increase the "cost impact" of interconnection on New York Tel. That is, it would force the company to raise its rates for exchange service to compensate for the loss of terminal revenue.

The lengthy study covered the impact of interconnecting on New York Bell from the beginning of 1970 to the end of 1973. The staff said that during this period, 4% of the company's private branch exchange (PBX) customers (1,080), 1% of its key systems customers (1,770) and 27.7% of its data set customers (2,630) switched to interconnect equipment.

The report said the loss in revenue amounted to $11.7 million for voice services and $1.9 million for data set services. The total, $13.6 million, was offset partly by revenues of $2.5 million from lease of connecting arrangements.

The staff estimated that by the end of 1984, interconnect suppliers would be pocketing 31% of New York Tel's potential revenue from PBX-Centrex equipment, and 49.5% of its potential key system revenue. The loss of data set revenue wasn't specified.

While recognizing that "interconnection does provide a choice of alternatives to many of New York Telephone Company's subscribers" which may lead to cost reductions, the staff insisted that residential customers and most individual line business subscribers cannot benefit from interconnection "because of the expense of interfacing with the telephone system." And these two groups, the staff added, are "the vast majority of telephone users."

Banking

From Zero DP to On-Line in 6 Months

"It's completely blown the minds of local data processing people."

Wayne McKay, controller of Vancouver City Savings Credit Union, Vancouver, B.C., Canada, was talking about the credit union's on-line system linking all tellers and lending and accounting areas to a central computer. The boggling part is that six months ago VanCity didn't even have in-house data processing and last month the first of its eight branches went on-line. The credit union expects to have all eight branches on-line by the end of June.

And that's just the beginning. VanCity is planning remote teller, cash dispensing terminals to be installed in various locations in downtown Vancouver, some in department stores. "It's too expensive to open branches these days," said McKay. "We don't have the same problems with these (remote terminals) as the U.S. and we want to get into it now before we do have the same problems." He was referring to the controversy surrounding a ruling by U.S. Comptroller of the Currency James E. Smith that customer-based communications terminals (CBCT's) should not be considered branches and legislation proposed by Sen. William Proxmire which would impose a two-year moratorium on Smith's ruling and all other electronic funds transfer (EFT) activity.

McKay said VanCity had looked at available cash dispensing terminals and found them all too expensive. "They're priced too high because everybody wants to build in a minicomputer. We don't want a mini. Our machines will hook into our on-line system." VanCity is working on a design of its own. "We'll employ an outside firm to build it for us and we'll market it to other credit unions for, hopefully, $6,000 apiece."

McKay said VanCity will test the first units inside its own branches.

Out for one dollar

Vancouver City Savings Credit Union is the largest credit union in Canada and the second largest in the world (first being that of the U.S. Navy Dept.). While it didn't have in-house data processing capabilities six months ago it has been using dp for more than eight years. A little more than eight years ago it started a service bureau, Central Data Systems, Inc. to serve its needs and those of other credit unions in British Columbia. VanCity sold operating right to the service bureau for one dollar five years ago to British Columbia Central Credit Union. "For the last three to four years," said McKay, "they (the service bureau) haven't been receptive to our needs."

The services provided to VanCity by Central Data were strictly batch. McKay says the service bureau has been working up to an on-line offering for two and one-half years but isn't close yet. The service bureau has a Burroughs B-4700 and its on-line plans called for Burroughs TC 700 terminals, one for every two tellers. "They're big. Where do you put them," said McKay.

The VanCity system uses six-inch crt screen/keyboard terminals produced by Informer Inc., Los Angeles. When the system is fully implemented it will include 70 Informer terminals, one for each teller "wicket" and several each for loan and accounting stations.

The system was put together for VanCity and will be run under a five year facilities management contract by GEAC Computer Corp. Ltd. of Toronto. GEAC is a systems house that specializes in on-line systems and has 25 of what it terms its GEAC 800 systems installed in Canada. The VanCity system is its first in a financial institution. GEAC buys most of the components for its systems and designs and builds its own hardware interfaces, does its own applications programming, and has its own operating system and a programming language it calls OPL for Our Programming Language.

VanCity's McKay called the contract the credit union has with GEAC, "beautiful." "They had no credit union back-

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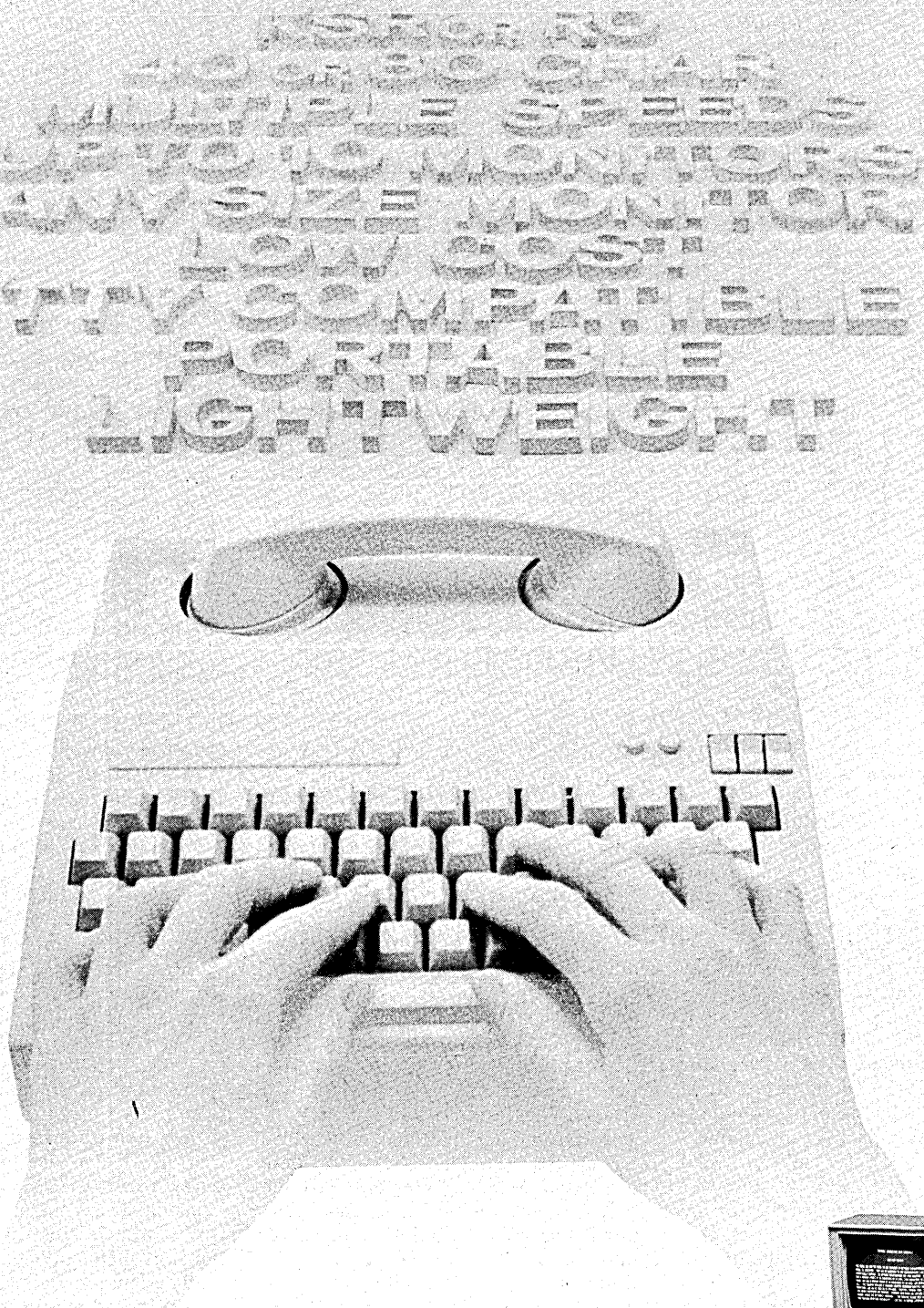

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ground at all yet they did all the programming in a short time." McKay said VanCity had looked around for two years before deciding to go with GEAC. "They're absorbing all development costs and we didn't have to pay a single dollar until we were satisfied with the system." They were and now they're paying.

But not as much as they might have been, says McKay. If they'd stuck with Central Data and gone with its on-line system the cost would have been $40,000 per month. The cost with the GEAC system will be 50 cents per member per month or approximately $25,000. This is only $1,000 month less than the credit union had been paying Central Data for batch services.

McKay anticipates the on-line system will save VanCity $6,000 a month on float alone. This will come from not having to hold checks overnight and having them in clearing operations for several days. "Every check received will be credited and cleared the same day," he said.

He also feels the new system will save in terms of staff requirements. "We won't fire anybody but we can expand the scope of our services without adding people."

McKay said VanCity employees are "gung-ho" about the system. "Every branch manager wants to be the first to go on-line."

GEAC uses a variety of modified cpu's for it's "800" systems. In the case of VanCity, it's using duplex HP 2100 As with 512K of memory.

VanCity went all out to promote the system to its members. It used Applied Digital Data Systems 26 in. crt's in branch windows to display explanations of the system and, in between commercials, displayed printouts of the Charles Schulz character, Snoopy, and Easter bunnies.

They used a similar promotion at a March 31 annual meeting, augmenting it with hockey and other games which could be played using the big crt's. These, McKay said, appealed so much to the junior members they didn't pay much attention to the meeting. VanCity has 3,116 junior members (under 16) among its total membership of 47,270.

McKay said members attending the annual meeting seemed enthusiastic about prospects for the new on-line system. They liked the idea that transaction time will be cut, probably in half. Another pleasing feature is the fact that the Informer terminals can be turned around after a transaction so a member can see the display covering the transaction. "When we went to the batch system (with Central Data) we eliminated member ledger cards so they really had nothing to see," said McKay.

VanCity soon will be adding a small, 32 character printer to each teller station which will be used to give members something more tangible than a look at a crt. The printers currently are being developed for VanCity by Informer, Inc.

—E.M.

Teller at Vancouver City Savings Credit Union handles a customer transaction via a small crt hooked into a new on-line system.

Wall Street

Central Market Bills Moving

Legislation authorizing establishment of a central securities market supported by an on-line computerized system for distributing market information, is making headway in both Houses of Congress.

The House Commerce Committee last month approved HR 4111 directing the Securities and Exchange Commission (SEC) to "take such steps as are within its power to establish a national market system for transactions in securities, which system shall include, as a minimum, a transactional reporting system, a composite quotation system, and a scheme of regulation to provide fair competition between competitors in the system." Another provision directs the SEC to "take such steps as are within its power to bring about elimination of the stock certificate as a means of settlement among brokers or dealers, and to report to the Congress the steps it has taken and the progress it has made toward this end." A stock certificate clearing system based on a computerized datacommunication network is one generally-accepted replacement for the stock certificate.

Similar language is included in S249, the Senate market-reorganization bill, which the Senate Banking Committee seemed about to approve in mid-April. Meanwhile, the SEC issued a directive which delays, at least temporarily, any action under a rule issued some time ago, aimed at encouraging development of a computerized system capable of distributing bid/asked quotation information to all users.

The SEC directive also gives the nation's securities exchanges time to change certain of their existing rules which "restrict. . . access to or use of . . . quotation information (by) quotation vendors." The commission said it was "deferring any further consideration" of the earlier rule until it has had an opportunity to observe the effect of "lifting the access restrictions."

The "restrictive rules" order was addressed mainly to the New York and American stock exchanges, both of which restrict vendors of their market information from distributing it to nonmembers. The commission said new rules, eliminating these practices, became effective May 1. An SEC spokesman said informal discussions with the two exchanges indicated there wouldn't be any difficulty in meeting this deadline.

The securities industry's first venture into consolidated, on-line reporting of

market information is in trouble. A system for reporting last-sale transactions of stocks traded inside five exchanges, as well as by over-the-counter dealers, began test operation last October. The system consists essentially of an "A" tape which reports sales within each of the six markets of stocks listed on the New York exchange, and a "B" tape which provides a similar listing of transactions in securities listed on the American exchange plus sales involving stocks listed on one or more of the participating regional exchanges. Regular operation of the "A" tape was supposed to begin early this year, while testing of the "B" tape was supposed to be completed in July. Recently, the system's managers announced that both operational dates have been pushed back several months. They attributed the delay to a "need for more testing than was originally anticipated."

Privacy

Questions on Legislation: Who Pays for Added Privacy? What New Laws Lie Ahead?

Those who contemplate the implications of privacy legislation demand more and more study before acting on the problem. One who disagrees with the approach is Dr. Ruth Davis, director of the National Bureau of Standards Institute for Computer Sciences and Technology. "Especially in technology, you don't have to understand the entire problem to take some action that is useful and constructive and which aids in the resolution of the problem as a whole.

"And as you take these actions," Dr. Davis said last month at a meeting on the subject, "you usually understand the problem better."

Her comments were made at a three-day symposium and workshop in McLean, Va., on "Planning for Action—The Privacy Mandate." It was sponsored by the NBS and the Mitre Corp. Dr. Davis said the conference could be a "first" because previous gatherings have been aimed at defining the privacy problem, whereas this meeting hoped to present a plan for action.

Throughout the symposium, though, many speakers continued to advocate more study. "Information processing techniques have grown so phenomenally in the last decade that we really haven't had time to make the adjustments that are required and to reinterpret our value system to guide this change," said Mitre's senior vice president Charles Zraket.

Zraket said it will be expensive to achieve data protection, an opinion not shared by all attending the conference. He maintained that the costs cannot be calculated without first determining what level of protection is critical to the preservation of individual rights. "We know very little about the relative value to the public of the protection of different classes of data," he said.

Who pays the price?

Determining the cost, furthermore, is only half the question, he continued. "We need to ask also who should pay

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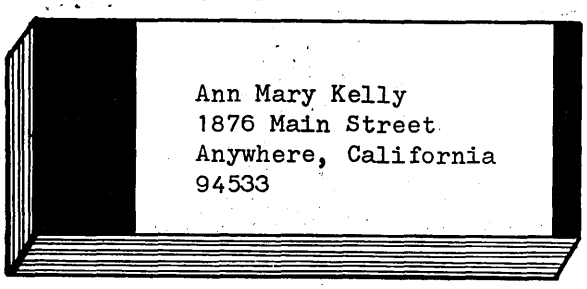

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this price." Should the assessment of costs among the government, industry and individuals be based upon the relative value of the service to the user, or an ability to bear the burden, or some combination of the two? he asked.

Rep. Edward Koch said at the meeting that the Privacy Act of 1974, which he cosponsored with Rep. Barry Goldwater Jr., "is far from perfect." The Congressman added, however, that few pieces of legislation can be described as perfect in their initial passage and only become so as the result of amendments after enaction. The Privacy Act will be improved on and expanded in this Congress, according to Koch. But notwithstanding its deficiencies, "I feel it represents a monumental breakthrough in the field of personal privacy safeguards," Koch said.

The most important improvement in the Privacy Act Koch said he'd like to see is the establishment of a permanent Federal Privacy Board to monitor government agencies' compliance. It would also hold hearings for individuals who might want to air grievances, in lieu of going to court. "The current law leaves individuals largely adrift if they need assistance, wish to protest agency denial of their request for access, or assert other rights regarding their personal records," Koch pointed out. Other changes he recommended include removing the near blanket exemption given to the CIA and tightening up exemptions pertaining to the FBI. The Congressman also said he believes that provisions in the act allowing an agency to withhold from an individual the source of confidential information in his file should be deleted. "We have a right under the Constitution to face our accusers," he stated.

Revisions planned

Hearings will be held in this Congress on the Comprehensive Right to Privacy Act (H.R. 1984), legislation introduced in January by Koch and Goldwater which extends privacy safeguards to state and local governments and the private sector. The two Congressmen recently sent out questionnaires to governors, mayors, county executives, industrial corporations, unions, trade associations and universities to find out reactions to the bill and determine where it should be revised to make it more workable. Koch said the bill will be revised after all the questionnaires are compiled and reviewed.

Turning to potential costs of privacy, Koch admitted that "cost is a factor with which we are all concerned," adding that some feel privacy is a luxury the economy cannot afford. But there are instances where privacy protection can be achieved at little or no cost, the Congressman maintained. "Privacy can be as inexpensive as telling employees to let no unauthorized person see a file and to be protective of the files when the files are physically on their desks," according to Koch.

Commenting on privacy from a business viewpoint, Joseph L. Gibson, senior attorney of Marcor Inc., says, "Privacy legislation will not, in all probability, put any big business out of business, but it will most certainly raise substantially the cost of goods and services."

If privacy legislation raises the cost of a credit report, for example, credit grantors such as large department store chains will order fewer reports. The declining volume received by the credit bureau will force it to engage in a secondary cost rise, further raising the cost of a credit report, Gibson told conference attendees. Credit grantors will either then restrict the amount of credit that they give because they can't afford the reports or charge the credit applicant a fee to process his application, he reasoned. "In devising solutions we must be mindful that the primary objective is to ensure privacy and fashion so-

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lutions which cause the minimum side effects in other areas," he said. "The objective here is not refashioning the government or devastating the economy or raising the cost of goods and services, but it is securing the privacy of personal information about individuals."

The P & L incentive

Gibson maintained that industry has its own reasons for proper handling of data—the profit incentive and competition. Collecting, processing and storing personal information is a costly activity, Gibson pointed out, so the annual profit and loss report of industry serves as a "powerful and effective" incentive for industry to collect only that personal information which is essential to its function. "Government lacks the profit and loss incentive," he continued. Furthermore, industry views the information it collects as proprietary and goes to considerable lengths to ensure that the information it does have will not become available to its competitors, according to Gibson.

Gibson objected to potential legislation which would require public notification of the existence of all data systems. Industry is "overwhelmed by the potential cost of publishing," he said, and doesn't feel such notice would serve any useful purpose. The existence of most of the industry files is already known to the data subject, Gibson pointed out, adding, "Credit customers get monthly reminders." The government has the alternative of publishing in the *Federal Register,* but industry must publish in newspapers, "where advertising rates are staggering," he told the group. "The Koch-Goldwater bill (H.R. 1984) could be referred to as the Newspaper Revenue Relief Act of 1975," Gibson quipped. Notice by special letter, as some have suggested, is equally prohibitive in cost, he claimed, as estimates of costs are "never less than $1 per letter."

Speaking on the technological implications of data protection, Charles C. Joyce Jr., assistant director for Government Communications in the Office of Telecommunications Policy, said, "We are not at the stage and may never be at a stage where the technological aspects of privacy protection should be legislated." Joyce said technological questions are complex and their answers are evolutionary.

Although the Privacy Act of 1974 does not address technological issues, technology might be affected by components of the legislation, says Joyce. A possible technological question is in the requirement that there be no secret record keeping, he pointed out. Would advanced information technology permit the maintenance of a large secret file, with knowledge of its existence limited to a very few people, thereby limiting the risk of its disclosure? If such a system is feasible, Joyce continued, auditing or other storage management controls to reduce this possibility may be a necessary safeguard.

Total encryption not needed

The Privacy Act's major areas of technological significance relating to the protection of privacy in governmental systems concern sharing and security, Joyce noted. In the past, he said, there has been concern about the possibility of a national data bank, or a *de facto* national data bank which would arise from the interconnection of Federal computer systems into a massive computer network. Proper implementation of the safeguards which the Privacy Act provides can deal adequately with concerns about computers and communications networks without ruling out the economic advantages of shared system architectures, according to Joyce. Certain procedures must be correctly implemented within such shared networks, "but there is no immediate need for esoteric technical requirements such as total encryption, multilevel security and ironclad compartmentation," he told the group.

Guidelines for evaluating security risks and protective measures would be useful to Federal agencies which must implement the Privacy Act, according to Joyce. However, if mandatory standards are developed, they should be minimum or lowest common denominator standards, he warned. "Federal agencies should not expect firm central direction as to what constitutes adequate security," Joyce noted. Sufficient security will vary from agency to agency, taking into account the sensitivity of data, the various means whereby unauthorized disclosure may occur and the feasibility and cost of safeguards, he said.

Potential weak points in the technical security area may exist, according to Joyce. He urged that early attention be given to the practice of providing access to computers by dialing through a common use telephone network, where "we are depending entirely on computer access controls for data protection." No physical barriers hinder a potential penetrator, who may be dialing in from almost anywhere. Another area for consideration is the practice of providing access to a general programming capability on a computer can break most known security barriers within the computer," he pointed out. "We seem to be some years away from provable security barriers in such a system, and the costs of such barriers are presently unknown."

More research

Reporting on activities of a panel investigating individual privacy rights in a record keeping society, attorney Robert Bigelow, of Computer Law Services, said suggestions made by this panel fell into two categories—research and legislative. "Our current lack of understanding about the specific needs for and the feasibility of implementing comprehensive privacy laws indicates a need for continuing research in many areas," according to Bigelow.

Privacy needs and desires of individuals as affected by situations, culture and economic levels should be studied to help clarify specific requirements for privacy legislation. Other research should cover standards for determining the relevance of data for specific uses and the feasibility of legislation to meet various needs. Such research, for example, might consider the cost benefit of alternative privacy protection mechanisms and data processing techniques which would permit statistical analysis of the contents of multiple personal data files without concurrently endangering the individual's privacy, Bigelow told the group.

In the legislative area, the panel suggested that until much more empirical data has been developed, legislation should proceed cautiously, providing remedies for specific and documented abuses. Bigelow said the panel was informed that many states lack comprehensive laws as to what public records are, so it suggested that those states consider both public record and privacy legislation simultaneously in order to evaluate the competitive factors properly.

Compliance by September?

Clark Weissman, System Development Corp., reported on the activities of a panel concerned with the technological implications of privacy. Speaking on the "technological bottom line view" of the privacy act, Weissman said, "It is highly questionable whether full compliance is possible by September for any specific government system and it is the general consensus of the panel that the lead time is impossibly short for full compliance for all equipment and systems.

"There is clearly an urgent need for guidance and direction so that those who are on the road to try to comply at least can start on that path today and

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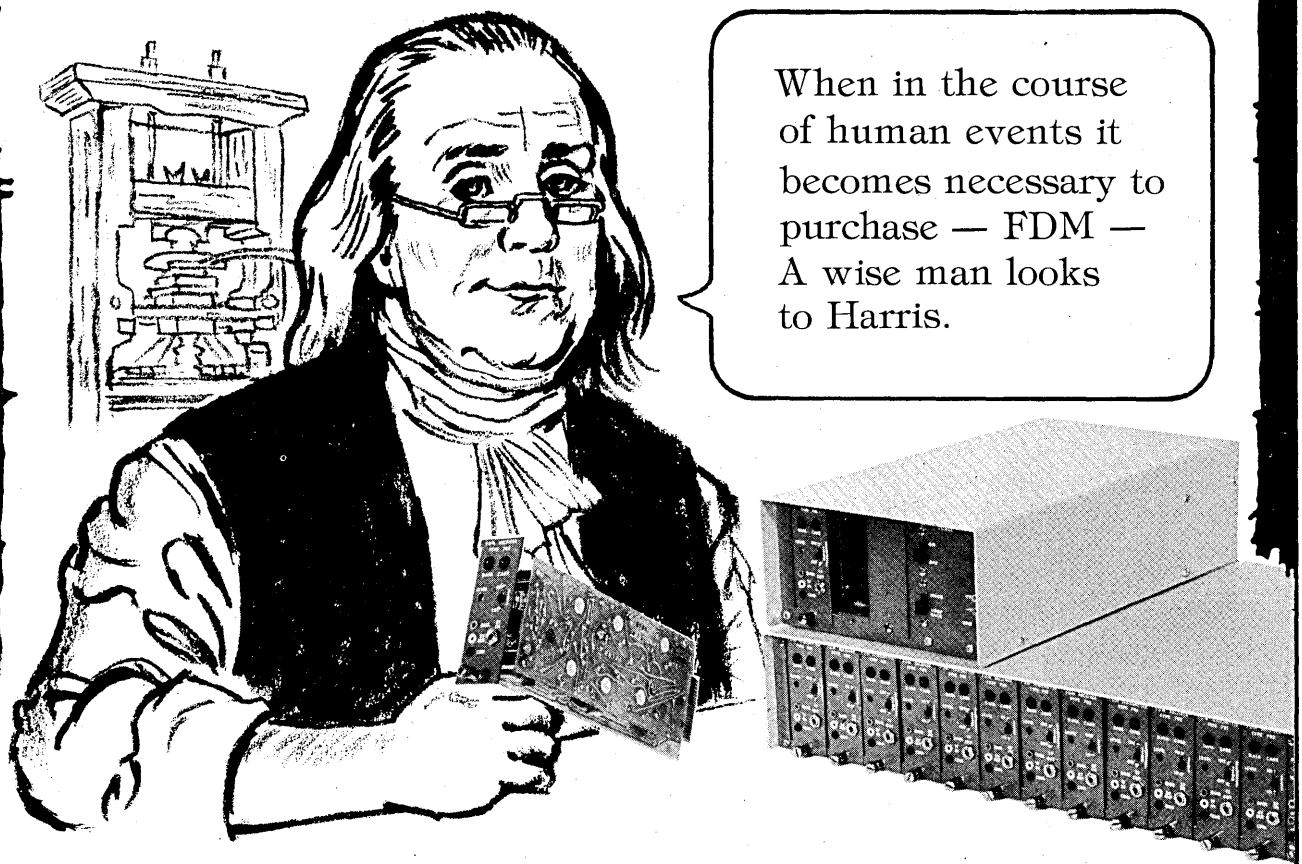

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not have to make any false starts," Weissman said. Such guidance must clarify key definitional problems in the legislation, such as common identifier, which Weissman said is not clear. Weissman warned that not all data is of equal sensitivity, "but the legislation seems to paint a big brush over that issue." It is also unclear, he continued, as to what level of access is concerned and what a system is (is it just a computer system, or does it overflow into the bounds of the whole governmental operation?).

—P.E.

Government Procurement

Big Procurement Plan Considered

The General Services Administration (GSA) is considering an "adp teleprocessing services program" that could generate $50-60 million worth of federal contracts during FY '76, and even more after that.

A draft bid solicitation, at least one inch thick, was sent to prospective suppliers. They were invited to attend a bidders' conference April 18, and to submit written questions and/or comments until May 16. After considering this input, and possibly revising the present solicitation document, GSA plans to issue a final one sometime this summer. Hopefully, the first contracts will be awarded before the end of the year.

The current effort will be a follow-on to a program that began in 1973, when Computer Sciences Corp.'s Infonet Div. became the "supplier of first resort" to all federal agencies needing outside dp services. This contract, which will earn the company an estimated $19 million in billings during the current fiscal year, excited the envy of competitors and persuaded GSA to embark on the current procurement.

Before additional firms can be added, however, the CSC contract has to be renegotiated. As now written, it bars competing contractors from doing many kinds of dp services jobs which the government farms out. According to a GSA source, the CSC contract renegotiation is "progressing."

CSC won this contract largely by offering handsome discounts. Suppliers who expect to receive business from the current procurement will have to offer a similar concession. In return, they'll be considered first whenever any federal agency needs outside support. An agency still will be entitled to procure support under separate contracts negotiated with other firms not in the adp teleprocessing services program, but only if it can demonstrate to GSA that none of the firms in the program can meet their needs. Also, such agencies will have to obtain waivers from GSA permitting them to negotiate contracts outside the program.

A GSA spokesman estimated that by 1978, suppliers who receive contracts under the pending procurement, will be filling about 80% of the federal government's requirement for outside dp services.

Although these firms, as a group, will be considered first when such support is needed, each one won't necessarily be the sole supplier of a particular type of service. "Anybody who qualifies will be

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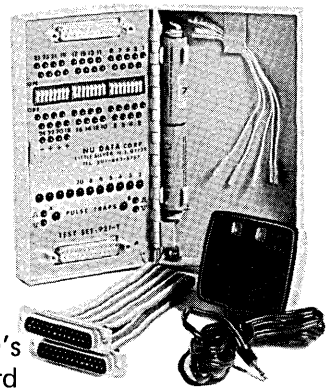

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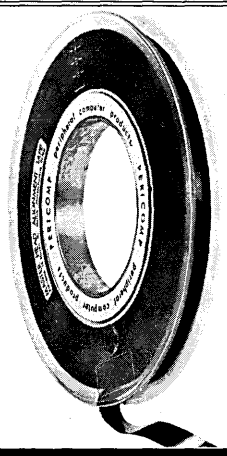

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awarded a contract," explained the spokesman, "so duplication is inevitable." An extensive section of the initial bid solicitation document describes the procedures agencies are supposed to use in choosing a contractor from the list of winners when more than one of them appears technically capable of doing the work.

Electronics

Catching up with Microprocessors

The rapid development of microprocessor technology caught the engineering fraternity by surprise, commented Daniel Alroy, president of Q1 Corp. of Farmingdale, N.Y. during the recent IEEE meeting in New York. "Things happened a lot sooner than anybody expected and we have an educational gap," said Alroy whose company makes microcomputer systems.

Although industry wants engineers who design with microprocessors, the universities are still teaching transistor/-diode level design principles. Catching up will require restructuring the engineering curriculum and this is going to take a few years.

The same sort of a gap exists between the users and the builders of microprocessors according to Alroy. While the semiconductor companies know how to build the devices, they know little about systems. The computer manufacturers know everything about systems but almost nothing about the use of microprocessors. To use a microprocessor properly requires an extremely sophisticated approach to design and integration; it may force companies to spread out from their current basic positions and overflow into the gap.

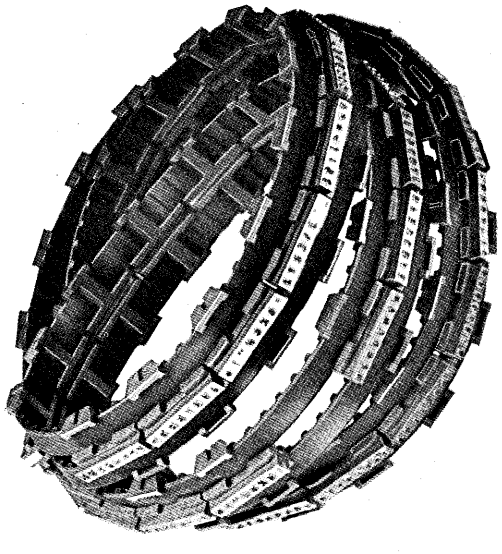
With microprocessor costs still dropping—in quantitites $50/unit is not uncommon—the real price breakthrough is still to come when high volume production gets started. Long production runs with high yields will only come about when the microprocessor is fully accepted as a potential replacement for any control, electrical, mechanical or pneumatic, in the factory, the office and the home. Eventually the devices will appear in systems that have a close relationship to the human organism. Developments such as those by Dr. William Dobelle (Bio-Medical Engineering Institute, Univ. of Utah), who exploited semiconductor technology to produce genuine sensations of sight to blind people, are suggestive of a whole spectrum of people-oriented products.

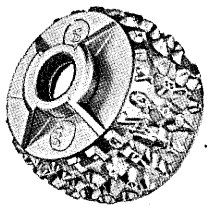
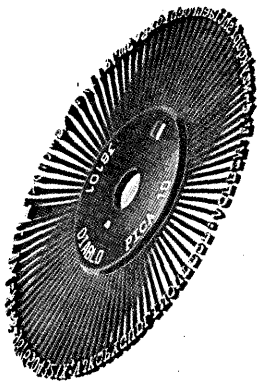
Dramatic cost reductions

Such experts as Dr. Carver Mead (Cal Tech) have predicted that the microprocessor cost trend will continue another 10 years and result in a thousandfold decrease in the cost of logic. Confirming evidence—the growth curve on the electronic calculator business and the one that is just beginning to happen with electronic watches—suggest that Mead is not far off. To date circuitry has dropped 50% per year since the 1960 advent of commercially available integrated circuits.

Alroy stated, "After a quarter of a century of development, the computer industry has reached its infancy with the development of the microprocessor." Even the tricky automotive fuel control systems recently predicted by Robert Sarnoff (RCA) seem no more than five years away. All the predictions suggest that the era of the microprocessor will bring the computer revolution directly to the doorstep of the average person.

—Philip H. Dorn



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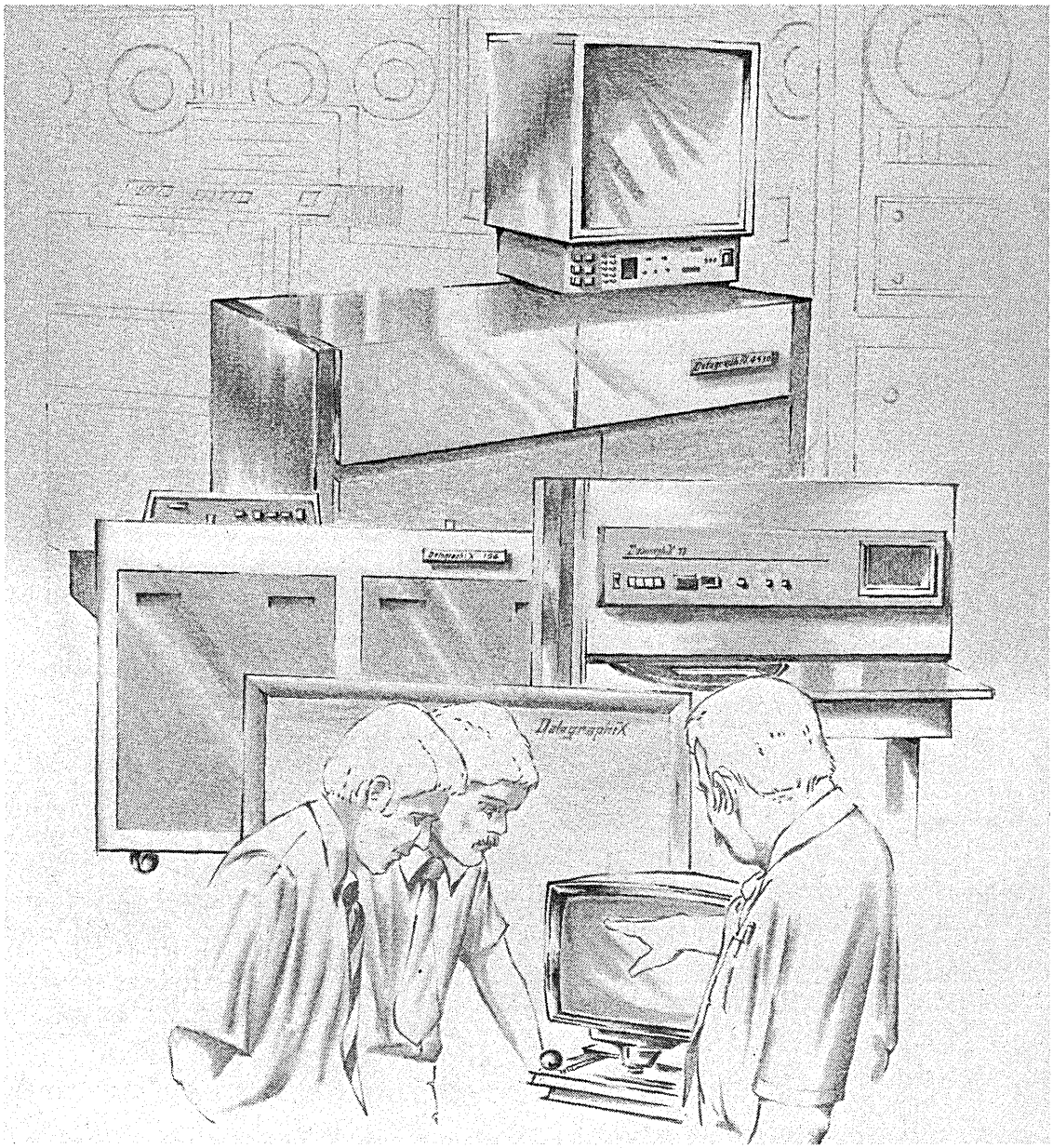

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News in Perspective
BENCHMARKS . . .

The Ups and the Down: Both IBM and Control Data Corp. had fiscal first quarters that were rebounds. Honeywell wasn't so lucky. IBM's earnings for the quarter were up more than 1% over fiscal 1974's first quarter to a record $437.2 million on a 9% increase in revenue to a record $3.27 billion. This following a fourth quarter in 1974 when the firm experienced a profit decline of almost 5%. Up or not, the current figures are seen as a flattening of growth. IBM reported an increase of almost 17% in income on a 15% rise in revenue for all of 1974. Control Data's rebound was more dramatic. After posting losses in 1974's final two quarters, the company has returned to profitability although earnings were below those of fiscal 1974's first quarter. CDC earned $11.1 million in the first quarter of 1975 on revenue of $282 million. In the first quarter of 1974, earnings were $15.3 million on revenues of $249.4 million. The company lost $7 million in 1974's third quarter and $16 million in the fourth quarter. The computer operations, which lost $24 million in the 1974 final quarter, earned $731,000 in the first quarter of fiscal 1975. Honeywell's president, Edson W. Spencer, predicted his firm's first quarter earnings this year will drop "sharply" from last year's first quarter and said "difficult business conditions are expected to continue "at least" through the first half. He didn't predict figures. In the first quarter of 1974 Honeywell earned $19.4 million.

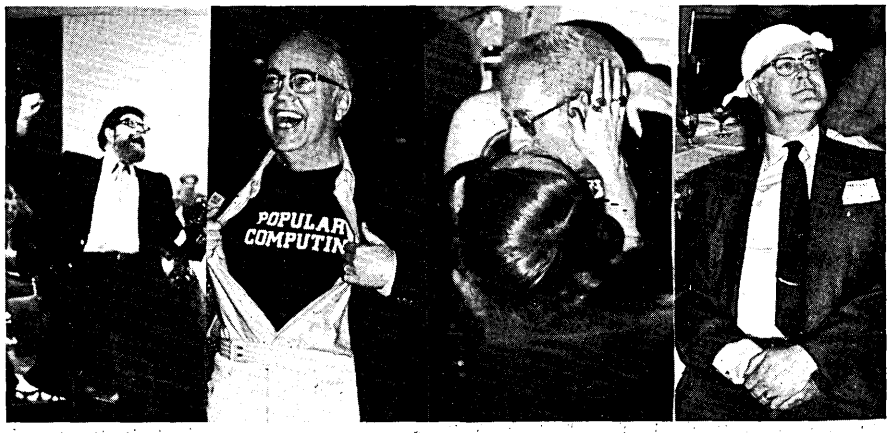
Joint Venture: Honeywell, Inc. and Control Data, long associated informally in disc drive development—CDC has produced disc drives for some of Honeywell's equipment—will make it highly formal this summer with the formation of a new company, Magnetic Peripherals, Inc. to make disc drives, drums and controllers. CDC will own 70% of the company, Honeywell 30%. It will combine CDC's disc operations in Minneapolis and Redwood Falls, Minn., Rapid City, S. D., Hawthorne, Calif. and Lisbon, Portugal and Honeywell's plants in Oklahoma City. The new company, with $75 million in assets and some 5,000 employees, will be headed by Thomas G. Kamp, president of CDC's Peripherals Products operation. Honeywell's vice president of computer manufacturing and engineering, William T. Bayer, will report to Kamp as chief operating officer. As with CDC's three-year joint venture with NCR, Computer Peripherals, Inc., the new company will sell only to its two partners.

Million Dollar Breach?: American Express Co. is seeking a total of $30 million in an action against Control Data Corp. and its subsidiary, Ticketron, Inc. The action asserts multimillion dollar breach of contract associated with its ticket fulfillment responsibilities in connection with computer operated ticketing for eight films making up the premiere season of the American Film Theater. American Express alleges that by reason of the inadequate performance of the ticket fulfillment functions, it and American Film Theater were required to expend large sums of money to correct these failures and to prevent collapse of the American Film Theater's first season. The complaint charges that program and computer failures as well as poor planning by the defendants forced American Express to take over, correct and complete the ticket fulfillment work after the first two performances of the Theater's offering.

Quantity Wands for Retailers: Recognition Equipment, Inc., Dallas, has begun quantity production of a new optical character recognition (ocr) wand for retail point-of-sale (pos) terminals. The wand is the first to reach this stage after being tested in a live retail environment, REI said. The unit is designed to read either OCR-A or OCR-B fonts and will be sold initially to NCR and Singer. Both companies contracted last year for 50K units. Wands capable of reading the National Retail Merchants Assn. approved OCR-A font will sell for $774 in lots of 10,000 or more. OCR-B reading capability will be available next fall. Wands with this capability will cost from $25 to $30 more.

"A Striking Affinity": When is a credit company like an airline? When the two are sharing a computer center. C.I.T. Financial Corp. and Eastern Airlines, Inc. are doing just that under a multimillion dollar, multi-year contract under which Eastern will operate a data processing and business communications network for C.I.T. called CITation. Processing for the system will be handled by two IBM 370/195s (March 1972, p. 104) at Eastern's Doral Computer Center in Miami. Walter S. Holmes, Jr., chairman of the board of C.I.T., said both companies recognized "a striking affinity" between the procedures involved in consumer financial operations and in handling flight reservations and airline tickets. He said CITation, when fully operational, will utilize 16% of the Doral center's processing capacity, making C.I.T. the largest single user, next to Eastern itself, of the computer complex.

EFTS Strategy Study: The American Bankers Assn. has selected 10 state bankers associations to join it in sponsorship of a multi-state pilot electronics funds transfer system (EFTS) strategy study. Associations chosen are from California, Colorado, Florida, Indiana, Kansas, Massachusetts, Michigan, Oklahoma, South Carolina, and Wisconsin. Willis A. Alexander, ABA executive vice-president said the 10-state mix includes two statewide branching, four no-branching, and four limited branching states. He named four distinct goals for the study which will be conducted by the Arthur D. Little Co., Cambridge, Mass. They are provision of a sound base from which to develop a national assessment of the current and future state of EFTS developments; the development of alternative strategies; development of a proven methodology for future EFTS strategy studies which may be utilized subsequently in other states; and an educational presentation customized to each state situation to be provided to participating states. □



CAPTION PLEASE: Photos from past Digital Computer Association meetings have been blown up as posters for a caption contest at this year's annual gathering of computer oldtimers May 23 at Los Angeles' Airport Marina Hotel.

LOOK AHEAD

(Continued from page 18)
second over the coax cables at distances of up to 500 feet.

The company, Network Systems Corp., is reluctant to talk more about its system, other than to note the interest of some centers with multiple large and super computers. It says there are about 1,200 of these.

SYSTEM/32: DIFFERENT IN EUROPE

IBM introduced its System/32 in Europe last month in a different way than in the U.S. (February, p. 67). Prices will be higher in some countries than in the U.S. and applications offerings also will differ. In Britain, the company offers special application packages for the wholesale food and construction industries, but does not offer three other specialized packages offered with the U.S. announcement.

In West Germany, what is called a "modular application system" is being offered, drawing from features of the System/3 applications customizer. The user, according to IBM marketing people, can select modules he needs and then have the system modules tailored to his specifications that are fed into a program generator on a 370/158. So far, only payroll and wholesale applications programs are available. Users in Germany will be charged a one-time fee for program generation and a monthly license for 12 months.

The System/32 will be built for the European market at the company's plant in Vimercate, Italy and be shipped in late summer.

UPC FOR MEAT AND POTATOES

At least one aspect of the Universal Product Code (UPC) program of marking grocery items for scanning by point-of-sale (POS) systems shouldn't bother consumers or legislators who are worrying about possible loss of individual item price marking (April, p. 113). That's what Leo Beinhorn, Distribution Code, Inc., administrators of the UPC program, calls the random weight category. This includes produce and meat and anything else where price depends upon weight. Currently some 10 stores are testing systems which combine a scale and a bar code printer to produce UPC codes for these items. These are systems which would be used in a supermarket's back room or at the produce counters. Beinhorn said manufacturers offering this type of equipment currently include Hobart Scales, Toledo Scales, and Interface Mechanisms, Inc. with 3M Corp. expected to demonstrate some at the Supermarket Institute show in Dallas this month. Consoling to price marking advocates is the fact that this code gives the price in human readable as well as machine readable form. And as for produce, was an individual carrot or potato ever price marked?

RUMORS AND RAW RANDOM DATA

Reporters were being told in late April at a trade show in Hanover, West Germany, of rumors that the West German government was trying to halt an expected merger announcement of France's CII and Honeywell Bull. French officials at the Hanover Fair seemed to confirm the rumors by their silence...A prospect for IBM's model 3800 high speed printer has estimated the price in terms of mileage: $15 per mile of paper...The No. 2 lawyer on IBM's crack antitrust defense team, Frederick A. O. Schwarz, has left the team to go to Washington to become legal counsel to the commission investigating the Central Intelligence Agency...The ACM's Anthony Ralston is the nominee to succeed George Glaser whose two-year term as AFIPS president expires this year. Al Hoagland, IEEE Computer Society, and Walter Johnson, DPMA, were the nominees for vice president and treasurer. Elections follow the NCC this month in Anaheim...Britain's ICL signed an order for its 1,000th model 2903 small computer last month at the Hanover Fair where it introduced the machine two years ago...Incoterm, the Marlborough, Mass., intelligent terminal manufacturer reportedly has been licensed to make a cash dispensing machine developed by France's Transac, an operation of conglomerate CGE. Transac has installed some 1,000 in Europe. Called the T-24, the on and off-line system uses an Incoterm intelligent terminal.

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CIRCLE 56 ON READER CARD

hardware

Off-line

Wabash Tape Corp. has developed a new tape reel called Quadreel it claims completely eliminates loose hubs, inhibits tape cinching and slipping, improves tape stacking, eases reel loading and unloading, extends reel life, and enhances drive performance. This is all said to result from bonding the reel components in four ways, yielding an integral monolithic structure that matches the physical characteristics of its tape. The Quadreel is sold only with Wabash's certified virgin computer tape.

National Semiconductor Corp., one of the pioneers in the microprocessor business, has just formed a user's group called COMPUTE. National ran a contest to name the entity, which was won by John R. Hannum of RCA in Camden, N.J. COMPUTE stands for Club of Microprocessor Programmers, Users, and Technical Experts. Mr. Hannum also suggested The Bit-Bucket as the name for the club's newsletter.

The results are in from a study entitled "Backplanes and Sockets--A Technology and Market Assessment," recently released by Darling and Alsobrook, a Los Angeles-based management consulting firm. The study shows that several factors will continue to slow the growth of wire wrap technique for backplanes, but that wire wrapping has such a head start on all other discrete wiring techniques that it will still account for greater than 98% of the total terminations in 1980. Other interesting conclusions of the study: Nearly four billion wire ends were wrapped to about 2.4 billion posts in backplanes and socket boards in 1973. This figure is expected to reach 3.16 billion in 1980. The comprehensive world wide study, with over 200 tables and figures and 6,000 individual items of marketing data is priced at $5K.

A 1,728 element charge-coupled device capable of reading an 8-1/2 x 11-inch page in less than a second--making possible very high speed facsimile equipment--has recently been introduced by Fairchild Camera and Instrument Corp.

For additional products being introduced at the National Computer Conference this month, please refer to the Product Preview feature starting on page 50.

Printing Terminal

A 60 cps wire matrix printer, tape cassettes, industry compatible, floppy disc, 256-character display, typewriter, and communications capability are the components of the TC 4000 series of printing terminal systems. Manual data entry is done through the typewriter, with automatic data entry accomplished through the floppy or cassette options. Communication rates range from 75-9600 baud, with simplex or duplex modes provided buffers with up to 1.536 character capacity. TC 4000s can communicate with each other, with a central computer, and with

other Burroughs terminal products. The plasma display panel can show data entered through the keyboard prior to transmission as well as responses from another system. A "forms compose" feature enables local or remote programming of any number of printing formats which can be set locally, or transmitted across the communication link from a central system. Depending on combination of options, the TC 4000 sells for $4,945-9,495, and can also be leased. BURROUGHS CORP., Detroit, Mich.

FOR DATA CIRCLE 225 ON READER CARD

Disc Pack

The 882 is a 12 high IBM-compatible disc pack for operation on 3330-11 or equivalent disc drives. The pack contains 815 cylinders (0 through 807) plus seven alternate cylinders, providing a capacity of 200 megabytes. Data surfaces are factory formatted, and the servo disc is written at the factory. End-user prices vary in the narrow range of $995-960, depending on quantity, and the 882 is currently available within two weeks time. CDC, Minneapolis, Minn.

FOR DATA CIRCLE 226 ON READER CARD

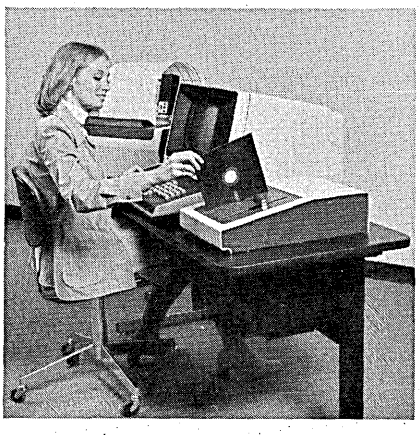
Low-cost Smart Terminal

Order entry, message switching, and information collection are just three applications that the model 4210 Buffer Communications System model 4210 can do, and there are undoubtedly others. The unit consists of an IBM Selectric typewriter, 4-16K character buffer with built-in microprocessor, and a 1200 baud automatic answer modem. The buffer system with its microprocessor is capable of editing, correcting, and searching for specific characters in text in order to extract or update the information. Once the data is verified, it is entered into the protected area of the buffer for automatic unattended transmission to the central site at 1200 baud. Incoming messages can be simultaneously stored in another protected region of the buffer. The typewriter can be used off-line for regular typing. The terminal is base priced at $6,500. TYCOM SYSTEMS CORP., Fairfield, N.J.

FOR DATA CIRCLE 227 ON READER CARD

3270 Competitor

The IBM 3270 intelligent terminal is drawing the attention of a number of competitors who are trying to come up with not only a pricing advantage, but application advantages as well. This manufacturer may have found one: it's a floppy disc option for its series 250



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line of 3270-compatible terminals that allows the user to store virtually an unlimited number of formats and programs locally instead of continually calling for them across a communications link. The floppies hold half a million characters and can be used to transmit batches assembled during the day to the host cpu at night when communication rates go down. For multiple page inquiry, the option permits operators to page forward and backward without having to access the cpu for each page. The model 255 standalone intelligent display terminal with built-in control unit and dual-floppy option is priced at $8,840, or $268/month on a one-year lease. SYCOR INC., Ann Arbor, Mich.

FOR DATA CIRCLE 230 ON READER CARD

Small-scale System

If a computer is properly designed, using all the technology easily available nowadays, it's easy to tailor cpus for various applications, and that's just what Data General has done with its C/300 model of the recently announced Eclipse line. To get them further into the systems business, the standard Eclipse cpu has been equipped with a commercial character-oriented instruction set to support the star of the show, a data base management system called INFOS: While DG isn't to the point of supplying complete, turnkey application systems, it is getting closer.

Three representative configurations

show the range of expandability of the C/300. A 96K character system with 10 million bytes of disc storage, keyboard console, and one video display terminal, 60 KB/second tape drive, 60 lpm printer, and four-line asynchronous multiplexor sells for $77,400. An additional 32K of storage, 80 megabytes of storage, two terminals, four communication lines, and 300 lpm printer goes for $113,950. A large system with 160K bytes of core, 180 megabytes of disc storage, keyboard console, seven crts, 60KB/second tape drive, 300 lpm printer, and 16-line multiplexor sells for $159,650. Prices include considerable system software, including INFOS.

INFOS is integrated with the RPG II and FORTRAN higher-level languages for easy access to data base applications in the fields of inventory management, order processing, production control, purchasing, personnel, law enforcement, reservations systems, and others. Summer is quoted for delivery of the new systems. DATA GENERAL CORP., Southboro, Mass.

FOR DATA CIRCLE 228 ON READER CARD

Microprocessor Peripherals

The MM2000 is a dual cassette system specifically set up for use with Intel Corp.'s 8080 microprocessor or INTELLEC Model 80 minicomputer. The 2000 consists of an interface board, programmable read-only memory, and dual cassettes with read/write rates of 180 cps. Other features include guar-

product spotlight

New Univac Line

The substitution of semiconductor memory technology for plated wire has enabled Univac to bring its 1100 series product line up to date, while at the same time increasing system performance, and giving an even more competitive price to the price sensitive low end of the line. The new line up consists of the 1100/20 and the 1100/40 systems that in general bracket previous 1106 and 1100 performance figures. The 1106 will continue to be built for the foreseeable future, however, as it can be priced somewhat lower than the smallest 1100/20 system.

Architecturally, the systems are similar to former Univac large-scale gear. The 1100/20 can be expanded from an initial 128K 36-bit words of 875 nsec MOS storage up to 512K. You can start with four I/O channels, expanding to 16 as application needs expand. The cpu has a 125 nsec rate that yields average instruction times of 1.16 usec, or about 860,000 instructions per second. A two-processor version of the 1100, the 1100/22 will be pitched to 370/158 users as an attractive alternative: the same performance for 75% of the price, plus the fall-back reliability of the second processor for critical applications. Other targets for the 1100 include the high end of the Burroughs' line, through the 6700 series.

The 1100/40 series is the new high end of the Univac line, using fast bipolar storage (280 nsec random read time, 380 nsec random write) in sizes ranging from 32K-512K words. Primary storage features four-way access. Behind the primary memory can be as much as 1 million words of 800 nsec MOS memory, almost twice the speed of the 1110 series' extended storage. This system can rent for as little as $45K/month in small configurations (one cpu, smallest memory, and a reasonable complement of peripherals), but there is plenty of room for expansion: Add one, two, or three more processors, supporting I/O controllers and lots of disc storage capacity for systems that will rent for as much as a quarter million dollars a month. Univac claims the 1100/42, dual processor model sports twice the performance of an IBM 158 for one-half the price. Could very well be—Univac's traditionally strong cpus now have the memory performance to match.

Other components of Univac's biggest announcement since the RCA customer base acquisition included several new peripherals for system and data base disc support, and several new software systems. UNIVAC, Blue Bell, Pa.

FOR DATA CIRCLE 224 ON READER CARD

Six New Minicomputer Products

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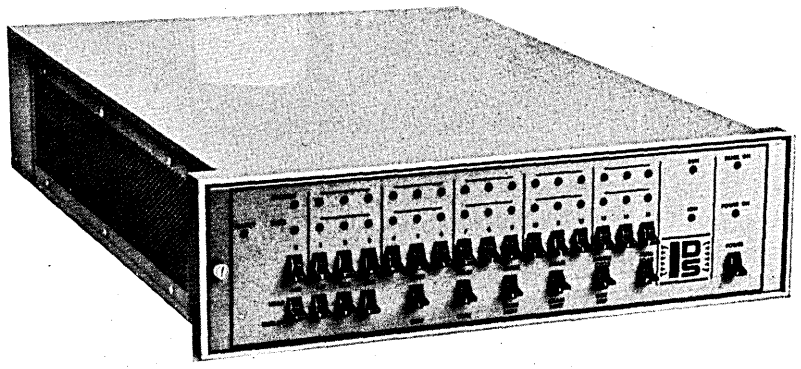

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anteed unit to unit cassette compatibility, high noise rejection ratio through digital signal processing, speed tolerant recording, signal drop out rejection, automatic data buffering and formatting, solid state motor controls, etc. In quantities of less than 10, the MM2000 is priced at $950. Two additional models are offered for the PDP-11 and Nova minicomputers. The vendor also sells an 8K by 8-bit RAM board that features jumper selection on the board of the four most significant address bits. This product is priced at $895. MICROMATION, San Diego, Calif.

FOR DATA CIRCLE 229 ON READER CARD

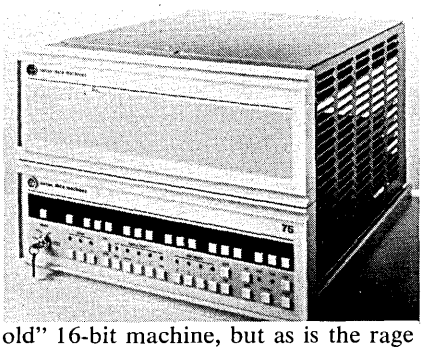
Paper Tape Conversion

The special products division of this well known manufacturer has developed a paper tape to 80-column card conversion system that does not require the participation of a computer. Industry standard paper tape codes are converted into Hollerith code at the rate of 45-75 cards per minute on the SP0010 system by using one of the firm's 8010 interpreting data recorders. Other similar products in the mill include a unit for going from paper tape to 96-column cards, conversion of punched cards back to paper tape (!), and reading of cards directly into a computer. The price of the SP0010 is $16K; delivery is something over three months. DECISION DATA COMPUTER CORP., Horsham, Pa.

FOR DATA CIRCLE 231 ON READER CARD

Minicomputer

Varian hardware has always enjoyed a good reputation in scientific computing circles, and its latest idea of what a high-performance minicomputer should look like will probably uphold that reputation. The V75 is a "good

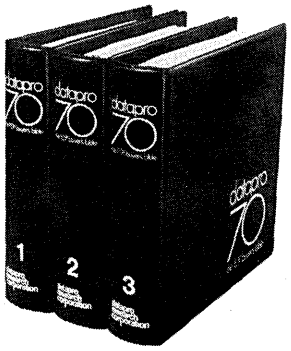


old" 16-bit machine, but as is the rage currently, the company likes to talk about its 32-bit processing capabilities. With impressive hardware speeds (330 nsec memory, 190 nsec writeable control store) and generous use of registers (eight, capable of handling 8-, 16-, and 32-bit operands, plus 1,024 mapping and protection registers for handling the large memory sizes) the V75 can probably do 32-bit work at a reasonable rate, but it would seem that if the user does a preponderance of it, he ought to investigate a 32-bit machine. Still, Varian might be right about the V75 being at least as fast as any other 16-bitter on the market, especially in FORTRAN and assembly language. Dual memory buses allow I/O transfers at up to three million 32-bit words per second, virtually the equivalent of a 12 megabyte bus, and that's fast.

To compete with recent systems offerings from Hewlett-Packard (3000) and Data General (Eclipse C/300), Varian users can now obtain the Cincom Systems TOTAL data base management software system used in over 1,000 installations. TOTAL sells for $9,500 to current Varian users. Prices for the V75 mini start at approximately $50K, with full systems (the manufacturer's specialty) running to $100K and $150K. VARIAN DATA MACHNES, Irvine, Calif.

FOR DATA CIRCLE 232 ON READER CARD

facts and opinions



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CIRCLE 84 ON READER CARD

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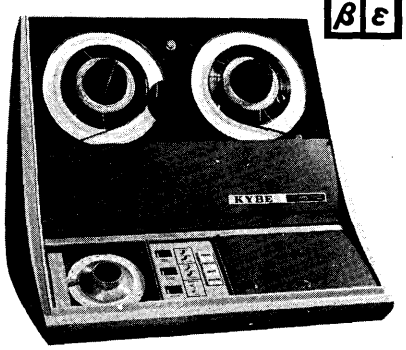


NCC booth 1244 & 1246

CIRCLE 103 ON READER CARD

Crt Terminal

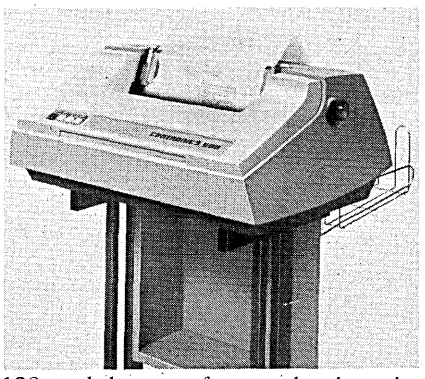
While the 980A is not an intelligent terminal, it is designed to operate in IBM 3270 networks where intelligent terminals are not required for every position in the network. It communicates via IBM binary synchronous com-

munication protocol at speeds up to 9600 baud. It features local editing controls, protected/variables format control, upper/lower case character display, a patented graphics capability, a local printer peripheral interface, an audible alarm, and a security keylock. Other features include 24-line by 80-character display format, black on white display for what is claimed to be increased legibility, simultaneous display of fixed, blinking, or variable data characters, fill in the blanks operation, etc. The price would seem to be competitive: $3,200, or $90/month on a three-year lease, excluding maintenance. APPLIED DIGITAL DATA SYSTEMS INC., Hauppauge, N.Y.

FOR DATA CIRCLE 235 ON READER CARD

Low Cost Printer

The 588 may be the lowest cost 132-column printer in its speed range, providing 88 cps performance from a 64-character set of ASCII for just $2,560. That sounds like a good oem price, but it's not: That's an end-user version—oems get to do even better. The 64-character set is expandable to 96 or



128, and the manufacturer has been in business long enough to be able to offer over 20 foreign language, scientific, upper/lower case and other special character sets. Options include two-channel vertical format unit, audio alarm, automatic on/off motor control, plus a number of serial and parallel interfaces. In addition to multicopy printing, the 588 also features paper feed from either the bottom or rear of the printer. CENTRONICS DATA COMPUTER CORP., Hudson, N.H.

FOR DATA CIRCLE 233 ON READER CARD

Mini Disc

A low-cost head-per-track disc unit is offered Data General Nova and Digital Computer Controls 116 users. The system is randomly addressable down to any 256-word block in 16.7 msec, and has a capacity of 128K words. The data transfer rate is 67K 16-bit words/second, or 15 usec/word. The controller, which handles direct memory access transfers, plugs into one slot of the mini's cpu, and is capable of controlling up to four drives. The system is said to be transparent to the manufacturers' DOS and RDOS operating systems, and can operate with the Data General 4019 NovaDisc controller. The price of $3,200 includes the controller, disc, and interconnection cable. INTELLIGENT MEMORY SYSTEMS, INC., Anaheim, Calif.

FOR DATA CIRCLE 234 ON READER CARD □

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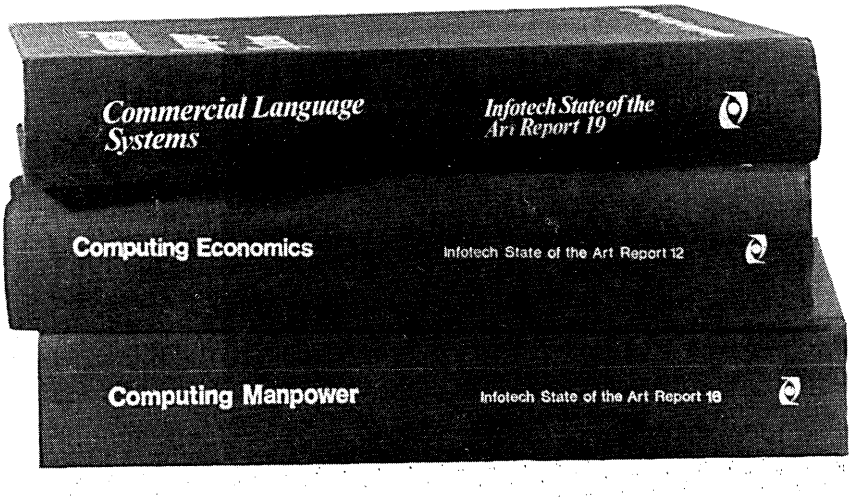

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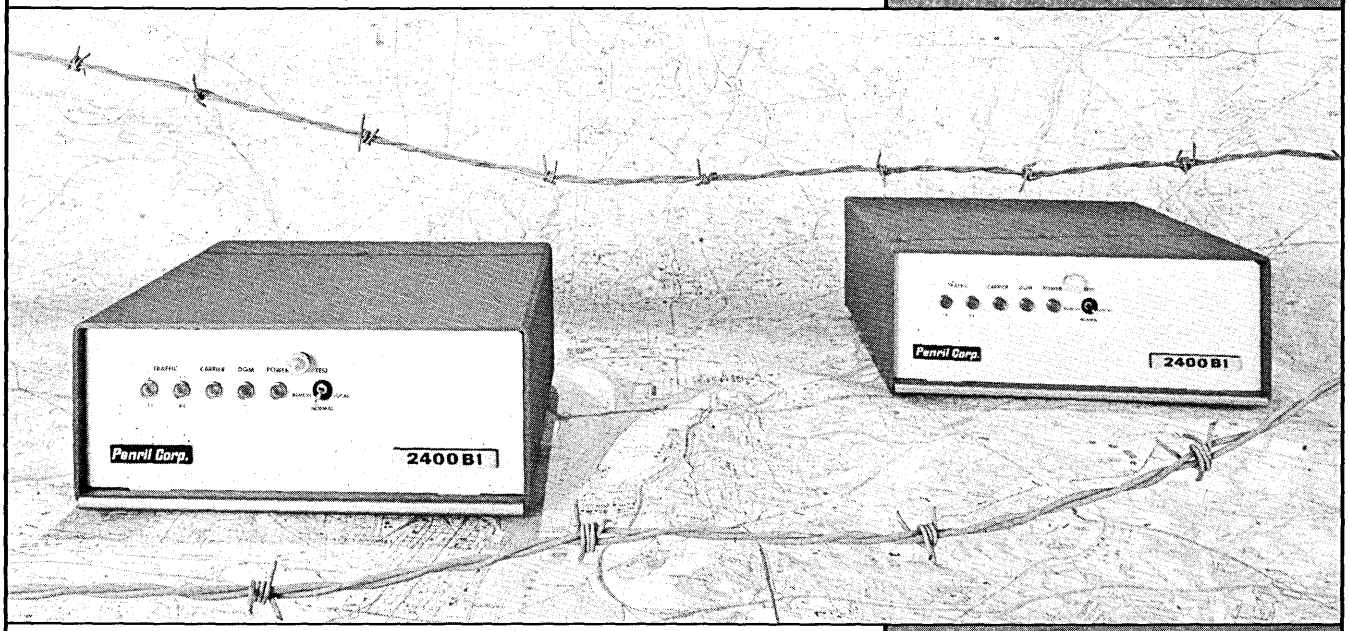

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Updates

Here's an idea that's bound to catch on around the country. An organization called Independent Computer Professionals Assn. has been formed in San Jose, Calif. to perform programming and system design tasks. As a user you tell the ICPA what kind of programs you need written, for what computer, and other pertinent information, and the association publishes it in its bulletins. Members bid on the jobs, and the user can select who will perform the work. The service is being promoted with pitches that you don't have to pay for the job until it's completed to your satisfaction and that even if you have an in-house programming staff it's cheaper to have the work done outside since staff programmers receive regular pay checks whether the job is completed or not. Might just be a good idea.

Watch out, world. The University of Southern California just could be scheming to take over the world record in the pole vault--permanently. One of its professors has recently simulated what an ideal pole for the purpose would look like and found that a curved pole could significantly increase the height of a vault. A bend of 1.3 feet in the middle of the pole is theoretically capable of raising the record an additional 1.8 feet. As impressive as that sounds, Prof. James Vernon of the engineering school calculated that a pole vaulter could conceivably reach a height of 28.5 feet--although it would take an athlete with the speed of an Ivory Crockett, the balance and agility of an Olga Korbut, and the strength and height of a Wilt Chamberlain. Knowing USC's alumni, the school is probably out looking for such an athlete right this minute...

Despite some slowdown attributable to the economy computer users are spending more than $400 million annually on software packages according to International Resource Development Inc., New Canaan, Conn. That's over a million per day, but still a small percentage of the more than $7 billion users will pay this year in the form of salaries to programmers and systems analysts. The firm has recently completed an extensive report on the changing shape of the software industry.

Time-sharing for VS/1

This firm has decided to concentrate on enhancements for IBM's VS/1 operating system, and its first announcement might cause the cancellations of some system analysts' vacations this summer. The Time-sharing option (TSO) monitor can now be run under the VS/1 monitor releases 3.0 and 3.1, thanks to some enhancements and changes made to the system. TONE, as the product is called, currently supports the VS/2 release 7 of TSO.

A full range of terminals is supported under TONE, including 3270 locals, 3270 remotes, 2741, 2260, 3215, 3210, 1052, ttys, and the 2740 models I and II. Also available is full batch support for teaching purposes. Console I/O is supported through BTAM, GAM, or EXCP for the respective terminals.

Installation is said to be "roughly" equivalent to an I/O system generation, requiring five hours of system time if you go at it in an organized fashion. Documentation is provided in dataset form to allow reprint by the user at minimum cost—a nice feature. TONE rents for $200/month under a nondisclosure agreement, including 24-hour maintenance. TONE SOFTWARE CORP., Garden Grove, Calif.

FOR DATA CIRCLE 212 ON READER CARD

Data Collection

The Source Data Collection System was developed for small (50-500 employees) businesses going into source data collection applications for the first time. Principally of interest to users in the fields of manufacturing, printing, distributing, and smaller hospitals, the program performs such functions as recording shipments and receipts, tracking production, recording attendance, and monitoring employee time spent on a particular job. The program operates on IBM's System/7 industrial computer. Up to 31 2796 and 2797 data entry units can be attached to the system by using a special hardware attachment that obviates the need for a separate controller. Data is entered into the terminals with cards, badges, or a keyboard. The program compiles and reports the collected information in either punched paper tape or punched card form for later processing on a System/3 or other computer. Available in July, the Source Data Collection System is available under a license charge of $130/month for six months. IBM CORP., GENERAL SYSTEMS DIV., Atlanta, Ga.

FOR DATA CIRCLE 213 ON READER CARD

Information Management

CONFIRM is described as a "poor man's IMS" after IBM's Information Management System in use in many large installations for years. The service is offered to non-programmer people who need access to a computer to manage a number of smaller files.

Conversational File Information Re-

software spotlight

IBM Disc Maintenance

IBM users who have upgraded to 3330 disc systems from 2314-type devices will immediately appreciate the significance of this routine, called DASD 3336. It allows the user to re-DASD his disc packs and recover the use of flagged tracks. Since alternate tracks are always located beyond cylinder 404—on the innermost reaches of the physical pack—programs accessing data on tracks that have been copied to alternate cylinders pay a processing overhead penalty by forcing the 3330 pack to jump from flagged track locations to the inside of the pack.

DASD 3336 actually performs three functions. It scans packs and lists all flagged tracks together with their alternates; tests all flagged tracks to determine whether they will successfully hold data and if so, incorporates the alternate tracks back onto their proper place in the file sequence; and initializes new packs from scratch. The program is probably best used in conjunction with regular disc pack cleaning procedures. The package, priced at $1,250, is supplied in object deck form for 360 and 370 system users, and requires approximately 48K of memory on non-virtual systems. ECONOMIC DATA PRODUCTS INC., Long Beach, Calif.

FOR DATA CIRCLE 211 ON READER CARD

ASI-ST

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trieval and Management is written in FORTRAN to operate with short English commands. The user can create tailored reports from his data base, complete with report titles, column headers, page numbers, dollar signs and totals and subtotals accurate to 60 places. All that is required is a 10, 15, or 30 cps terminal for accessing the vendor's nationwide time-sharing system. Each data file can have up to 100 columns of either numeric or alphanumeric data. Each column may be up to 31 characters wide, provided the sum of all column widths does not exceed 2,048 characters. There are no restrictions on the number of rows. The user, in building his reports, can include or exclude whole rows and columns of data, or he can include or exclude only those rows and columns that meet certain conditions. After specifying the data to be extracted, the user can sort it with another command eight different ways simultaneously in either ascending or descending order. Charges for using CONFIRM are $10/hour terminal connect time, 20¢/second cpu time, and 40¢/month for each one thousand characters stored on disc. MCDONNELL DOUGLAS AUTOMATION CO., St. Louis, Mo.

FOR DATA CIRCLE 223 ON READER CARD

System Documentation

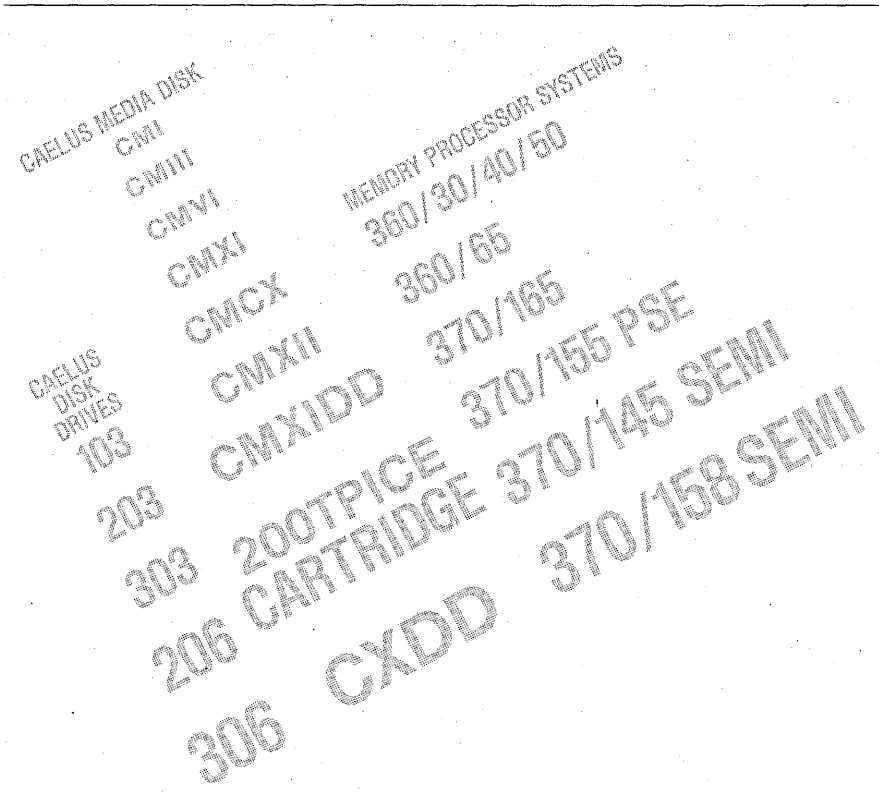
The very successful AUTOFLOW II program analyzer/auditor has had a very interesting option added to it called the Automated System Charter (ASC). Extracting information from the job control language of IBM's DOS and OS monitors, ASC generates reports for a hierarchy of dp personnel, including system analysts, programmers, operators, and shop managers. The user can select from reports that include: a system chart, in graphical form, which diagrams the relationship of jobs, processes, and data entities (input, output, etc.); a tabular report with supplementary annotation giving the same information as the system chart; a job report, primarily an index of jobs and their processes; a process report that acts as an index of all processes (programs) and their related data elements; a data report, a directory of all data elements that interact with the system; and a system logic chart, diagramming processes of the system in terms of the decision logic which determines whether each process will be executed. DOS AUTOFLOW users can take advantage of ASC for an additional $3,740, while OS users will have to come up with an additional $550. APPLIED DATA RESEARCH, INC., Princeton, N.J.

FOR DATA CIRCLE 214 ON READER CARD

Data Base Development

With the trend toward data base processing clearly established, IBM has come up with a programming aid to simplify the development and organization of data base structures. Called the Data Base Design Aid (DBDA), the tool can be used with vs/1 and vs/2 operating systems both to design data bases for new applications, redesign existing data bases, or add new elements or relationships to existing data bases.

The application system designer starts by providing DBDA with a description of the input, processing, and output requirements of applications that will use the data base. DBDA analyzes the design choices in structuring the data base and detects omissions, inconsistencies and redundancies



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CIRCLE 114 ON READER CARD

in the requirements. Reports show the designer the data elements of the data base, the relationships among the data elements, a grouping of the data elements in suggested segments, a suggested hierarchical organization of the segments, and a list of candidate segments for secondary indexing. Available before the end of next month, the Data Base Design Aid program has a monthly charge of $200. IBM CORP., White Plains, N.Y.

FOR DATA CIRCLE 215 ON READER CARD

Mini Cobol

A COBOL compiler complete with a sort/merge is offered users of Data General minicomputers with at least 16K words of memory, one disc unit, and a tty. Surprisingly, the ANSI compatible compiler is very close to the minimum ANSI COBOL subset for big machines. Among MINI COBOL's features are random and sequential I/O provisions; extensive PICTURE editing capabilities; "unlimited" paged PROCEDURE DIVISION size; COMPUTEd expressions; accommodation of external subroutines; extensive IF conditions; data redefinition capabilities, and more. Including a user's manual and installation instructions, MINI COBOL is priced at $2,500. The package can also be leased. INTERNATIONAL COMPUTER TRADING CORP., San Francisco, Calif.

FOR DATA CIRCLE 216 ON READER CARD

Varian Software

This firm offers data processing services to nearly 600 law offices from Alaska to New Mexico using Varian hardware—machines that are not often thrust into commercial applications. The firm is high on the Varian equipment, however, and is offering some of the routines that have made their services successful to other Vortex I and Vortex II operating system users.

Four routines are offered. The first is an indexed sequentially file access technique (ISAM) that permits random access to sequentially maintained, multipartitioned (to 30), and multivolume files for $2,500. A QSAM package is offered featuring dynamic space allocation on output for a uniform set of block/deblocking and multibuffered sequential access facilities, $1,200. Sort/Merge, operational in foreground and background partitions is offered, with full record sort or tags providing for up to eight simultaneous, intermixed, overlapping control levels, $2,500. The Move/Copy routine provides facilities to condense and reorganize user data files as well as foreground/background object module libraries, $700. PRODATA INTERNATIONAL CORP., Santa Rosa, Calif.

FOR DATA CIRCLE 217 ON READER CARD

Manufacturing System

The Manufacturing Material Control System (MMCS) represents nine man years of development to give users a choice between a complete turnkey system and a complete in-house "from the ground up" application system. Designed to operate on IBM's 360/370 series equipped with the DOS operating system, the MMCS includes a full Bill of Materials Processor, including summarized bills, parts list and catalog, costed bills, and where used reports. Also generated are requirements reports, inventory reporting encompassing several types of inventory movement, stock levels, allocations, kit lists, price lists, and ABC analysis.

MMCS, which can either be run "as is" or be modified to installation requirements, can also be expanded to handle sales orders and warehouse files. Three standard IBM bill processor

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mainlines are used to maintain files for parts, job/purchasing, and work center, as well as three chain files for routing, work in process/job purchase order, plus a parts product structure file. All 34 edit, calculation and report programs are written in COBOL, with source code, JCL, and manuals included in the $7,500 price. Lease plans and installation assistance are available. RLD ASSOCIATES, Los Gatos, Calif.
FOR DATA CIRCLE 218 ON READER CARD

S/3 Information Retrieval

The growing number of financial, business, industrial, and governmental users of the IBM System/3 computer are offered an information retrieval package for use by non technical personnel. SYS3AUDIT can be used to generate multiple free format reports, perform selective report sorting, calculation, subtotaling, file footings, record counts for beginning users, while providing more sophisticated capabilities to advanced users, such as parameter value extraction, sequential internal extraction, multiple file handling, etc. Optional capabilities include confirmation printing, aging, file outputs, proportional sampling, and special file handling modules. The package is a parameter driven load and go system that requires a 16K system, one disc, printer and reader. Written in assembler language, SYS3AUDIT rents for $2/day after an installation fee of $500. COMPUTER AUDIT SYSTEMS, INC., West Orange, N.J.
FOR DATA CIRCLE 219 ON READER CARD

Assembler Debugging

SHOW ME is another product that attempts to speed up the debugging of assembler language programs by giving more and clearer information than IBM system SNAP and ABEND memory dumps provide. The SHOW macro uses a simple syntax to provide data formatting capability for printing registers and user data and tracing intermediate program states. Data may be printed in decimal, scientific "E" notation, character, and hexadecimal formats. The format control is said to be powerful enough to allow the writing of reports. Program checks are trapped, allowing multiple tests per each program run, instead of merely exiting. Execution is transparent to the user program and does not alter data fields, registers, or even the condition codes, it's claimed. A perpetual lease for SHOW ME costs $885, and a 30 day free trial is offered. OS and VS versions are available now, and a DOS version is being worked on. SALSBURY INFORMATION SYSTEMS, Palo Alto, Calif.
FOR DATA CIRCLE 220 ON READER CARD

Information Retrieval

A general-purpose information retrieval system is being offered to users of DEC's PDP-11 minicomputer equipped with the RSTS time-sharing monitor. GPRS features on-line updating, field editing, sorting, generalized logical subset selection, tabulation and control break options, "virtual" files minimizing storage requirements, user-defined utility functions, simultaneous multiple user access to a file, automatic letter writing, etc. The report generator produces columnar reports, single or double spaced, with headings. Control break capability (forms or line-eject at changes in field contents) and a field editing function (for floating dollar signs, zero suppression, decimal insertion, etc.) provide formatting flexibility. An additional "literal print" module allows for printing fields mixed with user-specified characters, useful in generating letters, grade reports, or invoices for specified sets of data base records. The source code software is accompanied by support documentation and "building block" software modules to facilitate integration of user-developed software into the GPRS file scheme. The package is priced at $3K. EDUCOMP CORP., Hartford, Conn.
FOR DATA CIRCLE 236 ON READER CARD

Operator Aid

An IBM DOS installation purchasing OP-EASE-ONE could reasonably be accused of making life a lot easier for its computer operators—with a corresponding increase in productivity more than likely. Essentially the package is a very minor modification to the console message OP6OD INTERV REQ message that signifies an I/O intervention is pending. The message occurs all the time in multiprogramming environments, and if the operator gives the wrong reply, programs bomb out. OP-EASE-ONE changes the message to a purely informational line and readies the console for communications. Source decks are priced at $200, object decks at $100, and the package reportedly can be installed in less than a minute. GENERAL ELECTRONICS, Lyons, Ill. □
FOR DATA CIRCLE 222 ON READER CARD

CIRCLE 95 ON READER CARD

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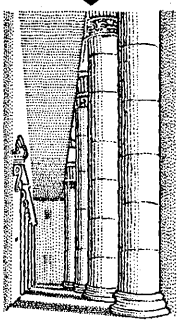

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'75 NCC Product Preview

(Continued from page 54)

lighted, non-glare 2x magnification of the disc surface through its adjustable optical system. It is designed for front loading 2315-type and top-loading 5440-type cartridges. It's priced at $850 in small quantities.

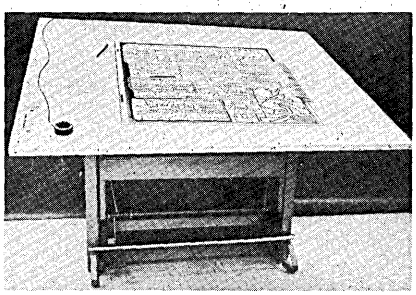
FOR DATA CIRCLE 156 ON READER CARD

TALOS SYSTEMS

Scottsdale, Ariz. **Booth 1350, 52**

Electronic Digitizer

One—and four-button cursors for its Cybergraphic digitizer line will be displayed by this manufacturer. The large viewing area and precision graticule are



said to give the cursors no parallax or vector error. A magnification option is available for highly detailed work. The one-button cursor is $200; the four-button model is $250.

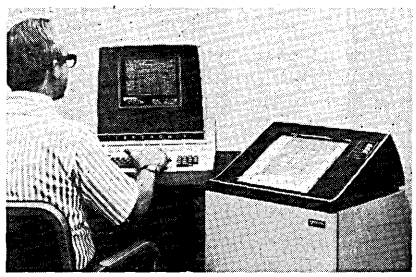
FOR DATA CIRCLE 157 ON READER CARD

VERSATEC, INC.

Santa Clara, Calif. **Booth 2558, 60**

Graphics Hard Copy

High volume graphics terminal users will see a hard copy unit that attaches to numerous models in the Tektronix terminal line. The use of an electro-static printer/plotter reduces the cost per



copy considerably compared to using dry silver paper—after the front end cost of the product is absorbed. The C-TEK controller can handle up to four terminals of the 4010, 4012, 4013, 4014, and 4015 nomenclature. The new controller is priced at $950; the associated printer/plotter at approximately $6,900.

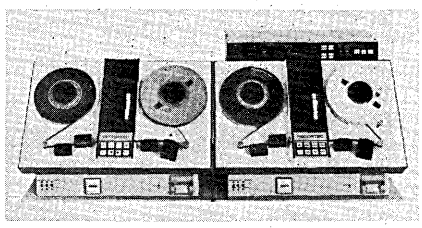
FOR DATA CIRCLE 158 ON READER CARD

RECORTEC, INC.

Sunnyvale, Calif. **Booth 1304, 06**

Magnetic Tape Duplicator

The Computer Tape Copier (CTC) is designed to duplicate 1600 bpi tapes off-line so that no original tapes need ever leave installation tape libraries. Less



than 10 minutes is required to copy a complete 2,400 foot reel. The device can be used to write headers, verify incoming data tapes or archival tapes while cleaning them, and clean and evaluate scratch tapes. The unit is priced at $24,750—which is less than one high-performance tape drive alone on many systems.

FOR DATA CIRCLE 159 ON READER CARD

Added Attractions

VECTOR GENERAL, Canoga Park, Calif., graphics terminal manufacturer claims to have the largest booth at the show at 40 thousand square feet. It's the home office. Inside booth 2615 will be a pilot who will whisk potential customers to the plant in a twin engined Cessna, serving canapés and drinks en route. That's class—first class. The whole tour will take 2 ½ hours. . . Local mini manufacturer KERONIX, booth 2563, who is suing Data General Corp. for allegedly setting fire to its plant recently, reportedly has the booth immediately adjacent to DG—which might cause some friction. . . DATAPOINT CORP. will be displaying its Datashare 3 operating system in booth 1649. The system is a business-oriented, dispersed data entry and processing system for the firm's top-of-the-line 5500 intelligent terminal. . . If Anaheim is anything like Chicago, the trophy for "longest line of people to get in a booth" will probably fall to SPATIAL DATA SYSTEMS, Goleta, Calif. The COMPUTER EYE model 108 will probably be used to generate photographs of attendeees willing to stand in the line. Booth 1740. . . New 5 and 10 megabyte capacity fixed-discs will be on display at DIABLO SYSTEMS, INC.'s booth 1461 which are designed to match the disc storage capacities of IBM's recently announced System/32. . . GLASER DATA COMPANY, Palo Alto, Calif., will be showing several versions of its plotter design, an 18 x 22 1/2-inch unit that operates at 2.8 ips, booth 1258. . . Plotters will also be the subject in HOUSTON INSTRUMENT's booth 2717. . . TRUE DATA CORP., Santa Ana, Calif. will be one of the firms at the show with a version of a single-feed card reader. These devices are intended for hand-marked inventory cards and restaurant or fast-food tabs, punched cards used for product manufacturing monitoring, and automatic toll road/rapid transit gates. Booth 1209. . . The VALCOMP division of Tym-share, Inc., Westlake Village, Calif., might have the most unusual offering at the show: refurbishment, parts, and services to keep dp systems operating for 20-40 years, the typical lifetime of heavy plant equipment. Booth 2650. . . TELETYPE CORP., Skokie, Ill., will show its model 40 receive only printer in booth 1617. It operates at speeds up to 2400 baud through RS232 interfaces and prints 80-character lines. Pricing can be termed attractive if you are a potential customer, aggressive if you're a competitor. . . BASIC TIME-SHARING CORP., Sunnyvale, Calif., will show its largest system so far, the 4000, in booth 1221. It's claimed that up to 256 simultaneous users can be supported on the BASIC-language system. . . TALLY CORP., Kent, Wash., will show its series 4300 300 lpm printer in booth 1539. The just announced unit is designed for oem's to sell to end users for something under $10K. . . DATARAM CORP., Cranbury, N.J., will show a 32K x 20-bit single-board core memory system and four new 16K systems in booth 1260. . . Perennial attendeee NORTRONICS CO., Minneapolis, Minn., will be showing a new ferrite floppy disc head in booth 1641. . . The IBM compatible device is electrically interchangeable with steel floppy disc heads currently in use. . . INTERDYNE, Van Nuys, Calif., will be showing oem and end user configurations of digital cassette tape drives in booth 1312. . . POWERTEC, Chatsworth, Calif., will be showing a new series of oem open frame DC power supplies in booth 1655. . . MONOLITHIC SYSTEMS CORP., Englewood, Colo., will be displaying plug-compatible memory addons for DEC PDP-11 minicomputers in booth 1500. . . A 64K system using 4K bit chips is priced at $7,760. . . DIGI-LOG SYSTEMS, INC., Horsham, Pa., will show its data line monitor in booth 1468. . . The device gives users thumbwheel selection of any of 15 data rates to help diagnose communications problems. . . A new low-cost conversational crt terminal, the Elite 1520A, will be displayed by DATAMEDIA CORP., Pennsauken, N.J. in booth 1141. APPLIED SYSTEMS CORP., St. Clair Shores, Mich., will display a microcomputer-based controller for supporting a variety of terminal devices, including tty's, crt's, 3M cassettes, etc., in booth 2145. . . MELCO U.S.A., INC., Compton, Calif., will show a tricolor display of 2000 characters and a small-scale computer system in booths 2145, 47, 49. □

source data

(Continued from page 34)

application may be installed independently on- or off-line. THE WEILAND COMPUTER GROUP, INC., Oak Brook, Ill.

FOR COPY CIRCLE 204 ON READER CARD

Project Graphics

A report describes cost and time savings for users of automated project graphics (time scaled networks, Gantt barcharts, etc.). Included are cost tables for manual and automated productions for both logic-only and time scaled network diagrams. The calculation method is presented in general terms so the reader can plug in his own labor rates, drafting speeds, etc. SYSTONETICS, INC., Anaheim, Calif.

FOR COPY CIRCLE 205 ON READER CARD

Timesaver for Programmers

This vendor claims up to 80% timesaving in programming IBM 360/370 systems with its DYL-260 software package. An 11-page brochure describes the package's use in areas such as operations, applications programming, auditing, and systems programming. It provides three main functions as a report writer/composer, a data management system, and as an extended utility; and it operates on OS, DOS, and virtual systems. DYLAKOR SOFTWARE SYSTEMS, INC., Encino, Calif.

FOR COPY CIRCLE 206 ON READER CARD

User's Program Library

A library of over 55 nonproprietary programs, subroutines, procedures, and macros written for Intel's 8008/8080 and 4004/4040 Microcomputers is available by subscription, or free to contributors of a qualified program to it. As new programs are added, subscribers receive periodic updates, including revisions to appropriate indexes. Some of the programs are operating, testing, and debugging programs; math and numerical manipulation programs; quicksort procedures; a binary search routine; etc. Subscription: $100/yr. INTEL CORP., Santa Clara, Calif.

FOR DATA CIRCLE 207 ON READER CARD

Remote Video Display

A four-page illustrated brochure describes this vendor's SERIES 700 MIDS (Microform Information Dissemination System). This remote video display system allows the user to query a remote central file for display of the retrieved record on a terminal in his own office. The system accommodates massive personnel, insurance, fingerprint, and photographic files, all miniaturized on microfiche or other microforms. DYMAT PHOTOMATRIX CORP., Santa Monica, Calif.

FOR COPY CIRCLE 208 ON READER CARD

Monitoring System

Continuous monitoring and control of individual production operations by the DATACOM system is detailed in a six-page brochure. A plant's profitability/productivity can be increased by this system, it is claimed, by reducing downtime, setup time, and in-process inventory, and by providing accurate production counts. The system consists of work station terminals that automatically collect production information from each individual machine, a central control unit, data display, and report printer. On-going communication with machine operators, foremen, and supervisors is a feature of the system, which can also be directly linked

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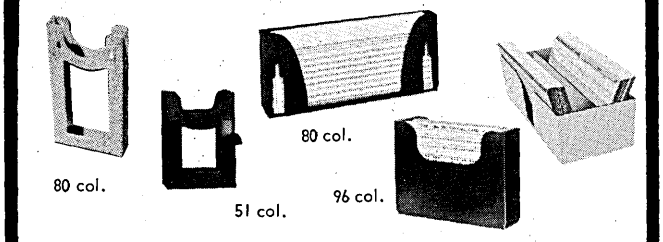
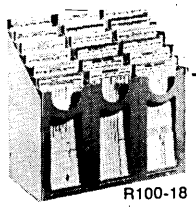
FOR SYSTEM 3—80 COL.—51 COL.
RACKS — TRAYS — ACCESSORIES



Holders with magnets or adhesive strip. Spring clips for attaching to shelves.



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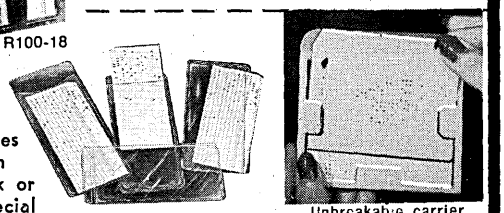

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Two Cheers for the Affluent Society

by Wilfred Beckerman
St. Martin's Press, New York, 1975
238 pp. $7.95

Subtitled "A Spirited Defense of Economic Growth," this book by a British economist presents an argument in favor of orderly increases in the gross national product, with specific discussions of the effect on the environment.

Reliable Software Through Composite Design

by Glenford J. Myers
Petrocelli Books, 1975
159 pp. $11.95

Aimed at the experienced programmer or systems analyst, this book tackles the problem of "poorly constructed, far too expensive, and unreliable" programs by offering "a set of design measures, strategies, and techniques collectively known as 'composite design' [used for] highly modular programs." Emphasis is on practical applications rather than on theory.

Guide to Reference Sources in the Computer Sciences

by Ciel Carter
Macmillan Information, 1974
237 pp. $25

This useful book, international in scope, contains detailed evaluations and descriptions of materials—journals, books, encyclopedias, dictionaries, handbooks and manuals, bibliographies, etc.—plus professional organizations, research and information centers, computer industry trade associations, etc. Full addresses and phone numbers for all organizations, plus publishers, are included.

Changing Patterns in Information Retrieval

Carol Fenichel, ed.
American Society for Information Science, 1155 Sixteenth St., N.W., Wash., D.C. 20036, 1974
192 pp. $15.00

This book contains the Proceedings of the 10th Annual National Information Retrieval Colloquium, May 1973, in Philadelphia. Contents include papers on user behavior, organization strategies, and information as a product.

Computer Accounting Methods

by Gregory A. Cook, Barbara J. Wade, & Clark C. Upton
Petrocelli Books, 1975, 184 pp. $6.00

This handbook, geared for business managers and accounting personnel, presents computer comcepts, techniques and methods needed to develop computerized accounting systems.

Digital Engineering

by George K. Kostopoulos
John Wiley & Sons, 1975
508 pp. $24.95

The book purports to "effectively relate the theory and development of digital techniques to actually available hardware." To achieve this goal, the text features over 300 illustrations and a number of problems ranging from "simple routine exercises to practical engineering applications."

Essentials of Flowcharting

by Michel H. Boillot, Gary M. Gleason & L. Wayne Horn
Wm. Brown Co., Dubuque, Iowa, 1975
114 pp. $2.95

The title summarizes the contents—the authors have presented an introduction to flowcharting along with definitions, illustrations, and numerous examples. An appendix contains sample COBOL, BASIC and FORTRAN programs. □

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letters

(Continued from page 10)

```
IF (X.WAS.EQ.5) GONE TO 50)
IF (X.WILL.BE.EQ.7) GOING TO
70
```

These operations have countless uses in tracing and debugging by determining previous and future values for a given variable when they have been written over or not yet calculated.

MALCOLM D. TEMPERLY
Editor, APL Supplement
Canberra Computer Bulletin
Canberra, Australia

Phi on iph phunctions

As a consultant to a company that is thinking about using microcomputer components to replace portions of a large discrete logic network, I have been following with diligence the recent discussions in your magazine concerning "Divergent Programming" techniques. I feel that these methods could yield very powerful software mechanisms for simulating the arbitrary logical system.

One useful tool, whose lack I often regret, would be a method for the simulation of the logical ø, or PHI function. An example of the use of the PHI function is in the reduction of the truth table of the OR-GATE:

A	B	C=A+B	A	B	C=A+B
0	0	0	0	0	0
0	1	1	ø	1	1
1	0	1	1	ø	1
1	1	1			

The first table might be represented in a program by something equivalent to: C=.NOT.(.NOT.A.AND . . NOT. B).OR.(.NOT.A.AND.B).OR.(A. AND . . NOT.B) .OR.(A.AND.B)

Whereas the second table, given the PHI function, would generate: C= .NOT . (.NOT.A.AND . . NOT.B) .OR. (.PHI.A.AND.B) .OR. (A.AND . . PHI.B)

This is a reduction from 4 terms to 3! When one further considers that, in theory, any logic network can be implemented as a combination of OR- and NOT-GATES, one realizes the power of the concept.

It would further be reasonable to expect that a PHI function could be useful in other types of data processing. For example, COBOL might have a REGARDLESS WHETHER statement.

There are also times (admittedly more rarely) when an inverse or complementary PHI function could be useful. (Perhaps we would call such a complementary PHI an IPH function?)

MICHAEL RAY SPEER
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Edward Yasaki does an exceptional job in your February issue of discussing a subject that does not get enough attention in data processing circles. At some time in the near future I hope that he will turn his attention to two other developments that will soon strongly impact the automated office . . .

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BELDEN MENKUS
Bergenfield, New Jersey

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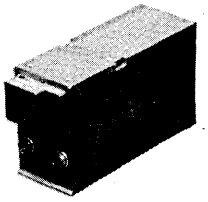

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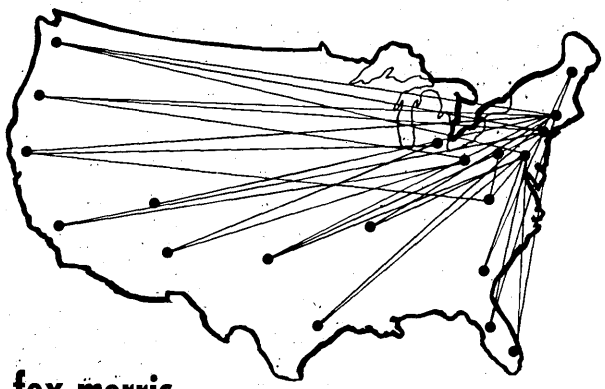

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Applied Technology, Inc. 196
BASF Systems 16
Basic/Four Corporation 129
BASIC Timesharing 112, 113
Beehive Terminals 97
Beemak Plastics 192
Bell & Howell, Inc. Business Equipment Group ..6, 7, 32, 33
Boeing Computer Services, Inc. 187
Cadillac Associates, Inc. 197
Cambridge Memories, Inc. 121
Caracteres SA 171
Centronics Data Computer Corp. 116
Computer Corporation of America 76
Computer Devices Inc. 188
Computer Sciences Corporation 206
Computer Transmission Corporation 107, 115
Comtal Corporation 23
Control Data Corporation 132
Cooke Engineering Company 138
Cummins-Allison Corp. 72
Data General 134, 135
Data 100 Corporation 42
DatagraphiX 172
DATAMATION 38
Datapoint Corporation 40, 41
Datapro Research 180
Datran 8
Delta Data Systems Corporation 198
Digi-Log Systems, Inc. 164
Digital Equipment Corporation 78, 79
Documation Incorporated 22
DPMA 195
Electronic Memories & Magnetics 186
Elgar Corporation 4
ESP Associates 197
Fabri-Tek Inc. 139
Fenwal Incorporated 77
Formation, Inc. 158
Fox-Morris Personnel Consultants 197
General Computer Systems, Inc. 149
General Electric Company, Communication & Control Devices Department 35, 36, 37
Gould Inc., Instrument Systems Division 108, 109
Robert Half Personnel Agencies 200
Harris Corporation, Data Communications Division ..... Cover 3
Harris Computer Systems 104, 105
Harris Corporation R F Communication Division 169
Hazeltine Corporation 28
Hewlett-Packard 25, 160, 161
Houston Instrument, Division of Bausch & Lomb 69
IBM 154, 155
IMLAC Corporation 85
Incoterm Corporation 100
Independent Computer Professionals Association, Inc. ... 192
Info 75 205
Inforex, Inc. 118, 119
Information Terminals Corporation 31

ndex

Infotech 182
Infotron Systems Corporation 156
Integrated Software Systems Corp. 110
Interdata 126, 127
International Communications Corporation 11
International Power Machines Corporation 122
Iomec, Inc. 90
ISCOL, Ltd. 199
Itel Corporation 2
Jacquard Systems 76
Kennedy Co. ..... Cover 2
Keronix Corporation 179
Kybe Corporation 180
Liebert Corporation 142
Logicon-Intercomp 24
LRK Associates 201
Maxell Corporation of America 84
Microdata Corporation 1
Modular Computer Systems Inc. 150, 151
NCR Retail Systems Division 197
Nudata Corporation 170
Oregon Research Institute 202
Penril Corp. Data Communications Division 183
Pericomp Corporation 170
Quest Systems Inc. 196
Randolph Computer 5
Raytheon Service Company 92
RCA Service Company, A Division of RCA, Technical Services 166
Research Inc. 12
Romac & Associates 196
Royal Label Company 166
RSVP Services 206
Rusco Electronic Systems 70, 71
S C Electronics, Inc. 124
Shinshu Seiki Co., Ltd. 190
Software AG 181
Source EDP 200
Spatial Data Systems, Inc. 205
Sperry-Univac 145
Sweda International, OEM Products Division 203
Sycor 98, 99
Systems Engineering Laboratories 140, 141
Tally Corporation 175
T-Bar Incorporated 68
TEC Incorporated 189
Tektronix, Inc., Information Display Division 39
Teletype Corporation ..... Cover 4
Telefile Computer Products, Inc. 177
Texas Instruments Incorporated, Digital Systems Division 26, 27
3M Company, Data Recording Products Division 162
Trendata 128
Tri-Data 204
United Air Lines 130
University Computing Company 136
U.S. Trade Center 194
Varian Data Machines 19
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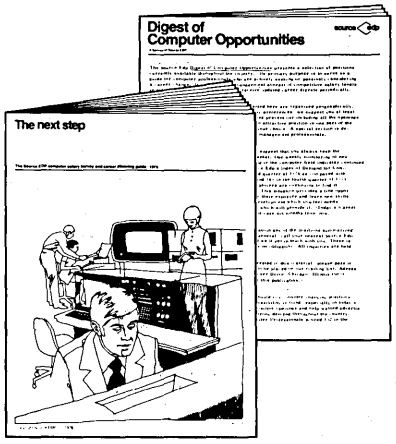

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the forum

MEMORIES OF THE FUTURE

It is not too soon to begin anticipating unlimited real or apparent computer memory. Although there is a natural tendency to think of advancing hardware technology in terms of central processing unit speeds or calculations per dollar, we are all aware that the hardware state of the art has many facets. These divide themselves into two areas, the "How fast?" area and the "How much?" area, and progress and the potential for progress in the two areas differ. It is also true that the impact of progress in the two areas differs, for while increases in processing speed produce cost savings, increases in storage capacities invite qualitative and methodological changes.

Cpu performance is largely a function of the time needed for a reliable component to change its binary state and the physical distance between components. To a lesser degree, it is influenced by cleverness of design. In theory cpu performance can yet be enhanced considerably by further miniaturization and by the use of specialized subsciences such as cryogenics; and it is also true that the changes that distinguished the second generation of computer hardware from the first, and the third from the second, were cpu performance-related changes. Nevertheless it seems likely that future progress in this area will be less significant than an extrapolation of events to date would lead one to believe. For the business community especially, large memories may be both more likely as affordable possibilities and more important to the extension of data processing influence than will faster cpus.

There are two avenues to the near-infinite extension of memory size. One is the treatment of on-line storage devices as virtual memory, examples of which already abound. Double-density discs and IBM's cartridge tape systems, coupled with new software, could conceivably be combined to produce the effect of unlimited memory, although it would be rather too slow for practical use.

The second method of enlarging computer memory is to actually build a device that is directly addressable by the cpu and stores trillions of bits. Proposals for accomplishing this range from the apparently workable bubble memory, through closely spaced pits burned by laser into a data layer, to controlled modification of a standing light wave.

I expect unlimited memory to be the technological innovation that characterizes the true fourth generation. Now is the time to weigh the potential of this innovation, not in terms of stock market fluctuations and corporate gamesmanship but in relation to what computer users need and to what seems to be the promise of the computer phenomenon.

The following brief history of the future is possible:

a. Major vendors develop or secure the rights to an unlimited computer memory capability.

b. Forbidden to promise or preannounce, each modifies its existing hardware and software to utilize the new technology and hits the market with a new generation of machines as quickly as possible.

c. Several tons of conversion aids accompany release 1.0 of what might whimsically be referred to as the "future system."

d. User improvements to FS crop up all over the place. These are all good, and all different.

e. Fourth generation prices are determined by free and open competition, and when entered into the cost/performance equation are seen to barely but definitely justify conversion.

f. Release 1.6, 2.0, 2.6, 2.62, ... ad infinitum.

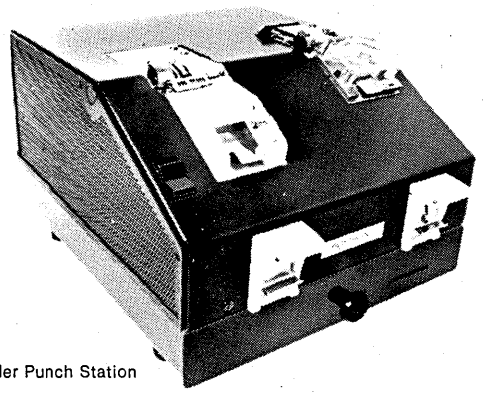
This scenario is not necessarily a bad one. It admits of no big losers. It is tolerable, even redundant. But for the industry to follow it blindly would be an esthetic blunder, something like sending a bright child into the mines. For there is a clear-cut end to computer development, reachable after our machines become so efficient that only the human factors of time and education matter, and it would be better to look to this end now than to visit every node of the tree of intermediate states which branches from it.

Some of the elements of ultimate data processing, the achievement of which will require cheap unlimited memory, are: the elimination of the concepts of data files and records, and their replacement in programming languages by logical methods of invoking properly qualified data elements; the thorough separation of data entry functions from data reporting functions; the development of better and more universal languages, particularly of one common remote terminal language; the elimination of data storage device considerations, even at the systems programming level; and the elimination of systems programming.

Of course the tendency toward each of these elements except possibly language commonality is already with us. There is nothing new here. The point is that pace and direction are being determined almost in secret and are being dictated to users by vendors, instead of the other way around.

Open talk about the future of computing is limited by legal and business considerations and by editorial practice.

slow poke



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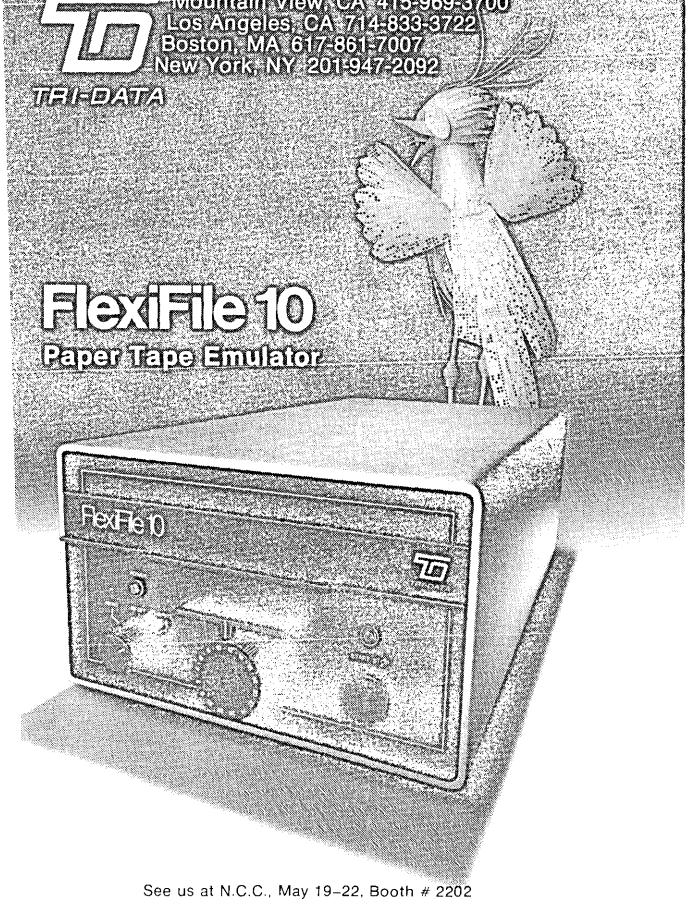

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CIRCLE 81 ON READER CARD

the forum

Perhaps this should not be. Perhaps at some point in the near future these considerations should be set aside to permit public speculation by manufacturers and interested scientists, and perhaps language, the true heart of the matter, should be discussed. Perhaps not every magazine article should deal with payrolls in Poughkeepsie. If so, such speculation should be oriented toward developments entirely of the future, so that no one now would have a financial stake in their conclusions. This is a reason not to wait too long.

—Ben W. Shelton

Mr. Shelton put in apprenticeships as programmer and software analyst before becoming assistant director of computer services for the Associated Colleges of Central Kansas.

"COMPUTER FRAUD" IS A FRAUD

For you, the computer user, what meaning lies in the multitude of stories about the computer-related fraud: the Equity Funding scandal, the Pacific Telephone equipment theft, the Los Angeles check caper, and the great number of embezzlement stories so faithfully reported by the news media?

I think the sensation-provoking headlines screaming "COMPUTER FRAUD" in 3-inch letters seems to highlight the real question: Is it really the computer system's (including the hardware, operating system and applications programming) vulnerability that contributed to the almost deceptive ease with which the fraud scheme was executed, or is it, in reality, a breach of the organization's procedures, especially those governing the use of the data processing facility, that permit these schemes to succeed?

Consider the headline-producing Los Angeles check caper in which certain people allegedly stole 18 blank check-like warrant forms ultimately en route to the computer room, filled in these forms with a typewriter, and subsequently passed off these official looking documents as negotiable instruments to reputable financial institutions.

Or consider the widely reported Pacific Telephone Co. equipment theft in which a certain individual reportedly found documents describing the detailed procedures for using the touch-tone equipment order entry system and other documents listing management-set "acceptable" equipment loss levels.

Or consider the estimated $2 billion Equity Funding scandal in which certain individuals allegedly found themselves able to add bogus insurance records to a computer-resident file and then use specially written programs on a second computer system to provide bogus reports which were then fed to auditors.

If you look closely enough, these cases seem to have a point in common: They were usually perpetrated by people who did not alter or modify the computer's "system," but violated the organization's established accounting, auditing and facility-use policies to gain access to computer-resident data banks or computer-produced records and negotiable instruments. In effect, they merely converted legitimate data processing techniques to their own benefit by violating standard and commonly accepted procedural control practices.

In the case of the Los Angeles check caper, the computer

wasn't even involved until after the warrant had been cashed and a reconciliation computer run was under way. If the finger of blame must be pointed, let it be pointed squarely at those individuals who allegedly did nothing to stop payment on the missing checks even though the check loss was reportedly noticed months before the fraud attempt.

In the Pacific Telephone equipment theft, the person involved used legitimate order entry procedures and appeared to the computer system to be a legitimate user. Whether or not the documents were actually found in a trash can as alleged or passed along by a friendly employee matters little; the procedures controlling the dissemination and/or destruction of confidential documents had been violated.

In the case of the Equity Funding scandal, the government prosecutors allege that both the employees and the firm's outside auditors participated in the fraud by "bending and breaking normal accounting rules and adopting a 'see no evil' attitude." The computer itself was involved, more so than in the other cited cases, but the hardware and operating system were, again, unaltered and intact.

And yet, there are those data processing professionals who seem preoccupied with seeking *innovative* solutions for an organization's security problems within the realm of sophisticated computer architecture, black box devices, and special software encrypting and monitoring schemes.

And others are attempting to solve their security-related problems by turning to mechanical "checklist-type" security audits (which usually feature single-department oriented controls and physical access restrictions) or to security consultants with data processing expertise to provide that comprehensive "report to management"—supposedly revealing all the potentially dangerous security problems and the corresponding "cost-effective" remedies.

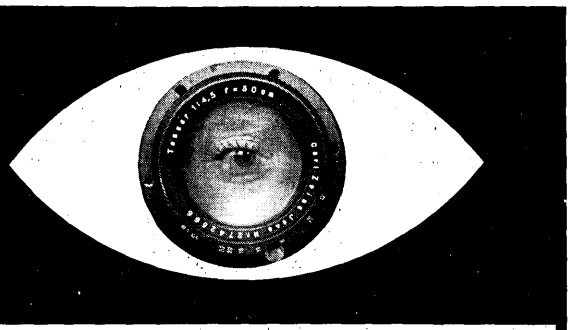
Despite the fact that one well known thief-turned-security consultant is capitalizing on his public exposure to make an "honest buck," consider the great numbers of people who may have set up shop as security consultants using only a glib, jargon-filled line and one of the many published security audits. Or consider those institutions which produce self-aggrandizing reports, studies, and memoranda which turn out to be little more than a comprehensive literature search, a methodology for reporting and classifying computer-related incidents, and that well known conclusion: If only we could obtain additional funding, we could surely produce another meaningful report highlighting innovative security programs which would prove to have great impact on those computer users in government, education and, of course, industry.

It is now time to step back, pause, and take that long, hard look at the way we are doing business before we rush out to spend money for what may turn out to be dated, ineffective, or mechanical solutions to our security problems.

We need a qualitative philosophy for designing security procedures which are fully compatible with computer-resident data, a set of procedures which treats the computer as a business tool to be protected in the same manner we protect our other income-producing assets.

Management at all levels should make every attempt to ensure favorable results when designing a security system by adopting common-sense criteria which will recognize that the true solution to our security problem may not be within the realm of departmental or machine oriented solutions, but in a security system that will:

1. be *people oriented,* taking into consideration the possibility that a person with full knowledge of the system's detailed functioning is more likely to attempt system entry than a person with lesser knowledge.
2. be *machine independent,* recognizing that more than



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99% of any security related countermeasures would be attributable to an organization's systems and procedures governing the use of the data processing facility rather than to specific hardware or software innovations.

3. be *company-wide*, considering that stringent security procedure enforcement in the dp department can easily be negated by laxity in other departments such as accounting, engineering, and, most likely, janitorial.
4. consist of easy-to-understand procedures which will be *applied consistently and without exception* to all company personnel and outside visitors.
5. provide realistic *penalties* for procedural defaults or lapses in security measures.
6. feature a *feed-back reporting system* which may contain provisions for anonymous reports of suspicions to be sent directly to the company's outside auditors or to some other unbiased company-designated authority which would record, and possibly investigate, any allegations of wrongdoing.

Of course, adopting these criteria implies that your company's security effort is, as it should be, simply a part of the overall business methodology for ensuring the efficient and profitable functioning of the company in that competitive environment known as the real world.

—Stephen R. Levine, III

Mr. Levine is president of Innovators International, a Los Angeles management consulting firm.

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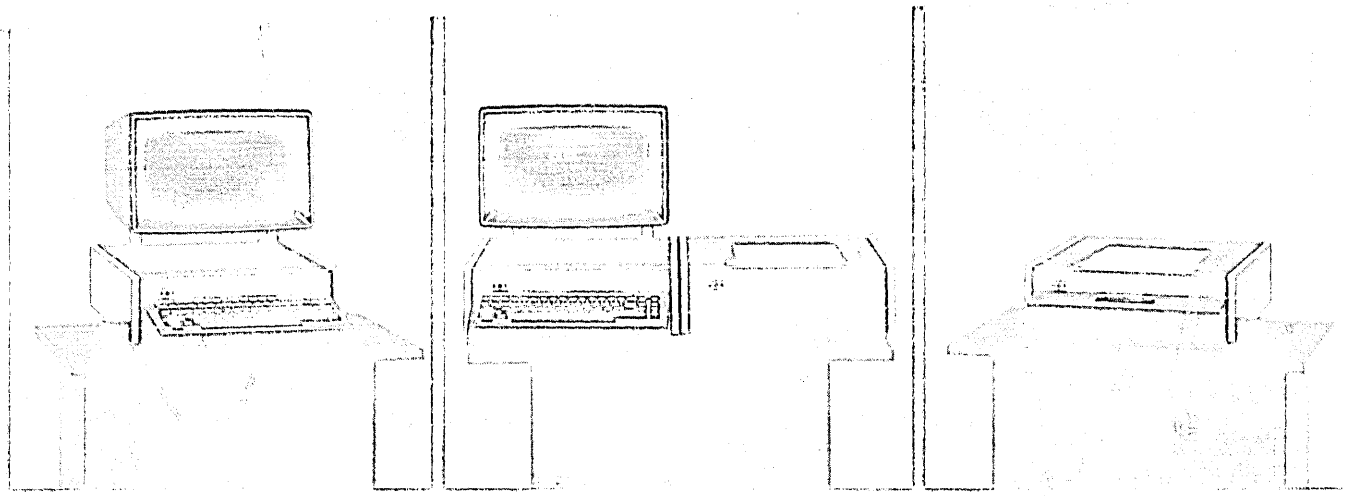

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COMMUNICATIONS AND INFORMATION HANDLING

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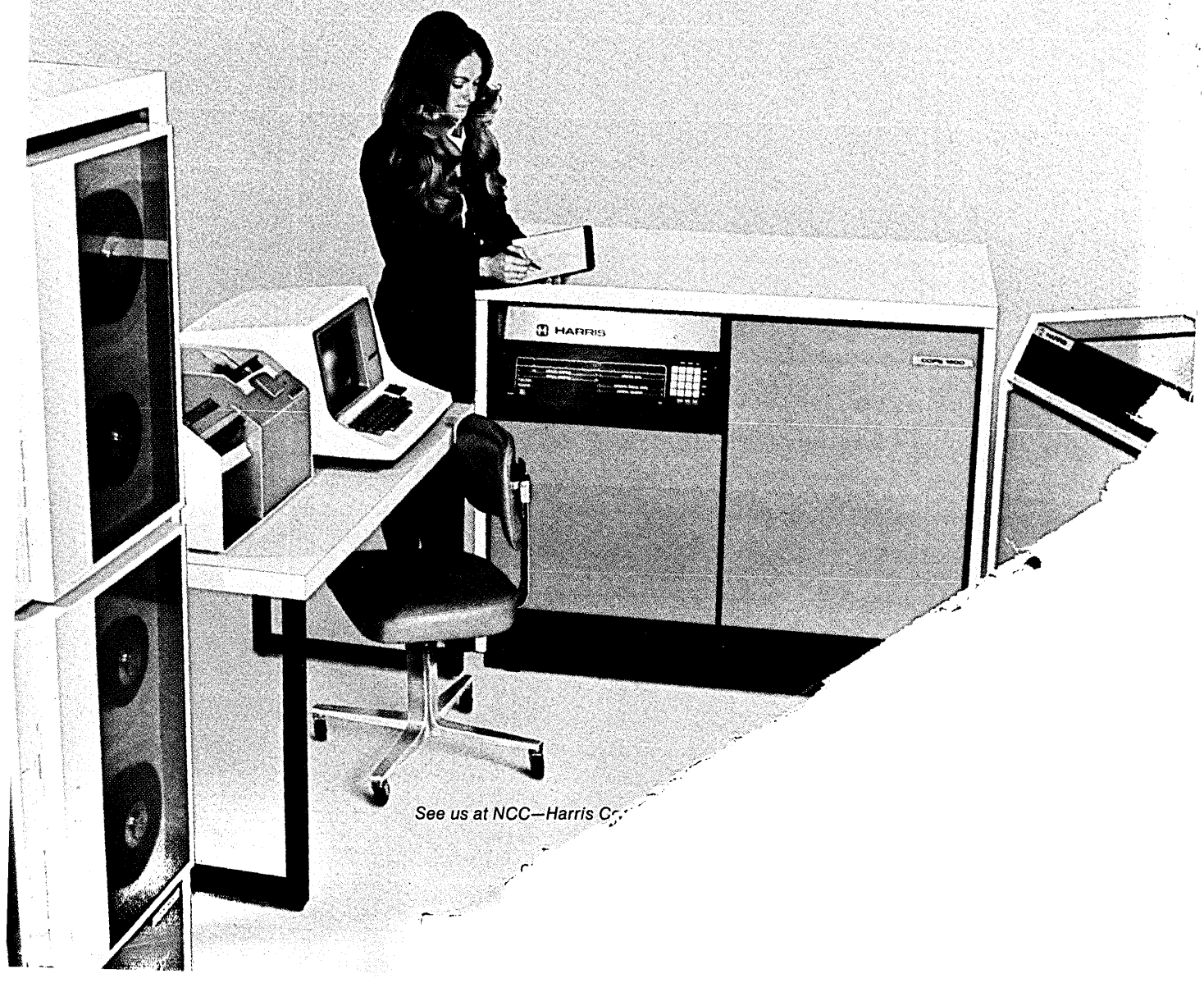

See us at NCC—Harris Co