1957
DATAMATION 77
1977
September

20 YEARS
in the industry

Also: small business systems survey, on-line banking in Japan, computing in Korea, and a data base story . . .

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When you're hot, you're hot, and the thousands of Series 9000 Digital Tape Transports in use around the world prove we're doing something right. Part of the reason is the many unique features of Series 9000 — features such as:

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- 7 and 9 track NRZI and PE format/ control units to simplify custo[illegible] electronic[illegible]. Also, a variety of popular mini-compu[illegible] [illegible] tape con[illegible]ollers are available.

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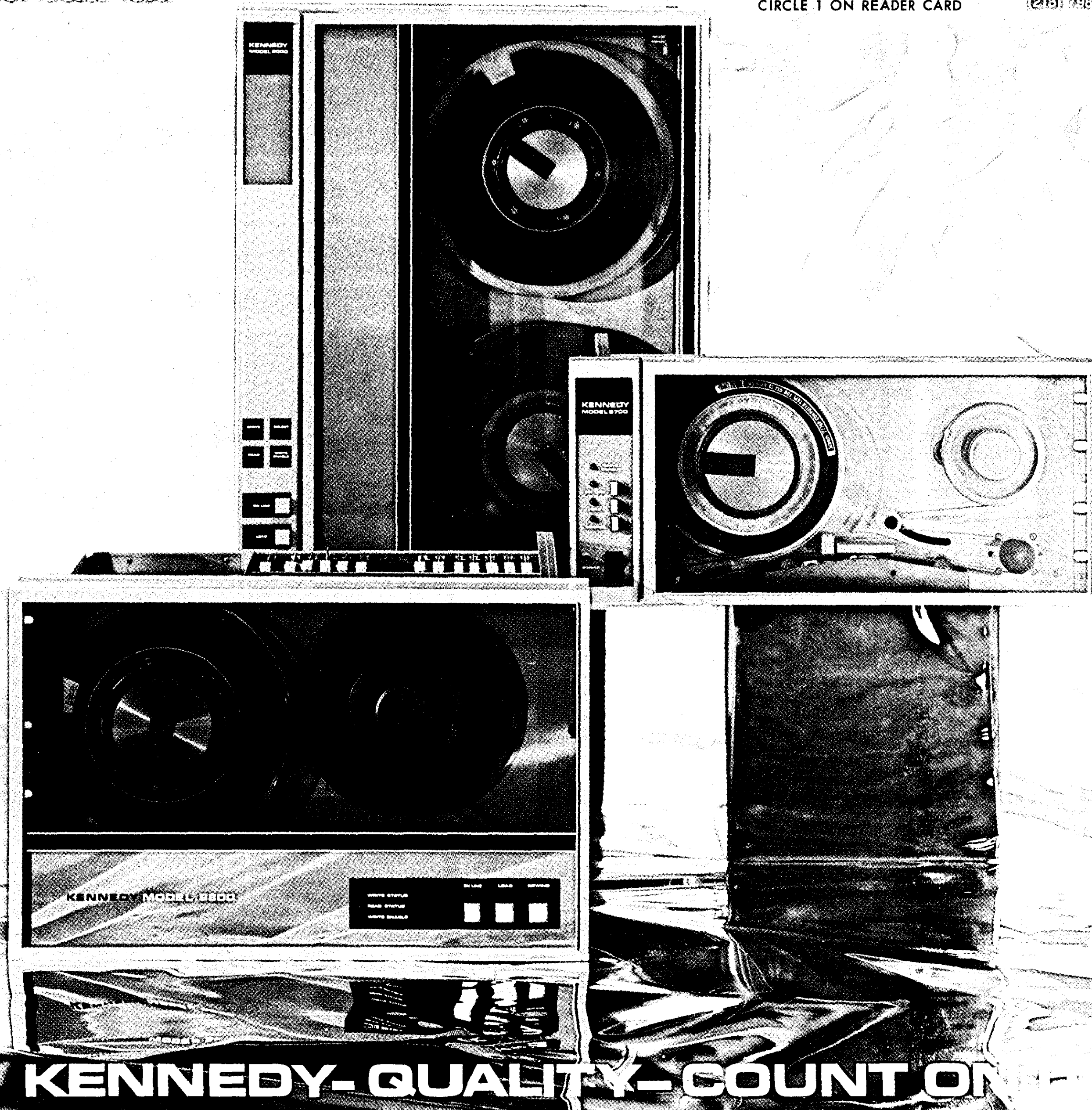

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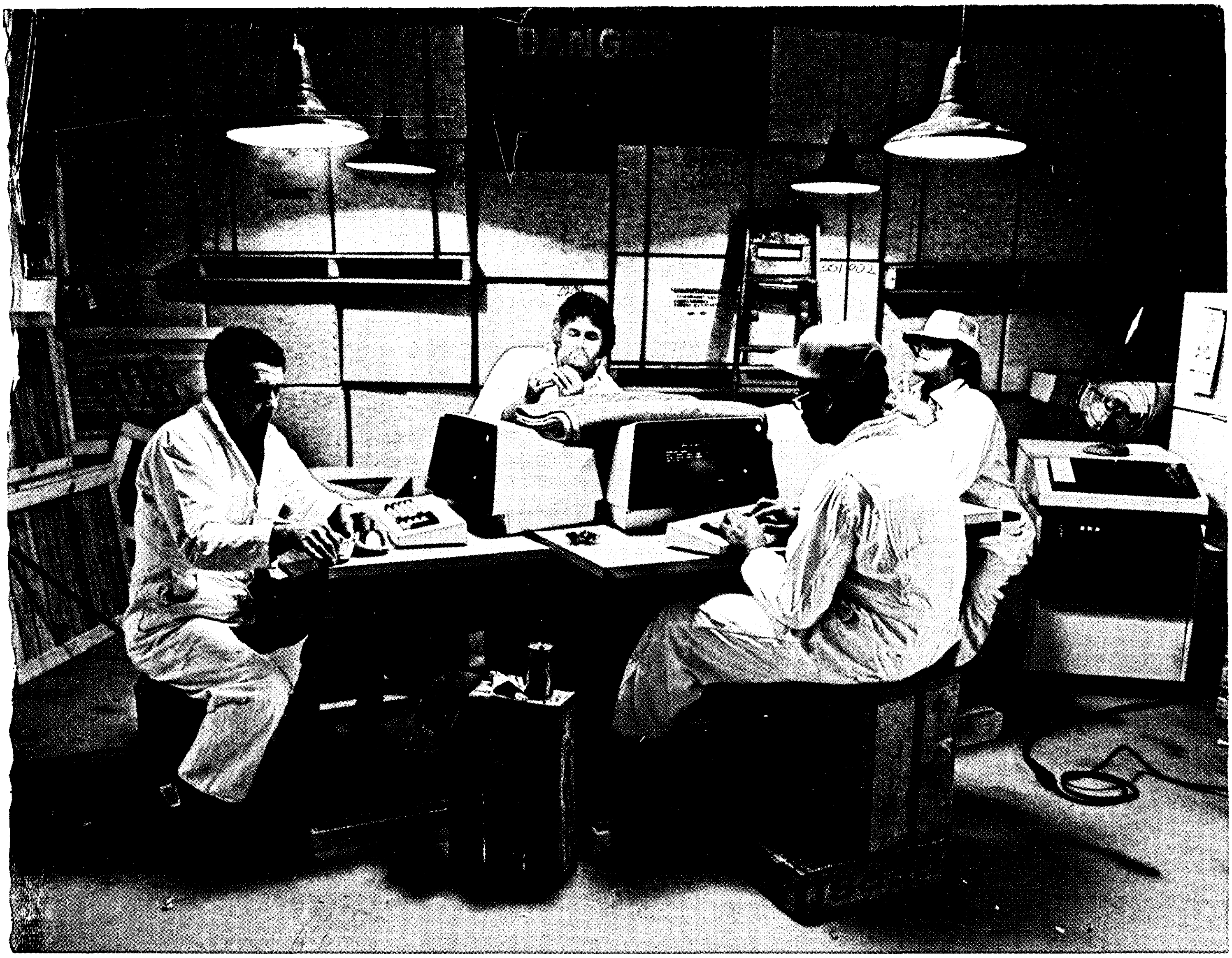
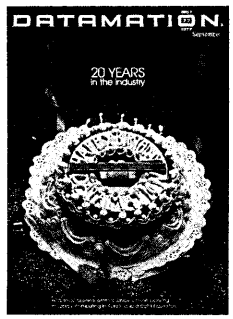


DATAMATION®
1957 77 1977

VOLUME 23 NUMBER 9 This issue 146,805 SEPTEMBER 1977

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

About the Cover
Many people contributed to this small celebration of ourselves this month: Designer Barbara Benson; Photographer Bob Joan Lesser/Etcetera; Pastry Decorator Dino Sarno, Pastry Shop, Inc.; and CalComp, which loaned us the "c

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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 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 in the United States and Canada who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $24. Reduced rate for qualified students, $14. Foreign subscriptions $42.50, or £25.00; for airmail, additional charge $40, or £23.75. Japan and Australia $60, or £34.50 (air shipped). 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. Microfilm copies of DATAMATION may be obtained from University Microfilms, A Xerox Company, 300 No. Zeeb Road, Ann Arbor, Michigan 48106. Printed by Beslow Associates, Inc.
Circulation Office: 34 East Putnam Avenue, Greenwich, CT 06830. POSTMASTER: Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000, Greenwich, CT 06830.
Publication Number: 148800. Single copy $3.00 in U.S.A.

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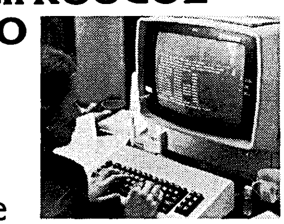
ROSCOE Gave Our Programmers Their Own Computer "Our 30 programmers and analysts are very high priced people to be spending time keypunching and running around trying to find program decks. To cut that time and get out of the card business, we needed the ability to interact directly with our computer. The logical solution was ROSCOE," said Don Clark, DP Division Vice President. "Within a week after ROSCOE was installed we could see the change.

The individual who had been in a laborious, archaic card environment had his own online terminal. In effect, he had his own computer. He can submit entries, verify them and have them in the system within seconds. "Everybody wants to use ROSCOE now. For online maintenance. Updating. Development programming. Batch submission of testing. Every programming function."

One Big Difference Between ROSCOE and TSO



"Many of our key people who had come from TSO shops thought ROSCOE would require learning many new procedures. It didn't. They all found ROSCOE easy to use with almost no additional training," added Systems and Programming Manager Reg Campbell. "We did, however, find one big difference between ROSCOE and TSO. ROSCOE requires much less overhead. Nearly 70% less, I'm told. It doesn't interfere with batch jobs and operations functions the way TSO did."

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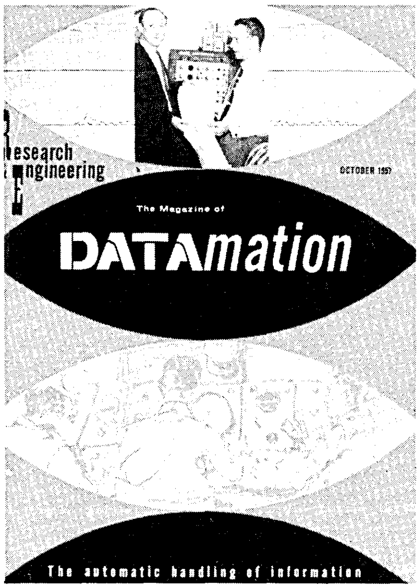
Looking Back in
DATAMATION
On our 20th anniversary

The First Twenty Years



Twenty years ago publisher Frank Thompson decided to take a gamble on a new industry called information processing. On Oct. 1, 1957, an existing Thompson property, *Research and Engineering,* sprouted the subtitle, "The magazine of DATAMATION."

Advertising in this first issue reflected DATAMATION's rather confused embryonic state. An ad for Tektronics' scopes fit the new format fairly comfortably, but on the next page Narta Ultrasonics Corp. was into beer foaming, hull barnacle inhibition, and boiler descaling. Syntronic Instruments sold yokes, Amphenol pushed connectors, and Oster offered servos. But a DATAMATION house ad on page 12 indicated that Thompson knew where he was going. "Are you in step with progress?" he asked. "Get your profit where the money is," he urged manufacturers of computer components and subassemblies . . . "Be the first."

Editorially this issue also was an interesting hodgepodge with articles on data processing joining the regular R&E editorial package. On the cover, Caltech's Dr. H. L. Richter handed Dr. W. H. Pickering, director of Caltech's Jet Propulsion Laboratory, a printout of data from a Sputnick pass. Richter also wrote the lead article which described an amateur tracking receiver for satellite communications.

But the first editor, Charles R. Kluge (no connection to the "kludge" later coined by Jackson Granholm in a DATAMATION article), was tentatively backing his way into data processing. Below the satellite story a little filler answered the question, "What is an analog computer?"

Back to aerospace with an article about a Ryan AN/APN-67 navigation system, and then, once again, a pertinent filler—this time 10 inches on a system for data communications called Kineplex from Collins Radio.

By this time Kluge had established a pattern. A rather turgid article on the use of choppers in d.c. amplification fell five inches short of filling its allotted space. The filler announced Nicholas Metropolis' intention to build a new supercomputer at the Univ. of Chicago —a follow-on to his Maniac I and Maniac II developed at Los Alamos.

Now the magazine was getting into it. Excerpts from a speech by David Sarnoff predicted computerized medical diagnosis and voice response systems. Program highlights from the Eastern Joint Computer Conference were followed by several interesting hardware announcements.

IBM's Data Processing Div. announced the 750III, "one of the most powerful electronic systems on the market for the processing of business data." From IBM's Time Equipment Div. came the introduction of the 610 Auto-Point Computer ("about the size of a spinet piano") and the 8200 Time Punch, an early source data entry device. The 610 was capable of 214 additions or subtractions or 52 divisions or multiplications a minute.

At the Stanford Univ.-SRI Computation Center, an ElectroData 205 was chugging away at various research tasks (those that would fit into 4K of memory). And down in Los Angeles, Ramo Wooldridge had announced their great white hope for the process control field—the RW-300, a "stored program" digital computer curiously enough about the size of a spinet piano.

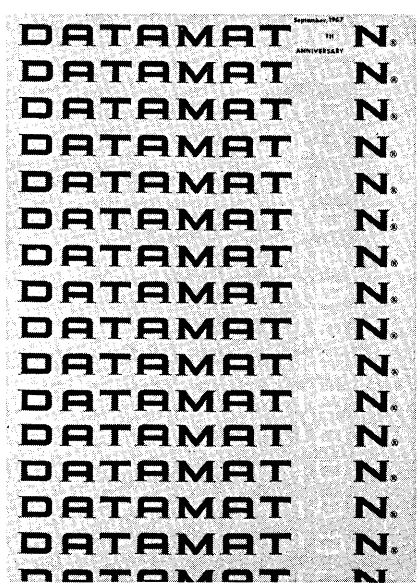
September, 1967

Well, 10 years later IBM's Time Equipment Div. was gone, ElectroData had been absorbed into Burroughs, R.W.'s process control effort had been sold off to G.E., scattering Dan McGurk and his colleagues all over southern California . . . and *Research and Engineering* had disappeared from the DATAMATION logo.

DATAMATION and the industry had changed radically over the decade. Kluge had disappeared after two issues. Sandy Lanzarotta became DATAMATION's first real editor, followed by Hal Bergstein, and then Bob Forest who held the job for 10 years until 1973.

The 10th anniversary issue sported a pretty silver cover. Inside, five of DATAMATION's editorial advisors fearlessly held forth about the industry, past, present, and future.

Said Robert L. Patrick, after a broad and somewhat caustic look at the previous decade, "We have yet to learn how to manage our affairs really well so that we can produce a computer program on schedule and within a budget. We have allowed our applications to become more complex without developing the tools necessary for



checking out on-line systems and those involving huge data files. We have made little progress toward measuring our own performance or consciously adjusting our own behavior so that the customer gets all the computing he pays for." Plus ça change, plus c'est la même chose.

Lowell Amdahl, writing about "the DATAMATION decade," noted an interesting anomaly in 1960 when 10 computers were announced, among them such notables as the General Mills Customized Computer, the IBM 7080,

the Ramo-Wooldridge 400 "polymorphic" machine, and the GE-225.

Bob Head predicted the rise of industry associations which would develop industry-tailored software; user groups concurrently would dwindle in significance. And, with the manufacturers no longer firmly in control, the independent software houses would flourish.

Howard Bromberg chronicled the rise of the computer consultant and wished fervently for the profession's continued good fortune. Ascher Opler urged a slowing down of the "breathless years"—the ballyhooing of cryton memories, predictions of the imminent supremacy of ocr, the claims of the machine language translation buffs and the time-sharing mavins—and a move toward experience and stability in the industry.

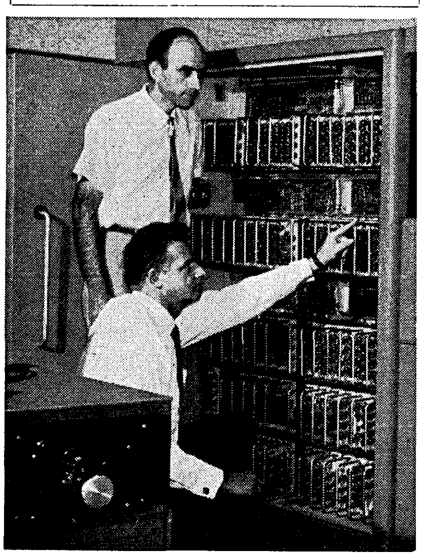
Wrapping up the 10th anniversary section was an interoffice memo from the Kludge Komputer Korp.'s marketing headquarters to their sales representatives of the Kludge Model 97. It began, "Shortly after the announcement of the Kludge Model 97 Super Time-Sharing System, research was begun into its feasibility."

It was a great year, 1967. Companies were hiring, venture capitalists were venturing, the industry was booming.

In three years it would be 1970.

•

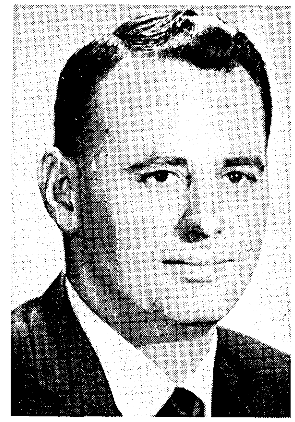
The birthday "cake" on our cover is a Trident P-50 disc pack from CalComp; Don Wanless of Hughes Aircraft Co., and Hewlett-Packard Co. were the suppliers of the chad confetti and paper tape streamers.



SRI's S. L. Perry and Arthur Briner, ElectroData resident engineer with the 205.

PATRICK

AMDAHL



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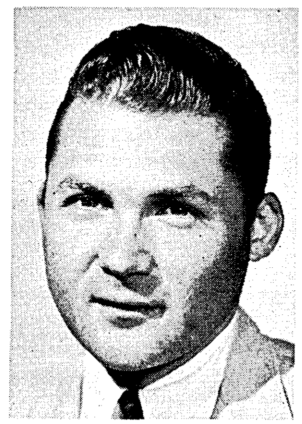


BROMBERG

OPLER

The Early Years

Two former Datamation editors reminisce about the industry's formative years.

"It was the end of the beginning," recalled Santo A. Lanzarotta of the late '50s when DATAMATION was started.

Lanzarotta, today manager of corporate affairs, Western Operations for Xerox Corp., was the magazine's first editor under its current logo. "DATAMATION was started at exactly the right time," he said. "Computers were starting to multiply and it wasn't just IBM. There were a lot of other companies jumping in like Bendix, Royal McBee, Packard Bell, and a lot of little companies. Business computing had arrived."

He said the computer industry at that time was characterized by "the high priest syndrome. There was lots of talk about magic brains that buzzed and blinked. Programming was a black art. The anointed few who understood reveled in talking of such things as memory and programming in machine language. It was like the early days of aviation. The barn-stormers were the consultants who really understood the business, who cruised around a lot."

Self-characterized as a "journalism generalist" at the time, Lanzarotta joined Thompson Publications (which merged with Technical Publishing Co. in April 1970) not to edit DATAMATION, but to be associate editor of a regional electronics publication, *Western Electronic News*, in October 1957. In the same month, Thompson acquired *Research & Engineering*, a magazine for research and develop-

SANTO A. LANZAROTTA
"Like the early days of aviation . . ."

ment management. The company wanted to shift the magazine's emphasis to computers and to change its name to DATAMATION, but law required retention of the R & E name for a year. So the early issues were called *Research & Engineering,* the magazine of DATAMATION. Two issues were published in 1957 in the East. One was distributed at the Eastern Joint Computer Conference held that year in Washington, D.C.

When the magazine was moved west, the first editor, Charles R. Kluge, decided he didn't like the West Coast and left. Lanzarotta took over, and the present logo was adopted with the January 1958 issue. "I did everything," he recalled, "wrote all the copy, made up all pages, and made up the magazine."

He was the whole editorial show through '58 and '59. He got his first editorial help in mid-1960 when he hired the late Harold Bergstein, who was to become editor in 1961 when Lanzarotta left to join IBM.

Of himself and his two immediate successors, Bergstein and Bob Forest, Lanzarotta said: "DATAMATION had the right guys at the right time. As a journalism generalist, I functioned well as a one man gang. Hal, with his aggressive reporting techniques, was an attention getter. Bob Forest was by far the best writer among the three of us. He had a natural writing style and could present complicated subjects with clarity and entertainingly."

AT THE BEGINNING OF THE CURVE

Robert Burns Forest, the man who became DATAMATION's editor in 1963, in many ways exemplified the industry's inmates at the time. Everyone came into computing from "somewhere else," and Forest's particular route was via the English department of a California college.

He was in marketing and public relations at ElectroData (now part of Burroughs) and a computer industry free lance writer before joining DATAMATION.

"My official arrival was April 1," recalls Forest. "I don't know who the joke was on. I inherited an editorial staff consisting of wonderworker, Ed Yasaki, and a secretary who liked to take long lunch hours. I lucked out, getting into the magazine when the industry was beginning its big growth curve. It was very young, unstructured, although IBM already had a predominant role. Many new companies were coming in and exciting things were happening. Money was becoming easier and easier to raise. We began to see the first of the true software companies and firms making disc drives, memory devices, and other peripherals.

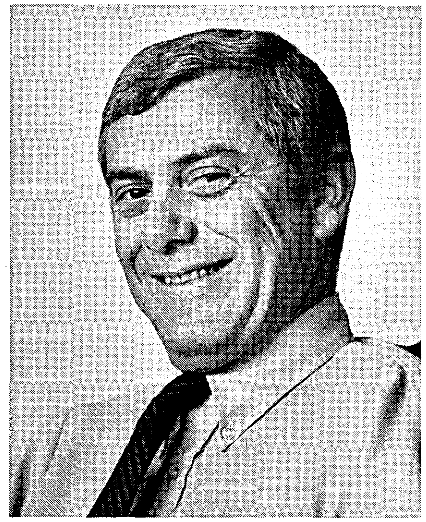
"Many new trends were evident. About then, RCA came up with a brand of magnetic auxiliary memory—the RACE system. A year later, NCR came up with one that was startlingly similar, followed by Magnavox and then someone else. I found out later that the same engineer was wandering from company to company, improving his design at every stage.

"People didn't stay in jobs very long, especially programmers. A programmer who had been around for three years was a manager and, a year later, he was an entrepreneur, having started his own software company."

In user establishments, said Forest, "programmers commanded big salaries for a minimum of expertise and practically no loyalty. They were like fruit tramps who followed the newest machine or newest program language from job to job and piled up experience of dubious value."

Elaborate and complicated systems were developed, he said, that no one could use. "That's not to say that there wasn't a lot of good work being done, but users started to catch on to what an expensive proposition software development was."

Forest arrived in the industry in time to see the likes of Bendix and Packard Bell phase out of the business "sensibly, probably," while GE, RCA, and others were "still dreaming the big dream." New companies, like Control Data and Scientific Data Systems, were "gathering steam, trying to attract stockholders, investors, and cus-



ROBERT BURNS FOREST
"Dreaming the big dream . . ."

tomers." CDC's leader, William Norris, was out giving speeches saying that only companies whose main business was computers—not ovens, not thermometers—would survive. "It turned out he was right."

Forest described the industry of the '60s as being "full of people who didn't limit their vision and played it like a game in which the rules were made up as they went along . . . Many daring, energetic people who had an infinite number of ideas worked long, hard hours. . . . You had music majors, German majors, math majors, psychology majors, and English literature majors who'd somehow been sucked into this vast vacuum machine. Suddenly they were programmers or technical managers or marketing people. To my mind that was very healthy. I think now the trend is toward a more narrow approach to education and training and a more homogenized product . . . a little more discipline . . . a little dull."

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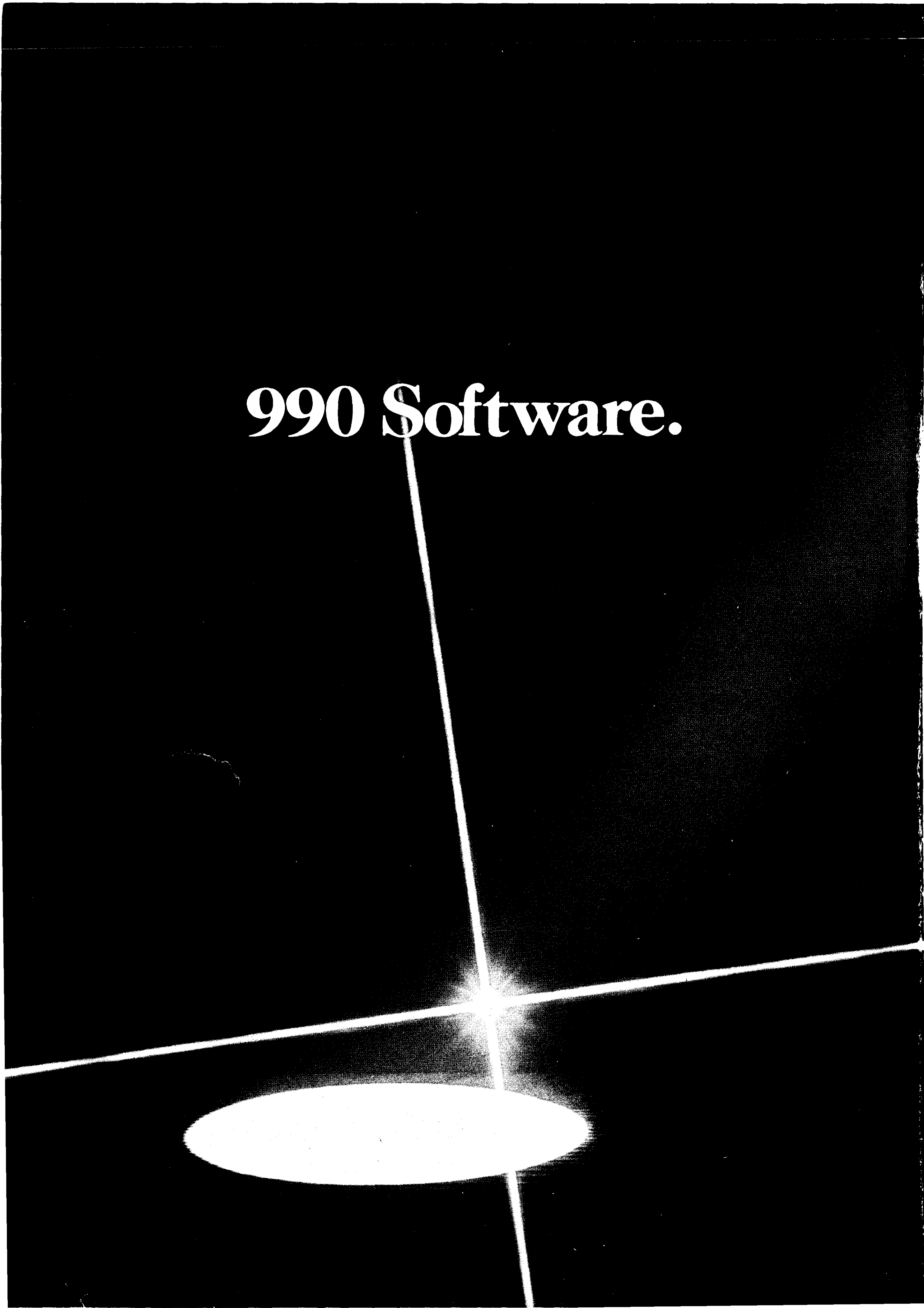

990 Software.

3033 DELAYS: NOT EVERYONE'S IN A HURRY

Rumors that the unveiling of the 3031 and 3032 is imminent are "all wet" says a source close to IBM. With all the demands of the 3033--and the long lead times being quoted on delivery--IBM probably won't get to those machines until early 1978. IBM is planning to accelerate production, but right now the 3033, 158, and 168 are straining the resources at the Poughkeepsie plant.

Regardless of what IBM does, it probably won't deliver more than 300 to 400 3033s in 1978, with a big spurt coming in 1979. Says one user, "Most of those companies buying them couldn't have handled the cutover logistically, anyway. Neither could IBM. It takes a lot of teams to make the cutover. Firms have big solid applications and data bases now that take enormous planning to convert. The ones who are hurt by the long lead times are those that planned to cut their budgets (due to the price decreases of the 3033) and those running out of capacity."

While problems with logic circuitry are said to be the culprit in the lead times, some feel IBM knew this on announcement and intended to stretch out deliveries. They accomplished several things: one is that the 3033 is a fighting machine against the PCM's almost like the 360/90 was against CDC, putting the onus on competitors to keep up with IBM's pricing or bail out. Another is that the lead times make it economical for users to buy more 158s and 168s, keeping IBM revenues up in a transition period.

TWO AGENCIES EYE MERRILL LYNCH PLAN

A Cash Management Account program which Merrill Lynch will test this fall has yet to run into regulatory stumbling blocks though it is being closely monitored by both the Federal Reserve Board and the Justice Dept. The Fed told Merrill Lynch in a letter that the plan could "reduce effective monetary control over the growth of transactions balances in the economy," and that it was studying this and the issue of "unregulated banking" to determine if legislative and regulatory actions are needed.

Justice is reviewing the program, which would, among other things, provide Merrill Lynch customers with VISA cards and bank checks issued by the City National Bank and Trust Co., Columbus, Ohio, to see if it violates Sec. 21 of the Glass-Steagal Act, a law which seeks to separate functions of banking and securities. Merrill Lynch plans to test the program in Atlanta, Denver, and Columbus. Card and bank check transactions would be paid by cash funds maintained in a CMA. If cash is exhausted, a loan would be generated through the customer's margin account.

MORE COMPETITION IN PACKET SWITCHING

Packet switched communication carriers like Telenet and Tymnet may be facing additional competition soon. National CSS, the Norwalk, Conn., computer services company, has added packet capabilities to its 60,000 leased data communications line network. And though National claims it doesn't intend to sell the capabilities directly, several industry sources suspect the firm eventually will file a 214 application with the Federal Communications Commission in order to enter the market as a full-fledged carrier. Also waiting in the wings is GE, which is considering the packet route for its Information Services Network. And in the Netherlands, Logica, Inc., has a packet switched network in the works.

COMINGS AND GOINGS IN WASHINGTON

Some interesting comings and goings are expected this month out of Washington. Coming to fill the now empty slot of chairman of the Federal Communications Commission, is 43 year old lawyer Charles Ferris, a Capitol Hill veteran who formerly was general counsel to House Speaker Thomas (Tip) O'Neill. The Ferris nomination, expected to be announced by the White House early this month when Congress reconvenes, has the backing of such political powerhouses as O'Neill, Sen. Edward Kennedy, and Senate Majority Leader Robert Byrd.

Another top post also will be empty this month as Philip Verveer leaves the Justice Dept. where he honchoed the antitrusters' agonizingly slow AT&T suit. Verveer, who handed in his resignation letter in July, reportedly had differences of opinion with top trust-busters over how the sticky suit should be handled. "He wanted to run it his way," relates one Justice source, "and other people didn't want it run that way." There was also a question of how hard Verveer was pushing his staff--particularly the slew of outside economic experts Justice had rounded up for the case. "His leaving," points out the Justice source, "doesn't indicate a softening of our position. If anything, it indicates a greater resolution," he argues.

NETS SOLVES A PROBLEM

The Nebraska Electronic Transfer System (NETS) has gotten around anti-trust objections to its operation expressed by the Justice Dept. by giving operating control of the network to Micor Inc., a Phoenix, Ariz., data processing subsidiary of Ramada Inns. Micor designed and installed the network for NETS. The new plan will permit NETS member banks and non-members to deal directly with Micor and will reduce NETS activities as the system's middleman.

SYCOR'S FIRST 3270-COMPATIBLE PRODUCT

Its very first IBM 3270-compatible terminal also is Sycor Corp.'s answer to IBM's recent price cuts and enhancements to its 3270 terminal line. To be called the model 290, two versions of it will support eight and 16 devices, and communicate under both bisynch and IBM's Synchronous Data Link Control (SDLC) protocol at 1200 and 9600 bps. Its 15-inch crt screen has a capacity of 1,920 characters. The Ann Arbor, Mich., firm will offer the 290 at 20% below IBM's new prices, even lower for quantity buys.

It will be announced Sept. 21 at the same time that Italy's Olivetti--the overseas distributor for Sycor's intelligent terminals--announces its Sycor-made version, the model 280.

ANOTHER BULK CORE OFFERING

Minneapolis memory manufacturer Fabri-Tek, Inc., is about to join Dataram and Ampex in offering a bulk core device that is aimed at replacing the function of fixed head discs in minicomputer systems and some large special application computers. Its BCM-750, a 512KB device, and the BCM-750 with 128K, are priced at around two-tenths of a cent per bit when purchased in large oem quantities. The 1.5 microsecond cycle time is about the same as Dataran's, but its access time is 500 nanoseconds, compared with 625 for the Dataram device. Fabri-Tek also will offer 16 and 20 bit word lengths, giving it the flexibility to offer odd-ball word sizes for various makes of computers.

(Continued on p. 278)

If you've reached that certain level of equipment and professional sophistication in the 'DP game', you are probably looking beyond IBM for your more specialized software needs.

And if one of those needs is for a teleprocessing monitor, you should look to Informatics.

Not only are we the largest independent software vendor in the world, we're also the Number One independent supplier of TP monitors. And as the recognized leader, we offer MONITOR IV,™ a product line of super-efficient, cost-effective teleprocessing systems oriented toward different user needs and requirements.

For smaller DOS and DOS/VS users who want to get on-line fast, we have MINICOMM — a powerful, flexible system that installs easily, takes minimal main storage, and doesn't require hardware upgrades.

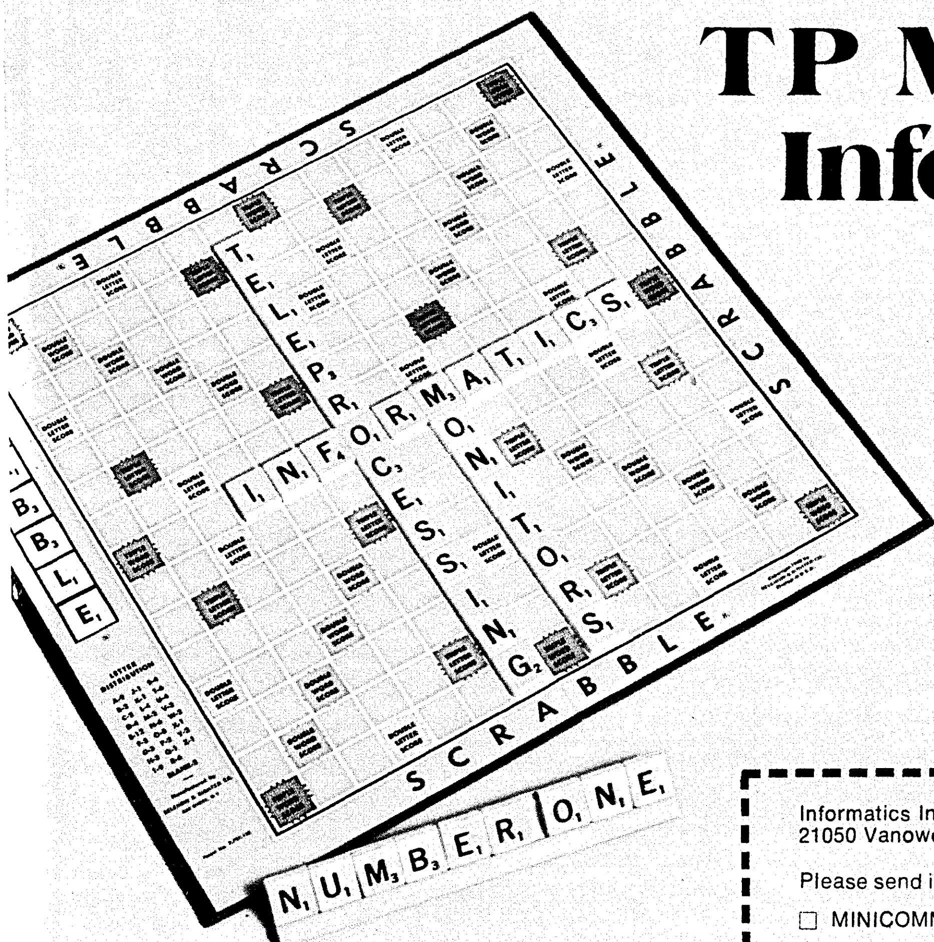
For DOS and DOS/VS users who want the ultimate in flexibility, there's BETACOMM — a fully queued, multithreaded system that provides multitasking for application programs as well as the monitor. A comprehensive file handler supports all standard access modes and popular data base systems.

INTERCOMM, for OS and OS/VS users, is the most sophisticated teleprocessing system available anywhere. Its many advanced features include device-independent support for over 30 terminal types, comprehensive error recovery with integrated checkpoint, message, queue, file, and data base recovery, plus a unique program-isolating feature.

Naturally, all of our MONITOR IV™ products have the full technical and educational support of the over 1,800-person Informatics team around the country and around the world. Our reputation among our more than 300 TP monitor customers is the envy of the software industry and we intend to keep it that way!

So remember . . . when you spell out your TP monitor needs, don't settle for the three-letter word. Think Informatics . . . the *last word.*

When it comes to TP Monitors, Informatics® is the last word.



MONITOR IV

Informatics Inc., Software Products, Dept. D977
21050 Vanowen St., Canoga Park, California 91304

Please send information on:

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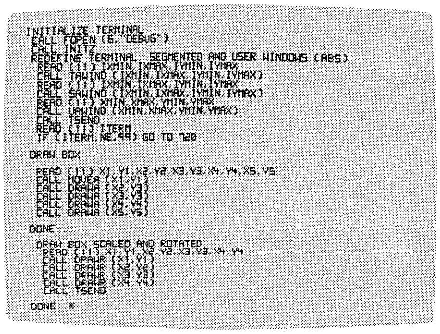
CIRCLE 74 ON READER CARD

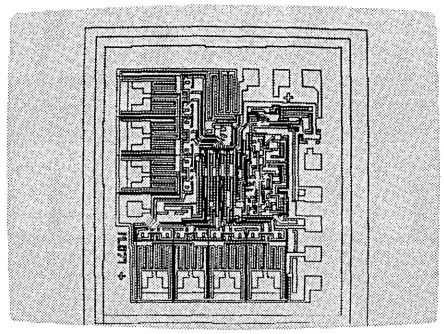
ed graphics terminal computer's power. or's patience.

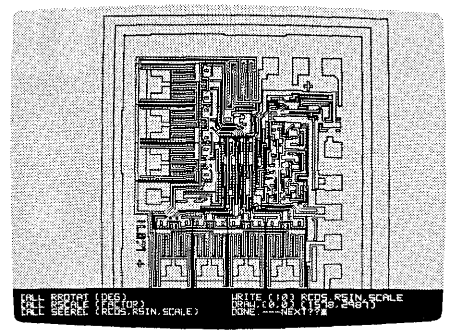
Six images that warrant some serious comparison shopping.
A quick look at basic viewing capabilities and you'll soon discover there's not a more versatile graphics terminal around than the CalComp IGT-100.

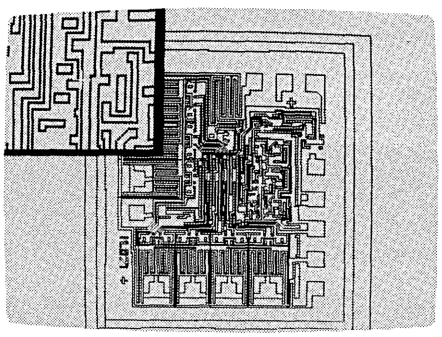
100's introductory price is super-competitive. Especially compared to storage tube devices. (And there's an equally attractive leasing plan, too.)

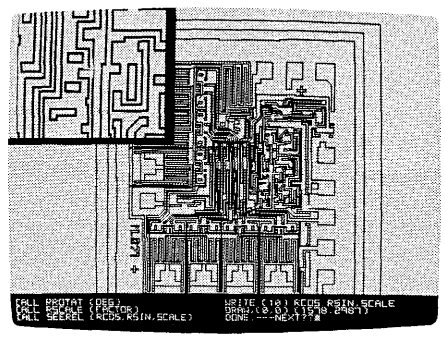
But we didn't stop with just a great terminal at a great price. We added an entire year's worth of

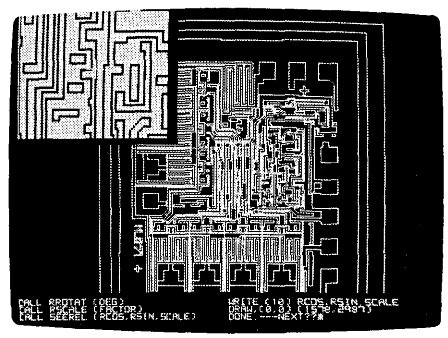

1. All alpha-numerics.


2. All graphics.


3. Alpha-numerics & graphics.


4. Graphics & View-window.


5. Alpha-numerics, graphics & View-window.


6. Alpha-numerics, Graphics & View-window (with reversed-out section).

To begin with, the IGT-100's special three-way, split-screen design provides you with separate alpha-numeric, graphics and view-window sections.

Plus the ability to independently view and control (i.e. panning, zooming, etc.) one or a combination of these sections simultaneously.

Images can even be reversed (white on black) in the graphics and view-window sections.

The IGT-100's basic screen design maximizes the amount of data that can be displayed while providing you with six basic screen arrangements. Annoying superimposed messages have been totally eliminated.

It's about time someone came up with a screen that you can tailor to fit the job — instead of the other way around. And that's exactly what we did.

Did we mention the competitive price?
Price shouldn't be the primary consideration when you're looking for a full-powered graphics terminal.

But it's usually close to the top of everyone's list. That's why you'll be glad to know that the IGT-

service — labor, parts, everything — to the deal. Right along with the finest graphics terminal support software. (It's even compatible with standard CalComp plotting software and Plot 10.)

And then we backed it all up with CalComp's worldwide network of field engineers.

So if you're looking for a great deal on a graphics terminal, take a hard look at the new CalComp IGT-100.

And don't let a little thing like a low price scare you.

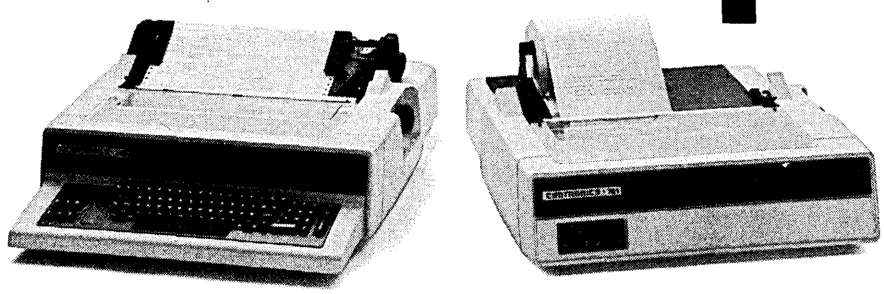
CalComp's New IGT-100.

The time you save may be your own.

CALCOMP

Dept 100-DNS 2411 W. La Palma, Anaheim CA 92801
Tel (714) 821-2011 TWX 910-591-1154

You won't find a more versatile teleprinter for the price. It's that simple.



The New Centronics Model 761.

No other teleprinter offers you more operating features—or a lower price. Because the 761 gives you microprocessor-control for maximum flexibility *and* lower-priced options.

Plus, the 761 gives you easier, more versatile operation . . . with maximum printout visibility . . . typewriter-style electronic keyboard that anyone can use without special training . . . table-top or free-standing installation . . . pinch roll, pin-feed platen or tractor paper handling systems . . . and a wide choice of 300 baud serial interfaces . . . in KSR and RO models.

And when you need fast, dependable service, remember the 761 is backed by one of the industry's best service programs. More than 100 professionally staffed service offices worldwide . . . a unique on-line diagnostic test center . . . central dispatch with toll-free phone access . . . and maintenance contracts as attractively priced as the 761.

More versatility, better service and reliability proven by more than 80,000 Centronics printers installed, make the 761 teleprinter simply a better choice. The *only* choice. Call today for details. Centronics Data Computer Corp., Hudson, N.H., 03051, Tel. (603) 883-0111 or Centronics Offices in Canada and throughout the world.

CENTRONICS® PRINTERS
Simply Better

CIRCLE 75 ON READER CARD

letters

9,453,600 papers to shuffle

I am beginning to be appalled at what is going on in the whole field of automated information handling. My experience in the area of paperwork started before the first computer came on-line, and I have lived through the entire development of this information era in which we now live. I am convinced that we are in a state of overkill on information. There simply aren't enough people to pay attention to all the information we have and are developing. Let's look at examples:

Take the IBM 3800, which with the laser beam and electrostatic reproduction, processes paper at the rate of 31 feet per second. That's 1,860 feet per minute; 111,600 feet per hour.

If the paper is cut off at 8½-inch intervals to produce forms 8½ x 11-inches, that's 13,130 forms per hour filled in with information.

Let's assume a seven hour day (few computers or high speed printers are run only one shift) with six productive hours of work; that's 78,780 filled in forms per day, or 393,900 sheets of information per week. In 48 working weeks per year, that's 18,907,200 forms per year, and that's a lot of information. But maybe we're getting a mite ridiculous, so let's arbitrarily cut that in half (but why are the other half printed?). That leaves 9,453,600 sheets of information from only one IBM 3800.

Now let's assume again that each of those sheets consumes only two minutes of time for all the things that are done in paper handling and use. That's 18,907,200 minutes or 315,120 hours per year. Again assuming that there are 1,500 productive hours per year, that's 210 people, or the equivalent, working on the output of only one machine.

If those people are paid an average of only $20,000 per year (clerks and mailroom personnel don't read computer printout), that's a whopping $4,201,600 payroll per year. One machine, one shift, and that cut in half! Who's going crazy here?

But someone may say, "He's taken an extreme example." Okay! Let's go to the other extreme, the in-house print shop which produces the majority of the average company's forms which are used in average quantities of 500 or fewer per year. Most of these forms aren't subject to any management control worth speaking of.

In the lower and middle ranges of office work we will assume (seems I'm doing a lot of assuming, but if anyone has better figures, I'd like to see them) that there are 1,715 available hours or 1,286 productive hours, at 75%, per year.

If each of the 500 copies of that little form requires only 10 minutes of clerical time at $8,000 ($10,400 with fringe), and two minutes of supervisory time at $12,000 ($15,600 with fringe), that's $877 worth of payroll for each one of those little forms which cost only $6 to $8 to produce.

So, whether the information comes from the little form or the big automated form, I'm of the opinion that there aren't enough people or hours or dollars to justify what is being done.

What's the answer? Certainly not the philosophy of "bigger is better." That is being proved fallacious throughout our entire society today. Whether the information comes out of government or private business; whether it's manual or automated; whether it's on paper or film; the only answer that I can see is that management simply is not managing paperwork and information. And that's an abdication of responsibility.

Paperwork expands according to the means available for its production. And it will continue to expand until management takes hold and restrains it within reasonable bounds.

FRANK M. KNOX
New York, New York

SSA's reel-y busy

I have just finished reading with great interest your article, "SSA's Huge Systems Scheme" (July, p. 140). There is an error in the article that bothers me somewhat. Our tape library now has close to 400,000 reels, not 400 as stated in the article. Would that we had only 400 reels!

There is also a minor discrepancy in the number of "service sites" referred to in the article. The "3,400 nationwide service sites" should refer to our secondary facilities. (Secondary facilities are locations where we provide service on less than a full-time basis, e.g., county court houses and post offices in smaller cities.) In addition, we have 1,300 primary field facilities which provide service on a full-time basis in the larger cities of the United States. We thus provide service to the public from over 4,700 locations nationwide.

My thanks for a well-written and objective article.

E. R. LANNON
Director, Office of Advanced Systems
Department of Health, Education, and Welfare
Social Security Administration
Baltimore, Maryland

Accentuate the positive

I was disappointed when I read the write-up on our new product, IAM, in the "Software and Services" section (July, p. 176). Though it is not widely held, it is too often a strongly held misconception that software from other than IBM is a mishmash of "special purpose and one of a kind odd jobs," or worse, a place to go for replacement of non-supported products for those who make the mistake of not keeping up with IBM's latest hardware.

Your headline, "ISAM Replacement," and your oversight or omission of just what benefits IAM offers over VSAM was short-sighted and almost an accusation. IAM is an alternative or replacement for all non-operating system uses of VSAM and ISAM. To survive, the software industry traditionally has had to provide products superior to IBM's. Those products often have been the stimulus for IBM to improve the performance of its own software, or incorporate facilities demanded by users of the IBM products who threatened to switch to similar non-IBM software. Innovation hasn't ignored VSAM.

IAM has been shown by its users to reduce EXCP counts by 50% from comparative VSAM runs. IAM uses less memory and 20% to 40% less cpu time. There is a 10% to 30% savings in peripheral storage. Job elapse time is significantly reduced.

Comparison to any competitor's offerings should be made to the best they offer, not the worst.

THOMAS J. MEEHAN
Vice-president
Innovation Data Processing
Clifton, New Jersey

First ask the typist

In "What's Happening in Word Processing" (April, p. 65), it is said that the dp manager should be in charge of the word processing facility because of his vast experience and knowledge of all aspects of computerized activity. Then we are given a long list of the novel requirements of word processing systems which the dp manager will need to learn about if he is to venture into this unfamiliar field.

Let's face it, the average dp manager is machine-oriented, wedded whether he likes it or not to one particular manufacturer, concerned with achieving an acceptable general throughput for customers who are more likely to be departments than individuals. The word processing manager, on the other hand, must be people-oriented, concerned with the individual jobs of personal customers who know what they want and don't

letters

take kindly to attempts to tell them otherwise, particularly by a technician from another field.

I suggest that the right way to set up a word processing system is first to ask the office and typing staff what they want the system to do for them, and then get advice from an independent consultant on the best hardware and software to buy in order to carry out the tasks so defined. This way the system will start off with user support and won't be distorted in order to cover up past mistakes in hardware acquisition by the dp department.

E. W. WATSON
Watford, Herts., England

Pioneers are still plowing

Okay, let's hear it for the 1440 programmer—a nearly extinct but crusty bunch of old men and women. You say you never heard of one? (A 1440 programmer, that is?) Well son, there's still a few of us hardy souls left, out here in the old folks' home. While the rest of you ran away to fool around with some 370/155s we had to keep the homefires burning with our DCW's and MLC's. Someone had to stay home and keep the 1440 fed with autocoderisms. So it became our lot. We're still plowing the fields with gear from the second generation. Still, you kids don't know what a thrill it is to hold hands with a 16K and a 240 lpm.

I read in DATAMATION where they had a computer conference in Dallas. Be nice if they could have displayed our 1440 and some of us gray-heads fiddling around. Also, saw some employment ads in the same issue, but none wanting a 1440 programmer. Well, that's the way it is, but don't you kids forget us pioneers. Good luck.

AL KEPHART
USA Madigan Army Medical Center
Tacoma, Washington

Think cool

Mr. Ecklin's reverse logic amazes me. After reading "Keeping Cool" (July, p. 24), I called and confronted him with $E=mc^2$. This equation kept the law for the conservation of energy intact. His response—the law already had to be changed once as Einstein found mass could be changed to energy, so why not change it again, and convert cold to energy?

He brought out another important point—since a superconductor has zero resistance, there is no voltage drop across it and as much current flows from a wire or coil (electromagnet or motor winding) as we originally put into it.

THELMA S. BAUER
Silver Spring, Maryland

The basic logic your readers should use about "Keeping Cool" is the law for the conservation of energy or the first law of thermodynamics. This law says energy cannot be created as Mr. Ecklin proposes. Further, we have not even been able to build a perpetual motion machine let alone some device that will output energy.

W. J. CATES
Arlington, Virginia

Mr. Ecklin has written us: "From the responses so far, many people apparently read your "Letters" department without reading the headlines. Scientists, and some of your subscribers, really get hot under the collar when someone dares to question the law that energy can neither be created nor destroyed. They conveniently forget Einstein has already corrected and modified this law once (as Ms. Bauer noted above).

A large superconducting ring, anchored in bedrock, can store billions of watts of energy. If the temperature of this ring should rise less than a degree, all this energy suddenly vanishes. All the stresses from it's magnetic field disappear at the same time. If energy can so easily and completely be destroyed, there should be other ways, besides rearranging mass to get energy which we can surely use. Don't forget, cryodynamics is limited to a minus 459 degrees Farenheit, but there is no known limit to heat.

PERFORM-ing

I agree with the suggestion by Mr. Parkes (July, p. 21) that a PERFORM DEPENDING ON feature in COBOL would be useful, but the example he gave would be much better handled by simply defining a table of counters and using the record type as a subscript to increment the proper entry:

ADD 1 TO RT-COUNT (RECORD-TYPE)

Assuming, of course, that RECORD-TYPE is a numeric item and a check has been made to ensure the value is within the allowable range.

WILLIAM E. WEEMS, JR.
McDonnell Douglas Automation Company
St. Louis, Missouri

After reading Roderick Parkes' letter concerning the counting of record types using the DEPENDING ON option, I feel it would be much simpler and quicker to count using direct subscripting.

Since the DEPENDING ON option requires the value of interger-2 to a value from 1 to n, the direct subscripting could be employed with only one statement.

ADD 1 TO TABLE-CT (RECORD-TYPE).

In addition to less procedure coding, working storage accumulators would not have to be individually defined.

JIM FLOWERS
Blue Cross Hospital Service, Inc.
St. Louis, Missouri

Dump validation

In "Integrity in Data Base Systems," (May, p. 64), Mr. Curtice provides us with an excellent article. The techniques he describes are valid ones, however, most of them will work only if the log and/or dump tapes are valid. Many problems can occur when creating a tape and can be caused by software or hardware. For example, hardware can produce duplicate or short blocks.

Usually dump and log tapes are not used immediately after creation, but are retained for future use in case of a failure.

A bad log/dump tape at recovery time can have disastrous results. Retreating to a previous backup (if available) requires longer recovery time. A bad log tape however, is not so easily bypassed. All batch runs to cover the time period represented by the bad log tape must be reprocessed, or in the case of an updating on-line system, the remote users would be required to resubmit all their transactions. Clearly, these solutions seem unacceptable.

Our solution has been to write an extensive dump/log tape validation program for each of our file handlers. The success of our approach has prevented many headaches and saved many rerun hours. Whenever we discover an invalid tape, we are immediately aware of the problem and can take appropriate action, which in most instances is a dump (or redump) of the data base.

LAURENCE B. LEGORE
Data Base Administration
Commonwealth of Pennsylvania
Middletown, Pennsylvania

First teta, now peta

The June "Look Ahead" (p. 16), is in error when speaking of "First Terabit, now Tetabit." The prefix for 10^{15} is "peta," not "teta." Just in case technology develops too fast, "exa" stands for 10^{18}.

HANS J. OSER
U.S. Department of Commerce
National Bureau of Standards
Washington, D.C.

Thyn cayme a programmyr

To Louis Fried ("The Programmyr's Tale," June, p. 161):

(continued on p. 26)

Kodak announces 3 dry, convenient, laser COM's, on-line & off-line.

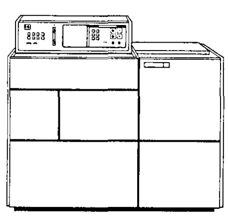
One step produces completely finished jobs.

Dry—absolutely no solutions, no wet processing.

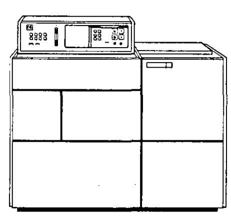
Laser imaging—advanced technology gives outstanding image sharpness on a new Kodak film.

Control software—automates job setup and operation, simplifies operator tasks and training, greatly reduces error potential.

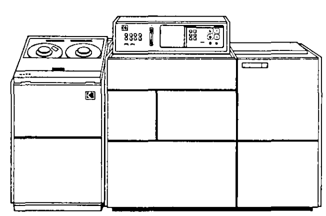
Total convenience—utmost ease of operation, a demonstration will prove it.



Komstar 100 microimage processor—on-line to IBM S360/370 computers, for distributed processing.



Komstar 200 microimage processor—intelligent, on-line to IBM S360/370 computers, saves CPU formatting time.



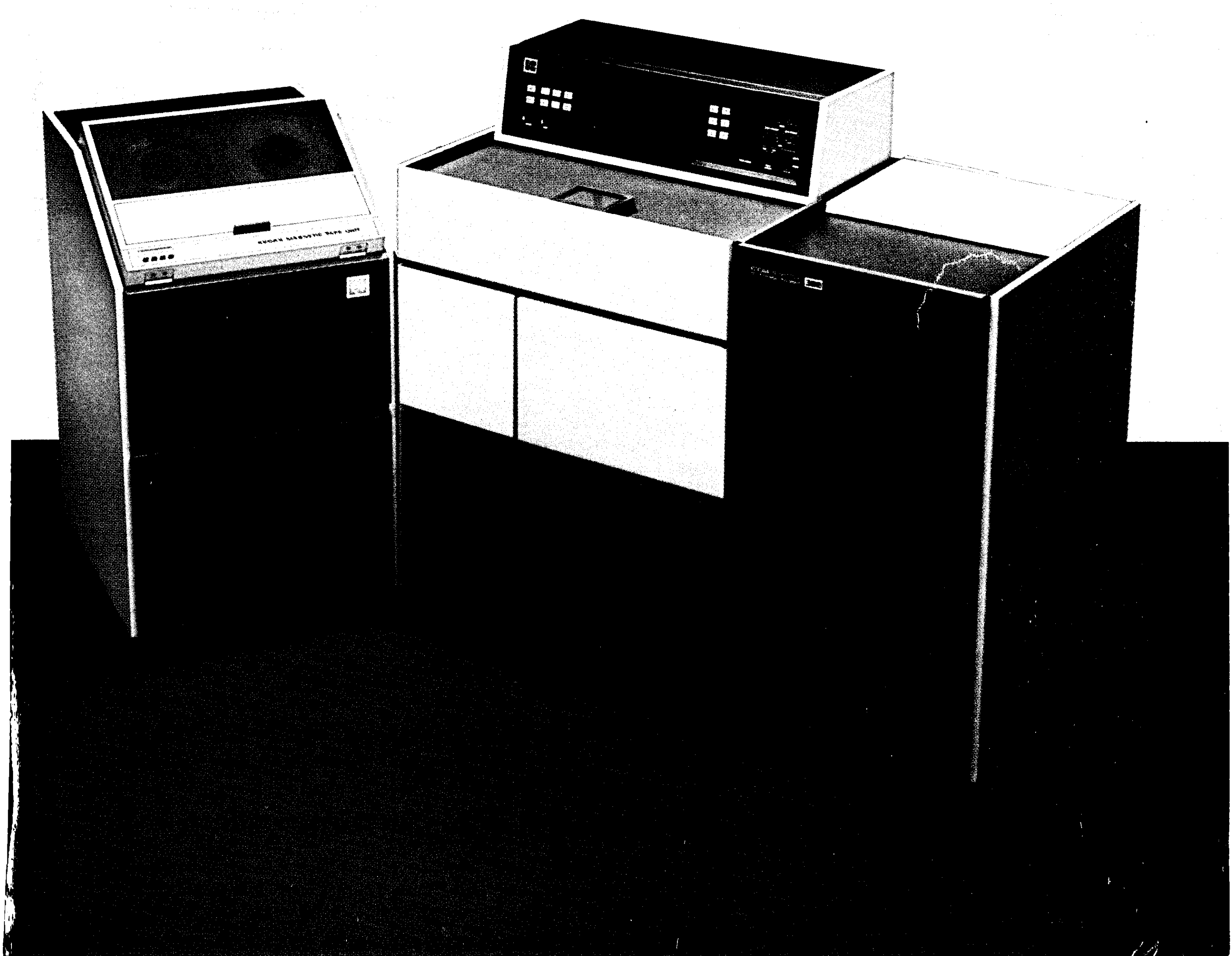
Komstar 300 microimage processor—intelligent, off-line COM, formats print tapes from most major mainframes.

For the detailed story, write Eastman Kodak Company, Business Systems Markets Division, DP-7933, Rochester, N.Y. 14650.

KODAK KOMSTAR Microimage Processors

Kodak

CIRCLE 123 ON READER CARD



letters

(Continued from page 22)

Whan that ensconced oncet in limousyne
That carryes to and fro the aeroporte,
I had twa bagges o' wynde both mayking paem
Whilst seated juste behinde me for their sporte.

For respite I recyted the *Prologue*
Commencying from the toppe: "Whan that Aprille . . ."
Whyche prooved to be a moste effectif drogue
Agaynst a rising gorge fair'ld mayke me ille.

But lo! Whence came this bogus Programmyr
(A tale that has the metre and the lilte
't would mayke a true addichy-on, no fear,
Excepte for argot whyche keepes lyghtinge "TILT?").

But alle in alle, I'll mayke to ye no bonyes
It reade ryghte fairly welle for the nones.

A. J. CRAWFORD
Manager, Corporate Management Information Services
Colgate-Palmolive Company
New York, New York

Mr. Fried replies:
Whan at firste that foolish tale was ywrit,
Of any publick ken I trulie feared.
How gladde am I to see swyche piece of wytte . . .
'Sblude, a kyndred spyryte has appeared.

The joke's on who?

The May issue (p. 266) reported a high school senior prank—report cards with mysteriously obtained "straight A's" were received by students at Los Altos High School while their rivals at a cross-town high school, Awalt High, received the "authentic" computerized forms reading "straight F's." Pranksters rather anxiously observed the effect that their hoax had upon the startled community. What it boiled down to was that our parents and classmates were instantly unveiled as people whose lives, however temporarily, are alterable by the grade point average assigned to them by a computer.

We began to see our prank as a social experiment, and at first thought were dismayed at the sight of computer control of society. If high school students with training given a twelfth-grade computer course were able to abuse the machine, how much more destructive will the prank in store for America be when those more qualified turn to reprogramming computer banks?

Despite our wrongdoing, we came to the conclusion that the pranksters were not as corrupt as the community affected. Corruption lies in placing human value on evaluations reportable by something as impersonal as a machine. Rational people used totally insufficient input—high school grades—to reprogram their lives. We, as a nation or as a community, are prone to machine terrorism or to subtle mockery so long as we overemphasize the importance of artificial classifications and place no value on reality.

HIGH SCHOOL STUDENTS RESPONSIBLE
Los Altos High School
Los Altos, California

Personality vs. preparation

. . . Mr. Patrick (April, p. 45) speaks of the *personality* of a good keyboarder who "for reasons best known to herself *chooses* a routine job." He is obviously unaware of the basics of the job market—economics of educational emphases, competition, and simple bias—which are far more involved than personality in job choices of this sort. Women go into routine jobs for the same reason that men do—they sometimes pay a bit better than any other job for which they are prepared. They sometimes are all there is to be had. The difference is in pay scales and society's respect. What keypuncher is paid the wages of an auto assembler? What secretary wouldn't like her manager's words to the effect that the office depends on her translated into better pay and more responsibility?

It is inexcusable that a dp professional be so unaware of basic attitudes among other professionals and among users. Whether or not managers set out to create sweatshops, the fact is that the data entry person is the least respected of dp workers, usually the least well-paid, and surely the least often consulted on her/his working conditions.

ROBIN KOWALCHUK BURK
Consultant
Information Systems Consultants, Inc.
McLean, Virginia

We welcome correspondence from our readers about the computer industry and its effect on society, as well as comments on the contents of this magazine. Please double-space your letter when you write to DATAMATION, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. We reserve the right to edit letters submitted to us.

Said a mellow old robot named
Newman,
"When a man does not act with
acumen,
but is clumsy and coarse,
I consider the source
and remember that he's only human."
—Gloria Maxson

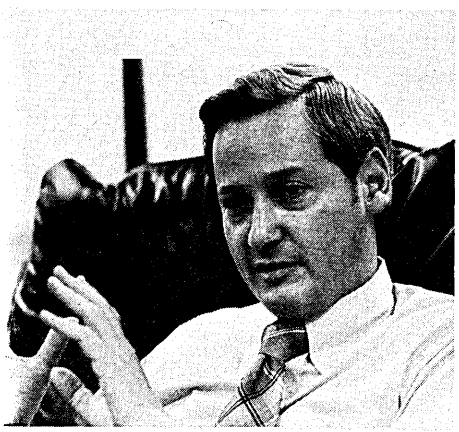
"This wasn't my idea. Tell it to the school print-out."

people

Time For A Change In Style

In its eight years of selling in IBM's shadow, Data 100 of Minneapolis has encountered a lot of problems financing its lease base. But the shocker hit early last year when it found it had overextended its revolving bank credit. And just prior to that, an ambitious oem plan had blown up in its face, when it decided not to market a microprogrammable minicomputer that emulated the DEC PDP-11 line because it didn't want the expense of litigation with Digital Equipment Corp. Further, foreign currency losses of nearly $1.5 million were being suffered in 1976.

Edward D. Orenstein, the company's 45 year old president and chairman, had been through it all before, and had no doubts that the company would weather this latest setback. "But, I knew it was time to change our management style," said the tall, slender, former Air Force physicist. "When we opened our doors in 1969 we had seven v.p.'s and a secretary. All but two are still with us. We knew what we wanted and we did it. We wanted to go to $100 million in revenues. In six years we had reached $100 million. We had our own management style. Everyone used to report to me in an informal way. We didn't want outsiders."



EDWARD D. ORENSTEIN
He'll wait to become rich

Now the v.p.'s report to Bruce Bambrough, the company's chief operating officer and a founder. It has built a computer modeling program that tracks 40 to 50 key indicators of the company's business and projects results several years into the future. The company, now spread throughout 28 nations, has installed a distributed processing network, to help with dispatching and spares management and to expedite order handling. "Whether we're right or wrong, we'll at least be consistent," quips Ken Tiede, another company founder, who built the model.

And the company has restructured its financing by convincing banks of the long revenue earning life of its equipment, which consists of batch terminals, key-to-disc data entry systems and remote processing equipment. For instance, serial number 2 of its Model 70 has been used by six different customers in the last seven years, at 214% of cost.

When the company started in 1969 with its hard-wired Model 70 remote batch terminal, it estimated a market where 70% of what it made would be leased and the rest would be cash-generating outright purchases. It turned out, though, that 96% of what it made went on lease. Lease financing became a problem right away. So much so that Orenstein observed in 1973 when the company arranged for an $11.5 million financing deal with a private source, "For the first time, we've got enough money to last more than two weeks."

At first, the cash hungry company thought it would be in the clear in three years as revenue from residuals poured in. Then it changed this forecast to seven years. "It's now more like eight to ten years," say Orenstein. Says one staffer, "Ed wants us to make him rich, but he's going to have to wait."

He will.

Last summer when the company again had gone to the money trough for cash—this time a $15 million debenture offering—it was approached by an unidentified company with a tender offer for Data 100 shares, provided it withdrew the debenture offering. Data 100 turned it down flat.

Orenstein has always wanted to run his own shop—although he's reluctant to be interviewed for a profile, "which makes it seem like one guy has built a successful company from nothing. We're a team at Data 100. The right people are on board and working together."

Orenstein began working as an instructor in nuclear weapons with the Air Force at Lowry Field in Denver. He later went to Univac in Minneapolis, his home town, but left 15 months later when he was 27 to form Data Display, which made crt's. Control Data, which gave the company its first commercial contract for a crt to be used on the console of that company's 6600 computer, acquired the company seven years later when it was up to 200 employees and was doing $2 million a year. Orenstein went to CDC along with the company as general manager of CDC's terminals operation. Three years later he set off again on his own to make and sell remote batch terminals. "It was a market that IBM had pioneered, but to such an extent that there was a three to nine month waiting period for the IBM equipment."

Private investors put $2 million into the company and Data 100 raised an additional $4 million through a stock sale. It displayed its first product the following spring at the Joint Computer Conference. Its success—"selling at 15% below IBM's price and delivering fast"—has been phenomenal. More than 6,600 terminals are installed throughout the world; it operates seven manufacturing plants, has 64 sales offices and 340 maintenance centers, and it employs 3,063 persons.

Its software power constantly is being beefed up as Data 100 offers "multifunction" systems—its buzzword for distributed processing systems. And price isn't all that matters any more. "We sell at about 10% below IBM when the competition is direct, but sometimes the price is higher when we have an edge on performance."

Orenstein, the engineer and physicist who "hasn't had a soldering iron in my hand since 1963," said the recent reorganization in management at Data 100 allows him to devote most of his time to "knowing where we want to be in the future . . . what will be the effect in three to five years of what we do today." It's a unique market "that allows us to grow as fast as we want to." The challenge is being able to manage the growth. Data 100 and Orenstein seem now to have that part under control.

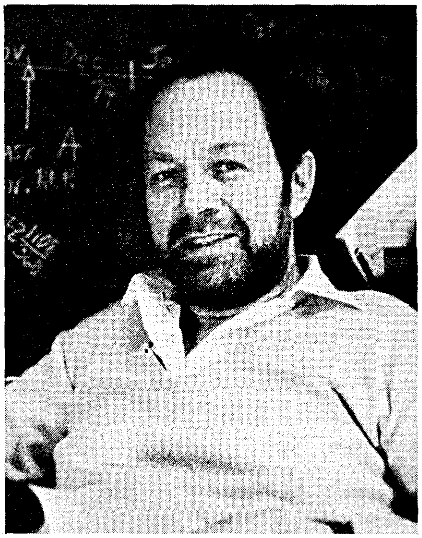
"They Should Be Paranoid"

He seems like the last person in the world who would ever talk about being paranoid. Sitting serenely behind his well-organized desk, Herb Bright, in the current vernacular, is a "laid back" man. But behind all this coolness and calmness lurks an irrepressible need—a need to incite what he calls "educated paranoia" among computer users.

They're slowly beginning to recognize," he says, "that they should be paranoid—that they should be scared." And what they should be scared about, according to the Computation Planning Inc. president, is the vulnerability of their dp systems which, in many cases, are easy rip-off targets.

"I don't think there's going to be anything," he avows, "that's perfect from a security standpoint. You can always find some gimmick to get around a system solution—whether it's bribing the customer engineer or chairman of the board." But what you can do, he claims, is "make it economically infeasible" for any would-be system scuttler to launch a direct attack.

One way to do this is through computational cryptographic techniques. A crypto convert, Bright believes these techniques can help in one of the toughest security areas, program protection. It's in this program security area that the 57 year old Complan chief sees one of the most "serious hazards" to system security. But he doesn't overlook data security either. Ever since the Bethesda, Md., firm was established in 1966, founder Bright has plotted its course, originally in the direction of offering multidimensional computer consulting services. More recently, three years ago to be exact, the company decided to change course by plunging into the near-desolate computer security marketplace. Today, its crypto software/hardware products make up the bulk of its business. Comments Bright: "We've made a very heavy commitment (in the crypto area) and we're hoping that this part of our business will grow."



HERB BRIGHT
"You can always find some gimmick."

One thing that may brighten Bright's business prospects is the data encryption algorithm which earlier this year became a federal standard with the National Bureau of Standards' blessing. "The DES (Data Encryption Standard)," affirms Bright, "has been a big help because it's made people take the whole concept seriously." The IBM-developed formula also has been a boon, he admits, since the company has found it can sell its own algorithm products against DES. Complan peddles a DES emulator and other proprietary algorithms with 128-bit key lengths. (DES uses a 64-bit key, but its effective length is 55 bits.)

While there's been some criticism that this key length is too short, Bright feels it's "quite adequate since it would be economically unrealistic to consider a brute-force attack" (trying every possible key) on a system using DES. All things considered, he believes both IBM and NBS should be commended for their work on the encryption standard.

But he still thinks much more progress in computer age cryptography can be made. And it would have been made years ago, he argues, if the military community hadn't used "cloak and dagger" methods to keep these techniques so secret. Instead, Bright urges the crypto military mavins to open up more and adopt NBS' sensible approach, which is that "competent cryptographic applications should be capable of being completely in the open, aside from one thing, the cryptographic key."

Bright knocks the "traditional 1940-style" systems security methods used today as "a bunch of one-bit controls." But he's heartened by the fact that some more savvy system users are becoming more aware of their security loopholes. And those people who are turning out to be more security conscious, he claims, are not the computer specialists, but the system users—"the people who are going to be most embarrassed if they get in trouble." However, even with the most advanced system safeguarding schemes, he cautions with characteristic coolness, "our best is still none too good."

"Enthusiasm is Contagious"

Grace Householder is living proof of the power of enthusiasm.

The diminutive director of data processing for Weirton General Hospital, Weirton, W. Va., is enthusiastic in just about everything she undertakes.

"Gracie's enthusiasm is contagious," said a fellow member of CHUG, the Cooperative Health Care Users' Group of the National Federation of NCR Users. Householder is past president of CHUG, and is credited with having boosted the organization's membership and scope of activities. She currently is vice chairman of the federation in which she has been active since its inception in 1970.

She is firm in the belief that the future of health care is closely intertwined with the development of computer applications for the medical community, and her enthusiastic espousing of this belief has converted many a resistant medical professional. Twenty-two years ago, when she joined Weirton General Hospital, Grace didn't know much about health care or data processing. Today she can discuss both fields knowledgeably and with ease. Armed with a degree in accounting from West Virginia Northern Community College, she joined the hospital as a night switchboard operator and admitting clerk. One year later, she moved into the business office as a compensation clerk; was cashier a year after that; and within four years was office supervisor.

"The data processing department," she recalls, "was started by me as a one man show in 1966." The hospital purchased an NCR 500 first, and shortly thereafter some Addressograph-Multigraph bar coding equipment. "I did all the programs for the 500," said Householder. Her only training was one week spent at NCR headquarters in Dayton, of which four days were devoted to class work and the fifth to a tour of the facilities.

She was the data processing department for the first year, at the end of which she got some help—one person, part-time. "I taught the clerks in the payroll office to do their own input which was kind of distributed processing for those days."

Designing programs for new applications is Grace's special delight though she admits her ideas are not always enthusiastically received initially. "But they (the medical staff) usually come around," she said smilingly.

During a tour of St. Louis' Deaconess Hospital conducted during an NCR users' meeting last spring, Grace viewed demonstrations of a pilot installation of the NCR Medics on-line interactive system like a child looking into the window of a candy shop. She wasn't only impressed with the technology. "They must have had fantastic support from management."

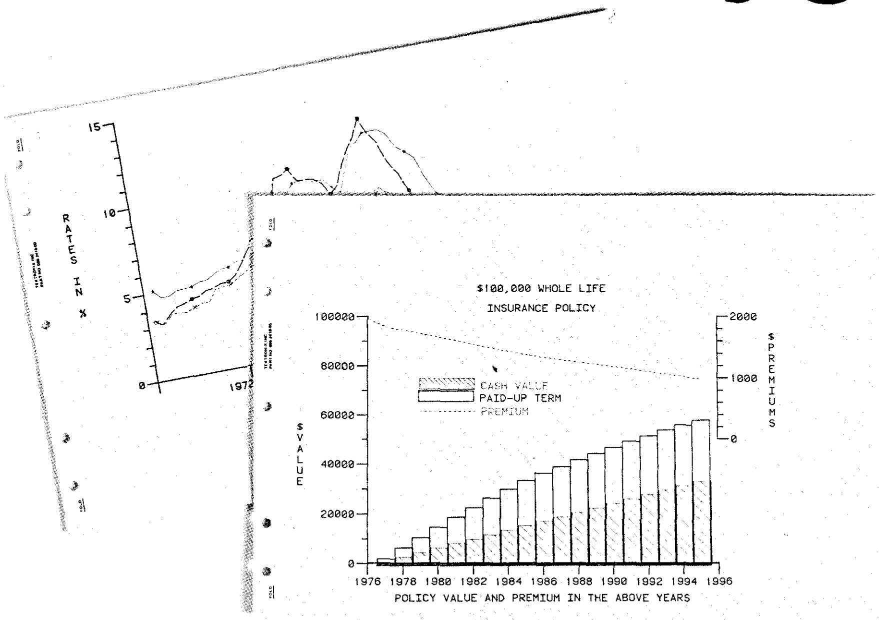
She is quick to say that she gets support in some instances too. In talking of a computerized system for maintaining inventory control in the hospital's dietary department, implemented recently, she said implementation was expedited by "total cooperation and excellent communication between the two departments (dietary and data processing)."

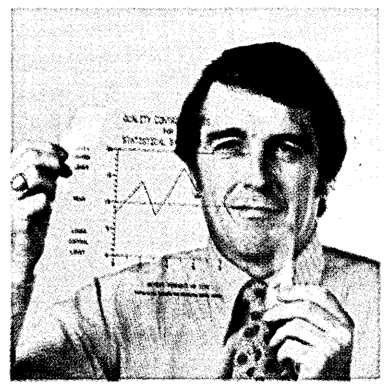
Householder's staff now numbers 15. Equipment includes an NCR Century 101 and an IBM System/32 in the pharmacy. "I surprised a lot of people when I got the 32. They thought I wouldn't look at anything that wasn't NCR." As an avid user groupie, she's considering joining an IBM user group. And, as a believer in on-line systems

(Continued on page 34)

HELPING PEOPLE SEE RESULTS **TEKTRONIX 4662**

"There's no plotter like it. My terminal easily commands any graphics."





The 4662 can draw precise plots on Mylar® polyester film or acetate, offering an especially valuable graphic assist to overhead projectors.

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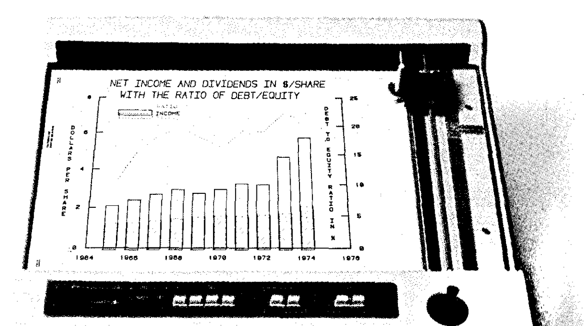

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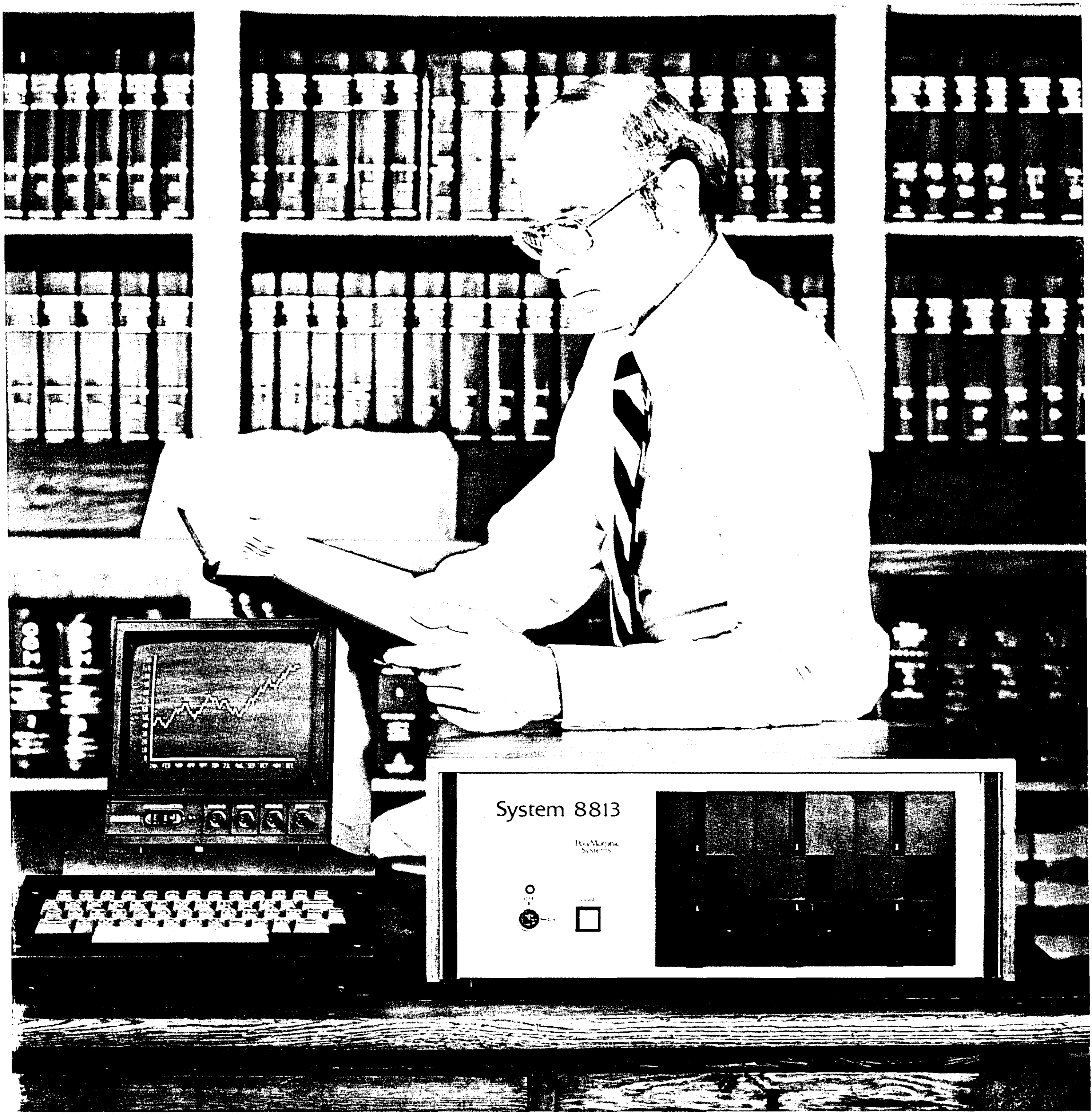

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Reliable hardware and sophisticated software make this system a useful tool. Several software packages are included with the machine: an advanced disk operating system supporting a powerful BASIC language interpreter, easy to use text editor, assembler and other system utilities. Prices for complete systems start at $3250.

See it at your local computer store or contact us at 460 Ward Dr., Santa Barbara, CA 93111, (805) 967-0468.

PolyMorphic Systems

people

(Continued from page 30)

for hospitals, she's eagerly awaiting delivery of an NCR 8250 which will do on-line patient registration at Weirton General.

A source of pride to Grace is a Microbial Sensitivity Reporting System she began developing three and one-half years ago. It compares patient sensitivity to a wide variety of antibiotics when used in treatment of diseases caused by a variety of organisms. "The Center for Disease Control in Atlanta was interested in it and excited about it. A representative come to see it and

GRACE N. HOUSEHOLDER
Health care and computers

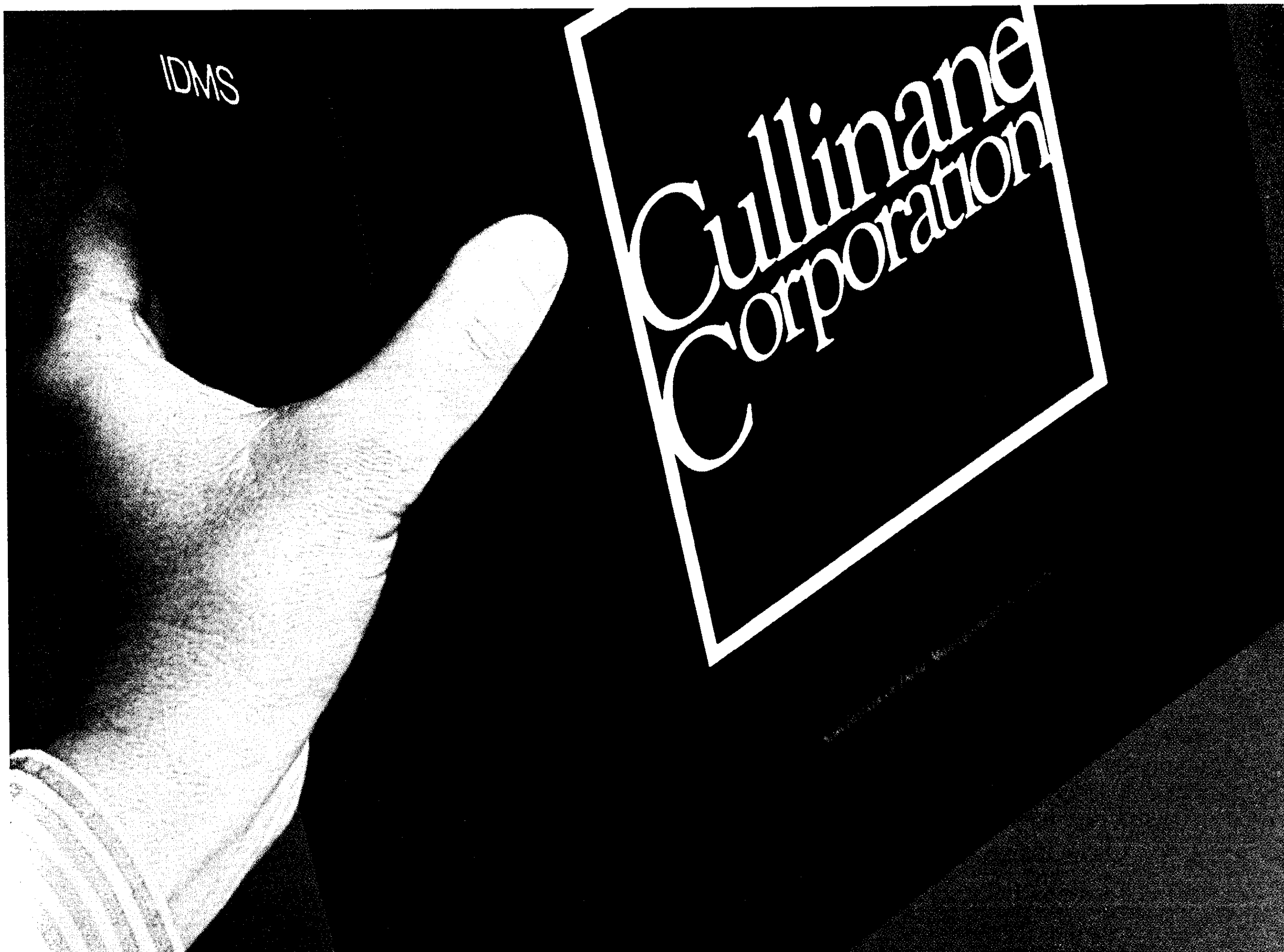
helped me refine it."

The system also has been picked up by other hospitals which are members of CHUG who can get it free under a CHUG sharing policy.

A native of Mingo Junction, Ohio, Grace attended secondary schools there. She is married and the mother of two grown daughters and has been living in Wierton since 1948. She describes Wierton as "located in the panhandle of West Virginia." The hospital serves patients from three states: West Virginia, Ohio, and Pennsylvania.

In New Posts

JAMES B. ALDRICH was named vice president—Airlines Operations for Sperry Univac Americas National Operations Div. . . . DONALD P. MOFFET joined Sycor, Inc. as chief operating officer and executive vice president . . . Harris Corp. appointed JACK C. DAVIS a corporate vice president—group executive . . . ARNOLD L. FELBERBAUM was named assistant vice president—operations for Mutual Institutions National Transfer System (MINTS) . . . HERBERT W. WHITEMAN, JR., joined the Federal Reserve Bank of New York as vice president in data processing . . . JOHN F. WATTERS was appointed president of Pharm-Assist, a wholly owned subsidiary of Synergex Corp. ❋



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CIRCLE 52 ON READER CARD


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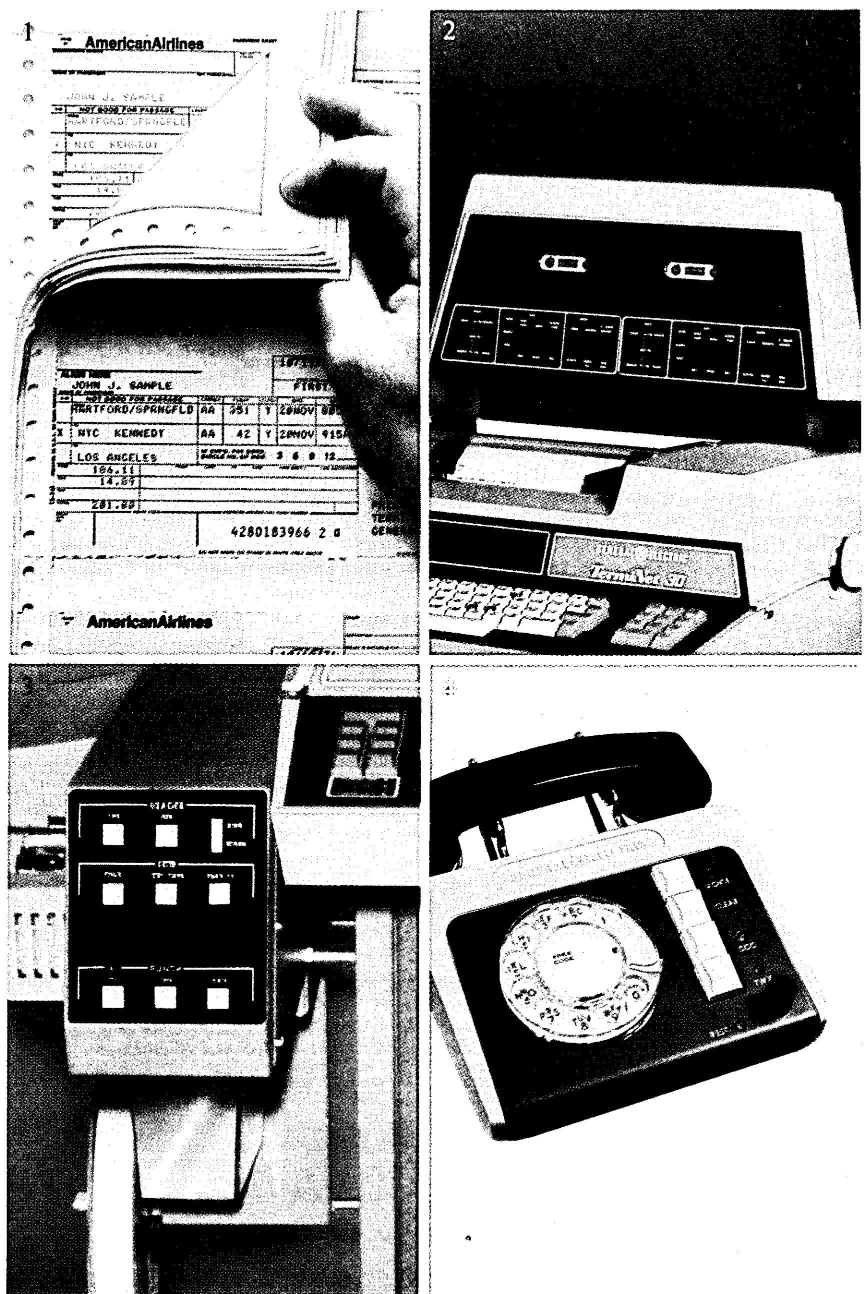
GENERAL ELECTRIC

CIRCLE 37 ON READER CARD



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- NASA-Ames Research Center—A number of Evans & Sutherland graphics systems play a role in the challenging research projects undertaken at NASA-Ames.
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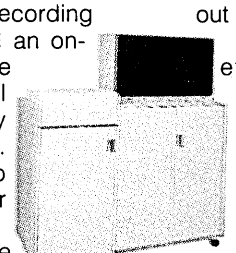

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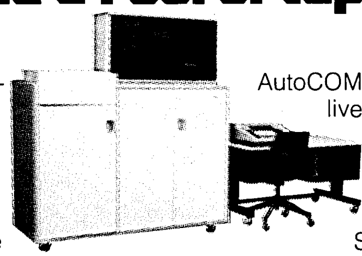

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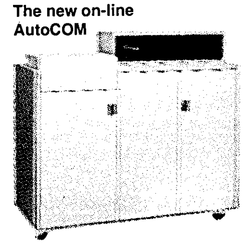

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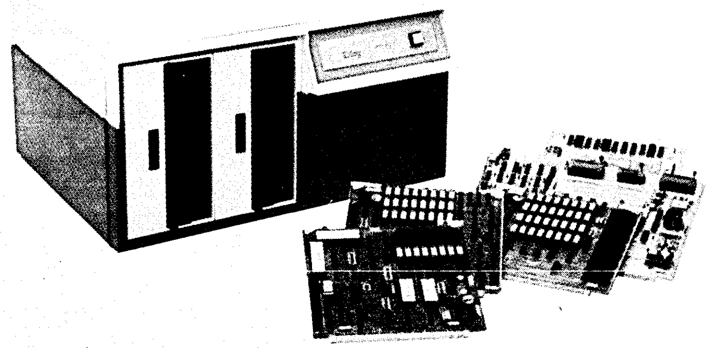
CIRCLE 56 ON READER CARD

Zilog introduces the first Z-80 disk based microcomputer system.

The Z-80 MCS Microcomputer—designed to be the most advanced general purpose microcomputer available today. You get massive computing power at a price so low you'll find it most difficult to believe.



A bold new weapon is Zilog's breakthrough Microcomputer System.

It's a general purpose unit that gives users high performance at remarkably low cost—and it features all the reliability and low maintenance you have come to expect—and get—from Zilog.

Just for starters consider these Z-80 MCS system features.

- Full use of the powerful Z-80 CPU with its 158 instruction set, considered to be the most advanced in the industry.
- Main memory storage capacity of up to 64K bytes of RAM, PROM or EPROM. The standard basic system comes with 3K bytes PROM and 16K bytes of dynamic memory.
- Dual floppy disks with 600,000 bytes of storage.
- RS-232 or current loop serial interface for communication with a CRT or TTY. And room is available to add more.
- Two parallel I/O ports for simple interface to other peripherals, and more ports are available.

And a nine slot card cage, housed along with everything else in a heavy duty metal chassis, allows the Z-80 MCS the expansion capability and flexibility you need for design options. And you get a full complement of expansion cards. Read on.

Standard software ready for development.

With the MCS you get a PROM Based Monitor. A Macro Assembler, File Maintenance, Editor, Debug and Utility Routines are also part of the standard package.

Available options: BASIC. MCS/RIO with relocating assembler and linking loader. And coming soon a powerful repertoire of programs including MCS-COBOL and PLZ.

Needless to say complete documentation and system support comes along as part of the package.

Get unprecedented power thanks to the Z-80 MCS internal architecture.

Not only does it include all of the instructions of the preceeding processors, but goes far beyond.

Memory Block moves. Up to 65K bytes can be moved at the rate of 8.4 microseconds per byte.

Memory Block searches. The entire memory of the system can be searched with a single instruction.

Block I/O operations. I/O transfers at rates of up to 125 kilobytes/second can be accomplished under software control.

Bit Handling. Any bit in any register or memory location can be set, tested or cleared with a single instruction.

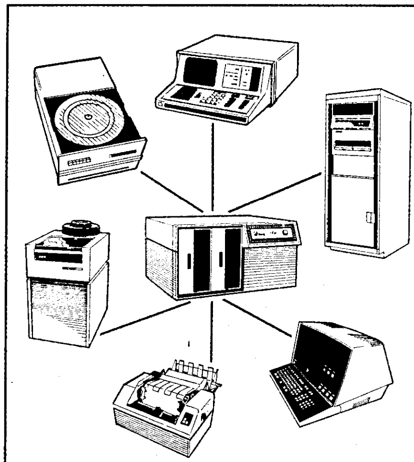
Relative Jumps. Short, two-byte relative control transfers reduce program sizes. Three-byte absolute jumps provide access to any memory location.

Eight and sixteen bit arithmetic operations provide fast data and address calculations. BCD arithmetic and shifting is also supported.

Plug in these cards to further expand the Z-80 MCS's capabilities.

- RMB: contains 16K bytes of RAM consisting of 4K dynamic RAM devices.
- IOB: allows you to expand the system by four I/O ports per board.
- SIB: allows you to add 4 Serial RS-232 ports per card.
- PMB: contains 16 sockets for additional PROM Memory per board.

Configure the MCS the way you want it.



8 connector slots let you add a variety of peripherals such as CRT, printers, paper punches, etc. It's your choice.

This is all a part of our pledge.

That pledge, to stay a generation ahead is further demonstrated by the new Zilog MCS. We urge you to learn more and a suitable brochure has been prepared. It can be yours, just write or call.

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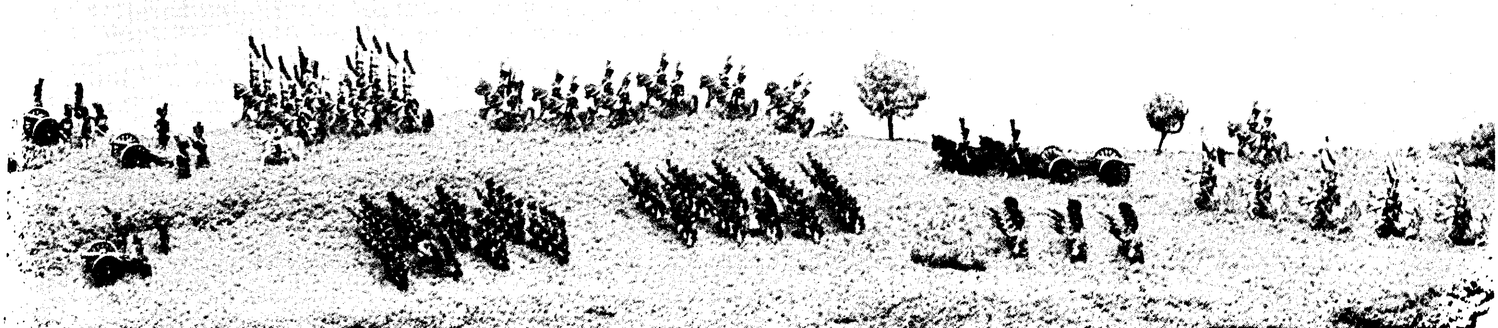


calendar

OCTOBER

Northwest Systems Conference, Sept. 15-16, Edmonton, Alberta, Canada. "Making Systems Effective" is the theme of this two-day conference sponsored by the Assn. for Systems Management. Sessions will feature lectures on such topics as applications techniques, staff development and retention, microfilm, computer auditing, minicomputers, and data base management. Fee: $70, ASM member; $80, non-member. Contact: Assn. for Systems Management, c/o K.I. Stuparek, 10040 104 St., Edmonton, Alberta, Canada T5J 2V6.

9th Annual SMIS Conference, Sept. 26-28, Los Angeles. MIS productivity as related to the issues of efficiency and effectiveness is the theme of this three-day conference. The conference will focus on the contributions of planning, measuring, technological innovations, new management approaches, and decision support systems to MIS productivity. Two days of workshops on how to apply the newest techniques in MIS will follow the conference. Contact: SMIS, 10 W. 31 St., Chicago, Ill. 60616.

22nd Conference of the Assn. of Records Managers and Administrators, Oct. 2-5, Houston, Texas. The emphasis of "A Forward Look in Record Management" will be on education for the records manager. All-day introductory sessions on the basics of records management will be presented on Monday and repeated on Tuesday. For the begineer, two of these sessions will provide a thorough grounding in the requirements necessary to begin a complete program of records management. Special interest groups will meet to discuss needs peculiar to groups such as the financial industry, manufacturing or processing industry, insurance, public utilities, law enforcement, and transportation. Half-day sessions aimed at the more advanced manager will be presented on Monday and repeated on Tuesday. Fee: $150, complete member registration; $180, complete non-member registration. The difference in the fee for the non-member may be applied towards the first year's membership dues in the ARMA. Contact: ARMA National Office, P.O. Box 281, Bradford, R. I. 02808.

Euromicro Symposium, Oct. 3-6, Amsterdam, The Netherlands. Euromicro provides a European forum on microprocessor systems and microprogramming. The technical program will cover subjects such as microprocessors, bit slices, microcomputers and their software, microprogramming, multi-microprocessor systems, design aids, debugging tools, and applications for microprocessors. An industrial exhibition and seminar will accompany the symposium. Contact: Ted Holtwijk, Philips Elcoma, Bldg BAE2, NL Eindhoven, The Netherlands.

Conference on Very Large Data Bases, Oct. 6-8, Tokyo. Tutorials intended to promote an understanding of very large data bases in terms of complexity of structure and physical size will highlight this conference. Topics covered will include: data base design, machine architecture, system analysis and evaluation, machines, systems, and performance evaluation, as well as applications, integrity and recovery, user interface, and data base languages. Contact: James Gabbert, Room E53-330, MIT Sloan School, 50 Memorial Dr., Cambridge, Mass. 02139.

INFO/EXPO'77, Oct. 9-12, Washington, D.C. Nearly 60 seminars and panel presentations plus an exhibit of the latest in computer equipment, supplies, and services have been arranged for this annual gathering of the DPMA. The keynote speaker will be C. W. Spangle, Honeywell Information Systems president. The educational base of the conference has been organized along four tracks: management functions, management skills, technological forces and trends, and business and industry applications. Fees: total conference $175, member; $225, non-member; total education: $115, member; $165, non-member. One day, student, and guest registrations also are available. Contact: DPMA-Info/Expo, 505 Busse Hwy., Park Ridge, Ill. 60068.

Micro/Minicomputer Exhibition and Seminar, Oct. 10-12, Stockholm, and **SYSTEMS '77, Oct. 17-21,** Munich. The first event is an exhibition of microcomputers and minicomputers at the U.S. Trade Center in Stockholm, to be held in tandem with the second event, the Systems '77 seminar and exhibition. Systems '77 is a biennial computer show which is expected to attract a large audience of industry, government, and military users to the U.S. pavilion at the Munich Fairgrounds. Contact: Dwight L. Umstead, DIBA/OIM Room 1015C, U.S. Dept. of Commerce, Washington, D.C. 20230.

INFO '77, Oct. 17-20, New York, N.Y. Discussions on topics related to a particular business or industry will be concentrated into a single day so that a short visit to this annual conference and exposition will provide an overview of information problems and solutions in specialized fields. Those fields will include: hospitals, insurance, banks, manufacturing, office automation, financial management, marketing, and retailing. The sessions are geared to corporate managers who need information for planning and decision-making, and to dp managers who operate information systems, and towards showing those two groups how to work together to meet management needs. Contact: Clapp and Poliak, Inc., 245 Park Ave., New York, N.Y. 10017.

ON THE AGENDA

IFAC Symposium on Discontinuous Computer Control Systems, Sept. 19-23, Prague, Czechoslovakia. Organizing Committee, Suchbatarova 4, 160 00 Prague 6, Dejvice. **International Electrical Electronics Conference, Sept. 26-28,** Toronto, Canada. IEEE, 1450 Don Mills Rd., Don Mills, Ontario M3B 2X7. **Data Communications Symposium, Sept. 27-29,** Snowbird, Utah. IEEE Computer Society (301) 439-7007. **International Conference on Computers in Cardiology, Sept. 29-Oct. 1,** Rotterdam, The Netherlands. Dr. Jerome Cox, Dept. of Computer Science, Box 1045, Washington Univ., St. Louis, Mo. 63130. **Western Systems Conference of the Assn. for Systems Management, Oct. 4,** Los Angeles, Calif. Larry Muich, Price, Waterhouse, and Co. (213) 623-2131. **Annual Conference of the Canadian Micrographic Society, Oct. 5-7,** Ottawa, Canada. R. Desrosiers (613) 741-2007. **10th Annual Workshop in Microprogramming, Oct. 5-7,** Niagara Falls, N.Y. Peter H. Lutz, Dept. of Computer Science, SUNY—Buffalo, 4226 Ridge Lea Rd., Amherst, N.Y. 14226. **Symposium on Information Theory, Oct. 10-14,** Ithaca, N.Y. Dr. Richard Blahut, IBM Corp., Owego, N.Y. 13827. **13th Meeting of CPEUG, Oct. 11-14,** New Orleans. Dennis M. Conti, A265/Technology Bldg, National Bureau of Standards, Washington, D.C. 20234. *

THE DATAPOINT 6600--

Datapoint 6600 Computer with 20-megabyte disk drive

For Network Planners It's a Disturbing System

The Datapoint 6600 is indeed a disturbing system. Because it will change the way computer network planners now think about "small" computer systems.

True, the 6600 is small physically, like the Datapoint computers that have come before it. But it is equipped with the latest technology, including features like 120K user memory, and can support up to 24 independently-functioning video display terminals in a true timesharing mode. In fact, the Datapoint 6600 packs the processing wallop of many of today's large-scale computers, at a fraction of their cost.

When combined with Datapoint's wide range of peripheral equipment, such as the new 20-megabyte disk drive, the 6600 can be used to produce a variety of disturbingly capable systems. It will free network designers from many of the constraints that previously bound them. With the 6600, regional centers can remove a major processing burden from the central mainframe computer while boosting the efficiency of local operations. In fact, a well-planned dispersed processing network can in many cases eliminate "mainframe inflation" altogether.

Like other Datapoint dispersed processors, the 6600 functions well in a stand-alone mode. It has the speed and power to handle 24 different user programs simultaneously, or to run batch jobs in COBOL, BASIC and RPG II. And with communications capabilities always available, a stand-alone 6600 can be converted almost instantly into a functioning node in a dispersed processing network.

In truth, the 6600 is a disturbing system because it will challenge your present assumptions about what a small computer can do for your operation.

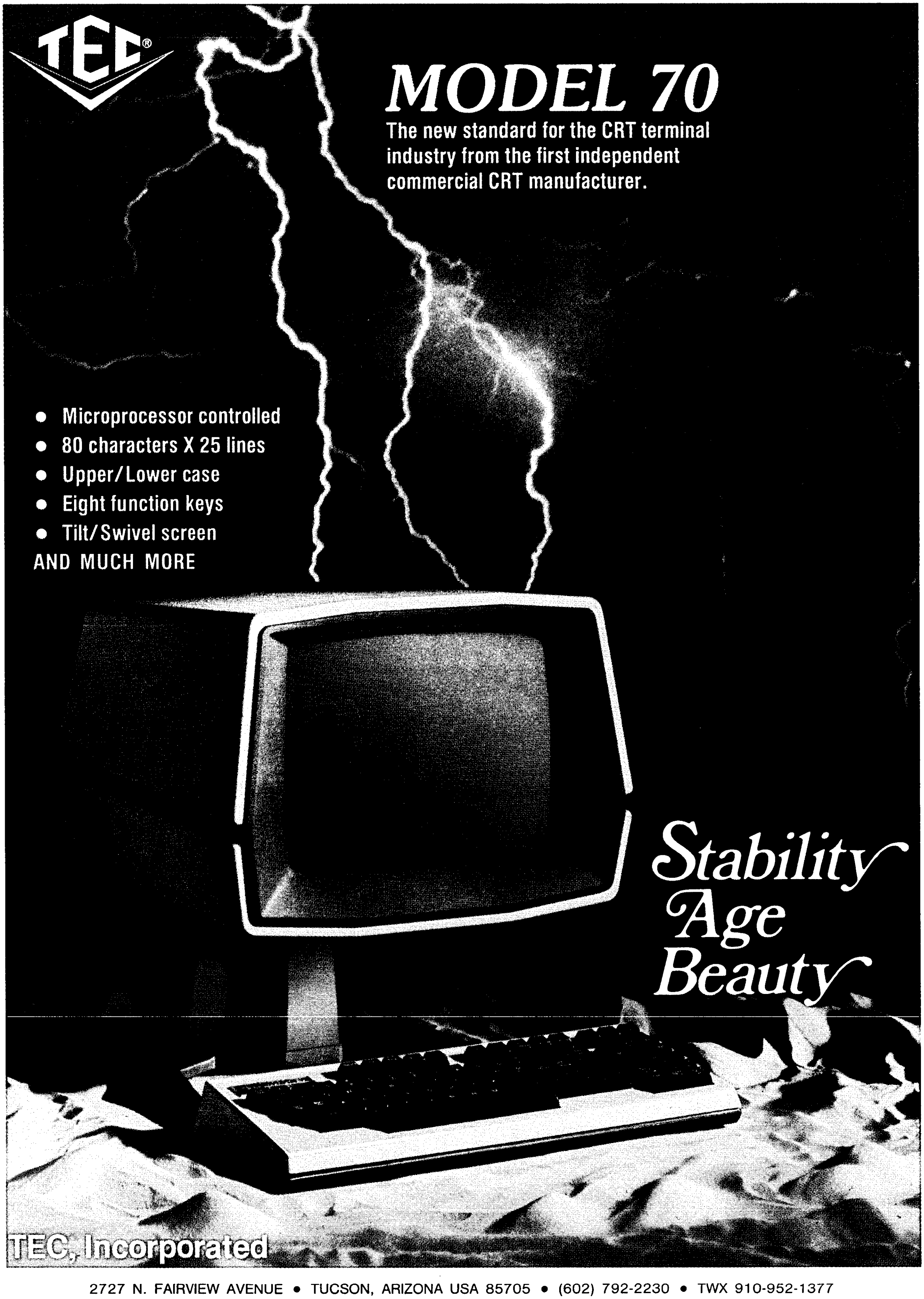
Accept the challenge. Study the Datapoint 6600 in detail. Compare it with the competition. Look at the carefully planned sequence of compatible Datapoint hardware and software products which have preceded it. We think you'll come to the conclusion that the 6600 has more to offer than any comparable system now on the market.

For more information on the 6600, contact the Datapoint sales office nearest you, or write Datapoint Corporation, attention: Product Marketing, 9725 Datapoint Drive, San Antonio, Texas 78284 (512) 699-7151.

DATAPOINT CORPORATION

The leader in dispersed data processing™

Sales and service offices in principal cities



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books

Data Dictionary Systems

by Henry C. Lefkovits
Q.E.D. Information Sciences, 141 Linden St., Wellesley, Mass. 02181
1977
(500 pp, $75.00, prepaid; $85.00, invoiced

The subject of data dictionaries is becoming more important to managers of data processing installations (see "The Role of the Data Dictionary," June, p. 129). A data dictionary can give the data processing department tools with which to create and enforce good data management.

For the interested person who would like to know what a dictionary is and how it can be useful, this book (actually more a soft-cover monograph report) is an overkill. However, for the serious prospective purchaser who is in the process of evaluating competitive packages to make a decision on purchase, this report is a must.

To the reviewers' knowledge, this report is the only available in-depth evaluation and comparison of the major data dictionary systems available on the market. The systems analyzed are: Arthur Anderson's Lexicon, Cincom Systems' Data Dictionary, IBM's DB/DC Data Dictionary, MSP's DATAMANAGER, Synergetics' Data Catalog, and UCC's UCC TEN. Unfortunately, two of the principal new competitors are not covered—MRI Systems' Control 2000, and Cullinane Corp.'s IDMS Data Dictionary. PRIDE Logik also is not covered.

The first two chapters in the book do a good job of defining the functions and uses of data dictionary systems in general. In chapter two, the author covers the full spectrum of the various features currently provided by data dictionary systems in general. Notable items covered are: security, the role of the data administrator, reports, and a fine explanation of the "bridges" facility which provides for the passage of data between the data dictionary and the DBMS. Also provided are clear explanations of processing and usage entities, and a detailed look at the attributes of various data structures.

In chapters three through eight, Mr. Lefkovits has done a masterful job of providing enough "nitty-gritty" high level technical information to enable the reader to make well-documented comparisons in choosing the system best suited to the organization's needs. For nontechnical people, this material will be too in-depth to assimilate. However, study groups and committees that are evaluating packages will appreciate the level of detail provided. In chapter nine, Mr. Lefkovits compares all six data dictionary systems in several key areas: security features, supportive documentation, bridges, and other facilities. You don't have to rely on the author's evaluation, however, when he makes comparisons across the different systems. The detail supplied in chapters three through eight enables the reader to make his own analyses.

For the serious purchaser, this book is a must.

Chapter 10 is a look at the future, and speculates on such areas as: integrated data dictionary systems, centralized data dictionary systems in conjunction with computer networks and distributed data bases, end user facilities, and the storage of security attributes in the dictionary data base.

The report also includes a glossary, a favorite feature of the reviewers'.

The book's weak points include the fact that some of it is pompously written, and the fact that typographical errors occur at about the rate of one every other page.

Because the report's subject matter is a comparison of "current" products, its obsolescense rate will be extremely fast. For example, the information on the on-line facilities of Data Catalog is already largely obsoleted. The half-life, in general, for information contained in this report is probably no greater than 12 months.

Nevertheless, it would be hard to justify the $10,000 to $20,000 that one would normally spend on purchasing a license for a data dictionary without having first read a copy of this report.

—George Schussel and Richard Fitzpatrick

Mr. Schussel is vice-president of Information Systems for the American Mutual Insurance Companies in Wakefield, Mass., and also is a lecturer and author on data base-related materials.

Mr. Fitzpatrick is documentation services manager for American Mutual.

reports & references

New from Datapro

There are several new reports from Datapro Research.

The 36-page *All About Microcomputers* provides detailed specifications of 144 current models of microcomputers. The report is $12.

The new *Directory of Suppliers* is 179 pages of profiles of 870 companies supplying products and services to computer users. Designed to help dp managers choose qualified vendors, the directory is $15.

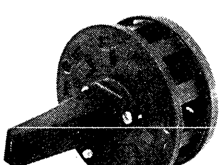
Twenty-three Datapro Honor Roll members address questions such as: where does the software industry stand today? where is it going in the future? and, how will the trends affect the end users of proprietary software? in the 16-page report, *Leading Software Vendors Analyze Industry Trends*. The report is available for $12.

Computer Performance Evaluation Tools: How to Select What's Right for You describes the basic types of computer performance evaluation tools and identifies the major products available in categories such as job accounting systems, hardware and software monitors, simulation models, and data management utilities. Charts provide information on each type of tool, including product name, price, number of users, and names and addresses of each of the vendors. This report is $12.

The 73-page updated report *All About Minicomputer Printers*, details 315 models of minicomputer printers from 96 vendors—all for $12.

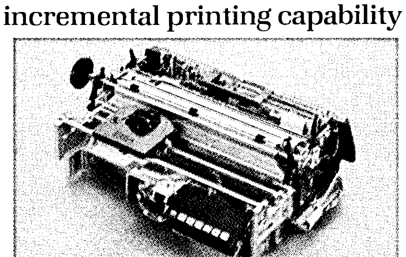
Users of optical readers will be interested in the 30-page report, *All About Optical Readers*. The report combines the ratings assigned by 85

Matrix Horsepower



A 100% Duty Cycle Makes Ours The Workhorse of Matrix Printers!

Inherent Diablo ruggedness and reliability and our unique ballistic head design give our Matrix printer a 100% duty cycle. Add to that, bidirectional printing, high speed tabbing, skip-over spacing and vertical forms control and the result is greater throughput. Our wide-gap ballistic head means paper clearances are never a problem and field head change requires only an allen wrench – no alignment! (All this plus incremental printing capability make our printer an ideal component for a workhorse terminal.) For a complete product demonstration, Diablo Systems, Inc., 24500 Industrial Blvd., Hayward, California 94545, Diablo Systems, S.A., Avenue de Fre 263, 1180 Brussels, Belgium, or Mitsui & Company, Ltd., 2-1 Otemachi 1-Chome, Chiyoda-ku, Tokyo.



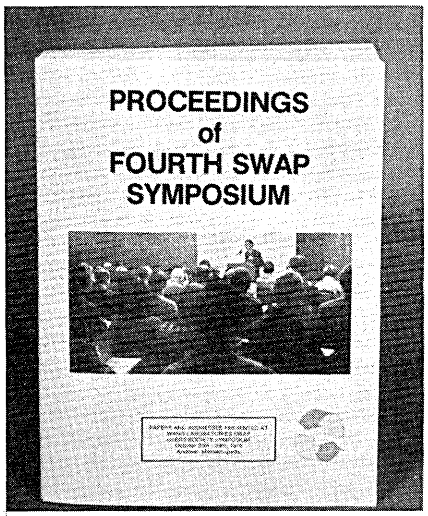
Diablo

Diablo Systems, Incorporated
A Xerox Company

responding users to 112 optical character and mark code readers, and reaches the conclusion that users of the readers are reasonably well pleased with the performance of the devices. This report is $12 per copy. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

SWAP Proceedings

The 725-page *Proceedings of the 4th Annual Society for Wang Applications and Programs* is now available from the users' society. The publication contains over 50 papers on a large array of applications including general, business/commercial, education,



science, engineering, statistics, on-line, and medical applications. Also included are the transcribed questions and answers from the sessions. Copies are available for $17.50 (prepaid—make check payable to Wang Laboratories) from SWAP USERS' SOCIETY, 1 Industrial Ave., Lowell, Mass. 01851.

Financial Systems

An Introduction to Financial Reporting and Modeling Systems is designed to help users compare and select the most effective service for their individual needs. The 100-page report includes detailed information on vendor name, address and contacts, primary package offered, computer utilized, consulting availability, graphics capability, key selling points, guidelines for selecting a system, cpu costs for six runs, connect charges per hour, monthly storage cost per 1,000 characters, and the actual coding used by each system. The 14 financial packages evaluated include FML, CUFFS, FCS, IFPS, EPS, FAL II, SIMPLAN, FISCAL, PROPHIT II, XSIM, OLSFMS, FPS, BBL, and FORESIGHT. The report is $85. REAL DECISIONS CORP., 870 High Ridge Rd., Stamford, Conn. 06905.

Book of MUMPS

A summary of current MUMPS activities is given in the 48-page *Book of MUMPS*. The center of the booklet is a cross-reference of the 197 major institutions using MUMPS worldwide, and the 230 applications they have made. Also included are articles on the MUMPS language, the users' group and its application library, computers on which MUMPS is implemented, publications, and MUMPS vendors. The summary is $2; a pocket guide to standard MUMPS is also available for $1. MUMPS USERS' GROUP, 700 S. Euclid Ave., St. Louis, Mo. 63110.

Intro to Micros

Volume two of the *Introduction to Microcomputers—Some Real Products* is now being updated twice each year to keep pace with the rapidly developing LSI chip market. The new edition describes in detail all microprocessor LSI devices available today, and some devices that will enter the market in the coming months. The book includes product descriptions and part descriptions, and describes how to mix and match various manufacturers' devices for best results. The 1200-page book is $15, and may be ordered from OSBORNE AND ASSOCIATES, 630 Bancroft Way, Berkeley, Calif. 94710.

Evaluating Minis

The importance of application software, the requirements of day-to-day operation, how to analyze proposals and contracts, and how to figure the true cost of installing and operating a mini are discussed in the new publication, *Points to Consider Before Selecting a Computer*. The 24-page primer lists both pros and cons of acquiring and operating a mini, and points out the pitfalls that can result from uninformed decisions. It is designed to be particularly helpful to those companies without prior computer experience. The guide is available free of charge from KEYDATA CORP., 20 William St., Wellesley, Mass. 02181.

English/French Glossary

A comprehensive glossary of computer communications and telecommunications terminology has been prepared by the Computer Communications Group of the TransCanada Telephone System. It contains universally accepted definitions for terms used in some of the latest technologies such as packet switching and fiber optics technology. The glossary is available in English or French; the French version contains a complete English to French and French to English lexicon. For ordering information, contact Joanne P. Stanley, THE COMPUTER COMMUNICATIONS GROUP, 12-160 Elgin St., Ottawa, Ontario, Canada K17 3J4.

CICS Guide

The new CICS *Applications Design Guide* has been designed to help the CICS programmer analyst in developing applications with less difficulty, the vendor says. There are nine basic sections to the publication: systems specification guidelines, system design concepts, CICS programming concepts, recommended naming convention, testing procedures, source module turnover procedures, documentation requirements, IBM and TelTech productivity aids, and TelTech utility transactions/programs. The appendix includes a sample CICS/VS turnover sheet and CICS turnover log. The guide is offered at $15 per copy plus a $2 postage and handling charge. Yearly updates will be available for $7.50. TELECOMMUNICATIONS TECHNOLOGY CORP., 200 Park Ave., New York, N.Y. 10017.

Micrographics Index

The 408-page key to the National Micrographics Assn.'s collection of books, journal articles, manuscripts, and other material concerning micrographics is now available from the association. The *1977 Micrographics Index* is divided into five major sections: main entry, journal, author, key word-in-context, and subject indexes. There is coverage of publications of historical interest dating from 1952, some classic works, and current material through March 1977, with 2,227 entries in all. Included are case histories of applications, user evaluations, research and project reports, descriptions and "how to" of technical processes, directories, state of the art reports, and standards. Price: $12, members; $18, nonmembers. All orders must be prepaid. NATIONAL MICROGRAPHICS ASSN., 8728 Colesville Rd., Silver Spring, Md. 20910.

Computer Services Survey

The Eleventh Annual Computer Services Industry Survey, commissioned annually by ADAPSO, is designed to provide management with information concerning financial performance, markets served, and many other aspects of the computer services industry. Analyzed in detail are financial performance industry indicators, services rev-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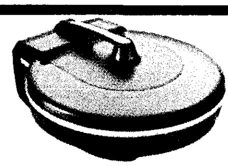
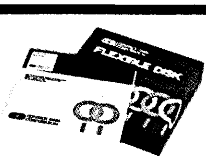
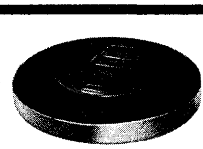
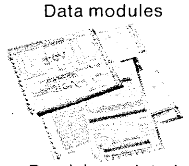

Data modules

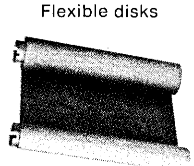


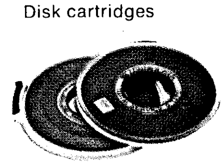
Flexible disks


Disk cartridges

Get all these high quality EDP supplies from one convenient source.


Precision printed business forms


Printer ribbons


Half-inch magnetic tape

CONTROL DATA CORPORATION

enue analysis, customer analysis, new product development, and future plans. The information provided presents a profile of what methods and products have caused companies to become profitable in today's market, and also provides an overview of what to expect from those competitors in the near future. There also are quantitative forecasts for the industry developed from IDC's marketing research sources. Price: $395; quantity discounts are available. INTERNATIONAL DATA CORP., 214 Third Ave., Waltham, Mass. 02154.

IBM Product Guide
All popular IBM teleprocessing products, current and past, including terminals, satellite processors, software packages, and communications controllers are included in this index of information sources for IBM communication products. Also included are references to 800 IBM technical manuals, and books, reports, and articles that deal with all aspects of IBM teleprocessing. The 144-page report lists sources for IBM's SNA/Advanced Communications Function, and a glossary of IBM communications terms, acronyms, and abbreviations. There also is a description of how IBM's technical document order and supply system provides suppliers and users with up-to-date information, and a description of their Service to Consultants. Price: $45. Discounts for quantity orders are available. CONTEMPORARY COMMUNICATIONS, INC., P.O. Box 3075, Culver City, Calif. 90230.

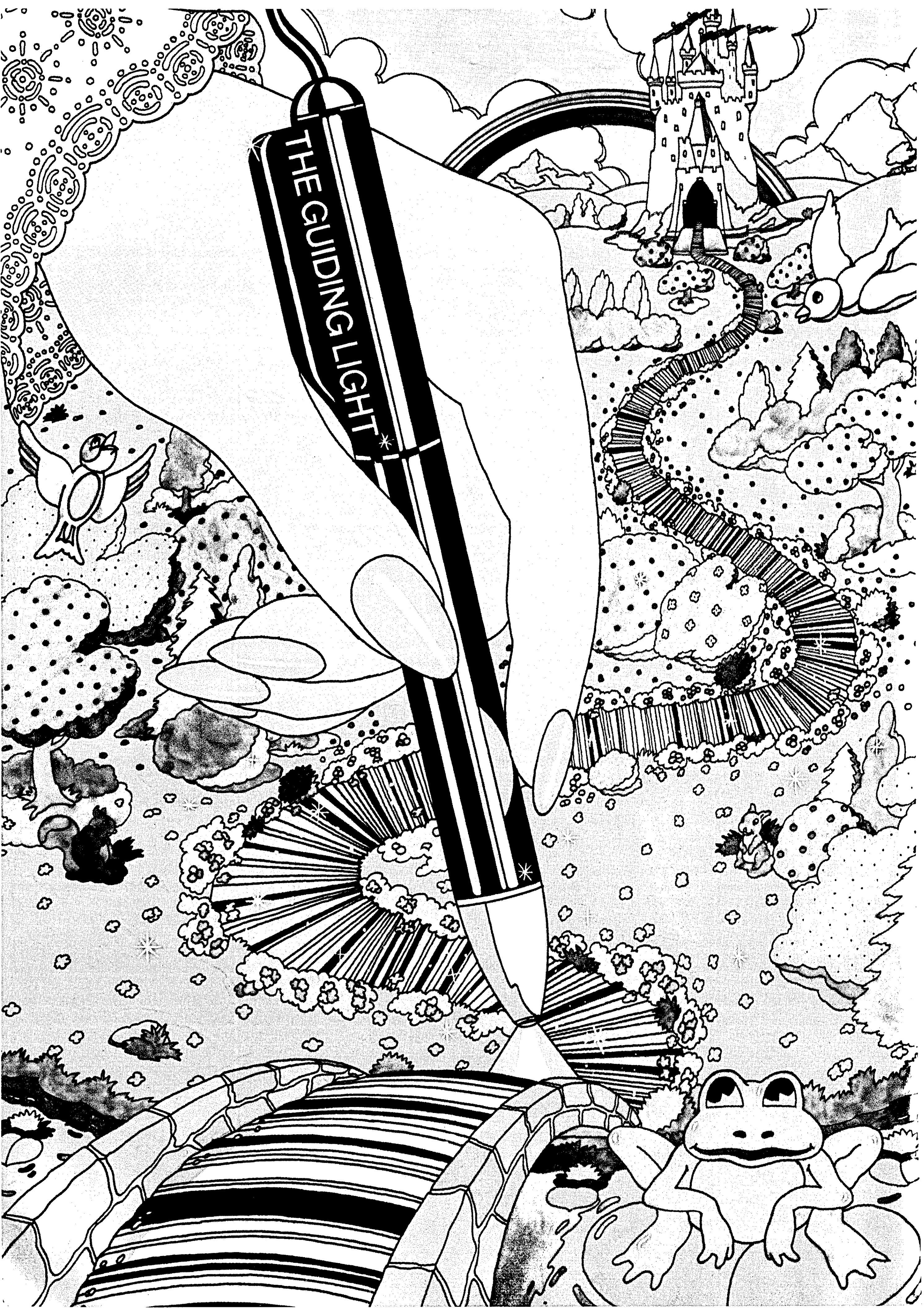
Intelligent Terminals
The Auerbach Guide to Intelligent Terminals has been updated to include the genuinely intelligent terminals—those that meet the criteria for intelligent terminals as opposed to programmable terminals. The 292-page report presents information on four levels of detail. The Product Class Report provides insight into the entire intelligent terminal market. The Search Chart gives the reader a quick glance at the functionability of the intelligent terminals on the market, and the Specification Chart offers a closer look at the terminals, listing detailed technical specifications for each. The individual Product Reports are narrative close-ups of each intelligent terminal. Also included is price information and a directory of suppliers. Price: $24.95. AUERBACH PUBLISHERS INC., 6560 N. Park Dr., Pennsauken, N.J. 08109.

Southwest Facilities
The 300-page *Directory of Computer Facilities in the Southwest* has recently been updated by Texas A & M Univ. More than 900 organizations with a total of 1,340 computers in Texas, Louisiana, Arkansas, Oklahoma, and New Mexico are listed in four different ways: alphabetically, geographically, by application, and by manufacturer and model. Included is information on the type of computer, memory size, peripheral equipment, operating system used, whether rental use or programming assistance is available, application areas, and programming language. Price: $20. TEXAS A & M UNIV., Industrial Economics Research Div., College Station, Texas 77843.

Pioneers of Computing
It is only 25 years since the first practical working computers came into the market, and science is in the position of having the pioneers of the industry directly available for comment. The Science Museum of London, with the National Physical Laboratory, has commissioned a series of 30 taped interviews with some of the most distinguished scientists involved in the early years of computing. The resulting cassettes, each about one hour long, and said to be of excellent audio quality, are now becoming available, with the full set to be available by the end of 1977. Among those already recorded are: A.D. Booth, D.W. Davies, J.P. Eckert, J.W. Forrester, G. Hopper, T. Kilburn, J. Mauchly, J. Pinkerton, F.C. Williams, J.A. Wilkinson, and K. Zuse. Price: £2.50 each, plus postage and handling. SCIENCE MUSEUM, South Kensington, London SW7 2DD.

vendor literature

Source Data Processing
Aimed at an audience of data processing managers and corporate executives, the 22-page illustrated booklet, "A Pocket Guide to Source Data Processing," tackles the problem of distinguishing the source data processing (SDP) concept from similar terms in the field, such as decentralized, dispersed, distributed, and distributive processing. The brochure includes critical elements to be considered by users in system selection—autonomous central control, data base management software, interactive and batch communications, and data capture at the source or point of data entry. It concludes with an overview that outlines how this vendor's family of source data processing systems—the 600 Series of minicomputers—are


THE GUIDING LIGHT

And then, with a wave of her magic wand, the wicked evils of keypunching disappeared forever.

With the possible exception of Prince or Princess Charming, a better data entry system has been the most frequently recurring dream since key punching came on the scene.

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work ever was. Data just gets picked up and swept off to the computer, leaving no room for error. And it's ten times faster than keypunching.

Happier day still when we tell you our system's plug compatible with most computers. The Guiding Light can read most code formats, including, AMES CODE, CODABAR™, UPC versions A, E, and Extended Distribution Code. It also traces out-of-file records, controls quality, production and inventory, posts charges, verifies credit, communicates two-ways, and boasts four function keys and sixteen different tones.

And if you think all that's compatibility, wait till you see what happens when keypunching turns into wandwaving. Then anybody can enter data directly into the computer.

Oh all right, it's not a coachman and six horses. But it'll get you home before midnight, pumpkin.

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12 Park Street, Somerville, Mass. 02143
(617) 776-1142

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Firm ____________

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City ____________

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We've found one or two companies that couldn't use the new Xerox 1700 terminal.

It happens. But not very often. Because, of all the 1700's we sell or lease, over 98% find permanent homes. And for plenty of good reasons.

Most companies who do interactive work want very high print quality and that's exactly what they get with the 1700. The quiet, reliable HyType II prints sharp, crisp characters even at 45 cps.

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And you know that if something goes wrong, Xerox is going to be there to make it right.

If you think your company could use the new Xerox 1700, call 213/679-4511, Ext. 2231. Or write Xerox, Dept. A1-15, 701 Aviation Blvd., El Segundo, CA 90245.

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Xerox Computer Printing

XEROX

CIRCLE 82 ON READER CARD

designed to free centralized processing power, reduce communications costs, and provide operational flexibility. ENTREX, INC., Burlington, Mass.
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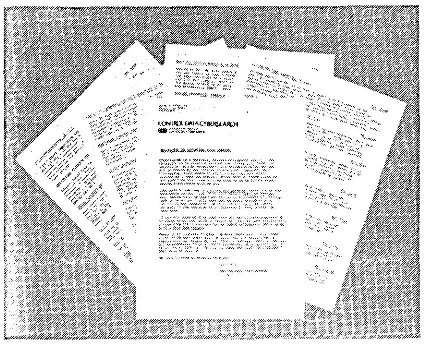
Dp Job Bulletin

A new nationwide private employment agency owned by Control Data Corp. is providing computer-assisted recruiting by periodically listing openings with companies coast to coast. The service is said to combine individualized personal service with the Cybernet system. Individual resumes are



programmed and stored in the computer's memory to be automatically included in every search made for client companies. When a match occurs, Cybersearch notifies the qualified individual and arranges an interview. CONTROL DATA CYBERSEARCH, Chicago, Ill.
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Patient Information System

A new eight-page, four-color brochure describes a patient information system from this vendor. A data base of more than 9,000 hospital-related computer programs integrates and automates patient data processing and communications into an on-line, real-time system that may be installed in all departments and used by the doctors, nurses, and other staff people responsible for patient care. Subsystems applicable to admissions/discharges/transfers, pharmacy services, diagnostic and treatment services, surgery, medical records, and dietary and housekeeping departments are described. Also detailed are the vendor's technology and customer support services. NATIONAL DATA COMMUNICATIONS, INC., Dallas, Texas.
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Heathkit Computer Lit

Two new "total design" computer systems are described in this new 16-page, four-color catalog. The two mainframes are based on the 8080A and LSI-11 MP modules. Vendor-designed software, crt terminal, paper tape reader/punch, serial, and parallel interfaces are said to make total system setup easy and fast. Easy self-service and trouble-shooting are also said to be benefits of the kits. The computers are to have full expansion potential. Mass storage capability is available in both audio cassette and paper tape format on the H8 and in paper tape format on the H11 for added convenience. Memory expansion boards can be added to either unit, along with an expanding number of I/O devices. HEATH CO., Benton Harbor, Mich.
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Interconnector

This company's solution to the multicomputer interconnect problem is described in a new eight-page brochure. The HYPERchannel is said to provide an effective method of handling voluminous data traffic between the computer, storage, and access elements of large-scale computer systems. Features detailed include: dynamic switching for cpu access to all other systems elements; resource sharing between facilities up to one mile apart; data transfer up to 59 megabits over coaxial trunk; multiple, simultaneous data paths; and up to 64 devices on a single trunk. The brochure also details user benefits and contains typical application examples. NETWORK SYSTEMS CORP., Brooklyn Center, Minn.
FOR COPY CIRCLE 307 ON READER CARD

Care and Feeding of Floppies

A new brochure, "An Operator's Guide to Care," is geared to the operator/user of floppy discs. The release outlines the storage and handling of floppies with practical information on the do's and don'ts of disc care. The brochure provides an overview of some of the problems encountered in disc use, with some positive and helpful suggestions on how to prevent the loss of data. ADVANCE ACCESS GROUP, Westchester, Ill.
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Mini Accessories

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	Weighted Average User Ratings*						
DATACOM/DB	**3.7**	**3.8**	**3.6**	**3.8**	**3.1**	**3.8**	**3.5**
ADABAS	3.6	3.4	3.7	3.7	2.3	3.2	2.4
IMS	2.9	2.4	2.2	2.5	2.8	2.8	2.9
DL-1	2.6	2.4	2.3	2.4	2.4	2.5	2.6
IDMS	3.8	3.3	3.4	3.6	3.0	3.6	3.5
SYSTEM 2000	3.0	2.6	3.0	3.0	2.5	3.0	3.0
TOTAL	3.5	3.1	3.4	3.4	2.8	3.0	2.8

All figures based on latest available Datapro survey.
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Courtesy of Datapro Research Corporation, Delran, N.J. 08075

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	Weighted Average User Ratings*						
DATACOM/DC	**3.4**	**3.4**	**2.8**	**3.7**	**2.3**	**3.6**	**3.0**
TASK/MASTER	3.3	3.2	2.8	3.3	2.5	2.7	2.7
ENVIRON 1	3.1	3.1	3.2	3.1	2.3	2.5	2.5
CICS	3.1	2.8	2.4	2.8	2.8	2.9	2.8
INTERCOM	2.7	2.8	2.2	2.5	2.1	2.1	2.5
IMS/DC	2.8	2.5	2.4	2.5	3.0	2.9	2.8

*All weighted averages are based on a scale of 4.0 for excellent.
Courtesy of Datapro Research Corporation, Delran, N.J. 08075

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—Gary Dyer, Data Processing Director, Blue Cross of Idaho.

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—David Harp, Director of Data Processing, New Castle County, Del.

"My programmers say DATACOM/DC is very easy to use; as simple as writing a COBOL program. The documentation also is very good. Technical enough for the technical people yet simple enough for management people to understand."
—Harvey Kennedy, Vice President and Director of Management Systems, Southern Baptist Annuity Board (Dallas).

"Vendor technical support is Insyte's largest shining star. The support people are unparalleled in the industry."
—Ben Driver, Data Base/Data Communications Software Manager, Brockman On-Line Systems (Houston).

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periodicals

Mini Matters
The member news publication of the Minicomputer Industry National Interchange recently has been inaugurated. Volume one, number one of *Mini Matters* included articles such as "Preparing for Your First Computer," "IN-VU—System of the Future," and new product announcements on minicomputers from NCR and Sharp, a small scale system from Burroughs, and a small business computer from Sperry Univac. The columns "Current Reading" and "Worth Reading" are expected to be regular features in each issue. For more information on the organization and its publication, contact the MINICOMPUTER INDUSTRY NATIONAL INTERCHANGE, 4902 Tollview Dr., Rolling Meadows, Ill. 60008.

People's Computers
The five year old publication *People's Computer Company*, has changed its name and format. Now called the *People's Computer*, the magazine is bimonthly and is aimed at those hobbyists, programmers, students, and educators who want to learn more about computers—how they work and how to use them. Planned articles include an introduction to computer networking, a continuation of a series on 6502 assembly programming, and information on how microcomputers are used in biofeedback applications. Each issue also will contain programming tips, book reviews, and computer games. Subscription: $8/year, U.S.; $12/year, Canada. PEOPLE'S COMPUTERS, 1263 El Camino Real, Menlo Park, Calif. 94025.

WP Information Service
The Word Processing Industry Service will provide continuously updated information covering markets, products, technology, and companies. In addition to the updated notebooks, there will be newsletters, unlimited inquiry privileges, and an annual two day conference. The service is directed at industry participants, suppliers, equipment users, and financial analysts. DATAQUEST, INC., 3000 Sand Hill Rd., Menlo Park, Calif. 94025.

courses

Humanized Technology
Humanized Technology for Edp Management is a seminar intended for all dp managers and their technical staff. The seminar is designed to provide participants with information on methods which can contribute to increased technologist and system user productivity. Day one of the two-day seminar will have as its theme "Software Metrics: Specification and Measurement of System Quality." The second day's theme will be "Humanized Input and Data Engineering." The course instructor will be Tom Gilb, author of *Humanized Input* (April, p. 45). The seminar will be held Oct. 6-7 in Washington, D.C.; Oct. 10-11 in Chicago; Oct. 13-14 in Toronto; Oct. 20-21 in Seattle; Oct. 24-25 in San Francisco; and Oct. 27-28 in Houston. Price: $450, includes all course materials and lunches. TSI SALES AND MARKETING, INC., 19 W. 44 St., New York, N.Y. 10036.

The People Side of Dp
The aim of the five-day workshop, *How to Assess, Supervise, and Administer Computer People* is to provide a comprehensive review of the key factors bearing on the management and supervision of computer people. The workshop will dissect job components, consider selection of talents to match job characteristics, describe the variables affecting performance, and will stress the long-term retention of effective employees. The impact of systems controls and use of organizational dynamics also are emphasized as major factors in people performance. The workshop will be conducted in Washington, D.C., Sept. 19-23 and Nov. 7-11; and in San Francisco, Dec. 12-16. KESTON ASSOCIATES, 11317 Old Club Rd., Rockville, Md. 20852.

●

A studious robot in wrath
abandoned the flower-strewn path
  of music and lit,
  for he had to admit
he was a lot better at math.

—*Gloria Maxson*

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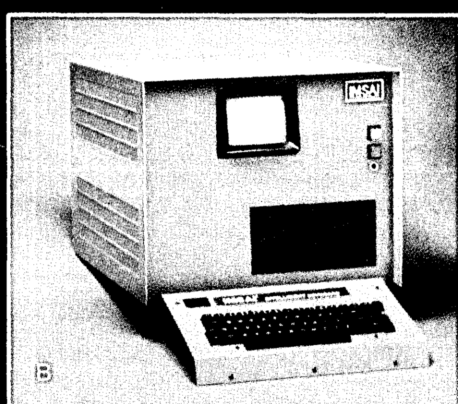
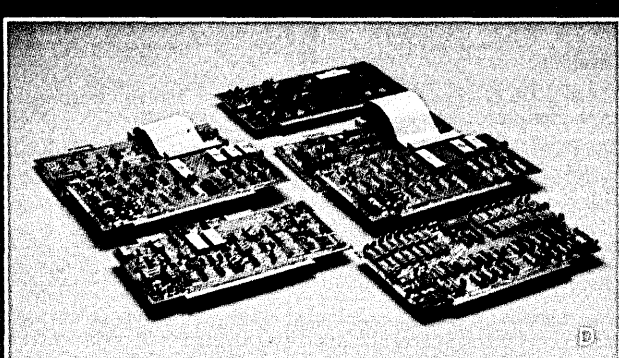
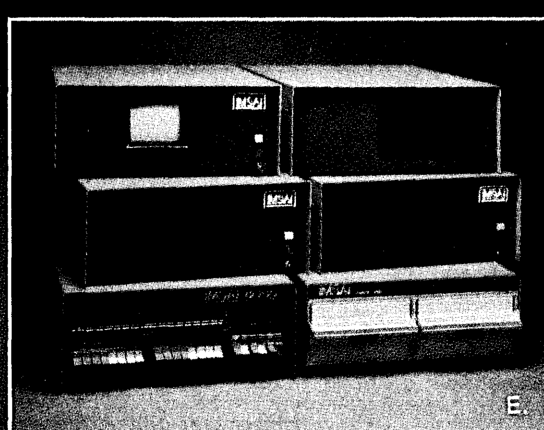






A. VDP-80 Computer with 300 lpm printer.

B. PCS-80 with CRT, dual floppy disk & Intelligent Keyboard options.

C. Peripherals—(clockwise from left) 45 cps daisy-wheel printer/terminal, 24x80 CRT terminal, 45 cps daisy-wheel printer, Intelligent Breadboard, 44 col. alphanumeric line printer.

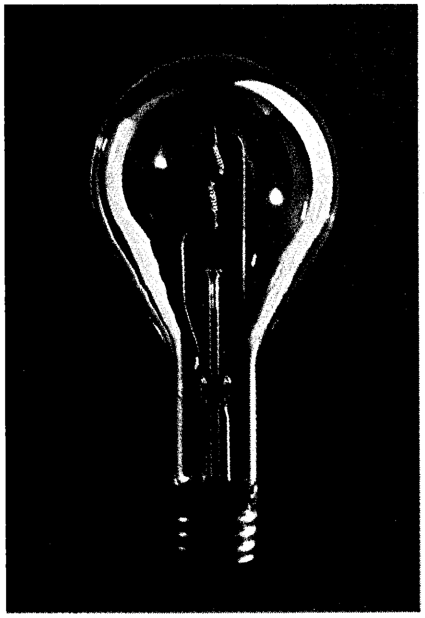
D. Processor, Memory & Interface boards—shown MPU-A, 65K RAM, and floppy disk, line printer and serial I/O's.

E. PCS-80 System—sample component configurations.

The more significant the innovation, the more the corporation comes to depend on it.

Distributed Processing.
Distributed data processing represents a significant advance in an organization's ability to monitor and control its own operations. So significant, in fact, that a large decentralized corporation quickly comes to depend on its distributed processing network in the same way that a biological organism depends on its nervous system. For this reason, it is vitally important that such a network be supported by a fast and efficient field engineering team.

Field Engineering. Four-Phase Systems provides 24-hour-a-day maintenance support to distributed processing sites from more than seventy field engineering offices nationwide. The Four-Phase field engineering organization is structured to support network operations, and combines such unique features as a national alert center, remote diagnostics, and local-regional-national spare parts inventory to insure the highest reliability in the corporate nervous systems we build and support.



This team of field engineering professionals helps Four-Phase distributed processing systems achieve better than 99% uptime nationwide in typical multi-shift use. And every service incident which does occur is analyzed by the Four-Phase field engineering support group to determine whether maintenance response was timely and efficient and to supply statistical data to guide our product engineers toward even higher equipment reliability.

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Editor's Readout

John L. Kirkley, Editor

The First Twenty Years

As you may have gathered from this month's cover, it's our birthday.

Twenty years in the computer industry. Long enough for the industry to grow and change dramatically, and long enough for what was *Research and Engineering* (the magazine of DATAmation) to evolve into the publication it is today.

Because DATAMATION is an integral part of the industry, our editorial coverage and our fortunes have taken the same wild roller coaster ride.

In the fifties we were small but growing steadily, moving from the oscilloscope and hot solder world of scientific and engineering computing into commercial data processing. In the sixties the magazine grew fatter and fatter until the November 1969, Fall Joint Computer Conference issue resembled a Sear's catalog. Following some sort of Malthusian logic, the industry promptly collapsed. The burned out husks of companies were strewn around the landscape like bodies in a Sam Peckinpah movie. And DATAMATION was so thin you could practically see through it.

But the industry recovered and so did the magazine; we were both basically healthy.

Even though many undercapitalized and undermanaged firms bit the dust, the industry survived because it was firmly based on a technology whose time had come. DATAMATION was able to regroup and once more flourish because it was rooted in a solid editorial foundation, a framework clearly spelled out 20 years ago by the magazine's first publisher, Frank D. Thompson, in DATAMATION's second issue.

Thompson said, "All of automation is young . . . and the field of handling information automatically even younger. Because this field of endeavor is presently pioneering, it needs a voice—a voice which is responsible, intelligent, and which will assist its people by reporting and interpreting the industry's developments. DATAMATION intends to be that voice."

He stressed that DATAMATION was not to be a news magazine, but rather a "news report magazine," concerned with in-depth interpretive reporting. "DATAMATION will publish thoughtful articles by leading men in the data processing field," he continued. With admirable foresight, Thompson directed the magazine to cover international as well as domestic computing, recognizing data processing's potential as a worldwide activity.

As we go into our third decade, the industry is changing again. Low cost logic, personal computing, distributed systems, data communications, Japan, IBM and AT&T's strategic manuevering, increased government intervention and regulation — these are just some of the forces that are reshaping the industry into forms that were inconceivable in 1957.

And as the industry changes, DATAMATION will inevitably change as well. But the basic editorial approach will remain—quality technical articles and leading edge reports by industry practitioners, interpretation and analysis of industry news, an international orientation, and a perspective that sees computers and data processing within a social and economic context.

Right now times are good for both the magazine and the industry, and we expect this condition to continue for some time to come. But we'll keep our seat belts fastened. After all, we're still on a roller coaster and we're only a little way into the ride.

Twenty Years of Data Processing

Brickbats and bouquets, commentary and observation, hindsight, foresight, fact and fancy . . . a view of the industry by some of its more vocal insiders.

Over the years DATAMATION has been fortunate to have some of the brightest, most capable, and experienced people in the computer industry associated with the magazine as contributing editors, advisors, and friends. In the next few pages some of them take a look at our industry, past, present and future. From the irascible Bob Patrick's view of our continuing foibles to Portia Isaacson's enthusiastic welcome to personal computing, there's a wide divergence of opinions and perspective which reflects the fact that after twenty years, the computer industry is still alive, changing, and growing. We wouldn't have it any other way.

The Data Processing Business— 20 Years Backward and Forward

by Frederic G. Withington

I dug out a 1956 report on the computer industry. It seems that in 1956, about 500 computers were installed in the U.S. worth about $200 million. In 1976, maybe 300,000 computers were installed (depending on your definition of a mini) worth close to $50 billion—pretty fair growth!

But not everything has changed so much. The 1956 report discussed 15 companies that made computers. The top five were IBM, Sperry Rand, Burroughs, Honeywell, and NCR. In the June 1977, DATAMATION feature "The Top 50 U.S. Companies in the DP Industry," guess which companies occupied five out of six top positions? (Control Data was the other one.)

And on a more sobering note, all ten of the remaining companies discussed in the 1956 report have left the general-purpose computer business. Twenty years from now, will the same pattern apply—the rich getting richer, and few others need apply? Perhaps not: there are numerous semi-rich now (the next ten or so in the top 50) that will be hard to kill. Also, as words, images, and voices get increasingly entangled with data during the next 20 years, other big names like Xerox, Siemens, 3M, Nippon Electric, and Eastman Kodak may join the list—not to mention AT&T.

The 1956 report bubbled happily about the rapid state of hardware evolution. New techniques and devices for logic, memory and peripherals were appearing almost daily and being implemented rapidly in new products. New hardware technology still appears, but its implementation has become depressingly slow. Also, it seems that by the time new technology reaches the field any promised bottom line benefit has been frittered away in increased overhead. The reason is that the business is dominated by software (the 1956 report said nothing at all about software). The manufacturers' systems programs dominate and constrain their product lines, and user investments in program libraries constrain freedom of choice.

Does this mean the business is grinding to a halt? Certainly not in terms of revenue and profit growth, judging from industry performance in 1976 and the first half of 1977. Probably not in new areas, either, such as distributed minisystems for responsive support of local activities and the aforementioned word, image, and voice processing.

But in terms of production data processing applications, once the general transition to interactive transaction processing with data bases has been completed (and it will be for most users well within the next 20 years) a period of maturity may follow. During the next 20 years, then, the companies may consolidate the conquests that have occupied them for the last 20 and send their armies increasingly into new territory.

In no case is progress likely to stop — but I'll bet some 1401 emulation will still be going on 20 years from now! ☼

Ted Withington, a senior staff member of A. D. Little, Inc., is one of the most often quoted and influential members of the computer industry. He is a Datamation advisor and contributing editor of long-standing.

The Curmudgeon's Corner

by Robert L. Patrick

Bah, humbug! We're ten years older and we have the same old problems! In the last ten years we've seen explosive growth and we've learned to speak of persons and be blind to the fact that men and women exist. That's not much progress for ten years' time.

Ten years ago we had training problems, we lacked a viable standards mechanism, and the computer societies were faulty. Today we have more partially trained personnel than ever before; our foremost standards authority says we must reorganize; and the computer societies are charging more and doing less than ever before.

We hit a new low just the other day when I received an announcement for a local computer meeting with a hand-written label on it.

I guess a little progress has been made in some fronts. The auditors finally decided they couldn't audit around the computer and are now trying to find out what goes on inside the computer center. Prices have come down so you pay less for your computation. Computers come in smaller boxes and the little ones seem to operate satisfactorily in an office atmosphere, so we have stopped building hospital wards to house them in.

But there is no indication that we've reached the age of reason.

Several months ago a fellow at the National Archives put forth a proposal for a Taj Mahal which would house a few million magnetic tape reels in air-conditioned splendor for the scholars of the next century. Now that will take a heap of doing considering we sometimes have trouble reading last quarter's tape due to program updates and density changes. Since our files aren't self-defining, documentation is seldom current and practitioners have difficulty in determining the exact meaning of the data elements and codes today, I suspect a Taj Mahal containing a few million tape reels would be the biggest boondoggle since typing tests for Washington secretaries.

Ten years ago the academic community predicted time-sharing was going to revolutionize the world. Well, I guess it did revolutionize the academic world. But to the commercial and industrial users it is just another tool, and while there is quite a bit of time-sharing going on, remote job entry stations seem to be very popular too.

On the way to massive integrated management information systems predicted ten years ago, we went hard aground on a reef called complexity. The hardware was pretty good, data management extensions appeared on most operating systems, and programmers managed to get their transaction processing codes checked out (more or less). But the beasts were hard to administer and unless you took extraordinary precautions, they occasionally suffered a catastrophic failure. The successful systems are highly tuned monuments to the diligence of the data base administrators.

Distributed systems have a certain appeal since they'll relieve the political pressure on the central site and put the responsibility and the authority back in the user's hands. However, without a strong dose of data administration (and some systems features to render all this possible), distributed data is likely to go the way of its predecessors.

Our biggest problem is people. The average age of the staff in most of the established shops is 35 creeping towards 40. Some shops have a few older people and we are beginning to see an occasional retirement party. I still don't see any career planning. Most of the troops are so interested in living the good life they don't perform the elementary arithmetic to discover that 65 minus 35 gives them 30 years yet to work.

The younger folks coming out of college and entering the work force can code fairly well. We need to retread a large portion of our existing work force so they can pursue new jobs and leave their old jobs to the younger folks. The current crop of after-hours courses, books, magazines, and newspapers aren't filling the job. In the face of this need, one of the computer societies is turning itself into a guild while the other two seem to be dying on the vine. The biggest problem of the next ten years will be how to keep people productive in their middle years.

I guess we'll bumble through somehow. We used to have an opportunity to bury our mistakes since each new computer was incompatible with its predecessors. Now, since most manufacturers are building lines of compatible equipment, the only time you get to throw it all out and start over again is when a vendor dies and you're forced to change.

Some of our past decisions will be around to haunt us for a long time. ❊

The word curmudgeon is an interesting archaism meaning "a cantankerous fellow." The equally archaic Bob Patrick is Datamation's oldest and most venerated editorial advisor, known for his incisive and sometimes splenetic views of our industry and its shortcomings.

On a Fast Track To . . . ?

by Phil Dorn

What progress in 20 years? The command languages are harder to use, the core dumps fatter and less readable, printing a file is a major project. Progress?

The hardware works; that wasn't true when DATAMATION was born. Most commercial shops still don't stretch their processors but the atombusters and weather-watchers smile a bit more broadly every year. Hurray for Cray! Programmers still can't get at the hardware, "layers and layers of bug-ridden software" (a Maury Laver phrase) still intervene.

The hardware-happies led by T.I.'s Mark Shepherd think all software will be loaded into ROM's at the plant. Great! Where is the evidence engineers will be better at writing error-free programs than today's programmers?

Help is coming, at least for those not brainwashed into total centralization, dumb terminals, and massive data bases. Even inside IBM one hears muted protests against rote centralization.

The communications alphabet soup can be replaced. Minis can handle functionally discrete applications. Word processing, order entry, inventory control, energy management, customer inquiry, distribution management, all have been sliced off the central blob. Unfortunately, too few MIS managers are able to understand that this is revolution, not a minor change.

Immediately ahead? Central management, remote processing. Not decentralization — a 1401 in every office isn't the answer. If Gene Amdahl thinks distributive processing is a fad, he will hear a lot of arguments in the next few years. The feasible route seems to be locally held operational data used locally to directly support local business transactions.

The next five years? Most will plug along trying to disintegrate oversized applications. The goal? Reliable, low cost, managerially effective computing that supports corporate goals and objectives. How? The many forms of intelligent remote processing.

Call me back in 1982! ❊

Phil Dorn has earned his ribbons. He's been a battle-scarred user (dp manager at Union Carbide) and vox populi (past president of SHARE) to name just two milestones in his long and checkered computer industry career. He's long since parlayed this experience into a good living as a consultant, and serves Datamation as a contributing editor and industry advisor.

The Challenges are Changing

by Lowell Amdahl

Twenty years are significant. This period constitutes most of the history of electronic computing, and even covers a tenth of the lifetime of our nation.

Looking through the slim early issues of DATAMATION, one is quickly reminded that much of today's technology was being discussed even then in embryonic form. With new appreciation, the reader is drawn to articles that testify to the inventiveness of the time. Designers, with expensive and recalcitrant components, managed to develop products and systems that were grand achievements. The programmers of that period realized a sophistication in software with (from today's perspective) exceedingly limited storage and modest peripherals.

Where have we made the most

gains in 20 years? First and foremost in device technology. Semiconductors for arithmetic and control, in combination with magnetic cores, tapes, and discs, were just then ushering in an era of computer stability and performance/price improvement that has had no parallel in other industries. Today's integrated circuits for memories, microprocessors, and general logic, are creating yet another revolution.

Through the efforts of the machine architect, the network designer, and the ubiquitous software designer, old computer applications have been steadily improved and new applications conquered. More and more, the user of a system perceives the computer as a tool that need not be understood.

As always, there is an abundance of problems to match these successes. As a large and growing industry we more frequently encounter the environments of government and other industries. The foibles of the communication industry now, in large measure, are our problem.

Banking regulations loom as a major obstacle to electronic funds transfer. Standards, security, and privacy are issues of the first magnitude. The solutions to these problems are vastly more difficult to implement than solutions to purely technical problems that the computer industry has addressed so well in the past.

DATAMATION has recognized its leadership publication role in reporting to its readers not only the technical side of computing, but also these broader issues that we are confronting. It has been a great satisfaction to me to have been a small part of this activity for quite a number of years. My congratulations on this 20th anniversary go to the DATAMATION management and staff, past and present, for a job done well and with considerable foresight. ✻

Lowell Amdahl has been a Datamation advisor and contributing editor for well over a decade. His article here is an update of his thoughtful look at the industry that was part of the magazine's silver anniversary celebration back in September 1967. Lowell is the director of advanced engineering for the Infonet Division of Computer Science Corp.

"... an age of government regulation gone wild."

by Ray W. Sanders

There is little doubt that the technology of data communications will be able to provide on-line computer capability on a massive scale in the next 20 years. Certainly in the last 20 years we have seen data communications progress from a small number of teleprinters being remotely connected to computers to the implementation of large-scale computer networks. With these dramatic changes we have witnessed so far, it should be clear that the future will produce additional changes of great impact, right?

Not necessarily!

We have, in the last 20 years, witnessed not only rapid changes in technology but, as well, we have seen great changes occur in the market environment. If present trends continue, we will most assuredly see the future of data communications controlled by political considerations and *not* by free markets and technology.

It takes only a short list of events of the recent past to vividly make the point that we could well be entering an age of government regulation gone wild. For example, the rapidity with which private line, TELPAK, and WATS tariffs are being changed under the direction of the Federal Communication Commission lead one to believe that Future Shock has finally arrived on the regulatory scene.

This is only the latest of a series of events which began in the United States several years ago when in the name of "competition," we have seen the emergence of additional regulated common carriers whose existence depends almost entirely on regulatory policy and political considerations. Unfortunately, the concept of "regulated competition" has about as much semantic validity as attempting to define the "new" color "flourescent black." There is no more a way one can expect free market forces to operate overtime in an environment of regulatory tinkering than one could expect a black object to spontaneously emit light. In our modern world it appears that where politics and free market forces both are attempting to influence a particular marketplace, politics will prevail every time to the detriment of the ultimate user. This is particularly evident in the data network market outside the U.S. It is clear that the governments of some countries with state-owned communication facilities are attempting to institute pricing and technology policies which will provide direct government control of local data communications markets and indirect control of computer and terminal markets.

So what about the next 20 years? What we can expect is going to depend on the vigor with which the ultimate user can influence the political processes around the world. There is little evidence to suggest that regulated or government controlled entities can meet the challenges of a rapidly changing market such as the value-added data network market. There is much evidence to suggest that the best one can expect over time from the regulatory process is politically controlled market-sharing with innovation occurring at a slow pace.

The users are bound to lose in the end, and it appears that there is little time left for them to influence a seemingly inexorable chain of events. There are solutions which will clearly define regulated monopoly transmission services and leave the remaining value-added market open to free market forces for all participants. We must insist on a reversal of the current trend or suffer the consequences 20 years from now. ✻

A Datamation advisor for several years, Ray Sanders continues to contribute an occasional lucid article or express his candid views about the state of the computer/communications industry. However, he spends most of his time as the globe-trotting president of Computer Transmission Corp., the El Segundo, Calif., based data communications firm.

Not the Même Chose

by Howard Bromberg

Twenty years may not seem like a long time when measured against the spectrum of the totality of Western civilization, but it can feel like a millenium when one has lived through it recently. Twenty years of effort may not have produced 20 years of results although I most certainly believe that we've gotten more out of these past two decades than just 20 years older. My feeling is that we've become smarter. Maybe not as effective as we would like, but still smarter. Perhaps not as efficient or arrogant or productive, but wiser.

Now I don't intend to get involved in a dialectic regarding the nuances among the terms smarter, wiser, knowledgeable, and so forth. I am certain that you understand the point that I am making without that kind of exercise. And it is that from our experience of the past 20 years we know more about what we are doing. This is not to say that we know how to do anything, but rather that we know more about what we are doing.

Let me illustrate with an example. About 20 years ago I overheard a telephone call being taken by the late Werner Von Braun at the Army Ballistic Missile Agency's computer center in Alabama. The Congress had recently taken away the responsibility of building long-range missiles from the Army and given it instead to the other services. Von Braun was called to the phone to respond to a design question from the Navy. He answered that he had the same problem in 1939. The difference is between knowing the problem and encountering the problem. The former makes us smarter.

Twenty years ago, most of us would be hard-pressed to handle a new payroll system, much less on a fixed-price basis. Yet today, there are enough hard core data processors who would accept the name "Payroll" as the extent of the specification from which they could produce a system 80% effective. And look at the COBOL compilers today. Not that putting them on minis is such a great accomplishment. Years ago the first compilers were implemented for machines smaller than many of today's so-called minis. What is an accomplishment, however, are the techniques we have learned that allow fast compilation and development. COBOL compilers are built today in six months and for substantially less than $100K. We are even building a compiler right now that will generate code for any machine, regardless of whether it has a COBOL. Now that is a pretty fair extension of the "OBJECT COMPUTER IS" clause.

Most problems have moved from the insurmountable to the unaffordable. Differences in measuring machine costs between cpu hours and wall time wane in the face of the rising labor costs. Programmers with one year's experience are looking to be paid $10/hour while IMS experts are approaching $50/hour. So the tab for rewrites is astronomical while the cost for merely hanging in there is foolishly labor intensive as well.

On the systems software side, we've made great strides in operating systems, data bases, and communications. Did you ever wonder what happened to all the OS jokes? And even the hardware side looks smarter. Big is no longer by definition better. False pride has given way to true economics. DEC, for example, could care less whose name appears on their case work and Itel is totally indifferent to whose software they execute. Systems houses negotiate deals with mini manufacturers (or vice versa) so they can disguise software costs in hardware discounts.

We've become so smart that we are now entering an age of new first-time users. Not the Fortune 500 types of 20 years ago, but the small business of today that cannot afford the entrance fees paid by their big brothers. So a new type of challenge is upon us. And one that undoubtedly will be met successfully by the NCR, Burroughs, and Univac types who have encountered the problem before while DEC, DG, HP, and the like, along with their oemers will spin a lot of wheels before they really know the problem.

One of the major accomplishments of these past two decades is that we have become much more aware of what we do poorly. For example, it is pretty clear that we must concentrate on improving the way we design systems, how we measure their workability, individual productivity, testing procedures, automating maintenance and modification, and so on. And some of these are changing already because we have, over these past 20 years, become knowledgeable about the problem. Programmer communication is a case in point. Our staff of trained C3PO's is already able to interpret user requirements. Within the next 20 years we will have thousands of R2D2 robots available to reduce human labor intensity and apply the force of automation to the new found skill of on-time program production. ✲

Howard Bromberg has been a Datamation contributing editor for longer than anyone can remember. To support a rather florid life style, he founded and is president of International Computer Technology Corp. in San Francisco. His French is impeccable.

The Localized Machines Are Coming
by Fred Gruenberger

In case you hadn't noticed it, there is a lot of action going on among the do-it-yourself computer group. As one indicator, there are already seven journals catering to this group, all offering much the same material and competing for the same advertisers. They publish lists of things (clubs, meetings, stores, manufacturers); endless programs in BASIC (programs liberally sprinkled with GO TO's and usually reproduced in six-point type); BASIC interpreters in ever-smaller versions; and a great deal of material that is misleading, badly documented, and sometimes downright wrong.

Not much harm is being done, but not an awful lot of good, either. When the smoke clears (and at least four of those seven journals die) and the computer-as-big-toy craze subsides, there will still be left a distinct trend: hobby → home → personal → small business applications, and that will be followed (if, indeed, it is not already taking place) by the use of desktop computers for distributed computing in large businesses.

When you can have at your fingertips, all to yourself, something like:

- 64KB of random access storage
- endless auxiliary storage on cassettes or floppy discs
- microsecond cycle times
- keyboard, cathode ray tube display, and hardcopy
- packaged software to run all of the above

then, with some knowledge of what computing is all about, you can declare your independence from the tyranny of the big machine, its endless red tape and long turnaround time, and the inevitable interference factor caused by sharing the resources with others.

There are drawbacks to this scenario. The squirrel factor will be high (just who owns company-produced data?); the opportunities for bad or even worthless computing; an efficiency level that will almost certainly be low; opposition to the point of internecine war from the centralized high priests—but it's coming, and fast.

There is going to be a tremendous need for quality software; not just languages and miniature operating systems, but statistical packages, scientific problem solutions, and tiny management systems (a mini MARK IV?). We should be busy transliterating the best systems and software now available for large machines into quality products for the 8080 crowd.

If the movement I've described is inevitable, then it should be guided and planned by older and wiser hands at the trade. There is a huge education and training problem. The people who will use the localized machines (the distinction between mini and micro will soon be academic) will not want to be computer experts, nor should they be, but they will have to know some of the basics of the art. You won't want them writing programs to search their files linearly for each transaction. They ought to know about looping and subrouting and the use of library programs and, of course, how to document what they do. All these things have been worked out over the years—usually painfully and at great cost—and the whole process can now be shortcut for the coming masses of users. An article on looping that fails to tell about initializing the loops (as in one recent journal article) can do immeasurable harm.

We know that quality software is frightfully expensive, so the question is, who is going to pay for it in this new area? It seems to me that as small machines proliferate in business applications, the companies involved may find that *not* arranging to pay for it will be far costlier in the long run. It will not arrive "free," although there might be significant aid from the government, since government agencies will be one of the biggest groups involved. ✻

Fred Gruenberger is a professor of Computer Science at California State Univ., Northridge, and is the publisher of Popular Computing. He is the most widely published author in the field, with 26 books to his credit, and over 100 journal articles in the past 25 years.

Besides being just awfully good at pointing out all the mistakes that have ever been made in the field, he can point with pride to having predicted the rise of the minicomputer, in a 1967 Datamation article.

A Little Less Method in Our Madness

by Louis B. Marienthal

So far, during the short, turbulent life of the computer industry, changes in hardware have been more dramatic than the changes in software. But software suffers only by comparison.

Money and intellectual effort have been spent lavishly on programming. There are libraries of books about programming languages and compilers, operating systems, programming techniques, and project management. And there are libraries of, by, and for the programmer.

Most of the investment has focused on the methodology of programming. But, unhappily the functions to be programmed have received comparatively little attention. We have made *how-to-program* into a science while largely ignoring the *what-to-program.*

Problem definition traditionally has been an *ad hoc* process whereby a system analyst converts the user's desires into problem statements for the programmer. Exceptionally, there are three problem/function areas that have received some general attention: sorting, report writing, and data entry.

Sorting was recognized as a bottleneck in the first Univac installations, and so intensive theoretical study resulted in several different methods of sorting. Because the problem is limited, most of these methods present the user with similar sets of parameters to use in defining the file to be sorted.

The functional analysis of report writing resulted in RPG, which is a statement of a report in its own terms, but with a grammar familiar only to programmers. There are the beginnings of procedures whereby non-programmer users can define reports interactively with computer assistance. We could use more study of a theory of report writing — the options that a user may want, the terms that a user might employ to express his options, the logical constraints imposed by various data structures, and the physical constraints imposed by various output devices.

I believe that other functions can be defined in user-oriented or problem-oriented terms. Candidate functions include record selection (e.g., for a report), record purging, record transformation (i.e., input plus old record yields new record).

Over the next 20 years some measure of intellect and money should be diverted to the analysis of the tasks to be programmed as opposed to programming methodology. ✻

Lou Marienthal, a consultant in the small business systems end of the industry, has been a Datamation author and small systems advisor for many years.

The Computer as Household Appliance

by Portia Isaacson

The age of the personal computer is clearly foretold by recent happenings. The triggering factor was the decline in the cost of a computer system to about $1,500. Tens of thousands of these low cost computers have been purchased by individuals during the past two years. A new hobby was born complete with clubs, posters, t-shirts, bumper stickers, and conventions.

The enthusiasm displayed by computer hobbyists is derived from the very general nature of the computer itself. The personal computer is the solution of a different problem for each individual and its uses are as varied as the individuals that apply them. Applications include entertainment via computer games, control of systems such as model trains, word processing, experimental music synthesis, financial analysis and planning, and speech synthesis for the mute to name only a few.

The computer is a mind-amplifying tool. As muscle-amplifying tools have enabled us to make physical achievements far beyond our unaided abilities, the abundant computer will allow us to make intellectual achievements far beyond what we can now imagine.

The computer hobbyist's activities are the leading edge of computers' movement into the home. By the very early 1980s, most American households will own personal computers. What family wouldn't be willing to spend a few hundred dollars for a device that would tutor their children in every conceivable subject from early childhood through college? Or, if the family is only casually interested in the educational value of the personal computer, perhaps its nearly unlimited entertainment value will be the convincing factor. Of course, the personal computer is hardly limited to education and entertainment since it will be capable of a seemingly endless variety of other tasks. The personal computer, with its large library of program cartridges, will soon be an essential appliance in the American home.

We live at a marvelous time—we are at the threshold of a change in our society as fundamental as the changes that came with the printing press, the assembly line, or the automobile. The change will begin when information processing power becomes available to the individual. The change has started. ✻

Dr. Portia Isaacson is Datamation's newest contributing editor and our specialist on personal computers. She comes by it naturally, being the proprietor of The Micro Store in Dallas and the chairperson of this year's highly successful NCC in Dallas where her addition of a personal computing show almost upstaged the main conference.

The Rough Road to Today's Technology

by Dan M. Bowers

People may come and go, but some products continue to haunt their designers. A look at some of them over the last quarter century provides clues to future technologies that have real-world possibilities.

The quarter-century history of the computer industry has left us with many significant milestones to look back upon. The serial processor. Von Neumann's machine. The magnetic core memory. The magnetic drum and disc, and the removable disc. The crt terminal. The digital modem. Solid state memory. The microprocessor.

In addition to the milestones on our road, there are also many headstones in our graveyards and even skeletons in our closets. These represent developments of exotic techniques and devices that, in their time, were as highly touted and as enthusiastically received at that great crap table on Wall Street as the truly significant and lasting breakthroughs. Holographic and laser memories. Fluid logic. The optical disc memory. Array processors. The digital unit-record microfilm chip. Cryogenic memories. Ternary logic. Viatron.

What was it that separated the developments worthy of a Hall of Fame (and which not incidentally reaped untold millions for those who bet on them early enough) from those that exhibited equal initial brilliance but turned out to have the lifetime of a meteorite (and sent venture capitalists to driving taxicabs in Altoona)? Was it luck, timing, science, engineering? Or promotion, soothsaying, statistical extrapolation, the Monte Carlo method? Or devotion, dedication, hard work? Fraud and deception?

Many of these breakthroughs died because the results of early experiments could not be consistently manufactured, because the early experimental results were too optimistically interpreted, because costs of production units could not be made attractive, because the development effort took so long that other techniques overtook them, and in some cases because the early announcements were more stock promotion puffery than technical fact.

Many others survived, but on a much more limited scale than earlier hoped; they exist today within or on the fringe of the computer industry, still alive but not setting the world afire. A few may yet prosper and even become cornerstones of the industry.

Let us call from memory some of these possibly (and in many cases, best-) forgotten breakthroughs, study their origin and the state of technology at that time, recount their history and ultimate destiny, and derive lessons that might profitably be kept in mind as we read the publicity for the "breakthroughs" of today and tomorrow.

Search for bulk memory

Computer-man has sought after the high speed, low cost, random access bulk memory almost from the dawn of computer-time, from the day he began to envision being freed from the shackles of serial delay-line memories and oxide-on-metal magnetic tape (at seven pounds per reel, with structural reinforcements to the building under the tape cabinet).

Bulk memory highly depends on the point of view. The first wondrous bulk memories, circa 1960, contained on the order of 50 megabits (which, for those of you who were not around when bits were the standard unit of measure, is just over 6MB), took up as much room as a grand piano, and looked variously like a stack of records on Goliath's changer (IBM's 305 RAMAC), a miniature steel rolling mill (Univac's Randex), two dozen Chinese laundry lists hung out to dry (NCR's CRAM), or a wheel lost from Casey Jones' locomotive (Bryant's 320 and 4000). With access times on the order of one-third second, at a cost of 0.1¢/bit, these bulk memories opened whole new applications and methods of data processing. Between them and the high speed (8.3 msec.), low capacity (100 kilobits), medium price (10¢/bit) head-per-track drums, plus the new core memories (1 usec., up to 8K characters. $1/bit), computers had the capability to solve any problem.

Still we continued to yearn for the bulk memory which could be roughly defined as an order of magnitude more storage per device than we already had at any given time. For two decades we have been presented, on roughly a yearly basis, with *the* answer to the bulk storage problem. Let's analyze some of the answers we have seen over the past decade and a half, most of which are equally as well-remembered as Whistler's Father, M. LeFarge, or Queen Kong.

What is a magnetic drum but a thin, virtually massless layer of ferrous oxide whirling in circular fashion, tangentially proximate to magnetic heads, and supported by a sinfully massive metal cylinder. What could be more logical than to eliminate the metal mass, float a layer of oxide-on-mylar, in the form of magnetic tape, on a layer of air, thereby simultaneously improving cost, speed, and operation in rugged environments (discs and drums, because of their mass, tend to act like gyroscopes and tear up their bearings under G forces such as those encountered in airplanes and ships).

Thus, in 1962 when the 50 megabit devices were the largest available, the tape-loop RAM emerged: 16 30-inch loops of two-inch-wide magnetic tape whirling at 360 rpm, each continually floating past its own head-positioning mechanism which positioned a set of read-write heads to any of 112 channels. Fifty megabits of removable-module storage with access time of 87.5 msec. at a mere $15,000—a bargain price in 1962.

What happened? The tape-loop RAM was laboratory-proven using one-inch tape on hand-built models. Unwise extrapolations were made ("if it works on one-inch tape it must surely work at least twice as well on two-inch tape"), and the product was announced to the public before further tests or any production engineering was done. It ultimately proved impossible to produce units that would work for more than a few hours of continuous whirling (and consequent flexing of every part of the tape and oxide and the bonding between them) before chewing up the outer channels and then the inner channels on the tape.

Several years were spent trying to solve the problems. They never were solved, and even if they had been time had marched on and the world no longer cared about 50 megabit storage at 87.5 msec., even for $15,000. Other simpler forms of tape loop memory were introduced during the mid and late '60s, but aside from a brief vogue as speed-shifting buffers in rather mundane telecommunications systems, they achieved no success.

The tape-loop RAM would have been a resounding success had it fulfilled its 1962 press releases in 1962 or even 1963. It was 1965 before "production" units were delivered, and even they could not fulfill reliability specs without extensive and frequent hand-engineering. By that time the world had gone on to greater things; the notion of a "mass memory" had moved up an order of magnitude. The RAM had missed its time.

What killed the RAM? It was announced and touted to the world before being completely engineered. It could not be mass-produced to meet both advertised specifications and price. The concept was timely but the execution took so long that nobody cared.

Magnetic cards, strips, and chips

Numerous attempts were made to provide bulk memory—as many as a trillion bits—using magnetic media in nonrotating form. Some even were used at a few installations for a few years. The most successful of this class of device was NCR's CRAM; 384 foot-long sheets of four-inch wide mag tape were hung from five binary coded rods. One sheet was selected, dropped down a chute, and wrapped around a drum for reading. CRAM was, in effect, a magnetic drum with a replaceable surface. It was widely used for a decade and was an important contender for half of that period, until the dramatic increases in density (and capacity) of the magnetic discs and reductions in their access time through significant mechanical sophistications left it behind.

The other card, strip, and chip systems utilized equally bizarre mechanical-magnetic systems. None achieved the success of CRAM. In fact, none of them ever worked very well at all, ever. For two decades, our father who art in Armonk expended tens of millions of dollars developing a magnetic-strip tubfile memory under names like Walnut and Cypress. The basic concept had magnetic strips hung radially in a tub that rotated eccentrically, thus providing access to all strips by a fixed-in-place plucking mechanism. The plucker extracted a chip, passed it by a read/write head, and returned it to its correct place—usually.

What went wrong? The storage capacity of these strip memories was tremendous, and the mechanical complexity does not seem beyond that of the finely positioned access mechanisms of today's disc files. However, it has been the case in our business that devices requiring two dimensions of controlled motion have been at least four times as difficult to make work reliably and repeatedly, and the two-dimensional systems have never endured. The 305 RAMC—the first disc file concept—gave way to comb-arm one-dimensional devices. The successful CRAM was one-dimensional and endured long after the 305 had disappeared. The masses, momentums, inertias, and shifting reference points of two-dimensional systems have kept their inventors busy trying to reproduce their laboratory concepts on the production line. Meanwhile, disc file engineers again double both the track and bit densities, the price of heads and electronics again drops by half, the disc access mechanisms again become 25% faster, and the established world has passed by the inventor.

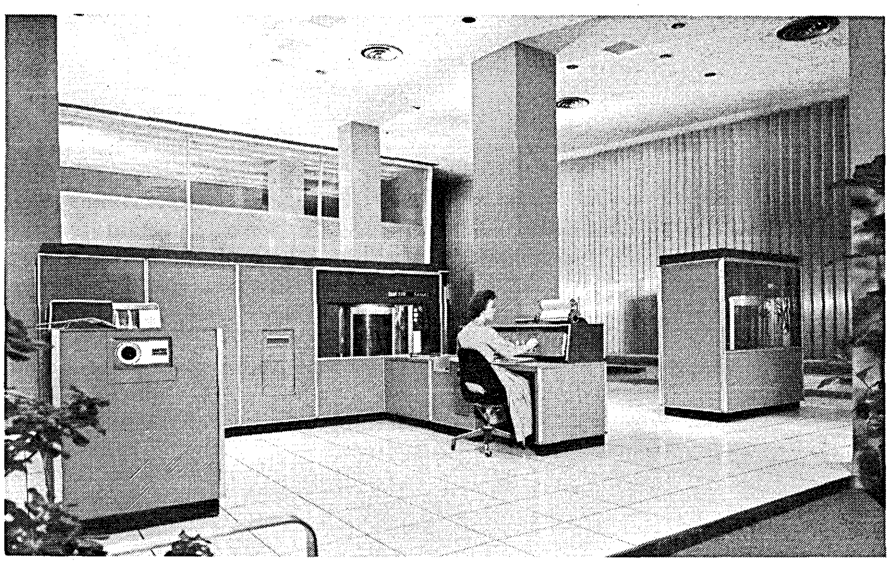
Memories

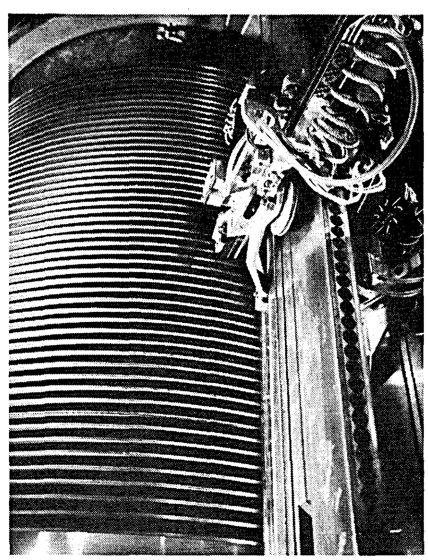
Another breakthrough of the early 1960s was the optical disc memory, with 2,000 bits per inch and 2,000 tracks per inch density, read by a servo self-tracking light spot, providing throughput of 2.7 MHz and 65 megabits on a single disc. Granted it was a read-only memory, but many library-class problems can use read-only storage.

Our father in Armonk was the second company in a series of four (spanning a decade) to sponsor the concept and attempt to put it to useful work, as the dictionary in a machine language translation system. Like the RAM, however, the Photostore looked good as a laboratory concept but never worked satisfactorily in the real world of useful work and bottom lines. A mote of dust in the production process (using a laser in an evacuated chamber) was enough to obscure hundreds of words, making a perfect disc impossible, and all the errors were different from disc to disc. This meant that each disc had a different errata file in core (or magnetic disc), a programmed skip to it, etc. All this hassle was simply not worth the bother for a read-only mass memory that was not cheap in the first place.

Another laser-produced read-only memory used holes burned in a mylar tape. It had similar technical problems, balanced by no shining virtues as to reliability, cost, or performance, and the world pretty much ignored it. Read-only memories were not very exciting when the magnetic disc densities had just doubled again and gone down in cost.

During the mid-'60s, Ma Bell's prestigious research laboratory announced another breakthrough in mass memory, again of the read-only (or, in their words, "semipermanent") class. Information was stored as an array of holograms, and reading was performed with a laser and an array of 10^4 photo-





The IBM 305 RAMAC system and IBM's answer at the time to bulk memory—the RAMAC's discs stacked like a giant juke box.

detectors. Any of 256 holograms, each containing 10^4 bits, could be positioned and projected upon the same array of photodetectors.

For such a device to function, significant advances in a number of technologies were required: mechanical positioning, deposition of photodetectors, photographic preparation, laser beam deflection, etc. This was not easily done even in the environment of the world's most advanced laboratory, and to make such a device mass-producible and make it function in the usual working environment, at a price the ordinary user was willing to pay for a read-only memory, was beyond even Ma Bell.

Since so many of our wonderful and now extinct breakthroughs in storage were read-only, a word is appropriate regarding a significant shortcoming common to most of the programs discussed. Laboratory engineers created devices, and announced them to a world that, in most cases, was properly impressed. However, the inventors by and large left it to the users to imagine how these wonderful inventions could be put to useful work. The users, faced on the one hand with working systems marketed at a firm price with well-defined performance characteristics, and on the other hand with an unknown device having apparently marvelous performance by requiring an unknown amount of time and effort to put into use, chose (rightly) the known quantity.

It is still the case today that the computer industry has all the devices needed to perform any kind of processing; the challenge is to create cost-effective systems from existing devices, Had the purveyors of some of the read-only memory devices marketed them within useful systems, they might be important factors today. It is unfortunate that engineering expertise and applications know-how seldom reside in the same individual, much less in the same company.

Almost annually during the 1970s, a major company has announced the answer to the bulk storage problem in the form of a room-size bank of tape cartridges or small tape reels that can be plucked and read or written by a single read/write head and mechanism. In some devices the mechanism is transported, in some the tape containers are transported, and in others they both move. These devices are clever combinations of some of the least attractive features of earlier inventions. They have at least two dimensions of motion. They transport objects of considerable mass. They have a large number of moving and wearing parts to fail. They are expensive and slow. They must be combined with an information retrieval indexing and directory system of considerable complexity to find the desired information. And they automate a function that has historically been done inexpensively and effectively by manual methods. Although they have not been with us long enough to completely write their epitaphs, we would not be wrong to begin chiseling the headstones.

Core memory

Since memory is such a vital element of any data system (and, in fact, widespread use of data processing systems began only after memory devices of some capacity and convenience had been developed), the attentions of inventors have been devoted to other forms of memory, not just bulk memory. Principal among these has been the development of replacements for core memory, the demise of which has been widely predicted for a decade.

Originally internal memory consisted of mercury delay lines, which were slow, touchy, and bulky, but far more economical than the relay and vacuum-tube flip-flop alternatives. A generation of machines that followed were based upon acoustic delay lines using quartz or magnetostrictive wire, and several of these remained successful even after the introduction of the much faster core. But the cost of core systems fell, they achieved a dominance that only now, a decade-and-a-half later, is being lost.

And the challengers

The thin film memory was one challenger to the core system. They utilize deposited spots of ferrite material for storage of bits, rather than the ferrite donuts used in core. Because the deposited two-dimensional film has different storage characteristics from core, a thin film memory is inherently faster than core, but requires more costly driving and sensing electronics. Since it is a basic tenet of computing equipment that in many cases higher speed is worth more money, a bright future was seen in the mid-1960s for thin film memories in scratchpads and in machines requiring very high speeds. The technology was well-developed, and several popular computers were marketed using thin film. Predictions were made that the ability to batch fabricate thin film memories would result in considerable price reductions and the displacement of cores.

A funny thing happened on the way to conquering the world. Integrated circuit memories began to eat into thin film's advantage at the high-speed, low-capacity end. And magnetic core technology, pushed by several strong vendors with massive self-interest in seeing cores remain dominant, continued to improve in performance and price. Caught between two strong technologies, one old and one new, thin film smothered and quietly expired.

Several varieties of cylindrical film memories—variously called plated wire, rod, rope, or woven wire—were developed in the mid-60s. In cylindrical film memories the thin film was variously wrapped around one of the sense wires, or woven among them, or wrapped in rod or whisker form. It was slower than thin film but faster than core, and designers claimed it would ultimately be the cheapest of all magnetic memories for a given capacity. Such memories were used in some lines of commercial machines, but the predicted manufacturing efficiencies were slow in coming, and the squeeze between advances in solid-state memories and improvements in core memories snuffed out whatever promise might otherwise have existed in cylindrical film.

One of the seven dwarfs developed and announced in the late '60s was the laser-film memory using a thin ferromagnetic film combined with a laser. Writing was accomplished by heating a spot of the film with the laser to the Curie temperature (360°C), at which the original polarization is destroyed and a new polarization can be induced by a weak magnetic field as the material cools. Reading was performed by sensing the rotation of plane polarized laser light as it passed through the magnetized film (the Faraday effect), the rotation being proportional to the direction of magnetization (among several other things).

Such a device would constitute an interesting laboratory experiment for a graduate student in physics, but one could hardly imagine a more complex and impossible-to-mass-produce conglomeration of technologies. Despite its forecasts as the answer to the mass memory problem, this Rube Goldberg machine quickly and mercifully died.

Cryogenic, cryoelectric, and superconductive memories are based on the ability of certain metals to sustain electrical currents indefinitely, without outside power, until disturbed by an outside power source such as a magnetic field. These metals thus exhibit zero resistance; unfortunately, this phenomenon occurs only at a temperature in the range of 3°K (−270°C, −454°F), which is not found in your ordinary computer room.

The physical arrangement of the cryoelectric memories should make them easy to mass produce. When combined with the refrigeration units required, however, cryoelectric memories have not been proven feasible on any useful scale or in any useful environment, despite extensive efforts on the part of the largest and most capable laboratories. Their ultimate (and perhaps only) usefulness may come in the space environment, where absolute zero temperature comes for free.

The big busts

Once upon a time, in the wild and wooly days of the mid-1960s, any two engineers and/or programmers working in a garage with an oscilloscope and a mimeograph machine, and capable of making exponentially ascending curves on a sales and P & L forecast could get at least a half million dollars from some "knowledgeable," high-technology venture capital outfit. Rumpled-suited, tieless, long-haired, with the gleam of the inspired but distracted scientist in the eyes behind horn-rimmed glasses, these entrepreneurs dispensed, in reserved tones, obfuscational descriptions of breakthroughs that would merely revolutionize the data processing world. Immaculate in silk suits with wide silk ties, well-barbered and mustachioed, with the gleam of greed behind their gold-rimmed glasses, the gunslinger venture capitalists soaked up every word, understood not a one, and eagerly handed over their money (or, more properly, the money entrusted to them by equally greedy investors) to (ad)-ventures with names like Viatron, Energy Conversion Devices (Ovonics), Computing Efficiency, BIT, and Foto-Mem.

Many of these enterprises had no viable business plan or direction and no demonstrated product. Some, like Viatron, bet upon wildly optimistic extrapolations of the rate of technology advancement. Some, like Ovonics, were based on supposedly new, but unproven, basic physical principles.

Their histories were similar. Gather a technical staff. Announce the breakthrough. Get the money and spend it. Go public. Announce the breakthrough in even more glowing terms. Watch the stock skyrocket to ten times the opening price, while spending the money raised at the public offering. Take orders. Announce logical reasons why equipment is not being delivered. Deliver some hand-built models. Take them back when they can't be made to work. Borrow money, leaning on your now fearful investors to come up with guaranteed loans, debentures or preferred stock to "protect" their investment. Abandon the originally touted breakthrough and frantically seek other products or workable business plans to salvage the company using this new money. Go into Chapter XI as quietly as possible. Exit wiser than before and seek new adventures. Leave behind on Wall Street a fear of new computer-field ventures that will endure for a decade.

Retrieval systems

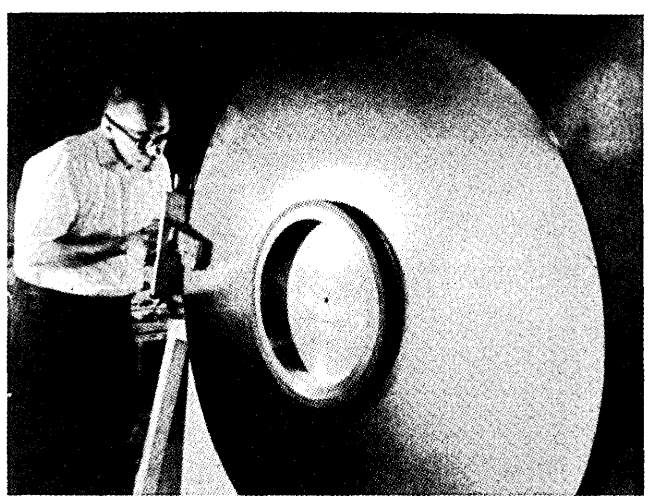
Several of the memories discussed above utilized (or died in the attempt to use) optical techniques to accomplish digital data storage. The generalized problem of information retrieval—the "library" problem—requires rapid random access to a combination of digital data (names, numbers, etc.) and graphic data (maps, signatures, original invoices, catalog pages, parts drawings).

During the 1950s and '60s, a number of major attempts were made to develop the true unit record retrieval system, in which one search process would retrieve one record containing both the digital data and graphic images. The early efforts—Minicard, Magnecard—utilized microfilm chips as the storage medium. Each postage stamp-sized chip contained a half-dozen or so 8½" x 11" pages of images, plus a few thousand associated bits. Retrieval of information required the handling and scanning of thousands of chips and the reading of digital information to find the right ones. In order to reduce the number of chips handled during a particular search, chips were massively duplicated and cross-filed into subcategories selected by human analysts. A complete system required input equipment, processors for code generation, cameras, film processors, film duplicators, clean rooms to keep the dust off the high-reduction photochips, chip sorters and selectors, chip copy-maker, viewers, and enlargers. All of these devices pushed the then state of the art in optics, electronics, mechanics, hydraulics, and chemistry. A complete system was in the \$3M range, in 1960 dollars. Some were sold to the Defense Dept., where cost is no problem, but attempts to commercially market the systems failed.

Similar in concept but vastly simpler was the aperture card, which also combined digital and graphic information on a single element, the common 80-column punched card. Digital data was punched as usual into the card, and a microfilm chip was glued into a square hole in the card. The digital capacity was much less than that of the microfilm chips, and the density of the microfilm was also less, but this made dust less of a problem. The aperture card could be handled by conventional punched card equipment, and the preparation equipment was mundane and

A random access memory from Potter Instruments used loops of mag tape in cartridges, each storing 3 to 40 million characters. Average access time was 168 milliseconds.

Back when discs were not considered a removable medium, General Precision offered them in this size.



inexpensive. The microfilm chips became scratched after many passes through readers and sorters, but since they were inexpensive this presented little problem. The system was slow but worked reliably. Aperture card systems were the backbone of most of the useful unit record image-digital retrieval systems, and are still in use today.

Another attempt at the storage and retrieval of combined digital and graphic information was made in the early '60s by the major manufacturer of videotape equipment. Using conventional videotape for image storage, and recording digital information on the audio track, 250,000 pages could be stored on one reel of tape. Little interest was shown in this concept, and no known working commercial installations were made.

Roll microfilm devices with digital encoding, such as Miracode, have been a popular answer to the image retrieval problem. These are semimanual (or semiautomatic, depending upon your point of view). Probably the most sensible solution was introduced by 3M in the late 1960s. Recognizing that digital information is most simply and effectively stored by magnetic means and graphic information by microfilm, the Microdisc I combined a minicomputer retrieval system with disc memory for indexing and content searching, controlling a roll-microfilm viewer for display. Fiche versions of this also were available, and these are still today the most natural, effective and reliable "library" information retrieval systems.

Processing and I/O technology

Although many of our "breakthroughs" have been in storage devices, the remainder of the technology has not been ignored. The answers to "whatever happened to . . ." many formerly prominent items are rather simple. Digital modules, once a $20M industry, were quickly obsoleted by integrated circuits, despite the efforts of manufacturers to peddle module cards containing IC's. Incremental magnetic tape recorders had an extended heyday in the '60s because they eliminated the need for an expensive core buffer to create tape records; once the cost of the buffer was drastically reduced, the awkwardness and slow speed of the incremental method was no longer justifiable.

Punched tape and cards, which many expected to be on the "whatever happened to . . . " list by now, are thriving despite competition from tape cassettes, cartridges, floppy discs, and key-to-tape and key-to-disc equipment. Equipment and techniques have improved, costs have decreased, and paper tape and cards are now more widely used than ever before. They are still convenient, reliable, well-known and accepted, and they have the massive support of two of our most influential companies, IBM and Teletype.

In the mid-1960s came the announcement of a complete set of fluid logic elements and a working fluid computer. The fluid in this case was air, and the complete system needed only a small air compressor as the power source, a handful of cheap (a few cents) injection-molded gates, flip-flops, and some plastic tubing to "wire" it up. No noise problems, no radiation-proofing, no heat and humidity restrictions.

A decade earlier, fluid computing doubtless would have achieved some market penetration against $150 electronic flip-flops and $50 gates. But in 1965, the integrated circuit had already given us the $10 flip-flop and would ultimately give us the 10¢ flip-flop. The computing industry, totally invested in electronic technology, ignored the slowly operating fluid logic, despite the fact that in many control applications it might have made good sense. The fluid gates and flip-flops were incorportated into simple pneumatic control systems, which are now frequently driven by the integrated-circuit computers that excluded them from the computer business.

Fluid logic was foreign to the electronic-based computer industry. It was also slow and quite obviously would never solve more than a very small part of the industry's needs. But in the early 1970s, optical digital circuitry—and therefore the possibility of an optical computer—was announced. Faster even than electronics, optical processing would seem to be the ultimate answer to a technology that has always announced new speed improvements in banner headlines.

The results are not yet in, but the high cost of optical elements has limited their use to critical and low-volume applications, such as noise isolation between devices. These self-contained devices are TTL-in and TTL-out; we have not yet seen computers or computing elements with logic connections made by mirrors, lenses, or fiber optics. Thus far the declining cost of electronic elements and their speed have been satisfactory, so there is no clamor for the optical computer. Nor has anyone satisfactorily answered the question of how to store and retrieve data optically, thus avoiding the need for a hybrid optical-electronic-magnetic system. And there has not been a massive R & D effort in the development of optical devices on a production basis.

It will come, probably in another decade; not with a bang but with a whisper. Self-contained chips such as the present opto-isolators will appear, perhaps first containing a complete opto-processor, with electronic in/out. Momentum will build, such problems as storage will be attacked and solved, and we will have the optical computer —but not within the working lifetimes of most of us. The advance of technology is inherently irresistible.

Fiber optics

For more than a decade fiber optics (FO) has been an accomplished solution, one in search of a problem. Medical fiberscopes, image guides, light pens, FO magnifiers and faceplates for crt's were developed early, and the advent of flexible plastic FO to replace glass reduced the cost and increased the potential range of applications. Scanners, sensors, movement detectors, the man-machine interface—all were suggested as ripe for adapting FO to data processing.

Aside from a few minor applications such as illuminating all the holes in a paper tape reader from one light bulb, FO has failed to penetrate the dp business. In fact, its impact on the world at large seems to have been limited to feed-back from automobile turn-signal indicators and cute "trees" on chrome coffee tables.

But the solution is about to find is rewarding problem in communications. Equally with the dp business, the communications industry perpetually needs more bits-per-second (they call it bandwidth) and transmission using an optical rather than electrical carrier can provide it. Over the next decade FO manufacturers may be kept so busy building optical telephone lines that they will not miss the business they never got from dp. And a well-developed optical communications technology cannot help but speed the advent of our optical processing units.

Ternary logic

A digit in the binary system can describe either of two quantities, two digits describe any of four quantities, three digits eight quantities, etc. A single ternary (three-valued) digit can describe any of three quantities, two digits can describe any of nine quantities, three digits 27 quantities, etc. Why not, then, develop three-valued devices and vastly improve our processing efficiency per number of devices? Working on this premise, a number of logicians, mathematicians, researchers, and others who have no better use for their time than to toy with mathematical games, have developed a complete set of rules and theory for ternary machines, all of which is published exhaustively in such unread journals as the *IEEE Transactions on Electronic Computers*.

The problem is that the physical devices used to build machines are inherently binary—or, more accurately, are easier and cheaper to build as binary devices. The difference between writing and sensing one or zero in a punched card, magnetic spot, relay, or flip-flop, and being able to write and sense three states (how, for example does one detect half-a-hole in a punched card?) is tremendous in terms of reliability, operating margins, and producability.

Some ternary devices have been produced, but their cost is sufficiently greater than binary devices that it is always more cost-effective to stay in binary. Further, a full range of ternary devices—most notably including storage—is by no means available. Further, the computer world has always been binary and will not change in the absence of compelling economic reasons to do so.

Ternary logic cannot be counted out since there is always the possibility that someone will discover a naturally three-state material or device. Nature does not seem particularly inclined to do so, however, so we might as well reserve the cemetery plot.

Analog and hybrid computing

As computing technology developed through the 1940s and '50s, there was nearly an equal split between those who believed that analog computing was the most effective processing technology and those who advocated digital techniques. At that time, both kinds of circuits were horribly expensive, there was no important storage of either kind to influence the decision, and analog processing was much faster for a given amount of data.

This status changed with the development of binary devices and the headlong rush through the 1960s to make them cheaper and faster; the influence of the Hollerith card and its principal exponent were no small factor. Seeing the world rushing toward the digital bandwagon, the analog people countered with the hybrid machine, which was made up of both an analog and digital computer and divided problems into two parts, solving each part on the machine for which it was better suited. This system was effective for large simulation problems, such as space vehicle and nuclear power plant design, but never achieved any acceptance against fast, effective, inexpensive digital computing in the ordinary working world.

The analog people are still playing their old tune, but their market is now largely limited to educational toys, such as college laboratory demonstrators. Even complex simulation problems are now best solved on fast digital machines. There are segments of everyday processing where analog and hybrid computing might be effective, such as data acquisition and business forecasting, but those who understand the problems do not understand analog/hybrid, and those who understand analog/hybrid do not understand the real world. If the gap can be bridged, perhaps we can avoid digging another grave.

Like analog and hybrid computers array/associative processors and their kin, content-addressable memories (CAM), are not well understood by the general population of computer people. These devices perform many operations in parallel. In a CAM, for example, the entire memory is searched in one memory cycle. They have been used principally for pattern recognition, signal processing, scheduling and routing, and mass information retrieval problems.

Despite the fact that solid state technology is now capable of cheaply producing the complex elements of an array processor, there is no great push in this direction because the mass-market applications are so effectively handled by conventional machines. These techniques seem to be relegated to the restricted applications they have always served; perhaps until some complete revolution, such as the conversion to optical computing, occurs.

What's been learned

The list of "whatever happened to . . ." items is more endless than the pages of this magazine. Graphic computing and terminals and computer output microfilm both had a brief publicity vogue and then settled down to their own corner of the market. Flat-panel displays have been heralded for a dozen years but are just now beginning to appear and to challenge the uncounted millions of crt's. Color crt's are finally available (though a luxury). Optical character recognition and optical mark reading are still with us, but they have yet to surpass the widespread usefulness of their brother, magnetic-ink character reading.

Data entry is the facet of computer systems most ripe for new technology; ocr/omr/micr will play a part in the reconstitution of data entry that must come. Just as it is no longer possible to handle all telephone calls through human-operated switchboards, it will not always be possible to input all data through a human-operated keyboard.

Some of the "dead" breakthroughs may live on as appropriate portions of them are adapted for use in new ways or other systems—fluid logic elements, analog/hybrid, laser-based memories. Some may yet see the promised land of milk, honey, and an 18-month order backlog—bubbles and CCD's, cryogenic memories, optical circuitry, array processors. The others are gone forever, in most cases deservedly so.

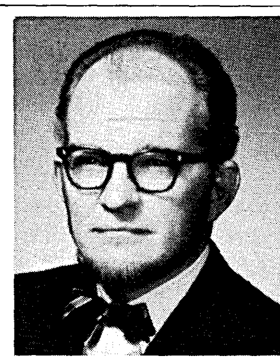
What can we learn from the past to help us as we evaluate new advancements? First, do not underestimate the power and momentum of entrenched technology and invested dollars. The mature computing industry has well-established conventions of software practices, hardware design, etc., and these habits are protected by massive investments in products, plants, production equipment, and training. A breakthrough, even though technologically sound and promising, is unlikely to succeed if it requires abandonment of current directions.

Second, the strongest underpinnings of our business, over a long period of time, have been semiconductor technology and magnetic storage. Do not bet against either of these. When they challenge each other, hedge.

Third, the real "breakthroughs" have natural scientific bases, such as the hysteresis property of magnetic material, or the holes in semiconductors. Rube Goldberg contraptions are usually trying to circumvent some natural law (or someone else's patent), and usually fail of their own weight.

Fourth, beware the entrepreneur with his sincere scientific demeanor, his abstracted gaze on your wallet, and an incomprehensible explanation of his wonderful new device. If it cannot be made comprehensible and sensible. It probably isn't.

Fifth, technology will improve. We will have faster, cheaper, better, and bigger, and not at the expense of the environment, minority groups, or endangered species. Our natural-law breakthroughs will provide more benefits while consuming less power and occupying less space. There is still room in the cemetery for the others. ❋



Mr. Bowers has been active in the industry for more than 20 years, dating back to the Univac I days. He has been a design engineer, research scientist, and engineering manager, and has been heading his own consulting company in Fairfield, Conn., for the last 11 years. He has served with the National Security Agency, Computer Control Co., IBM, and Potter Instrument.

The Way It Was 1957

A vintage year.

by H. R. J. Grosch

Here's some vintage Grosch, complete and unexpurgated—a free-flowing romp through the early days of computing by the industry's unchallenged l'enfant terrible. Not all the names may be familiar, but the flavor of the fervent fifties comes through with a clarity mellowed only slightly by time.

A vintage year, it was; one of the great ones. The big companies were jumping into the bear pit. The first three user groups were off and running. Books—good books—were beginning to appear. The professional societies were taking firm shape; ACM was ten years old! And yet, the sugar in the grape was still there: the feeling of unity, the ability to know most of the people, most of the installations, most of the problems. It had not fermented to the heady optimism of the early sixties, or the vinegar of Viet Nam.

Let me take you on a tour of the times. It will have to be a short one, and certainly many old-timers will be offended at the places where we stop, and at the guide's prejudices. Let's

Dr. Herbert R. J. Grosch may be best known for three laws that have come to bear his name: in computing, economy is as the square root of the speed; no one gets a foreign assignment who wants it; things can get worse without limit.

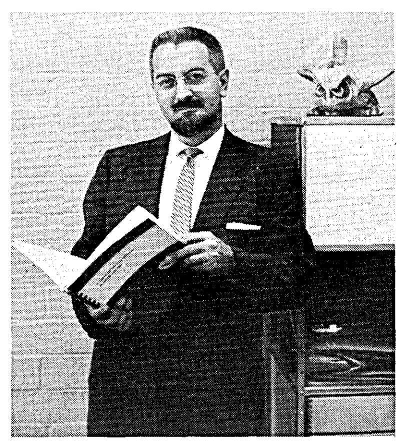
Or it may be for the fact he is the only man hired and fired by IBM twice. Then it could be because he was the first and only person with a beard hired by IBM in Thomas Watson, Sr.'s, lifetime.

He has been referred to as "the dp industry's most persistent gadfly," and as "the unsinkable computer consumer advocate," He himself is quick to agree with those who describe him as "outspoken."

Dr. Grosch listed computer history as one of his professional interests in his successful campaign late last year for the presidency of the ACM. And he knows his history and most of the people who made it.

He began his computing career in 1936 when he published his first orbit calculations while still an undergraduate in astronomy at the Univ. of Michigan. Since that time, in addition to IBM, he has been with General Electric, MIT, and the National Bureau of Standards. He did a stint as editorial director of Computerworld and for one issue, September/October 1959, was listed as an editorial advisor to Datamation.

It's a rare computer conference that doesn't have Herb Grosch among its attendees and, even when he's not on the program, he always has something to say.



Herb Grosch, circa 1957
During his tour in the desert with GE, Phoenix.

20 YEARS in the industry

see: in 1957 I had gotten over floating point and the open shop, and hadn't yet generated a full head of steam about Magic Languages. Guess I was doing my grumping within General Electric, of which more later.

How big were we? Well, when SHARE started in August 1955, there were 17 founding members. Two years later there were less than a hundred, but there were 705s being delivered, and GUIDE had crept out of IBM's pouch. The 1103A had generated another dozen centers. A hundred major installations? Probably not too far out; the Office of Naval Research and the Ballistic Research Laboratory at Aberdeen, where primitive EDVAC had just been endowed with a box of floating point, put out a newsletter and a biennial census.

You would walk around inside a STRETCH . . . but inside SAGE you could get lost!

There really wasn't any way to be an installation without a big computer, although change was coming fast. The Bendix G-15 and the IBM 650 were spreading, and on the data processing side there was that jolly jukebox, the IBM RAMAC. In two more years, when DATAMATION began to really flower, there would be hundreds of medium-sized shops—but their time had not *quite* come. Can I titillate you with a few specifications? Well, big core was 8K words (36KB), and RAMAC was five megabytes—but Poughkeepsie hadn't coined "byte" yet, not by half a decade. The Philco TRANSAC announced an upgrade, the S-2000, with an all-transistor ALU. We call 'em cpu's now, and they fit in a briefcase. Average multiply time on the 2000 was a startlingly fast 60,000 nanoseconds. Tubes in NORC (which was running) and SAGE (which had been shipped to McGuire) were a good deal faster, but the solid state handwriting was clear: "Mene, mene, LSI, upharsin!" IBM was STRETCHing their best transistors and architecture.

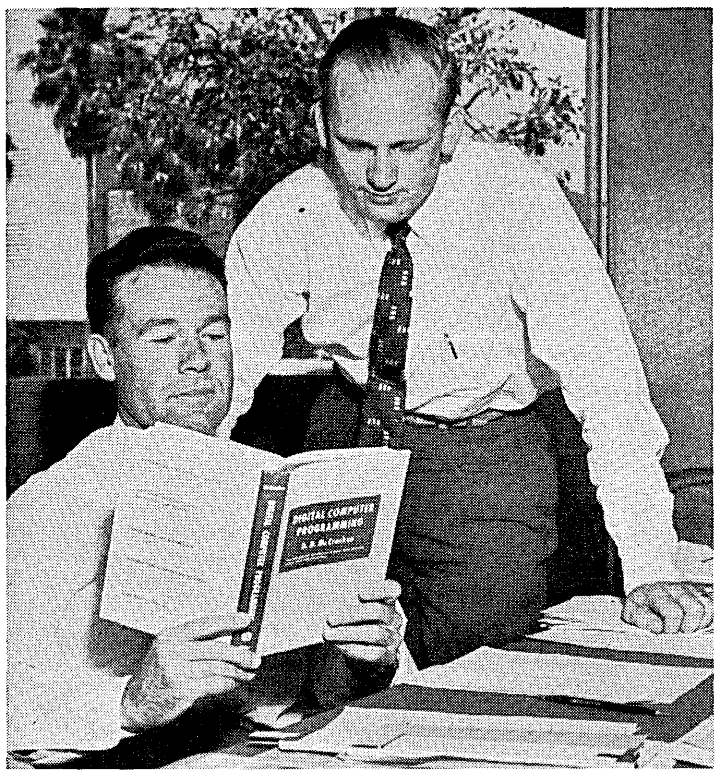
Do you realize the golf-ball typewriter was three years away? Now, *that's* primitive: "Grandma, how did you type? Well, you reached up and untangled those funny little arms, and rolled the paper up, and scrubbed at your mistake with a gritty eraser . . . Oh, come on!" But it was an adventurous time; I had my secretary's machine painted to match her lovely hair. Eheu, fugaces!

DATATRON from ElectroData had begun deliveries from Pasadena—most machines, whatever the size, were made Back East—and nice people like Sybil Rock and Paul Brock were helping. There were even minicomputers. Autonetics, the electronics branch of North American, was pushing one called RECOMP, and at the very bottom of the spectrum was the Burroughs E-101, which was a sort of electronic cribbage board. I remember RECOMP as all transistors, and that RADC or its 1957 predecessor, was the first victim.

I had my secretary's machine painted to match her lovely hair.

Before I leave machinery—the 701s and 702s and 705s, the Univac I's and the 1103s, the ALWAC's and the BIZMAC's, I ought to talk about the physical shops themselves. We had lots of variety in those days. United Aircraft remodeled a hangar, and GE Lynn, a pre-Edison dark satanic mill. Other sponsors hired fancy designers and put in show places. Air conditioning was rife; I had left 220 tons behind in Ohio, and a beautiful bowling-alley floor that we cut holes in for cabling (they had invented flexible flooring, but no one was buying it yet).

Networking was beginning. I had put in a four-node transceiver net a year or two before, the Signal Corps (remember the Signal Corps?) was sending data from Pennsylvania to France, and Sylvania had just announced an 18,000-mile private telephone net centering on a Univac I in Camillus, New York. We talked glibly about real-time, but only SAGE, still in its earliest months, and the first primitive airline reservation system (Eastern), were really very close. But the ideas were familiar, and the pitfalls—notably, huge wodges of unworkable programming—were already listed.



The June 1957 issue of the *General Electric News*, ran this picture of Dan McCracken (standing) smiling an author's proud smile as Dr. Lee Thompson of Arizona State College leafs through the author's copy of McCracken's book, the first ever published on digital computer programming.

Oh, and we didn't call it software—Freddie Gruenberger or Old Leopard Bowtie, or whoever, hadn't popularized the word. Let alone uglies like "firmware" and horrors like "peopleware!"

We had, if not the world's greatest hardware, at least the world's greatest people. Some of them, like Big John Lowe of Douglas, Santa Monica, have disappeared; some, like Bill Bell, founder of the first American technical computing bureau almost a decade earlier, have died; many are still vigorously active, if a little grizzled around the edges. The West Coast ones appear at the annual DCA bash; the Digital Computing Assn. was still semi-serious in 1957, but the chowder-and-marching flavor was obvious. Gene Jacobs was president (SDC had just split off from Rand, but he had not yet converted).

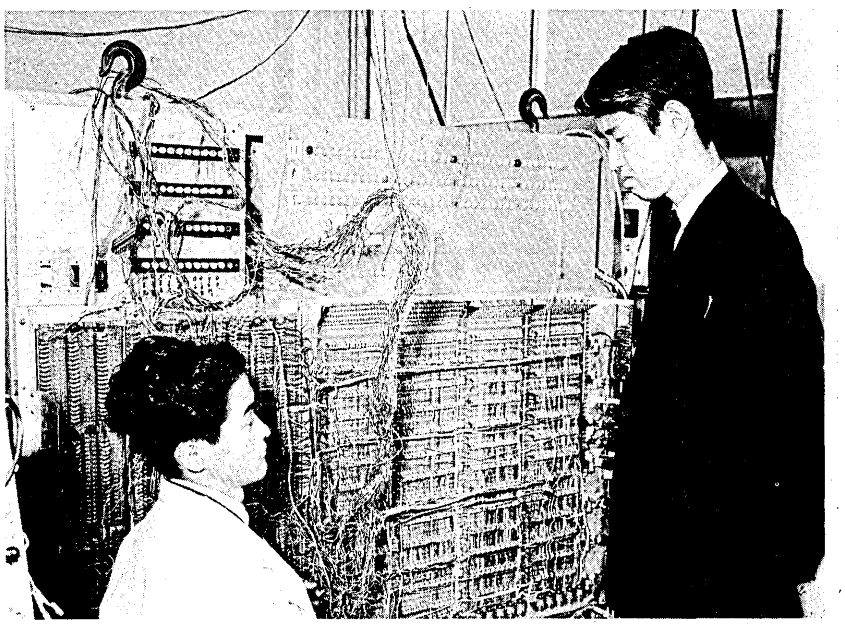
On the East Coast, ACM was being run by John Carr. Other officers, all *very* straight, were Dick Hamming, Charlie Concordia, and Jack Moshman. Two not quite so straight council members were Cuthbert Hurd, very big in IBM in those years, and Grace Hopper of Remington Rand Univac. The Eastern Joint was in Washington, so naturally it had been chaired by Sam Alexander; the Western was to be in L.A., and was the first to be reported by DATAMATION, The Western featured "the" paper on FORTRAN by John Backus and (count 'em) twelve co-authors. They reported 18 man-years of programming to produce 24,000 instructions. They called it an "automatic coding system"—the jargon was much, much simpler 20 years ago. Tony Ralston, a youngster at Bell Labs, talked about error detecting and correcting codes for real-time computing.

We had, if not the world's greatest hardware, at least the world's greatest people.

ACM was about to bring out its *Communications*. Al Perlis was editor-in-chief, and department editors included Walt Bauer, not yet working on his first million; Bob Bemer, still at IBM as I remember it; and Ubiquitous Grace. The *Journal* was already several years old; in 1957 it had a microprogramming article (!), an article on real-time by Dave Israel, and a description by Tom Steel of the long-forgotten but seminal cooperative project called PACT (Project for the Advancement of Coding Techniques). Sounds more practical than today? Well, most of our efforts were.

It wasn't that we were pinched for money. And Heaven knows, our bosses knew even less of what we were about than in 1977. But there were still so few of us—and so many great projects begging to be worked on. The IRE (Institute of Radio Engineers, now part of IEEE) reported in March that its members, pretty much hardware types, in the Professional Group on Electronic Computers, ran to about 2,500: 1,500 Eastern, 400 Middle Western, 600 Western. And believe it or not, still many more analog people than digital. In 1957! They went to the EJCC, the WJCC, but also to their own national meeting and to the early Wescon.

Salaries? The average engineer in the survey leveled off at $12K and stayed there; the 90th percentile finally got up to $19K. And the Ph.D. was only worth about $2K extra, to 1957 engineers. Fits my own experience; I didn't break the $20K barrier until I went back to IBM in 1958.



The parametron computer used no transistors, diodes, or vacuum tubes in its arithmetic and control units. Instead it used 3800 parametrons, a discovery of a 27-year-old Tokyo research assistant, Eiichi Goto, shown here on the left with Dr. Hidetoshi Takahashi, the computer's designer. A commercial prototype model was to be built according to the story in the May/June 1958, issue of *Datamation.*

And where was I in 1957? In Phoenix, of all places. "It was the best of times, it was the worst of times," said Dickens. General Electric had decided, just a year before, to enter the arena. They had watched the Remington Rand thrust, the powerful IBM riposte, the fumbling RCA entry—that was BIZMAC, the size of a house but with dog-kennel performance—the Honeywell buy-out of Sylvania. They had seen the proliferation of big machines in-house. They were dimly aware of Burroughs, of National Cash, of English Electric, and Bull. Bull! If they had known . . . ah, me!

BIZMAC, the size of a house but with dog-kennel performance . . .

Anyhow, I'd transferred from my beautiful shop in Ohio to the new site, and was trying with the help of some true believers like Dan McCracken and Charlie Asmus, and nearly a hundred new-hires, to explain programming and applications work to a dull bunch of Syracuse transplants. Off in Palo Alto, Bob Johnson and Joe Weizenbaum were struggling with ERMA, the check-cruncher GE was building for the Bank of America.

The exact moment of DATAMATION's birth? Well, I was probably on a plane between Phoenix and Huntsville. Some time in the early fall I had won a pioneering facilities management contract to operate von Braun's technical computing shop at what was still the Army Ballistic Missile Agency (yes, NASA came next year).

I had not yet decided to go back to IBM and the muggy East; the desert was wonderful, I had a charming new wife. But already the clumsiness of GE's entry was obvious. McCracken, who had finished his first book in Ohio, was at work on a thick second one with Arizona collaborators, but nevertheless pulled up his stakes. Soon I would reluctantly do the same.

I think of 1957, and the year or so before, and the year or two after, as the time when IBM began to do its tremendous thing *on purpose.* Look at what was going on. Manny Piore was putting them heavily into real research; the Old Man had given the concept terrific support, but never really understood it; now, Tom Junior and Al Williams and Vigorous Vin Learson were pouring on the coal. The *IBM Journal of Research and Development* started, with a foreword about sharing new advances with others "throughout the world." Good show!

STRETCH and SAGE were walloping along. There were preliminary photos in IBM papers, along with a lot of stuff about cryotrons and superconductivity. (Even IBM doesn't win 'em all.) And don't forget, down in the bowels of Endicott or worse, they were still making timeclocks!

SAGE had had a big part of the early 1957 Eastern Joint. Bob Everett, then at Lincoln Labs, gave the basic story; there were photos, and models, and some of the real-time philosophy which would expand so overwhelmingly in the next two decades. There were 60,000 tubes in each center; two coupled machines. And lots of simple but powerful graphic displays; a fantasy! You could walk around inside a STRETCH; there is still one at Brigham Young to saunter through, if you don't believe me. But inside SAGE, you could get lost! And all this was pouring relentlessly out of steadily expanding, sophisticated, rich IBM.

Even on the international front, IBM had some special victories. Just as I had put a 704 into Phoenix to help General Electric, so did the engineering department of AEG in Germany put in a 650. And World Trade Europe was enlarging the Place Vendome scientific bureau, planning for a 709 in a year or two. This was in response to the Univac I which Carl Hammer was running for Battelle in Frankfurt. I was to ask, a few months later, for a World Trade assignment. The boys and girls overseas were awake! Alas, I was shackled in Pallid Flats instead.

IFIP was not yet dreamed of, nor had Ike Auerbach proposed the 1959 UNESCO preliminary session. But the control people had just put together IFAC (International Federation of Automatic Control) under Harold Chestnut; the pattern was coming clear. Japan was still asleep; Goto was known here, but the first government support, to set up JEIDA, the electronic industry development operation, came only in 1958.

The British were in full cry, and in Canada Kelly Gotlieb and Pat Hume published their first book. There had been a big early Ferranti machine in Toronto for three years, and I had seen the companion installation in Picone's institute in Rome in 1956.

Perhaps the areas most different from 1977 were the human, the educational, the hobby ones. The latter did not exist at all, of course; the relics of the forties and the very early fifties were so lugubrious, so slow, so battered, that the thought of operating any of them in one's basement or garage had not dawned. And the kind of familiarity that led to high school clubs and The Resistors, years later, was present only in special localities. Harley Tillett, one of the dozen SHARE founders, worked in such a place; he and his wife put a bunch of Navy kids (junior high level, mostly) onto the China Lake 701, using SPEEDCO, an antediluvian BASIC. And used the 704 and some SHARE softwear later, I recall. He reported it was "feasible to introduce computer programming instruction below the college level." Don't we know!

> Perhaps they knew the golf ball was lurking in the IBM rough!

The big university push had begun, as had the transfer of funding from ONR, and almost entirely for hardware and hardware development, to multiple agencies and for more general purposes. The MANIAC III sort of thing, at Illinois, was passé before it started; industry had already forged out of sight. But instruction, and software research, were in full flower. One sad note for the socially conscious: the Army began funding the Mathematics Research Center at Madison in 1957, little dreaming of the bang and the whimper to come so sadly a decade later.

The cybernetics cult was still alive, and the term "artificial intelligence" was not abroad in the land, although Newell (still at Rand), Simon, and John McCarthy, were cranking up. At the other end of the spectrum, professorial attention to data processing was beginning; people like Tony Oettinger were interested, and *Fortune* had an article about it, instead of the usual "Gee Whiz, Williams tubes!" of the previous quadrennium. Even word processing (the term itself still fifteen years in the future) had its tiny notices; Remington Rand announced a paper-tape office typewriter. Perhaps they knew the golf ball was lurking in the IBM rough!

The 705 III marched on the scene, and Howard Aiken's monstrous MARK II relay calculator at Dahlgren was retired. MONROBOT, a sub-mini, and Honeywell's giant DATAMATIC 1000, were unveiled, to the mini and giant yawns of the IBM/Univac enthusiasts. Perhaps the flavor is best recalled by the BRL report, which listed 103—yes, 103!—different computer systems, from DEUCE to Zuse, around our sprightly universe.

In that universe many of today's greats already flourished. Two year old SHARE had, of seven senior officers, Frank Wagner, Herb Bright, Paul Armer, and Frank Engel. But the others were Ben Ferber of Convair, Lee Amaya of Lockheed, and Walt Ramshaw of Pratt & Whitney: *"Où sont les neiges d'antan?"* said Villon five centuries before. Mel Grosz was at GUIDE; Cecil Hastings, the Compleat Approximator, not yet the first honorary member of the Polynesian Information Processing Society ("They're PIPS!"), was visiting from Hawaii. And can you believe it? The 1957 DCA meeting featured a Pioneer Session!! History, yet! Gruenberger was program chairman.

Yes, it was an eager time; the technical papers, the meetings, the books—from "Automata Studies" through Dick Canning to the last of the Bureau of Standards math tables—the new publications which DATAMATION was to complement, all were eagerly absorbed. Even the first book in English on the abacus!

There were great things happening in the outside world. At precisely the moment DATAMATION crawled from its R&E cocoon, the Sputnik signal went up, and with it not only NASA, and the space component of aerospace, but the long string of adventures that led to Armstrong's "giant step for mankind." Here the computer was to shine, to share with heroic but fallible human beings a voyage unequaled in our short and largely brutish history. It was the beginning of a new era.

And it was the end of an earlier one. John von Neumann, great Johnnie, had died earlier in the year. The first steps had been taken, by Babbage and Hollerith and Comrie and Aiken. And by von Neumann. Now development would proceed; IBM would swell and burgeon; a great trade would make its contribution across the whole world.

It was, indeed, a vintage year. ❊

George Stibitz and the Bell Labs Relay Computers

by Evelyn Loveday

It all began with a dry cell, some flashlight bulbs, and pieces of a tobacco can.

On September 7, 1977, at its Washington, D.C., meeting, the prestigious Institute of Electrical and Electronic Engineers presented its first Emanual R. Piore award and citation to George Robert Stibitz, Ph.D., Sc.D. The Piore award is given for outstanding achievement in the field of information processing, and is sponsored by the International Business Machines Corp.

Dr. Stibitz' citation read, "For pioneering contributions to the development of computers, utilizing binary and floating-point arithmetic, memory indexing, operation from a remote console, and program-controlled computations."

Many people today find it hard to believe that less than 40 years ago no one had a computer. In fact, only a handful of people dared dream that mathematical computations could be done more swiftly than with a gear-operated desk calculator.

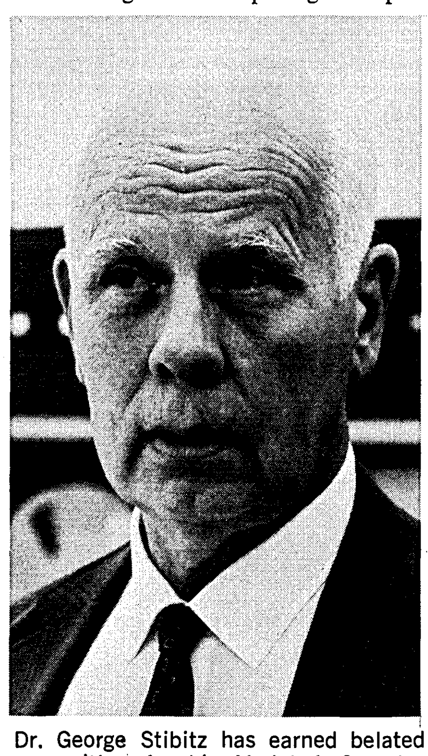
Who is Dr. Stibitz? When did he make his pioneering contributions to information processing? How do those contributions relate to today's complex and incredibly rapid computers? Where is Dr. Stibitz now, and what is he doing?

In 1937, Stibitz was a Bell Labs research mathematician. He couldn't stop thinking of new ways of doing things. (He still can't.) Laborious mathematical calculations by hand or desk calculator were not rapid enough to suit him. In his work he had observed the circuit paths through relays and the similarity to binary notation for numbers, and had an idea he wanted to work out.

He liberated some relays from a scrap pile and, as a play project at home one weekend, he made a little model of a binary adder with relays, a dry cell, flashlight bulbs, and strips of a tobacco can.

The relays were wired to give the binary digits of the sum of two one-digit binary numbers, which were entered into the arithmetic unit by pressing switches made of metal strips. The two flashlight-bulb output lighted up to indicate a binary 1 and remained dark for a binary 0. (The table on which this model was built is still in use in the Stibitz home.)

No lightning flashed to signal the computer age had begun.



Dr. George Stibitz has earned belated recognition for his Model 1 Complex Computer, the earliest form of the digital computer, but his favorite invention is a bouncing ball device.

When Stibitz took the model to the Labs to show it to some of his colleagues, no bells rang and no lightning flashed to signal that the computer age had just begun.

He began to wonder what could be done with a large number of such adders. More time was spent at home in sketching circuits for addition, multiplication, and even division. Next came the idea of setting up decimal digit adders in binary form, with each decimal digit expressed in binary form by multiple contacts on keys.

To avoid use of complicated "carry" circuits, the range of decimal digits was shifted to the middle of the list of four-bit binary numbers. This shift was equivalent to adding three to the decimal digit so that the decimal 0 was represented by binary 3 (0011), and so on. If two digits were added, the binary sum was shifted six units, and nine became binary 1111, while 10 (carry one), became 10,000 with an extra digit: a simple indication that a carry was to be made.

It is difficult to tell how many modern computers use this excess-three code today, but a glance at the specifications of commercially available integrated circuits shows that both binary coded decimal (BCD), and excess-three codes are embodied in chips such as excess-3-to-10 to wire code, and reverse.

All of this was still a Stibitz leisure time activity until his section chief asked if his calculator could do complex arithmetic. It could, and because of a need at Bell Labs, the weekend play project became daily work. Dr. Stibitz always emphasizes that, while his was the mathematical concept, the project could not have been completed without the help of a skilled switching engineer, Sam Williams. He was thoroughly grounded in all the properties of relays and yet had to assimilate from Stibitz mathematics and number theory in order to complete the detail design.

Before the end of 1939, the Complex Calculator (later to be known as Bell Labs relay computer Model 1), was debugged. It was set up for the mathematics department's calculations people in January 1940, and had a Teletype machine as an input device.

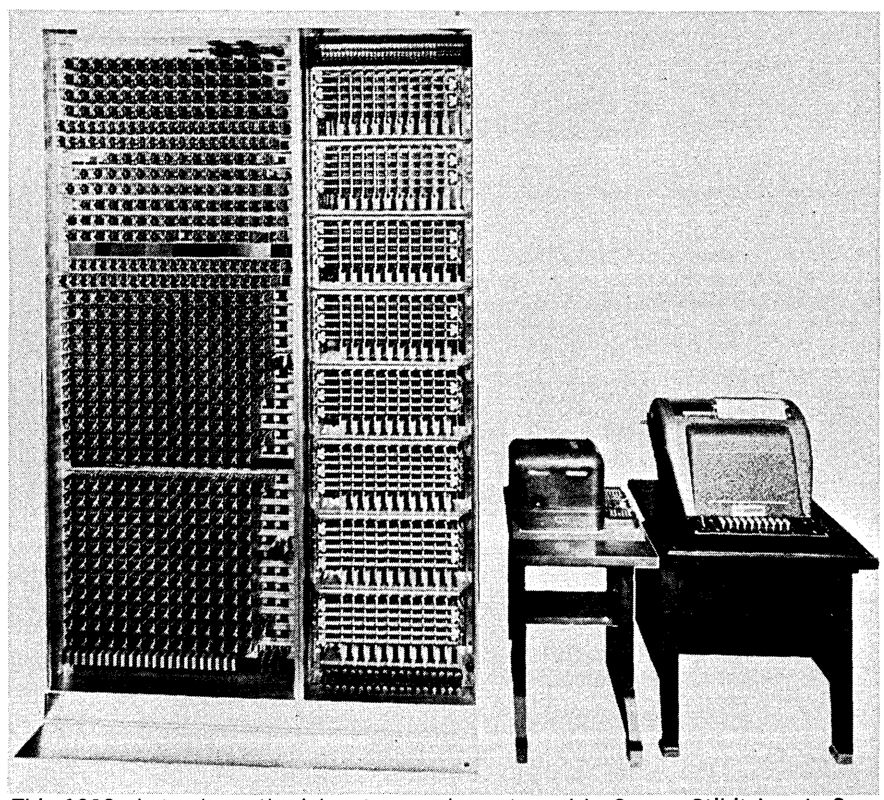
It is believed that this relay computer was the first (at least in this country), to employ binary components and to use the excess-three code.

Another group at BTL, outside of the mathematics department, was doing a large number of calculations with complex numbers. Soon a second Teletype was installed in another part of the building for that group's use. A third was added later in still another location. Thus this relay computer scored another "first." In a crude way it was the nucleus of a time-sharing system with lock-out facilities. Any one of the three Teletypes could be used on a first-come, first-served basis. Not for several years after that, well into the computer age, would time-sharing be in common use.

Stibitz used random walks to calculate the diffusion of drug and nutrient molecules through the walls of capillary blood vessels.

In September 1940, the American Mathematical Society met at McNutt Hall at Dartmouth College in Hanover, N.H. At first, Dr. Stibitz had been asked to read a paper on the BTL relay computer. He did that and something more. Transceiving panels were installed in McNutt Hall, and a direct telegraph circuit to the computer at BTL in New York City was arranged.

After the paper was read, the audience was invited to submit problems for the computer to solve. These were transmitted to the computer, and the teletypewriter in Hanover printed out answers in less than a minute. This was the first public demonstration of the remote operation of a computer, and foreshadowed the tremendously rapid growth of today's data transmission services.



All photos courtesy of Bell Laboratories

This 1939 photo shows the laboratory equipment used in George Stibitz' early Computing System for Complex Numbers, including a relay and switch frame, a Type 14 distributor, and a modified Type 26 printer.


computex

GEORGE STIBITZ

During the years 1938 to 1941, Stibitz made several written proposals to extend the relay computer's original design to new areas. These included the evaluation of polynomials and programmed calculation. However, Bell Labs had decided not to build any more computers because the first one had been so costly. One proposal concerned what Stibitz called the "floating decimal." Today this is sometimes called "scientific notation," and nearly every computer manufactured currently provides this option.

The need for this feature was noted by Stibitz when he saw that as the programs became longer, the user found it difficult to predict how large his results would be.

Why not have the computer itself be made to introduce factors that would keep the results within reasonable bounds? Thus, if the computer saw that the numbers in the run of the program were becoming too large for the capacity of the machine, it would divide by 10, or 100, etc., and remember that fact to be accounted for later. This accounting would be neatly done at every step.

This proposal was to lie dormant for some years. Bell Labs resumed building relay computers during World War II, and only one, the Model 5, reduced all numbers to the form called the floating decimal.

While the first relay computer (Complex Calculator), was extraordinary in its time, it had a very limited range of operations: addition, subtraction, multiplication, and division of complex numbers. Dr. Stibitz' mind was running ahead before construction of that first computer was completed. In 1939, he was thinking about a computer that could at least evaluate polynomials or other algebraic expressions according to instructions entered on a keyboard, or punched on tape: in short, a program.

Early in 1942, after the entry of the United States into World War II, Dr. Stibitz was loaned to the National Defense Research Council which functioned under the brilliant leadership of Dr. Warren Weaver. Stibitz brought to the council his knowledge of, and experience with, the capabilities of computers. It soon became obvious that with the masses of computations to be done for military fire control, more computers would be useful. So BTL built four more computers, planned by Stibitz (ably assisted by engineer Earnest Andrews), between 1942 and 1945. Model 2 used a taped program such as Stibitz had proposed in 1940. The program tapes were punched in machine language which included five-hole codes for "transfer from register B to adder," "read data," "punch," and so on. The tape was then looped, with ends glued together, and added to the program library.

Model 2 was put into service in September 1943. It was designed to handle thousands of problems having identical programs, and ran for days at a time with only housekeeping attention by an operator. Thus, it was probably the first fully programmed computer.

In BTL's Model 4, the number of distinct programs increased greatly and programming became an art in itself.

> Today a programmer who found no jump capabilities would not know what to do.

These programs were written in modified algebraic language.

It is interesting to note that the combination of key-controlled and stored programs has reappeared after 35 years in the small, hand-held programmable computers on the market today.

In the larger computers, many programs are stored on magnetic or paper tape as a cheap, long-time storage means. With the decreasing cost of more rapid and accessible forms of storage, the tape becomes less important and is used far less frequently.

In the relay computers, with programs limited to punched paper tapes, the use of jump instructions was limited by the delays in finding indicated instructions. With two-way drives injected into the Teletype tape readers, it was possible to tell the computer (Models 3 and 4) to jump to a specific address on tape. In Model 5, subprograms were placed on separate tapes and called in by jump instructions on the main program tape.

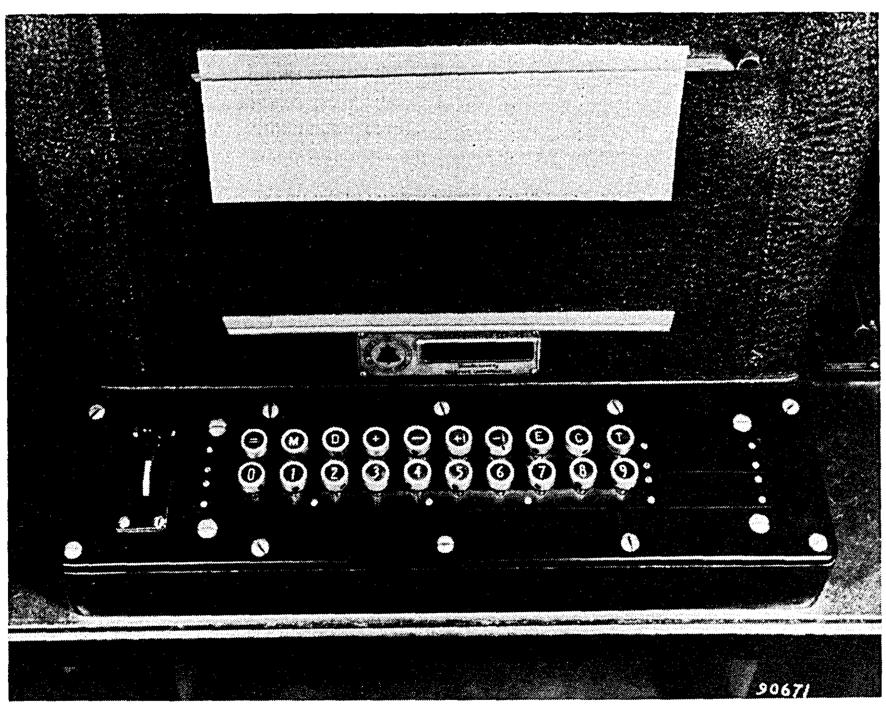
Today a programmer who found no jump capabilities would not know what to do. But in the early 1940s they didn't know what they were missing, and somehow wrote programs anyway. If a jump was absolutely unavoidable, two programs were created and one or the other was run according to requirements.

Finally, when Model 5 was used to solve differential equations, two subprograms were customarily used. These respectively expanded and contracted the time increments in the solution and were called in by the computer under control of a computed numerical text in the main program.

Both the conditional and unconditional jump instructions are found today even in the hand-held programmable computers.

At the end of World War II, there appeared to be no support for further work in computers, and, primarily a mathematician, Dr. Stibitz left BTL for a slightly different career as an independent consultant in applied mathematics. He moved with his family to Vermont, and for the next 19 years worked as a consultant to various business firms.

New ideas and new ways of doing



This is the keyboard of George Stibitz' first relay computer which was put into operation on January 8, 1940, at Bell Telephone Laboratories' West St. facility in New York City.

things have always crowded Dr. Stibitz' mind. Of course, many of his computer inventions were assigned to BTL, but he has patented many of his inventions for himself. His 35 patents range from computer elements to a stereophonic organ, a V-belt equalizer and a reversible lifting device.

Dr. Stibitz, when asked which one of his many inventions pleases him most, had difficulty in naming just one. Finally, he did so—the bouncing ball counter. He said, "It is ingenious, but vastly unimportant. However, every mathematician enjoys finding something simple and satisfying." He went on to describe the device on which he assigned two patents to BTL in 1942 and 1943.

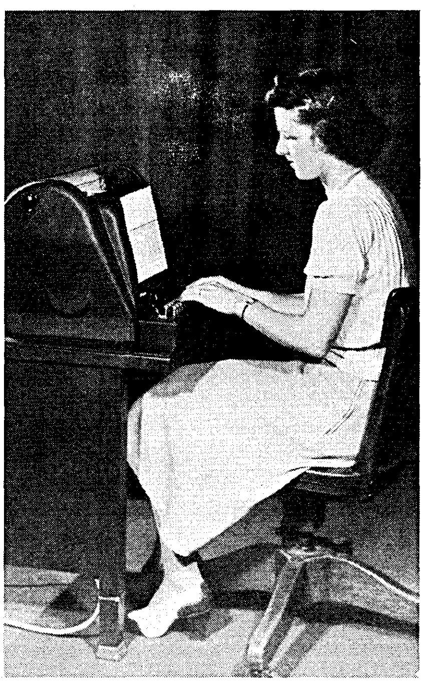
"An instance of combining two disparate ideas is the bouncing ball counter of 1942. Like most school children I had been fascinated by the device for demonstrating the conservation of momentum found in every classical physics lecture room. A series of large wooden balls hung on cords from the ceiling, and normally all were in light contact. When the instructor swung the last ball in the series so that it struck the next ball, the intermediate balls remained quiet, but the ball on the other end swung out. This fact was the first of the ingredients in my counter.

"The telephone company has frequent occasion to count rapid pulses, as for instance, your dial sends pulses to the exchange. Expensive relays were and are used as counters. This is the second ingredient in my counter.

"A few months later I added a third now-familiar ingredient, namely binary notation. By a tricky combination of balls in a two-dimensional array, I persuaded the balls to count in binary notation.

"A simple two-ball counter was also good. The 'row' of balls was reduced to an equivalent of five, two of them actually being fixed magnets, but acting like balls. The middle ball is movable and the end ones are driven together. When an electrical signal arrives it claps the two-balled driver together. If the movable ball is at the right end it is driven left and vice versa, so its motions are (count of pulses), Modulus 2, or the representation of the last binary digit of the count. A contact on the mid ball can drive another two-ball set and give the next binary digit, and so on."

"Like most school children, I had been fascinated by the device for demonstrating the conservation of momentum . . ."



This photo of H. L. Marvin at a keyboard communicating with George Stibitz' Complex Computer, appeared in the Bell Labs **Record** of October 1940.

Not only has Dr. Stibitz been inventing and designing hardware, since 1930 he has been publishing many of his findings. To date he has been published 46 times on topics ranging from work in the computer field to mathematical models of biomedical problems. Two of his published works are books.* The Smithsonian Institution has indexed all of the Stibitz papers which have been given to the archives of the Baker Library at Dartmouth College.

In 1964, Dr. Stibitz had a challenging offer from Dartmouth's Medical School. He was asked to become a research associate in physiology, using his tested techniques of applying mathematics and computers to biomedical areas. He had already done some work in this field with researchers at the Univ. of Vermont Medical School. He enjoyed it. He accepted the offer at Dartmouth and became a professor in physiology in 1966. Today he is a professor emeritus.

At age 73, Stibitz today theoretically is on half-time at work. He seldom spends more than eight hours a day at the Medical School! And he is proud of the fact that last fall he cut and split three cords of wood for his fireplace.

It seems peculiarly fitting that from 1964 to the present his work has involved the use of computers. Dartmouth has a large one with time-sharing capability, and there are eight Teletype stations in the Medical School alone.

He could be called a resource person at the school and the associated Mary Hitchcock Hospital. His skills have been called upon by a pharmacologist, a neurophysiologist, a pathologist, and a radiologist, to name but a few.

Some of the problems he has dealt with by mathematical and computer methods are the motion of oxygen in the lungs, the diffusion of drugs and nutrient molecules in capillary blood vessels, the exchange and secretion of substances in the kidneys, the mechanical work of breathing, the dosage of radiation and the anatomy of brain cells.

The laws of physics are expressed in firmly established mathematics, but in the biological environment the details of application are often multitudinous and complicated. Therefore, the help of the computer is essential.

As an example: it was necessary to write a program to find the rate at which oxygen moves in the airways of the lungs, letting the computer trace imaginary molecules in random walks. With a pharmacologist, Stibitz used random walks to calculate the diffusion of drug and nutrient molecules through the walls of capillary blood vessels with over 100 million random steps, in various sizes and shapes of slits in the wall. The electron microscope shows the slits fairly well, but there are other problems in which there is no such firm information. Hence, it is necessary to construct tentative mathematical models which are defined by sets of equations that determine the response of the system under given conditions. Then the computer must try out many variations in the model in order to find the one that predicts responses which best agree with laboratory tests of the biological systems.

It requires little imagination to see how tedious and time-consuming such an effort would be without the use of the computer which, because of the complexity of most biological systems, has become absolutely indispensable in much research work.

Computers are equally involved in many other fields. The crowning irony for Dr. Stibitz was an incorrect computer billing from a nationwide company. It took him months to have the matter straightened out.

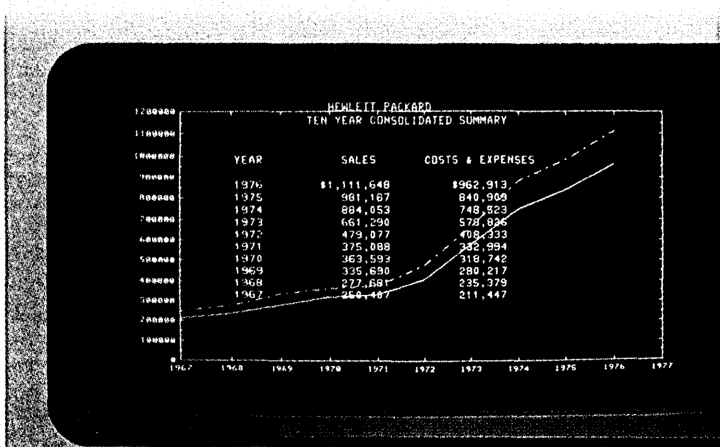
With a strained expression on his face, Stibitz quoted the phrase known in all computer centers: GI-GO—"Garbage in, garbage out."

Not all inventors live long enough to see their ideas expressed in practical and useful hardware, and to make professional use of the result. Certainly George Robert Stibitz was the right person in the right place at the right time. ❊

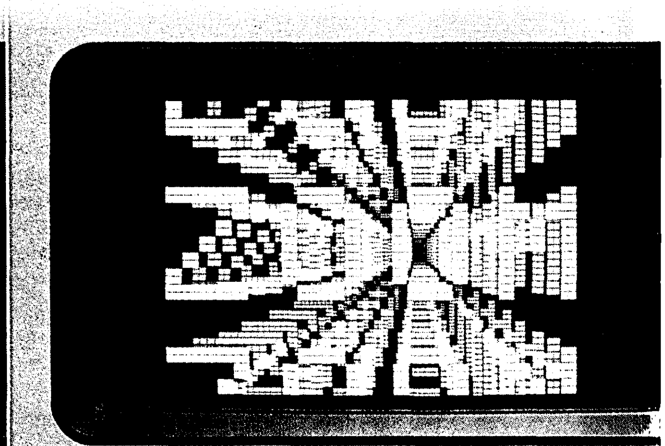
*Stibitz, G.R. and Larivee, J. A., *Mathematics and Computers* (New York: McGraw-Hill, 1957).

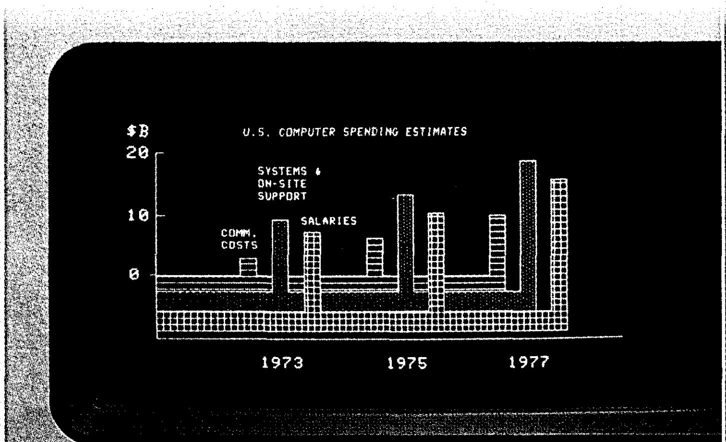
Stibitz, G.R., *Mathematics in the Life Sciences* (Chicago: Year Book Publishers, 1966).

Hewlett-Packard brings a bright new look to low-cost graphics.

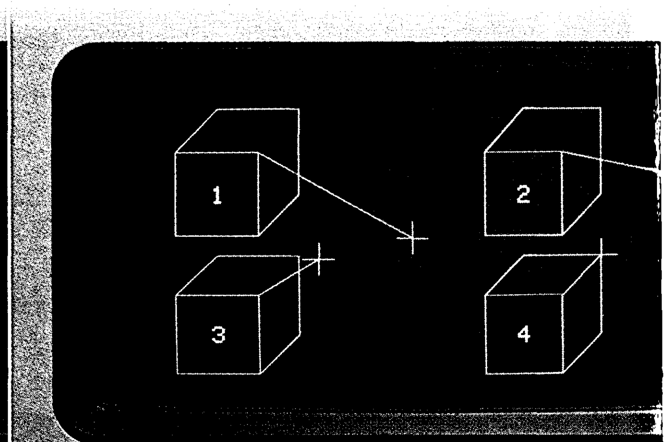


Auto Plot

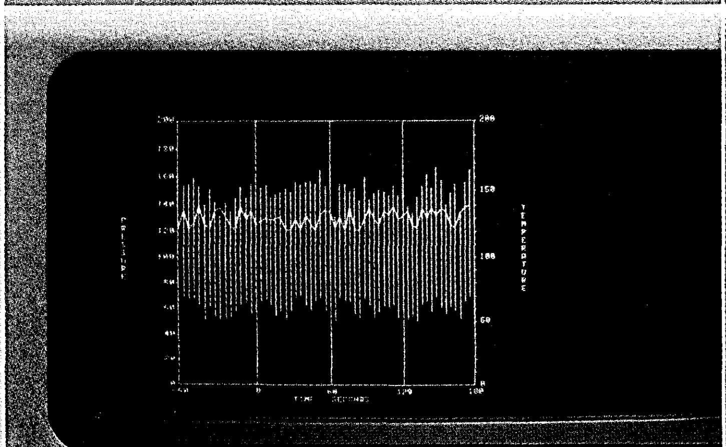

Zoom

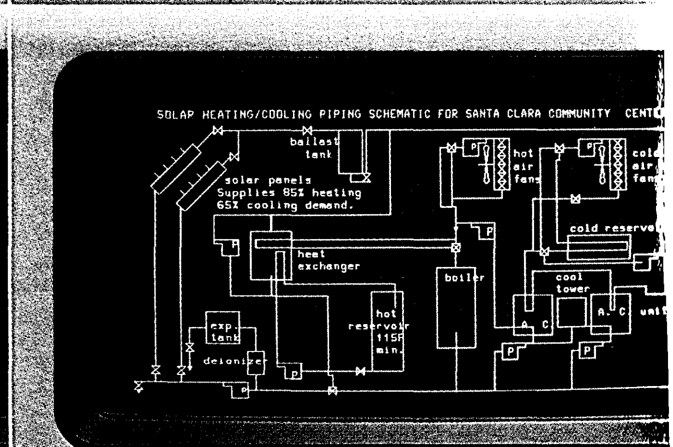


Area shading



Rubber-band line


Typical application: scientific plotting



Typical application: process flow diagram

The new Hewlett-Packard Graphics Terminal uses a microprocessor and raster scan technology to combine high performance with low cost.

The HP 2648A introduces a whole range of bright ideas to graphics. There's so much power built into the terminal itself that you can perform everything from auto-plots to zoom without any CPU help at all.

Auto-Plot. You don't need to know programming or invest in costly software. Once you've entered your facts and figures from the alphanumeric keyboard, press a few keys and your tabular data is plotted instantly.

Raster Scan. No more pulling down the blind to make your plots visible. Our display is clear and easy to read even in bright light. And the raster scan technology permits selective erase, cutting down the time it takes to modify your picture also.

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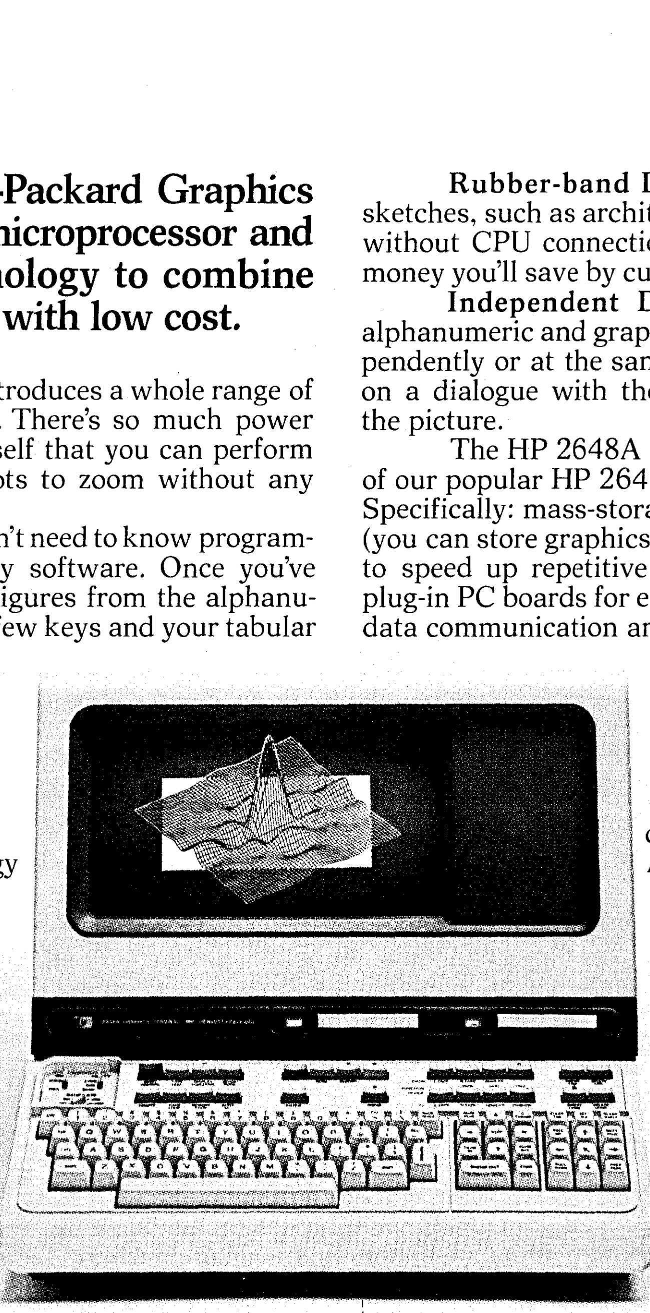
Area Shading and Pattern Definition. This makes it easy to distinguish areas with similar shapes, such as bar charts, mechanical parts and architectural drawings.



Rubber-band Line. You can draw trial sketches, such as architectural floor plans, with or without CPU connection. Think of the time and money you'll save by cutting down mistakes.

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We'd like to give you a graphic demonstration of everything the HP 2648A can do. Send us the coupon and we'll set it up. Or contact the nearest Hewlett-Packard sales office listed in the White Pages. We're sure you'll get the picture.

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Yes, I'd like to take a closer look at your low-cost HP 2648A Graphics Terminal.

☐ Contact me to arrange a demonstration. ☐ Send me complete information.

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Mail to: Ed Hayes, Marketing Manager, Hewlett-Packard Data Terminals Division, 19400 Homestead Road, Dept. 407, Cupertino CA 95014.

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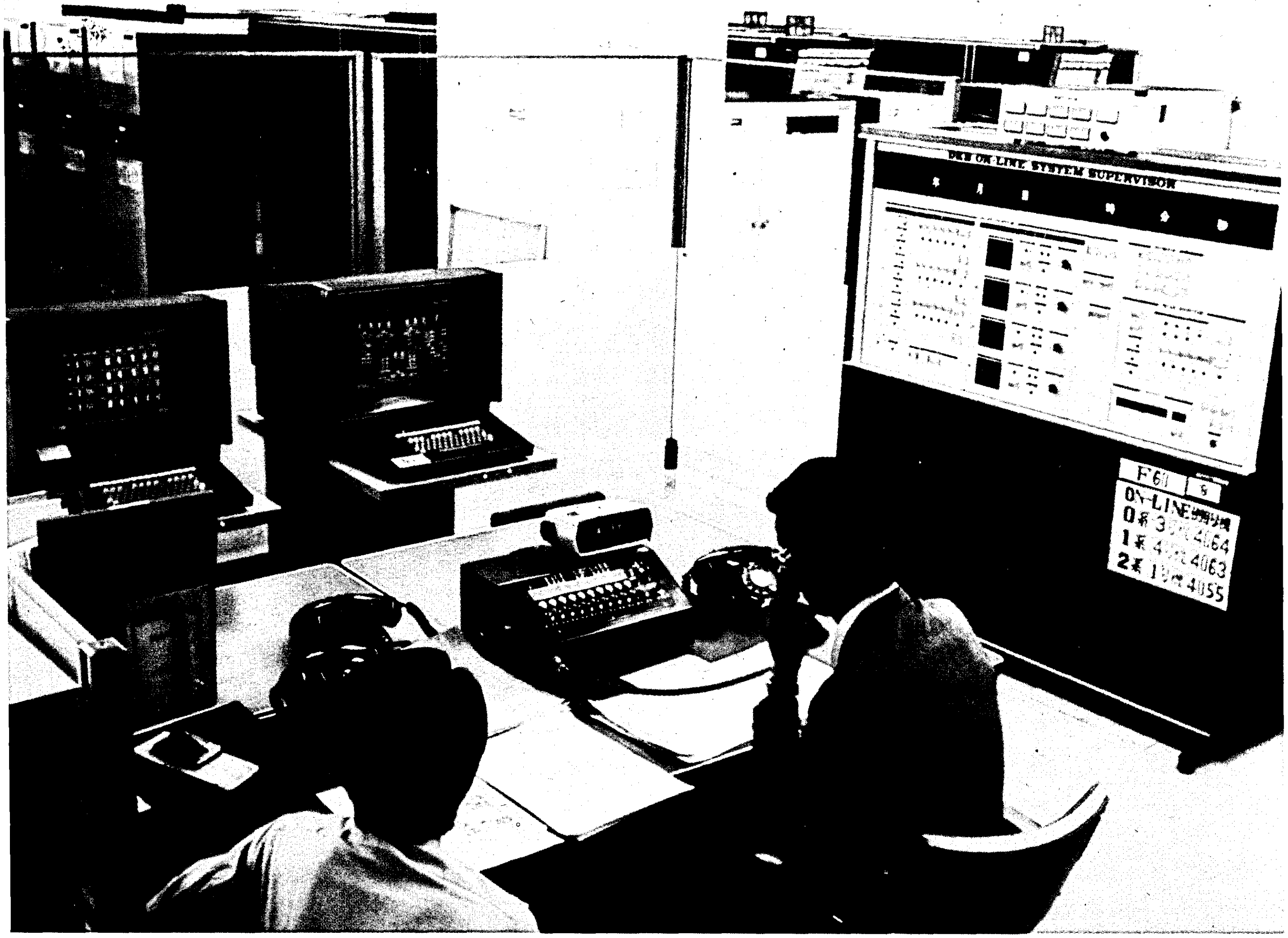


A Japanese On-Line Banking System

by Yuzuru Abe

Eight large-scale mainframes, 700 minis, and 4,000 terminals have been handling an average of 5,000 on-line transactions a day at Japan's largest bank, "the bank with a heart."

This February, our new on-line system centered around three super-scale computers went into operation. The new on-line system was named "HOPS," an acronym derived from "Heart On-line Processing System." The heart is the trademark and symbol of the Dai-Ichi Kangyo Bank and it represents our motto "the bank with a heart."

It took three years and 3,200 man-months to develop the HOPS system. Currently our terminal system consists of 700 minicomputers and 4,000 terminals, all up and running.

At the time of this writing, we were in our 150th day of continuous service without downtime, although we had a few I/O failures. These did not affect the on-line service of the system because of the built-in fail-safe functions.

Table 1 shows the extent of DKB's banking business as well as the number of on-line transactions on a peak day. Table 2 gives the background for the DKB on-line system and how it evolved.

The on-line system prior to HOPS consisted of three dual-processor 256K word FACOM 230-60 systems connected in a triangular configuration, where the load was shared among the three systems. Its processing capability was on the order of 300,000 transactions/hour. However, our needs required that we design a computer center capable of handling twice that number of transactions and at the same time allow us to expand the system's processing power as much as three to four times. However, if we were to follow the same configuration principle each time we added one more system, our configurations would have looked like the illustrations in Fig. 1. We found out that if this were the case, the hardware as well as the software would become excessively complicated and the development work extremely difficult. Further, since in the previous center system data files were *not* being shared, if one of the systems crashed, it would cause a 10 minute break in the on-line service offered to all of the branches connected to that computer. We also realized that our needs would entail the use of higher speed transmission lines than we were using at that time (600 1200 bps lines and 170 200 bps lines).

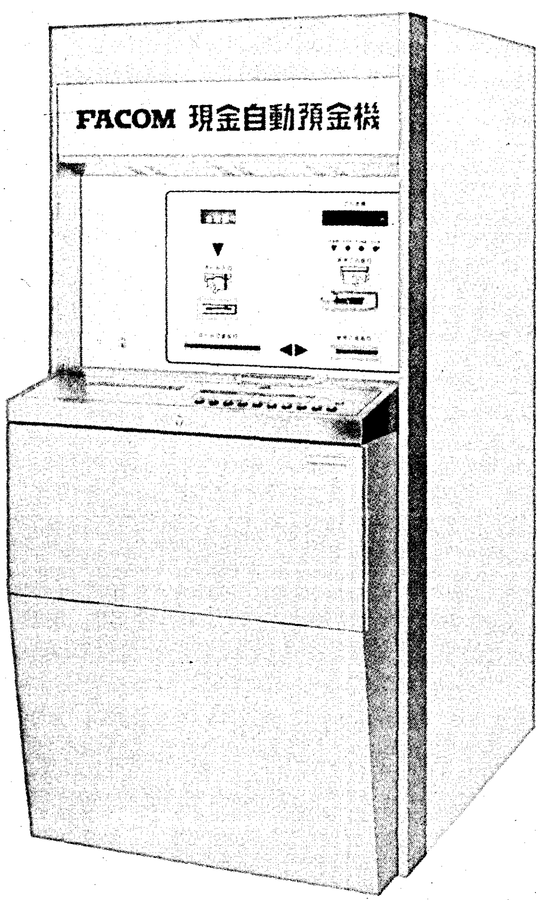
Japanese banking habits

In order to understand why Japanese banks have to handle a voluminous number of transactions, one must look at the characteristic banking habits of the Japanese people. In comparison with the U.S., very few Japanese write checks, as this is not a Japanese custom. They prefer to use cash for settling accounts, and so a large number of people personally go to the cash withdrawal and deposit counters of the banks. In addition, all money remittances and transfers to the payees' accounts are carried out by the clients who appear in person at the banks' counters. This naturally brings about a dire need for rapid on-line transaction processing at the banks' counters. It also results in a tremendous volume of transactions that must be processed between the particular branch and other banks through the data communications network. The increased use and preference for cash dispensers have caused their proliferation, and today there are roughly 10,000 units in operation all over Japan. Almost all of these cash dispensers are connected to the computer centers and the transactions are processed in an on-line basis. Also, many large enterprises and firms recently have started bringing to their banks magnetic tapes containing payroll data, and the employees' salaries are automatically

Capital	$346 million
Deposits	$31,045 million
Employees	25,000
Industry ranking Domestic (Japan) International	 1st 5th*
Number of branches/offices Domestic International	 316 (312 branches & 4 sub-branches) 18 (7 branches & 11 representative offices)
Number of accounts	16 million
Number of on-line transactions on a peak day	3 million

*Source — **Fortune,** August 1976 issue.

Table 1.



Japanese banking habits make an automatic cash depositing terminal like this an important component in an on-line system. There also are some 10,000 cash dispensers in operation throughout the country.

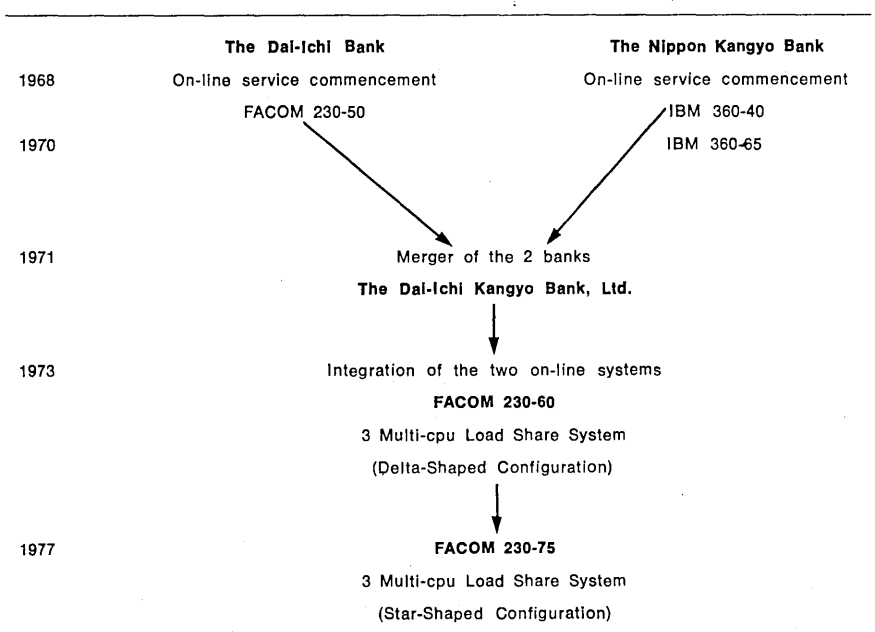
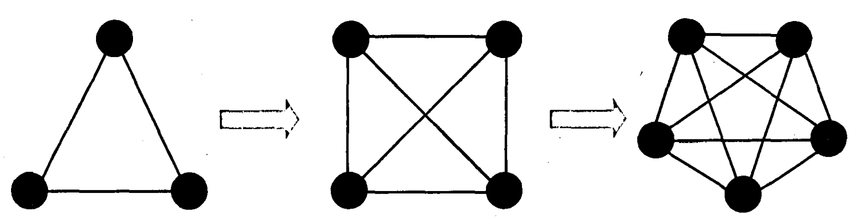


Table 2.



Load-share among 3 MP systems (delta-shaped configuration)

Load-share among 4 MP systems

Load-share among 5 MP systems

Fig. 1.

transferred to their personal accounts at the various banks. This causes a rush of employees and their dependents who come to withdraw cash on or immediately after payday. Again, all of these are on-line, and one can imagine the colossal number of transactions that have to be processed. For reference purposes, there are 45,000 registered accounts and 5,000 daily on-line transactions for an average of 1,300 clients per day at a DKB branch.

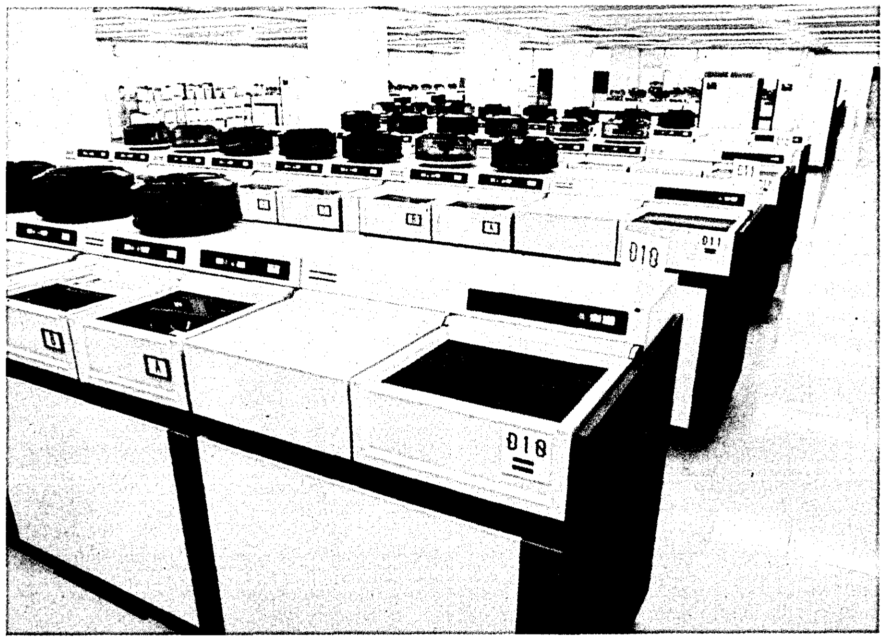
Bottlenecks in the previous system, and demands from the changing social situation formed the background leading to the development and installation of the HOPS on-line system by DKB. A few of the problems needed to be overcome were:

1. Need to remove the limits on processing capability to allow handling an increased volume of transactions.
2. Need for high speed mass storage files to handle the increasing burden of customer accounts and improve customer services.
3. Need for improved terminals with advanced functions.
4. Need to change emphasis from clerical to customer management-type processing with improved client service.
5. Creation of customer information files.
6. Need for a fail-safe or crash-free system.
7. Diversification of banking services and customer needs.

New technology was needed to realize the HOPS system, which could solve these problems. That technology included: high performance cpu and stable software, reliable load share system and shared-file technologies, high performance I/O equipment, high speed lines (48K bps), and improved terminal equipment with high intelligence.

From the numerous problems we faced, five significant problems drew a lot of our attention during the design phase, and these are briefly described below.

1. Even if a system were to go down, it should not under any circumstances cause all the terminals of any one branch to stop functioning even for a short time. That is, we were intent on achieving a fail-safe design.
2. The system would have to have enough processing power to handle 500,000 transactions/hour at the time of implementation and still allow for future expansion to handle as many as 1,100,000 transactions/hour without having to change any fundamental system concepts and/or design.
3. Another problem was alternating



Foreground unit labeled D10 is the cross-call adaptor devised to assure fail-safe operation of peripherals.

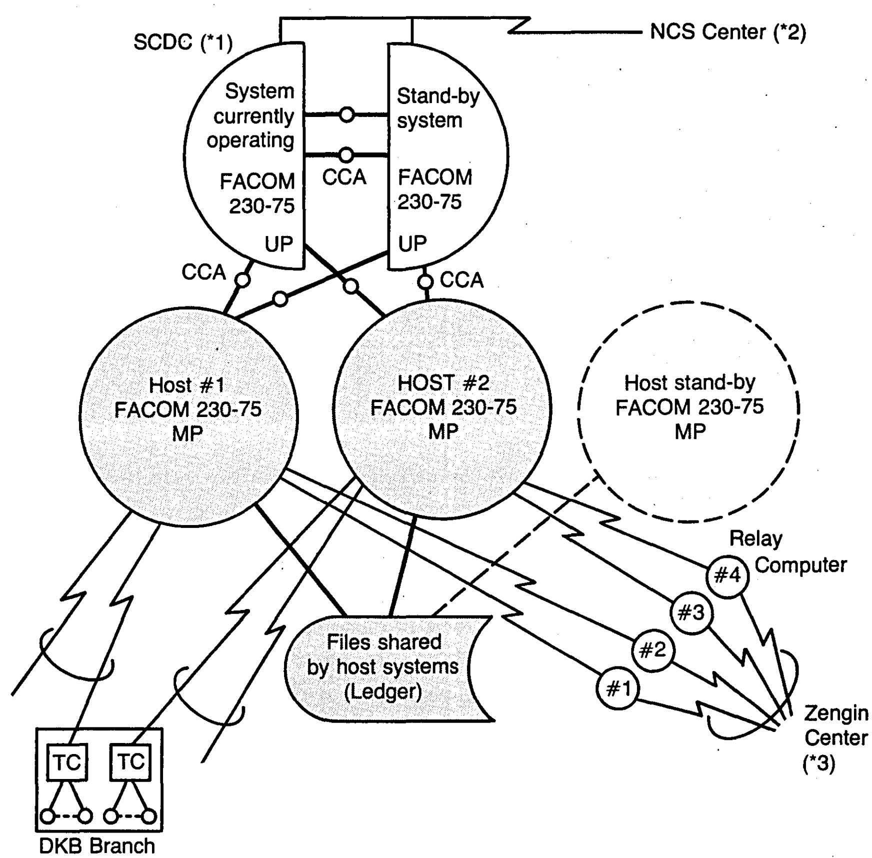


Fig 2. HOPS center configuration.

NOTE:

UP = Unit Processor
MP = Multiple Processor
TC = Terminal Controller

(*1) SCDC = System Control and Distribution Computer

(*2) NCS = Nippon Cash Service; 200 cash dispensers installed at geographically dispersed public places allow depositors to withdraw cash from any of the 54 subscribing banks.

(*3) ZENGIN = The on-line exchange system of all banks in Japan. This is a common network shared by 7,500 branches of 90 banks throughout Japan.

the data files, consisting of records arranged by item sequence and account sequence, to a structure that would permit better management and control of individual customer account data, thus improving the bank's service to individual clients. This file would have to serve as a customer information file for all the bank's customers.

4. The communications network would have to be planned to realize significant economies of scale in line utilization.

5. We would have to adopt the use of minicomputers and much more intelligence in the terminal system to allow the connection of various types of terminals in the future as well as to achieve a 50% improvement in the overall terminal performance (including factors such as ease of terminal operation, etc.).

	Host	SCDC	Remarks
Cpu	6 units	2 units	
Memory	1MW x 3	384KW x 2	
MTU (FACOM 611A)	68 units	16 units	Recording density = 6250 RPI Used as transaction detail files
DPU (FACOM 479B)	174 spindles	16 spindles	Storage capacity: 200MB/spindle Used to store customer ledgers and system resident files.

Table 3. Additional details of the HOPS system configuration.

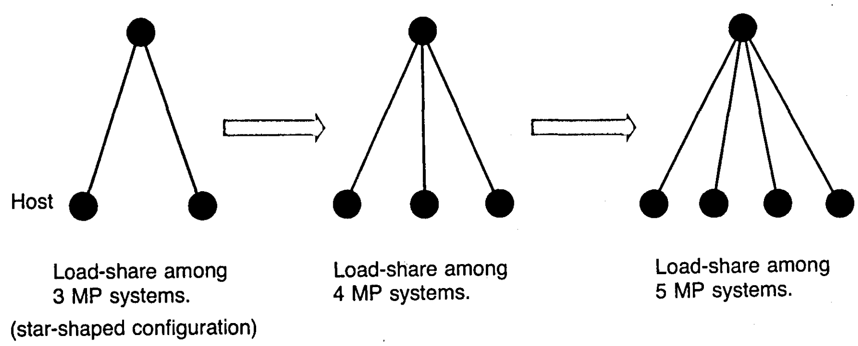


Fig. 3. The method of linkage.

Center system configuration

A schematic diagram of the center system configuration is given in Fig. 2. Table 3 gives additional details regarding the system configuration.

Various reliability considerations were implemented in the system configuration such as load sharing among the host systems, and the shared access and use of the customer ledger files. The computer center is linked to each of the branches by two communications lines so that the entire terminal system of that branch would not become inoperative even in case of a central computer failure. In other words, the fail-safe concept was adopted in the system configuration as well. To ensure fail-safe operation of the peripheral devices such as the discs and tape drives, all of them are linked in a cross-call configuration. In addition, redundancy of all important files, such as the resident system file, assures added safety and protection.

Each host system is connected to the front-end System Control and Distribution Computers through channel-to-channel adaptors (CCA's) in a star-shaped configuration. The SCDC serves to monitor and control all of the host systems, as well as to relay data transferred from one host system to another. This method of linkage, as shown in Fig. 3, also has the added advantage of allowing future additions of host computers to cope with the need for increased processing power.

The SCDC monitors the operation of all of the host systems and issues commands to the host(s) or to the operator when the need arises, thereby making possible centralized control of the entire system.

Device failures and/or system resource utilization status can be displayed on color display units whenever desired. The system is provided with a System Supervisor control unit that permits instantaneous switching to a different hardware configuration, or to an alternate linkage with the communications control unit by simply pressing a button. The entire system, which covers a floor space of 4,000 square meters on two floors of the building, is controlled centrally by two persons in a small room. In an on-line system of such a large scale, the crucial importance of this centralized control cannot be over-emphasized.

The network

A schematic diagram of the communications network linking the computer center to the bank's branches all over Japan is shown in Fig. 4.

Table 4 shows the types and numbers of different communication lines and how they are used in the on-line network.

Each line linking the terminal system of the branches in the HOPS network is capable of carrying all types of texts/messages for deposits, loans, and other business transactions. No line is dedicated to specialized transmissions.

The geographically remote branches of DKB are linked to time-division multiplexers installed in each geographical area which relay the data to the center over high speed lines, making substantial line cost reductions possible.

The terminal system

A typical terminal system of an average DKB branch is shown in Fig. 5.

Each terminal controller consists of a mini with a maximum memory of 256KB. The mini's software makes the terminal system highly intelligent and allows multiprocessing of concurrent jobs entered from the various terminal units, each of which handles a different type of job. In addition, the use of the mini provides flexibility for connecting different types of terminal devices in the future.

The specialized terminals tailored to perform specific jobs were jointly developed with the manufacturer.

The fail-safe concept was also ap-

Line Speed	Number of Lines	Usage
48Kbps	10	Relay lines linking geographically remote concentrator installations with the center.
4,800bps	4	Lines linking the DKB center with the Zengin (The on-line exchange system network of all banks in Japan) system.
2,400bps	700	Lines connecting the terminal systems of the branches to the HOPS network.
	1	Links the HOPS system to NCS (Nippon Cash Service) computer center.

Table 4.

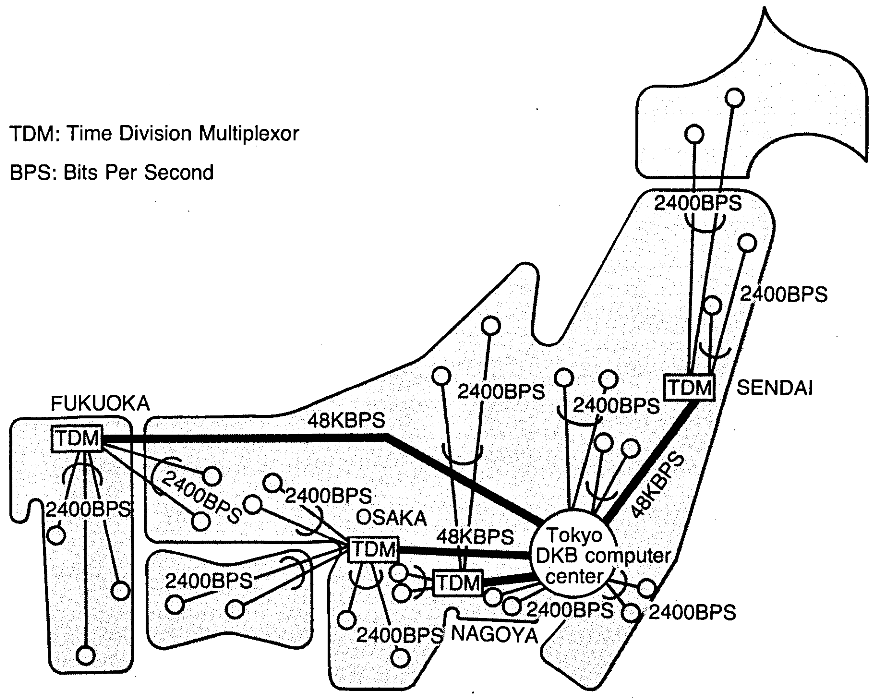


Fig. 4. Network of the new DKB on-line system (HOPS).

Description of Terminal Equipment	Number Installed
F1531M Terminal control units (minicomputer)	700 units
F1532N Terminals for handling deposits	2,500 units
F1533K/N Terminals for handling exchange & loans	800 units
F1538 Automatic cash dispensing terminals Automatic cash depositing terminals	700 units
F1552B Cassette-based data transmission/ receiving terminals	100 units
Total	4,100 terminals excluding the terminal control units.

Table 5. The number and type of terminal devices that make up the HOPS terminal system.

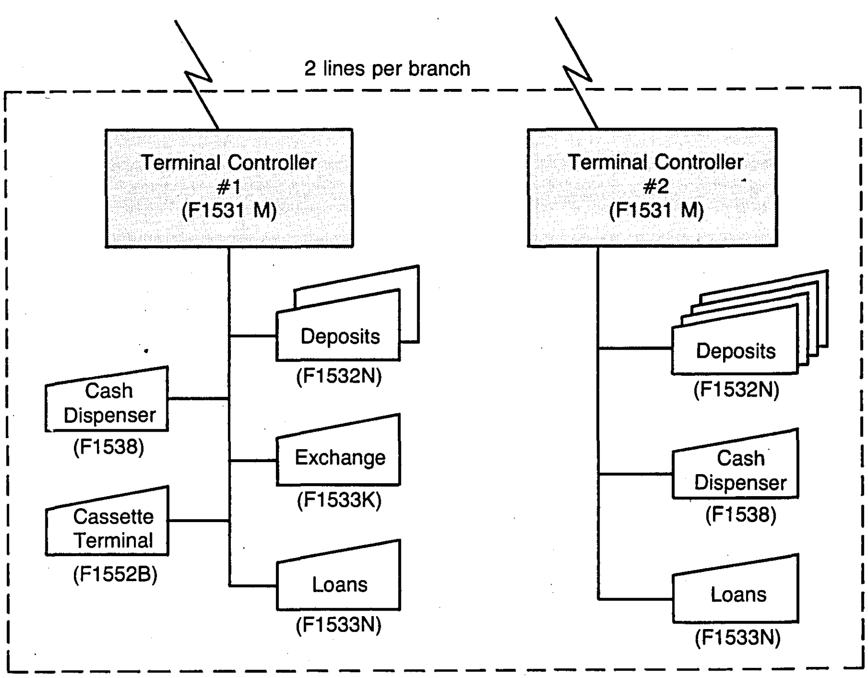


Fig. 5. A typical DKB branch terminal system.

plied to all of the terminal systems by having two lines connect the two independent terminal controllers of each terminal system to the network. Since the computer center itself shares the load among three host systems, continuous normal operations are ensured even if failures occur in the center computer, in the communications lines, or in the terminal control units.

Customer files are shared and allow cross-calling in the HOPS system. This feature too was implemented as part of the no-down concept. Although in principle it is not different from the conventional sharing of files as a common resource among a number of systems or jobs, we found that with conventional methods we would have certain problems in access control. (In the conventional method of controlling the right of file access, access rights normally are given to the system after the RESERVE/RELEASE declaration has been made, to prevent possible conflicts.) Some of the prolems are as follows:

1. Difficulty in implementing recovery measures if a device crashes or a whole system goes down.
2. Increased access times (which would in turn cause a deterioration in the processing performance).
3. Increased path and file loads which would in turn cause an increase in overhead.
4. Complicated operational procedures.

These problems were solved in the HOPS system by implementing an improved control technique and developing some new utility programs.

Control of the commonly shared files is taken care of by microprogrammable hardware in the file control units. When a file access service request from a system is received by the file control unit, it complies with the request by permitting the access of the specified files in units of devices. The access right given to the requesting system is recorded in the stable reserve matrix of the file control unit and the cross-call adaptor. By using such a stable reserve matrix, simplified and therefore speedier accessing was made possible, in addition to allowing the commonly shared files to be handled as if they were dedicated (not-shared) files.

Several utility programs were developed to solve problems relating to failure recovery measures and ease of operation. One of these was the emergency recovery program. If a system were to go down while a portion of the customer ledger file, say, was in the reserved status, that file could not be accessed by another system. However, a solution to this problem was found by developing a utility program that is activated by an alternate and operational system, instructed to do so by the SCDC after the crash occurs. The reserve status of the system that went down is first determined from the contents of the reserve matrix of the file control unit and is then automatically transferred to the alternate system. The particular record that was being processed when the system went down is retrieved from the checkpoint file by the operational system; it is then flagged to prevent any transactions from being made to this record. In this way the file is quickly released and normal operation is restored.

Thus we were able to solve the problems concerning file sharing and apply the solution to all customer ledgers. Some of the direct benefits of this are:

1. Realization of a fail-safe system.
2. Tremendous savings derived from making the file devices a shared resource.
3. Ease of future expansions in the applications or in customer files.

This resulted in noticeable improvements in customer service. Fig. 6 shows the shared file access control technique used in the HOPS system.

Fujitsu software

The basic software MONITOR VII and the on-line software COP (Common On-line Package) used in the HOPS system was supplied by the hardware manufacturer Fujitsu Ltd.

All of the on-line application programs written by us are activated or deactivated under the control of COP. In addition, COP supports the intersystem shared file access control functions previously mentioned, plus communications between different system functions including the CCA control functions, queue control, buffer control, etc.

Writing the on-line application programs was not very different from writing off-line batch programs as we did not have to worry about interlacing with COP; this was easily done by using macro instructions in that package. In fact, we did not have to write any on-line control programs.

System evaluation

To ensure the quality of computer services to each of our branches and to ascertain the expected lifespan of the system, a lot of our attention went into system evaluation. Innumerable tests were carried out jointly in cooperation with Fujitsu.

The Generator/Logger (G/L) function of COP was utilized as a means of evaluating system performance. There are two types of Generator/Loggers; one is used to test hardware aging of each individual system, and the other to test the performance capability of the actual systems in operation in the entire HOPS system by using the two individual system components as shown in Fig. 7 (p. 96).

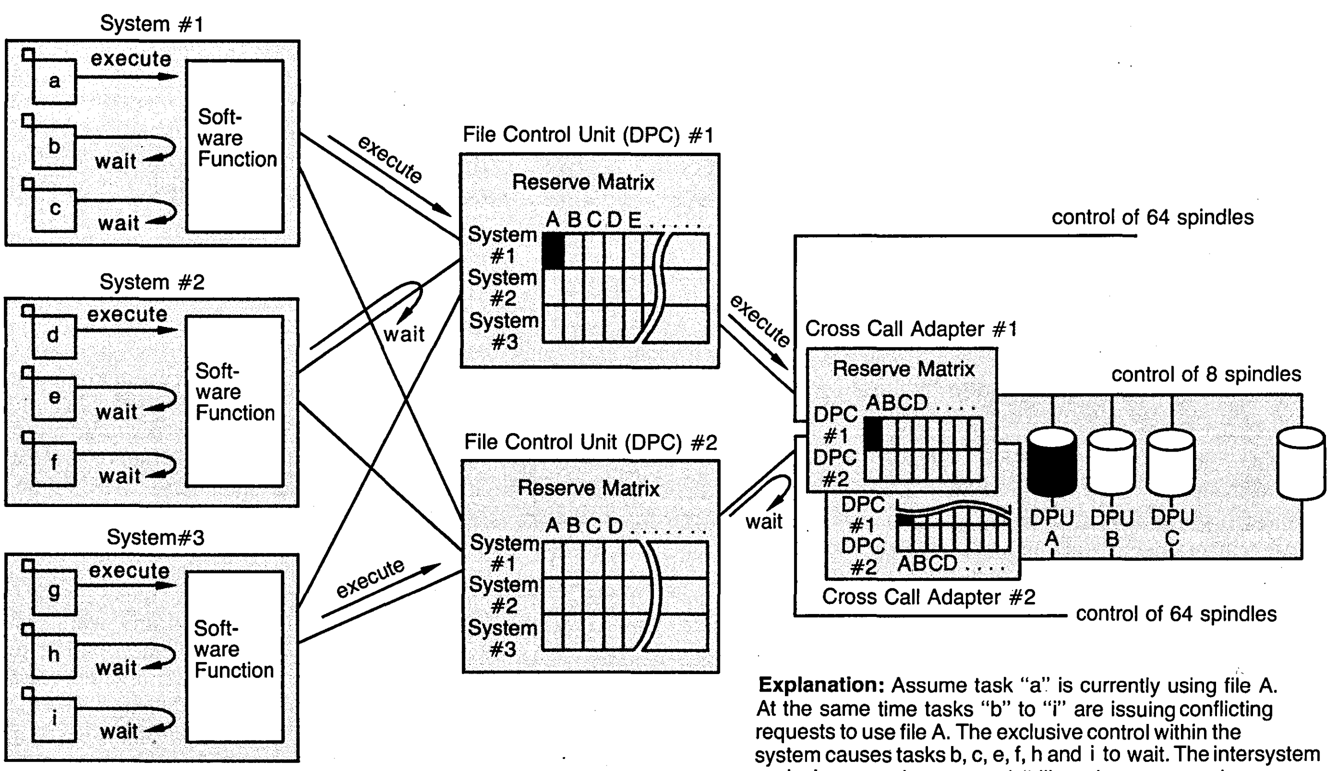
In the latter performance evaluation test, the terminal simulator generates and logs message texts and measures the traffic and response times. On the other hand, the central system carries out the actual processing, and cpu loads are measured by a program package called PANSY (Performance Analyzing System) which is also supplied by Fujitsu.

The center and the terminal simulator both have multi-cpu's and the memory is interleaved 16 ways.

On-line Processing Performance:

Response Time—this is defined as the time taken from the point a request to send is made by the terminal simulator to the central center system until the processed results are received by the terminal simulator. The results are recorded together with the original text on mag tape.

Fig. 8 (p. 96) shows the mean response time curve determined from the results of the measurements. It shows that response time does not increase until a 90% average cpu load is reached. (The logical mean response time value of 950 msec, predicted by the curve for an average cpu load of



Explanation: Assume task "a" is currently using file A. At the same time tasks "b" to "i" are issuing conflicting requests to use file A. The exclusive control within the system causes tasks b, c, e, f, h and i to wait. The intersystem exclusive control causes task "d" service request to be refused at DPC#1. Task "g" request for service is negated by the cross call adapter.

Fig. 6. The shared file access control techniques.

72% came very close to the actual measured value of 910 msec.)

Number of Transactions Processed Hourly by Each System—The relationship between the average cpu load and the number of transactions processed hourly per system is almost linear, as can be seen from the graph shown in Fig. 9. Therefore we can say that the processing capability is cpu-limited.

In a dual cpu system, normally, because of the effects of memory conflicts and system resource lock-outs, the multi-cpu coefficient M is not equal in value to two. The equation commonly used to determine the multi-cpu coefficient within a fixed time duration is as follows:

$$\frac{\text{number of transactions processed by multi cpu's}}{\text{number of transactions processed by single cpu}}$$

But with an on-line system we must also include time considerations (see Fig. 10). Along the x axis is the number of transactions processed in one hour, and along the y axis (P) the percentage of these transactions processed within the 1.5-second response time.

For example, the curve shows that 97% of 150,000 transactions processed by a single cpu have a response time within 1.5 seconds, but with a multi-cpu system that figure is 90%. Thus with an increase in the number of transactions the cpu load factor also increases and the value of P decreases until it reaches a limit. If the multi-cpu coefficient is computed when the value of P is 80% for both the single- and multi-cpu, we get the VALUE $B/A = M = 1.8$.

MONITOR VII software allows concurrent processing of on-line and batch jobs. The batch jobs concurrently processed consist of a data conversion program and a sort program.

In the MONITOR VII system, on-line task execution has a higher priority than any of the batch tasks. As the average cpu load goes up, the change does not affect the on-line task, but the batch tasks are affected considerably. The increase in turnaround time is gradual until an average cpu load factor of 60% is reached. After this point the rate of increase becomes very steep. When the load factor reaches a value in the region of 80% to 90%, the turnaround time for batch jobs deteriorates to the following values:

a) Convert program—1.8 to 2.0 times as long to process

b) Sort program—1.3 times as long

c) Convert + sort program (2 concurrent jobs)—3 times as long

The problems

When we commenced the operation of the HOPS system, we had in effect started a comprehensive on-line banking service consisting of numerous activities such as: ordinary deposits, current accounts, deposits at notice, time deposits, loans, business exchange, customer information file service, etc. These services were implemented simultaneously, along with new equipment such as terminals and minicomputers that make up the terminal system. We started with 150 terminals.

With regard to the implementation of the new system, our objectives were to achieve a degree of reliability from the start, exceeding that of the previous system which had been operating satisfactorily.

For this purpose, we planned and implemented additional tests apart from the application program tests. However, we experienced more difficulties than we had anticipated in:

- hardware failure tests
- special tests for the complex system configuration—that is, reliability tests to confirm that load sharing control functions and shared file control functions, etc., were working properly
- overload tests using the G/L system.

In order to implement these tests, over 5,000 combinations of failures were simulated. It took 3,000 hours of machine time and 600 man-months

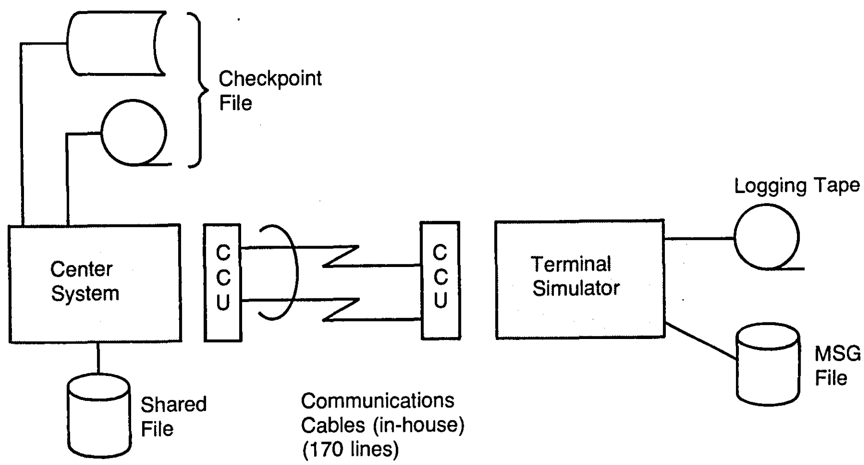


Fig. 7. The G/L concept.

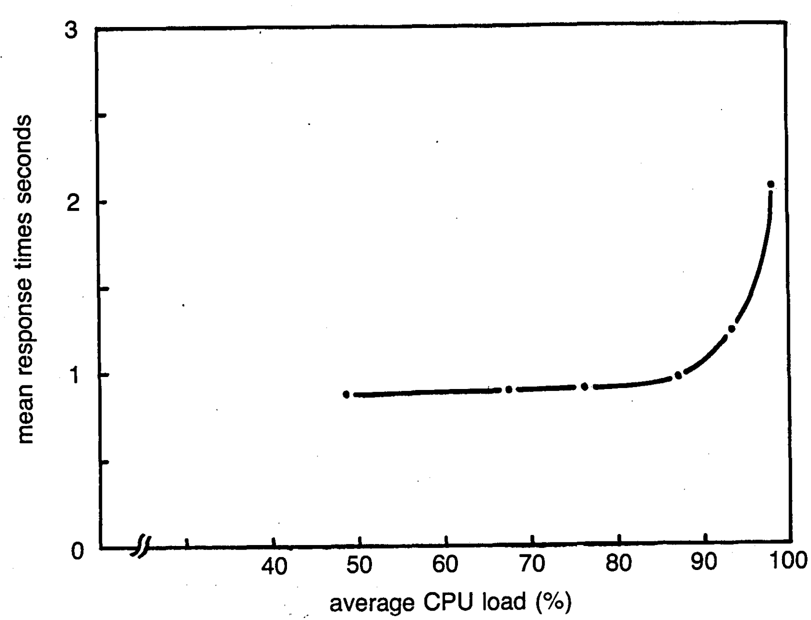


Fig. 8. Mean response time.

to complete the tests (which were conducted jointly with the manufacturer).

Some of the test combinations included double or triple hardware failures. Mainframe and I/O failures were intentionally caused during the testing, and software reliability was checked for each failure combination. From these tests we learned the hard way how difficult it is and how much manpower it takes even to produce a good operator's manual.

We were unable to achieve a completely automated hot standby SCDC system. From the outset we planned to use a dual-processor system, hoping to have one processor take over instantaneously when the other went down. As the system design work progressed, however, we found that software development was a lot more difficult and complex than anticipated. Therefore we lowered our objectives to a more realistic level, whereby recovery could be achieved by operator intervention within two to three minutes after a system went down.

Now as we look back, we can feel a sense of satisfaction and pride at the techniques we had developed such as: the shared file access control method, load share technology, the system evaluation methods, etc. In fact, we can confidently say that the online banking system we developed was a state of the art system of the highest level in Japan. ❊

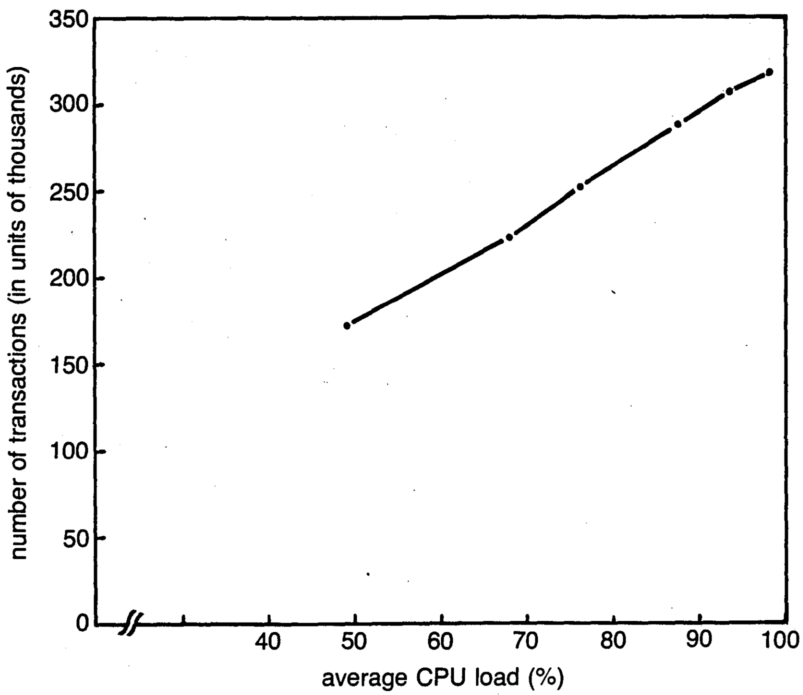
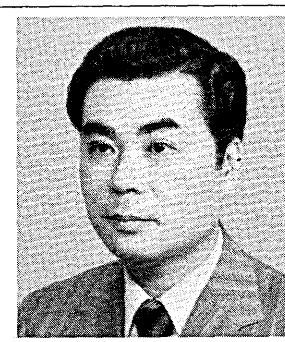


Fig. 9. Number of transactions processed hourly per system.



Mr. Abe joined the dp division of the Dai-Ichi Bank in 1960. Five years later he was given responsibility for the design and development of an on-line system based on the Facom 230-50 computer. In 1973 a merger produced the Dai-Ichi Kangyo, and two different systems were integrated into one. Since '76 he has been manager of the DKB's On-Line System Development Dept.

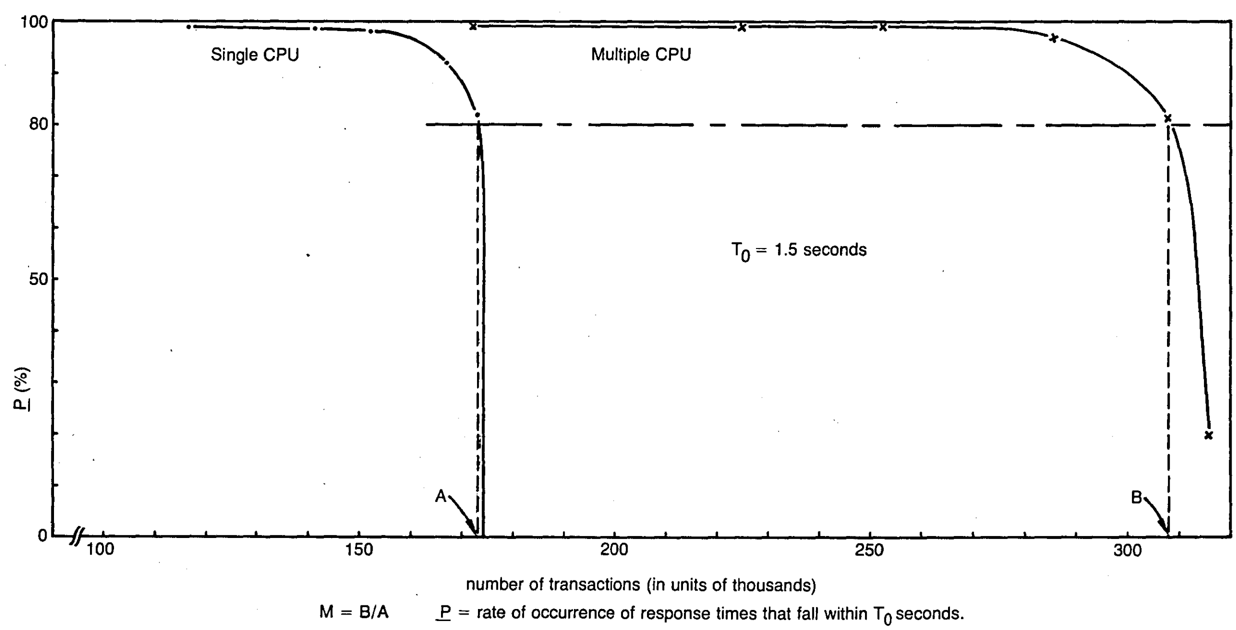
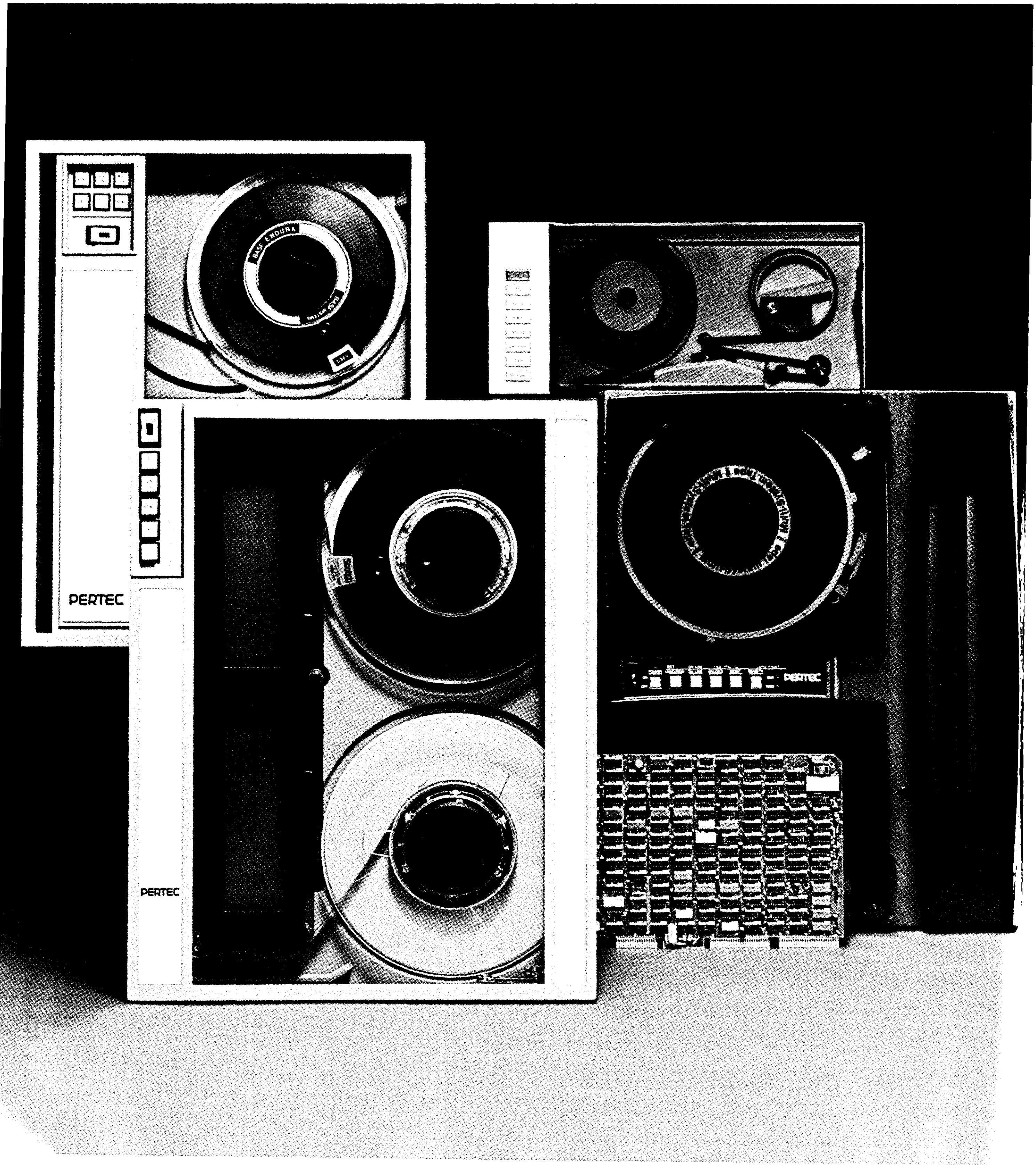


Fig. 10. Multi-cpu coefficient.

CENTRAL INTELLIGENCE:



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1. On-line availability rose from an unacceptable level to 99.9%, translating into an average downtime of less than 10 minutes per month. The reason: the Rockwell-Collins system controls the entire network and can capture data on disc even if the host computer goes down.
2. Communications throughput capability tripled. The Rockwell-Collins system can handle up to 150 transactions per second.
3. The host computer got a new lease on life. Freed of most of its communications-related activities, the capacity of the host computer was increased by 25%, expanding its growth potential. Costly host computer upgrading can now be deferred much longer.

*Sparekassernes Data Centraler

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CIRCLE 105 ON READER CARD

Computing Under the Gun in the Hermit Kingdom

by Bill Orr

A genuine economic miracle in the making.

Suddenly everybody seems to be talking about Korea. Will the peninsula explode into war again? Is South Korea replaying the Japanese "economic miracle?" If so, will a technology-smart South Korea be customer or competitor in the world dp market-place? From a broader perspective, there is a growing interest in the dynamics of "nation building." What kind of society is most likely to make it into the charmed circle of modern industrialized nations? How long does it take?

After hundreds of years of quiet agrarian obscurity, the "Hermit Kingdom" is suddenly ready to move into the limelight of the international economic stage as an industrialized world trader.

Projecting from a 15-year track record, South Korea will match Japan's present level of national affluence before the end of the century. In the next 5 to 10 years, South Korea will become a major world trader in such key industrial areas as shipbuilding, steel, and automobiles. In the process, this intelligent, intensely competitive people will have made their unique mark on the world economy, just as postwar Japan & Germany have done.

Or will the bubble burst in fratricidal war before it's full blown?

A top ranking U.S. military officer in South Korea said that war is inevitable if American troops are withdrawn from their front-line positions on the invasion route from the north. Well, the troops are going—over a five-year period on a schedule yet to be detailed. The North Koreans have a two-to-one advantage in aircraft and a heavy superiority in tanks. Their crushing perpetual war budget is widely regarded as an index of their military intent.

Still, it's hard to imagine the North Koreans overrunning their brothers and cousins to the south, who are determined, well armed, superbly trained, and thoroughly psyched-up for cold or hot war conflict. It's even harder to imagine military support coming from either of North Korea's quarreling superpower sponsors.

The celebrated hassle over withdrawal of U.S. troops goes beyond the arithmetic of tanks and

aircraft. The whole subject is wrapped in emotional doubts that, after Vietnam, the U.S. will really live up to its commitments unless its own troops stay on as cold-war hostages. And South Korea has a big stake in whether the troops go sooner or go later, what equipment they leave behind, and other details of the inevitable withdrawal. It will cost two to four percentage points of GNP. Total self-defense will mean stretching out the country's growth plan.

Economic evolution in a hurry

Korea's swift evolution from an impoverished agrarian society to a middle-income industrialized one began in 1962. The devastating war had ended, or at least moved to the political battlefields. The dust of internal political turmoil had more or less settled. Firm-handed former general President Park Chung Hee had launched the first Five-Year Plan.

In 1962, per capita GNP was $87. In 1976, a year of 15% GNP growth, the per capita share was $698. During the fourth Five-Year Plan (1977-81), South Korea expects to push it to over $1,500 (at the current market price). One government researcher's projection, based on conservative growth rates, forecasts a per capita GNP of over $3,000 in the 1990s. At that point, South Korea will have achieved a level of general affluence about equal to that of 1973 Japan. Most Korea-watchers will be surprised if those goals aren't reached years earlier, especially if the ongoing exploration for offshore oil pays off.

South Korea's economic credibility got a big boost during the oil crisis years of 1973 and '74. Thanks to some daredevil financial tactics, real GNP actually rose by respectable percentage points—while every other country in the world (excepting oil producers, of course) posted declines.

An affluent modern country must be a strong exporter. Korea's exports grew at an average annual rate of 40% between 1962 and 1976. This year, South Korea's exports will hit $10 billion, comparable to Japan's in the mid-sixties. Exports are expected to double by 1981. And the mix will have made a "textbook" transformation from raw materials, to fabricated products exploiting cheap labor, to the current and future export superstars—250,000-ton tankers, cement plants, oil refineries, and automobiles. In 1976, over two-thirds of the GNP was derived from foreign trade, compared with about one-tenth in 1965. By 1981, heavy industry will contribute nearly half of the export total.

	Population (Millions)	Per-Capita GNP (In 1975 $US)
World	4,078.8	$1,531
Developed Countries	1,112.9	4,445
Less Developed Countries	2,966.0	437
United Arab Emirates	0.2	33,182
Qatar	0.1	21,111
Kuwait	1.0	13,900
Sweden	8.2	7,428
United States	213.6	7,098
Switzerland	6.4	6,975
Canada	22.8	6,362
West Germany	61.8	6,144
Japan	111.0	4,358
East Germany	16.9	3,574
USSR	254.5	3,088
Puerto Rico	3.5	2,474
Singapore	2.3	2,516
Venezuela	12.0	2,277
Spain	35.5	2,080
Argentina	25.4	1,569
Iran	33.0	1,514
Portugal	8.8	1,333
Brazil	107.1	913
Taiwan	16.0	900
South Korea	34.0	551
North Korea	16.5	545

Table 1. Selected per capita GNP's in 1975. (Source: U.S. Dept. of State, Special Report 33, May 1977.)

Hermit Kingdom: front and center

Oriental scholars and Western Korea-watchers have good reason to marvel at the sudden transformation of the one-time "hermit kingdom" into a free-wheeling world trader.

In race and language, through the centuries the Korean society has been one of the world's most reclusive and inbred. But in this case, "inbred" doesn't imply "backward." Korea has a long tradition of religious and scientific scholarship.

Universal public education has been pushed hard for the past 15 years. The result is a literacy rate already well over 90%, on the verge of matching the levels of the most advanced Western societies and Japan. Most observers give Koreans high marks as quick-learning, resourceful technicians, and innovative theoreticians. This kind of educated populace is clearly a necessary foundation for the rapid development of a high-technology society.

Computers and GNP

Two centuries ago, what we now call the industrial "revolution" began in England. It's still continuing, building on itself and enriching the nations lucky enough to have gotten in on the ground floor. Computers have become the intelligent prime mover of 20th Century industrialization.

Today, the world's highest per capita GNP's were reported by the familiar list of advanced industrialized nations. (See Table 1.) At this year's National Computer Conference, attendees heard the keynoter give computers credit for about 15% of the U.S. growth in per capita GNP over the past 30 years. Other United Nations studies have found a close correlation, in industrial nations, between GNP and the population of computers.

One of the more interesting questions for developing nations is whether the correlation applies to them, too.

South Korean planners seem to have staked much of their growth expectations on the use of computers to increase national productivity. So the optimistic projections of GNP growth indicate a bright future for computer suppliers.

Let's look at what's happening in computers, and what's projected for the future.

South Korea's first computer, an IBM 1401, was installed in 1967 for econometric calculations. In the ensuing eight years, to the end of 1975, the computer population grew to 140 units valued at $44.2 million. As Table 2 shows, U.S. manufacturers, led by IBM, dominate the market. Facom Korea, a unit of Fujitsu, is pushing hard for a larger share and seems sure to get it. The "9 others" furnished minis. At present, there is no local manufacture of computers.

Table 3 (p. 104), projects the computer population and total value through 1986.

The average compound annual growth rate is more than 20%, and the numbers get more interesting as the

Supplier	No. of Units	Value $(Mil)	Share %
IBM	33	19.0	43.0
UNIVAC	19	10.6	24.0
CDC	9	6.3	14.3
FACOM (Fujitsu)	11	3.0	6.8
9 OTHERS	68	5.3	11.9
TOTAL	140	$44.2	100.0%

Table 2. Computer manufacturer market shares as of Dec. 31, 1975. IBM is number one, but Fujitsu is pushing hard.

	Units	Total Value	Avg. Value
1975	140	$44.2M	$316,000
1986	6300	340.0	54,000
Increase*	5160	295.0	262,000

*Avg. annual growth rate: 20.4%

Table 3. The projected computer population and its total value through 1986.

process rolls along.

It's also interesting to see—although it shouldn't come as a surprise—that the average value of each unit drops from about $316,000 to $54,000. This rapid swing to minis clearly suggests that the South Korean computer market is getting to be a whole new ballgame with plenty of opportunities for new players.

As this article goes to press, it wasn't clear how much of this potential market will be available for foreign suppliers. The answer may be determined by an intense "make or buy" debate now going on at the highest levels of government which is considering these options:

1. Continue to purchase complete systems from mainframe manufacturers.
2. Develop a Korean minicomputer industry to serve local needs and offer exports in the world marketplace.
3. Function as a national "systems house," purchasing most components from foreign oem's and assembling complete systems in Korea.

Obviously, the final decision, expected this year, will have a deep impact on the character of the computer marketplace.

Officials in the government who are responsible for technology development are said to favor the "systems house" course of hardware procurement. They argue that developing an indigenous industry could actually slow the pace of computerization by diverting such scarce resources as materials, plant facilities, and trained specialists.

These officials also advocate an all-out effort to develop a South Korean software industry that will speed up the application of computer methods and at the same time provide software systems for export. These systems may be part of small- and medium-size process control plants designed and built for developing nations.

Whatever course is adopted, computerization throughout the South Korean economy will continue at top speed.

And the pace-setter in developing and applying computer methods will continue to be the Korea Institute of Science and Technology (KIST).

KIST was formed in 1967 as a nonprofit center of excellence in applied research with the mission of reversing the "brain drain" and helping to improve business methods.

Within KIST, computer applications are supported by a staff of about 200, half of whom are programmers and analysts. This year, KIST formed a Software Development Center, reflecting the new emphasis in development strategy.

The institute has a CDC CYBER 73/18. As of mid-year 1977, KIST's nationwide data communications network linked 16 batch and 25 interactive terminals to the computer center in Seoul. The system has hundreds of users, ranging from "drop-in" businessmen to the country's largest private enterprises, the telephone company, banking institutions, and government units at all levels. All customers are charged for services, and KIST plows back any surplus revenues into personnel or equipment. The amount of resources allocated to specific groups and projects is directly related to revenue from users. When revenues fall off, staff and budget do too, all the way to the vanishing point. Growth is brisk under this formula.

KIST presently is in the middle of a major upgrade of its computer installation. Among the goals are a three-to-one improvement in cost/performance and the ability to support thousands of users.

For the evaluation, KIST has prepared a comprehensive set of benchmarks, which are being run through summer and probably into fall. Competition is keen, befitting the size of the purchase and the prestige of the buyer. The field includes CDC, IBM, Univac, Burroughs, DEC, and Facom. The Facom entry may be the big M-190, equivalent to a 3033 or Amdahl 470-V6.

Upgrading installations

Because of the acceleration of computer applications throughout South Korea, many other large users will be upgrading their installations in the next year or two. Among them are the huge Samsung conglomerate, Korea's largest business establishment, and Korea Electric. The trend appears to be toward a centralized data processing facility linked to branch offices via remote batch and interactive terminals. Distributed data processing (i.e. serious local computing) does not seem to be in the mainstream of currently planned applications, at least for big users.

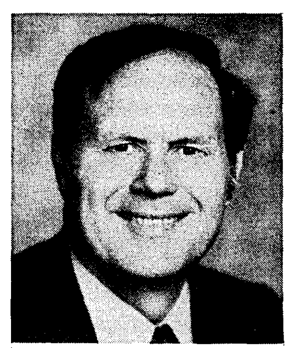
So what?

Most of us in the computer industry have been bombarded with "gee whiz" hyperbole so long that we may miss some of the implications of the South Korea experience. "Economic miracle" is a term that rolls easily off the promoter's pen. But what does it really mean? It is a miracle when a country joins the select circle of advanced industrial economies? In the late 20th Century?

Since World War II, only Japan among the major nations has made the full transition from agrarian to advanced industrial status. And we can identify only a handful of candidates for the rest of the century: Spain, Argentina, Brazil, Yugoslavia, South Korea, and some special situations like Singapore, Hong Kong, Taiwan, and Puerto Rico. The oil-exporting countries may post some spectacular per capita GNP numbers, but they have a very long way to go to achieve the balance of economic activity and the distribution of wealth that are part of the definition of an advanced economy.

There is a growing consensus that computers can play a major role in transferring technology and finding innovative, environmentally "clean" approaches to nation building.

If the world dp industry can avoid being mesmerized by its own "hype," it has a chance to upset the rather dismal trend and make an historic contribution to the quality of human lives around the world.



Mr. Orr reported on the first Southeast Asian Regional Computer Conference (December 1976, p. 99), and the material for this article came from personal interviews, including some at "Blue House" (Korean White House) level, augmented by research in periodicals and statistical publications.

Over the past 15 years, he has been active in AFIPS affairs, chairing sessions on the social implications of computers.

Mr. Orr is a marketing consultant based in Santa Monica, Calif.

Hewlett-Packard

Computer Advances

Vol. 2 No. 3 September 1977

HP 2648 - a bright idea in graphics terminals

The controllers

The HP 2026 keeps the data flowing

A bright idea for a graphics display

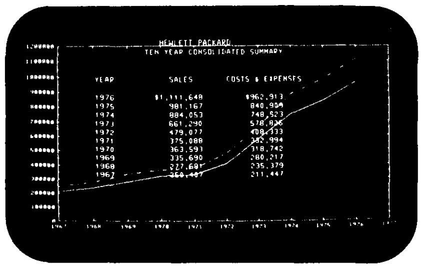
The world of graphics is expanding to serve more and more people. High-performance graphics, previously found only with more expensive systems, are now available on the new HP 2648 which has microprocessor control and uses raster scan technology.

The advantages of refreshed raster scan technology are a continually bright display and selective erase— the ability to make changes without having to redraw the entire image. Raster scan graphics require a bit of memory for each displayable point. Low-cost, high-density semiconductor memory now makes this technology economical.

Ready to plot

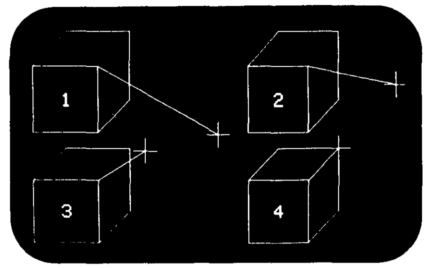
The HP 2648 is usable the minute you turn it on. The terminal was designed to be system and software independent, to solve real world problems right away without additional investment in software. All the graphics capabilities are hardware and firmware implemented and executable as simple keystroke functions. Off-line, the HP 2648 can record locally-generated drawing commands on optional tape cartridges, play them back, and support graphics program development. With a CPU complement, the user can interactively create more sophisticated graphics.

◀ *Cover*
The design on the screen of the HP 2648 was zoomed to a 10 times magnification. The pattern used emerged from that enlargement.



Auto plot

User-generated tabular data can be automatically plotted with X & Y axes. The data can originate from a computer program, from the mini-cartridge, or from the CRT screen. A simple set of questions, in the form of a "menu," is displayed for the user. After first answering these questions—thus defining the data parameters—the user starts the plotting with a single keystroke. Within seconds, and independent of any system or software, the data is plotted. Sophisticated graphic representation of data is now available to more people in business, education, science, and management.

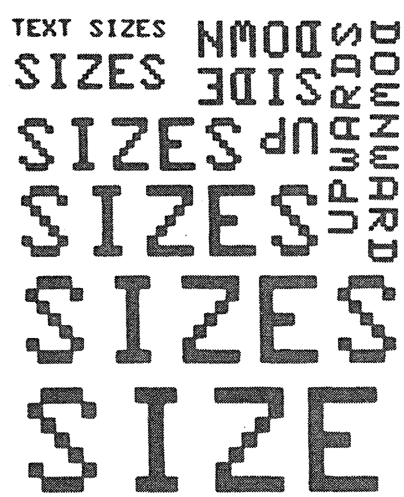


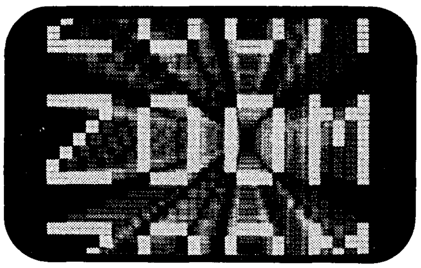
Try it first

There are times when you want to change your drawing without disturbing the data points stored in the CPU's memory. The rubber band line offers a snappy solution to such trial sketches. Line drawings, such as architectural floor plans, can be made and modified quickly. They can even be recorded off-line on the optional mini-cartridge tapes for later batch transmission.

Choices galore

As a user of an HP 2648, you can choose characters of varying shape, size, and orientation, and can right/left justify.



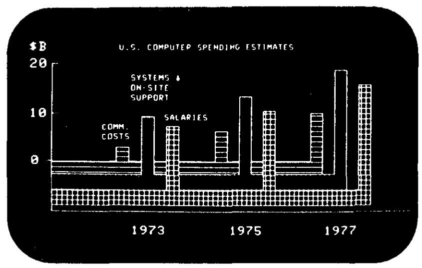


Zoom and pan

Select an area of your display; move right in and magnify it. Zoom one step at a time, or with the touch of a key, zoom automatically to sixteen times the size. Then, pan in any direction through this enlarged display for closer investigation of complex designs. You do not need to reinitialize the data, since the graphics memory has not been disturbed. As zoom and pan are under microprocessor control, they are system and software independent. Without any special software packages or user programming, you can zoom and pan on or off-line.

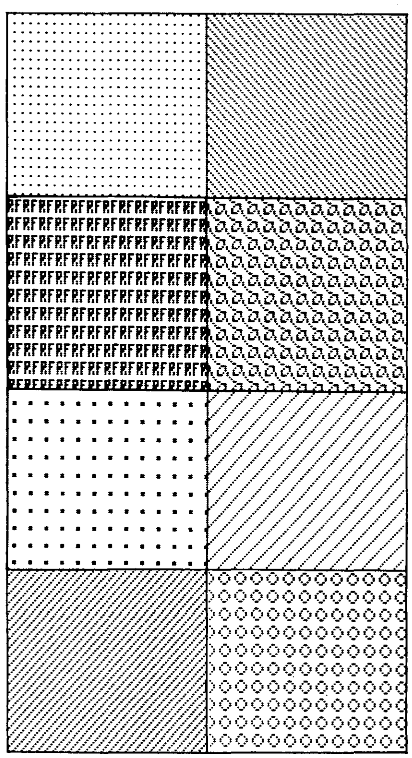
Now you see it, now you don't

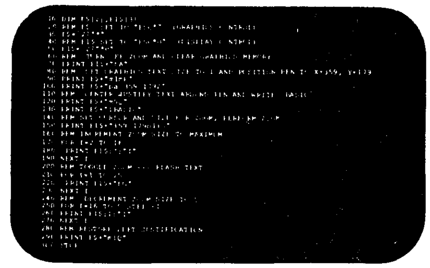
The independent alphanumeric and graphics displays each have their own separate random access memory (RAM). So you can view the displays independently or both at the same time. Either memory can be suppressed without disturbing the other. Interact with the CPU/program in one memory and view the resultant picture in the other. This feature makes the HP 2648 perfect both for program development and trial-and-error graphics generation.



Shade your drawings

Rectangular area shading helps distinguish similar shapes. The user can specify different portions of the drawing to be shaded with any of eight available patterns or with his or her own design.





Two terminals in one

The HP 2648 is a dual-capability terminal. Not only can it do sophisticated graphics; it also has those characteristics of HP's 2645 data entry and communications terminal that make programming so easy. These include flexible communications protocols, eight user-programmable keys, full editing, block or character transmission, and off-line data preparation with the dual mini-cartridges. This graphics and alphanumeric combination results in an especially versatile tool.

In the U.S., the HP 2648 costs \$5500; when equipped with cartridge tape drives, the price is \$7100. Quantity discounts are available.

It is difficult to describe on paper what happens on the display of an HP 2648. **Check A on the reply card for a live demonstration or for more information.**

There's more than one way to weigh a mouse

There's more than one way to weigh a mouse because there's more than one Hewlett-Packard controller that can automate and control processes such as the weighing of medical research animals. Mettler Instrument Corporation of Princeton, N.J., for example, selected HP 9815 desk-top controllers for electronic balance systems that quickly weigh animals that don't want to be weighed. Hazeltine Corporation, of Green Lawn, N.J., on the other hand, plans to weigh fidgety animals using HP 2649 terminal/controllers. One of these products may be the way to solve your controller needs

Terminal controllers

Hewlett-Packard's 2649 is a versatile, microprocessor-based terminal/controller for which technically-oriented users can design their own firmware or hardware. With the help of a Technical Information Package, custom designing application firmware is a three-step process.

Application programs are first assembled on any system capable of producing 8080 object code, such as an HP 1000. Object code is transferred from the program development system to mini-cartridges using an HP 13290 development terminal.

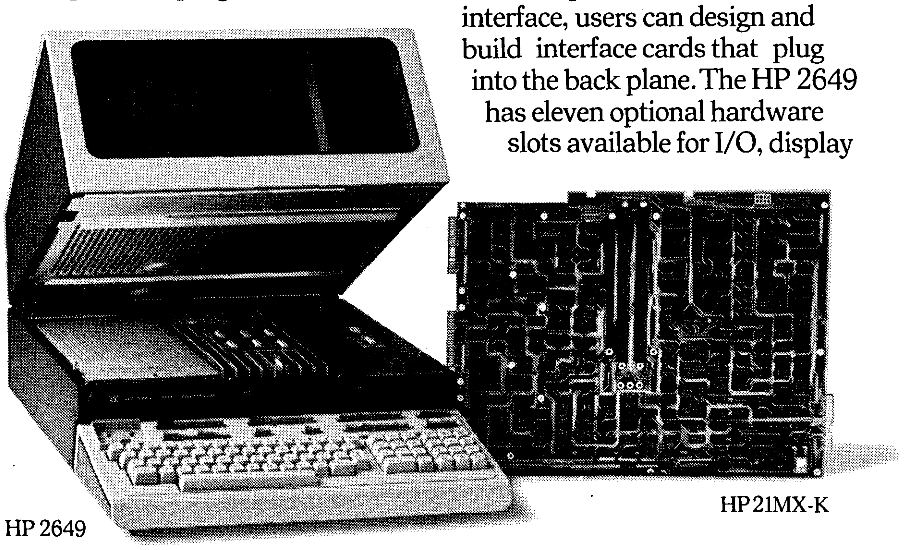
The second step is to test and debug the application firmware by loading and executing these mini-cartridges into the RAM of the development terminal.

Then, application firmware object code is transferred to programmable-read-only-memory (PROM) chips for installation in multiple HP 2649 terminal/controllers. For high-volume applications, read-only-memory (ROM) chips are available from specified vendors.

There are two ways a designer can interface the HP 2649 to external devices. With HP's standard interface cards that provide for serial or parallel data transfer, the user need only fabricate a cable to complete the interface. If the application requires a nonstandard interface, users can design and build interface cards that plug into the back plane. The HP 2649 has eleven optional hardware slots available for I/O, display enhancements, or memory.

Inherent networking capability of the HP 2649 makes it an ideal tool for interfacing specialized devices to various mainframes. Devices controlled by the HP 2649 vary widely. Among them are laboratory scales, cash registers, typesetting equipment, and analog sensors.

Because of the software and hardware development needed to customize an HP 2649, it is most economical when a quantity of systems are needed for dedicated applications. In a business or industrial environment, where untrained people are using the terminal, the customized HP 2649, with its display screen and modifiable keyboard, becomes an especially friendly interface. The HP 2649 costs $2150.*



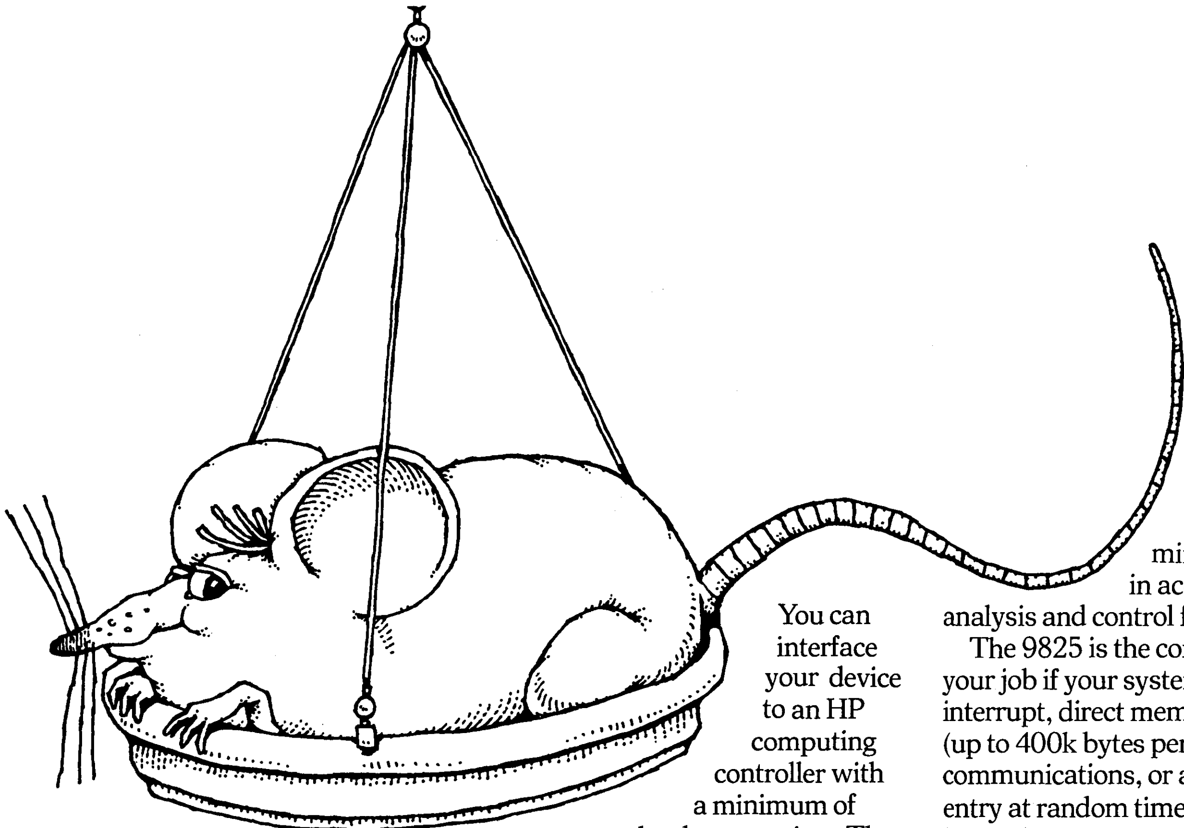
HP 2649

HP 21MX-K

Buy a board, build a system

For the OEM designer who needs the power and flexibility of a microprogrammable minicomputer, HP offers the K-series processor, a component version of the 21MX computer family.

Designed to fill the need for high-power processing in a low-cost form that integrates easily into OEM systems, K-Series components offer flexibility in configuring inexpensive products with the full power of a minicomputer. The K-Series can be a full minicomputer that is hardware and software compatible with HP's entire 21MX line. Or, systems engineers can gain direct access to an extraordinarily fast control processor with 325 nano-second cycle time and 210 powerful microinstructions.



Among the many systems applications which can use the speed and power of K-Series components are spectrophotometers, numerical control units, smart data-entry terminals, word processing equipment, graphic display systems, medical diagnostic systems, and many kinds of test equipment. Because the K-Series uses the same I/O scheme as the 21MX family, a wide selection of subsystems is available. These include interface cards for data communications, measurement and control, HP-IB**; and all of HP's broad range of computer peripherals. Prices for the processor board (OEM quantity 100) are $975*.

Just plug them in and program

HP computing controllers, the 9815 and 9825, make system automation easy and direct. Unlike microprocessors and minicomputers, these controllers are integrated in a small, self-contained package that includes printer, tape storage, display, and keyboard. And, you get an operating system and high-level language (pre-programmed in ROM) so you do not need to learn machine language.

You can interface your device to an HP computing controller with a minimum of development time. The physical connection is an off-the-shelf interfacing card with a pre-programmed I/O driver in its read-only memory. You choose from four different interface options — BCD, bit parallel, bit serial (RS-232-C), or HP-IB**. Just insert the card into the controller, and connect the cable to your product. The controller is ready to be programmed for your application using a powerful but simple-to-learn, high-level programming language. HP 9825's HPL provides the ease of BASIC with much of the power of FORTRAN. The HP 9815 uses reverse polish notation, RPN.

Computing controllers manage your instruments, gather data, and process the data to present it in an understandable form. For selected medical and analytical instrumentation applications, and for many measuring systems, HP's computing controllers deliver performance paralleling that of many minicomputers in acquisition analysis and control functions.

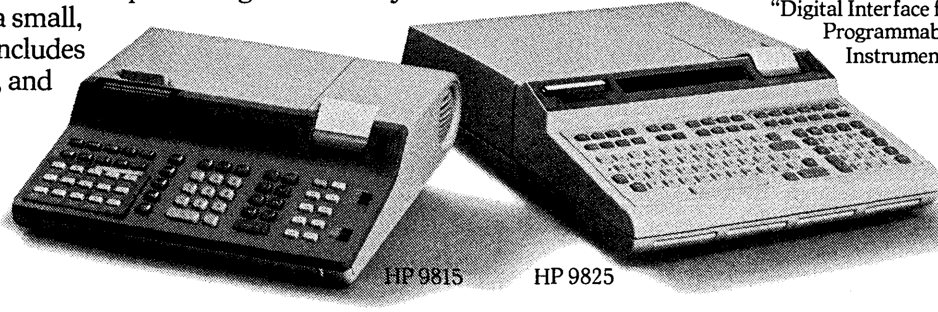
The 9825 is the controller for your job if your system requires interrupt, direct memory access (up to 400k bytes per second), data communications, or automatic data entry at random times; or if you will be working with data bases of more than 100,000 bytes. If these capabilities are not essential, consider the HP 9815. It is the perfect cost effective controller for systems of one or two input or output devices.

The HP 9825 is the first small desk-top computer with interrupt capability. Interrupt gives the controller flexibility to respond to several independent devices that require service at unpredictable times. "Live keyboard" capability enables you to interrupt the 9825's processing to calculate or to interrogate — for example, to monitor a program, or to alter a variable while a program is running.

The HP 9815 is available for $3100*; the HP 9825 for $5900*.

For more information on HP's controllers, the 2649, 21MX-K, 9815, and 9825 indicate B, C, D, and E respectively on the reply card.

*U.S. domestic prices only.
**HP-IB is Hewlett-Packard's implementation of IEEE Standard 488-1975, "Digital Interface for Programmable Instrumentation."



The HP2026– and how it keeps the data flowing at Hewlett-Packard

Hewlett-Packard's 2026 data entry and communications system takes a dramatic step beyond traditional data entry. Besides source data entry, it also supports local data storage and retrieval, data communications, and remote job entry—all in a single proven package that costs $38,500.*

The terminal-intensive HP 2026 system is suited to large companies with geographically-dispersed locations. It satisfies their need to enter, store, and retrieve data locally, yet process it elsewhere.

Source data entry

The powerful Data Entry Application Language (DEAL) makes the development of data entry applications quick and easy. With development of screen formats at a central location, DEAL ensures that the same set of screen formats and edit specifications are used throughout the HP 2026-based network. Source data entry, then, is complete, accurate, and consistent.

Local storage and retrieval

File management capability gives users the ability to quickly scan and retrieve information locally. It eliminates the need to enter repetitive data, and allows sophisticated source data editing.

*U.S. domestic price (currently available in North America and Europe only)

Point-to-point communications

Any HP 2026 system can act as a central data collection point within the network or transmit information directly to any other HP 2026. Use of innovative software technology results in significant reduction of data communications costs.

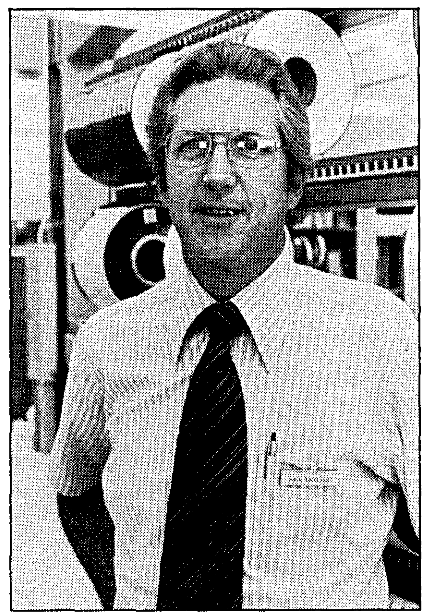
Remote job entry

An RJE capability allows any HP 2026 system to communicate directly with large computers, such as HP 3000's or IBM 370's.

The basic HP 2026 system consists of an HP 21MX E-Series processor and disc drive in a desk-style cabinet, and an HP 2645A console terminal. Each HP 2026 can support a total of sixteen additional page-mode multidrop, 9600 baud 2645A CRT terminals. If your applications require more than just data entry and retrieval, and you need sophisticated data management, data processing, or program development using traditional programming languages, Hewlett-Packard offers the multi-purpose HP 3000 computer system.

The HP 2026 was originally developed to meet Hewlett-Packard's needs. Today, after six years of intensive use, it affects virtually everyone at HP...

"Over 10 million words funnel through my data center every single day"



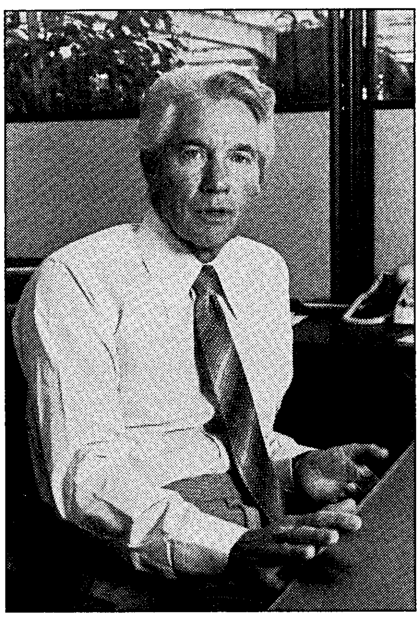
Bill Taylor, HP 2026 manager at HP headquarters, comments; "It's a flexible, all-purpose network that transmits any digital information. Our central system receives data several times a day from other 2026 locations around the world.

"Sixty percent of the data is marketing-related," Bill states, "such as customer orders and acknowledgements. Fifteen percent is accounting data, 10% is employee personnel/payroll data, another 10% is general message traffic, and 5% special files.

"An RJE capability also allows HP 2026 sites to directly communicate with larger host computers. Communication is possible via

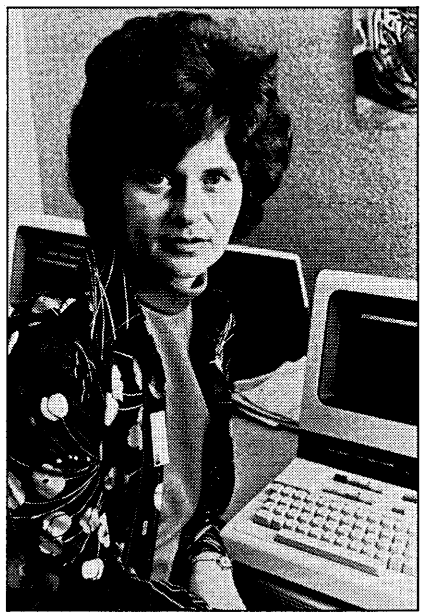
2780 emulation and multileaving HASP workstation protocols. All data communications and RJE programs can be executed concurrently with data entry."

"With just 20¢ and four hours I can send a message to any HP office in the world"



"It wasn't that way six years ago; our commercial TWX service costs were skyrocketing," reflects Bob Boniface, Hewlett-Packard's executive vice president of administration. "Now, with the 2026 network, 117 systems at any of 94 network sites can communicate with each other. And... the costs are descending, not spiraling upward."

"If I ever again had to enter orders the way we used to, I'd quit"



"I transmit over 3700 sales and service orders monthly," begins Carol Larsen, HP order entry clerk. "As I input an order, the HP 2026's CRT terminal prompts me through all the screens I need. And, it blinks to alert me if I make a mistake. Most errors are corrected at the terminal, so only valid data is transmitted to the system.

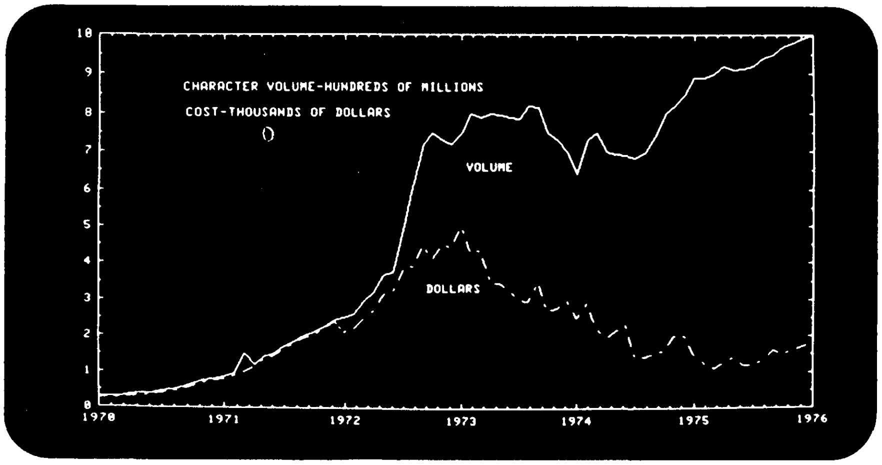
"We received the system 1:30 one afternoon," Carol relates, "and, by the time I went home, I felt comfortable using it. I didn't even pick up a user's manual—the terminal taught me with a 'how to' tape cartridge.

"Besides entering new orders, I can store and retrieve order status here, where we need it, to assure quick response to customer inquiries. If a customer calls me about an order, I simply key in that order name and number, and provide a timely status report over the phone.

"Plus, I don't have to type repetitive data. Our sales office assigns a number to each customer. By entering that number alone, I can retrieve and automatically include customer name, address, phone number, shipping destination, and other pertinent information—all stored on local files."

"We paid off all our capital equipment costs in nine months"

"The HP 2026 gave us a significant, easily-measured return-on-investment," says Hank Taylor, HP corporate marketing services manager.



In the last four years, the domestic volume of data transmitted by the HP 2026 has more than doubled. But, during that same time, costs have decreased by 60%.

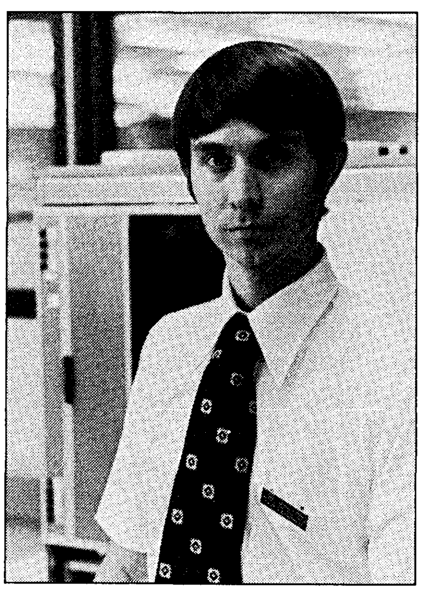
This graph was generated by "auto plot" on the new HP 2648 graphics terminal. (See page 3)

"Comparing data communications costs before and after installing the system revealed that, in less than a year, our line charge savings paid for the system.

"I also recall another significant measure. HP's data entry error rate decreased by 60% using HP 2026 system CRT's rather than former methods. This reduction in errors is also a result of the use of the HP 2026 Data Entry Application Language (DEAL). This powerful software simplifies and shortens the source data entry program development process.

"You see, our central data processing staff develops all data entry screens so that consistent formats and edits can be transmitted to each HP 2026 site. In this way, we maintain central control and ensure that everyone in the network is using the same set of data entry screens. All the development is done by one central data processing staff. Remote sites, of course, still have the capability through DEAL to quickly tailor our screen formats without data processing experts."

"HP'S 2026 is one of the most efficient point-to-point communication systems available"



"We use voice grade common carrier facilities and two HP 2026 data transmission innovations which make the system unusually efficient," explains Terry Eastham, lab engineer.

"A data compression/expansion technique used between HP 2026's typically compresses our data to 50% of its original volume," continues Terry. "Blanks, numeric strings, alpha strings, and redundant data are compressed and expanded by this feature. In addition, we use a reverse channel line protocol which can yield up to another 40% throughput improvement over normal bisynchronous techniques.

"The combination results in reduced data transmission time and, therefore, significant line cost savings."

For further information on the HP 2026 and HP 3000, check F on your reply card.

HEWLETT hp PACKARD

Improving System Testing Techniques

by Laura L. Scharer

Systems testing is a quality assurance function, yet it often bumbles along without standards or formal procedures to insure its own quality.

The system test is data processing's attempt to control the quality of the computer-based systems which it produces. Yet this quality control procedure itself often suffers from lack of thoroughness and organization. This needn't be the case, as we can show.

To begin with, a system test must be a joint effort of the data processing staff and the affected user group. Each party must contribute its specialized knowledge to the testing task. Basically, the data processing practitioners are responsible for technical assistance to the users in developing and executing the test plan. The users, on the other hand, lend their functional expertise to the project and are eventually responsible for creation of test data and evaluation of test results.

The management of each of these groups will direct the testing effort and will bear responsibility for the quality and acceptance of the software product. A team of programmers, analysts, computer operations personnel, supervisors, and clerks will join management in establishing system "correctness" relative to original system specifications.

Ideally, planning for the system test will commence as soon as detailed design and program specifications have been approved. The test plan will be devised by much the same group of users and technicians as contributed to the system definition and design stages. And the time and manpower required to produce and execute a thorough test plan should not be underestimated. (It is likely that understaffing and short time projections for the testing phase of the system life cycle are major contributors to overruns.)

Who's who in testing

Specifically, the responsibilities of each of the members of the system test team can be described as follows:

The *data processing manager* or project manager is ultimately responsible for the quality of the applications software produced by his staff. Although he cannot personally execute or evaluate every test of every system produced in his department, he can and should develop a testing standard and require that all tests meet its requirements. He can demand that all tests be documented and reproducible. In addition, the manager can periodically spot-check testing procedures using his standards as a guideline.

The *systems analyst* coordinates the system testing effort. The analyst must understand how to construct a test plan according to shop standards and must guide both users and programmers toward meeting testing requirements. He is responsible for educating the users in the use of the new system. Transaction types, input formats, editing criteria, and use of data entry forms should be explained in detail so that the users may create test data with the analyst's assistance.

The *programmer* is responsible for unit-testing all modules before turning them over for system testing. This means minimum unit testing standards must also be established and enforced. During system testing, the programmer remains responsible for additional debugging or reprogramming found necessary.

Computer operations personnel must provide machine time and manpower support for data entry, test file creation, and test execution.

The *user department manager* bears responsibility for final acceptance or rejection of the product delivered by data processing. He will assign and coordinate the tasks of the supervisors and clerks who participate in the system test. He will review the test plan proposed by the systems analyst in terms of completeness and appropriateness. Thus, the manager becomes a participant in setting the conditions for acceptance of the computer system, and in so doing accepts some of the responsibility for seeing that these conditions are met.

A user of *supervisory* level should work closely with the systems analyst in learning the new system, understanding the testing standards, and developing a detailed test plan. Together, the supervisor and analyst will document the test plan, isolate classes of test cases to be generated, and instruct clerical workers in the creation of test transactions and prediction of test results.

Clerical workers will often actually produce the test transactions and predict the results which should be generated by the computer system. After test execution, they will compare actual results with predicted results and note discrepancies.

Such an arrangement of responsibilities within the system testing group assures several critical factors:

1. System testing does not occur in the vacuum of the data processing department. User participation is not only solicited, but required.
2. A test plan is developed in parallel with the programming phases of the project. Ideally, a system test plan will be ready and waiting as soon as all modules pass the unit testing stage.
3. Management must become involved with system testing. For one thing, quality control standards for software products must be developed by the data processing manager. For another, acceptance is the responsibili-

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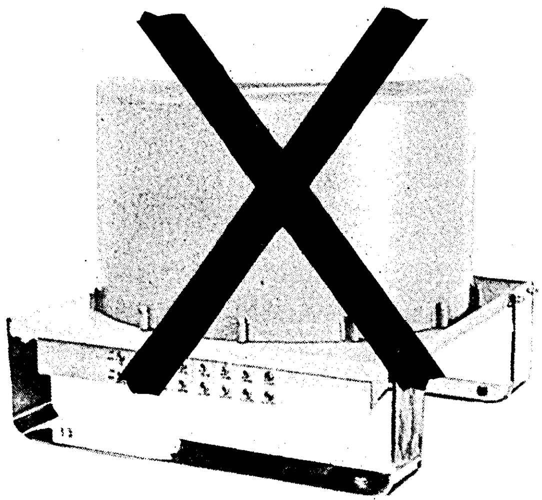

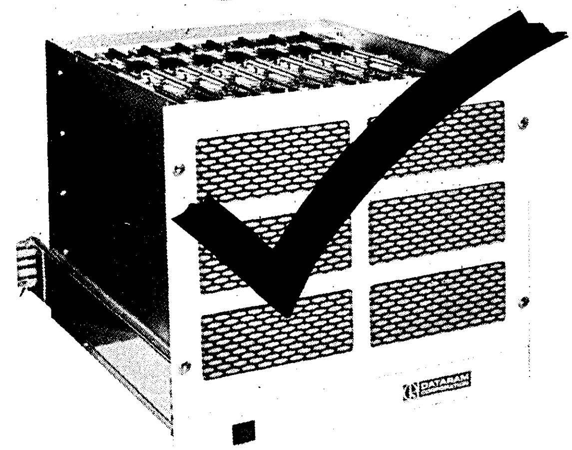

Now, all the remarkable features of Dataram's BULK CORE memory system are available to you in a unique storage peripheral with complete interfaces to emulate DEC and Data General fixed-head discs.

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Reasons enough to find out more about BULK CORE. If you use a DEC or Data General minicomputer—or any kind—and want to move ahead in performance, move a BULK CORE into your system.

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ty of the manager of the user group. The manager of the user group can demand evidence of a successful system test before he allows a new system to be installed.

4. User education about the new system begins early and continues throughout the system development process. The user group is an important contributor to the establishment of the correctness of the new system and, as such, is more interested in making the new system work.

The operating environment

As we know from experience, a system which performs well in an artificial testing environment may fail when executed within its own specific operating ("live") environment. To keep this from happening, the elements of the operating environment must be defined, and these elements must be duplicated at some point during system testing.

The elements of a computer system's test or production environment include, for example:

1. the hardware upon which the system will execute
2. the operating system
3. the assembler or compiler producing the object code
4. the author of the test data (programmer vs. user)
5. data entry procedures
6. transaction volume
7. file size and content (test records vs. live records)
8. computer operations procedures
9. recipient and interpreter of output (programmer vs. user)
10. time frame imposed

A pure testing environment will minimize user participation and will often utilize hardware and systems software which is different than that upon which the system will be run in production mode. Thus, an artificial testing environment may be comprised of:

1. off-site hardware (same or different manufacturer or model)
2. different copy or type of operating system
3. different copy or version of the compiler or assembler
4. programmer-constructed test data
5. programmer-keyed test data
6. small number of transactions
7. small test files
8. system execution by the programmer in the computer room
9. programmer interpretation of results
10. expanded or unlimited time frame

In contrast, a "live" testing environment will be hardware-specific, will simulate real volume and timing characteristics, and will effectively test procedures and documentation as well as simple computer output.

Testing in a live environment may, then, include:

1. in-house (target) hardware, operating system, compiler
2. user-constructed test data
3. normal data entry procedures (data entry staff using standard instructions, or users from a terminal)
4. realistic transaction volume
5. live, full-sized files
6. execution by the operations staff using a standard run book
7. user examination of results
8. realistic time frame

A complete test plan will usually require more than one iteration of the testing procedure, each iteration assuming a different, and gradually more live, testing environment. Testing standards should require that the production environment be defined in detail and that a successful test be demonstrated in that environment before the system may be delivered for installation. This is particularly important when installing systems which have been developed off-site or which have been purchased as a package from a software house.

The complete definition of test cases is often viewed as impossible, so no attempt at completeness is made.

Calling the shots

The premise underlying system testing is that a prediction of correctness can be made and that the validity of a computer system can be ascertained by comparing predicted results to results obtained using the computer.

Prediction may proceed in one of two ways: by manually computing the expected results, or by using parallel techniques. Either way, it requires the following steps:

1. documenting the conditions which are to be tested
2. preparing transactions and test files to demonstrate each activity
3. documenting the exact expected results given these transactions and test files
4. comparing computer output to this standard

Parallel testing (involving the use of two systems) still requires completion of step one, the enumeration of test cases, and step two, the creation of test data. However, in parallel testing an equivalent program or system is used as the standard of correctness. Identical test data and test files are run through the new and the existing system and results are compared. And this comparison may in fact be automated.

The key to constructing a minimal yet logically complete set of test data is the accurate and explicit enumeration of all cases or conditions handled by the program or system. Ideally, all conditions can be discovered from existing documentation of error messages, condition codes, parameter settings, transaction types, updating rules, etc. But the task is painstaking, slow, and relies heavily upon the quality of the available documentation and specifications.

The quality of the systems test often breaks down precisely at this starting point. The complete definition of test cases is viewed as an impossible task, so no attempt at an orderly enumeration of conditions to be tested is made at all.

In suggestion: begin by eliminating the obvious test cases. *Do* force all error conditions; *do* test all program terminations before normal end-of-job; *do* examine all aspects of the updating logic; etc. There is no excuse for failure to test the immediately obvious conditions.

After a list of test cases is complete, test files should be constructed to establish the set of valid identifying codes (customer numbers, product numbers, etc.) which will be used when building groups of transactions. Give special care to several aspects of test file creation, such as the time period for which the files are created, starting values in amount fields, inclusion of all record types, and inclusion of sufficient numbers of records so that control groupings and page breaks on reports can be demonstrated.

Test transactions can now be created. Each transaction should have a single specific purpose, either to force an error condition or to demonstrate some normal system function. As each transaction is coded, the test case which it is illustrating and the exact expected result of processing the transaction (such as an error message or an adjustment to an amount field) should be written down. The prediction process can be extended even further by recording the actual column entries and subtotals which will be generated on reports.

With the predicted results documented in such an orderly manner, the determination of system correctness becomes almost trivial. File dumps and edit and update reports can be compared directly to the manual predictions. The exact cases causing prob-

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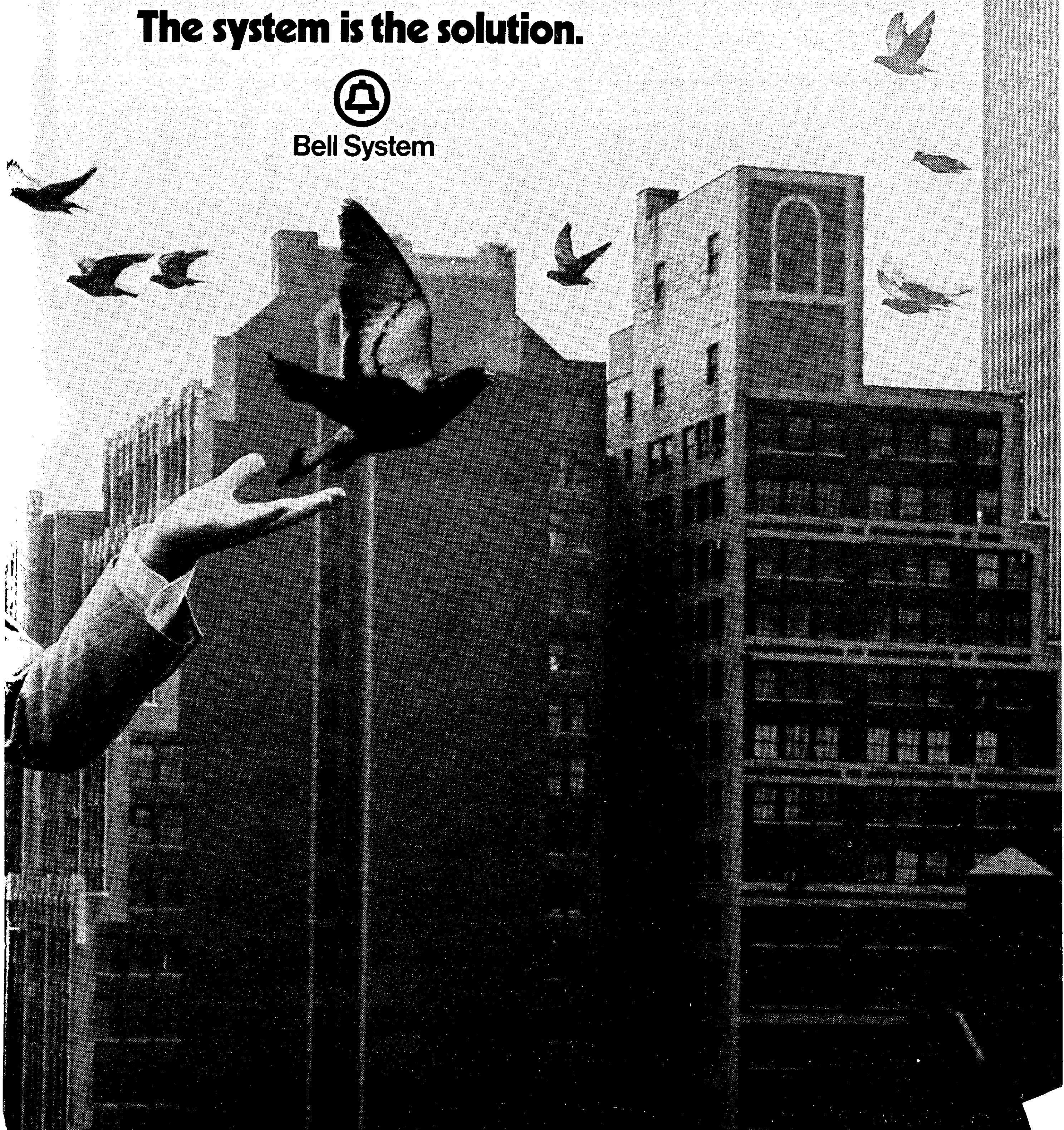

SYSTEM TESTING CHECKLIST

	Yes	Comment

I. TEST PREPARATION.

1. Test team members given assignments.
2. Final operating environment defined.
3. All conditions to be tested identified and documented.
4. Test files created for execution of all system functions.
   a. file sequences correct
   b. meaningful starting values established
   c. all record types included
   d. file volume large enough to demonstrate control groups, totals, page breaks on reports
   e. meaningful time period established
5. Test transactions developed to demonstrate all test cases.
   a. unit testing criteria satisfied
   b. system testing criteria satisfied
   c. transactions created for at least two cycles of system execution
   d. end-of-period (month, year) system options demonstrated
6. Test results predicted and documented for later comparison with computer output.
7. Parallel system output identified for standard of correctness.
8. Acceptability and accuracy standards established and documented for later assessment of results.
   a. core availability in production mode.
   b. timing constraints in production mode
   c. if 100% accuracy not required—justify

II. TEST OPERATIONS.

1. Test transactions entered by data entry department using standard procedures.
2. Tests executed by operations personnel without programmer supervision.
3. Transaction listing obtained before text execution.
4. File dumps obtained prior to program execution.
5. System executed to demonstrate all test cases. (May require multiple executions of the system or of individual modules.)
6. All hardcopy (reports, control totals) obtained.
7. Transcription of console messages (and timing information) obtained.
8. File dumps taken after test execution.
9. Output from parallel run available.

III. UNIT-TEST EVALUATION.

1. JCL executes program without errors or unnecessary operator intervention, and file labels are correct.
2. JCL-defined file capacities adequate, assuming moderate expansion.

	Yes	Comment

3. Execute time acceptable according to preestablished standards.
4. Sufficient core available for execution and moderate expansion of program size.
5. Input data accepted as formatted without data exception.
6. All logical paths executed correctly.
   a. all invalid data trapped
      - troublesome transaction combinations discovered
      - edit messages all forced
      - no-match or invalid-key conditions forced
   b. program-controlled terminations before normal EOJ tested
   c. no-file case executing
   d. empty-file case (file exists, but has no member records) executing
   e. file updating accurate, complete, according to specifications
      - first-record processing accurate
      - addition of a record prior to the first record executes correctly
      - multiple-file match logic working
      - last-record EOF processing accurate
      - addition of a record after the last record executes correctly
      - fields updated as specified: quantity replacement, quantity addition, etc.
      - record deletion, addition executes correctly
      - multiple transactions per master record all execute correctly
      - changes to keys handled accurately
   f. all report breaks demonstrated
      - page overflow
      - detail, minor and major control breaks, final control break
7. Created files conform to design specifications.
8. Field sizes in files adequate: no unexpected truncation, loss of significant digits.
9. Mathematical accuracy, rounding
10. Reports conform to designed layout.
11. Report information contents agrees with titles, headers.
12. Report page numbering accurate.
13. Spelling correct on report titles, headers.
14. Field sizes on reports adequate.
15. Audit trails (control totals) accurate.

IV. SYSTEM TEST EVALUATION.

1. JCL executes system without errors or unnecessary operator intervention, and file labels are correct.
2. JCL-defined file capacities adequate, assuming moderate expansion.
3. Execute time acceptable according to preestablished standards.

(Checklist continued on page 124)

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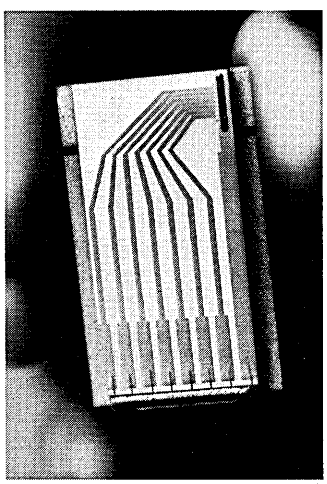

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	Yes	Comment		Yes	Comment
4. File sequences (sort specs) accurate throughout system execution.			work.		
5. No-file case executing throughout all system steps.			13. System restart procedures satisfactory.		
6. Empty-file case executing throughout all system steps.			14. File recovery procedures satisfactory.		
7. Available means for cross-checking system results exhausted. a. different reports with same or derivative information b. file contents vs. report values c. control break totals vs. final totals			15. Files and reports conform to output from parallel test, if applicable.		
8. Interfaces working accurately. a. between programs b. between subsystems c. between other computer systems d. with existing manual systems			16. Output accurate after more than one execution cycle.		
9. Files closed at EOJ (normal or due to error).			17. End-of-period output accurate, and period-totals reset to zero.		
10. Execution sequence (system flow) accurate and workable.			**V. ACCEPTABILITY TEST**		
11. Audit trails (control totals) accurate.			1. User review of output.		
12. Error-correction procedure loops			2. Judgment of acceptability according to predetermined standards.		
			3. Services provided by the system conform to originally stated user requirements.		
			4. Changes in user requirements since original statement.		
			5. System testing judged complete.		
			6. User sign-off on output.		

lems can be readily determined, and distinct blocks of code can be examined for debugging purposes.

A stepwise prediction process as described above assures that several attributes of a good test are achieved:

1. All test cases are included in the testing procedure.
2. The test is reproducible.
3. Test results are easily demonstrated and reported.
4. Predictions (such as calculation of expected values) are carried out before system execution, thus counteracting the tendency to accept computer-generated results because they "look right."

Use the proper tools

Automation can be applied quite effectively to system testing. In all but the most trivial instances, creative use of available testing tools can reduce the costs and increase the thoroughness and accuracy of the testing procecure.

The classes of computerized testing aids are:

1. program execution monitors
2. test data generators
3. terminal input simulators
4. file conversion programs
5. redundant programs
6. file comparison programs

A *program execution monitor* creates a record of the program statements which are executed during a run. Reports produced by the monitor summarize execution characteristics at the section, paragraph, or statement level. Additionally, the reports may display the activity of statements of a certain type (such as all IF statements).

An execution monitor can provide the typical debugging advantages offered by the TRACE feature found in some programming languages. For example, infinite loops, or code which is mistakenly fallen into, are easily identifiable. On a higher level, and one more important to system testing, the program execution monitor can be used to evaluate the "logical completeness" of a given set of test data. Unexercised code is easily isolated so that additional test cases can be provided to complete the data set.

Conversely, a series of reports from the monitor may be examined when attempting to reduce the size yet retain the logical completeness of a test data set. Such a procedure may be undertaken to establish a minimal set of test transactions for maintenance testing.

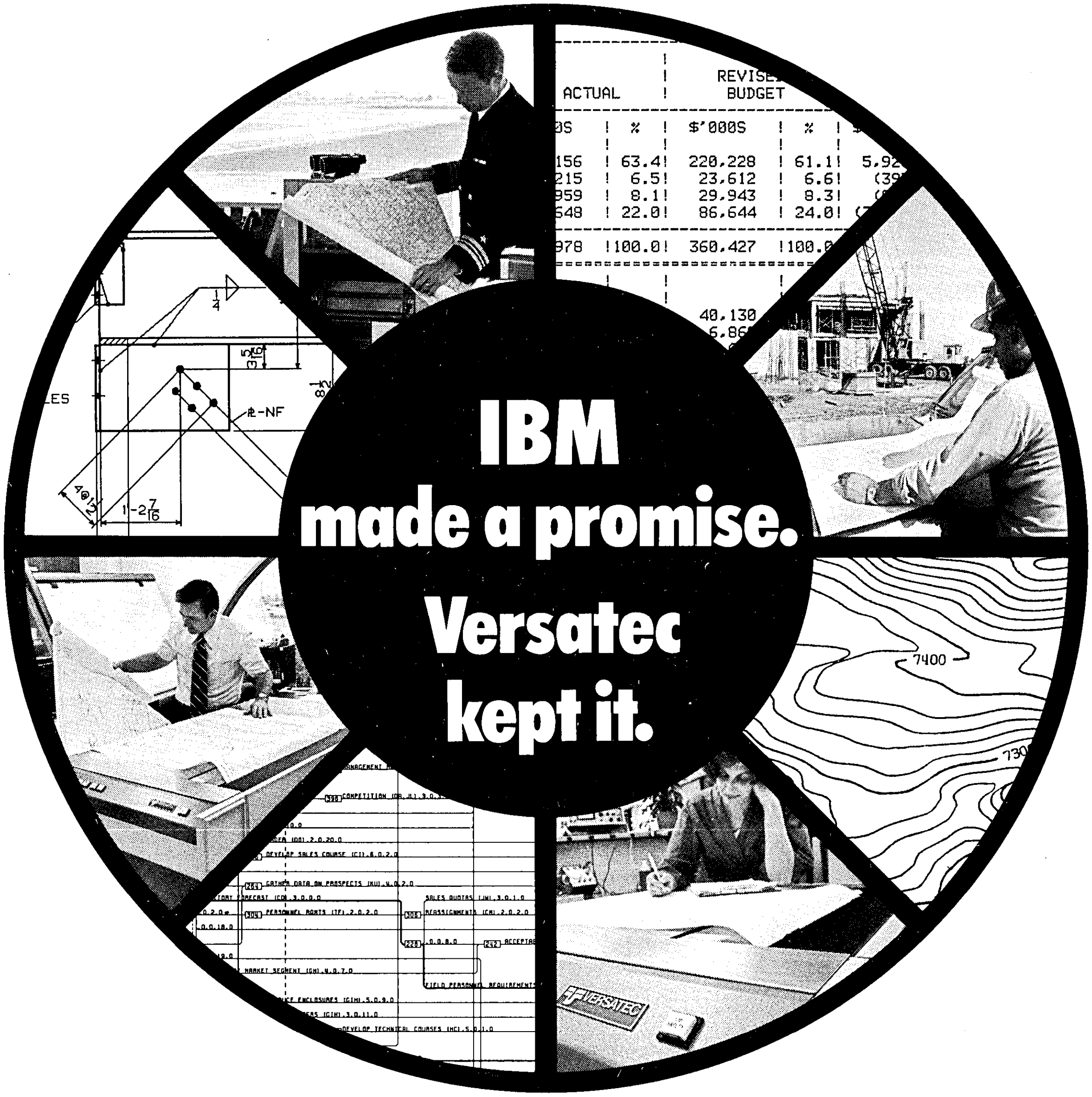
Some language preprocessors allow the programmer to include the execution monitor capability on a permanent but inactive basis within the body of the program. The associated statements may be activated for testing by selecting compile-time or run-time options.

A *test data generator* is basically a sophisticated file-generation program. The test data generator translates a generalized description of the data base, file, record, and field characteristics into files meeting the desired specifications. The test data generator can be employed to create the test data base, the set of test transactions, or files containing predicted results of system execution. In any case, an explicit definition of the characteristics of the data must be supplied to the generator, including:

1. the overall interrelated data base structure (Some test data generators can build specific proprietary data bases, including IMS and TOTAL structures.)
2. sequence in which records are to appear
3. record characteristics: blocking, length (fixed or variable), record types
4. number of each kind of record to be created
5. field characteristics: length, data type, repeating structures (arrays)
6. special field formats: date, time
7. value or range of values possible
8. distribution of values within the stated range
9. dependency of one field value upon the value of another field in the same or in a different record

A test data generator may be used to incrementally develop a set of test transactions as additional functions are added to the system. After all normal functions have been tested, invalid transactions may be added to the data set for exception testing. When all logical conditions have been exercised using a minimal set of transactions, a much larger test data set may be generated from the same definition of file characteristics, usually simply by changing the volume parameter. High-volume testing may then proceed.

After testing is complete, a fully developed test data set may be stored in the form of its parameters rather than



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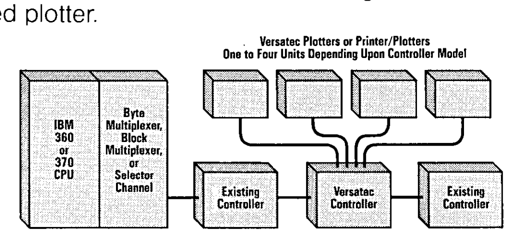

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"We're doing salary administration reports and engineering plots on one machine (Versatec). Either application would have justified purchase."

"A CalComp drum plotter needed 175 24-hour days to plot the 9000 drawings. Versatec did the job in less than 15 hours."

"Sure, we're saving $50,000 a year in direct cost, but the economic value of timely graphics is incalculable."

"Our first Versatec system is performing beautifully. I've recommended purchase of Versatec systems for our 370's in every operating division."

"The turnaround is fantastic. Not days, not hours, but seconds."

"The programmer couldn't believe it. Before he could order a second plot, the first one was done."

"Resolution is great, even on long curves. We can use Versatec for final drawings."

"Our 36-inch wide Versatec plotter is in an engineering building half a mile away from our 370, but we're operating on-line without a hitch."

"CPU time is no problem. Total I/O and CPU time for 33,000 vectors is less than ten seconds."

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in its extended form in order to save secondary storage. The file may be easily regenerated from its definition when it is needed for maintenance testing.

Automated test data generation is not a cure-all, however. The quality of the test data sets remains a function of the completeness and accuracy with which the test cases are defined. The analysis of what must be tested, and of how testing ought to proceed, is still a manual procedure. Only the mechanics of the file creation can be automated.

Also consider the fact that the values assigned to fields are usually generated in random nature within the designated range. This is often satisfactory; however, there are times when a specific mix of transaction types or field values is desired rather than random output. Moreover, it may be desirable to vary these combinations over several iterations in a specifically defined manner. This is often difficult if not impossible to define to the generating program.

Finally, using a test data generator does not directly relieve the analyst of the burden of predicting the results of each transaction. The anticipated effect of each generated transaction must still be individually documented for later comparison with the system's results.

Some features of the test data generator may be helpful to the prediction process, however. For example, record counts are maintained as test files are created. Also, the analyst may request that a grand total of all values generated in a specific field be provided. These amounts may be compared to similar totals which are derived by the system being tested.

The test data generator may be a standalone package, or it may be in the form of special statements which are incorporated into a higher-level language program. In the latter case, the test data generator draws in part upon the file, record, and field descriptions which are already present in the application program.

A *terminal input simulator* becomes important when testing on-line systems. The job of the input simulator is to present test transactions to the processing program in such a manner as to imitate the anticipated multiple-terminal environment in which the system will eventually operate. A user profile, containing information about the volumes and types of transactions which will enter the system relative to the time of day or the day of the year, should be incorporated into the simulator.

The use of a terminal input simulator makes it possible to begin testing an on-line system before terminals have been installed or users fully trained. In association with a test data generator, the terminal simulator can be used for stress testing by loading the system with excessive numbers of transactions in a limited period.

File conversion programs also can be used to advantage when creating test files or files of anticipated results. Especially if parallel testing techniques are being used, files can be converted from the old system, which has presumably been checked out and operating correctly for some time. Some test data generators may, in fact, incorporate file conversion into the building of records by allowing the specification of fields in external files as the source for the values in newly generated records.

Redundant programming is an infrequently used technique for ascertaining the accuracy of new software. The technique works on the same principle as parallel testing: the results obtained while using two different computer systems programmed to accomplish the same task are compared. A discrepancy in results indicates an error in one of the systems.

The problem with redundant programming is that both of the systems are usually newly written during the system development period, and thus each remains subject to a thorough system test before either one can be called the standard for correctness. Thus, an equal result does not necessarily mean that both programs are correct (both could be wrong in the same way); similarly, an unequal result does not necessarily isolate which program is in error.

In some complex systems, however, where no parallel system is available for comparison, redundant programming may be the only realistic method for evaluating system results. In this case, the testers must assume that there is a high probability that equal results imply correctness of system execution.

A file comparison program runs a field-by-field or a character-by-character comparison of the contents of two files in the same sequence and format. Automated file comparison greatly facilitates the comparison of system-generated results to the predicted correct results. Even if no parallel system exists and all results were predicted manually, it is often advantageous to enter the predictions onto a computer-readable file so that file comparison programs may be used. Depending on the capabilities of the available file comparison utility, even hardcopy reports may be directed to disc or tape and compared.

Exception reporting isolates only the discrepancies between files, so that erroneous procedures may be easily isolated. Automation of the file checking task not only speeds the assessment of test results, but also assures that entire files are examined to the letter, and that further errors are not introduced into the system during manual checkout.

An important point about all of these tools is that a front-end investment in the purchase or development of automated testing aids will benefit the system testing process not only during original system development, but also throughout the lifetime of the system as it is maintained.

Continued testing is the best preventative medicine for premature system degeneration.

If it is true, as sometimes claimed, that a programmer making even a minor modification to a program has less than a 50% chance of making that modification without generating a new error in the program, then it becomes obvious that a complete test should be executed and carefully evaluated every time a change is made to a program or a system function. Maintenance programming and maintenance testing should go hand-in-hand. Therefore, to facilitate maintenance testing, system documentation should include a copy of the system test plan, test data files, and files of predicted results.

Careful attention to continued system testing is the best preventative medicine against premature system degeneration. In fact, it is perhaps during maintenance testing that automated testing aids are of *most* value. For each system module, parameters for the generation of test data can be retrieved from a system testing library. Testing of new functions can be added by modifying the existing test file definitions.

It becomes necessary, then, to predict only the results of the newly added transactions. A file comparison program can be used to isolate the differences in the results obtained using the modified version of the program and the results obtained using the previously checked-out version. The differences can then be justified as being due to the introduction of new functions, or due to error.

Sharing the recipe

The concepts presented here are also in the boxed set of guidelines. They are offered for use as a system testing standard. The standard is expressed as a list of tasks or quality checks which should be completed during a system test. The checklist can be used as a framework for constructing a test plan, or as a

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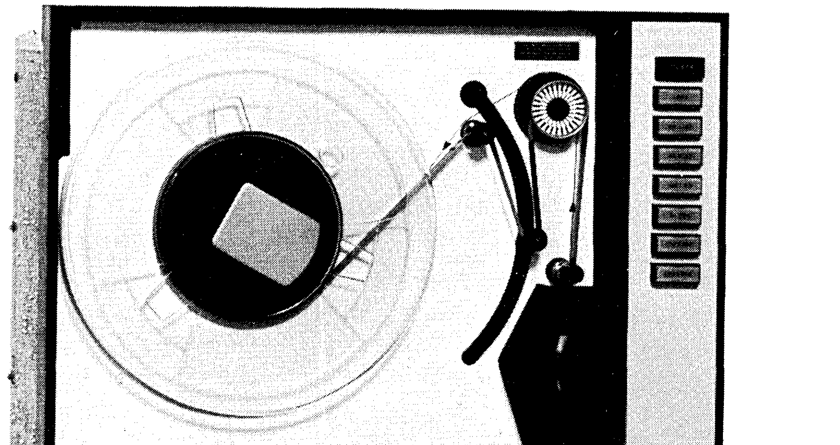


standard against which current testing efforts can be evaluated.

Before undertaking a system test, evidence of a complete and successful unit test for each constituent program or module should be available. Criteria for evaluating the completeness of unit testing are included in this checklist in order to emphasize the importance of this phase to overall system testing.

System testing, as such, usually progresses through two iterations, each time with a more "real" environment. This too is reflected in the guidelines.

The first execution uses the minimal, logically complete set of test data which is created using the prediction process described above. Each condition and each transaction type were checked in turn by the analyst and supervisor who are coordinating the testing.

The second iteration uses a much larger set of test data and much larger test files (or copies of "live" files). This test data is usually generated by the users in a random or unstructured manner, or by a test data generator. Here, operating conditions should approach live as much as possible. All logical cases will probably not be included (they rarely are in a single live run), but the volume and mix of transactions will reflect the expected values under normal operating conditions.

Due to the larger volumes and the more random nature of this iteration, less formalized checking procedures, such as tracking selected transactions through the system, may be used. Also during this iteration, subtle combination-of-input errors may be uncovered. In addition, the larger volumes may push the system toward its limits, allowing a check on factors such as file space allocation and time limits.

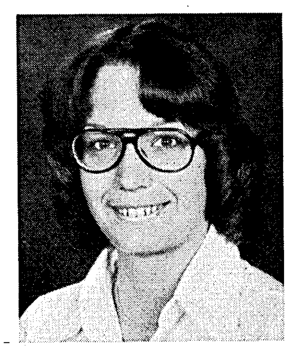
The testing standard divides the testing process into four phases which must necessarily occur in order. The first phase is preparation for testing. During this phase, test cases are enumerated, test files and test transactions are developed, correct output is predicted, and acceptability standards are established.

The second phase occurs in the computer room and is the actual execution of the test: running the programs, listing input and output files, and collecting reports.

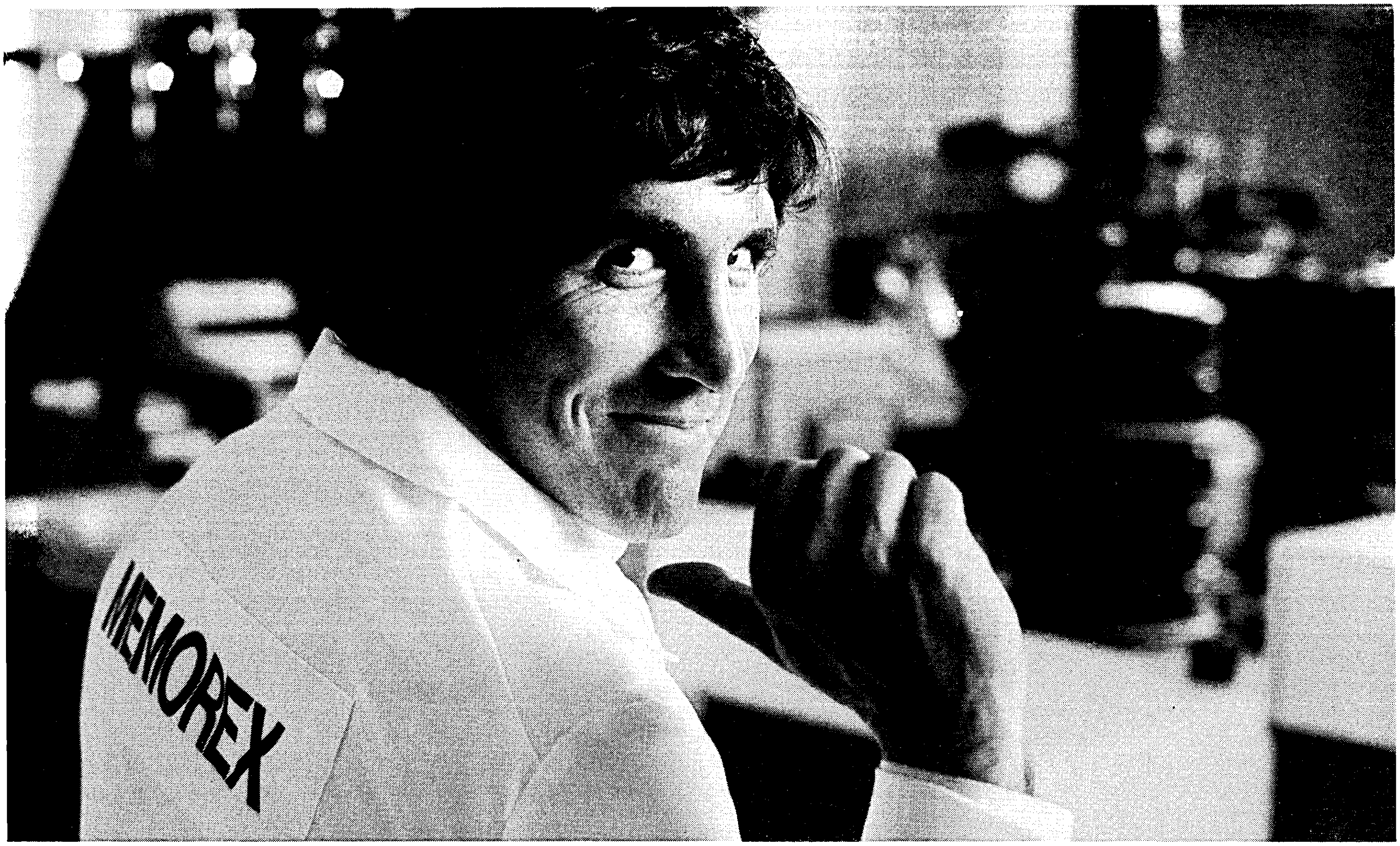
The third phase is the evaluation of test results using criteria specific to the type of testing being done, such as looking for certain logical errors during unit testing and interface errors during system testing.

The last phase is the acceptability test, during which users review and sign-off on generated output according to the predetermined acceptability standards.

In all cases, a testing standard such as this must be applied with care. Some factors may not be at all applicable to the problem at hand. As with any generalization, this checklist should be applied when relevant, but ignored when it would become immaterial or superfluous. ❄



A systems analyst at the Ohio Wesleyan Univ. in Delaware, Mrs. Scharer also consults privately in the Central Ohio area. Her past experience includes work as a programmer and analyst for a national consulting firm, and the teaching of several business dp courses.



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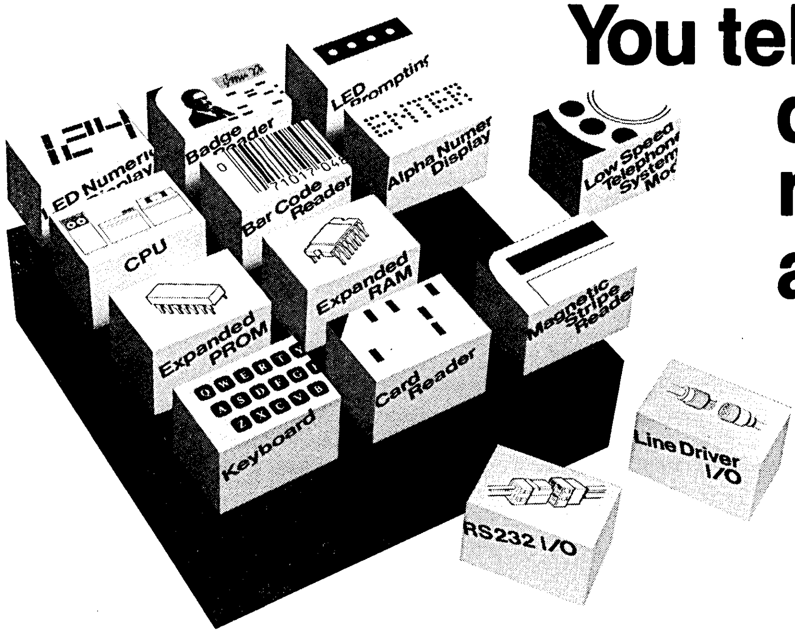

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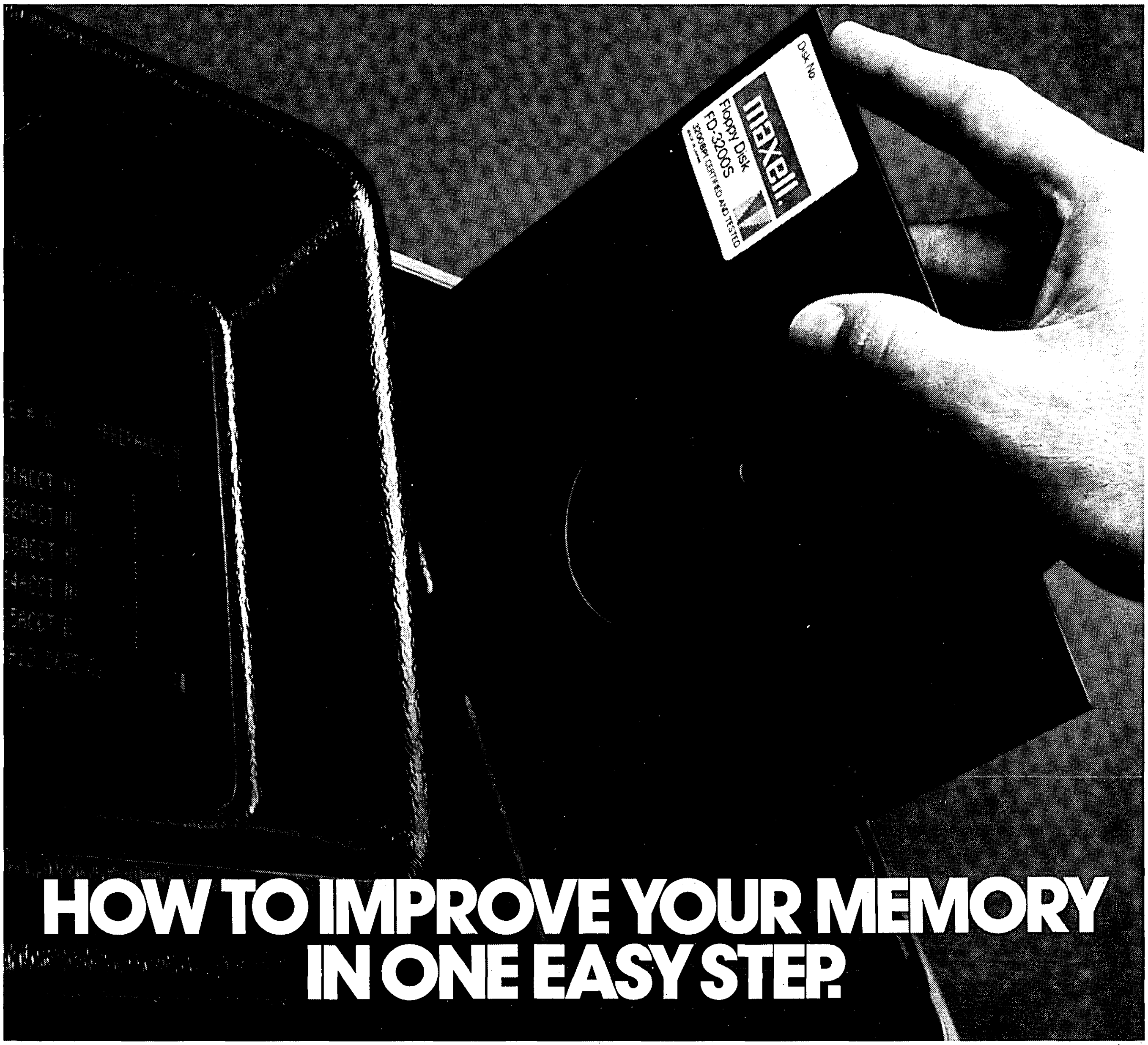

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A Data Base Story

by J. J. Sobczak

Proving once again that what goes around comes around.

One day several years ago, in the data processing department of a large eastern manufacturing firm, the v.p. of dp decided that many of his people had been in the same job for too long. He and his managers decided to have a number of employees make nonpromotional moves to broaden their experience.

Included in these job assignment transfers were two senior systems analyst/project leader types we'll call Charlie and Joe. Both Charlie and Joe had similar backgrounds. Though neither was rated as exceptional, both were quite competent and had distinguished themselves through the years. Charlie had been associated with the accounts payable system for seven years, including the last three as project leader. He fully understood the system and there was not a question about accounts payable that Charlie could not answer. Joe had had similar experience with the inventory control system, and was recognized in the department as the only one who really understood the entire system. They approached their new assignments with great apprehension. Each was being asked to leave a world where he had full control and complete job knowledge, and enter a world where he knew very little.

A month or so after the transfers, Charlie and Joe were having a cup of coffee together.

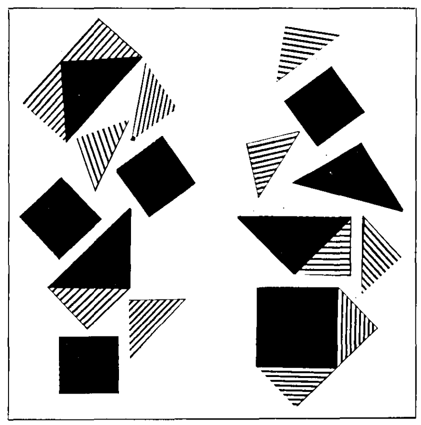
"You know Charlie," Joe said, "the other day I spent some time going through the accounts payable master file and I was amazed how many fields the two systems have in common. It's not always obvious because the terminology is different, but I found that not only were many fields the same, many come from the same source document. Fields such as part number, vendor, vendor address, the three digit vendor code, plants shipped from, plants shipped to, price, and at least twenty others."

Charlie said, "I've noticed the same thing. In fact, I was wondering whether we should write a little program to compare the common data between the two systems to make sure there aren't any discrepancies. I've got a programmer I can spare for a few days, and if you can have one of your guys create an input file for him, I'll have him write a comparison program. What do you think?"

"Well," Joe said, "I think that's a good idea. If there are discrepancies it's better we find out before someone else does. I'll have an input file in a few days. Have your guy call Sam and tell him the data he wants and the format he wants it in."

About two weeks later Charlie and Joe met again to discuss the results of the comparison program. Murphy had struck again, and there were countless discrepancies.

"Boy," Joe said, "this is worse than I



thought possible. We better find out why the files don't match." Within a few days a number of problems were discovered. In many cases field sizes and edit standards were different. Often, when errors with noncritical data were detected, the using department didn't bother entering the correction. Many times discrepancies existed only because of the timing differences in update cycles. The corrections were made and Charlie and Joe slept easier.

Then one day, three months later, Charlie and Joe decided to run the comparison program again. A few days later Joe stopped into Charlie's office to review the program results.

"How does it look?" Joe asked.

"Well," Charlie replied, "it's not as bad as last time, but there are still a number of discrepancies."

"What should we do?"

"I don't know," said Charlie, "but we better do something. Let's take the same type of corrective action we did last time, but at the same time I think you and I should think about a more lasting solution. Let's sleep on it for a few days and meet again Friday to discuss it."

Friday came along and Charlie was anxious to discuss some of his ideas with Joe. He had been doing quite a bit of thinking and had arrived at what seemed to him an ideal solution.

As Joe walked in his office Charlie blurted out, "Sit down Joe, I think I have an answer but I want to bounce it off you."

"Great, go ahead," said Joe, somewhat relieved because to him the problem was still as perplexing as it had been three days before.

"Well," Charlie said, "my idea is to combine the accounts payable master file and the inventory control master file into a single master file. Then there will be only one entry for each field, and discrepancies will be impossible. If the vendor's address is wrong at least it will be consistently wrong wherever it appears."

Joe interrupted, "That doesn't really seem like much of a solution. It would make our lives more comfortable because our bosses are less likely to find out about our current problem. But the basic problem as far as the company is concerned would still be there—we'd still have bad data."

"Wait a minute Joe, you're jumping the gun. There's more," retorted Charlie. "I think we could improve our data accuracy by having the department most interested in an element of data be responsible for updating it. For example, the accounts payable department would be responsible for updating the price field. If you remember, that was one of the fields where our investigation of discrepancies showed that the inventory control file was usually the one that was wrong."

"Right," Joe inserted, "that's because the material people use that field more as a memo item." Joe began to show more interest.

Charlie went on. "There is another advantage that I think will help sell the idea to management. Think of all the duplication of effort that will be eliminated. For each duplicated field, the using departments have to mark up the input documents, submit data for key-

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 CIRCLE 60 ON READER CARD

punching, and process the error corrections. The data must be keypunched and the cards handled. Computer resources are used to edit and update the data, and storage resources store it. That's a lot of extra work. Well, what do you think?"

"Great," Joe said, "and I just thought of another advantage. The accounts payable department manager asked just last week for some special reports that included information we don't have, but I know is in the inventory file. For example, he wants the company part classification code on his reports. If we had a consolidated master file, I could easily give him reports like that."

"Hmmm, I never thought of that," said Charlie, "this is sounding better all the time. What do you think our next step should be?"

"Well," Joe said. "I think we should run this by Gardner. He's in systems programming now, but he's still the sharpest guy around here. If there are any holes in it, he'll find them."

"Good idea, Joe" agreed Charlie. "I'll give him a call and ask him to meet with us as soon as possible."

Gardner was the most respected member of the data processing department. He had been a programming hotshot and then an outstanding systems analyst. He eventually was transferred to head up the systems programming department because he knew more about systems programming than anyone else, even though his career had been mainly in the applications area. The next day Gardner agreed to sit down with Charlie and Joe to discuss their problem and proposed solution.

They explained the history of the discrepancies and the concept of eliminating them by having only one master file. They described their theory on why they believed accuracy would be improved, how duplication of people and machine resources would be eliminated, and the advantages to each department of being able to receive special reports containing data from the other's master file.

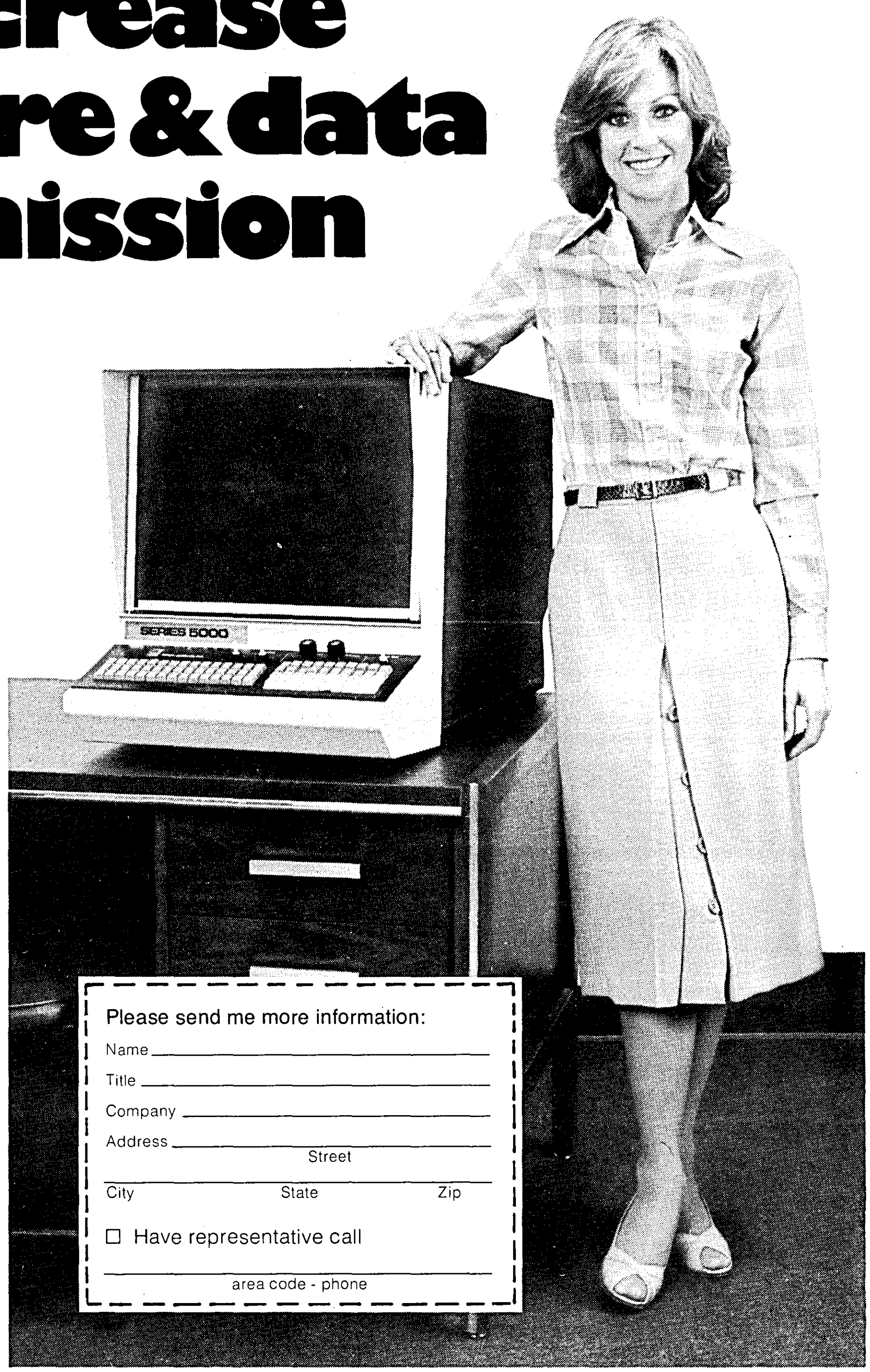
When they finished, Gardner, who was not the type who jumped to conclusions, said, "You guys have an intriguing idea. There may be a few implementation problems, but let me spend a few days analyzing your idea. I'll get back to you in about a week."

"Fine," said Charlie. "Let's set up a meeting now for a week from Monday. We can all benefit from spending a little more time thinking about this."

When the time for the meeting came around, Charlie and Joe were anxiously awaiting Gardner's opinion.

 CIRCLE 5 ON READER CARD

How to distribute your data processing <u>and</u> decrease software & data transmission costs.



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"Well Gardner, what do you think?" blurted Joe.

"First of all," Gardner started, "I think implementation of your idea is more complicated than you imagined. In fact, I've concluded that special software would have to be written to manage the data." A look of dejection came over Joe's face. "Don't look so forlorn," Gardner continued. "I know that sounds like bad news but on the other side of the coin, I think it may be worthwhile to develop that software. In fact, I've discussed it with some of my people and they're raring to go. All we need is management approval. You see, I think you have an idea that could actually revolutionize systems in our company.

"One of my people found that many of the data fields your two systems have in common can also be found in the customer service files and the engineering master files. And the same problem you found exists with other systems, too. You've uncovered the tip of the iceberg, so to speak.

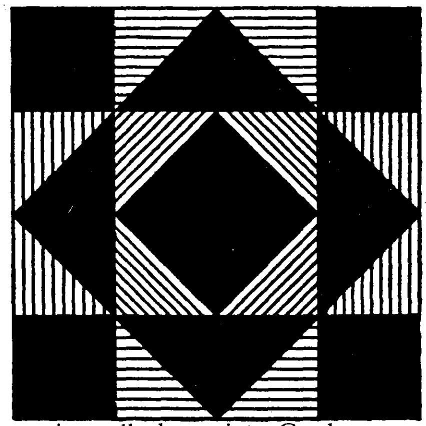
"For example, the employee skill file and the payroll file have all kinds of duplicated information, not to mention the redundancy in many of the manually maintained files departments need because our data processing systems don't serve their needs. "You really started me thinking when you mentioned the accounts payable department manager requested a special report that required information from the inventory master file. I suddenly realized that many others in the company might be able to use information contained in somebody else's master file. That information itself could be considered valuable. Our problem is that we think of data as belonging to a using department and computer application. Instead, we should think of information as a corporate resource."

"That sounds great," said Charlie, not really understanding, or caring to understand what Gardner meant when he said information should be a corporate resource, "but tell us about the special software that has to be developed."

"Okay," Gardner continued. "You see, if you just combined the data into one large master file with the idea of sorting it into the appropriate sequence, you're going to run into a number of problems. First of all, you both are planning to eventually change your systems to an on-line operation, right?" Charlie and Joe both nodded. "Well the first thing a software package must do is store the data so both of your systems can access it at the same time and obtain the information it needs in the proper form. Even if you didn't go on-line, you would have a problem organizing your master file, because although duplication exists, a one-to-one record correspondence between the files does not exist.

"You will have another problem preventing changes in one system from affecting the other. For example, you don't want to have to change all the programs in one system just because the size of the other's master file has increased.

"Security will be another problem. The accounts payable department won't be happy about having its data so readily accessible to other people. What I would propose to do is have my people write a software package for handling these problems and others I foresee. It would allow for storing information in what I'll call a data bank." Charlie and Joe didn't fully ap-



preciate all the points Gardner was making, but now they understood that the problem was more complicated than merely creating a single consolidated master file.

"Well, what's our next step?", asked Joe.

Gardner replied, "I think we should present this to Morley. He has the authority to let us proceed and will have some ideas on how to sell it to management. He's pretty forward thinking, and I'm sure he'll support us." Morley was the department manager with responsibility for both applications development and systems programming. Gardner enjoyed working for him and considered Morley the only really competent data processing manager in the firm. Though Charlie and Joe had difficulty grasping the concept of centralized data banks, Gardner was confident Morley would understand the potential.

They met with Morley the following day. Charlie and Joe explained the background carefully, omitting the data discrepancy part of the story. Gardner then explained his ideas, the potential he saw for revolutionizing systems in the company, the need for a software system to manage the data, and his manpower estimates for developing the software.

Gardner was right. Morley's eyes lit up and he understood what Gardner was getting at almost immediately. One of his major concerns was that top management viewed data processing as simply a method for reducing "general and administrative" expenses. Computers did not help them make the critical decisions that are vital to the company's success. Top management's general view was that if the computers weren't here, the only real effect on the company would be that there would be a lot more clerks with eyeshades running around. One of Morley's concerns was that before long, there wouldn't be any more clerks with eye-shades to replace. If that happened, the status of dp in the organization could drop even further.

Now Gardner, with Charlie and Joe, was proposing a whole new way of looking at data processing. If the vital information in the company somehow could be stored in centralized data banks, all kinds of possibilities opened up for inserting data processing into the firm's decision-making process.

Morley recalled his own ill-fated attempt to develop a corporate financial model that suffered from the inability to obtain accurate and timely data. The one thing that experience did teach him was that management was amenable to such applications. If someone could develop a better way of helping them run the business, they would be willing to spend the money required to develop that capability, even though the benefits could not be quantified in dollars and cents.

Morley gave Gardner, Charlie, and Joe the go-ahead. He proceeded to sell his management and the using departments that initially would be affected. An early decision was to concentrate first on the original idea of combining the accounts payable and inventory control systems. Gardner and his people, however, set out to develop a generalized software package that could be used for combining other applications.

Shortly thereafter, Gardner received a promotion to a position outside data processing. A few years later he was transferred to the company's European subsidiary for a two-year tour of duty. During that time he wasn't able to stay abreast of the corporate data bank project, but he did read the various articles that could be found in management-oriented publications on what was being called data base instead of data bank. These articles made him proud that he had been instrumental in what appeared to be a significant advancement in data processing. Occasionally, he received miscellaneous reports and letters from his old dp department that made it clear that the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data base philosophy had taken over.

When his European assignment was over and Gardner was transferred back to corporate headquarters, he made it a point to visit the data processing department. He wanted to discover first hand the progress they were making toward developing a corporate data base.

As he walked into the department he first ran into Joe.

"Hi Joe," Gardner greeted him. "How are things going?"

"Fine Gardner, it's nice to see you," replied Joe.

"How is your data base coming along?"

"Well overall pretty well, except for a few software problems we've had converting to a new version of our data base management package. About three years ago we found it was too costly to maintain the software package your department developed because equivalent packages were commercially available at a reasonable price. The only mistake we made, I think, was that we haven't standardized on one package. For example, Charlie, who is now the data base administrator for the inventory control data base, uses different software than we do with the accounts payable data base."

Gardner was startled. "Are you saying that the inventory control data base and the accounts payable data base are separate?" he asked. Joe nodded affirmatively. "How can that be? The whole idea in the first place was to combine them into a single data base. If they're separate you're right back to where you were years ago. What happened?"

"Oh, we gave up on that idea years ago," Joe replied. "We had too much trouble with the users. Soon after we launched the system the accounts payable department wanted to expand the vendor classification code to include a credit rating. There were a lot of good reasons for doing it, but the material control people wouldn't agree. Their people were used to the old code, and they'd have to change their forms. They just weren't going to go along with it. I was the data base administrator but I didn't have the power to control either user. We ended up putting in two codes, one for each department. We continually had similar problems until we just gave up. Well, I'd like to talk to you longer but I have a meeting to attend." With that Joe rushed off leaving Gardner visibly shaken. Gardner headed for Morley's office.

He found Morley in his office and after exchanging greetings mentioned the conversation he had had with Joe. "What happened, Morley?" It sounds like you're right back where you were years ago except that you're using more exotic and expensive software to access the data."

"Well Gardner, that's not quite true," replied Morley. "The new data base software packages have on-line query facilities that give us a capability we didn't have before, but other than that, you're right. We haven't progressed much. In fact when you consider the added machine overhead and cost of the data base software, we may have regressed."

"Joe described a problem you had with the vendor classification code. Was that typical?" asked Garnder.

"Gardner, that was just one of many, many problems. We had cases where the accounts payable department was pressured by their management for reports that required data that was controlled by the material control department. The material control manager refused to work the extra overtime required because they were already over their overtime budget and had their own priorities to worry about. Well, you can imagine the frustration that created in the accounts payable department. Instances like that forced us to split the data bases."

"Where did we go wrong?" Gardner asked, though he almost knew the answer.

Morley replied. "We completely underestimated the people problems involved in establishing a data base. Users think of the data associated with their application as their data. You don't just appoint a data base administrator and eliminate those feelings. The psychological ties are too strong. Instead of being concerned with these problems, we got all wrapped up in the technical detail associated with setting up a data base. We concentrated on things like network vs. hierarchical structure, inverted lists, and audit trails. We should have concentrated on the organizational aspect of the problem."

"What about all the other data bases you have around? Did they have the same problem?" queried Gardner.

"No," answered Morley, because none of them are integrated data bases in the way you and I think. You have to understand that data base has become the "in thing." People are using data base management software where they used to use sequential or direct access methods. Otherwise the applications are no different than they used to be. In fact, some of the so-called data bases we have don't even use data base software. They just started calling their old files data bases. One of the other managers here takes pride in the fact that he has installed thirty-seven different data bases. Sometimes it gets quite humorous to watch. I've sat in meetings where they argue about data base administrator job responsibilities. Because they don't have a true data base they don't need one. Yet they read that they do need one. They end up defining a job that sounds suspiciously like a systems programmer."

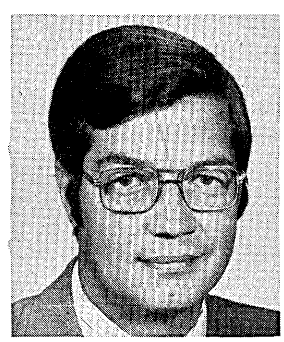
"What about other companies?" Gardner asked. "Do they have the same situation?"

"I've been attending manufacturer user group meetings for the past few years," replied Morley, "and I've made it a point to find out what others are doing. Surprisingly, many are just like us. Occasionally I run into someone who is developing an integrated data base system. Almost always they are the ones who talk about the data administration problems rather than the technical software problems. But we are definitely not alone."

"Have you given up hope?" Gardner asked.

"No, the potential of what we are trying to accomplish is too great. I still have dreams that data processing can become an essential part of the company's decision-making process. That true company-wide information systems can be developed using the data base approach. But we are going to have to stop devoting 95% of our resources to the technical data base software details because that's only 10% of the problem. We have to think of data base as a systems philosophy, not a technology."

As Gardner left, he wondered whether he was part of the biggest hoax ever perpetrated on data processing, and whether there were enough Morleys in the world to turn the situation around. ❄



Mr. Sobczak is a member of Ford Motor Co.'s corporate systems staff where his responsibilities include advising company systems activities on data base matters. Previously, he managed the development of several data base applications, and also worked as an internal management consultant. His experience includes a variety of data processing assignments with emphasis on hardware and software planning and systems performance evaluation.

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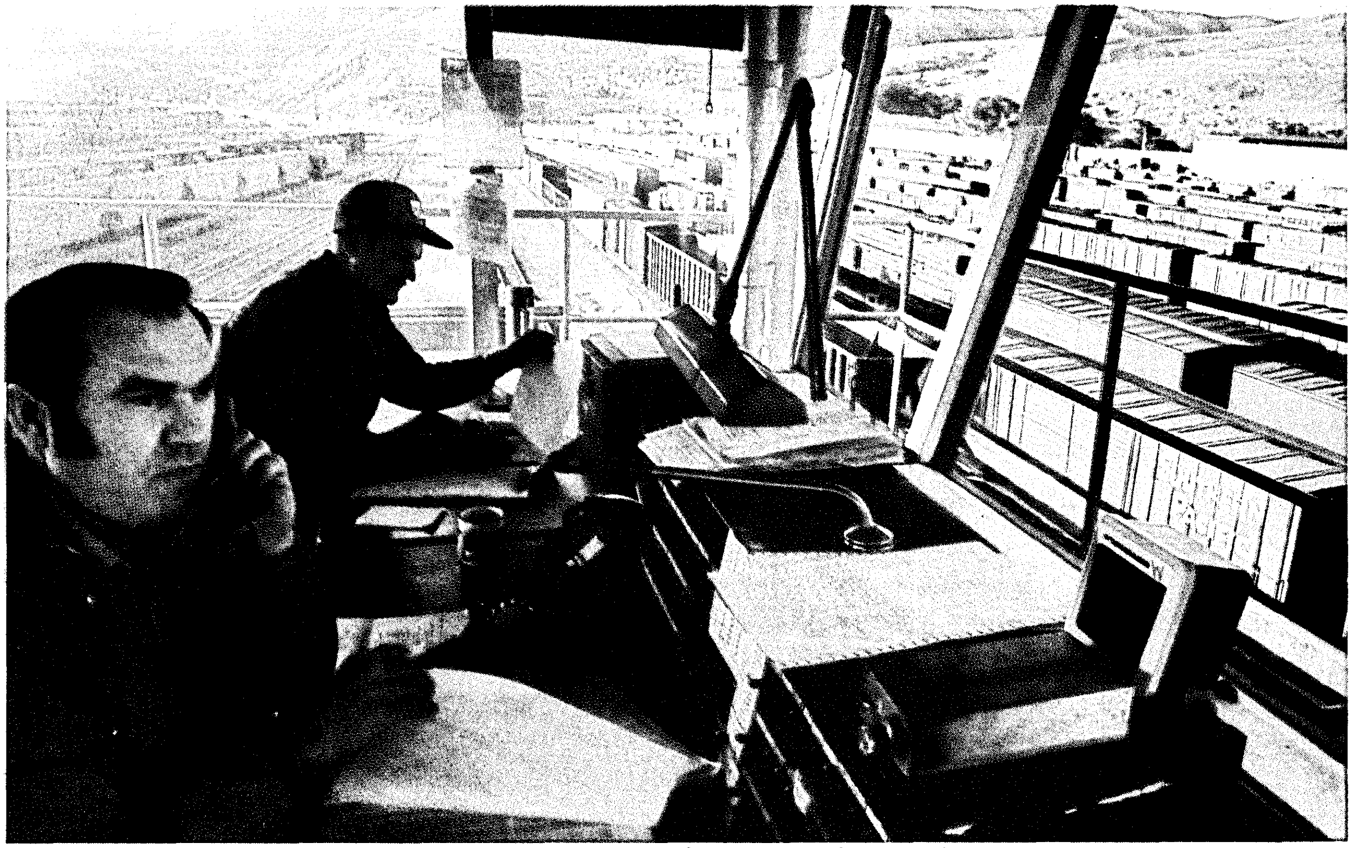
DP Dialogue

Notes and observations from IBM that may prove of interest to data processing professionals.



TOPS supports freight car classification at Southern Pacific's Bayshore Yard, just south of San Francisco. Data on car movement is supplied by 545 terminals linked by telephone and microwave to dual IBM computers.

TOPS Saves Southern Pacific $6 Million Yearly

The Total Operations Processing System (TOPS) of the Southern Pacific Transportation Company keeps track of the 100,000 freight cars that roll over 13,445 miles of railroad. According to railroad president Denman K. McNear: "TOPS is producing tangible recurring savings of $6 million annually."

Terminals in switchyards throughout the vast rail system supply data on car movement to TOPS' dual System/370 Model 168's in Southern Pacific's San Francisco headquarters. From there, TOPS assigns cars to shippers, directs their movements and stores each car's current location. As a train approaches a switchyard, TOPS transmits the "consist": a listing of all cars, their contents, destination and special handling instructions. From this, yard men create a track list which directs switching operations. When a departing train has been assembled, its new consist is transmitted to TOPS.

"We've been installing programmable units of the IBM 3770 Data Communication System at our terminal locations," says J.W. Germany, vice president of management services. "We can perform local switchyard data processing functions as well as computer input-output on the 3770. This integration has speeded up operations in the yards and cut down on errors.

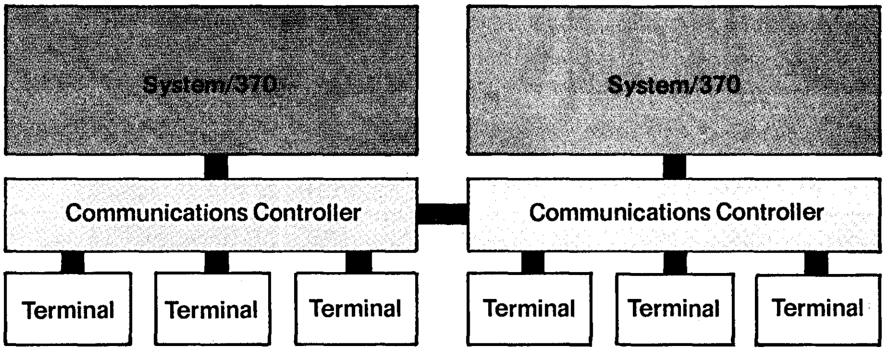
"Overall, there has been no increase in our hardware costs, and TOPS data is more current. The higher data rates of the 3770 make better use of our communication links, resulting in further direct savings.

"The 3770 has opened the way for continuing enhancement of TOPS. We are currently running a pilot project in which we eliminate the paper waybills which accompany all freight cars. Instead, TOPS supplies required waybill data through the 3770 system.

"This is a substantial change in how we operate, and it holds a lot of promise. We're projecting important gains in personnel productivity, customer satisfaction, cash flow, error control, and shortened time from completion of movement to rendering of the bill."

Adds railroad president McNear: "The TOPS data base has made possible online inquiry of car location for shippers. And it permits better planning and better reporting on all levels of management."

Networking Extends the Reach of Computers



The engineer, visiting corporate headquarters, has a sudden requirement for a mathematical routine resident in a plant computer many miles away. He sits down at a terminal in headquarters—one which normally accesses business applications in the corporate computer—and logs on just as if he were at the plant. The local system senses that he is requesting a program available only at the plant, and routes his request to the computer there.

Similarly, a headquarters visitor to any company location with a terminal can as easily establish a link with an application in the corporate computer.

This mode of computer use is a feature of *networking*, and now a new form of networking is available from IBM under Systems Network Architecture (SNA). Called Advanced Communication Function (ACF), it includes enhancements to both the Virtual Storage operating systems for System/370 and the Network Control Program for the 3705 Communications Controller.

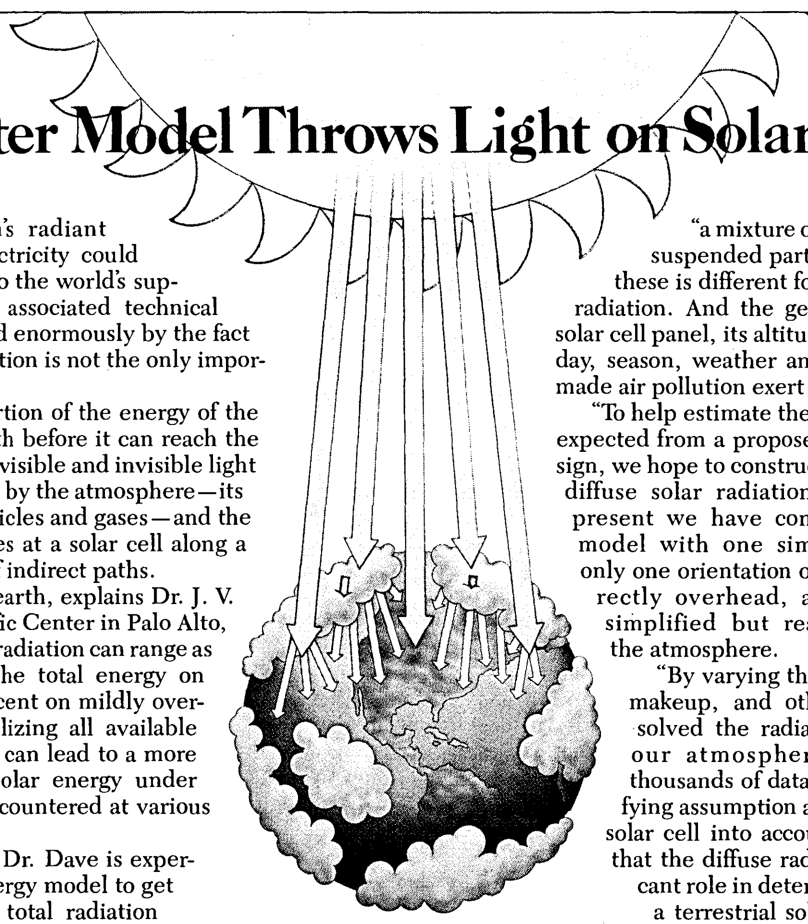
The 3705 can automatically switch a service request at any terminal to an application in any computer in the network. This action is "transparent" to the user, who sees a "single system image" and is not aware of or concerned with the computer to which his work is routed.

ACF provides an architecture which lets the user specify recovery procedures, switching rules, the Initial Program Load (IPL) sequence, emergency reduced-service operation, and communication to and from operators. This structure is provided by the Network Operation Support Program (NOSP)—a programming mechanism by which the user enters his own decision rules and priorities.

Networking with ACF offers great advances in reliability, availability, and cost/performance. Idle capacity can be put to use quickly since a new application can be installed wherever there is room for it. And ACF can greatly improve the economics of such general applications as text processing and interactive training systems, by making them widely available through existing terminals. Similarly, more terminal sites become economical, since each can access more applications.

Tying computers together in a network makes their power more accessible, reliable and economical. It extends their reach to more users and into new application areas.

Computer Model Throws Light on Solar Energy



Important amounts of solar energy reach the earth's surface indirectly, after dispersion in the atmosphere.

Converting the sun's radiant energy directly into electricity could contribute significantly to the world's supply of energy. But the associated technical problems are complicated enormously by the fact that the sun's direct radiation is not the only important energy source.

A very significant portion of the energy of the sun is reduced in strength before it can reach the surface of the earth. This visible and invisible light is absorbed and scattered by the atmosphere—its water droplets, dust particles and gases—and the scattered radiation arrives at a solar cell along a nearly infinite number of indirect paths.

At the surface of the earth, explains Dr. J. V. Dave of the IBM Scientific Center in Palo Alto, California, such indirect radiation can range as high as 40 percent of the total energy on sunny days, and 100 percent on mildly overcast days. A system utilizing all available radiation, he points out, can lead to a more efficient harvesting of solar energy under average conditions as encountered at various feasible locations.

Using the computer, Dr. Dave is experimenting with a solar energy model to get a better picture of the total radiation energy arriving at the earth's surface.

"We live at the bottom of a very complex atmospheric soup," he notes, "a mixture of gases, water droplets and suspended particles. The effect of each of these is different for each wavelength of solar radiation. And the geographical location of the solar cell panel, its altitude and orientation, time of day, season, weather and natural as well as man-made air pollution exert an influence.

"To help estimate the energy output that can be expected from a proposed solar energy system design, we hope to construct a computer model of the diffuse solar radiation in the atmosphere. At present we have completed an experimental model with one simplification: it considers only one orientation of the solar cell—aimed directly overhead, at the zenith. It uses a simplified but realistic representation of the atmosphere.

"By varying the time of day, atmospheric makeup, and other parameters, we have solved the radiative transfer equation for our atmospheric models for several thousands of data points. Taking our simplifying assumption about the orientation of the solar cell into account, these results indicate that the diffuse radiation plays a very significant role in determining the performance of a terrestrial solar cell. We are now planning for the radiation modeling for an arbitrarily oriented solar cell which requires several million data points."

Advertisement

OLIS: A Powerful New Tool for Legislators

In the Oregon State Capitol Building, in Salem, a Senator or Representative can step up to an IBM 3277 Display Station and learn the detailed status of any of thousands of bills pending before the state legislature: what committees have held or will hold hearings on it and when; what recommendations they made; how and when the bill was amended or otherwise acted on in each chamber; and when it will be called up for action again.

This information, referred to as Measure Status, is stored in one of two data bases included in the Oregon Legislative Information System (OLIS), an online computer system.

The Measure Status subsystem helps schedule and manage the business of the legislature. It is used to generate daily and weekly Legislative Calendars with details of past and future activity on every pending bill, in committee and on the floors of the two houses.

"Without Measure Status," says Jason D. Boe, president of the Senate, "we would be hard pressed to keep track of the workload, to organize proper consideration of all the important legislation that comes before us. The computer is the ultimate legislative tool."

Adds William Stow, director of OLIS: "During the 1975 meeting of the legislature, the Measure Status subsystem was one of the factors that enabled the presiding officers to shorten the session to 153 days, compared to 180 in the previous session, despite a rise in the number of submitted bills from 2303 to 2449."

The other OLIS data base contains the complete text of the body of state law, known as the Oregon Revised Statutes (ORS), and the complete text of all measures pending before the legislature.

By means of this data base, members of the legislature's staff can edit and proofread statutory language, working directly at 3277 Display Stations, entering all amendments to each bill as they are proposed.

To maintain this data base in the IBM

Prior to a session of the Oregon State Senate, staff aides Marcella D. Green and Gladys Johnson can check the status of pending bills, accessing the OLIS data base at an IBM 3277 Display Station in the Senate chamber.

System/370 Model 158, OLIS uses IBM's Advanced Text Management System (ATMS). Each new bill is entered via the keyboard of a 3277 Display Station or by means of an IBM Communicating Magnetic Card (CMC) Selectric Typewriter which can operate online, entering text directly, or off line, accumulating text on magnetic cards for later entry.

Some executive branch agencies have begun submitting bills already recorded on magnetic cards, which also serve as backup to the online data base.

ATMS permits material to be inserted, altered or deleted without rekeying of surrounding material, and with automatic renumbering of paragraphs and sections. For the 70 percent of all bills which revise existing statutes, ATMS serves to incorporate the unaffected language into the bill, avoiding manual entry and proofreading of this material.

A Text Retrieval subsystem of OLIS, based on IBM's Storage and Information Retrieval System (STAIRS/VS), is used for retrieving statutory material from the data base. It displays the desired portion of any statute, selected by subject matter or by key words in any combination.

At the end of each legislative session, the ORS must be set in type in its new form and printed. In recent years, as the legislature accomplished more work in each session, manual methods of typesetting and proofreading had begun to prove inadequate; the time required to prepare the ORS for printing had stretched into months, and the cost had mounted steeply.

Now, at the end of a session, ATMS is used to incorporate the new and amended laws into the ORS, to generate a new ORS index, and to prepare for the required biennial printing of the ORS.

OLIS uses TERMTEXT/Format, an IBM program, to prepare material for the phototypesetter. Non-printing format-control characters in the text indicate to TERMTEXT/Format the required column width, type size and font, page and in-text numbering systems, page top and bottom matter and similar format details of the printed document.

"ATMS and TERMTEXT/Format work beautifully together," Stow says. "They were simple to incorporate into OLIS and they produce complex finished documents, remarkably free of errors, with very little wasted effort at the keyboard.

"After the session," he notes, "the ORS was printed earlier than ever before. And the cost was $300,000 less than our best proposal from a private company using phototypesetting.

Software Products from IBM

Three products available from IBM extend the power of data processing systems:

1. **Teleprocessing Network Simulator (TPNS)** enables test and load measurement of terminal-oriented programs prior to installation of terminals.

2. **Conversational Monitor System (CMS)** provides the full spectrum of IBM interactive computing capabilities under Virtual Machine Facility/370 (VM/370). Supports both program development and personal computing.

3. **Advanced Text Management System II (ATMS II)** is a conversational system that permits a terminal user to enter, edit, store, format, proofread and display textual material.

DP Dialogue is designed to provide you with useful information about data processing applications, concepts and techniques. For more information about IBM products or services, contact your local IBM branch office, or write Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

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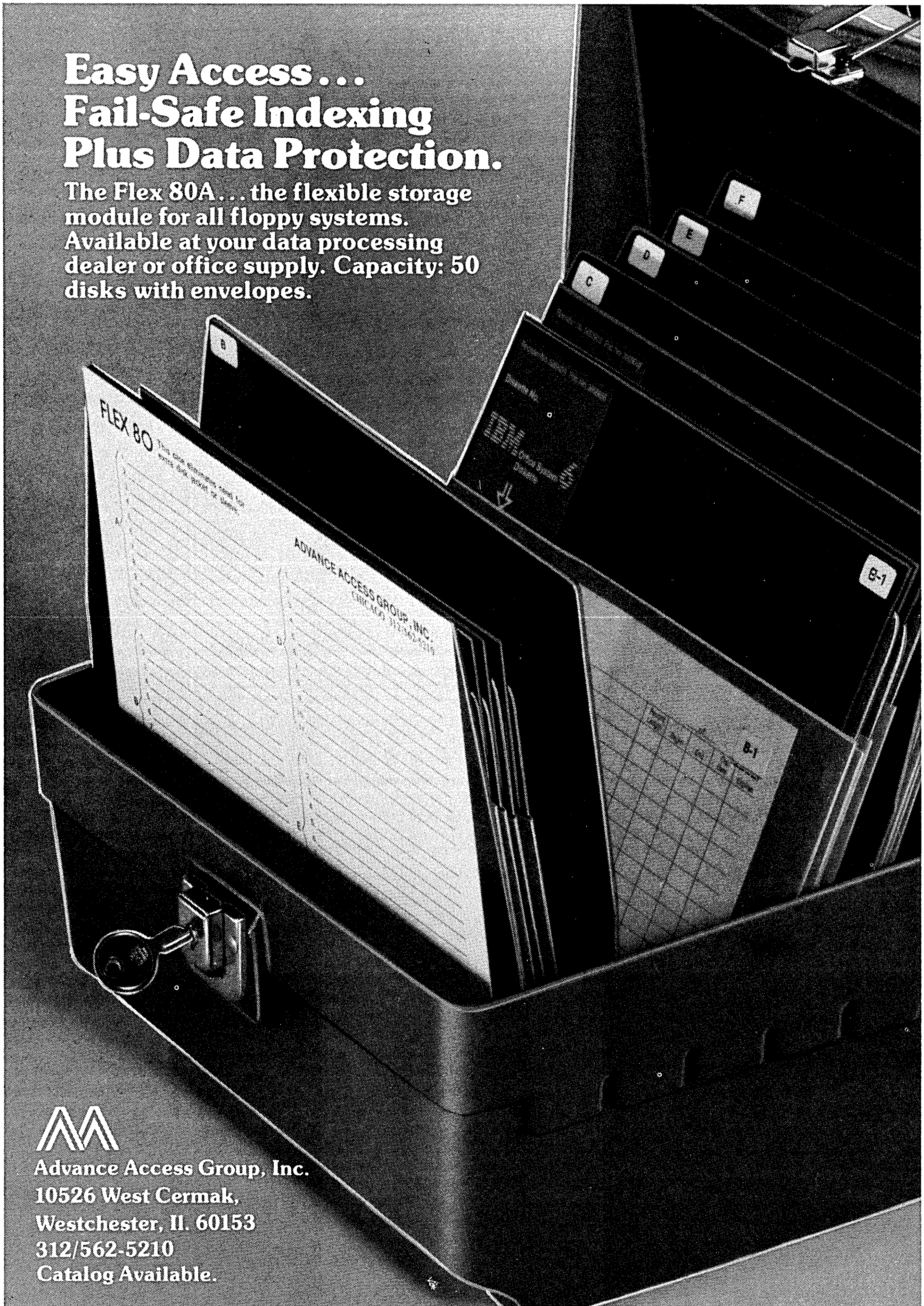

 CIRCLE 76 ON READER CARD

United Brands had an idea for delivering financial reports as fresh as their foods...

Foods and financial data have at least one thing in common.

Both are highly perishable. So unless they're delivered quickly to the customer, they soon lose their appeal and their usefulness.

As a leading international producer, processor and distributor of foods, including Chiquita* Bananas, John Morrell* Meats and A&W* Root Beer, United Brands Company, and its subsidiary companies, depend on the freshness of its food products.

And, as the world's leading supplier of commercially available computer services, General Electric Information Services' reputation depends on the freshness and immediacy of the data it provides to more than 5,000 companies around the world.

GE and Falcon replace manual system

So when United Brands wanted reports faster, and more easily produced than those delivered by the existing manual methods, their idea was to upgrade to a proven automated system.

General Electric computing services and FALCON, an automated management reporting system, proved to be the best solution.

Developed by a major international accounting firm and available exclusively on General Electric MARK III® Service, FALCON consolidates reams of financial and operating data from United Brands' 145 worldwide subsidiaries.

Complex reports easier to produce

FALCON then automatically accummulates data, balances it, and delivers a wide variety of reports to United Brands management. These include financial statements, as well as information needed for tax returns, SEC and other government reports.

The combination of FALCON and General Electric computing services

*Registered Trademarks of United Brands Company

General Electric computing services helped bring it to reality.

has performed so successfully that United Brands is adding a companion system called FORECAST, which provides pro forma financial statements using the FALCON database to attempt to predict future financial positions.

Computing services... think of the possibilities

Thousands of major companies in practically all industries have discovered that General Electric computing services can provide a good business solution to many of their information/data processing needs. Whether they use one of the hundreds of our standard programs, or have GE completely design a customized system, they can rely on the computer power of GE MARK III Service for such tasks as economic analysis and planning, order service, cash management, budgeting, profit planning—and much more.

To see how other managers have harnessed the power of MARK III Service to their ideas, drop us a note on your company letterhead. We'll add your name to our award-winning executive magazine, "LEADER", and forward you a current issue. Write to: Roger Hobbs, General Manager, Sales Department, General Electric Information Services Division, 401 N. Washington Street, Rockville, Maryland 20850.

And, the next time you have an idea that you'd like to bring into sharper focus, give our local GE Information Services Branch Manager a call. He can marshal all the people, programs, network, and computer power you need to help you make things happen. 291-17A

GENERAL ELECTRIC

CIRCLE 59 ON READER CARD

Terminal Distributors: "Our Most Important Asset."

by Vin McLellan, Boston Bureau Manager

There are plenty of deals to be made as they slash prices to achieve big vendor discounts.

Wall Street doesn't like them because they don't manufacture anything; users describe them as slick, aggressive, but helpful with both pricing and the choice of the mix-and-match terminal systems; manufacturers find them sometimes insolent, often awkwardly independent, and occasionally brazen enough to sell a terminal system head-to-head against the manufacturer's own end user salesmen— and skilled enough in the arcane arithmetic of averaged discounts and lease accounting to do so successfully.

They call themselves terminal system dealers or distributors, and manufacturers call them independent "retailers" or "resellers." Their lineage goes back to the Teletype leasing warehouse speculators of the early '60s. They've been the major actors in the fierce price cutting that has reshaped the market for teleprinters — and as the spoor of a price war in crt's becomes overwhelming, there's little doubt that they'll be in the front of the fray. They've evolved into an increasingly important middleman in the terminal industry as the cost of establishing nationwide sales and support organizations rises enormously, particularly for the growing number of smaller manufacturers who need but can't afford such expensive services.

These firms lease, rent, and sell (and the spectrum of them is perhaps best represented by the nearly 100 resellers who market Digital Equipment Corp.'s DECwriter line). All prefer to lease, of course, because that gives the compounded yield, the big payout over time. But financing is tight and lease capital requirements high, so throughout the industry it's common practice to finance the leases you can afford — and then sell for whatever you can clear on a tight price-cutters margin, or simply to turn over volume to make a pledged sales goal: to "wholesale" or sell cheaply at or above cost, preferably outside the seller's chosen market area.

Price-cutting is rampant

The economics of lease financing and manufacturers' volume-based step-discount schedules have made wholesaling inevitable, and while virtually everyone involved curses the price-cutting rampant in the market, it's not without a certain degree of hypocrisy, since virtually all parties aid and abet. The math is simple: with volume discounts, price-per-unit drops as resellers take more units, and any

WILLIAM CHALMERS: DEC's terminal product manager says resellers are very important and "I have to learn to live with them."

reduction of price that can be factored into terminal leases has a multiplied or leveraged effect on lease payout. Terminal leasor-resellers are constantly striving for volume to reach the higher discount level. As a caution to resellers, though, the manufacturer retains a "billback option." If the reseller doesn't turn over promised volume, he is charged retroactively for the difference between the volume-discount price he claimed and the higher price his volume deserved. It's a sure-fire formula for a high volume, bitterly price-competitive market.

Perfected the system

The company that perfected this system and evolved the most sophisticated techniques to exploit it has been Digital Equipment Corp., the Massachusetts-based minicomputer giant that has moved into terminals with phenomenal success. DEC jumped into the medium-range teleprinter market a mere three years ago; now it has a $100 million sales operation, and the DECwriter II, a 30 characters per second serial impact teleprinter, is the standard of challenge in the industry. This year DEC begins shipping its third generation machine, the programmable DECwriter III. Wall Street sources close to the company gleefully report that Digital expects to have no difficulty selling 100,000 terminals in fiscal 1978.

The first DECwriters were introduced in 1974 into a virtually moribund market that had been locked into Teletype's 10 cps, 110 baud format. By January 1975, when it introduced the DECwriter II, it had redesigned the unit to tailor it for the reseller-leasor market, using a modular, option-upgradable architecture. By early 1976, DEC had completed a crash program to develop data communications options, and sales soared. The redesign of the machine had complemented the marketing strategy, which focused on catalyzing a vigorous independent reseller network: DEC offered the highest reseller discounts in the industry, and still does, but it also promised not to lease or rent against the resellers, and never to sell to anyone in less than 50 unit volume.

It's the only game in town

"People had been out there with the old Teletype KSR 33s whacking away at 10 characters per second, and all of a sudden along comes the DECwriter at 30 cps. Cheap, reliable— it became the only game in town," ruefully acknowledged Centronics product manager Fred Graham. Centronics' new model 761 will join new units from Teletype and Texas Instruments in a direct attack on the DECwriter market this year. But, ad-

Remex launches a PDP-11 floppy disk system with above DEC performance

It's an integrated hardware/software system so compatible with DEC's RT-11 operating system that we named it Remex-11.

It connects directly to the PDP-11 or LSI-11 bus, offers about 25 percent greater storage capacity than Digital's RX11 disk system, and it costs less.

In addition, the Remex-11 provides faster throughput than standard DEC configurations with more efficient sectoring, by far. A single command transfers up to 65K words.

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CIRCLE 49 ON READER CARD

mitted Graham, "right now the DECwriter is king of the mountain!"

"I really think Digital really woke everybody up to the size of that (low end) market," he added, "just by pushing so many terminals out into the field. I mean, this year they will have sold 70,000 terminals, and the feeling is that if they had produced any more they could sell them. 70,000 terminals! From one manufacturer! That's incredible!"

Impressive anyway. Last fall, less than two years after they introduced the DECwriter II, the DEC components group, which markets DEC terminals and small business systems in volume, announced the shipment of the 50,000th LA 36, the keyboard/send-receive model (KSR) of the DECwriter II. Competitors estimate DEC sold 20,000 DECwriters in 1975, 32,000 in 1976, and 70,000 this year.

In a sense, the DEC components group is a reincarnation of its parent. The DECwriter is a device that can be sold stripped and handled in volume, and DEC laid the foundation for its astonishing growth in minis with a volume manufacturing operation and a marketing plan that concentrated on pushing raw iron into the hands of oem's. Today, with most of DEC evolving into market-oriented groups increasingly involved in end user system development, the digital components group (DCG) remains product-oriented, a lean organization dedicated to moving iron.

The mimics

DEC's success with volume-only sales and their innovative use of the resellers has inspired mimicry within the industry, but there also is considerable caution on the part of other manufacturers. All the major terminal and datacomm peripheral manufacturers have sought links with the independent resellers. Teletype Corp. has jumped its volume reseller discount from a standard 20% to 30% to ensure their interest in its model 43; and Centronics, pitching its model 761, and Data General, trying to broaden the market base for its own minisystem terminal, the Dasher, have both been wooing the resellers. But everyone is moving much more cautiously than DEC did, more than a little hesitant to risk the sort of rampant price-cutting that has characterized the DECwriter market. They want to give volume discounts and all the rest, but they want a tamer, more stable price environment. Ironically, it is Texas Instruments — the firm that first followed DEC into the reseller channel, then reconsidered and tried to back out, that now has flipped again and seems to be offering an open door policy for the smaller resellers—while DEC, having created and gotten the best of the energies in the reseller's surge, begins to force consolidation in its retail network.

Resellers' troubled cash flow

Despite their increasing market importance, all is not rosy among the resellers. The leasors' need for capital and the increasingly complex finance requirements of the business (reflecting new Financial Accounting Standards Board rules on lease accounting and the trend toward shorter lease terms), on top of the tight margins in the sales end of the business and the debt risks common in any bargain hunter's price-cutting market, have generated severe cash flow problems among almost all the resellers. And it's a highly leveraged business: machines are bought on credit from the manufacturer and leased units are wholly or largely bank financed. The industry has a long cash tunnel, with several tight corners. And as the average volume of the resellers has grown, Digital, the dominant supplier in the reseller market, has brought up tighter credit requirements. (DEC's resellers on the average took 100 units in 1975, 200 in 1976, and 350 in 1977, according to the offhand estimate of a DEC executive.) This year, particularly, Digital has begun to demand solid equity (roughly 10% of two monthly shipments). With their cash flow problems, this is a crisis for many smaller resellers. Many of these firms evolved from the Teletype repair firms of the 1960s, they're small single-proprietor companies or incorporated individuals, managers who keep a minimum of equity in the business to avoid double taxes on personal and corporate income.

Digital, while it's tightening the screws on credit, this year offered a new discount schedule that gives their largest volume retailers an even larger discount advantage over the smaller firms.

Managing tier sales

This new volume pricing, together with DEC's tighter credit requirements, seems likely to accelerate — and at least temporarily, institutionalize—the growing practice of tiering, in which

Market Size is Underestimated

Actual size of the teleprinter market is subject to some dispute, but it's accepted wisdom in the terminal industry that it's a market deeper and more elastic than any of the standard industry research profiles acknowledge.

Datapro, for instance, recently estimated that there were now more than 1.5 million terminals installed, with teleprinters and printer-only terminals accounting for 47% or 700,000 units. Yet Datapro estimated 1977 teleprinter shipments from all manufacturers at only 70,000—an estimate apparently to be dwarfed by actual total sales.

Teletype Corp., the grandfather of the industry, has shipped over 700,000 Model 33 and 35 terminals since 1962, placing about 75% of these in data communication applications (many in the Bell and Western Union systems, and the huge time-sharing market) and 25% as minicomputer terminals. Teletype now estimates that 40% of their present sales go on minis, and 60% into data communications.

Fred Graham, product manager at Centronics (a former reseller himself), believes that 76% of low and medium-speed teleprinter terminals are now attached to time-sharing systems—"That's where the big market is!" — and he and virtually the whole industry agree that despite all the hoopla about terminal sales, 70% of the market is a lease business.

With not only the gigantic Teletype base, but with both GE and Texas Instruments, among others, well ensconced in the market, Digital's terminal product manager Bill Chalmers estimates the actual installed base of conversational teleprinters to be "in the millions"—and growing at 250,000 annually. "I've seen them all, and I believe that figures normally used are woefully understated," said the gruff, amiable RCA veteran. "I have to believe that after what we've done!"

He pointed out that the price for a used Teletype has risen from $800 to $900 or $1,000 since DEC entered the business three years ago. "So they're not being thrown away, and we haven't put anybody out of business. I think the market is just much bigger than anyone realized. And with new technologies and quieter machines, I think it's more elastic and growing faster than people realized. So DEC, the new guy on the block, can dump this many machines and *still* not screw up anybody else!"

DISTRIBUTORS

smaller resellers buy through larger resellers. Anachronistically, the politics of the industry today have led many of the larger resellers to set up separate and ostensibly independent telephone booth sales operations to broker high volume turnover and manage tier sales. Atlantus, in Germantown, Md., has Data Communications International in Dallas; International Computing Equipment has National Terminal Corp., both in Oakland, Calif. and the same relationship is likely to be established between Data Access Systems (DAS) in Mountain Lake, N.J., and Transnet, a brokering operation in which DAS recently purchased a 25% interest. Other firms, preeminently Management Response in Chicago and Data Dimensions (DDI) in Greenwich, Conn., have let it all hang out and broker and tier through their normal sales operation.

The politics behind the subterfuge reflect the bitter divisions among the resellers, where there is a hierarchy of "respectability" according to lease-to-sale ratio and, more importantly, the full-service and maintenance program offered. Brokering or "wholesaling" is roundly cursed by everyone, sometimes loudest by those most active in it. The practice reflects the economic reality of the lease business and the volume discount schedules, but sales with little or no margin leave little reserve to finance maintenance and support service. Uncautious buyers sometimes get hurt, but although the industry gossip is full of damage reports and horror stories, few can be tracked down. In a handful of cases, DEC has moved in voluntarily to help a stranded end user, but —perhaps due to the extremely high reliability of the machine — "there have only been very, very few," said William Chalmers, DEC terminal manager, "less than we expected, really." There are a number of firms that have been, by reputation, predominantly "marketing companies" (large national firms like DDI, regional companies like Management Response, and local firms like Consolidated Data Terminals in Oakland, selling with DEC and third party maintenance)—but here again, the blustery volume sales image of each belies the internal effort to squirrel cash away for the lease-base development.

"Everybody leases and wants to lease more," remarked Chalmers. "If you ask me what I think is out there, I'd say there are companies that lease 70% and sell 30% and companies that sell 70% and lease 30% . . . there's a natural lid on all this called finances."

Off the record

Chalmers has a bulky earnestness that's impressive, particularly face-to-face, and he spent nearly 40% of his time on the road in his first two years managing DEC terminals, getting to know his market and his resellers. He has a habit, he concedes, of listening to everything and somehow giving the unjustified impression that he agrees when he doesn't contradict, or that he accepts a recommendation when he agrees to merely consider it. His habit and his earnestness have stood him in good stead. While there are a number of resellers who bitterly and furiously accuse him of duplicity (refusing to go on the record, like virtually all the reseller executives interviewed). Most come away from talking with him believing that DEC is biased toward them, or will at least give them a fairer shake than they had expected.

Opportunity for newcomers

Chalmers believes the reseller scheme still offers a rare opportunity for newcomers to cut into the computer industry; a mere $50,000 can be the entrance fee, he argues, but it takes financial management—perhaps more of a finance mind than is now prevalant among resellers. "If you and I start a business and we're careful and have a good cash-management program, we'd quickly find we could only put so many dollars a month away into a lease/rental program that is going to pay us big bucks in 18 months. But there are individual companies today who have not been careful figuring out what those bucks are. And so a salesman can't turn down an order—so they put a few extra terminals out on rent this month and around 12 months later those terminals bite them in the rear end, because they haven't begun to pay off yet and its still a drain on them." They still have to pay the bank on the purchase loan, against which rental payments come up short, leaving a compounding debt that hits cash flow, even if the paper equity of the machine polishes up the balance sheet.

Currently a sizable number of maintenance-supporting resellers are being sustained through the price wars by the communications market, the Western Union Telex and TWX services. Western Union decided in 1973 not to invest further in terminals, reserving capital and opening their customer base to outside suppliers. It's a perfect market for resellers, who provide used but refurbished Teletype 33s and turn over a clean 20% margin; many in the industry say this is the crutch that will support the maintenance companies until the market stabilizes with the programmable terminals.

Shake-out coming

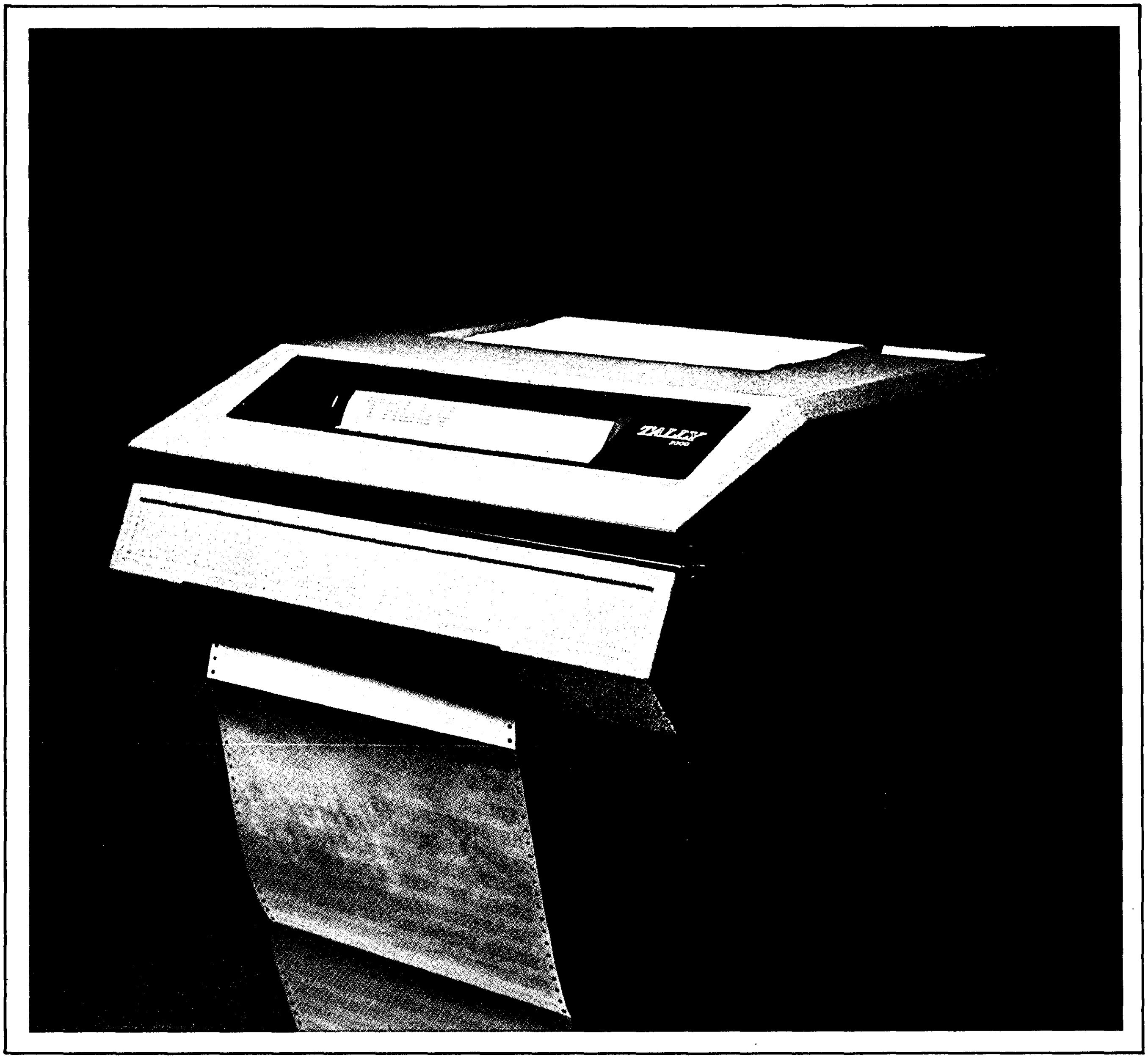
It's an industry consensus that there is a shake-out coming. Already cash flow problems plague the whole industry. Even the largest companies are not exempt, and among the smaller firms it's an epidemic. The largest national companies are heavily lease-based, Atlantus (formerly Leasco), DDI, and Carterfone Communications — all DEC-oriented — and the GE and Teletype-based RCA Service Co. and Western Union Data Services. But even size and experience are no guarantee against poor financial planning. Carterfone of Dallas is a major data communications firm, but this year it has had major financial difficulties and current cash-crunch problems have all but removed them from the market. (Earlier this year, explained Carterfone marketing director Pat Houston, the company "put itself on

DEC'S DISCOUNTS ON SCHEDULE TO RESELLERS/LEASORS

Qty.	1976 Discount	1977 Discount
5,000 plus	NA	56%
3,000-4,999	NA	50%
1,000-2,999	44%	49%
500-999	42%	48%
350-499	40%	45%
200-349	38%	44%
100-199	34%	42%
50-99	29%	40%

TEXAS INSTRUMENTS DISCOUNT SCHEDULE

Qty.	Intelligent programmable terminal, except Model 742 discount	Model 742	Programmable teleprinter — Mod. LS-120
1,000 plus	30%	NA	NA
500-999	29%	NA	48%
200-499	28%	NA	NA
100-199	25%	NA	NA
50-99	22%	22%	41%
25-49	18%	18%	NA
10-24	14%	14%	NA
1-9	10%	10%	NA



Tally reliability. As good as gold.

Tally reliability is unmatched in the printer industry. The value to you is a 100% duty cycle, 200 line per minute printer that costs far less to own. Less than any other printer around.

You can run the T-2000 as long and as hard as you want without the frustration of downtime and costly repairs. Plus, preventive maintenance is unnecessary. Sliding bearings, pivots and lubrication points are eliminated. There are no electronic timing or hammer flight time adjustments. In short, there's nothing to adjust.

The reason behind this unparalleled reliability is the patented Tally print comb mechanism. It uses a unique flexure technology that's impervious to wear and designed for unlimited life. While other printers like to talk about calculated MTBF, Tally points to field proven MTBF. Most of the Tally printers that have been in the field, including those in operation for over four years, have never required adjustment or repair to the print mechanism. In fact, many have experienced no malfunction at all! No one else can safely make that statement. And Tally backs every T-2000 with a full year print mechanism warranty.

The gold printer above is Tally's commemorative unit marking 10,000 machines delivered. The noteworthy statistic is that 99 per cent plus have never had a mechanism failure.

Find out all the facts on this proven performer and call your nearest Tally sales office, or write or call Tally Corporation, 8301 S. 180th Street, Kent, WA 98031. Phone (206) 251-5524.

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Boston (617) 272-8070 • Chicago (312) 325-9788 • Miami (305) 665-5751
Washington, D.C. (703) 471-1145 • Seattle (206) 251-6730 • Business Systems (415) 254-8350

CIRCLE 108 ON READER CARD

credit hold" with DEC when they had difficulty completing biannual refinance arrangements with their lender, Westinghouse Credit. Apparently even after that was settled in April, the 45-day marketing freeze had so disrupted its cash flow that the company had to drop into low-gear to wait it out.)

Carterfone executives echo many other service-based resellers in complaining that DEC's resale program generated this fierce price market simply because DEC didn't understand that the low-priced DECwriter would inevitably become a commodity — "traded like wheat or pork bellies." One repercussion from the price war that DEC apparently did not foresee, however, was having its own volume resellers bid against DEC's own salesmen. DEC has a tough beat competition policy that allows them to outbid whoever, and they used it several times to put uppity resellers in their place. But volume resellers, with their ability to mix and match and juggle average discounts in package deals, can put together attractive bids. When, in July 1975, Data Dimensions (DDI), by repute the most aggressive of the large resellers, actually beat out DEC for a major time-share network sale, DEC took it very seriously. "It really shook up the entire industry," recalled Chalmers. The next time the two went head-to-head, bidding Dartmouth College in August 1975, the DEC salesmen came in with an "adjusted bid" with terms that would, according to DDI, be the envy of many institutional users. By the spring of 1976, after several clashes, DDI was preparing to sue DEC for restraint of trade under antitrust laws. The suit was never filed, but the threat was apparently enough to shake up DEC; making them more careful who they "put in their place" and how.

Wading into the fray

DDI, the largest reseller for Texas Instrument terminals, led others into the fray bidding against TI salesmen too. Resellers with long experience with TI explain that TI wanted its dealers to go for the "onesy-twosey business" leaving the big business for TI's own end user salesmen. When the resellers turned against them, TI's salesmen were getting "creamed," claimed a salesman for one reseller. "I didn't have the slightest sympathy for TI," growled the sales manager for another. "They introduced a portable tabletop thermal printer several years ago; they took it around to resellers and promised them the world. Now the guys who bought the con are using those things for boat anchors, because TI turned around and went into the rental business in direct competition several months later."

TI, unlike DEC, both leases and rents against its resellers; and whereas DEC has a single discount schedule, TI offered different schedules for end users, dealers, and oem's. Apparently —TI executives refuse to discuss the situation—the resellers' rebellion came just as TI was moving to strengthen its own end user sales force. TI declared war on the resellers. Last summer they froze the dealer network, accepting no new resellers (or effectively forcing new resellers to buy as end users). Then they had their salesmen try to close on small accounts normally left for the resellers. Then in January 1977, TI decisively shuffled the deck: they readjusted the discount schedules, sweetening the oem discounts, but cutting the dealer volume discount, dropping it from a 1,000-unit maximum to a 200-unit maximum.

The jinx in the plan was the practice of TI salesmen using the oem pricing in sales pitches to a variety of clients — banks, service bureaus, time-sharing firms — that would be difficult to define as oem's in any

classical sense. By the spring of this year, TI faced at least two imminent lawsuits: one from a small Oakland reseller, Herb Williams of Consolidated Data Terminals; and a second, apparently seen by TI as a major threat, from an as-yet-unidentified end user who claimed as much right to the oem discount as Tymshare, a California time-sharing company that had received oem status.

All contracts cancelled

Williams said he was approached through a third party to be an expert witness in the other suit regarding TI's oem policy, but he planned his own suit against TI's general effort to clamp down on the resellers. He was charging discrimination because TI sold to him as an end user, refusing to give him the dealer discount, although they knew he was reselling. TI, caught in a pincer, capitulated. On June 1, TI informed all their customers that they were cancelling all contracts and again redesigning their discount program. Oem's and "dealers" are now called "resellers" and given a single discount schedule; only end users get separate rates. A number of resellers who had been refused TI dealer discounts during the little war received telephone calls inviting them to apply for "reseller" discounts. Herb Williams had a TI sales manager drop by to deliver the new contract by hand.

TI's new reseller discount schedule is interesting in that it is not biased toward high volume retailers, like the DECwriter II's new schedule—but like DEC, TI also separated their intelligent programmable terminal in a much more limited discount program. TI's discount schedule for all but the programmable Model 742 offers up to a 1,000-unit volume discount, but the schedule tightens at the high end.

Major market changes

The next 12 months are likely to see major changes in this teleprinter market: AT&T, locked out of the industry for five years by the terms of their 1971 sale of TWX to Western Union, is reentering the market; FASB rules now require payout leases to be recorded as purchases; the beginnings of a crt price war have led some industry veterans to predict a $500 crt in 1977. And most importantly, this year will see strong direct competitors to the DECwriter II enter the market with volume: Teletype 43s will be available, significantly undercutting DEC's standard LA 36 pricing; Centronics will push its Model 762, and TI is expected soon to introduce a keyboard send-receive model of its impact printer, the 150 cps model 810. The monthly rentals from the Bell companies and the FASB accounting rule probably will accelerate the shift toward shorter contract lease terms—which will only increase the difficulties of those resellers currently having cash flow and finance problems. And some resellers are already worried at having to deal with a used DECwriter market that is expected to develop over the next six months, now that the three-year term of the 1975 leases is up.

(For firms which cannot legally or practically accept any possibility of retroactive price hikes—ie. bill-backs —DEC now offers a volume terminal purchase contract which offers a lesser discount, but a discount none the less, without a billback clause. It's a deal that only the manufacturer can offer, with terms that only those firms with specific limitations on their purchasing will find attractive. DEC qualifies only purchasers with solid credit and a three-year history of major terminal buying, and limits the no-bill-back purchaser's discount by dividing the purchaser's volume commitment in half and using that figure to determine price on DEC's standard volume/discount schedule. Thus, a purchaser planning to buy 1,000 DECwriters on a no-bill-back contract gets the discount normally given to 500-unit buyers.)

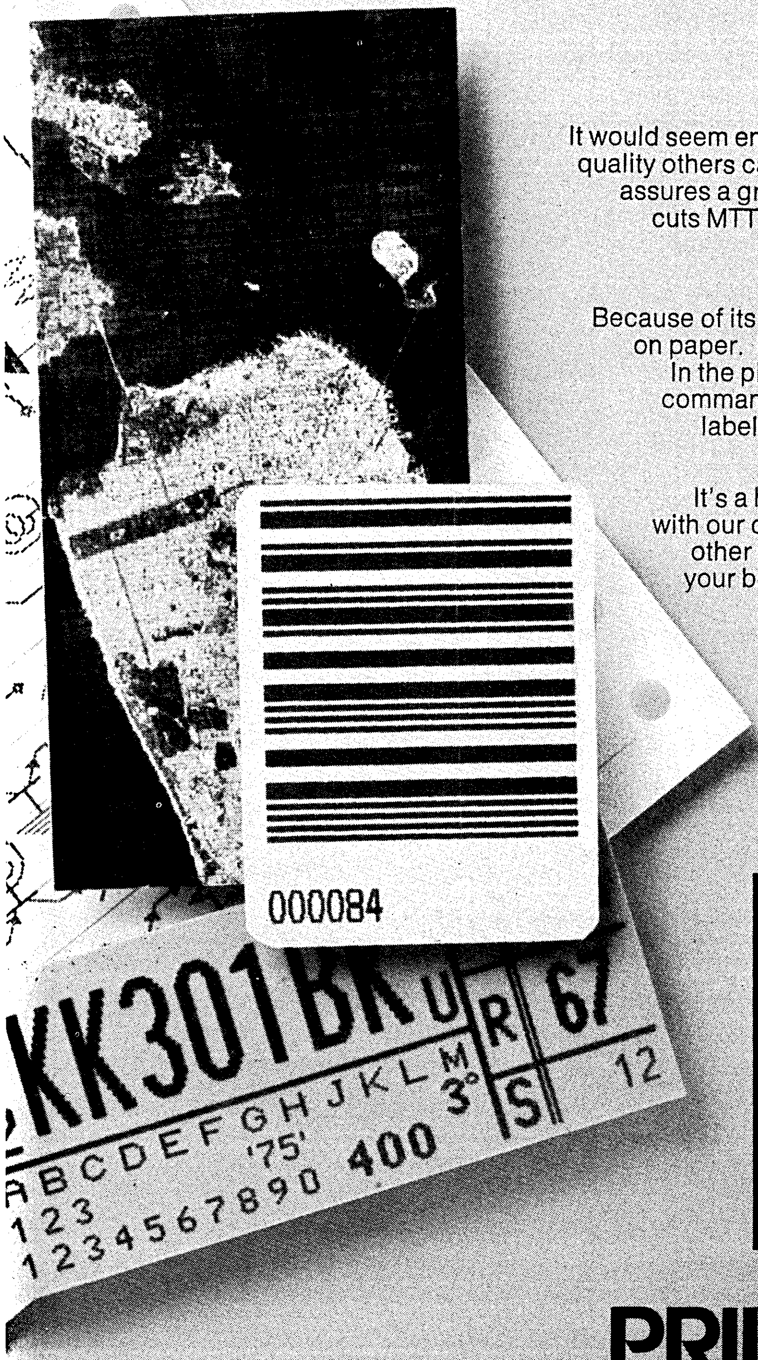
The rich discount benefits of the ultra-high volume levels have already led two of DEC's largest resellers into 5,000-unit commitments. It also may lure non-DEC independents like WU Data Services and RCA Service Corp. into the DEC sphere. Chalmers at DEC acknowledges that he hopes it will lead to refinancing among "a fair number" of DEC's present resellers. It certainly will lead the large resellers into extraordinary efforts to shuffle iron giving DEC maximum market penetration now, while their new direct competitors still are gearing up for the attack.

Perhaps revealingly, the 3,000-unit discount price for the DECwriter just about meets the resale discount price of Teletype's new Model 43, a major challenger—and the 5,000-unit price undercuts it.

Some of the underfinanced small firms that were relying on flat-cost volume turnover for their discount rate—and the few firms who were trying to make money on $50 over cost mail order sales—are in trouble. With

The concept and design of the Printronix 300 Impact Matrix Line Printer/Plotter offers you several remarkable cost/performance advantages.

Like plotting capability ...at no extra cost.



It would seem enough to find a 132 column, 300 lpm printer with print quality others can't match, with an elegantly simple mechanism that assures a greater MTBF, and a modular design that dramatically cuts MTTR. The Printronix 300 offers all of these advantages. But it also offers plotting capability. At no extra cost.

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CIRCLE 103 ON READER CARD

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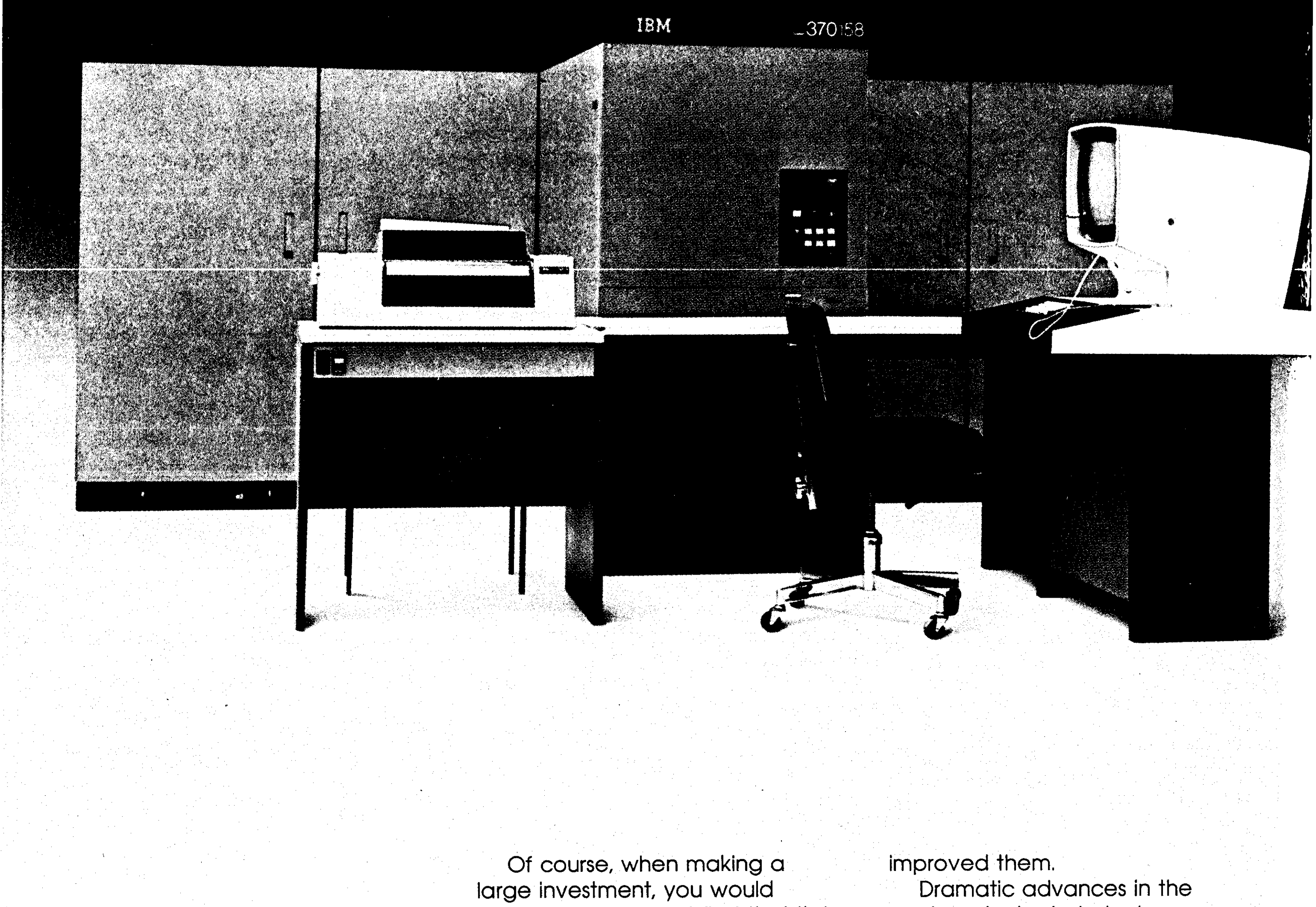


Of course, when making a large investment, you would compare price–and find that Itel offers you substantial savings over IBM. But if you didn't have to compare cost, you'd compare features–and choose Itel's Advanced System.™ Because we took IBM's best concepts and improved them.

Dramatic advances in the semiconductor industry have allowed us to build a more compact, more reliable and more powerful CPU using about half the components IBM uses. Which means Itel's Advanced System takes up much less space than the comparable IBM system. In addition, the Advanced System runs approximately 9 degrees

the big companies desperate to move machines and holding super-discount prices, the bottom line sale prices in the market will be offered by some price stability to the terminal sales end of the industry—without having undue impact on the lease base structure, which as always reflects the financing and support capabilities of the individual resellers.

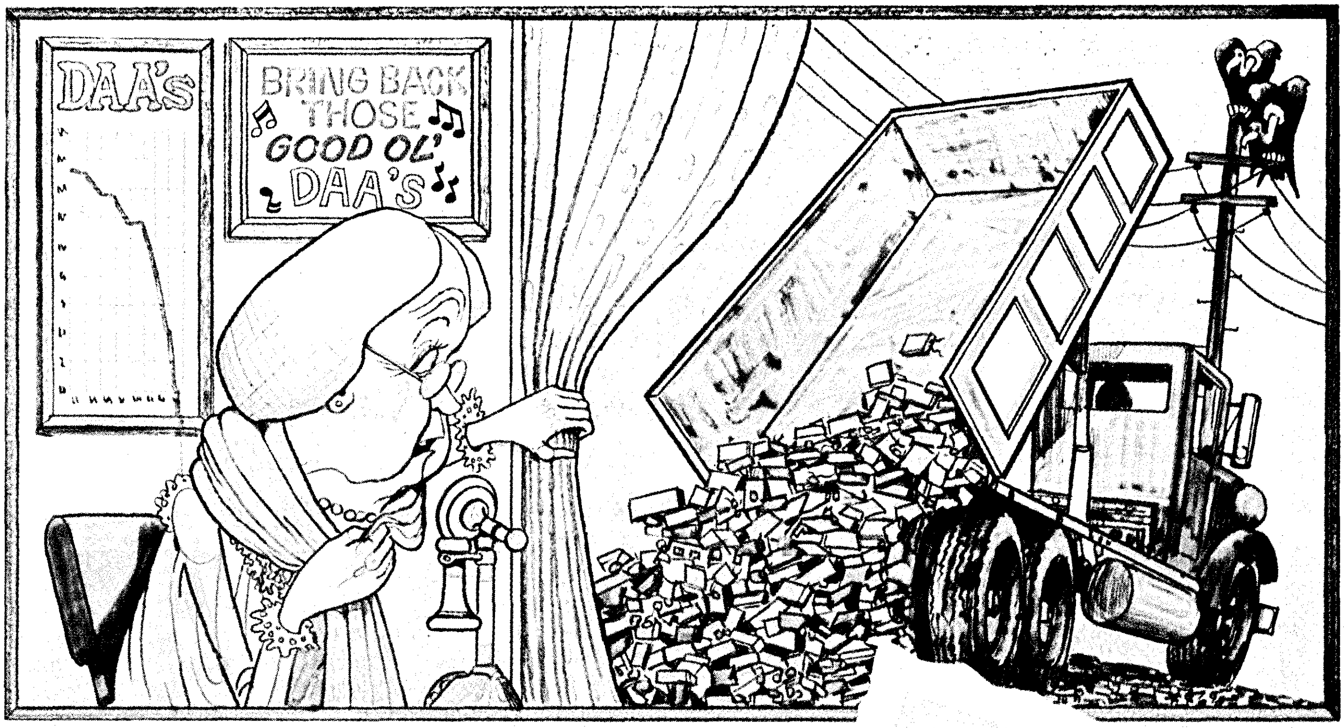
The third generation

To survey the ramifications of DEC's pricing and credit policies is to quickly sketch a model forum for the introduction of DEC's third generation terminal, the programmable DECwriter III, just beginning volume shipments. Antitrust law makes it very difficult for DEC to refuse to do business with any of their established resellers, but DEC probably won't be unhappy to lose some of the firms most threatened by the new developments in the DECwriter II market. One worry at DEC has been that dumping the DECwriter III—with its much higher service and support requirements—into the present price-cutting, fast-shuffling market could cause an embarrassing backlash from end users sold this complex piece of equipment by resellers who don't have the resources or inclination to properly support it.

Predictably, maintenance is another area in which DEC has been moving quietly to change the rules of the game. Last January, DEC surprised and angered many of their maintenance-based resellers by dropping the monthly price of DEC's own maintenance and service from $25 (a price that had been supported by many independents) to $19 a month. Said the marketing director of one of the larger reseller/leasors: "They just went around the country leaving six bucks on the table. It was crazy!"

The price cut was widely seen as a sacrifice move by DEC, cutting service margin to expand DEC's maintenance market share, estimated by resellers at a mere 6% or 7% of the installed DECwriters. What has not been clear until recently, however, is that the price drop was only part of a major reorganization of the company's terminal maintenance program. DEC until recently used its expensive computer maintenance staff to handle terminals, but as of last December they began to set up a separate organization of terminal repairmen. The price cut only reflected DEC's projected savings with the new maintenance organization, explained Jay Atlas, DEC's terminal service manager for North America, a projection of real savings they had already realized in a New York City test program. The new service organization now is operating in about 36 of DEC's 360 field service offices, said Atlas, and by the end of the year terminal specialists will be in well over 100 field offices.

The ramifications of the new DEC service program are as yet unclear, but obviously DEC will be offering a much stronger challenge to the independent reseller/leasors in the service end of the business. Certainly too, DEC will be reinforcing the service base for the DECwriter III, which with its microprocessor offers possibilities of a new world of centralized, on-line diagnostics and faster, cheaper terminal support. But in the current "old world," there may be some interesting complications. Some resellers report that they have been recently approached by DEC service salesmen and told that the new organization will enable DEC to offer service frills like onsite service during warranty and guaranteed fail-to-repair time with temporary unit replacement as backups, all of which would imply major changes in the contract terms and conditions the DEC component group currently offers. Top DEC repairman Atlas says he is studying the possibili-



Dear Ma:

You may be getting back some DAA's now that Vadic modems no longer need them.

A lot of folks will be moving out of your high rent district, Ma, now that Vadic is delivering direct connect 300 bps modems, the first to be registered under Part 68 of the new FCC rules.

It's an historic occasion, because modem users happily will no longer have to spend from $4 to $8 each month renting your Data Access Arrangements (DAA). Instead, the new Vadic 317S connects directly to the telephone network, using the FCC approved data jack.

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From now on, Varian's complete line of mini's will be brought to you by the mini-computer operations of Sperry Univac.

The whole family—from the world's first mainframe on a board to the top of the line—will carry the Sperry Univac label.

Of course, these machines were always a good buy. But now they're assured of all th service and support that Sperry Univac can command. All the former VDM employees, all the dollars, all the dedication.

What's more, we're totally committed to

ties of the fail-to-repair guarantee and replacement units, but notes cryptically that the warranty terms (which currently require that damaged sections of the machine be returned to DEC through the reseller who originally purchased the unit) have been integral factors in determining prices. As much as the volume-only sales policy, the contract T&C's which shift the cost of depot support and warranty follow-up onto the resellers have been cornerstones of DEC's component group market strategy and pricing. With the independent distributors already realigning themselves to adjust to DEC's ultra-high-volume discounts, the impact of DEC's new muscle in maintenance puts another wild card in the deck.

Syndicates locked out

There have been some attempts among smaller resellers to form syndicates or consortiums and buy collectively to get high-volume discounts, but DEC has refused to accept purchase orders from syndicates. Other companies have talked merger: Selecterm Inc. of Wakefield, Mass., and Data Access Systems Inc., two of DEC's most substantive regional resellers, met with Teltex of Dallas to discuss merger possibilities in a secret Virgin Islands conference after the Dallas NCC in June, but the talks apparently have broken down. Other groups have met around the country, but, as Chalmers at DEC remarked, "The individuals who are now running the businesses in this industry are rugged individualists. And when they get together to talk about who should take whose orders, it's probably the guy who has the least assets who thinks he should run the other guy's business."

Chalmers, the DEC point man whose personal pledge that DEC wouldn't lease, rent, or sell less than 50 units has been one of the few solid touchstones in this volatile and distrustful industry, has a list of complaints about resellers, yet remains firmly committed to the concept. "Doing business with this group of people may cause me more trouble or ulcers than it's worth," he grumped recently. "But right or wrong, I have a sense that they are very important and that I have to learn to live with them. . . . We kind of played right into their marketplace. By choice. And as I sit here talking to you, I still believe that this distribution channel is the most important asset that we have—beyond the good name of Digital and the quality of the product." ☼

There's a very thin line between making it or breaking it.

That's important to remember with high-density drives.

The advantages to 6250 CPI recording — like higher data transfer rates and a reduction in library size requirements — are numerous.

But there are also some disadvantages. One of them is the masking by the GCR format. Because of it the only way to get an accurate error listing is through sense byte interrogation. Ask your Graham product technology man why.

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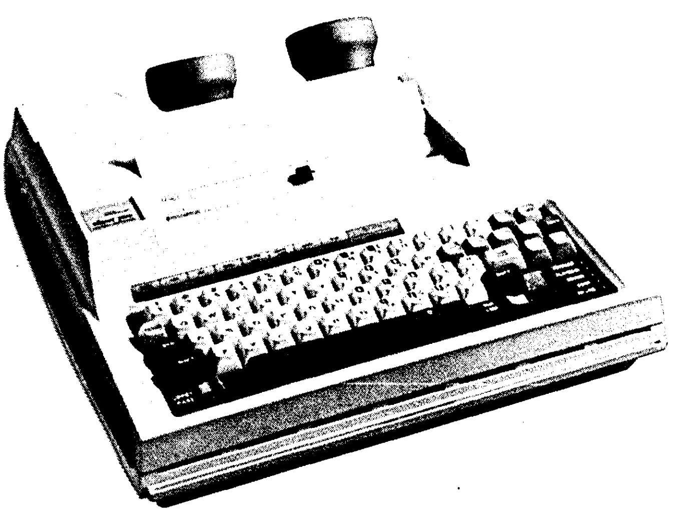
CIRCLE 57 ON READER CARD

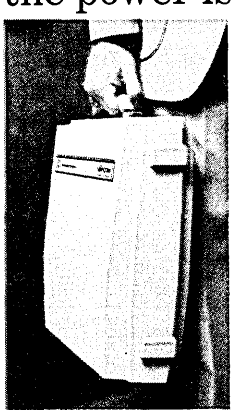
TI's new portable means remote



Until now, remote order entry meant expensive on-line operation with a computer via a telephone line.

But TI has changed all that.

The new *Silent 700** Model 765 Portable Memory Terminal has built-in bubble memory. So it can remember, even when the power is off, while it waits to talk to your computer.



With the 765 you can enter sales and order information all day long using the typewriter-like keyboard.

Then you can edit when you have time. The 765's powerful, yet easy-to-use text-editing functions let you add, delete, locate, and correct data on the spot. So you can transmit more accurate data when the phone rates are lower. At a fast 30 characters per second.

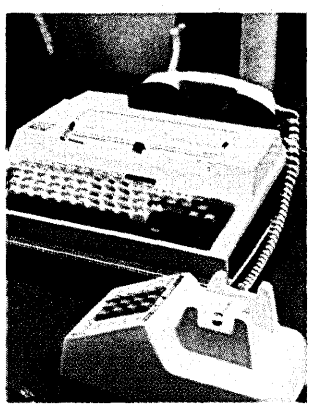
Traveling companion. Lightweight portability is the key to convenient field use. And at 17 pounds, the 765 is really compact.

But it's no lightweight when it comes to features. With its built-in numeric cluster, keyboard with upper and lower case characters, quiet 30-cps printer, and acoustic coupler for telephone connection, the 765 is a heavy-duty operator.

And the 765 gives you plenty of storage space. The basic terminal comes with 20K bytes of memory. And it can be expanded to 80K bytes—the equivalent of up to 20 fully typed pages.

memory terminal order entry.

Office companion.
Many people want a terminal with the features of the 765 for applications where portability is not required. So we designed the Model 763. A table-top version of the 765, the 763 has the same performance capabilities in a compact unit, and comes standard with either a TTY current loop or EIA interface instead of the acoustic coupler.



Small price for remembering.
TI's new Model 765 Portable Memory Terminal is priced at only $2,995.† Additional 20K increments of bubble memory are $500† each.

And, the table-top Model 763 at $2,695† is another price/performance leader. Of course, quantity discounts and a complete range of lease programs are available.

TI terminals mean business.
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The pioneer of small business computers now makes small business computers.

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Now we do.

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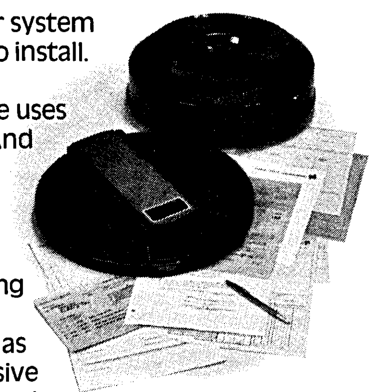
And the Basic/Four systems we make have been running, bug-free. Just like before – only better. The best small business computers available.

All-around simplicity



We also made sure our system would be the easiest to install. And operate.

The software uses BUSINESS BASIC. And we have applications modules that are preplanned and packaged, including such eminently usable programs as CBS (Comprehensive Business System) and EASY, an exception analysis system. Plus a multitude of specialty packages. For hospitals, insurance, travel agencies, bond brokers, banking, the apparel industry, trucking, publishing – literally dozens, and more on the way.

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Our specialty is small business computers; it engages our full attention, dedication and effort. And, of course, as the pioneer, we've been at it longer. Long enough to have established through SORBUS INC., our sister MAI company, a national network of support and service, 24-hours a day, if needed.

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And now we make our own. So we *know* we're offering the best.

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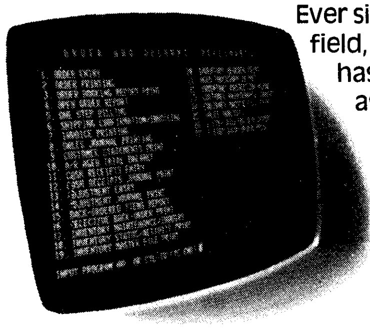
Look to the pioneer



Ever since we pioneered the field, our operating system has been acknowledged as the best of any small business computer. It had to be – because our systems were always interactive, even when others were batch.

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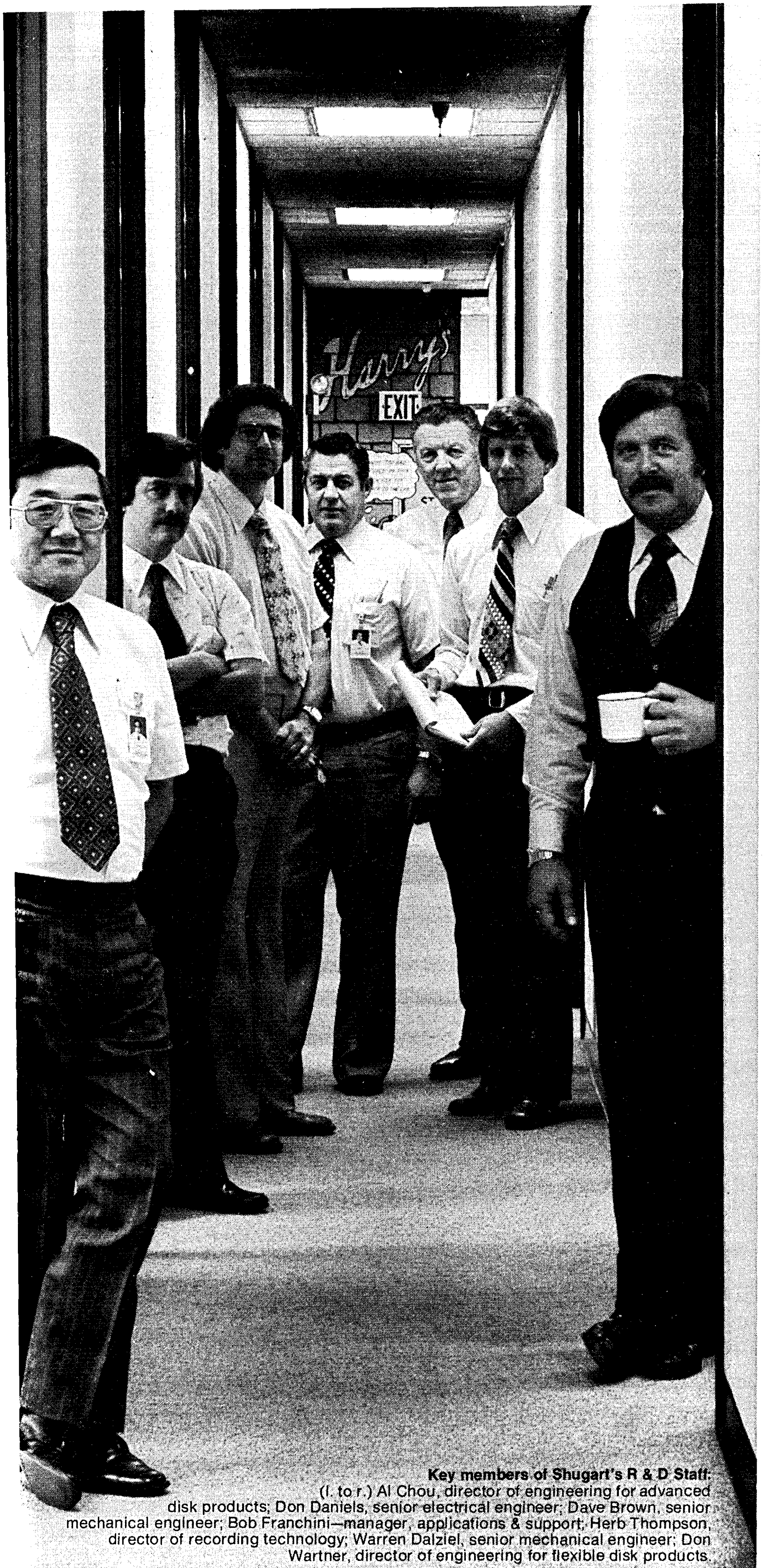


Key members of Shugart's R & D Staff:
(l. to r.) Al Chou, director of engineering for advanced disk products; Don Daniels, senior electrical engineer; Dave Brown, senior mechanical engineer; Bob Franchini—manager, applications & support; Herb Thompson, director of recording technology; Warren Dalziel, senior mechanical engineer; Don Wartner, director of engineering for flexible disk products.

They work for Shugart.

That's why Shugart works for you.

Commitment. Founded in 1973, Shugart is committed to being the leading independent supplier of low cost disk storage. To be a leader in this complex product area, we believe you must understand the basic technology and concentrate company resources on applying this technology to provide cost-effective products.

Technology. Our engineers invented floppy technology. This has allowed us to make industry breakthroughs like the first independently developed IBM compatible floppy disk drive, the first double density drive, the first minifloppy® and the first double-sided, double density drive. These product developments are at work in more than 100,000 drives.

Experience. Our engineering staff holds more than 40 patents in disk and related technology. They developed the first floppy and all subsequent generations. At Shugart alone in the past four years, our engineers have 17 patents applied for or granted.

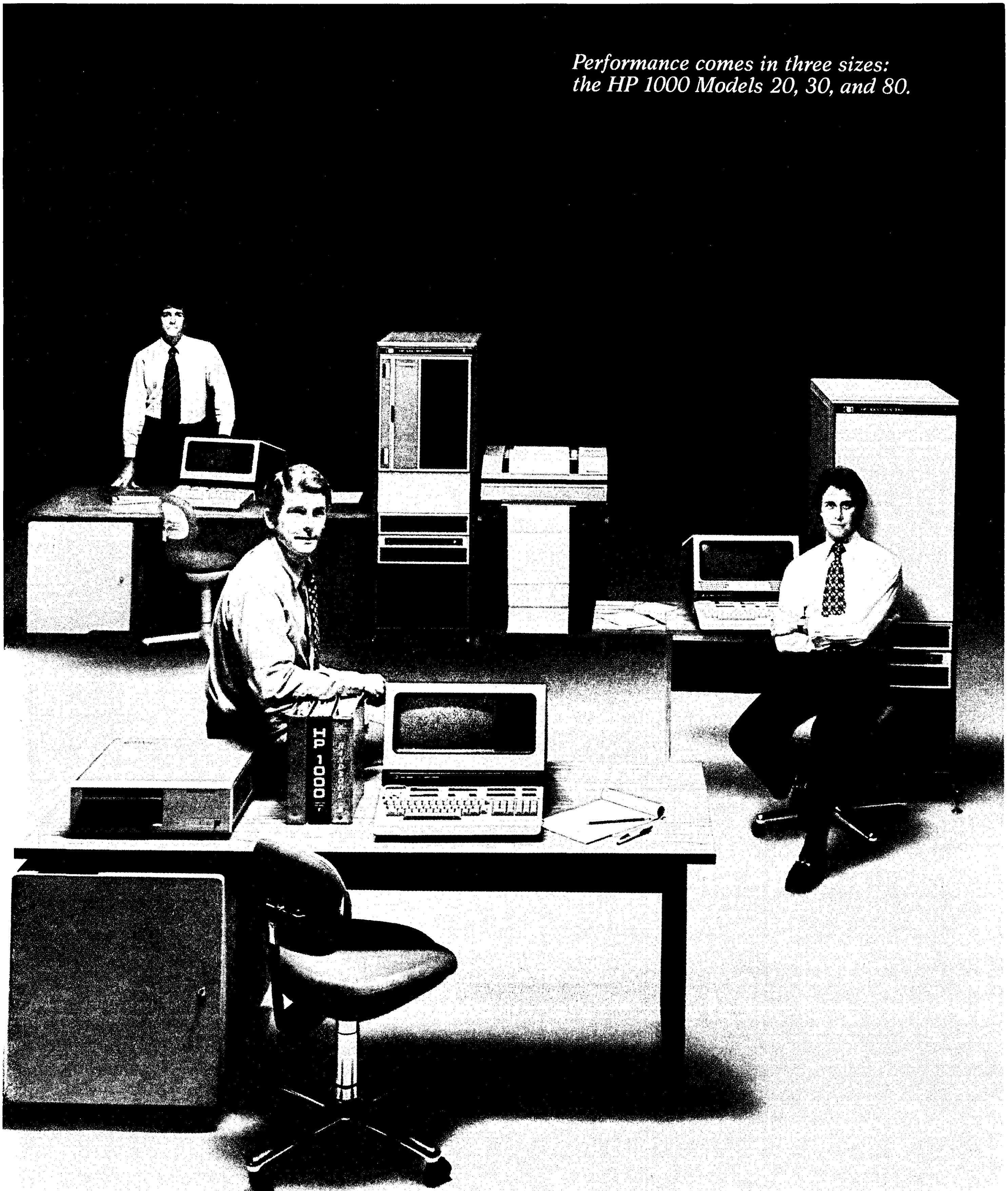
Leadership. More commitment, more technology, more experience. That's why more OEM's choose Shugart drives.

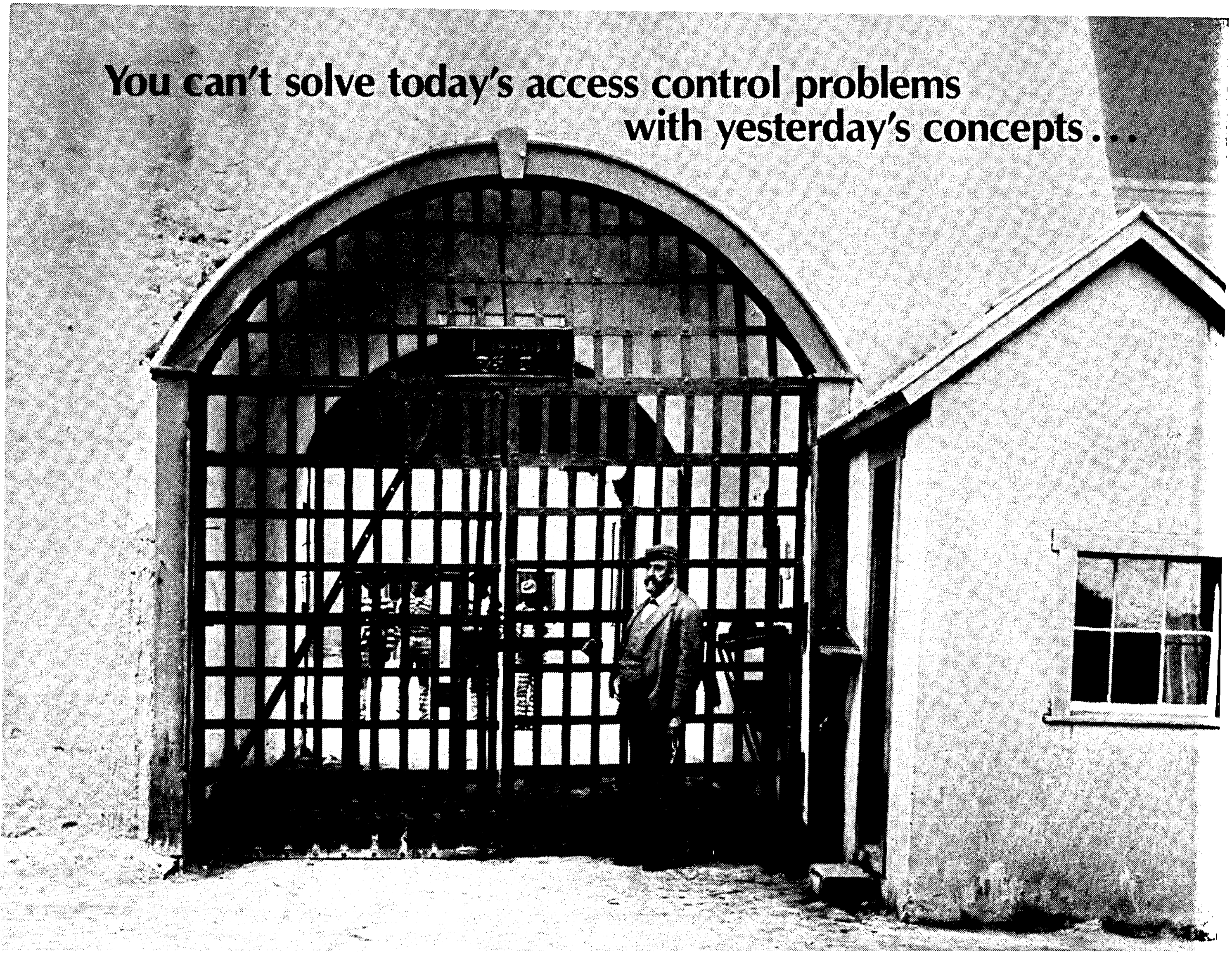
Shugart. The leader in low cost disk storage.

Shugart Associates

415 Oakmead Parkway, Sunnyvale, California 94086
Telephone: (408) 733-0100
Europe Sales/Service: 3, Place Gustave Eiffel, Silic 311
94588 Rungis, France Telephone: (1) 686-00-85

CIRCLE 7 ON READER CARD


Performance comes in three sizes:
the HP 1000 Models 20, 30, and 80.
HP 1000



When a valid command card passes within 4 to 6 inches of a concealed sensor, the door is activated immediately. Command cards may double as employee ID cards and can be used to activate the Schlage system while remaining in a pocket or purse.

Consider the hidden alternative — Schlage Electronics Access Control System

Schlage Electronics introduces an access control system that not only eliminates the need for guards and conventional keys, but for card slots or pushbuttons as well. It's the "hidden alternative," the first practical application of electronics technology to control access for business, industry, even residential complexes. Easy to use and install. Regulates and records access by door, time and individual. The Schlage system operates by proximity. A hidden sensor scans a credit card-size command card and transmits signals to a control unit, which regulates access, and to a printer, which records access and attempts. You program the system to suit your needs. Planning and installation is as close as your nearest Schlage Electronics dealer, backed by over 50 years of security service. You can start solving today's access control problems by calling toll-free, (800) 538-1755. In California call (408) 736-8430.

SCHLAGE ELECTRONICS

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CIRCLE 126 ON READER CARD

Survey of Small Business Computers

by Alyn J. Gorman, Edmund J. Armon, and Kathleen M. Fehrenbach

A net loss of nine vendors since last year's survey suggests a maturing and highly competitive marketplace for these 88 suppliers to serve.

It's not yet as ubiquitous as the office copier, but the small business computer is getting there.

Shipments have grown from $794 million in 1972 to $1.4 billion in 1975 and are expected to continue to grow to $2.2 billion by 1980. It is estimated that there are more than 100 participants in this lucrative market if systems houses are included. This update of a small business computer survey published by DATAMATION in October 1976, details characteristics of 249 systems currently available.

Generally, each system consists of a keyboard crt for data entry (cards, floppy discs, or cassettes also may be used), a processor with some 8KB of memory, a disc for file storage, and a 30 cps serial printer.

Increasing costs and complexities of doing business are forcing small businessmen to find ways to cut labor costs and gain tighter control over operations, and more and more of them are turning to the small business computers. But, small business computers (SBC's) are not only attractive to small business. Contributing to the growth of SBC's is the rapid increase in demand for distributed processing computer systems and word processing systems. This is attracting large companies to the market.

Major competitors in the market are IBM, Burroughs, NCR, Digital Equipment, Hewlett-Packard, and smaller firms like Basic/Four, Microdata, Nixdorf, and Wang.

In price and performance, SBC's span a wide range that fills the gap between conventional accounting machines and medium-scale computer systems. Purchase prices generally fall between $5,000 and $100,000. Microcomputer companies such as Applied Data Communications, Applied Systems Corp., Cado Systems Corp., and Wintex Computer Corp. are offering SBC's that sell for $20,000 and under.

Wide open market

It's a wide open market, still at a stage where eventual domination by the larger firms is uncertain.

And, as with all data processing markets, caveat emptor is the watchword, particularly for the first time users. These frequently have little or no understanding of data processing principles and are in danger of buying the wares of the salesman who arrives first or sells hardest.

No company should ever buy a computer from the first salesman who comes through the door. It's always wiser to check out the offerings of at least a few of the other major suppliers. And a buyer shouldn't hesitate to play one vendor against another in an effort to get the most for his money. All promises of extra software, technical support, or other concessions should be spelled out in the contract.

Before seriously considering the acquisition of any SBC, a buyer should demand:

- detailed specifications of all pertinent hardware and software;
- a full scale demonstration of the equipment on at least one of his own principal applications or, if that's not practical, on a demonstration program whose functions are similar enough to his own needs so that realistic conclusions can be drawn about the system's processing speed and ease of programming and operation;
- a detailed proposal that spells out exactly what equipment, software, and technical support will be supplied, estimated processing times for each of his applications, all responsibilities of both the vendor and the buyer, and the total purchase price;
- a list of users in his geographical area who are using the system for similar applications.

These users should be contacted and asked about their experiences. They can provide good leads as to what pitfalls to watch out for in installing and using the system.

Software is critical

Software is a critical area to be evaluated. Availability of software should be carefully investigated and the investigation should include the programming languages, preprogrammed utility packages, and application packages. Vendors' claims and promises concerning the availability and capability of software should be carefully checked. This is particularly true of software that has been announced but not yet released. Vendors have been known o fail to live up to their marketing publicity.

The small business SBC user typically starts with no programming staff. In such a case it is important that appropriate program packages be available to fit specific requirements. If they're not, the buyer should require the vendor to take on full responsibility for writing and testing the initial programs he'll need. The alterna-

This article and the accompanying comparison tables are condensed from material published in *Datapro Reports on Minicomputers*, a looseleaf information service that includes detailed technical reports on most of the computers listed here.

The 62-page report, "Small Business Computer Specifications," on which this article is based, can be obtained separately from: Datapro Research Corp., 1805 Underwood Blvd., Delran, N.J. 08075. The price is $12; postage and handling are free if a check accompanies the order.

tives are recruiting and training a programming staff or paying an outside software firm. Both are costly. If not kept under strictest control, software costs can accumulate until they equal, or even exceed, hardware costs. Potential dollar savings can quickly be devoured by software costs.

Availability of reliable and qualified vendor support for both equipment maintenance and software aid is another vitally important factor in the business minicomputer environment. The limited resources generally available to small computer users make them heavily dependent on their vendors for such assistance. In many cases the vendor will even design the initial system and make required changes to his program packages. The ability of the vendor to render competent and continuing service is a vital concern.

Some vendors do not offer equipment maintenance and/or software to complement their hardware offerings. In such cases, the user must deal with independent firms in order to complete the packages. In one respect, this is good, because overall costs may be lower. However, when a problem occurs, the finger-pointing game can begin; one vendor blaming another for the system's malfunction. Fortunately, this doesn't happen often. The multi-vendor approach can work well. If it didn't, the independent equipment maintenance and software firms would disappear, and that just isn't happening.

Purchase vs. lease

And then there is the question of purchase versus lease. The single most important consideration here is the length of time that the particular system is likely to be able to handle the data processing requirements of the buyer's company. Is there room for system expansion, with regard to both the processor and the peripherals, or is this the top of the line? In most cases, it is not a wise decision to make a first system the most powerful system offered by a particular vendor. If a company's operations expand, how can the system be expanded? Will it be necessary to acquire a new and more expensive processor? Worse yet, will it be necessary to change vendors? Generally, if a buyer feels confident that a particular system can handle his data processing needs for five years or more, purchasing the system will be advantageous. But, if he's selected the top of the line or if there are fewer than five years of potential life in the system, it would probably be better to lease.

From a basic configuration — data entry unit, cpu, storage unit, and printer — there is only one way to go, up, to more memory, additional peripherals, faster printers. The one limit should be what the buyer's wallet will allow.

A prime appeal of turnkey vendors such as Basic/Four, Mini-Computer Systems, Qantel, and STC systems is that all software is written by the vendor and there generally is a clear migration path. Most of these vendors also sell small business computers and services exclusively and, in many cases, are themselves small businesses. As such they understand the small business user, and what they lack in size and resources is often compensated for by their quick reaction time to problems, general expertise, and eagerness to satisfy.

All this also is true of the growing number of companies now offering microprocessor-based small business systems. This group, still in its infancy, seems destined to be a major force in the SBC marketplace in the near future.

Equipment from Europe

European-made equipment is making a much greater impact upon the

Minicomputer Use Up and Increasing

A 21% increase in unit volume purchase of minicomputers in 1977 over 1976 is projected by a study conducted by DATAMATION and G. S. Grumman/Cowen Institutional Services.

A 41% increase in minicomputer purchase dollars is projected reflecting a foreseen step-up in average system price.

These conclusions are based on a survey of DATAMATION readers who indicated an interest as a user or buyer of minicomputers and/or microprocessors when qualifying for their DATAMATION subscriptions. User responses totaled 4,639.

Not surprisingly, the survey indicates Digital Equipment Corp. will dominate among vendors selling minicomputers in 1977. Survey results gave DEC 39.6% in terms of units and 37.3% in dollar volume. Other vendors got: Computer Automation, 4.4% units and 2.9% dollars; Data General, 17.3% units and 15.2% dollars; Digital Computer Controls, 1.6% units and 0.4% dollars; General Automation, 2.4% units and 1.4% dollars; Hewlett Packard, 5% units and 9.1% dollars; Honeywell, 2.5% units and 1.9% dollars; IBM, 2.9% units and 2.5% dollars; Interdata, 3% units and 3.7% dollars; Microdata, 2.6% units and 2.4% dollars; Modular Computer, 2.4% units and 4.7% dollars; Texas Instruments, 2.7% units and 1.7% dollars; Varian, 1.8% units and 2.1% dollars and others, 10.8% units and 14.7% dollars.

The survey showed that add-on purchases are an important component of respondent spending, especially in the case of end users. Respondents indicated 17.1% of their 1977 minicomputer spending was slated for add-on purchases for memory and peripherals.

Respondents also indicated that some 2,300 of the minicomputers being purchased in 1977 would be for applications otherwise considered for, or previously performed on large mainframe systems.

The survey showed that applications areas with above average functional substitution of minicomputers for large mainframes included business data processing, scientific/engineering computation, time-sharing, and education.

By Standard Industrial Code (SIC) category those which apparently will be above average in substituting minis for big mainframes are food and kindred products, printing and publishing, rubber and plastics, banking, executive, legislative and general government, and administration of economic programs.

As for standalone use of minis as opposed to their use in a multi-cpu network, the survey indicated that Honeywell, Modcomp, and Prime equipment appear to be most heavily involved in multi-cpu configurations.

By vendor, respondents indicated standalone versus part-of-network use as: Computer Automation—standalone, 74%, part of network, 26%; Data General—standalone, 72%, part of network, 28%; DEC—standalone, 67%, part of network, 33%; General Automation—standalone, 76%, part of network, 24%; Hewlett-Packard—standalone, 76%, part of network, 24%; Honeywell—standalone, 51%, part of network, 49%; IBM—standalone, 73%, part of network, 27%; Interdata—standalone, 58%, part of network, 42%; Microdata—standalone, 79%, part of network, 21%; Modcomp—standalone, 51%, part of network, 49%; Prime—standalone, 53%, part of network, 47%; Texas Instruments—standalone, 70%, part of network, 30%; Varian—standalone, 67%, part of network, 33%. ❋

small business computer market than in any other segment of the U. S. computer market. Honeywell, International Computers Ltd., Olivetti, Philips, and Nixdorf are marketing equipment manufactured in France, Great Britain, Italy, the Netherlands, and Germany.

The range of equipment from which to choose is wide and growing. Marketing methods differ too. A buyer can buy directly from a manufacturer or a systems house, or he can deal with a dealer. While we're a long way from the point where computer systems are sold like automobiles—off the show room floor—a growing number of SBC vendors have what they describe as auto company-like arrangements with a network of dealers. These include Microdata, Basic/Four, and such smaller companies as Randal Data Systems and Business Systems Products.

And there are alternatives to SBC's for the small business user which should be considered before a decision for an SBC is made. Many small companies (fewer than 200 employees and sales of less than $5 million) have elected programmable calculators, computer service bureaus, or time-sharing companies to provide the same or comparable services.

Each user must decide which alternative provides the most cost-effective solution to his problem. Beyond that, decisions must be made regarding expandability, flexibility, ease of operation, reliability, turnaround time, compatibility with present operations, and the desirability of keeping all operations in-house. After careful consideration is given to these aspects and any other factors peculiar to a given buyer's operations, an informed decision can be made as to which approach will work best.

No report on today's small business computers could be totally complete. The field of suppliers is just too large and growing too fast. However, in this survey, every reasonable effort has been made to include all of the major suppliers and a high proportion of the smaller ones. The absence of any company from these comparison charts means either that the company was unknown to us or that it failed to respond to our repeated requests for information.

Reading the tables

The chart entries require only the following minor explanation:

Model highlights and *No. of models:* Space considerations made it necessary to combine many manufacturers' various models into a single column. This was only done when the various models were based on a common processor or compatible processors. The series name was retained in description, but specific model numbers are not present in every case. The number of compatible models combined is listed. (It should be pointed out that this "shrinking process" was not done by Datapro in its report; model attributes are listed for each model in the manufacturers' line-up.)

Communications: As an example of how complete the small business vendors' offerings have become, it wasn't always possible to list every communications protocol offered. Prospective users should either obtain the Datapro survey or rely on information supplied by the vendor through the reader service card mechanism.

Word size/add time: Add time was originally intended to be the time required to develop the arithmetic sum of two operands of at least five digits each. Most of the add times actually supplied, however, are for adding two words; some vendors didn't say how many digits were being added, and most of them obviously supplied register-register add times, not including fetch time from memory. Still, the figures can be thought of as a sort of *relative* (and somewhat subjective) power rating for the machines.

Peripherals: Not listed in the section of each column is "alphanumeric keyboard," but all of the computers included may be assumed to have one — though sometimes as an option.

Pricing: Base system purchase prices and lease or rental figures are approximate. They are included only as pointers.

Notation: Some abbreviations used might not be immediately recognizable, including "seq" and "indexed seq" for sequential and indexed sequential access methods; "cart," "pack," and "fixed" for cartridge, disc pack, and fixed-head disc; "10-key" for numeric keypad; and "ppt" for punched paper tape.

Two other features of the tables require explanation. First, the notation "n/g" sometimes appears; it means "not given" rather than something derogatory. Second, "support" means different things to different people, and the true story as to what each vendor means by support should be obtained directly from them. *(Tables start on p. 194, vendor index, p. 222.)* Good hunting! ☼

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There isn't a single single-that can touch Tandem in

To begin with, we're twice as good. With multiple processors. It's as simple as this. On-line means on-demand, and one processor won't do. Because any processor, even one of ours, can fail. And if that failure occurs during a peak period of transactions, you're out of business while it's down. And out of luck if you miss your re-start point or clobber your data base. And out of control if you lose or duplicate the transactions in process when the failure occurs.

You need a NonStop™ System.

Tandem has built the world's first multiple processor system, designed from scratch in both hardware and software, to provide non-stop processing—even during a failure—with no penalties in the speed, capacity, throughput or memory utilization of the system.

And it can grow without penalty. Starting with a basic two processor system, users can add processors, memory or terminals incrementally all the way to a fully expanded system of sixteen processors supporting 2048 data communications lines, with individual files of up to four billion bytes fully supported by a comprehensive data base management system. But the best part is that you never have to reprogram. Ever. Your Tandem NonStop System just gets bigger and better. At remarkably low cost.

Why the big ones fail.

The big mainframes are expensive to begin with. And even they can fail. Which can leave you high and dry in the on-line environment. But there are other difficulties with the big numbers, too. Of prime consideration in the on-line world, they offer very limited throughput for their price. And by the time you've hung a lot of communications lines on them, they suffer a derating which makes their performance even less attractive.

And whereas you may eventually need that kind of horsepower in your on-line system, chances are it's an expensive overkill at the outset. What you need is a system which will do the job efficiently on the way in, and grow as your needs grow, in modest price increments. It makes the big systems people wish they were more flexible.

One mini just won't make it.

Minis have made a name for themselves, justifiably. But in the world of on-line, where needs keep growing, the one mini system just can't cut it. With the architectural limitations inherent to a single mini system, growth can build system overhead so fast you'll grind to a halt before you know it.

And strap-ups will kill you.

The answer might seem to be to strap two processors together. One goes down, and the other takes over. Right? Wrong. It's not that simple. System software for a single processor system won't run on the strap-ups. And the fate of any transactions-in-process at the time of a failure is unknown. As is the state of any records being updated. And growth beyond the original system capacity is well nigh impossible.

What you really need is the one multiple processor system designed for multiple processor operation. Tandem's NonStop System.

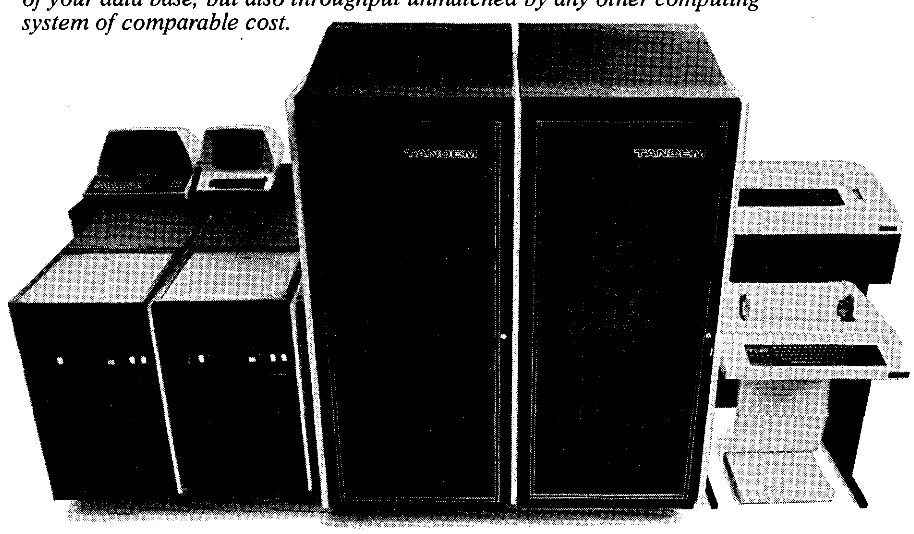
The four major "on-line" considerations.

When anyone is considering an on-line system, regardless of size, there are four primary points to consider. Throughput. Availability. Data Integrity. Transaction Protection. The system must be able to handle the job. It must be there when you need it. You must be sure of the integrity of your data base. And you must be sure you don't lose or duplicate a transaction. Even during a failure. No single processor system anywhere can provide that assurance. It takes a multiple processor system designed for the on-line environment, and Tandem is it.

For better throughput, spread the files.

We built the Tandem NonStop System with geographic independence of programs and files. They're handled automatically under Enscribe, our Data Base Record Manager. And instead of having one processor with one bottlenecking channel and a

The Tandem 16 NonStop System is composed of multiple, independent processors with dual redundant communications paths. The unique interaction between Tandem hardware and software assures not only continuous operation, and the integrity of your data base, but also throughput unmatched by any other computing system of comparable cost.



Manufacturer	Advanced Information	Advanced Information	A. K. Industries	A. K. Industries	Anderson-Jacobson
System Highlights	System 3000	System 4000	AKI-90	AKI-91	1500
No. of models	3	1	1	1	1
No. installed/date	60 since Mar 75	since Oct. '76	10 since Nov. 1974	1 since Aug. 1976	since April 1977
Multiprogramming	5 partitions	12 partitions	no	2 partitions	8 partitions
Communications	15 lines (2780, 3780, SDLC)	Unknown limit of lines	1 line; synch/asynch/ 2780	8 lines; asynch/synch/ 2780	9 lines (own protocol); opt asynch
Applications	insurance, inventory, word proc., order entry, distrib.	ins, inven, word proc., order entry, dist.	inventory	inventory	CPAs, public accountants
Processor	Interdata 7/16	Interdata 7/32 or 8/32	Datapoint	8080A	AJ 1500
Internal storage	32-64K core (1usec)	128K-1M core (750-300 nsec)	16K MOS	32K-64K MOS	32K-64K MOS core (1.2 usec cycle)
Word size/add time	16bits, 1.5usec	32bits, 600nsec	8bits/not given	8bits/not given	8bits/4usec
Mass Storage					
Discs	floppy, cart, pack	floppy, cart, pack	floppy	pack	floppy, cart
Access methods	random, seq. indexed seq.	random, seq, indexed seq,	random, seq, indexed seq	random, seq. indexed seq	sequential, direct
Mag tapes	reel-reel, cart, cassette	reel-reel, cassette, cart.	no	no	no
Peripherals	10-key acct keyboard, ppt, card, serial print (165cps), line print (to 600lpm), mag card, crt	10-key, acct keyboard, ppt, card, serial print (165 cps), line print (to 1000 lpm), mag card, crt	serial print (165cps), line print (to 600lpm), crt, 10-key	10-key, serial print (165 cps), line print (to 600 lpm), crt	10-key, line printer 300lpm serial print (45, 120cps) crt
Software	COBOL, RPG, FORTRAN, macro assemb, PL/1, acct pkg, dbms, BASIC	COBOL, FORTRAN, BASIC, macro assemb, PL/1, acct pkg, dbms	BASIC, assembler, Databus, Dataform, acct pack	BASIC, assembler	BASIC, assembly, ESP acct package
Base Prices	$18,528 ($426/month)	$66,750 ($1,535/month)	$25,000 ($550)	$30,000 ($660)	$19,990
Software/support	soft extra, support incl	soft extra, support incl	included	included	soft and supp extra
Comments			turnkey system; does not require dp professional for operation	turnkey system; does not require dp professional for operation	Two diskette system; also avail w/four diskettes; up to 10MB

Manufacturer	Applied Data Comm.	Applied Data Processing	Applied Digital Comm.	Applied Digital Comm.	Applied Digital Comm.
System Highlights	Series 70	Resource/100	101	201	301
No. of models	1	1	1	1	1
No. installed/date	100+ since May 1975	n/g June 1976	since 1977	since 1976	since 1977
Multiprogramming	yes	yes	yes	yes	yes
Communications	2 lines (asynch/synch/ bisynch)	7 lines; asynch to 1,200 bps, IBM 2780	no	no	no
Applications	n/g	not given	medicine, mfg.	process control	mfg. mgmnt., acctng., data logging
Processor	Intel 8080	Data General Nova	Wang 2200	Varian V77	HP 2100
Internal storage	16K-64K MOS (2usec)	64K-212K core (1usec)	8K-32K MOS	8K-32K MOS/660nsec	6K-32K MOS/0.65usec
Word size/add time	8bits/2usec	16bits/1.35usec	8bits/800usec (13 digits)	16bits/2.31usec	16bits/1.96usec
Mass Storage					
Discs	floppy, cart, fixed head	pack	floppy, cart	floppy	floppy
Access methods	random, seq, indexed seq,	random, seq, indexed seq	random, indexed seq, seq	random, indexed seq	random, index seq
Mag tapes	reel-reel; cart, cassette	reel-reel	reel-reel	reel-reel	reel-reel
Peripherals	10-key, acct keybd, ppt, ser. print (to 165cps), line printer (to 1,400 lpm), crt	10-key, ppt, card, serial print (to 330cps), line print (to 600lpm), crt	10-key, ppt, card, serial print, crt	10-key, ppt, card, crt	10-key, ppt, card, crt
Software	BASIC, assembler, acct package	BASIC (extended) assembler, DBMS, acct package	BASIC, acct pack	RPG, FORTRAN, BASIC, assembler	RPG, BASIC, ALGOL, FORTRAN, assembler DBMS
Base Prices	$8,285	$39,300 ($865/mo)	$30,000	$40,000	$40,000
Software/support	soft and support extra	soft and supp extra	soft and supp extra	soft and supp extra	soft and supp extra
Comments	expands to 8 double-density floppies or 4 10MB discs; time-sharing multi-user OS for 4 terminals		Drug inventory control, patient profile, payroll, text editing	Computer generated image systems, process control systems	

Manufacturer	Applied Digital Technology	Applied Systems Corp.	Applied Systems Corp.	J. Baker & Associates	Basic Four
System Highlights		ASC 80	ASC 1800	Distribution Systems	350, 400, 600, 700
No. of models	2	1	1	3	4
No. installed/date	10 since Jan. 1972	since 1975	since 1974	30 since Sept. 1975	4,000 since 1971
Multiprogramming	yes	optional	no	yes	8-16 partitions
Communications	4 lines; async/sync	16, 32 lines/synch/ asynch/ bisynch/DECnet	16 lines/asynch/synch/ bisynch	3-64 lines/2780	8-lines/9600/2780
Applications	property management, accounting	comm., graphics, dp	communications	manufacturing distribution	medical, insurance general business
Processor	General Automation SPC-16745, 765	Intel 8080/85; Opt. 780	Intel 8080	DEC PDP-11 models	RFC 1320
Internal storage	4K-64K core/1.4usec	4K-64K+MOS/0.5usec	4K-64K MOS/0.5usec	32K-4MB MOS or core	24-128K MOS (600nsec)
Word size/add time	16bits/1.4usec	8, 16bits/2usec,digit	8bits/2usec/byte	16bits/1.8-7.7usec/ word	8bits/7.4usec
Mass Storage					
Discs	floppy, cart, pack, fixed head	floppy, cart, pack, fixed head	floppy, cart, pack, fixed head	floppy, cart, pack, fixed	cart, pack
Access methods	direct, seq, indexed seq	seq, random	seq. random	random, seq, indexed seq	random, sequential
Mag tapes	reel-reel	reel-reel, cassette, cartridge	reel-reel, cassette, cart	reel-reel, cassette	reel-reel
Peripherals	10-key, ppt, card, serial print (165cps), line print (to 600lpm), crt	10-key, acct-keybd, ppt, card, serial print (to 30 cps), line print (to 300 lpm), crt	10-key, acct keybd, ppt, card. serial print (30 cps), line print (to 600lpm), mag ledger card, crt	10-key, ppt, card, serial ptr up to 180cps,line ptrs to 900lpm, crt	10-key, ppt, card, 165 cps serial ptr, line ptrs to 600lpm, crt
Software	COBOL, RPG, FORTRAN, assembler, acct pack	FORTRAN, BASIC, PL/M, assembler, acct. pack	BASIC, assembler, PL/M, acct pack	COBOL, RPG, FORTRAN, BASIC, assembler, DIBOL, acctng pkg, dbms	BASIC, acntg pkg
Base Prices	$50,000-$100,000	$1,500 ($75/mo)	$5,000 ($250)	$34,995	$34,400 ($757 month)
Software/support	soft and supp extra	soft and supp extra	soft and supp extra	software and support extra	soft and support extra
Comments	marketed in Chicago area only, purchase only	basic computer system for business and data comm, with modular expansion and peripheral options	oriented towards local and satellite processing w/comm support, or custom apps	distribution application pgms for a variety of vertical industries	available as packaged systems only

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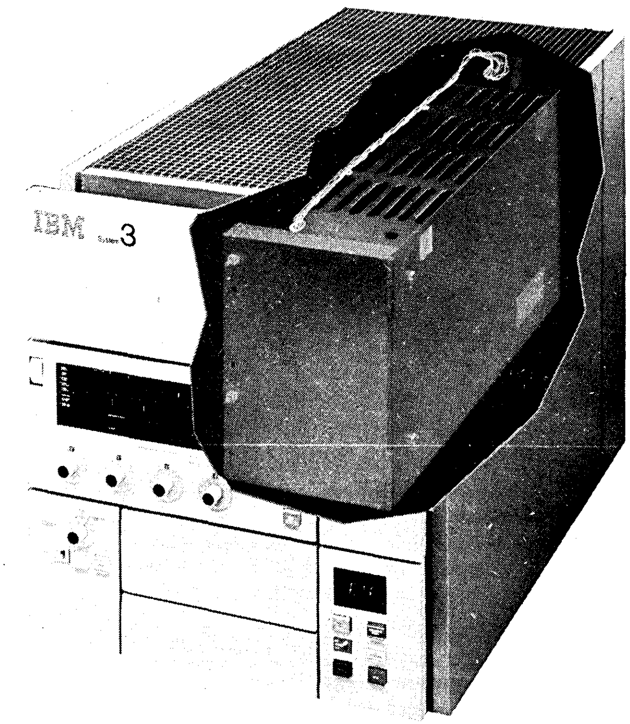

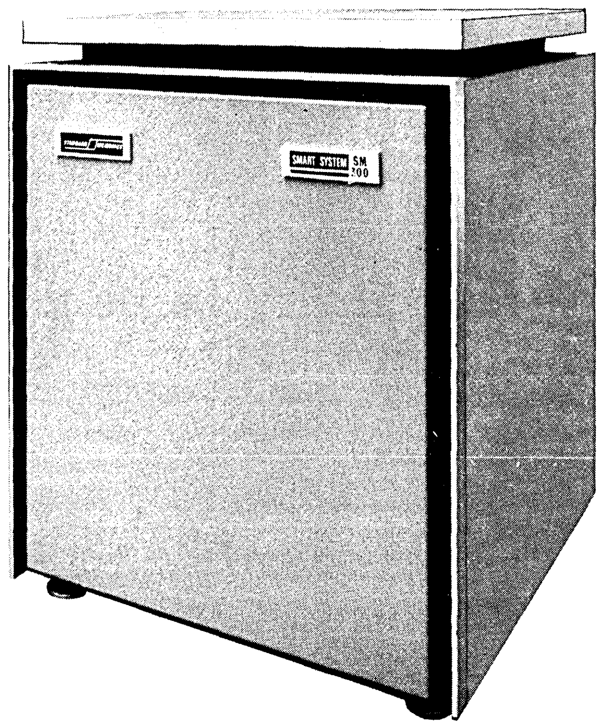

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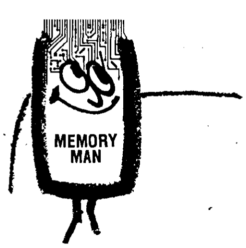

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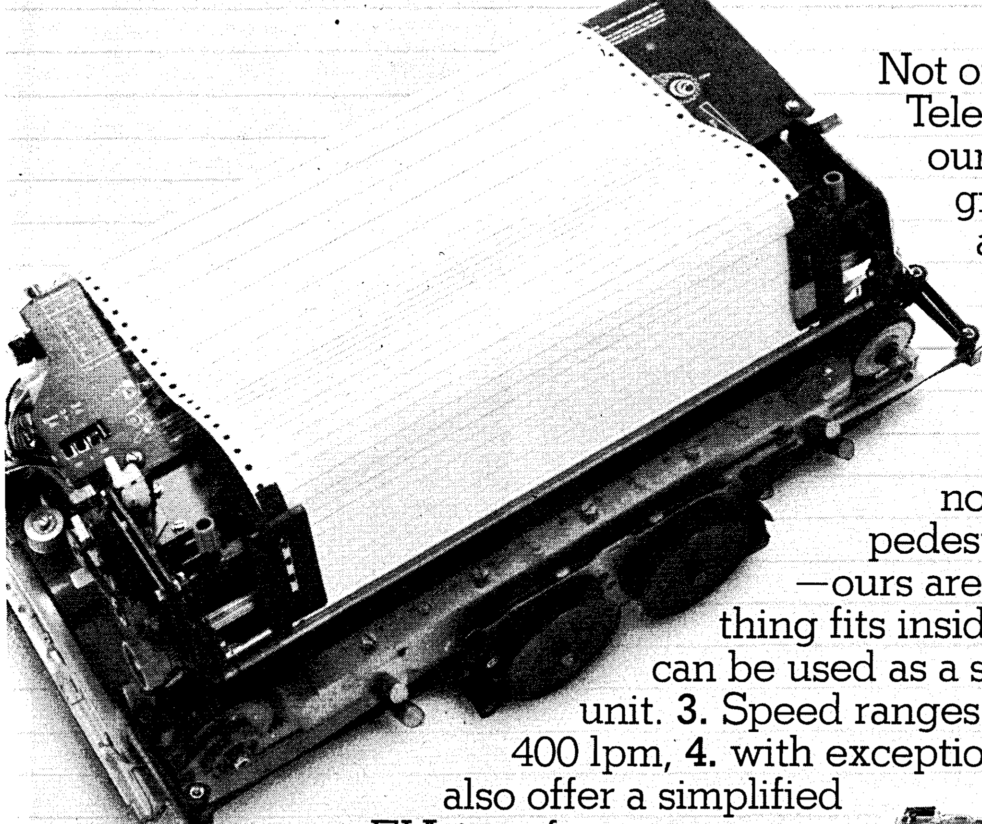

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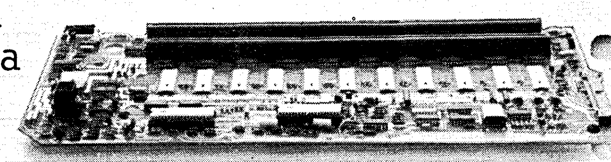

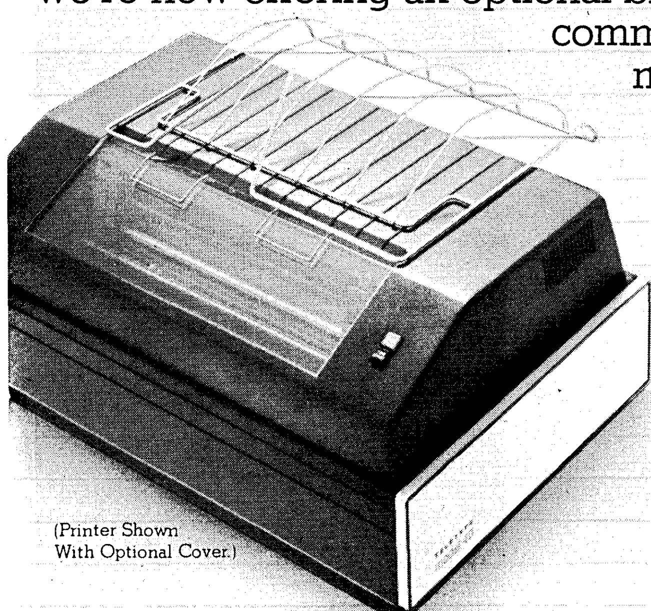

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CIRCLE 113 ON READER CARD

Manufacturer	Basic Timesharing	Binary Data Systems	Burroughs	Burroughs	Burroughs
System Highlights	4000 Series	UCOM	B 80	B 730/B 720	B 801/B 810
No. of models	2	3	3	2	2
No. installed/date	n/g, since Jan. 1976	n/g, since July 1973	n/g, since April 1976	since May 1973	n/g, since April 1977
Multiprogramming	no	up to 64 partitions	3 programs	yes	yes
Communications	up to 4 asynch 2500 bps lines	256 lines, 2780, SDLC	4 lines/asynch/synch/ bisynch/BDLC	1 line/asynch/synch/ bisynch/3780/BDLC	up to 4 9600bps lines
Applications	school administration	acctng, whlsl, dist, real estate, med	whsle, dist, med, financial	business	all business acctng applications
Processor	BTI 4020	Nova 3, 3D, or Eclipse	B 80/30, /40, /50	Burroughs B 731	B 800
Internal storage	64K MOS (650nsec)	64-512K (800nsec)	32K-124K MOS/1usec	32K-80K MOS/1usec	32-128K MOS (1usec)
Word size/add time	16bits/20usec (5 digits)	16bits, 10usec (word)	variable/not given	64bits/430usec	64bits/add time not given
Mass Storage					
Discs	cart, pack	floppy, cart, pack, fixed	floppy, cart	floppy, cart	floppy, cart, pack
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, index seq	sequential	random, seq indexed seq
Mag tapes	reel-reel, cart	reel-reel, cassette	cassette	reel-reel, cassette	reel-reel, cassette, cart
Peripherals	line printer to 900lpm	10-key, ppt, card, serial print (165cps), line print (to 1500lpm), crt	10-key, serial print (to 180cps), line print (to 250 lpm), crt	10-key, ppt, card, serial print (60cps), line print (to 400lpm), crt	10-key, card rdr, serial ptrs (120cps), line ptrs to 750lpm, crt
Software	BASIC, acctng pkg, dbms	COBOL, FORTRAN, BASIC, assembler, dbms, acct pkg	COBOL, RPG, DSC, MPL, NDL, acctng pack	COBOL, RPG, AEL, acctng pack	COBOL, RPG, AEL, MPL, NDL, actng pkg
Base Prices	$35,950	$45,000	$22,010 ($720/mo) w/MCP	$30,400 ($968)	$32,400 ($880/month)
Software/support	soft extra, support incl	soft incl, support extra	soft and supp extra	soft and supp extra	soft and support extra
Comments	Up to 32 user terminals concurrently, or 24 plus 4 comm lines	6usec (5 digit) add time for Eclipse-based models, dual processor redundancy		AEL programs can execute concurrently w/RPG or COBOL	

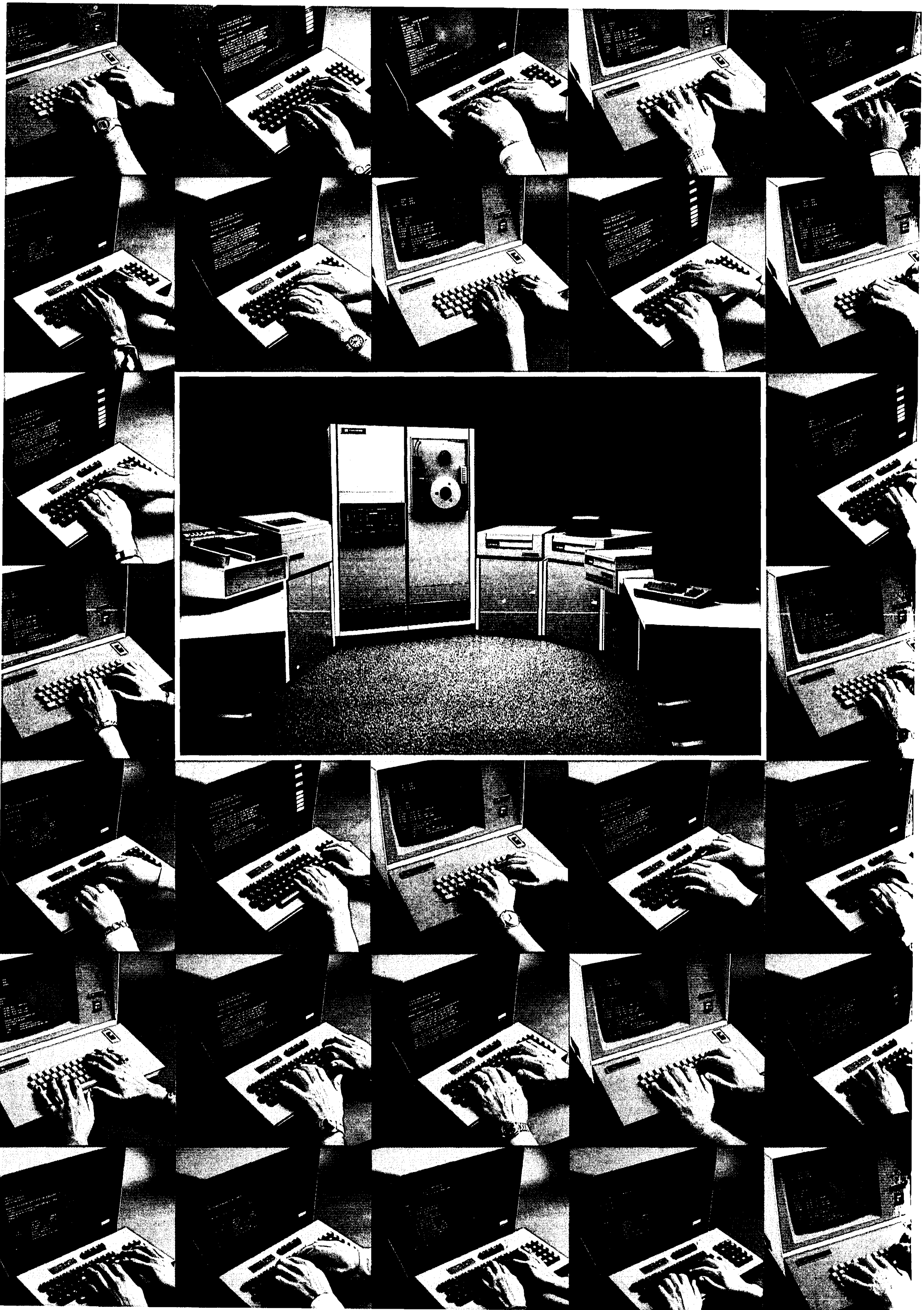
Manufacturer	Burroughs	Business Controls System	Business Controls System	Business Systems Prod.	Cado Systems Corp.
System Highlights	B 18XX series	System 80	System 80/11	Adviser II, Adviser III	System 40
No. of models	3	2		2	
No. installed/date	since 2nd qtr 1977	100 since 1971	since 1976	n/g, since July 1976	200 since April 1976
Multiprogramming	yes	15 partitions	63 partitions	24 partitions	no
Communications	up to 32/bisynch, BDLC	16 lines/asynch/synch/ 2780	64 lines/asynch/synch/ SDLL	up to 24 lines/3780, SDLC	1 line/asynch/synch/ 2780/3780
Applications	all business acctng applications	retail, mfg., dist., whsl., list maint.	retail, mfg, dist, whsle, list maint	distribution	distributed processing, text editing
Processor	B 1830, 1860, 1870	DEC PDP-8/A, E	DEC PDP-11/34, /70	Computer Auto. LSI-2/60	Intel 8080A
Internal storage	48-512K MOS	32K-256K core/1.2usec	64K-204K MOS, core	64-304K core (980nsec)	5K-9K MOS/1.1usec
Word size/add time	1220-333nsec 16bits/add time not given	12bits/2.6usec-3.0usec	bipolar/.98usec 16bits/2.7usec-7.3usec	16bits/8.24msec (8 digits)	8bits/200usec (9 digits)
Mass Storage					
Discs	floppy, cart, pack,	floppy, cart	floppy, cart, pack, fixed head	cart, pack	floppy, cart
Access methods	random, seq, indexed seq	random, seq, index seq	random, seq, indexed seq	random, seq, indexed seq	random, indexed seq
Mag tapes	reel-reel, cassette	reel-reel, cassette	reel-reel, cassette	reel-reel	reel-reel
Peripherals	card, serial ptrs to 300 cps, line printers (400-500lpm)	10-key, ppt, card, serial print (180cps), line print (to 600lpm), crt	10 key, ppt, card, serial print (180cps), line print (to 1,200lpm), crt	10-key, ppt, card, 120cps serial ptr, line ptrs to 600lpm, crt	10 key, ppt, serial print, line print (300lpm), crt
Software	COBOL, RPG, FORTRAN, BASIC, NDL, UPL, AEL, acctng pkg, dbms	FORTRAN, BASIC, assembler, DIBOL, COM, acctng pack	COBOL, RPG, FORTRAN, BASIC, assembler, DIBOL, DECform, acctng pack, dbms	FORTRAN, ABOL, accntg pkg, dbms	CADOL, assembler, dbms
Base Prices	$115,590 ($3,058 5-year)	$29,990 ($600)	$40,000 ($800)	$38,700 ($850 month)	$19,900
Software/support	soft and support extra	included		soft and support extra	software extra
Comments	fixed disc optional on B 1870		supports all DEC operating systems, sorts, etc.	vendor responsible for software incl applications package library	

Manufacturer	Cascade Data	Cascade Data, Inc.	CDA	Century Computer	Century Computer
System Highlights	Concept II, III	Concept IV	INVOMATS 20, 40, 60, 200	Century 300	models 400-1000
No. of models	2		4		4
No. installed/date	200 since January 1970	deliveries begin April 1978	68 since Nov. 1974	600+ since Feb. 1971	186 since March 1975
Multiprogramming	2, 4 partitions	2 partitions	no	10 partitions	10/20 partitions
Communications	8 lines, 2780/bisynch	8 lines/asynch/synch/ 2780	4-8 lines/2780	256 lines (asynch, synch, CCS)	256 lines
Applications	Actng, banking, medical, dist, networks	business acctng	dist, inventory, accntg	business acctng, dist	acctng, dist, finance, hotel
Processor	Cascade Data	Cascade Data	DG Nova 1200/DCC-116	Century 200	Century 400
Internal storage	16-64K core (1-1.2usec/ byte)	16K-64K MOS/1usec	32-64K core (1.35usec)	32K-60K MOS (600nsec)	32-512K MOS/600nsec
Word size/add time	16bits/8.8-7.5usec/word	8bits/2usec/byte	16 bits/1.35usec	8 bits, 2.6usec (5 digits)	16bits/2.6usec (5 digits)
Mass Storage					
Discs	floppy, cart	floppy	floppy	floppy, cart, pack	floppy, cart, pack
Access methods	n/g	random, seq, indexed seq	seq, indexed sequential	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel	no	reel-reel	reel-reel, cassette	reel-reel, cassette
Peripherals	10-key, ppt, card rdr, serial ptr (55cps), line ptrs to 600lpm, crt	10 key, serial print (60cps), line print (to 400lpm), crt	10-key, ppt, card, serial ptrs to 165cps, ptrs to 300lpm, crt	10 key, acctng keybd, ppt, card, serial print (165 cps), line print (to 600 lpm), crt	10-key, ppt, card rdr, serial ptr to 165cps, line ptrs to 1200lpm, crt
Software	RPG, assembler, acting pkg	BASIC, assembler, acctng pack	COBOL, FORTRAN, BASIC, assembler, and acctng pkgs, some separately priced	BASIC, CPL, assembler, acctng pack, dbms	BASIC, assembler, CPL non-standard FORTRAN, ALGOL, acctng pkg, dbms
Base Prices	$22,200 ($666/month)	$14,000 ($420)	$16,800 ($355 month)	$30,000	$34,000
Software/support	soft and support extra	soft and supp extra	includes support	soft and supp extra	software and support extra
Comments	Concept III to be delivered in Nov.		Turnkey systems include specific applications	turnkey system; software sold separately	expandable turnkey systems for handling small to large applications

Manufacturer	Complete Computer	Compucorp	Compucorp	Compudata	Compudata Systems
System Highlights	models 2820-3955	400 series	625	DEC 300/DEC 500 Series	IBM Series/1
No. of models	5	5		2	
No. installed/date	n/g since March 1974	119 since Jan. 1976	since July 1977	125 since 1975	1 since 1977
Multiprogramming	yes	no	no	yes	yes
Communications	up to 18 lines/2780	4-7 lines, asynch only	4 lines/asynch	up to 24 lines/2780, 3780	256 lines/asynch/synch
Applications	mfg, costing, printing, mortgage banking, acctng	general business, agriculture		mfg, dist, services, retailing	dist, services, retail, manuf
Processor	Nova 2/10/Nova 3/12	Compucorp 3000	Zilog Z-80	DEC LSI-11 to PDP-11/70	IBM 4953/4955 (Series/1)
Internal storage	64-256K core/MOS	8-16K MOS (speed n/g)	24K-64K MOS/1.6usec	42-512K MOS to 725msec	64K-128K MOS/660nsec
Word size/add time	16bits/1000-700nsec	64bits/80usec (13 digits)	48bits/50usec	16+2 parity/ (300-2030nsec)	16bits/4.2usec
Mass Storage					
Discs	floppy, cart	floppy	floppy, cart	floppy, cart, pack, fixed	floppy, cart
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, keyed, hashed	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel, cassette	reel-reel	reel-reel, cart	reel-reel	no
Peripherals	10-key, ppt, card rdr, serial ptrs to 660cps, line ptrs to 300lpm, crt	10-key, 30cps serial ptr, crt, mag card rdr (1 model)	10 key, serial print (80 cps), line print, crt	10-key, ppt, card rdr, 180cps serial ptr, 300lpm line ptr	10 key, serial print (120cps), line print (155lpm), crt
Software	COBOL, RPG, FORTRAN, BASIC, assembler, actng pkg, dbms	assembler, acctng pkg (1 model), dbms	BASIC, assembler, acctng pack, dbms	FORTRAN, BASIC, DIBOL, acctng pkg, dbms	COBOL, FORTRAN, assembler, acctng pack
Base Prices	$35,675 ($744/month)	$11,490	$7,000	$17,000 ($350 month)	$26,000 ($540)
Software/support	soft and support extra	support extra	soft and support extra	soft and support extra	soft and support extra
Comments	floating-point hardware and 100 MB disc storage optional	most models include software in price		core memory on 500 Series machine (980 nsec).	

Manufacturer	Computer Automation	Computer Covenant	Computer Hardware	Computer Hardware	Computer Horizons
System Highlights	SyFA	CPBS	2130, 3230	4210	CHC Distribution System
No. of models		3	2		n/g
No. installed/date	n/g since 1976	5 since June 1976	n/g since 1974	since 1977	32 partitions
Multiprogramming	43 partitions	yes	32 partitions	8 partitions	64 lines/asynch/SDLC
Communications	up to 25 lines/2780/	up to 60 lines, 2780, SDLC	36 lines/2780, 3780, 3741	8 asynch, 1 synch	inv, order proc, bus acctng
Applications	distributed processing	manufacturing, wholesale, distribution	general acctng	general accounting	
Processor	CALSI-2/60	DEC PDP-11	2130/3231	CHI 4210	DEC PDP-11/34
Internal storage	64-304K core (1.2usec)	56K-2MB MOS or core/	16K-4MB MOS/ (800nsec)	8K-4MB MOS/1.2usec	16K-248K MOS, core/
Word size/add time	16bits/76usec (5 digits)	16bits/as fast as 400nsec	16bits/2.7usec	16bits/50usec	16bits/2usec
Mass Storage					
Discs	cart, pack	floppy, cart, pack	cart, pack, fixed	floppy, cart	pack
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	seq, random	seq, indexed seq
Mag tapes	no	no	reel-reel, cassette	cassette	reel-reel
Peripherals	10-key, serial ptrs to 165cps, line ptrs to 600lpm, crt	10-key, 300cpm rdr, up to 180cps serial ptr, up to 1200lpm ptr, crt	10-key, ppt, card, 60cps serial ptr, 600lpm ptr, crt	10-key, acctng keybd, card, serial print (180cps), line print (300lpm), crt	serial print (180cps), line print (1,200lpm), crt
Software	FORTRAN, BASIC, SYBOL	COBOL, FORTRAN, BASIC, assembler, DIBOL, acct pkg, dbms	COBOL, RPG, FORTRAN, BASIC, assembler, ALGOL, SNOBOL, actng pkg, dbms	FORTRAN, assembler, acctng pack	COBOL, BASIC, acctng pack
Base Prices	$45,000	$24,000 ($530 month five year)	n/g	n/g	$30,000
Software/support	support incl, software extra	softwear and support extra	support incl, some soft extra	soft extra	supp extra
Comments	Supports up to 24 terminals and 35 peripherals BASIC and FORTRAN are unbundled	Price is based on 180cps ptr. Various models of PDP-11 used.	hardware floating point available		PDP-11/70 cpu may be substituted for 11/34

Manufacturer	Computer Interactions	Control Data	Corstar	Corstar	Data Communications
System Highlights	Compo-II	Cyber 18-10, 18-20	Corstar 310	models 350, 534, 570	TPS, DPS, DCS
No. of models		2		3	3
No. installed/date	77 since 1972	n/g since May 1976	10 since 1972	22 since November 1973	n/g since Sept. 1976
Multiprogramming	4 partitions	18-20 16 partitions	no	4, 32, 63 partitions	DPS only
Communications	32 lines/synch/asynch	n/g # lines, to 19.2 kbps	1 line to 2200bps, 2780	4, 32, 63 lines/2780	256 lines, many protocols
Applications	whsle dist, pharm, med	manufacturing distribution	manufacturing, distribution	mfg, dist, financial publishing	marketing, mortgage banking, broadcasting
Processor	DEC PDP-8/E, /F	Cyber 18-10, 18-20	DEC Data-systems 310	DEC Datasystems	DG Nova, S/200, S/300
Internal storage	16K-64K core, MOS/ 1.2usec	32-256K/core, MOS 750nsec	16-64K core/MOS (1.4usec)	32K-1MB MOS/core (980-720nsec)	8-256K core (800nsec)
Word size/add time	12bits/15usec (5 digits)	16 bits/1.76usec (word)	12bits/2.8usec	16bits/7-1usec dep. on model	16bits/600-800nsec/word
Mass Storage					
Discs	floppy, cart, pack	floppy, pack	floppy, cart	cart, pack	floppy, cart, pack, fixed
Access methods	random, seq, indexed seq	n/g	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel, cart	reel-reel	no	no	cassette
Peripherals	10-key, ppt, serial print (to 300cps), line print (300lpm), crt	10-key , card rdrs to 600cpm, line ptrs to 600lpm, crt	10-key, ppt, card rdr, 180cps serial ptr, 300lpm line ptr, crt	10-key, ppt, card rdr, 180cps serial ptr, 300lpm line ptr, crt	10-key, ppt, card rdr, 165cps serial ptr, line ptrs to 1200lpm, crt
Software	FORTRAN, BASIC, assembler, acctng pack	FORTRAN, BASIC, assembler, macro assembler	DIBOL, accting pkg	COBOL, RPG II, FORTRAN, BASIC Plus, DIBOL, actng pkg	COBOL, RPG, RPG II, FORT IV, FORT V, BASIC, ALGOL, assembler, acctng pkg, dbms
Base Prices	$50,000 ($1,200)	$27,840 ($982/month 3-yr)	$13,000	$36,000	$5,000
Software/support	supp extra	soft and support extra	soft and support extra	support and software extra	soft and support extra
Comments				larger versions exceed $100,000	transactional, distributed, and data collection systems



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Manufacturer	Data General	Datapoint	Decision Data Computer	Design Data	Digital Computer Controls
System Highlights	CS/40	Cassette 1100-6600	System/4	ECS40/EC330	Synergist 1500, 3700
No. of models	3	7		2	3
No. installed/date	n/g since Sept. 1977	15,500 since April 1972	15 since July 1975	20 since Nov. 1975	60 since Dec. 1976
Multiprogramming	yes	5500, 6600	yes, 2 partitions	2 partitions	no
Communications	1 line, 2780/3780	1-25 lines/most protocols	2 lines/asynch/synch/ 3780	up to 256 lines/ HASP, 2780	up to 16 lines, 2780, 3780
Applications	n/g	banking, insurance, government, accounting	distribution	manufacturing, order entry	manufacturing, wholesale, distribution
Processor	Nova 3/12, Nova 3/D	equals model number	System/4	DG Eclipse C/300	DG Micro Nova, Nova 3/12, Nova 3/D
Internal storage	64-192K MOS (700nsec)	4-120K MOS (600-1600nsec)	32K-64K MOS/1usec	96-256K core (800nsec)	48-256K core/MOS (1.usec)
Word size/add time	16bits/700nsec (word)	8bits/1.15-4.8usec)	8bits/not given	16bits/2.4usec	16bits/2.4-1usec
Mass Storage					
Discs	floppy, cart	floppy, cart, pack	floppy, cart	floppy, cart, pack	floppy, cart, pack
Access methods	random, seq, indexed seq	random, seq, indexed seq	direct, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel	reel-reel, cassette	no	reel-reel, cassette	reel-reel
Peripherals	10-key, 165cps serial ptr, 300lpm ptr, crt	10-key, 300cpm rdr, serial ptrs, line ptrs to 600lpm, crt	10 key, acctng keybd, card, serial print (120cps), line print (to 600lpm), crt	ppt, 165cps serial ptr, 1200lpm line ptr, crt	10-key, ppt, card, serial ptrs to 275cps, line ptrs to 1200lpm, crt
Software	COBOL	COBOL, RPG, BASIC, assembler, Databus, Datashare, acctng pkg, RPG II	RPG, Ideal ,acctng pack	COBOL, RPG, FORTRAN, BASIC, assembler, ALGOL, acctng pkg	BASIC, assembler, acctng pkg
Base Prices	$32,915 ($741/month)	$7,200 ($165 month 2-yr)	$20,000	$40,000	$8,000
Software/support	bundled	support incl, soft extra	some soft and supp extra	soft and support extra	support incl, soft extra
Comments	interactive COBOL from up to 9 terminals			ECS 40 is 32-96K core (1usec or 700nsec) 950-700nsec add time	executive inquiry systems

Manufacturer	Digital Equipment	Digital Equipment	Digital Scientific	Digital Systems	Dimis Inc.
System Highlights	DataSystem 310	DataSystems 322-570	Meta 4/1130, UM2-TSO,	Galaxy/5 130, 140, 150	Total 100
No. of models		6	3	3	
No. installed/date	n/g since May 1975	1,200 + since July 1975	430 + since 1970	11 + since Dec. 1975	3 since June 1974
Multiprogramming	no	two largest models	largest two models	yes	yes
Communications	1 line, to 4800bps, 2780	4-63, 2780/3780/SDLC	up to 32 lines/2780, bisynch	120-480 lines	32 lines/asynch/synch
Applications	bus accounting	business accounting	marketing, medical, engineering	acctng	distribution
Processor	DEC PDP-8/A	DEC LSI-11 to PDP-11/70	DSC 4030, 4031, 4040	Galaxy/5	Modcomp II
Internal storage	16-64K core (1.4usec)	32K-2MB core/MOS	16-256K core/900nsec	64K-1MB MOS (750nsec)	128K core/800nsec
Word size/add time	12bits/1msec (15 digits)	16bits/10-1.07usec (word)	16bits/2.9usec (5 digits)	8bits/5usec (5 digits)	16bits/800nsec
Mass Storage					
Discs	floppy, cart	floppy, cart, pack, fixed	cart, pack	pack, fixed	floppy, cart, pack
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	no	no	no	reel-reel	reel-reel
Peripherals	10-key, serial ptrs to 165cps, 30 crt	10-key, 300cpm rdr, serial ptrs to 180cps, line ptrs to 1,200lpm, crt	ppt, card	card, line ptrs to 900lpm, crt	10 key, acctng keybd, ppt, card, serial print, line print, crt
Software	DIBOL	COBOL, RPG, FORTRAN, BASIC, assembler, APL, DIBOL, dbms	COBOL, RPG, FORTRAN, BASIC, assembler, macro-assembler, APL, dbms	RPG, FORTRAN, BASIC, assembler, acctng pkg dbms	FORTRAN, assembler, acctng pack, dbms
Base Prices	$14,095	$19,315	$60,000 ($1,500 month)	$32,700 (cpu only)	$135,000
Software/support	soft incl, support extra	most software bundled	soft incl, support extra	soft and support extra	supp extra
Comments		support extra	can run most IBM 1130/1800 pgms; digital-analog I/O, real-time, batch, t-s	additional peripherals can be attached through commo port	3 crts standard; price includes training and conversion support

Manufacturer	Display Data Corp.	Distribution Mgmt Systs	Distribution Mgmnt Systs	Educomp-Quodata	Educomp-Quodata
System Highlights	In*Sight	DMS-1000-8	DMS-1000-11	E-1000, E-500	E-600, E-700, E-940
No. of models				2	3
No. installed/date	180 since Jan. 1974	43 since 1970	n/g	100 + since 1971	100 + since 1972
Multiprogramming	20 partitions	10 partitions	30 partitions	yes, up to 63 partitions	63 partitions
Communications	16 lines/asynch	10 lines (asynch, synch, HASP)	32 lines (synch, asynch, SDLC, etc)	16-32 lines (synch, asynch, SDLC)	32-63 lines/2780/3780
Applications	auto dealers, contrctrs, whslrs	distribution	distribution	educ, muni govt, general	education and governmen
Processor	Microdata 1600/30	DEC PDP-8	DEC PDP-11	DEC PDP-8/A	DEC PDP-11/34, PDP-11/70
Internal storage	32K-64K core/1usec	32K (6bit) core (1.2usec)	64K-2048K, MOS (980nsec)	64K-256K (6bit byte) core/MOS	32K-2MB core MOS (775 nsec)
Word size/add time	8bits/4.6usec	12bits, 3usec	16bits, 300nsec-3.7usec	12bits, 2.6usec-3usec	16bits/3-2.16usec)
Mass Storage					
Discs	cart	cart	floppy, cart, pack, fixed head	floppy, cart, pack, fixed	floppy, cart, pack, fixed
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel	reel-reel	reel-reel	reel-reel, cassette	reel-reel, cassette, cart
Peripherals	10 key, serial print (120cps), line print (to 600lpm), crt	10 key, serial print (180 cps), line print (300lpm), crt	10-key, serial print (180 cps), line print (to 1,200 lpm), crt	10 key, ppt, card, serial print (180cps), line print (to 900lpm), crt	10-key, ppt, card, serial ptr 180cps, line ptrs to 900lpm, crt
Software	assembler, acctng pack	assembler, DEAL, ORACLE, acctng pack, dbms	COBOL, FORTRAN, BASIC, assembler, DEAL, ORACLE, acctng pack, dbms	COBOL, FORTRAN, BASIC, assembler, FOCAL, DIBOL	COBOL, RPG, FORTRAN, BASIC, assembler, APL, PASCAL, DIBOL, acting pkg, dbms
Base Prices	$37,700	$54,000	$65,000	$6,000	$45,000
Software/support		soft and supp extra	soft and supp extra	soft and supp extra	soft and support extra
Comments	Specialists in complete turnkey systems, support forms, and maintenance for selected businesses			systems built to customer's specs	turnkey systems designed to customer's specs

Manufacturer	Financial Computer	Four-Phase Systems, Inc.	General Automation	General Information	GRI Computer Corp.
System Highlights	Fedder System 111/10, /6	System IV/40, /50, /70	440 Data Series, DM-130	ABLE Series	System 99
No. of models	2	3	4	3	
No. installed/date	170 since Jan. 1975	2300 since Feb. 1971	since Jan. 1974	4+ since December 1975	since 1975
Multiprogramming	32 partitions	no	up to 4 partitions	16-24 partitions	yes, 4 partitions
Communications	64 lines (synch, asynch)	(synch, asynch, 3270, bisync)	5-25 lines (synch, asynch, HASP)	16 lines to 4800bps, 2780	3 lines (synch, asynch)
Applications	dist, mfg, const, acctng	mfg, insurance, educ	mfg, ins, dist, med	acctng, mfg, dist, legal, medical, acctng, CPA	mfg, retail, dist, constr, banking
Processor	Fedder S 111	Four-Phase	GA-16/440, SPC-16 series	DEC PDP-11/03, PDP-11/34	GRI 99/50
Internal storage	32K-256K MOS (not given)	24-96K MOS (2usec)	64K-128K core (720-1440 nsec)	24-256K MOS (980-720 nsec)	32K-64K MOS (1.7usec)
Word size/add time	8bits, n/g	24bits, 16usec	16bits, 780-1440nsec	16bits/3.1usec (6 digits)	16bits, add time n/g
Mass Storage					
Discs	floppy, cart	floppy, cart, pack	cart, pack, fixed head	floppy, cart, pack, fixed	cart
Access methods	random, seq, indexed seq	random, seq, indexed seq	relative, seq, indexed seq	random, sequential	random, seq, indexed seq
Mag tapes	reel-reel, cassette	reel-reel (on IV/70)	reel-reel	reel-reel, cassette, cart	reel-reel
Peripherals	10 key, ppt, card, serial print (to 200 cps), line print (to 1250lpm), crt	10 key, card, ppt, serial print (30cps), line print (to 700lpm), crt	10 key, card, serial print (165cps), line print (to 600lpm), crt	10-key, full acctng kbrd, card, serial ptrs, line ptrs	10-key, ppt, card, serial print (165cps), line print (600lpm), crt
Software	BASIC, assembler, CPL, PL/X, acctng pack, dbms	COBOL, RPG, assembler	COBOL, FORTRAN, assembler, acctng packs	COBOL, DPG, FORTRAN BASIC, assembler, DIBOL, acctng pkg, dbms	RPG, assembler, acctng pack
Base Prices	$22,950 ($460)	$30,315 ($604)	$35,000	$24,000 ($500 month)	$33,333
Software/support	soft and supp extra	soft included	supp extra	soft and support extra	apps and supp extra
Comments	can run interactive or batch in any partitions; Fedder Data systems is a division of Financial Computer Corp.	no COBOL or RPG on IV/40, but the IV/40 can run object code from /50, /70		some models use core memory a turnkey financial control system	sold through distributor network

Manufacturer	Harris Computer	Hewlett-Packard	Hewlett-Packard	Hewlett-Packard Co. Calculator Products Div.	Hewlett-Packard Co. Calculator Products Div.
System Highlights	S Series	1000 Series	System 3000/1, /11	9830A, B	9896A
No. of models	8	3	3	2	
No. installed/date	n/g since 1975	n/g since December 1976	850 since March 1977	n/g since Nov. 1972	since March 1977
Multiprogramming	256 partitions all models	yes	yes	no	no
Communications	128 lines/2780/HASP	16 lines, 2780, bisynch	16-63 lines (synch, asynch)	1 line (synch, asynch)	no
Applications	many/plus time-sharing	manufacturing	mfg, educ	real estate, med, engineering	mfg, dist
Processor	Harris 100 Series	HP 21MX E	HP 3000	HP 9830A, B	HP 9831A
Internal storage	96-768K core/MOS 450-750nsec	64-608K (560nsec)	128K-512K core/MOS	3520-15,808 MOS (13usec)	7, 162-31, 738 MOS (1.83 usec)
Word size/add time	24bits/600-750nsec (word)	16bits/1.12usec	16 bits, 1.225-1.05 usec	8bits, 1msec (approx)	16bits, 470usec (12 digits)
Mass Storage					
Discs	floppy, cart, pack, fixed	floppy, cart, pack	pack	cart	floppy, cart
Access methods	random, seq, indexed seq	random, sequential	direct, seq, keyed seq	none	direct
Mag tapes	reel-reel, cassette	reel-reel, cart	reel-reel, cassette, cart	cassette	cart
Peripherals	ppt, card, serial & line printers	ppt, card, serial ptrs, line ptrs	10-key, ppt, card, serial print (to 120cps), line print (to 1250lpm), crt	10-key, ppt, card, line print (to 300lpm), crt	10-key, ppt, card, serial print (30cps), line print (to 300lpm), crt
Software	COBOL, RPG, FORTRAN, BASIC, assembler, SNOBOL, FORGO, dbms	FORTRAN, BASIC, assembler, ALGOL, dbms	COBOL, RPG, FORTRAN BASIC, SPL, APL, dbms	acctng pack	BASIC, acctng pack
Base Prices	$85,000 (3rd pty lease)	$21,000	$75,000 ($1,566)	$4,900	$18,700 ($500)
Software/support	some soft extra, support incl.	soft and support extra	soft and supp extra	soft and supp extra	
Comments		a maximum of four active terminals is recommended on commo lines	3000 Series II is upgrade from previous 3000 CX Series	Software assigns portions of read and write memory to serve as registers	soft and supp extra

Manufacturer	Honeywell	Honeywell	IBM	IBM	IBM
System Highlights	Series 60 Model 6	Series 60/Level 62	System/3	System/32	System/34
No. of models	4	1			
No. installed/date	since Jan. 1976	since Aug. 1974	30,000+ since Dec. 1970	10,000+ since Feb. 1975	deliveries begin Jan. 1978
Multiprogramming	yes	yes	3 partitions	no	8 partitions
Communications	8-128 (asynch, bisynch)	9 lines/asynch/synch	8 lines/asynch/SDLC	1 line,asynch/bisynch/SDLC	8 lines,asynch/bisynch/SDLC
Applications	hospital, mfg, inv, educ, office automation	distribution, mfg	dist, mfg, med, educ	dist, mfg, med, word proc	dist, med, mfg
Processor	Honeywell CPS-series	Honeywell 62	IBM System/3	IBM System/32	IBM System/34
Internal storage	8K-1024K NMOS (650-1200nsec)	48K-224K MOS/1usec	8K-256K core, MOS/1.52usec	16K-32K MOS/0.6usec	32K-64K MOS/0.6usec
Word size/add time	16bits, 1.9-2usec	8bits/not given	8bits/24usec (5 digits)	8bits/150usec (5 digits)	8bits/68.5usec (5 digits)
Mass Storage					
Discs	floppy, cart, pack, fixed head	floppy, cart, pack	floppy (via 3741), cart, pack	floppy, fixed disc	floppy, fixed disc
Access methods	random, seq, indexed seq	seq, indexed, relative	random, seq, indexed seq	random, seq, indexed seq	random, seq, index seq
Mag tapes	reel-reel, cassette	reel-reel, cassette	reel-reel	no	no
Peripherals	10-key, ppt, card, serial print (165cps), line print (to 1100lpm), crt	10-key, card, serial print (30cps), line print (to 1,600lpm), crt	10-key, card, serial print (85cps), line print (to 1,100lpm), crt	10-key, card, serial print (to 80cps), line print (to 155lpm), crt	10-key, serial print (to 120cps), line print (to 300lpm), crt
Software	COBOL, RPG, BASIC, FORTRAN, assembler, acctng pack	COBOL, RPG, FORTRAN, acctng pack, dbms	COBOL, RPG II, BASIC, FORTRAN	RPG II, assembler, acctng pack	RPG II, assembler, acctng pack
Base Prices	$3,700 (processor only)	$36,879 ($885)	$22,430 ($674)	$33,560 ($748)	$34,700 ($1,062)
Software/support		soft and support extra	soft and support extra	soft and support extra	soft and support extra
Comments					

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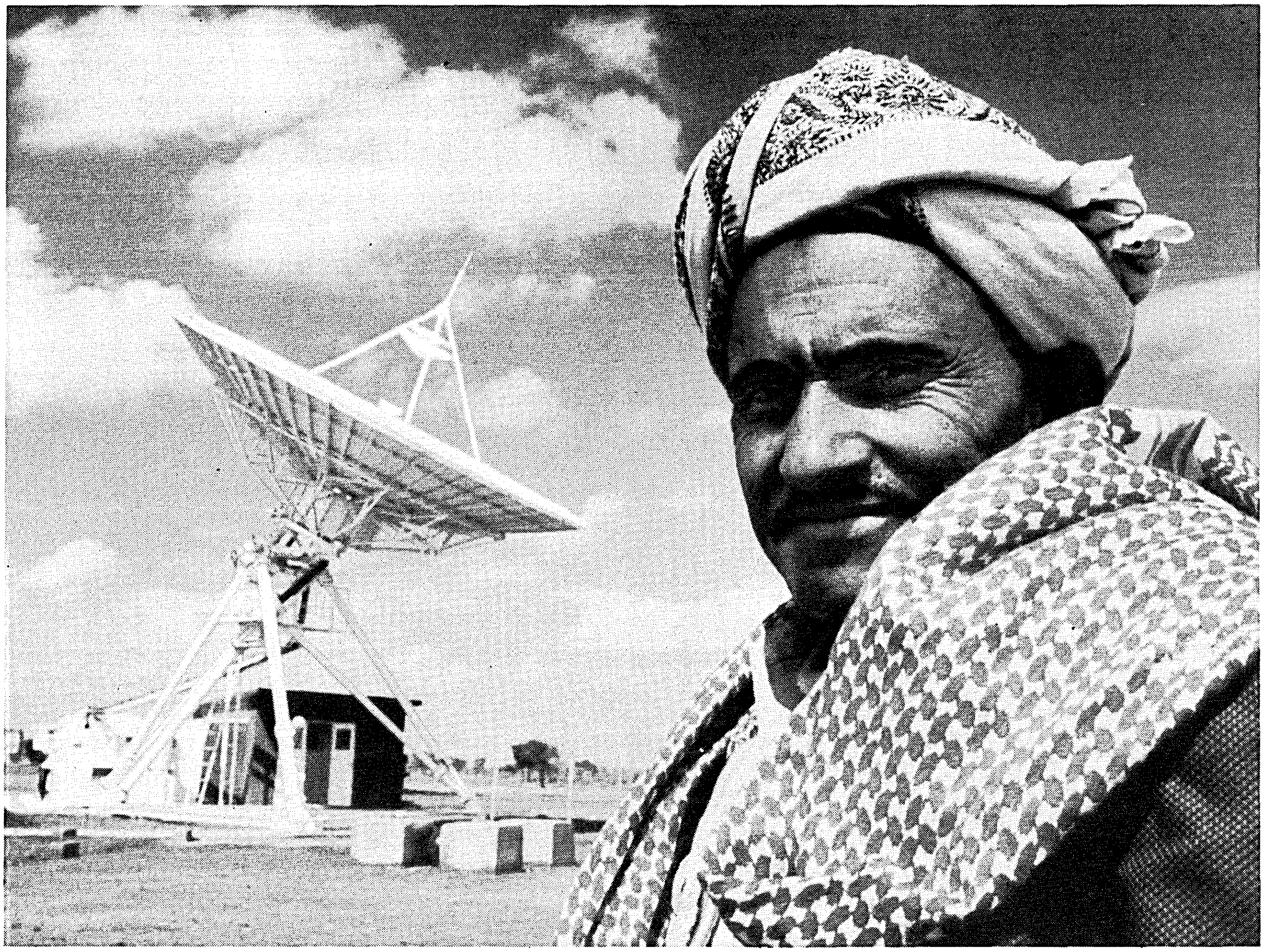

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CIRCLE 38 ON READER CARD

Manufacturer	IBM	IBM	IBM	ICL	Jacquard Systems
System Highlights	1130	System/360 Model 20	5100	2903/2904	J100-J50 Videocomputer
No. of models				2	2
No. installed/date	4,000 (approx) since 1965	10,000 since Nov. 1964	since Sept. 1975	n/g since 1974	650 since Aug. 1975
Multiprogramming	no	no	no	4 partitions	256 partitions
Communications	16 lines/synch/bisynch	1 line (asynch, bisynch)	1 line (asynch, 2741)	to 6 lines/2780, 4800bps	10 lines (asynch, synch, 3780)
Applications	engineering, mfg, med, dist.	mfg, dist, govt, educ	financial analysis, statistics	manufacturing, retailing, distribution	dist proc, word proc, med, business
Processor	IBM 1130	IBM 360/20	IBM 5100	2903, 2904	Jacquard J100-J50
Internal storage	8K-64K core/2.2usec; 3.6usec	4K-32K core (varies)	16K-64K MOS (530nsec)	64-384K MOS (1.14usec)	32K-256K core/MOS (1.5usec)
Word size/add time	16bits/4.9usec; 8usec	8bits, 209usec (5 digits)	8bits, 1nsec (approx)	24bits/17.7-11.8usec	16bits, 7usec
Mass Storage					
Discs	cart, pack	pack	no	cart, pack	floppy, cart, pack
Access methods	random, seq, index seq	random, seq, indexed seq		random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel	reel-reel	cart	reel-reel	reel-reel
Peripherals	ppt, card, serial print (15cps), line print (to 1,100lpm), crt	card, serial print (15.5cps), line print (to 1,100lpm)	10-key, serial print (80cps), crt	10-key, ppt, card, line ptrs to 1500lpm, crt	10-key, card, serial print (to 166cps), line print (to 900lpm), crt
Software	RPG, FORTRAN, assembler, acctng pack	RPG, assembler, PL/1, acctng pack	BASIC, APL	COBOL, RPG, FORTRAN, BASIC, acctng pkg, dbms	BASIC, assembler, acctng pack
Base Prices	$19,840 ($136)	$13,470 ($638)	$8,975 ($450)	$85,000 ($2,200 month)	$17,960 ($550)
Software/support	soft and support extra	soft support extra	some soft extra; supp extra	soft and support extra	app soft and supp exrta
Comments		low end of 360 series, cycle times vary with processor model	portable (50 lbs) desk-top computer	full simultaneity; direct data entry through 8 crts RJT, batch, spooling	

Manufacturer	Litton/Sweda International	Logical Machine Corp.	Medical Computer Sciences	Microdata	Mini-Computer Systems
System Highlights	Litton 1600 Series	ADAM	System 2000	Reality	Micos Systems
No. of models					4
No. installed/date	not given	250-300 since April 1975	15 since Oct. 1973	500+ since Nov. 1973	600+ since March 1973
Multiprogramming	yes	no	no	yes	yes
Communications	8 lines (not given)	no	64 lines (synch, asynch)	32 lines (asynch, synch, 2780)	1 line (synch, HASP, 200UT)
Applications	whsle dist, client acctng	acctng	hospital	engin, educ, time share, acctng	muni govt, fuel, educ, apparel, etc
Processor	Data General Nova 1220	LOMAC ALP	HP 2108	Microdata 1600	Data General Nova 3/12
Internal storage	64K core (1.2usec)	32K-64K MOS (800nsec)	4K-384K MOS (650nsec)	16K-128K core (1usec)	64K-256K core (800nsec)
Word size/add time	16bits, 950nsec	16bits, not given	16bits, 1.94usec (5 digits)	16bits, 5usec	16bits, 800nsec
Mass Storage					
Discs	cart	floppy, cart	floppy, cart, pack	cart, pack, fixed-head	cart, pack
Access methods	seq, index seq	indexed seq	seq, indexed seq	random, seq	random, seq, indexed se
Mag tapes	no	no	reel-reel, cart, cassette	reel-reel, cart	reel-reel
Peripherals	10-key, serial print (16cps), crt	10-key, acctng keybd, serial print (to 300cps), crt	10-key, line print (to 1,200lpm), crt	10-key, card, serial print (165cps), line print (to 600lpm), crt	10-key, ppt, card, serial print (to 330cps), line print (to 600lpm), crt
Software	BASIC, acctng pack	ADAM	FORTRAN, BASIC, ALGOL, assembler, acctng pack, dbms	RPG, BASIC, assembler, English, acctng pack, dbms	BASIC, acctng pack
Base Prices	$40,140	$34,995 ($720)	$150,000 ($2,500)	$33,950	$49,900
Software/support			soft extra	included	app soft and supp extra
Comments		ADAM is designed for use by non-dp professionals	separate systems for on-line adm and charge collection also avail	mktd through dealer network	

Manufacturer	Minuteman Computer Corp.	Modular Computer Systs	Modular Computer Systs	Mylee Digital Sciences	NCR
System Highlights	1774, 1775, 1776	Modcomp II	Modcomp IV	3056/3088	8200-8250
No. of models	3			2	2
No. installed/date	80 since 1973	since 1973	since 1976	62 since May 1976	300-400 since Sept. 197
Multiprogramming	no	yes, 256 tasks	256 tasks	12 partitions	7 partitions
Communications	1 line (asynch, synch)	32 lines (asynch, synch, SDLC)	128 lines (asynch, synch, SDLC)	16 lines to 1200bps	7 lines (synch, asynch, 2780)
Applications	dist, mfg, liquor whslrs	dist, mfg	dist, mfg	acctng, dist, inventory	hosp acctng, govt, dist, whsle, educ, mfg
Processor	Data General Nova 3	Modcomp 11/26	Modcomp IV/35	Mylee 3000	NCR 605-NCR 6080
Internal storage	16K-64K core (800-1000 nsec)	64K-128K core (800nsec)	128K-1M core (500nsec)	56-152K MOS (800nsec)	32K-128K core/MOS (1200-800nsec)
Word size/add time	16bits, 2.7usec	16bits, 2.4usec	16bits, 1.6usec	16bits/125usec (5 digits)	16bits, 2.4usec (8 digits)
Mass Storage					
Discs	cart, pack	floppy, cart, pack, fixed head	floppy, cart, pack, fixed head	cart	floppy, cart, pack
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	indexed seq	random, seq, indexed se
Mag tapes	reel-reel, cassette, cart	reel-reel	reel-reel	no	reel-reel, cassette
Peripherals	10-key, ppt, card, serial print (165cps), line print (to 900lpm), crt	10-key, ppt, card, serial print (165cps), line print (to 1,000lpm), crt	10-key, ppt, card, serial print (165cps), line print (to 1,000lpm), crt	10-key, card, serial ptr, 300lpm line ptr, crt	10-key, card, serial prin (175cps), line print (to 600lpm), crt
Software	COBOL, BASIC, FORTRAN, assembler, acctng pack, dbms	COBOL (next month), RPG, FORTRAN, assembler, acctng pack, dbms	COBOL (next month), RPG, FORTRAN, assembler, acctng pack, dbms	ACE, acctng pkg	COBOL, assembler, NEAT/3, acctng pack
Base Prices	$34,995	$45,000	$75,000	$37,500	$33,420 ($945)
Software/support	soft and support extra	soft and support extra	soft and support extra	support incl	soft and support extra
Comments		full turnkey system and support offered	full turnkey system and support offered	some soft separately priced; 8 inventory mgmt pkgs to choose from, 1 incl	

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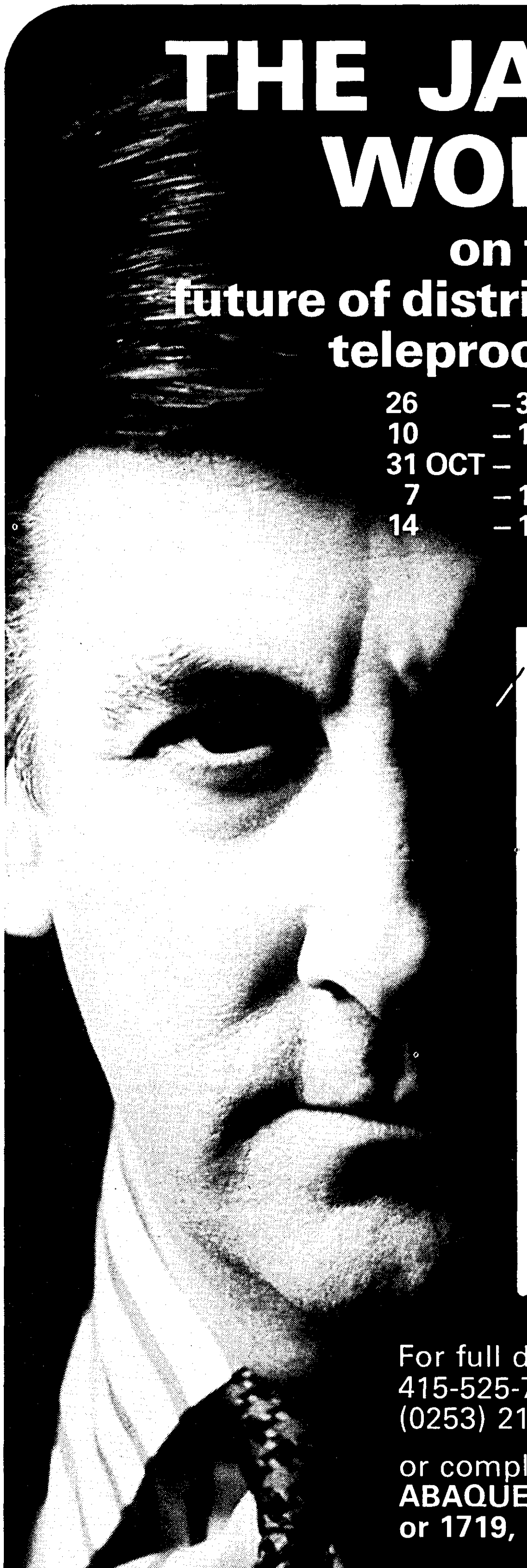
CIRCLE 32 ON READER CARD



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CIRCLE 70 ON READER CARD

Manufacturer	NCR	NCR	NCR	Nixdorf	Norfield Datasystems
System Highlights	Century Series	299-100/200	499	8870	Nova-, Eclipse-based systs
No. of models	5: 50, 75, 100, 101, 151				2
No. installed/date	1200 + since 1970	1500 + since Jan. 1974	300+ since Feb. 1976	n/g, since 1975	20+ since June 1973
Multiprogramming	9 partitions on large mods	no	no	yes	2 partitions
Communications	16-255 lines/2780/bisynch	1 line (asynch)	2 lines)asynch, synch, bisynch)	9 lines (synch, asynch, etc)	32-128 lines (synch, asynch)
Applications	all business	retail, whsle, mfg, financial	business acctng	dist, med, garment	automated reporting, order entry
Processor	615-910, -950, -955	NCR 299	NCR 605	DCC 116-H	Nova or Eclipse C/300
Internal storage	16-128K core, film, MOS	4K-16K bits Core (7usec/bit)	12K-32K core (1.2usec)	64K-128K core (960nsec)	32K-256K core (800nsec)
Word size/add time	8bits/15.8-59usec (5 digits)	64bits, 220msec	16bits, 1.7msec (5 digits)	16bits, 1usec	16bits, 600-800nsec
Mass Storage					
Discs	cart, pack	no	cart	cart	cart, pack
Access methods	random, seq, indexed seq	n/g	random, seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel, cassette	cassette	cassette	reel-reel	reel-reel, cassette
Peripherals	10-key, card, line ptr, crt	10-key, ppt, serial print (15cps), mag ledger card	10-key, ppt, card, serial print (to 130cps), line print (to 300lpm), mag ledger card, crt	10-key, ppt, card, serial print (165cps), line print (to 600lpm), crt	10-key, ppt, card, serial print (to 420cps), line print (to 600lpm), crt
Software	COBOL, RPG, FORTRAN, BASIC, assembler, NEAT/3, acctng pkg, dbms	assembler, acctng pack	NEAT/AM, acctng pack	BASIC, assembler, acctng pack	COBOL, RPG, BASIC, FORTRAN, assembler, dbms
Base Prices	$32,000 ($1,075 month)	$7,250 ($310)	$17,900	$37,990 ($851)	$35,000 ($1,250)
Software/support	soft and support extra	soft and support extra	soft and support extra	soft and support extra	soft and support extra
Comments	cycle times on all systems range between 750nsec and 1.2usec	rental price for 299-200; 299-100 is purchase only		turnkey system that includes NIDAS dist acctng system	automatic reporting syst for orgs w/multiple dispersed operations

Manufacturer	Northrop Data Systems	Olivetti	Olivetti	Olivetti	Pako Corp.
System Highlights	BDS 700, 1000	A4	A5, A6	A7	Pricing/Invoicing systems
No. of models	2		4	2	2
No. installed/date	20 since June 1972	2,000+ since Nov, 1975		n/g, since March 1975	since June 1975
Multiprogramming	3 partitions	no	no	2 partitions	10 and 15 partitions
Communications	4 lines (asynch)	no	1 line (synch, asynch, 2780)	1 line (asynch, bisynch, synch)	1 line (synch, 2780)
Applications	hospital, med, furniture mfg	credit union, fuel oil, financial	credit union, educ, dist	whlse dist, contractors	photofinishing
Processor	Microdata 1600	Olivetti 4000	Olivetto 5010, 20, 30, 40	Olivetti 7072, 7074	CAI LSI-2/20
Internal storage	16K-64K core (1usec)	224 MOS (5msec)	512K-4K MOS (1.5usec)	16K-48K MOS (900nsec)	16K-64K core (1.2usec)
Word size/add time	var. 8-32, 9.68usec (7 digits)	8bits, 150msec	64bits, 10usec)	8bits, 6.1usec	16bits, 25usec (8 digits)
Mass Storage					
Discs	cart	no	floppy	floppy, cart	floppy, cart
Access methods	random, seq, indexed seq	cassette	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel		cassette	cassette	reel-reel
Peripherals	10-key, card, serial print (to 120cps), line print (200lpm), crt	10-key, ppt, serial print (16cps)	10-key, ppt, serial print (16cps), line print (to 130lpm), mag ledger card	10-key, ppt, card, serial print (40 cps), line print (to 600lpm), mag ledger card, crt	10-key, ppt, card, line print (to 300lpm), crt
Software	BASIC, assembler, acctng pack, dbms	assembler, acctng pack	assembler, APLO, acctng pack	RPG, PL/1, assembler, acctng pack, dbms	dbms
Base Prices	$38,900	$2,395 ($86.45)	$4,900 ($177)	$12,935 ($455)	$29,505
Software/support	soft and support extra	soft and support extra	soft and support extra	soft and support extra	soft and support extra
Comments			floppy only on A6		includes pricing term. w/bar code reader

Manufacturer	Philips	Philips	Prime	Programmed Control Corp.	Q1 Corp.
System Highlights	P310, P320	P350	300, 400, 500	Prophet 21	Q1/LMC
No. of models	2		3	2	
No. installed/date	750 since June 1975	2,300 since June 1970	660 since Feb. 1973	20 since 1972	200 since 1975
Multiprogramming	no	no	31 and 63 partitions	22, 128 partitions	yes
Communications	1 line (synch, asynch, 2780)	1 line (asynch, synch, 2780)	64 (asynch, synch, HASP)	(asynch)	8 lines (3741, synch,
Applications	bank, insur, med, util	banking, insurance, utilities, med	graphics, statistics	industrial dists and wholesalers	acctng, credit union, word proc
Processor	Philips 310,320	Philips 350	Prime 300, 400, 500	TI 960B, 990/10	Intel 8080
Internal storage	8K-16K core (1.5usec)	12.8K-19.2K core (1.5usec)	64K-8MB MOS, 760nsec	32K-2MB MOS (700nsec)	8K-64K MOS (500nsec)
Word size/add time	8bits, n/g	64bits, n/g	16bits, 560-1560nsec	16bits, 2.8-3.6usec	8bits, 2usec
Mass Storage					
Discs	floppy	cart	floppy, cart, pack, fixed	cart, pack	floppy, cart
Access methods	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq	random, seq
Mag tapes	cassette	cassette	reel-reel	no	no
Peripherals	10-key, ppt, card, serial print (50cps), line print (70lpm), mag ledger card	10-key, ppt, card, serial print (40cps), line print (to 600lpm), mag ledger card	10-key, ppt, card, serial print (165cps), line print (1220lpm), crt	10-key, serial print (to 165cps), line print (250lpm), crt	10-key, serial print (to 200cps), line print (300lpm), crt
Software	assembler, acctng pack	assembler, acctng pack	COBOL, RPG, BASIC, FORTRAN, assembler, Forms, dbms	Prophet 21, acctng pack, dbms	assembler, PL/1, acctng pack, dbms
Base Prices	$7,500 ($170)	$15,500 ($350)	$21,500 ($473)	$42,500	$17,950
Software/support	soft and support extra	soft and support extra	soft and support extra	n/g	included
Comments			each user has virtual memory ranging from 128K to 512MB		

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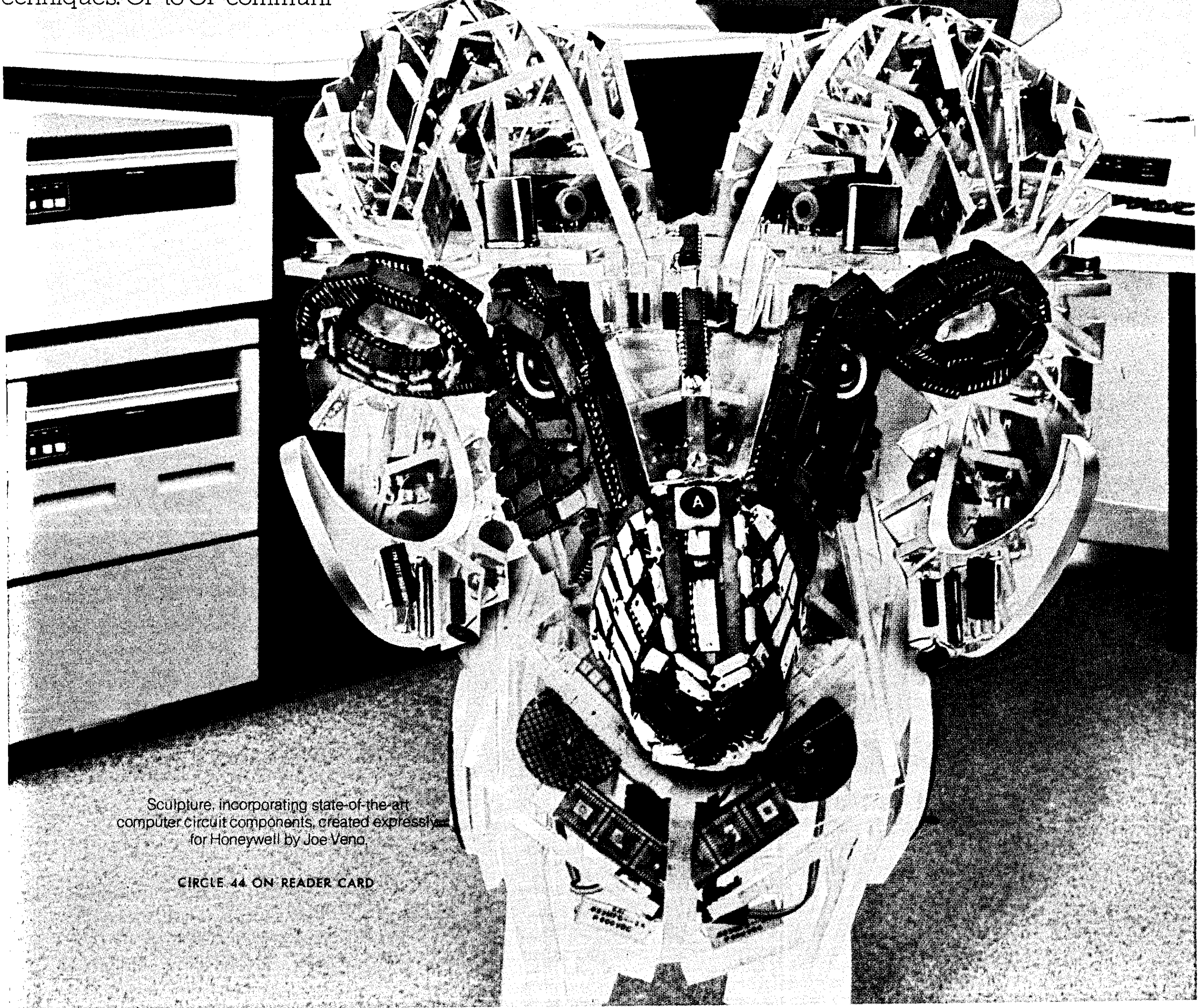

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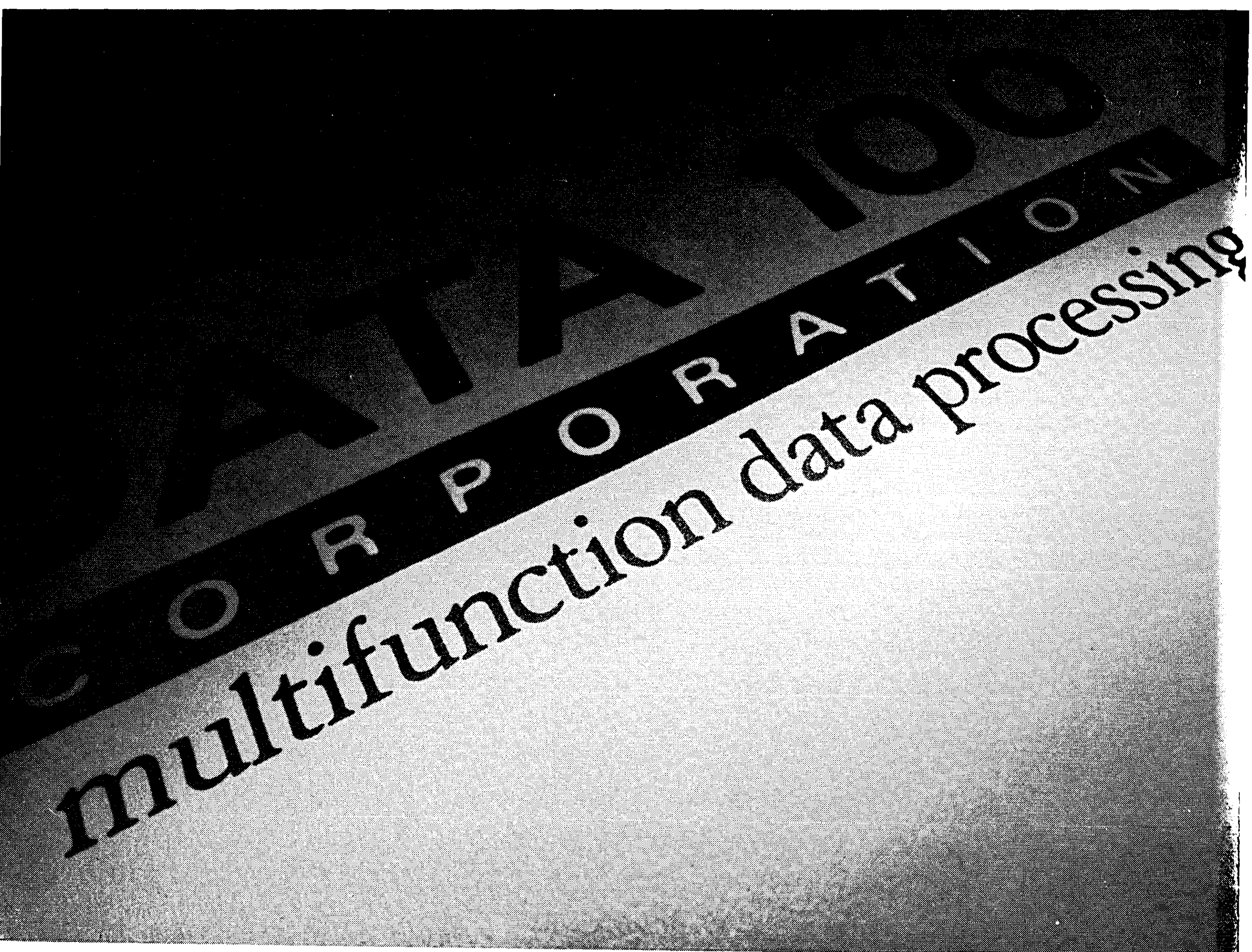
Manufacturer	Q1 Corp.	Qantel	Randal Data Systems	Raytheon	Shasta General Systems
System Highlights	Q1/LITE	900, 950, 1400, 1400-2	Link 100, 200, 500	PTS/1200	Diablo 3200
No. of models		3	3	1	1
No. installed/date	since July 1977	since 1975	200 since Oct. 1975	100 since Nov. 1974	50 since Dec. 1976
Multiprogramming	yes	5 or 30 partitions	2-16 partitions	yes; 20 partitions	yes
Communications	16 lines (asynch, synch, bisynch)	1 or 4 lines asynch, synch, HASP)	2-16 lines (asynch, synch, 2780)	1 line; asynch/synch/ 2780/3780	9 lines/asynch/synch/ 2780
Applications	credit union, banks, word proc, gen'l bus	whsle dist, med clinics	lumber industry, dental, med.	transport, insurance, finance	whsl, dist, med, financial, gen acctng
Processor	Q1-LITE	Qantel std and high perf	Randal 100,200,500	PTS/1200	Diablo 3200
Internal storage	16K-64K MOS (350nsec)	32K-128K MOS (1.1-1.5 usec)	32K-128K MOS (300nsec)	48K-128K MOS; 1.28usec	16K-64K MOS/0.488usec
Word size/add time	8bits, not given	8bits, not given	16bits, 1.2usec	16bits; 2.8usec	8bits/23.9usec (6 digits)
Mass Storage					
Discs	floppy, pack,	cart, pack	floppy, cart, pack	cart	floppy, cart
Access methods	ISAM, KSAM	random, seq, indexed seq	formatted, text, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	no	reel-reel	reel-reel	reel-reel, cassette	no
Peripherals	10-key, acctng keybd, card, serial print (45cps), line print (300lpm), plasma display	10-key, card, serial print (165cps), line print (to 600lpm), crt	10-key, card, serial print (to 180cps), line print (300lpm), crt	10-key, card read, serial print (to 165 cps), line print (300lpm), crt	10-key, serila print (to 200cps), crt
Software	assembler, PL/1, acctng pack	assembler, QICBASIC, acctng pack	BASIC, assembler, acctng pack	MACROL, dbms	assembler, DACL
Base Prices	$21,000	$27,900	$12,750 ($280)	$30,580 (830/mo, 3 yr lease)	$18,950
Software/support	soft extra	some soft and supp extra	soft and support extra	included	technical help extra
Comments	uses 6K ROM	program and report generation packages offered	marketed through distributorships	display-oriented distributed system. Apps also in RJE, data entry, 3270 emulation	DACL is an English-like compiler language

Manufacturer	A. O. Smith	Span Management Systems	Sperry Univac	STC Systems	Sycor
System Highlights	Mesa Two 7000 Series	Series/1	BC/7	Ultimacc series	410, 440
No. of models	1	2	1	4	2
No. installed/date	5 since May 1977	since June 1977	since March 1977	128 since 1973	1200 since May 1976
Multiprogramming	2 partitions	yes	2 partitions	8-50 partitions	no
Communications	16 lines/asynch/synch/ 3780/HASP	synch/asynch/bisynch/ SDLC	2 lines/synch	no limit (asynch, synch, 2780)	2 lines (asynch, synch, HASP)
Applications	distribution, mfg	many	distribution, mfg	mfg, banking, dist, govt, dist proc	used in many industries
Processor	Data General Nova 3	IBM Series/1	Univac T3038	Data General Nova 3	Sycor 410, 440
Internal storage	64K-256K core/1usec	16K-128K MOS/0.66usec	32K-64K MOS/1usec	32K-256K core (1-1.35usec)	24K-64K MOS (500nsec)
Word size/add time	16bits/not given	16bits/not given	8bits/106usec (5 digits)	16bit, 1usec	8bits, n/g
Mass Storage					
Discs	pack	floppy, pack, fixed head	floppy, cart	floppy, cart, pack	floppy, cart
Access methods	random, seq, indexed seq	IAM	random, seq, indexed seq	random, seq, indexed seq	random, seq, indexed seq
Mag tapes	reel-reel	no	reel-reel, cassette	reel-reel	reel-reel, cassette
Peripherals	10-key, serial print (165cps), crt	10-key, acctng keybd, serial print (120cps), line print (414lpm), crt	10-key, card, serial print (200cps), line print (to 250lpm), crt	10-key, ppt, card, serial print (165cps), line print (to 900lpm), crt	10-key, card, serial print (to 180cps), line print (300lpm), crt
Software	RPG, Mesa RPG II, FPG, acctng pack, dbms	assembler, acctng pack, dbms	RPG, ESCORT, acctng pack	COBOL, FORTRAN, BASIC, English 210, acctng pack, dbms	COBOL, BASIC, TAL-2, acctng pack
Base Prices	$56,700	$35,000 ($1,167)	$17,283 ($385 month)	$41,000	$25,230 ($553)
Software/support	included	soft and support extra	some soft and supp extra		included
Comments	system designed for data base mgmt w/RJE	offers time-sharing system and turnkey systems	interactive applications; ESCORT is high-level lang		designed for transaction proc; available thru distributors

Manufacturer	Tal-Star	Tealtronic	Terak	Vanguard	Wang
System Highlights	TDMS System	2500	8510, 8510A	V500, V400	WCS-20-WCS-40/2200T
No. of models			2	2	5
No. installed/date	since 1972	since 2nd qtr. 1977	since June 1976	6 since March 1976	n/g since January 1975
Multiprogramming	2 partitions	no	yes	yes, variable	no
Communications	15 lines (synch, asynch)	1 line (asynch, 2780)	4 lines (asynch)	up to 32 lines, 9600bps	up to 5 9600bps lines
Applications	graphic arts, newspapers	not given	small business, educ, graphics	customized inventory billing only	mfg, dist, medical, insurance, banking
Processor	General Automation 18/30	Tealtronic 2500	DEC LSI-11	Raytheon RDS-500	Wang 2200T or 2200 MVP
Internal storage	32K-64K core (1.2usec)	20K-64K MOS (600nsec)	24K-56K MOS (1.2usec)	64-128K core (700-900nsec)	8-64K MOS (1.6usec)
Word size/add time	16bits, 2.4usec	8bits, n/g	16bits, 3.5usec	16bits/400usec (18 digits)	8bits/800usec (13 digits)
Mass Storage					
Discs	floppy, pack	floppy	floppy	floppy, cart, pack	floppy, cart
Access methods	random, seq, indexed seq	sequential	random, seq, indexed seq	seq linked, indexed seq	random, seq, indexed se(
Mag tapes	reel-reel	no	no	reel-reel	reel-reel, cassette
Peripherals	10-key, ppt, card, serial print (10cps), line print (240lpm), crt	10-key, serial print (to 165cps), line print (300lpm), crt	10-key, serial print (100cps), line print (300lpm), crt	10-key, card, serial ptr, line ptr, crt	10-key, ppt, card, serial ptrs, line ptrs to 600lpm, crt
Software	COBOL, RPG, FORTRAN, assembler, acctng pack, dbms	assembler, ACL, acctng pack	FORTRAN, BASIC, APL, AG/1, assembler, acctng pack, dbms	COBOL, SPL, dbms	BASIC, acctng pkg, dbm
Base Prices	$73,600	$9,900	$6,615	$46,000	$6,400
Software/support	soft and supp extra	soft free, supp extra	soft and supp extra	soft extra, some supp bundled	soft incl, support extra
Comments	on-line db support; direct entr circulation system for publications	ACL is compatible with the IBM 3741	compatible w/DEC RT-11 and DEC languages; 8510A has graphics	terminal-oriented system designed for development and application: to 5cpus	2780/3780/2741/3741 protocols supported *110usec on WCS-40

Why do we sign our name with these words?



Because they sum up the basic concept behind our products.

Products that offer the user up to four functions in one system. Remote job entry. Key-to-disk data entry. On-line file management. And stand-alone processing. All configured to meet application requirements.

It's a concept that offers our customers a unique blend of stability, growth and economy.

A concept we also offer to you.

We protect your past and present.

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To protect the user's time and resource investment in system procedures and software, by providing continuity between every product in the Data 100 line.

Our first product was a remote batch terminal with remote job entry.

Today, we offer remote job entry, remote data entry, on-line file management and stand-alone processing.

In the meantime, we have protected the time and resource investments of our customers.

Software and system procedures used in early Data 100 products still operate with today's expanded multifunction systems.

We provide for your future.

Data 100 products are designed for multiple tasks.

That's the beauty of multifunction data processing.

For example, you can buy a remote job entry product now, then add key-to-disk data entry later.

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And you don't obsolete your system as you grow.

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CIRCLE 34 ON READER CARD

Manufacturer	Warrex Computer	Warrex Computer	Warrex Computer	Wintex Computer
System Highlights	Centurian Series	Centurian Series	Centurion VI	200 NS Bus. System
No. of models	3: I-A, II-A, III	2: II, IV		
No. installed/date	n/g since 1974	n/g since 1975	n/g since 1978	n/g since January 1975
Multiprogramming	yes	yes	yes	yes
Communications	4, 12	1-8 lines	4, 64 lines	1 line to 9600 bps
Applications	route acctng, invtry ctl, oil/gas, medical, banking	oil/gas, medical, dist, acctng	acctng, dist, oil/gas, banking, medical	dist, professional services
Processor	CC-201, 202, 203	CC-202, 204	CC-206	Wintex Microprocessor
Internal storage	16-60K MOS (800nsec)	16-60K MOS (800nsec)	32-252K MOS (600nsec)	8-64K MOS (650nsec)
Word size/add time	8bits/3.6usec (word)	16bits/8usec	8bits/16usec	8bits/1.5msec (5 digits)
Mass Storage				
Discs	floppy, cart, pack	cart	floppy, cart, pack	floppy, cart, packs
Access methods	random, sequential	random, sequential	random, sequential	random, seq, indexed seq
Mag tapes	no	reel-reel, cassette	no	no
Peripherals	10-key, ppt, card, crt	10-key, card, serial ptr, line printers to 600lpm	10-key, card, serial ptr, line ptr, crt	10-key, line ptr, crt
Software	assembler, CPL I, acctng pkg software bundled	FORTRAN, BASIC, assembler, CPL I, acctng pkg software bundled	assembler, CPL I, CPL II, acctng pkg software bundled	BASIC, assembler, acctng pkg
Base Prices	$20,000	$26,950	n/g	$12,000
Software/support	support extra	support extra	support extra	soft extra, some support incl
Comments				Two 300K floppy drives standard

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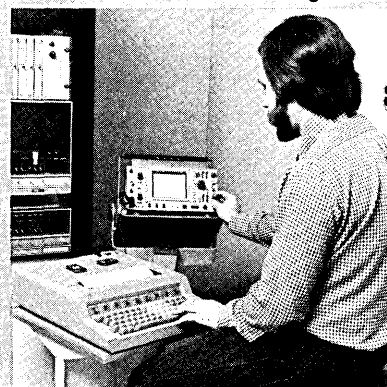
Miniterm 1205 Portable ASR

for newspaper reporters

for field diagnostics



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- Built-in Acoustic Coupler
- Portable Carrying case

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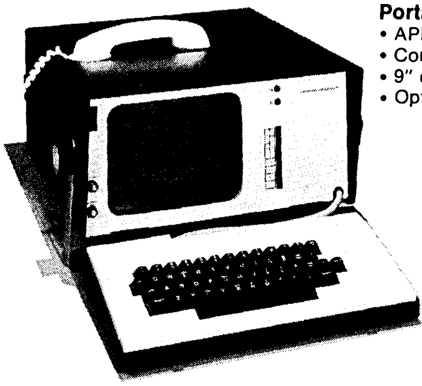

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- Compact, rugged construction
- 9" display
- Optional acoustic coupler

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Elite 1520A
- Conversational
- X-Y addressable cursor
- 64/128 character ASCII
- Display 80 x 24

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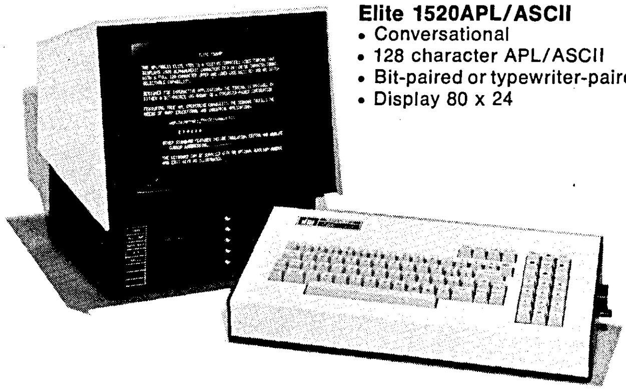

Elite 1520APL/ASCII
- Conversational
- 128 character APL/ASCII
- Bit-paired or typewriter-paired
- Display 80 x 24

Circle 139 on Reader Card

Elite 2500A
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- 128 character ASCII
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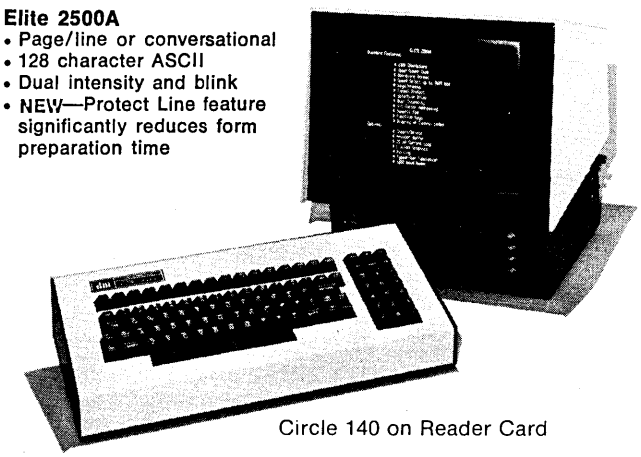
- NEW—Protect Line feature significantly reduces form preparation time



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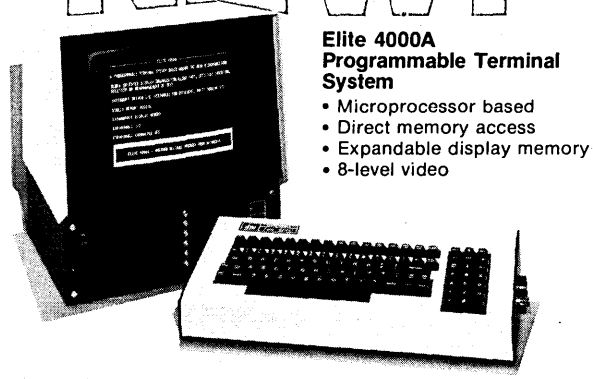

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- Direct memory access
- Expandable display memory
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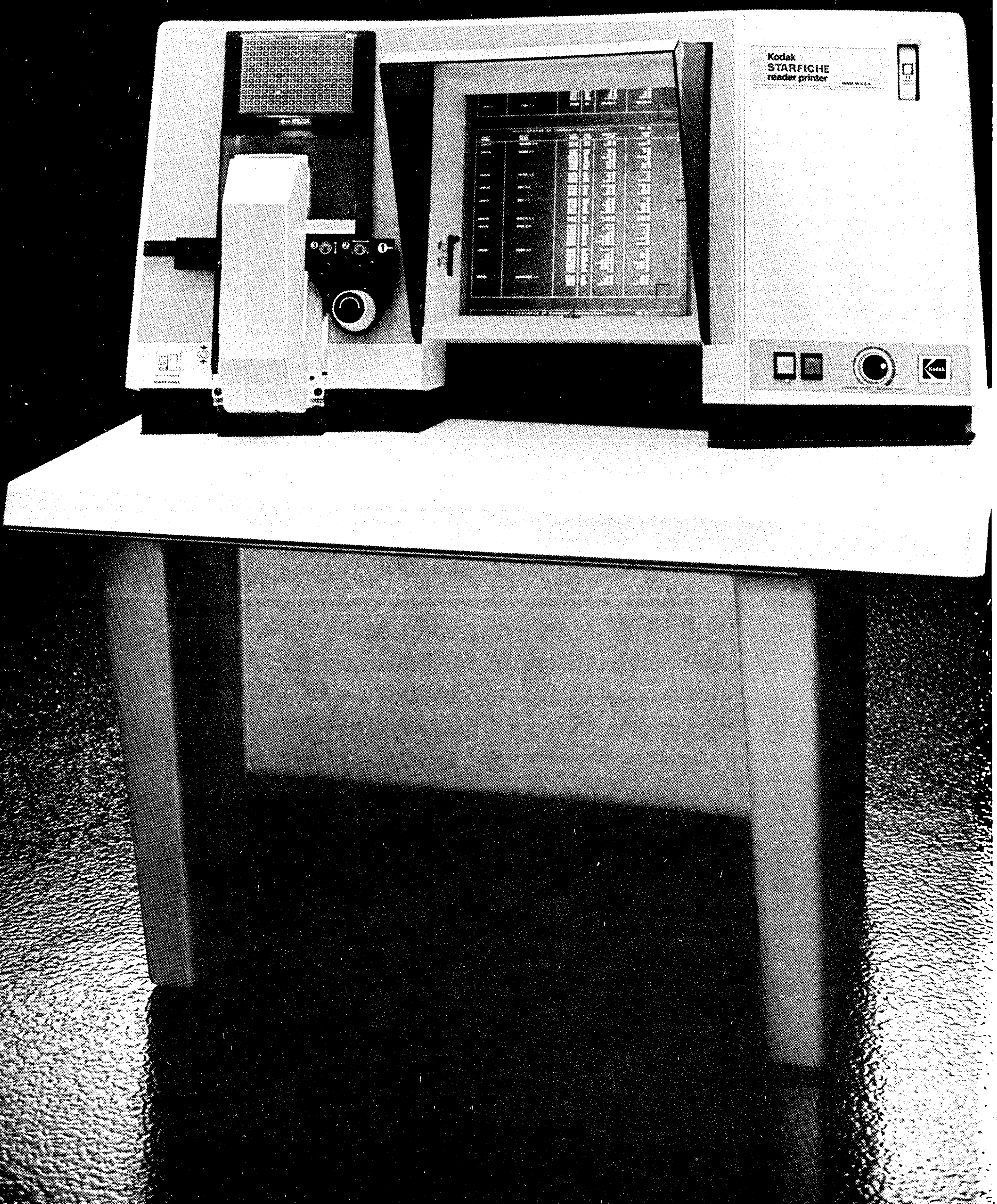
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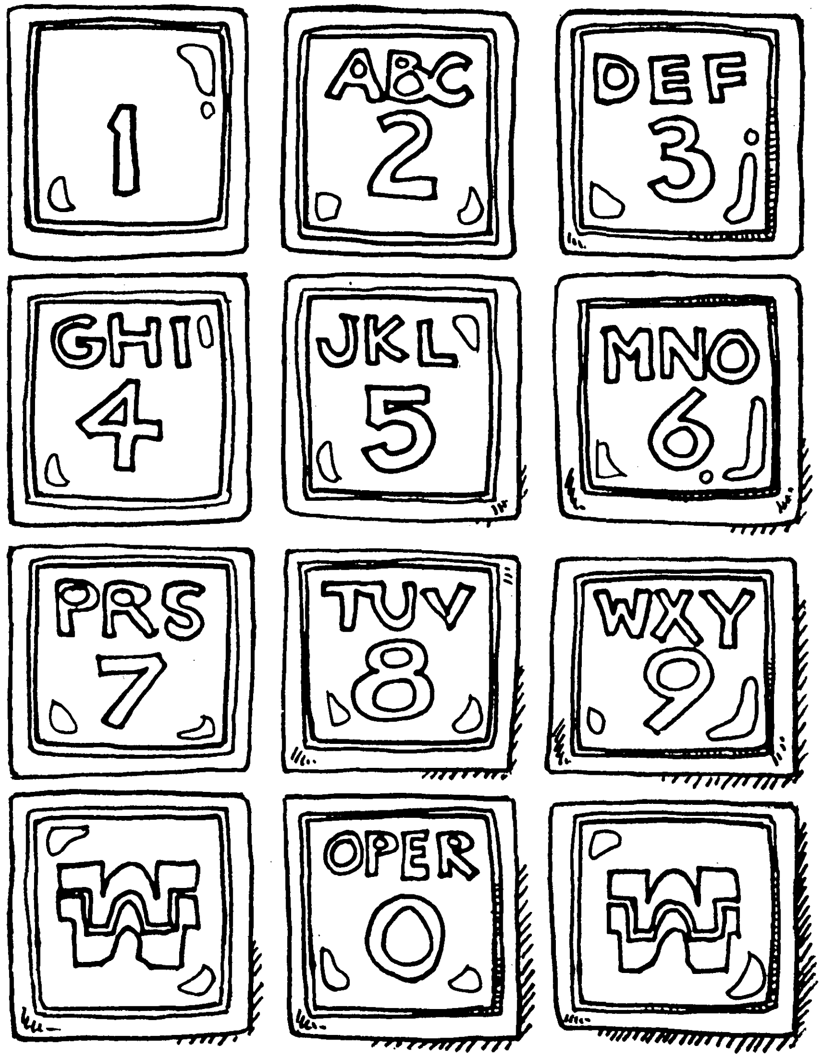

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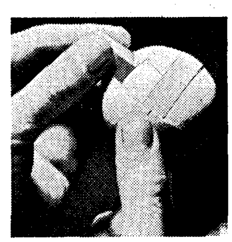

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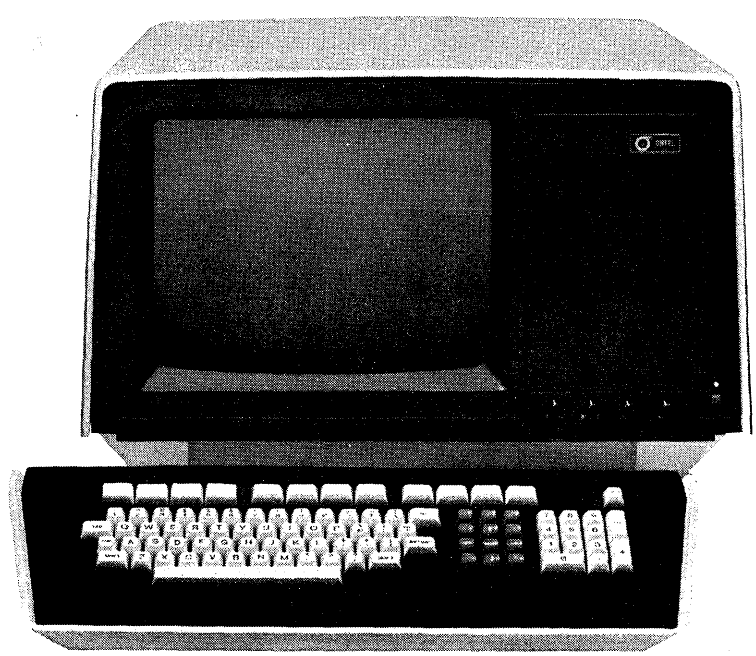

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CIRCLE 127 ON READER CARD

info 77

Back to the Big Apple

Fourth conference has more exhibitors and a streamlined program for people involved in information management systems. And it's all under one roof.

"I think we've finally arrived," says Ed Greif, a public relations spokesman for Info '77, the fledgling Information Management Exposition and Conference which opens Oct. 17 at New York's Coliseum.

Greif's assessment seems correct: there are more exhibitors than ever before in Info's four-year history. The conference of 225 speakers at 70 sessions has been streamlined to meet the needs of a more accurately defined audience. And both the exposition and conference are under the same roof.

When Info was established in 1974, reputedly to fill a gap left when the National Computer Conference emerged as a once a year event instead of the twice yearly Spring and Fall Joint Computer Conferences, it occupied the Coliseum for the exhibit and Lincoln Center and the Americana Hotel for the conferences. When the NCC returned to New York last year, Info '76 moved to Chicago's huge McCormick Place where everything was under one roof.

That led the sponsoring organization, Clapp & Poliak, to decide to hold everything under one roof in the Coliseum, even though it will require huge expenditures in building temporary soundproof walls to house up to eight sessions running at the same time. The decision was made after it was found that one out of four Info visitors spent the $150 Info charges to attend all four days of the conference which runs through Oct. 20.

Dr. I. Edward Block, managing director of the Society for Applied Mathematics, who has organized the conferences for Info, said this year's session will be grouped into 13 "conferences within a conference" on the following subjects: information management; distributed data processing and data base management; electronic data processing management; office automation; data processing for small business; recent advances in technology; manufacturing systems; financial management; physical distribution management; electronic funds transfer; bank information systems; insurance information systems; and hospital and health care information systems.

NEW YORK COLISEUM: For first time in three years, Info '77 will be held under one roof.

The keynoter

Harvey Poppel, senior v.p., Booz, Allen and Hamilton, Inc., a New York management consulting firm, will deliver the keynote address, "Strategic Planning for Information Resources—a View from the Top." The keynote session, at 10 a.m. on opening day, will be chaired by David W. Benjamin, v.p., data processing, with Blue Cross/Blue Shield of Greater New York.

That Info '77 is coming into its own is evidenced by the growing number of exhibiting firms. Some 155 companies will occupy 42,050 sq. ft. on the second floor of the New York Coliseum. That compares with 123 who took 29,276 sq. ft. of exhibit space in Chicago last year, and 104 exhibitors in 21,035 sq. ft. at the Coliseum in 1975. Attendance has ranged just under the 10,000 mark, but this year the sponsors won't argue with a projected turnout of 12,000 to 13,000.

Promotion budget

Its promotion budget has been increased by a third to $300,000 over last year's figure, and includes the purchase of 32 pages in technical and general business publications; four advertising inserts in the *Wall Street Journal* and the *New York Times*; the mailing of 600,000 invitations to secure an advance program for Info, and the mailing of some 200,000 programs. In addition, some 750,000 tickets have been distributed through magazines and exhibitors.

A charge of $5 is made to people attending the exhibits only (or $1 if they already have a complimentary ticket). Conference fees are as follows: $150 for four days; $90 for two days; $50 for one day; $30 for a half day.

The exhibit is dominated by software companies—at least 25 of them. Seventeen publishing firms also will exhibit, along with 15 manufacturers of terminals, 13 companies who make word processing devices, 10 firms offering communications devices, and seven minicomputer manufacturers. Six manufacturers of small business systems will exhibit, and five each in the data entry and microfilm business. There will be four time-sharing exhibitors and four selling printers. Most exhibitors are among the top in their fields.

Retrieval system

They'll be supported at the conference by an on-line retrieval system supplied by Service Bureau Corp. that links an attendee's buying interest with products or services supplied by the exhibitors.

Block said the make-up of the conference matches the interests of persons who come to Info, "primarily users with all sorts of titles involved in the management of information systems." Block said, however, that very few are of the type that attend technical conferences on computers. For instance, fewer then 10% of the persons surveyed at Chicago last year went to the NCC. Block said the survey found that 41% of the Chicago turnout do not go to other trade shows.

Block quotes other statistics that show a profile of persons attending: 64% have an information management department in their company; 56% of them work in that department; and 87% of them believe the information management function will become more important to their company over the next five years. "As the price of hardware continues to go down, the prime importance in the information management department will be in managing the far-flung dp functions, the data bases, the people, and to what use the company is putting its information," Block says.

Block said the program tries to reflect these needs. Here is a rundown of highlights:

Distributed Data Processing and Data Base Management: Eight sessions are to be devoted to this revolutionary subject, beginning Monday afternoon with a session, "From Mainframes to Minis," with Allan Proske of Manufacturers Hanover Trust Co. and Roger Taylor of Martin Marietta Data Systems. They'll discuss such subjects as the availability of cheaper and more capable minicomputers, demand by local management for control over their dp operations, and for the first time, the ability of management to map the structure of its data processing equipment and data communications network onto an organization chart.

A full day will be devoted to "Data Base Administration in a Decentralized Environment." The morning will be given over to systems and personnel management, with John Turner, of Columbia Univ.; Melvin Blitz, Corporate Technical Planning, Waltham, Mass.; and Eugene Altschuler, consultant, speaking. In the afternoon, data base administration through collateral management will be discussed by Mobil Oil's G. T. Gunnell and Equitable Life's F. H. Miller, followed by a comparison of the experiences of Grumman and Mobil in this area.

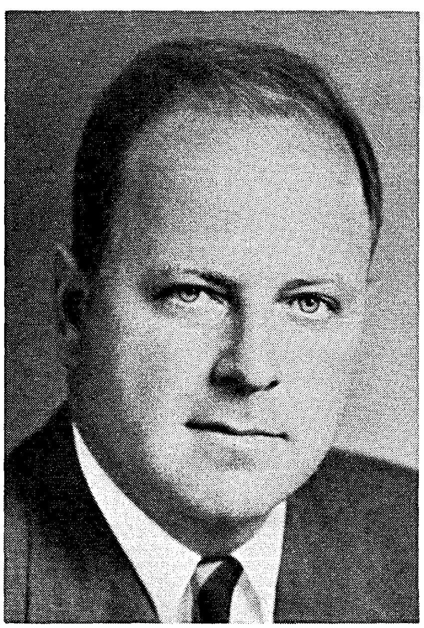
Four speakers will explain conversion to distributed data processing. They are Illario Simonette and John Nuxall of Peat, Marwick, Mitchell and Co.; Dr. J. A. Rockart of the Sloan School of Management; and J. L. Hughes of Citibank.

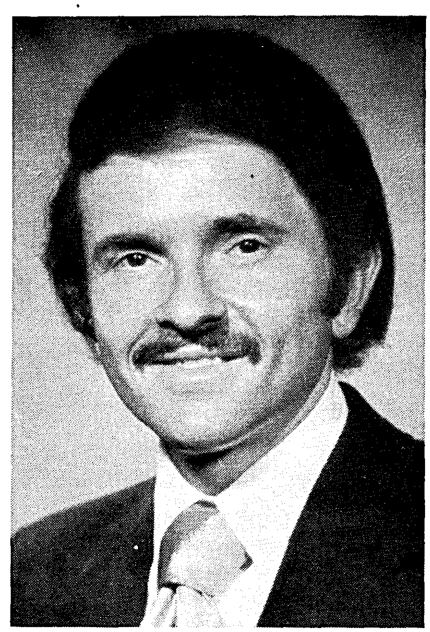
Another all-day session will present case histories of companies which are implementing distributed data processing. The participants are: Peter Augusta, regional director of financial marketing with NCR Corp. in New York; Larry D. Woods, manager of distributed processing with Deere and Co., Moline, Ill.; Tony Harris, director of data processing with Finning Tractor Co.,Vancouver, Wa.; Harry Vickers, v.p. of Entrex; and Dr. Norman Morrison, director of MIS with the Knight-Ridder Newspapers, Inc., Miami.

Data Processing Management: "Disaster Recovery in a Large Scale Data Processing Environment" is the first topic in this session, and it assesses the backup plans for dp departments to get back on-line after disaster strikes. Morton B. Comer, v.p. of Provident National Bank of Philadelphia will discuss how Philadelphia area firms have formed a cooperative data center to serve as a backup in the event of a huge fire or other disaster. The other speakers in this session are: John Konvalinka, Arthur Anderson and Co., Philadelphia; and Oliver J. DeSofi of the National Bank of North America.

A related session, "Cost Effectiveness in Protecting the Data Base," includes a talk on cryptographic security for file systems by Dr. S. M. Matyas of IBM, and security by software design by M. F. Smith of Norda Chemical Corp., East Hanover, N. J.

David M. Harris, a CPA with the firm of Lilly and Harris, Cleveland, will lead a session on "Planning for the EDP Audit," a course on getting ready for an audit and what you should expect from the auditor. Charles D. LaBelle, v.p. of human resources with Manufacturers Hanover Trust Co., New York, will lead a session on "Putting a 'Heart' in Your Dp Organization," devoted to a case study of a structured system to improve the people environment and increase the productivity of a dp organization. A related session, "Motivation and Management Styles—Essential Consider-





FEATURED AT INFO '77: Richard S. Wolcott, of Clapp & Poliak runs Info '77. Dr. I. Edward Block stages the conference program,and Harvey L. Poppel, of Booz, Allen and Hamilton, Inc., is the conference keynoter.

ations for Successful EDP Projects," will be headed by Nate A. Newkirk, a Mt. Kisco, N. Y., consultant. The final session in dp management is "The Corporate EDP Manager in a Decentralized Environment," a session examining the inevitability of decentralized computing because of the emergence of minicomputer and communications technology. Chaired by Edward J. Farrell, of AMAX, Greenwich, Conn., it will hear talks by Howard Frank, of Network Analysis; W. R. McCartin, of Nexell Corp; and Charles Siegel, of U. S. Fidelity & Guaranty.

Advances in Technology: Top dp managers must make strategic hardware and software investment choices for data communications today which they'll need to live with for the next decade. A session, "Data Communications Planning for the 1980s" will explore this subject from several points of view, including that of the session chairman, Dr. David N. Freeman, of Ketron, Inc., with a paper on "Buying Today for the '80s." Murray H. Robinson, of Murray H. Robinson and Associates, Ltd., will discuss circuits, messages, or packets, and consultant Ralph Berglund will talk on wire, microwave, or satellite. Finally, Dr. Carl H. Mayer, of IBM, will explore cryptographic protection of data communications.

Another session, "Using Minis to Replace Mainframes—What's Required and the Cost Effectiveness," pits two speakers with contrasting views: C. A. Conover, v.p. of systems planning and programs with Honeywell, Inc., Minneapolis, will suggest that the tasks of the general purpose computer be made modular, but kept centralized; and Jon S. Gould, of Citibank, N. Y., will propose that total computing power be distributed to small groups of users. The debate will be chaired by Dr. Jean-Michel Gabet, staff associate with Gnostic Concepts, Inc., Menlo Park, Calif.

Other sessions discuss new mainframes, micrographic systems for information storage and retrieval, smart terminals and clusters, and front-end systems that relieve the data entry bottleneck.

Data Processing for Small Business: Guidelines and pitfalls of installing your own small computer will be discussed in one of the four sessions on small business computers. Chairman Alan C. Verbit, a consultant with Haskins and Sells, Philadelphia, will talk about what to do if you don't like what you've acquired. Did the vendor fulfill his commitment: did you fulfill yours? Can the system do what you require? Should you expand it, change it, or change the vendor?

Another session, "Minicomputer Small Business Systems—Use and Effectiveness in the Business Community," will examine applications, and how users rate their installed small computer systems, this latter being based on a Data Pro 70 research project.

Information Management: Highlight of the information management sessions include "The New Management Function Combining Computer, Office, and Telecommunications Systems," by David S. O'Dwyer, of AT&T's strategy group. Some companies are now merging these three systems into an integrated information management function, and O'Dwyer will offer some guidelines to determine when a single information management function is appropriate and offer several approaches for implementing such a function. Robert J. Cymbala, of Booz, Allen and Hamilton, New York, will chair the session.

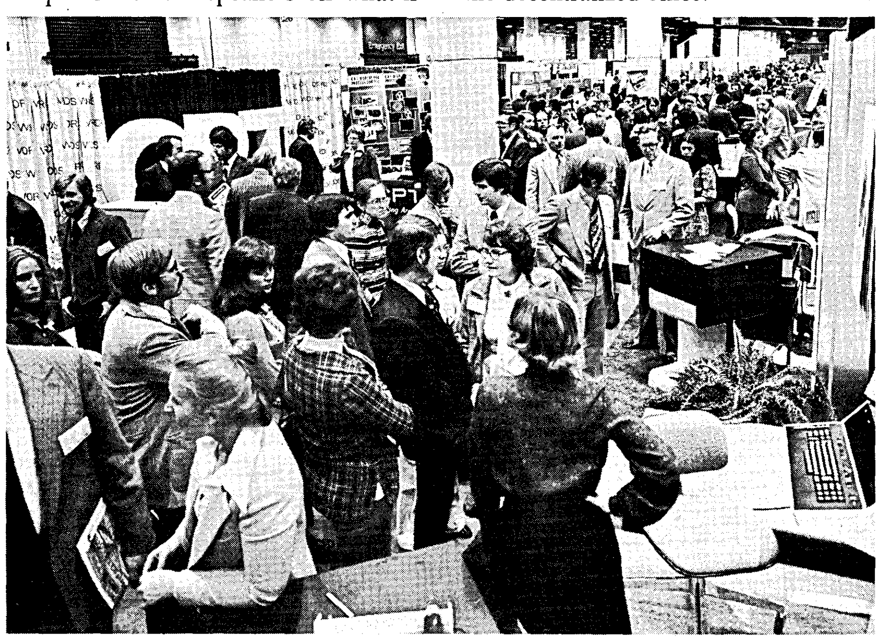
Other sessions deal with long range planning for information systems managers and how to increase the productivity of the information system. Cymbala, who will chair one of these sessions, discusses new ways for corporate management to assess capital investment, project the cost benefits and trade-offs between longer-term investments and short term savings, and offer a framework to set realistic goals for increased productivity.

Financial Management: Five sessions on financial management address financial data bases, "what if" planning models, and economic and business forecasting. Joel W. Darrow, Morgan Guaranty Trust Co., New York, chairs a session on "Financial Data Bases—What's Available and How They're Used." The participants are Richard B. Karram, Standard and Poors Corp.; Samuel A. Wolpert, Predicasts, Inc.; Dr. Dennis O'Brien, Data Resources; and Bruce E. Beene, Business International Corp. One of the speakers on what-if planning is Geoffrey R. Cross, managing director for International Computers Ltd., London.

Office Automation: Fourteen sessions are devoted to many aspects of the office of the future. For example, in a session, "The Merger of Computers and Micrographics in the Storage and Dissemination of Information," IBM's L. Patrick Briody will talk of the day when incoming paper won't be seen in offices. Documents will be stored on microfilm or digital media in the mailing room, and the paper coming in will be thrown away after it is stored for recovery on crt's or other imaging devices.

Paul G. Truax, president of Truax-Smith and Associates, will report on a survey of the needs of the user in a session, "User Needs and Trends in Office Automation." Truax will base his discussion on more than 400 independent surveys in 20 major industry segments. He'll examine what office system needs exist and what the major suppliers are doing to meet these needs, based on the current state of equipment technology. Trends in product offerings during the next five years will be considered.

Philip Hayes, director of telecommunications with Minnesota Mining and Manufacturing Co., will head a session, "Telecommunications Planning for the Office of the Future," in which the marriage of word processing, office systems, data processing, telecommunications, and electronic mail will be examined from the point of view of how it will effect the office work station in 1980. Daniel Lavery, a senior staff consultant with Quantum Sciences, will talk of "The Office of the Future—What It Will Look Like and How It Will Work." Charles S. Pedlar, of Tele/Resources, will discuss communications needed for the decentralized office. ✲



INFO '77 sponsors think this year's conference will exceed considerably past turnouts of under 10,000. Some forecast up to 15,000 at the New York affair.

Communications

NCR Readying Terminals That Interface with DNA Protocol

Software enhanced version of 721 communications processor is first of products that tie large systems to DNA

Several terminals in NCR's present product line will become interfaceable during the coming year with the company's newly announced Distributed Network Architecture (DNA) packet communications protocol. Interface software for the 280 and 2151 retail terminals, 279 teller machine, Financial Modular Terminal System, 1770 in-lobby self-service banking terminal, and 796 crt terminal is now being written or planned, according to NCR sources.

This month, the company plans to announce a software-enhanced version of its Model 721 communications processor which will tie NCR dp systems to DNA and also will act as an interface for clusters of remote terminals. The computers that will be interfaceable to DNA through the enhanced 721 include the Century and 8000 series. Included in this latter group are the Criterion computers (models 8550 and 8570) NCR introduced last year. Two new Criterions, which will extend the line upward and downward, are scheduled for announcement next month.

Montgomery Ward is reported to be one of the first users of the enhanced 721 communications processor. The retailing giant has a nationwide, multipurpose data communications network already in operation that uses numerous 721s to interconnect some 18,000 terminals. Most of these are NCR point-of-sale machines, but there also are other makes, including IBM System/3s.

New cash registers

Next November, NCR plans to announce a new family of electronic cash registers, designed "from the ground up" to operate with DNA. Based on an Intel 8080 microprocessor and featuring a resident memory of up to 128KB, the series is designed for supermarket, drug store, hotel/motel, and bar/restaurant applications. The new series reportedly will be significantly lower priced than the NCR 255, the company's most widely used checkout machine. Mainly, this is because the 255 needs a backroom minicomputer, costing about $120K, to provide additional processing and storage capability. The new ECR machine won't need the mini, at least in most installations, because it will have substantially more built-in logic and memory than the 255.

Delivery next year

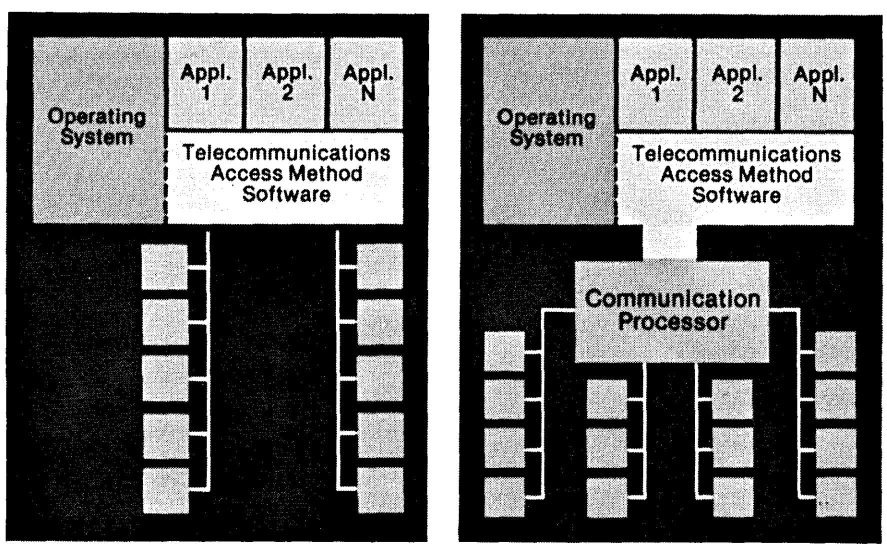
Delivery dates for DNA network software modules will be announced "early next year," said an NCR spokesman. He anticipates that the modules needed to provide both link control and end-to-end control will be ready for delivery before the end of 1978. A number of enhancements to this initial release are planned—including a capability to combine packets from different terminals into a single message frame and thus improve network utilization.

Key to the DNA architecture is the separation of communications processing from application processing, explained the NCR spokesman. He said this arrangement insulates the application programmer from procedural aspects of communications. This architecture also provides the means for interconnecting multiple computer systems in a distributed processing environment.

Proprietary protocol

Main elements of NCR/DNA include a proprietary, bit-oriented, link protocol—NCR Data Link Control—which is to be made compatible with ISO/ HDLC, ANSI/ ADCCP, and IBM/SDLC so that the network can be interfaced with non-NCR terminals, computers, and communications processors.

Another major component of the new communications system is the NCR/ Telecommunications Access Method (NCR/TAM). It encompasses several operating system services—for example,



NCR'S DNA: Key to the architecture is the separation of communications processing from applications processing. It also provides the means for interconnecting multiple computer systems in a distributed processing environment.

an ANSI COBOL 74 message control system that provides standardized access to applications programs. Other TAM functions include system and link control, queue management, resource scheduling, addition and deletion of packet headers, error recovery and reporting, and provision for in-service diagnostic capabilities.

The final major element of NCR/DNA is a data transporting network (DTN) module, which routes and controls the movement of messages over multiple paths between node processors. The first of these processors will be the newly enhanced 721, scheduled for announcement this month.

A special feature of the node-to-node control scheme, said NCR, is that the user's application processes address each other by unique logical names without regard to physical locations. Routing tables in each node processor then convert the logical addresses to physical addresses. "This technique permits an application process, such as a data base, to be moved to a new location without changing every application that communicates with it," NCR said, adding that "only the tables in the node processors must be altered."

DTN also provides rerouting in case a system element or an internodal link fails.

Other DNA components include a set of user tools designed to assist the user in defining the topology of a network, assigning and naming the processes attached to each node, and specifying the rules governing process-to-process access.

These user tools execute on appropriate processors as part of total system generation. They also allow terminals to be added, or assigned to different node processors, enabling the user to reconfigure a network dynamically.

The in-service diagnostic feature of DNA is said to aid in the isolation of faults to a particular location in the network or to a communication link between locations. Diagnoses can be performed on any part of the network without shutting down the rest of it, NCR said.

R. L. Phelan, NCR's vp for research and development, said, "NCR/DNA has been developed for use with distributed processing systems, message-switching systems, and large-scale retail and financial systems, including those providing electronic funds transfer. It provides a foundation for all telecommunications systems, large or small." ☼

Copyrights

Copyrights for Software?

Are discs, tapes, and punched cards literary works?

"It boggles the mind to think of the magnetized discs and tapes, the punched cards, and the silicon chips of programs in their object phase as 'literary works.' "

Such is the feeling of author John Hersey as expressed in a dissenting opinion amended to a report by the Software Subcommittee of the National Commission on New Technological Uses of Copyrighted Works (CONTU). The basic report essentially recommends that the commission advocate copyright protection of software and specific provision in law for the protection of programs.

CONTU was created by the Copyright Act of 1976 to recommend to Congress periodic revisions of the new law, which goes into effect Jan. 1, 1978. Its next meeting was scheduled to be held Sept. 15 and 16 in Chicago, and one day of the meeting was slated for testimony from people wanting to be heard on the software report and on one by CONTU's data base subcommittee.

Michael S. Keplinger, senior attorney for the commission, said in late August that some 20 people had requested appearances before the commission on one or the other report, and that an equal number of written comments had been received. Deadline for both written comment and requests to appear was Sept. 1.

Response to software report

He said most of the response was to the software report rather than to the data base report. The latter said essentially that the introduction of a work into a computer memory would, consistent with the new law, be a reproduction of the work which is one of the exclusive rights of a copyright proprietor.

The more controversial software report notes that in 1976 the commission received oral and written testimony from 20 witnesses representing 18 organizations. Their views, the report says, "may be interpreted as follows: 11 favored copyright; 3, patent protection; 3, trade secrecy; 8 had no preference; and 2 perceived no need for protection."

Hersey's "mechanical device"

Hersey, whose "additional views" amended to the report exceeded the report itself in length, essentially argued that copyright protection is inappropriate for computer programs because a program is a "mechanical device, which is engaged in the computer."

His suggestion was for new legislation which could be named the "Computer Software Protection Act" and could involve the creation within the Department Commerce of "The Registry of Computer Software" which would receive and register computer software products, and in which rights would be asserted under the provisions of the Act.

"Every (computer) program has but one purpose and use," Hersey argued, "one object: to control the electrical impulses of a computer in such a particular way as to carry out a prescribed task or operation. In its object form it does not describe or give directions for mechanical work. It does the work." The Software Subcommittee report calls a program "a writing which sets forth instructions or sets of instruction." Hersey doesn't believe this analogy will hold up. "Description and printed instructions tell human beings how to use materials or machinery to produce desired results. In the case of computer programs, the instructions themselves become an essential part of the machinery that produces the results," he says.

A true writing, he infers, doesn't 'do' anything, "no matter how fervently many an author" may have wished his words could.

He allows as how the computer "in rare instances may serve as a storage and transmission medium for writings in their original and entire text—in such cases these writings can be adequately secured at both ends by the present copyright law; but in the overwhelming majority of cases, its purposes are precisely to use programs to transform, to manipulate, to select, to edit, to search and find, to compile, to control and operate computers and a vast array of other machines and systems—with a result that the original writing of the computer programmer is nowhere to be found in recognizable form, because it has been converted into a mechanical device that does these sorts of work."

"It utters work"

He argues that a computer program, "once it enters a computer in its object phase, does not communicate information of its own, intelligible to a human being. It utters work. In its object phase its direct product is not communication but electrical work. It is purely and simply a mechanical substitute for human labor."

CONTU, Hersey said, "has a duty to consider the impact of its recommendations, not only on proprietors and users of information systems, but also on the public. Specifically, considering the long history of copyright's bond to the written word (in both works of literature and practical works), and its bond to musical composition, to painting and sculpture, to the theater, to dance, to film, we must weigh the impact of what we recommend upon the national culture. For copyright has always been a mainstay and a guarantee of the creative wellsprings of the culture."

Hersey, who is a member of the commission, often has said in commission discussions that the dual purposes of copyright are the encouragement of creative work and the wide scattering of its fruits. "The sanctioning of copyright protection for this new thing, which is both a writing and a mechanical device, would, in this view, tend to dampen the first purpose. Its impact on the creative community would be bound to be discouraging. Furthermore, its indirect impact on consumers of all forms of creative work would, in this view, be unfortunate," he says in his dissenting opinion.

"This pollution of copyrighted 'writings' with units of mechanical work would affect not only the creators but also the consumers of the culture. Placed beside such traditional end products as books, plays, dance, film, and music, under the aegis of copyright, what end products of computer programs would we find?" he questions.

"A definite danger to the quality of life comes with a blurring and merging of human and mechanical communication," he warns.

Fear of the future

Hersey has another fear. He notes that IBM's Ralph Gommery, in testimony before the commission, suggested that, "If the automobile industry had progressed on the same curve as computers in the last 15 years, we would now have been able to buy for $20 a self-steering car that would attain speeds up to 500 mph and be able to drive the length of California on one gallon of gasoline."

He noted that Peter Weiner of Rand "gave us the vision of a 'computer-based' society a quarter of a century hence, with terminals in every home for all sorts of mechanical and communications aids."

Says Hersey: "Loading all this expanding technology onto the field of copyright would be bound to bring a progressive change in emphasis, and the great new dominant interests would all be corporate. The Constitutional aim of encouraging individual 'authors' would have relatively less and less weight."

Hersey was expected to be as eloquent at the September hearings as he was in his dissenting opinion.

At writing it was unclear who would be called to appear at the hearings. Susan Nycum, an attorney with Chickering and Gregory, San Francisco, and chairman of the ACM's standing committee on legal issues, said she would be appearing at one or more hearings and would bring with her opinions expressed by members of her committee which would be varied.

Although the number of requests to appear and of written responses was hardly overwhelming, Keplinger said that while more than 600 copies of each subcommittee report were sent out, requests for additional copies continued to come in throughout the summer, indicating a latent interest which perhaps hasn't progressed into opinion.

—Edith Myers

Government

Computer Age Legislators

Senate doles out terminals while House members must pay

In the beginning there was a computer. First in the House and then in the Senate. Then there were more computers, more software and more applications, and the Congressional computer shops set up in the early '70s began to grow. And they're still growing, independently but cooperatively.

Bound together by a common service bond, the Congressional computer crews each cater to the administrative and legislative needs of the information-hungry Congress. But while the dp services they provide are usually the same or similar, the catering approaches taken to meet those needs are often markedly different.

Explains John Swearingen, head honcho of the Senate's Computer Services Staff: "The Senate and House are not carbon copies of each other and neither are their staffs. We work on many similar projects, but we're different in other ways." This difference between the two computer camps is directly reflected by twists in philosophies, dictated mainly by the size of the organizations they're serving.

SENATE'S JOHN SWEARINGEN
He envisions Senate putting terminals outside Washington

Says Swearingen: "When you have four and one-third times as many people to deal with (as the House does), you look at the economics much differently." While the Senate dpers must try to satisfy the computer needs of 100 Senate members, the House Information Systems squad has to contend with the computer demands of 439 House members. So instead of just doling out terminals or other dp wares to each individual member, as the Senate has done, the House has opted for a laissez-faire approach, allowing representatives to siphon money from their "clerk hire" fund to buy or rent computer gear or services.

Waste of money

If the House had taken the Senate route, speculates House Information Systems head Boyd Alexander, it probably would have resulted in a waste of money. Not only would it be very expensive to supply 439 terminals, but he also questions whether the equipment would even be used by all the members. "Suppose," he contends, "only half the members used the terminals and the rest pushed them in closets or used them to set plants on. I don't think the American taxpayers would be very happy to know that we wasted their money."

In the Senate, Swearingen explains that ever since the computer operation's inception in the early '70s, the idea has been to provide direct dp services to Senate and committee offices. Following this policy, Hazeltine Model 2000 terminals were set up in all member offices (most committee offices also have their own Hazeltine 2000s). Through this terminal network, Senators and their staffs, as well as committee personnel, have access to the Library of Congress' legislative and other data bases.

The House has comparable services available through terminals in 209 member offices, providing access to the library data bases as well as special data bases furnished by its Member Information Network (MIN). These terminals, all individually procured by the members themselves, come from 16 different vendors—the most favored suppliers being Diablo, Anderson Jacobson, Trendata, AT&T (Dataspeed 40), and Hazeltine. The word processing equipment stash also includes a wide variety of different types of gear which the House Information Systems office expects will be computer linked in the near future. Several IBM System 6s and System/32s also are being used in a few member offices, mainly for word processing chores.

To get this computer power, House members can take up to $1,000/month out of the kitty they use to hire staffers. But sometimes these computer-age congressmen are less than anxious to dip into this fund for dp devices. "Substituting machines for people," points out Alexander, "is a hard decision for any member to make."

On board the caravan

However, it's obvious the legislators —almost half of them anyway—have overcome their reluctance to make the trade-off. According to Alexander, this hands-off approach of letting members decide if and when to use dp technology reflects HIS' original philosophy of "letting the marketplace initially determine (computer) use." But that "initial" period may be coming to end as more and more members and committees jump on board the computer caravan.

As a result, Alexander explains, the House dp planners will have to rethink their game plan, possibly bringing it more into line with the Senate's bulk buying approach. However, that's just one of many alternatives being considered. "We don't know if we'll go exactly the way the Senate has," declares the

HOUSE'S BOYD ALEXANDER
A full-blown distributed processing network around minicomputers

HIS chief, "but whichever way we go, we want members and committees to know exactly how much this computer resource costs." To do this, he says, HIS would set up a special accounting and billing system to tally user dp costs.

Such a system would run off one of the two IBM 370/158s the House computer group is using. Both Houses now have two identical mainframes (the Senate's second 370/158 went on-line early last month). In addition to the IBM cpu's, the House also uses dual CDC 1700s and associated crt's in the electronic voting system which has been operational since 1973. Having a slight hardware edge over the Senate, the House has implemented two new systems which run off minicomputers. One is an electronic publishing system powered by a Digital Equipment Corp. PDP-11, and the other is an experimental word processing system using two Harris Corp. minis.

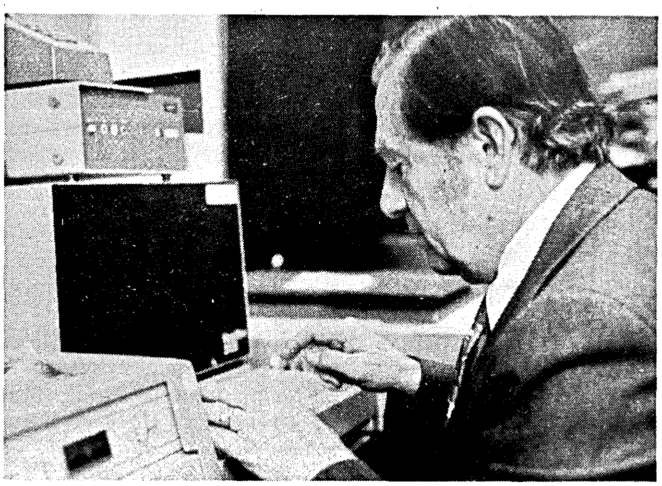
Both dp shops also use Comten front end communications processors for their terminal net link-ups. That solved one major compatibility problem, and also allowed better communication with the Library of Congress, which also uses the Comten.

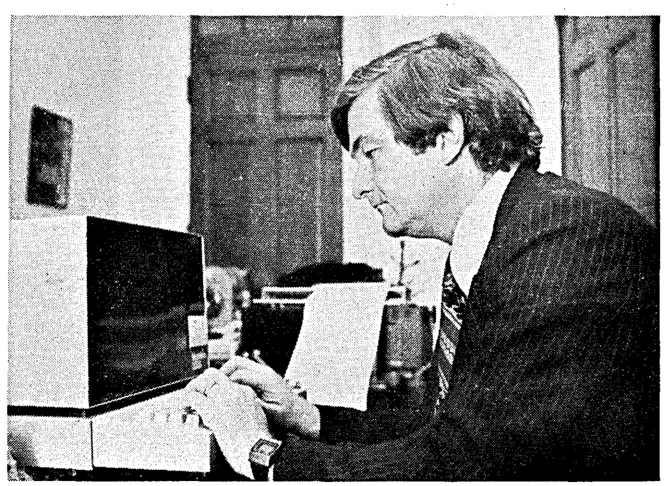
Compatibility and back-up

Compatibility and back-up muscle are two primary concerns of the House and Senate computer cadres. While both groups like to maintain their autonomy, they also realize that it's to their benefit to cooperate in certain areas. To formalize this cooperation, a joint Policy Coordination Group (PCG) was set up earlier this summer.

Made up of dp staffers from the House, Senate, and Library of Congress' Research Service, the panel will be looking at ways to step up efficiency and to avoid unnecessary duplication and redundancy between the three Congressional dp divisions. Task forces, most of which haven't been activated yet, will probe priority projects in such areas as word processing, computer output microfilm, and video/audio technology.

Work in these key areas has, of course, already been done by both Houses, but under the new cooperation pact, dp planners hope to come up with some shared solutions to their common problems. One prime example of this is the Legislative Information and Status System (Legis) which both system squads have been working on jointly for three years. A PCG task force currently is reviewing this work effort, trying to pull it together so the sophisticated sys-





HANDS ON: Sen. Howard W. Cannon of Nevada, chairman of Senate rules committee, left, and Rep. Charles Rose of North Carolina, of policy group on information and computers, pluck information from files through terminals installed in their offices. Senate uses Hazeltine model 2000 crt's, while House has a variety, including Diablo, Anderson Jacobson, Trendata, AT&T, and Hazeltine.

tem can run effectively in all three Congressional branches.

Tracking legislation

An upgraded version of the House-developed bill status system, Legis, which became operational in the House in late July, is a legislative information tracking system, providing status, content, summary, and cross-reference information on all official Congressional activities. To keep the system current, the House and Senate swap data bases every day. The Senate, trying to play catch-up with the House, just finished building its file and getting it up to date, and will be ready to offer limited Legis service next month. Top Senate dper Swearingen hopes the system will be fully operational in the Senate by the first of the year. As in the House, the system will be available over the terminal network.

The terminals in both the House and Senate currently operate over dial-up phone lines to the Comten front end switchers. Both Swearingen and Alexander would rather move to cable transmission facilities. The feasibility of such a move will be studied by the PCG's video/audio task group.

But in the meantime the House is exploring the possibility of using cables for audio, video, and digital transmission. Right now, it's running a video test in one of the House office buildings to provide coverage of floor action. Engineering studies also are being done to check out the costs of using a cable to pipe in audio, video, and digital signals—the digital transmission segment being used for the Houses' internal terminal communications network.

Less elaborate

The Senate's current data communications plans appear to be less elaborate. However, Swearingen backs the cable concept, and believes the Senate eventually will tie into the House through such a system. His other data communications schemes seem to mesh with his distributed processing goals. Distributed processing, he affirms, "is the next stage in our development of the communications system. We'll soon have enough terminals so that we'll have to start dealing with them in a different way than having the computer driving all of them. We may even," he notes, "put some of the terminals outside Washington."

HIS' Alexander envisions the possibility of having a full-blown distributed processing network centered around minicomputers in member offices. Under this decentralized plan, various offices would be clustered around a mini which would handle the dp chores of those offices. Alexander also sees distributed processing as an important element in word processing development in the House.

He cites the experimental wp system currently being operated in eight members' offices as an application of this technology. (Approximately 141 members have also set up wp systems through time-sharing companies like Digital Management and Dialcom Inc.) Word processing for committees is being provided by MITS, a version of IBM's Administrative Text Management System (ATMS) which interfaces with electronic composition gear at the Government Printing Office.

While HIS planners feel it's important to build committee word processing strength, their first concern is in getting this technology down to the member level. To do this, the planners started pilot testing a system called the Member Office Support System (MOSS) last year in eight member offices. It is designed to provide services such as constituent correspondence tracking, letter writing, and management reporting. Offices currently on the system are equipped with crt and hardcopy terminals linked to a Harris mini. Future plans call for MOSS to be expanded to more offices, with the possibility of setting up access terminals in members' district offices.

Senate, too

The Senate also is getting wise to the ways of word processing. The committees, according to Swearingen, are using IBM's ATMS system to produce calendars and reports. But it's at the member level, he notes, where the most sophisticated wp scheme is underway. That scheme is the highly publicized Correspondence Management System (CMS), which has been pilot tested for two years.

Thirteen Senators' offices are now using CMS under the pilot project to turn out letters and keep track of correspondence. System input is through the Hazeltine 2000 terminals which are linked to On-Line Systems' time-sharing service. Slated to be fully implemented in approximately one year, CMS will go on-line in four to five offices a month. Swearingen estimates that around 80 offices eventually will have CMS hookups, with each office having three terminals dedicated to CMS.

The Senate also is looking into getting a text processing system similar to one that was installed last April in the House. Swearingen admits this system "looks very good." The HISers think so too, mainly because they claim it's sliced $2 million off their printing bill. They also insist it's more efficient since it provides speedy computerized capture, edit, and printing of hearings and bills. Procured from ATEX Inc., the new publishing system, based on a Digital Equipment Corp. PDP-11 mini, supports up to 96 users at a time.

This printing power could put some real pizzazz into the Senate's publishing operation. Swearingen realizes this and probably so do some of his more savvy system users. He knows this too. "When people in the Senate want some (dp tool) we don't have and they find the House has it, we hear about it very quickly," he acknowledges.

The Senate computer team constantly hear about new projects it should launch. "The demand," contends the soft-spoken Swearingen, "exceeds our ability to supply it. We're still catching up."

Operating under the Senate Rules and Administration Committee, the Computer Services Staff includes eight full-time project managers. The Senate computer center itself is supported by a staff of 110, mostly programmers and operators. Swearingen would like to keep this work force from growing too large. "We don't want a huge computer center," he insists. His philosophy is that he and his staff will work with what they've got, "and if we have to go out and get special software or whatever, we'll go out and get it. We're not embarrassed about that."

Nor is HIS, which has adopted about the same stand on utilizing outside services and equipment. Dp requirements, explains HIS head Alexander, "can be met through HIS or other sources such as outside consultants, time-sharing services, or even other government agencies."

Seven divisions

Alexander's staff, totaling 204, is broken down into seven divisions, which include a mix of system personnel. The computer group operates under the House Administration Committee and gets additional scrutiny from the new Policy Group on Information and Computers, headed by North Carolina computer enthusiast Charles Rose.

Rose, along with House Administration Committee chairman Frank Thompson of New Jersey, has hammered home the need to view computerized information as a resource with intrinsic value. HIS leader Alexander strongly supports this concept and believes it should be applied throughout Congress.

This new mind-set about machines also seems to be reflected in the goals of the fledgling coordination project which is aimed at helping the three Congressional computer camps share some of their valuable information resources and know-how. Alexander is particularly pleased about this, and about the whole cooperative effort in general. He says it's "very important" to future Congressional computer operations.

Swearingen, who's been on the job for more than three years, is much more reserved in his enthusiasm over the project. While he agrees with newcomer Alexander that the project is worthwhile, he also adds that "we've done it before." But not wanting to put a damper on the whole thing, he quickly points out, "I guess it's an evolution from where we were before."

And Alexander couldn't agree more. "All of Congress," he reflects, "is finally starting to look at itself as a whole in the area of information and computers. And that's where I think the future lies."

—Linda Flato

Software

Is Software Valuable?

"The software industry was asleep at the switch," said James R. Porter, v.p., Industry Applications Group, Informatics, Inc.

He was talking about the industry's reaction when the Financial Accounting Standards Board in late 1974 issued Statement No. 2 dealing with treatment of research and development expenses and later, Interpretation No. 6, relating computer software to the Statement.

With the Statement, the standards board ruled that outlays on research and development should be charged off as incurred, rather than deferred and charged off only as income materialized from selling the resulting products. The interpretation detailed when software costs are deemed part of R&D.

"At first the industry didn't seem to think the ruling really applied to them," said Porter. "Some even thought it was a blessing because there had been abuses in the deferring of expenses. It wasn't until the auditors started coming around saying 'take this off the books and take that off the books' that we began to sit up and take notice. Do we want to be an assetless industry? No. We have assets and they are of value."

Porter is chairman of a subcommittee of ADAPSO's Software Industry Assn.'s Accounting Committee, formed 18 months ago specifically to deal with problems created by the FASB ruling. Serving with him are John Imlay, Management Science America; Larry Welke, International Computer Programs, Inc.; and Martin Goetz, Applied Data Research.

Told to go home

"I first became concerned two years ago when our auditors began telling us to take things off our books. It was as if the FASB was saying software has no value," said Porter. When he first presented the problem to ADAPSO, he said, "I was told to go home and shut up. Since that time, the subject has been on the program of just about every ADAPSO meeting."

Porter believes there is a problem in terminology. The software industry always has used the term software development. "The word development is inherently associated with risk, developing a form of prototype which may or may not ever be marketed." He would prefer the term software construction.

In a paper submitted to the FASB by Porter and Informatics' controller, Thomas F. Harincar, the development and production of software is likened to the production of motion picture films or recorded music. "In each instance, costs are incurred to produce an intangible asset which, if successful, will be licensed or otherwise marketed. All authoritative pronouncements containing accounting principles applicable to the entertainment industry require the deferral of production costs and the subsequent amortization in relation to projected future benefits."

Discernible future benefits

In its argument for expensing software, the paper points out, "The board refers to the general lack of discernible future benefits at the time such costs are incurred. Since the accounting treatment required for film and music production is the exact opposite of that prescribed for software production, one can only assume that the FASB, in its wisdom, feels that judgments and predictions concerning discernible future benefits are somehow more precise in the entertainment industry."

The board's response to this argument, said Harincar, was to point out that it had not issued the pronouncements on the film and recorded music industries, that these were a holdover from its predecessor, the Accounting Principles Board (APB) of the American Institute of Certified Public Accountants (AICPA). "They (the FASB) copped out on that one," said Harincar.

FASB pronouncements have the force and effect of law on public companies, Harincar explained, "because the SEC (Securities and Exchange Commission) enforces them." The FASB is an arm of the Financial Accounting Standards Foundation, formed and financed by private industry in the early 1970s to assure that accounting rule-making would be kept in the private sector.

High risk activity

In their paper, Porter and Harincar say the board, in ruling that costs incurred in the development of computer software systems must be charged to income as a current period expense, "reached its conclusion primarily on the premise that research and development is a high risk activity, and that future benefits are uncertain. The board, in its statement, did not properly consider the nature of software design and development, nor did it properly evaluate the historical risk associated with software products. The result is certain to be a significant distortion in reported financial results, perhaps even a negative influence on what otherwise might be a sound business decision."

"We're facing a depressed stock market making public funds for additional development out of the question," said Porter. "Institutional financing is going to be a fact, and institutional loans generally are made on assets."

He said his subcommittee informally surveyed 400 software companies and received some 35 to 40 responses. All generally agreed that "yes, we should be able to capitalize our software."

Porter said development in the software industry tends to come in cycles. "Generally there hasn't been a replacement cycle for original products as yet. We don't know what the financial problems are going to be. There are those in the software industry who are too entranced with technology to think in a businesslike way about the future."

Purchased software is deemed an asset by the FASB. "The rationale here," say Harincar and Porter in their paper, "is that purchase lends credibility to the asset's value. The result is a conflicting presentation of purchased assets on the balance sheet and constructed assets expensed as the costs are incurred. It is also conceivable that a businessman, faced with a make or buy decision, might decide on the basis of prescribed accounting treatment rather than the relative economics. Can anyone really argue convincingly that a purchased asset has more value than a constructed asset?"

Request for a hearing

Porter's subcommittee presented a position paper to the FASB last December. The board, via a letter to ADAPSO's Thomas Farewell from J. T. Ball, its director of the Emerging Problems Div., responded with a request for additional information. Additional information, including the fact that there have been incorrect applications of the pronouncements, was provided last May, and a request was made for an in-person hearing. As yet that request has not been granted.

"In my last discussion with them (the board), I was told there wasn't enough flack," said Harincar.

The paper he and Porter submitted to the board concludes: "Statement No. 2 was adopted with little or no opposition from the software industry as it did not appear to be applicable to software development when circulated as an exposure draft. Even after it was issued, there were misunderstandings as evidenced by the subsequent issuance of the interpretation dealing with computer software. The 'due process' procedures prescribed by the board's charter were, therefore, circumvented because the board did not have the opportunity to consider responses from representatives of the software industry prior to issuance of the pronouncement. No matter how distasteful, the FASB must reopen the issue to avoid additional loss of credibility."

—Edith Myers

Conferences

IFIP Congress: Out Of an Ivory Tower

The "wings of man" sometimes can let you down. And that's exactly what happened last month to weary travelers trekking to Toronto for the sixth triennial meeting of the International Federation of Information Processing. Trapped in the middle of a disruptive air traffic controllers' strike which broke out on the eve of IFIP Congress 77, the disgruntled conference goers were sent shuffling off to Buffalo and other close-in points to the air-locked Canadian convention capital.

"People," gushed one enthusiastic IFIP official, "made extraordinary efforts to get here." Some of those "extraordinary efforts" required tedious travel over circuitous routes which took up to 20 and 30 hours. One more enterprising group of IFIP-bound journeyers reportedly solved their transportation problems by chartering a private boat to take them across Lake Ontario. But most IFIP travelers had to resort to more mundane and time-consuming modes of transport such as trains, cars, and buses—many of which got hung up in customs for hours.

"The great airline shuffle," as it has since come to be called, cut into Congress 77 attendance, but not as much as conference planners had expected. Total turnout for the five-day meeting, held Aug. 8 to 12, was 3,540—over 500 short of the minimum 4,100 draw IFIP organizers had counted on. This lower turnout was in part reflected by a smaller U.S. contingent than was anticipated. The U.S. dpers, charged a chagrined conference spokesman, "let us down."

But despite the travel turmoil, the IFIP organizing crew managed to pull the conference together with what appeared to be a minimum of difficulty. Only one session had to be cancelled later in the week, although quite a few panels, especially on opening day, had to be reconfigured with stand-ins for the panelists who couldn't make it. In all, the conference's technical program included 90 sessions, 30 mini symposia and panel discussions, as well as 100 papers.

Employment troubles

Kicking off Congress 77, which drew delegates from 50 countries, Canadian Minister of State for Science and Technology J. Hugh Faulkner zeroed in on

CIRCLE 170 ON READER CARD

IFIP PROGRAM CHAIRMAN W. M. Turski talks at opening ceremony.

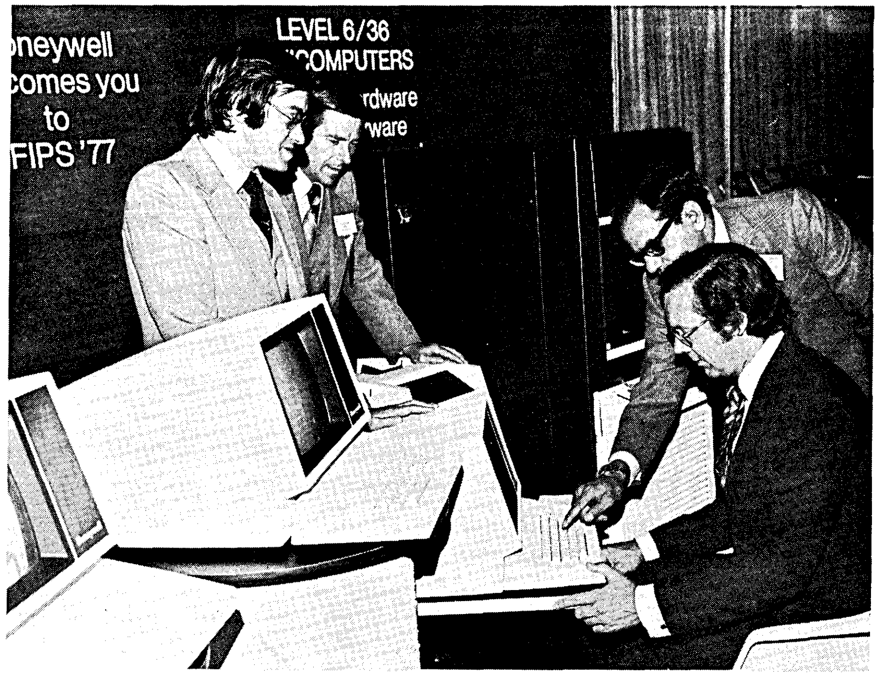
some of Canada's problems in the new "information era." According to Faulkner, rapid advances in telecommunications and computer technologies "have combined to accentuate the problem of national control over national destinies." This is particularly true in Canada, he pointed out, where the "technological drain" has created balance of payments and employment troubles. Another "worrisome implication" spawned by this dp drain, he maintained, is "the danger that industrial and social development will largely be governed by the decisions of interest groups residing in another country."

To keep this from happening, conference keynoter Josef Kates, head of the Science Council of Canada, recommended that middle powers like Canada take advantage of opportunities "to improve their international position in terms of technological interdependence." One way to do this, he explained, is through software developments which he said "will lead to employment of a kind that challenges the intellectual abilities of a large number of Canada's population. The reduced dependence on capital investment that this area involves, together with microprocessor technology and large-scale integrated circuitry," he noted, "poses an exciting challenge to the large multinational companies that have so far dominated the computer industry."

Communicate all implications

Calling science and technology, "the engines of social, economic, and industrial change," Kates stressed the need for scientists and technologists "to take more seriously the responsibility to understand themselves and to communicate to others not only the technical, but also the social, economic, and even philosophical implications of their discoveries."

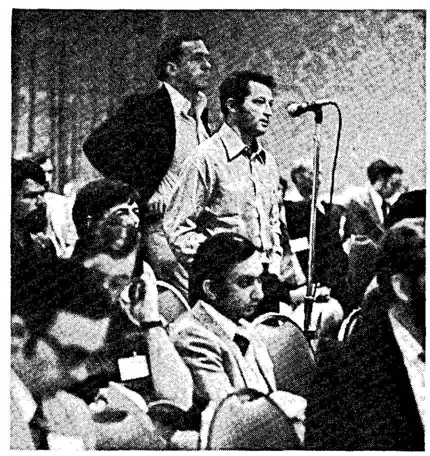
IFIP conference coordinators seemed to take this message to heart, structuring five panel sessions around the social impact of computers and information processing. Another welcome addition to the conference program was the plethora of sessions devoted to business applications and administration. The IFIP program committee carefully targeted these discussions at dp managers, bringing together the big names in international computing to talk on such topics as data base management, distributed processing, microprocessors, telecommunications, and programming.



OPENING DAY AT EXHIBITS: Dignitaries at exhibit include Paul V. Godfrey, chairman of Metropolitan Toronto Council; W. Hutchison, chairman of IFIP exhibition committee; Hugh Faulkner, Canada's Minister of State for Science and Technology (seated at terminal); and Surander P. Jain, systems engineer with Honeywell, Ltd.

Out of an ivory tower

This represented a marked departure from IFIP's normal emphasis on the theoretical foundations of dp. "This Con-



CONFERENCE ACTIVITY: Only one session had to be cancelled because of air traffic controllers' strike, but a few panels had to be reconfigured with stand-ins.

gress has finally come out of an ivory tower," quipped Paul Dixon, director of information systems for Massey-Ferguson in Toronto. Dixon, who was responsible for putting many of these business-oriented sessions together, is chairman of the IAG, IFIP's business arm. He claims conference organizers got "good feedback" on these "more practical" sessions.

They also got good attendance. And so did the Congress 77 exhibition which drew 9,780. Touting their dp wares and services, 116 companies had booths in the three-section exhibit area in the Sheraton Hotel which was four blocks away from the main conference hotel, the Royal York. Prominently located at the main door of one of these exhibit sites was IBM and its Canadian counterpart, IBM Canada Ltd. A clear standout however was the obtrusive NCR booth with its blazing red decor. Conspicuous by their absence, particularly since the conference is an international forum, were Siemens, ICL, Burroughs, and Control Data.

French showed packet network

Many companies offered live on-the-floor demonstrations of their gear. Particularly impressive was the French packet switching demo using the Canadian Datapac net via satellite to its own RCP (Transpac prototype) net in France. CII Honeywell Bull also put on a hands-on demonstration of its Cyclades teleprocessing set-up which serves the French government as well as scientific and academic users.

All exhibitors agreed that the first day of the conference was slow, but things picked up considerably by the end of the week. Toronto press coverage, stepped up due to the air strike situation, helped attract locals who wouldn't normally have bothered to attend, claimed one IFIP spokesman.

This made the hustling exhibitors happy, but what made them even happier was the solid lead prospects that many of them claimed to have picked up at the show. Considerably less enthusiasm, however, was expressed over the next Congress 80 conference which will be split between Tokyo, Japan, and Melbourne, Australia. Already worried about potential problems, miffed exhibitors, such as NCR, were trying to decide whether to show their wares in one or both conference locations.

The split site set-up for Congress 80 also seemed to bother other travelworn IFIPers who, along with the exhibitors, grumbled that there had to be a better way to structure the meeting than dividing it across 6,000 miles of water. But the final word on the Congress 80 controversy comes from irrepressible IFIPer Paul Dixon who optimistically declared: "Solomon, too, was a great king, and he, too, succeeded in sawing a baby in half."

—L.F.

Ford's Roark on Managing Change

The manager in the systems profession who can't cope with change can't be effective, Mayford Roark, Ford Motor information systems executive, said during a management program at the IFIP Congress in Toronto.

Roark set the tone for the sessions in a speech entitled, "Some Approaches to the Management of Change."

"In the systems profession," he said, "change is the essence of our work as we strive for continuing productivity improvement. The manager who cannot cope with change, plan for change, who cannot produce continuing change, will not be effective. This role... is something I believe to be new and different from the traditional roles of management."

Management of change is, in fact, a virgin area of study in the dp industry, and Roark's 12 propositions, based on Ford's own experiences, establish a framework for it. Among them was first, the warning that "the attempt to build Utopian-like total systems... invariably fails" due to their complexity, inevitable cost, and time overruns, and the enormous adaptation required of the user organization. "A series of achievable projects" in a long-range plan is the key.

The manager must recognize, too, that technological achievement is no longer an individual thing, but a product of highly skilled groups with considerable resources. In computers this is "even desirable," since it reduces vulnerability to abuse and fraud and "one man's fancies."

Maintain flexibility

Roark advocated the use of: techniques to maintain flexibility—matrix organization, specialized task forces, chief programmer teams, and structured walkthroughs; new development tools, especially top-down design and structured programming; and planning that allows for gradual revision and modification as the organization evolves.

Productivity within the system should be sought, he said, noting that Ford has increased system workload nearly 20% annually, but total dp expense has declined by more than 25% in ten years. In the last of his propositions, Roark told managers to conserve themselves as a "key resource." "For most of us the opportunity to grow, to develop new skills, and to explore new interests may be the most important elements of our jobs."

Not like the old days

Interestingly, during IFIP, a person who had attended a meeting of senior information executives said that persons nearing retirement age were not unhappy about it; they expected their roles to change so dramatically due to the distribution of systems that they would "lose their power" and "it wouldn't be like the old days." Roark's contention seemed to be that the manager's influence would increase as long as he himself changed.

"After experiencing the creative satisfaction of applying technologies to the solution of tough problems, could any of us settle for the static way of life of our ancestors?"

Robert I. Tricker picked up from Roark and delved into "The Impact of Information Systems Mangement on Organizational Thinking." Tricker's paper was based on the work done at the Oxford Center for Management Studies in the U.K. For the last four years, the center, with IFIP/IAG, has held discussion groups, or "Top Level Briefings," for executives in major international organizations.

Again the word "power" came up. "There are emerging pressures which identify information with power," he said, and the manager now has to cope with numerous forces fighting for their share of its control. This was exemplified in a recent briefing, he noted, when information systems executives were asked to identify the most critical issues affecting future system development. No mention was made of technology or methodology. Instead, they focused on internal organizational problems, third party involvement (labor, consumer groups, governments, etc.), and external factors.

Some of these "third parties" getting involved in the control of information and systems were represented in the social implications sessions of IFIP Congress 77. In a panel asking "Is the Erosion of Privacy an Unavoidable Consequence of Computer Applications?" experts from the U.S., Europe, and Australia described various developments in their countries. The Council of Europe, which is developing an international convention to rationalize privacy laws, was represented by a chief architect of that convention, Frits Hondius. Hondius noted that both a second draft of that general convention and a first pass at one for medical data are due out this month. **—A.P.**

Services

Bradford Natl: Keeping The Records Straight

In case no one's noticed, competition in the computer service industry is heating up these days. Firms like Automatic Data Processing have been making acquisitions right and left, while other concerns—National CSS, for example—have significantly bolstered their list of capabilities.

In short, the big boys are getting bigger, and more aggressive. And one of the firms that's emerging as a winner in this increasingly competitive environment, Bradford National Corp., is something of a surprise because the New York City-based company is not exactly a household word in much of the dp industry.

Even so, the nine year old company, which traditionally has functioned behind the scenes providing financial record keeping and computer/clerical processing services for banks, mutual funds, and the like, has been popping up more and more in the newspapers recently. Earlier this year, Bradford beat out EDS and Citibank for a highly lucrative ($100 million plus) contract to set up and operate a Medicaid watchdog system for New York State. In an ensuing donnybrook, Citibank subcontractors reportedly tried to pressure N.Y. State Social Services Commissioner Philip Toia into dropping Bradford, claiming the firm's performance capabilities were questionable. Toia stuck to his guns, and Bradford kept the contract that overnight made it a major factor in the health services field.

Now the SEC

Now Bradford is engaged in another fight, this time taking on none other than the Securities Exchange Commission. At issue: the market for processing thousands and thousands of stock transactions.

These controversies—and the headlines that have accompanied them—point up the fact that Bradford has entered the big league. Indeed, annual revenues now exceed $65 million, a 15% increase over last year. And they've been growing at a compounded annual rate of more than 21%. Perhaps more importantly, the revenue base has become increasingly strong and diversified, growing at a projected annual rate of 30%. Today Bradford boasts a customer list that includes:

- 400 banks including 10 of the 20 largest banks in the country;
- some 2,000, or so, corporations for which Bradford provides stock shareholder services, processing stock sales and purchases for about nine million shareholders;
- more than 75 mutual funds and 15 major fund groups.

In addition, the company has become the country's largest municipal bond clearing agent. It was a major contractor for New York City's Integrated Management and Financial Control System (February, p. 146), and currently is involved with a host of other projects that range from the design and implementation of an off-shore water pollution control and abatement system for the U.S. Navy and Coast Guard to providing portfolio record keeping for the Ford Foundation's $2 billion investment portfolio.

Mountain of data

Systems design, facilities management, consulting—Bradford offers a full range of services while processing a mountain of data for its various customers. "Each business day we process more than 100,000 separate transactions with a combined value in excess of $100 million," says the firm's chairman and chief executive officer, Peter Del Col.

At the heart of Bradford's processing business is its computer and data communications network. "To move these mountains of securities and cash from point to point across the nation (the company has facilities in 33 cities), we employ our own innovative and proprietary systems of electronic value transfer," Del Col explains. "We maintain six fully equipped data centers in major money markets, staffed by 400 transaction processing specialists whose work is coordinated through our national computer services center in Teaneck, N.J."

Because of the geographical diversity of its business and the tremendous amount of data it must handle, Bradford either had to have extensive dp capabilities on-site regionally or develop a high speed distributed system that divorced the central location from the regional clerical location. The company chose the latter approach, developing a network with two 370/158s (one of which is an advanced processor) at Teaneck as its nucleus; high speed printers as front-end devices; AT&T's DDS system as its communications lifeline, and terminals and minis in its regional offices for on-site processing.

Innovative thresholds

"We've crossed a number of innovative technological thresholds," says Ron Smith, president of Bradford National Computer Services, Inc., Bradford's service arm. "For example, the Pix II mini-driven printers we've gotten from Paradyne give us such high speed printing capabilities that we can transmit up to 56KB."

Smith says Bradford is considering a number of satellite carriers to further expedite transmission, and notes that IBM dropped its traditionally centralized posture and helped implement Bradford's distributed approach when it saw the handwriting on the wall.

Bradford's specialized processing requirements—and the need for distributed capabilities—are pointed up by its stock transfer application. For example, if an investor buys, say, 100 shares in

RON SMITH OF BRADFORD
Considering satellite carriers to expedite transmission

one of the 2,000 corporations Bradford services, the buy order and the corresponding sell order must be matched up ford's Manhattan personnel print up the and captured on ocr. These orders are subsequently batched to Teaneck where they're filed. Subsequently Teaneck sends a message back to Manhattan for a new certificate to be printed from the inventory of thousands of blank stock certificates stored in the Bradford vault. The inventory itself is under extremely close security and is continually updated and monitored through an on-site program utilizing historical records of past stock sales. Print order in hand, Bradford's Manhattan personnel print up the certificate for 100 shares in the new owner's name.

Business jeopardized

The securities transaction business, however, or a major segment of it, is now jeopardized by a recent move the Securities Exchange Commission has made to create a government-controlled securities clearance and settlement organization called the National Securities Clearance Corp. (NSCC). The SEC authorized NSCC to process all transactions for the New York and American stock exchanges as well as the National Assn. of Security Dealers, but Bradford, which has a multi-million dollar contract to provide these same services to the National Assn. of Security Dealers, as well as the Pacific Security Exchange, has asked the U.S. Court of Appeals to set aside the SEC-established service organization; it claims that a competitive national securities market can't be based upon a noncompetitive (the SEC created the organization without taking any bidding), monopolistic, government-regulated securities clearance and settlement agency empowered to fix rates for the national market and—in Bradford's view—engage in predatory pricing and stifle regional competition.

Bradford, and some of the leading figures in the regional stock markets, view the SEC move as a means by which the big New York brokerage firms—with the SEC's help—can capture the national market by controlling its underlying transaction process. In effect, Bradford is saying whoever controls the computer controls the game.

Whatever the outcome of its SEC suit, Bradford remains manifestly positive about its future. And ironically, it's a future that's increasingly dependent for Bradford and other service firms on the government's growing involvement in the private sector's affairs. "We believe Bradford is riding the crest of a groundswell in which government will require ever more detailed financial record keeping while industry, to keep pace, will require increasingly sophisticated reporting, record keeping, and accounting services," Del Col told Bradford stockholders at a recent annual meeting.

—Laton McCartney

Government Procurement

Fenaughty's Fight for a Fair Shot

It's not easy to woo the Social Security Administration. One company in particular that found this out the hard way is Information International Inc. which has been diligently courting the mammoth Social Security agency for six years. And now at last all their dogged persistence may pay off—and pay off big if the indefatigable company can capture an SSA contract claimed to represent "the largest government ocr procurement in history."

Trying to wean the stubborn SSAers away from the paper scanning gear they've been using for the past eight years, triple-I zealously has been touting its GRAFIX I, a sophisticated computer output microfilm system, as a more efficient alternative to SSA's paper scanner set-up. The Culver City, Calif., company has sold two of these multimillion dollar systems to date, one to the Navy's Air Rework Facility in Jacksonville, Fla., and one to the British government's Dept. of Health and Social Security in Newcastle-On-Tyne, England.

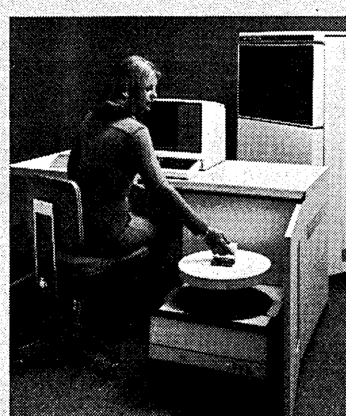
The UKers report that their GRAFIX system, in operation since last year, is performing well. So well that they've tried to tip off SSA on the advantages of setting up the same system. The biggest advantage of the system, according to the company, is its ability to read a mixture of hand-printed letters and numbers.

The substitution error rate also is impressive. The company claims the British system automatically reads over 99.2% of hand print and over 98% of machine line print. Unrecognized characters are stored in memory for later call up on a crt manned by an operator who then keystrokes the rejected characters back in.

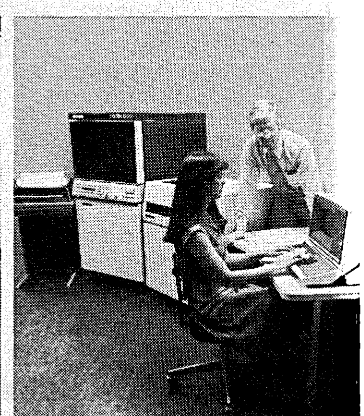
SSA, which originally started out in the '60s with IBM ocr gear, began to build up its ocr muscle by renting a Recognition Equipment Inc. Input 80 paper-scanning system in 1974. That system was then bought two years later and another Input 80 was put on lease earlier this year. The systems are being used to process Form 941s, the quarterly earnings reports that each U.S. employ-

Inforex 1300 and 1301 offer highly cost effective data entry capability for smaller installations (4 to 8 keystations) or remote locations where you can take advantage of our communications capabilities.

The 1303 provides medium range data entry capacity, with about triple the disc capacity of the 1301. It supports up to 16 keystations and the addition of edits, table look-ups, range checks and cross-footing. The 1303 also offers communications capabilities such as *spooling, HASP* and *RJE*.



With the 1330, you can consolidate remote job entry and batch data entry applications without compromising either function. The system features expandable disc storage (up to four—10 Mb. drives) foreground and background editing and bisync communications.



The Inforex 3300 is a powerful pre-processing system that allows you to edit data at the point of entry, enabling you to offload your mainframe. Its sophisticated editing capabilities can also handle many of those applications which you haven't had time to put on your present mainframe.

CIRCLE 87 ON READER CARD

er must file with SSA. Listed sequentially on these forms are all employees, their Social Security numbers, and the amount of Social Security tax paid.

Dramatic increase

These ocr processing requirements, while already steep, will increase dramatically by the beginning of 1979 when the agency moves to annual reporting of wages. Under this new set-up, employers, instead of sending in the 941 forms, will turn over to SSA a modified version of the W-2, W-2P (pension), and W-3 (summary) forms. After reading and processing the data from these forms, SSA will then hand over its mag tapes to the Internal Revenue Service.

To handle this heavier workload, SSA will have to get some new optical scanning devices. According to conservative estimates, the agency will be processing 32 billion characters in 1979. That's a lot of processing, and it will require a lot of ocr power. So to prepare for the ocr onslaught, SSA released a request for proposals (RFP) for bids on multifont optical scanning gear in late July.

There was one major problem, however—the equipment specifications spelled out in the RFP were totally tailored for a paper feed scanner-type system virtually identical to the REI Input 80. With such a restrictive spec, other alternative technological approaches, namely COM, were completely ruled out. Thus, it looked suspiciously like SSA was setting itself up for a sweetheart deal with REI.

Trip to California

That's apparently exactly what the discouraged Information International thought too. After five years of pleading with the intransigent agency to at least take a look at their GRAFIX I system, the firm had finally convinced SSA in June to make a trip to California to check out the system's capabilities. After an exhaustive demonstration, the SSAers "were really shocked to see how well the (GRAFIX gear) worked," claims triple-I's tenacious president Alfred Fenaughty.

But while they claimed to be impressed, he notes, they still had their minds set on Input-80-type hardware, and had already decided to write the system spec that would eliminate the company from bidding its GRAFIX wares.

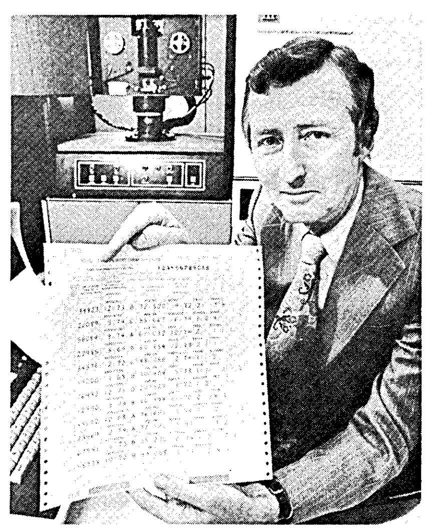
Undaunted by this setback, the company launched a counter-attack to get SSA to reconsider its options. As part of this counterattack, spearheaded by fearless Fenaughty, the company began bombarding top SSA dp policymakers (including the contracting officer) with requests to amend the ill-conceived RFP. They also took their case to key Congressional leaders and the Dept. of Health, Education and Welfare. As a last resort, they also were prepared to file a formal protest with the ultimate arbitrator in procurement disputes, the General Accounting Office.

"Take them to the mat"

The usually soft-spoken, low-key Fenaughty was adamant. "We have to take them to the mat on this," he declared emphatically. "All we want is a fair shot at (bidding on the contract). I don't believe the procurement at the technical level is dishonest," he explained. "I just think it's narrow-minded. SSA seems to be treating REI the same way the rest of the dp world treats IBM. It's comfortable for them."

But that "comfort" began to dissolve rapidly last month. Folding under pressure from the heavies on the Hill and HEW, SSA announced that it would amend the troublesome RFP. An initial amendment, expected out last month, will extend the due date for proposals. Another amendment will take care of the stickier technical changes—changes that will allow triple-I and other COMers to bid on the highly coveted contract. The technical amendment also is expected to include stringent requirements for benchmarking and total cost benefit evaluation.

This total cost benefit evaluation was not considered in the original RFP, which took into account only the procurement price of the scanning devices themselves, and not the costs associated with entering rejected copy and correcting errors.



ALFRED L. FENAUGHTY
With British Social Security form with mixed computer lineprint and human handprint

Information International's Fenaughty feels this was a serious oversight since the major system costs, he argues, would be incurred through these last two steps if Input 80-type equipment was used. These expenses would mainly be attributed to increased personnel needs. SSA estimates it will take 7,300 people to process the rejects and make corrections. (A staff of 1,000 currently is being used to process the 941s on the two REI systems.)

People saving

Information International claims that its COM system, with a substantially lower reject and substitution rate than Input 80, would require "no more than 635 people," saving SSA "between $200 million and $250 million a year in labor costs alone." The feisty firm makes a point of touting these purported cost advantages, since REI hardware costs are much lower than the $2.5 million price tag of the GRAFIX I system. That's why triple-I has been pushing SSA to look into the total cost aspect. But this approach also makes sense to one top SSA ADPer who seems to feel that the agency could well afford to shell out $15 million for six GRAFIX I's if labor costs could be trimmed.

Other SSA officials, although willing to give triple-I a fair shot at the contract, feel the tenacious firm overplayed its hand. They seem resentful of the pressure tactics, especially the political string pulling, the company used to cinch the RFP overhaul.

But triple-I boss Fenaughty believes his overkill methods were justified. Without the Capitol Hill clout, he contends, SSA never would have budged. And now that it has, he seems confident about the company's chances of clinching the contract. He sees the RFP modifications as the company's first step on the road to victory. But, he's also cautious in his optimism. "We've won the first battle," he declares, "but there are other battles to be fought. We're a long way from having won."

—Linda Flato

Security

Blackout Aftermath: No Data, No Computer

When J. Bruce Llewellyn, the 50 year old president of Fedco Food Corp., walked into his combined warehouse and office following New York City's July blackout and looting, he was in for a double-barreled shock.

Not only had the warehouse—along with half the supermarket chain's 16 stores—been ransacked by looters, but the company's Wang minicomputer also had been destroyed, and with it all Fedco's inventory and financial data for the quarter beginning May 1.

"It was completely ruined," Llewellyn says of the system he purchased from Wang three years ago for about $40,000, "and the duplicate discs we kept were destroyed too."

The discs had been kept in a big concrete safe in the warehouse. The looters who broke into the safe found no money and scattered the discs on the floor where they were ruined by heat and water resulting from a fire arsonists subsequently set. Also destroyed were Fedco's printouts of the records.

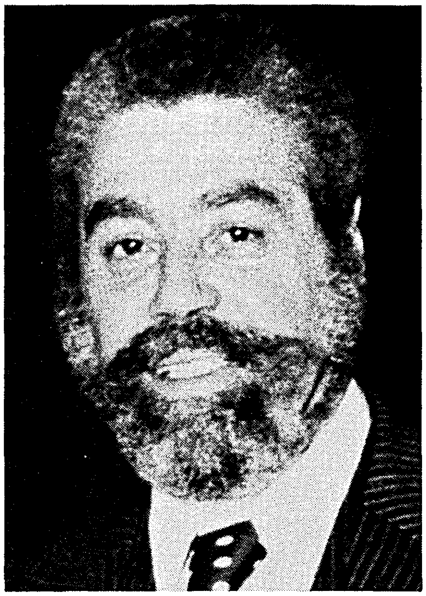
It was insured

Fortunately Llewellyn had the system insured. He also has a business associate who let him use one of his own backup systems until Fedco received a new computer on order from Wang.

"The Wang people also have been very helpful and have lent me pieces of equipment," Llewellyn adds. "I just wish that new computer would hurry up and get here."

Then, too, Llewellyn was lucky in that his printouts and discs from other fiscal quarters were stored elsewhere, as were his software programs. Consequently all escaped damage. "It would have been a total disaster if we'd lost the programs," Llewellyn says.

Llewellyn, who had to turn down a federal appointment as head of the



J. BRUCE LLEWELLYN
Turned down federal appointment to settle fire-damaged affairs

Overseas Private Investment Corp. so he could put his own business—the largest black-owned food chain in the country—back together after the looting damage, estimates it will be months before Fedco can reconstruct the lost data and tool up the new system. The price tag? At least $100,000, Llewellyn says.

As someone who's been through a computer disaster, Llewellyn has this advice for other users. "Secure the damn computer as best you can," he says. "And store data separately and by quarter, and keep your software locked up away from the computer site if possible." Those measures saved the Fedco system from being wiped out altogether. ❊

FBI Fugitive Found Dead

James Francis Collins returned a year ago last May to Denver, Colo., where he was born 40 years ago under the name Henry Joseph Manning, III. Thirteen months later he was found dead in a suburban hotel in Thornton, Colo., an apparent suicide victim.

The tall, friendly programmer/analyst was described by associates at the Davis Brothers Co., a large wholesale drug company in Denver, as being "friendly and competent in his work." He had worked there as a programmer/analyst for more than a year, after leaving a similar job with Cubic Data Systems in San Diego (August, p. 124).

Collins, or Manning, also was the object of a long search by the FBI after a federal warrant was issued in Kansas City in 1974, where he allegedly gave false statements concerning his net worth in connection with his application for a bank loan under the name of David L. Robinson. And there were arrests and convictions in Sioux Falls, S.D., and in California, where he had escaped from San Quentin Prison in June of 1973, during the second year of a 10-year sentence for grand theft of $14,000.

Bad checks in San Diego

When he suddenly left Cubic Data Systems in May 1976, leaving behind a wife and a trail of bad checks, company officials came to the realization that there was more to Kenneth Allen (the name he used in San Diego) than a competent COBOL programmer with experience on Honeywell equipment.

Last July, the FBI furnished the weekly newspaper *Computerworld* with a wanted notice on Manning and his many aliases. When the July 25 issue of the newspaper arrived at Davis

Brothers, Manning (or Collins) was confronted by fellow employees, but told them it was impossible that he and Manning were the same person. But he apparently knew the end of his career as a fugitive was near.

The next day he checked into the Capri Hotel in nearby Thornton. And late in the afternoon of July 28, police discovered his body. There was an open bottle of sleeping pills and Manning had been drinking heavily, but death was attributed by police to asphyxiation—a plastic bag was wrapped around his head. Police said there was no evidence that he had met foul play and that a fingerprint check had determined his identity as Manning.

Dick Jensen, head of data processing at Davis Brothers, said he was shocked. "We all considered him a friend. He got married only six weeks before it happened." (It turned out that it was Manning's sixth marriage.)

Jensen said, though, that when Manning applied for work at Davis Brothers, he gave as a reference a Denver contract programming house that had since gone out of business. And he told Jensen that before then, he had been in the Air Force for 20 years. "He was an excellent programmer." (The company operates an IBM 370/138.) "So good, in fact, that he'd just been named project manager for a huge inventory control program we were starting on." ☼

Products

The Entrepreneurial Urge . . .

"We'll have color by early November," said Bill Glover of Recreational Computer Systems of Atlanta.

He was referring to his firm's PDP-8 based systems (April, p. 168) which produce high quality pictures of people and can transfer them to t-shirts, tote bags, and/or wall plaques.

Glover's firm places the systems in such places as hotels and amusement parks either as its own operation or through sales to outsiders who want to buy an absentee business for from $29,000 to $46,000. To date the pictures have been black and white, although Glover has been working with color since early this year.

He believes his firm will be the first to offer color among the "dozen or so" competitors who have sprung up since he started his business two and one-half years ago. He also believes his is the only firm which buys equipment used in its systems outright.

Recreational Computer Systems in mid-August had 25 systems installed and was beginning to ship at the rate of three systems per month. Installations included one in Hong Kong, two in Taiwan, two in Canada, and one each in Brazil and France.

Doesn't have to promote

Glover said he does not have to promote. "We have trouble keeping up with the people who come to us on their own."

One of his competitors which apparently feels it does need to promote is Computers Ventures Inc., whose distributors, The House of Troy, Dallas, had a crowd-pleasing booth at a "Start Your Own Business" show last month in Los Angeles. "Our computer is an artist," proclaimed this company's literature to constant crowds who not only listened but asked some fairly penetrating questions about such things as service and support. Some even took notes.

A lonelier booth at the same show

was that of Tel-A-Computer, a division of Southwestern Alliance Corp., Shawnee Mission, Kansas, which has a microcomputer-based telephone calling and answering device. From them a prospective entrepreneur could, for $12,-200, receive three, three unit systems, a choice of five programs, and complete training in running an office and sales program.

REL Industries, Van Nuys, Calif., was offering custom minicomputer-based systems which prospective investors could peddle to a variety of businesses.

And then there was Computer Capital Corp. which, for a fee of $9,000, would set up the right person as something of an investment counselor. What Computer Capital would provide is access to a data base of some 2,000 worldwide sources of capital. The new entrepreneur would interview people needing investment capital and then would have these people's needs matched against the requirements of investors in the data base.

A nice meal

There were games galore, most microprocessor-based, but by far the most interesting game was based on a plain old barnyard chicken. Money Making Opportunities, a Northern Calif. firm, has conditioned chickens to respond to a series of lights to play tic-tac-toe. The firm claims their chickens have never been beaten. When a human player inserts a coin in the game machine, a light goes on telling the chicken to make the first move. Then the human player makes a move and another light goes on telling the chicken what that move was. And so the game goes on and when the chicken has won or played to a tie, he gets a reward, a kernel of corn. Any human player beating a chicken gets $5, but it hasn't happened yet.

And if the chicken malfunctions, it could make a nice meal— something that can't be said of a microprocessor. ❊

History

Was Computing More Fun Then?

In 1943, the world was at war. D-Day, when Allied forces would storm the beaches at Normandy, was still a year away. Hilter held the upper hand in Europe and a battle of sea power was not going well against Japan.

The United States, under President Franklin D. Roosevelt, decided to produce a superior weapon under a project which was code-named "Manhattan District." For the highly technical work involved in the project, a group of the country's best nuclear physicists was assembled at Los Alamos, New Mexico. The work they did there led not only to the development of the atomic bomb two years later, but also to very valuable contributions to the field of computing. And, since those early years, the Los Alamos Scientific Laboratories have continued to be known almost as much for work in computing as for work in physics. Thus, for its contributions to data processing, LASL was awarded the National Computer Conference's Pioneer Award this year, and made the subject of a Pioneer Day Session.

The pioneering work done in nuclear physics was supported at Los Alamos at first by armies of GI's working with calculators. But the list of computers used at the Labs through the years reads very much like a history of computing. The Labs acquired, for example, the very first models of the IBM 701 "Defense Calculator" in 1953; the IBM "Stretch" or 7030, in 1961; and even the first Cray 1 in 1975. When available machines couldn't handle the size of problems being attempted, the Labs constructed some of its own—the MANIAC I, finished by Nick Metropolis and Jack Jackson around 1951, and the MANIAC II around 1957.

Participants in the Pioneer Day session at the 1977 National Computer

news in perspective

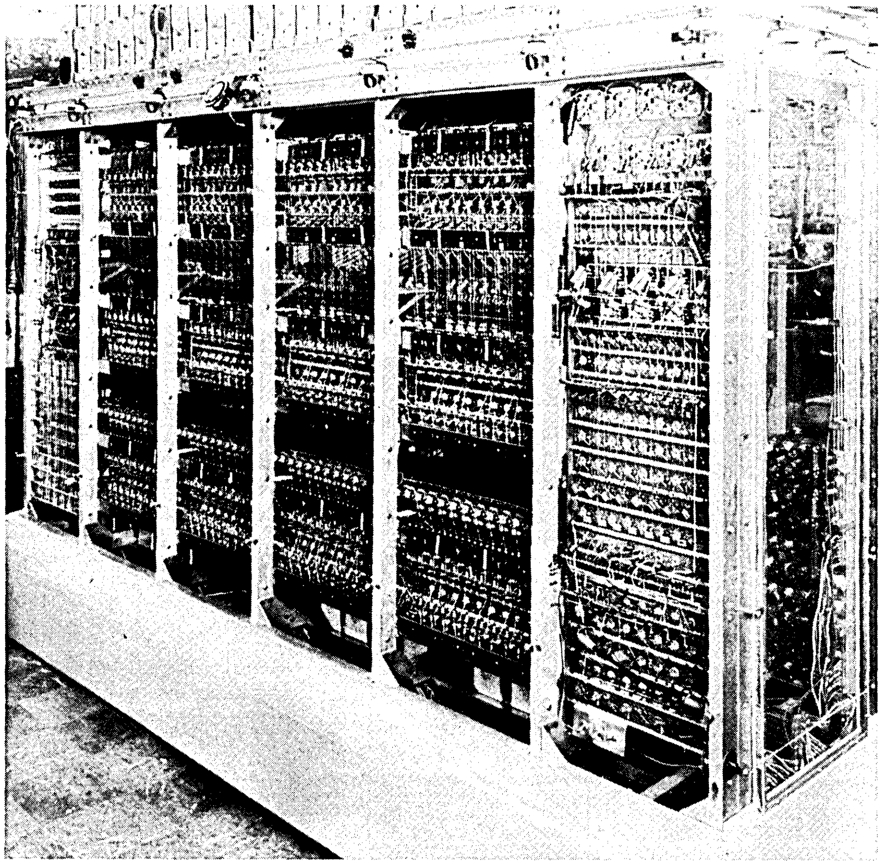
Conference in Dallas recounted some of the more interesting parts of the early days of computing, and did their best to field the question, "Why was computing more fun then?" Their answers suggest that there have been nearly as many losses as gains in the "progress" made in the industry.

Session chairman Jack Worlton of Southern Methodist Univ. reminded the several hundred people in his audience that day in mid-June that the ENIAC, finished just after World War II was over, was not a serial machine.

A sense of *deja vu* about structured programming was felt when Ed Voorhees (still with LASL) told of a 1956 paper he'd found suggesting that the GO TO was probably undesirable in machine languages. (The subject of the paper was the ALGAE language for the IBM 704.)

"Personal" computing

The idea of personal computing, a strong theme for this year's NCC, has no big claim to newness either, Voorhees suggested, since early computer users



MANIAC: In the early days at Los Alamos, it wasn't unusual to find one of the world's foremost scientists scrambling about on hands and knees on the floor picking up output from MANIAC's Annelex printer.

were most often scientists, programmers, and operators all at once. His claim was backed up by Mark Wells, also of LASL, who described how even Nobel Prize winner Enrico Fermi was a do-it-yourselfer where computing was involved, even doing his own key-to-paper tape input preparation for the MANIAC. Those who were at Los Alamos in the early days say it wasn't unusual to find one of the world's foremost scientists scrambling about on hands and knees on the floor near the MANIAC's Annelex printer, picking up output.

Intimacy lost

It isn't only the intimacy with the machines which has been lost, said Max Goldstein who now is with the Courant Institute in New York. There also was a greater intimacy between the programmer (then called a coder) and the problem being worked. The users, he said, knew the relations of their numbers. In this thought, he seconded the remarks of Roger Lazarus of LASL who said that early users did more initial analysis, estimating rather than calculating."

Other things have been lost. Voorhees noted that, "There was much pride in coding then. And now conventions, standards, regulations, and procedures have stifled that." Mark Wells added, "It's a shame that FORTRAN was frozen and became a standard so early in the game," as now its widespread use means it cannot be changed and improved.

Not missed

Some things gone are not missed including the radio amplifier used on the MANIAC and other machines so that users could listen to the performance of their programs—and even "hear" mistakes in code.

"Remember though," author Dan McCracken interjected, that "all the *bad* things were invented in the '50s too. And we're making them (the mistakes) all over again with micros. We're finding there is an infinite supply of new users who don't know the cost of software development."

And, it seems the artifacts of dp history are being discarded. McCracken said the last working Vannevar Bush analyzer, a room-filling pre-computer, very likely will be sold to the scrap dealer who bid $100 for the UCLA-owned "fossil"—because the university needs the space for vending machines.

Is there a way to rekindle interest in computer history? Herb Grosch, president of the Assn. for Computer Machinery (ACM) offered one. "Encourage computer companies like IBM to ask their own retired employees for their file material." Another suggestion was to have ACM trade life memberships for the files held by old-timers.

And there will continue to be the NCC Pioneer Day sessions.

—R.A.M.

History

Edward Kleinschmidt: Teletype Inventor

Edward E. Kleinschmidt, an inventor who was a founder of the Teletype Corp. of Chicago, died last month at the age of 101 in a convalescent home in Canaan, Conn.

Kleinschmidt, a German-born tinkerer who built his first workshop in the basement of his brother's drugstore in New York when he was 16, had 118 patents and invented or helped to develop the high-speed stock ticker, an automatic fishing reel, and a railroad signaling device. His last invention was completed when he was 92. It was a miniature teletype for use in police cars so messages didn't have to be sent by radio.

He told an interviewer when he was 91: "I got the habit of working quite young, and I can't seem to drop it."

"I got in the habit of working quite young, and can't seem to drop it."

Kleinschmidt's miniature Teletype was developed in 1966 for the SCM Kleinschmidt Div. in Deerfield, Ill., nearly a decade after he went into "retirement" when SCM acquired his Kleinschmidt Laboratories, Inc., which he had formed in 1931. He had been president of Kleinschmidt Electric Co. in New York, which developed telegraph printers in competition with Morkrum Co. of Chicago. The two companies merged in 1924 to form Morkrum-Kleinschmidt where, as v.p. for development and patents, he gener-

EDWARD E. KLEINSCHMIDT in picture taken in 1968 when he was 93. Kleinschmidt is shown with a multiplex printer model 3B (left) which was manufactured by what was then known as Kleinschmidt Electric Co. in 1914, and the typebar tape printer Model 22 made in 1919.

ally is credited with guiding to completion the now historic Morkrum-Kleinschmidt tape printer. The company later became the Teletype Corp., and in 1930 was bought out by AT&T in a stock deal estimated at $31.5 million. He recalled recently that his cut from the deal was only about $150,000. "I never seemed able to make money," Kleinschmidt said.

His Teletype machine, a communications breakthrough that linked the world, still is used by news wire services, which began installing them in 1914.

The inventor was born in Bremen, Germany, Sept. 9, 1875, and came to the United States at the age of 8. In addition to his wife, Kleinschmidt leaves a daughter, Mrs. Doris Knight of Cazenovia, N. Y., seven grandchildren, and six great-grandchildren.

International

U.K. Software Group Aims at U.S. Market

A strong new consortium of British service companies moved into the U.S. this month with an ambitious plan to acquire U.S. software firms, form joint ventures, and establish a U.S. sales force. It has $52 million with which to operate during the next five years. And there may be more coming.

Called INSAC Data Services—but better known simply as INSAC since its establishment in February—its purpose is to match software skills in the U.K. with world demand. Its first target in the U.S., which, according to the consortium's architect, John Pearce, provides about half of a world computer services marketplace believed to be worth $13 billion and growing at a rate of 19% a year.

Says Pearce of the U.K.'s software skills: "An American looking at his market 10 years ago noticed that it was a larger market with an abundance of venture capital. So he went into hardware. The Briton, on the other hand, looked at his market and noticed that it was small and lacking in venture capital. He went into software."

The result, said Pearce, is that there now are more than 500 software/service firms in Britain, probably as many as in the rest of Europe put together. But they are small firms. Only 5% do more than $4 million.

Seek world markets

Their main problem—squashed as many of them are in a $625 million U.K. market that no longer is large enough to contain them—lies between them and the world market. Many just do not have the resources to break out and tackle the attractive U.S., Middle East, and Japanese markets.

Pearce, who worked with IBM in New York in the 1960s and later in the early '70s when he formed the U.S. subsidiary for the British computer services concern, Hoskyns, which he cofounded with John Hoskyns, believes INSAC could be the catalyst to put U.K. supply in touch with world demand.

Fledgling U.S. operations are being run in New York by Seymour (Sy) Joffe, who will head INSAC Data Services's U.S. subsidiary. Joffe, a former Univac and Datran officer, will follow a three-point plan devised by Pearce: acquire market share; ship work back to the U.K.; ship product development back to the U.S.

Acquisitions provide a market

Pearce says the quickest way to gain market share is to acquire companies in the U.S. This gets you eyes and ears as well as a marketplace. It also has the added effect of giving you immediate credibility in the U.K. Once you get going, your acquisitions can be persuaded to ship work back to INSAC member companies in the U.K.

He notes that this is the kind of thing the British computer manufacturer, ICL, is doing with its Singer and Cogar acquisitions. Some spin-off high level software developments for a new 1500 terminal, under development at the Utica, N.Y., manufacturing plant, have been providing jobs for ICL programmers in Bracknell, England.

Later, says Pearce, the consortium must develop product specs. He estimates that the first class of work that INSAC will undertake in the U.K. will be "one-off" (one of a kind) turnkey jobs, or specials. For example, one of the Wall Street banks or finance houses may come to INSAC in the U.S. with a spec for a medium sized hardware/software system tailored to his needs. The specs then would be sent to the U.K. for programming.

The second class of work will be the development of packages. On occasion, Pearce said, INSAC will pay its U.K. members to develop packages it feels will fulfill a U.S. need even when there is no immediate user in sight. He said in such cases the product will be owned by INSAC, and its members will be given the right to sell the product in the U.K., where INSAC will not operate, or elsewhere outside the U.S.

Wide portfolio

"We intend to give our U.S. sales force a wide portfolio of software products to sell," says Pearce, exuding quiet confidence. "We have not assumed that all these products exist in Britain. That would be foolish. They must be built over time. But where good products do exist, whether in the hands of INSAC or non-INSAC members in the U.K. or U.S. firms, we would hope to persuade their owners to sell them via INSAC."

Pearce says that ever since news of the new software/services "power block"—as he likes to call it—first leaked out before it was announced in February, he's been approached by "potential clients both in the U.S. and the Middle East." He says this is just a "taste" of what will happen from now on as persons recognize the nature of the U.K. software industry, where for every New York programmer earning $22,000, there's an equivalent in London earning $10,000. Pearce said a U.K. firm is bidding to write a compiler for a Washington customer at one-third the cost and in 66% of the time offered by U.S. bidders.

National Enterprise Board

Pearce, who left Hoskyns in 1975 after it was sold to Martin Marietta, took his idea for INSAC to the U.K. National Enterprise Board in 1976, and in August that year joined the NEB's computers and electronics division to set up the consortium.

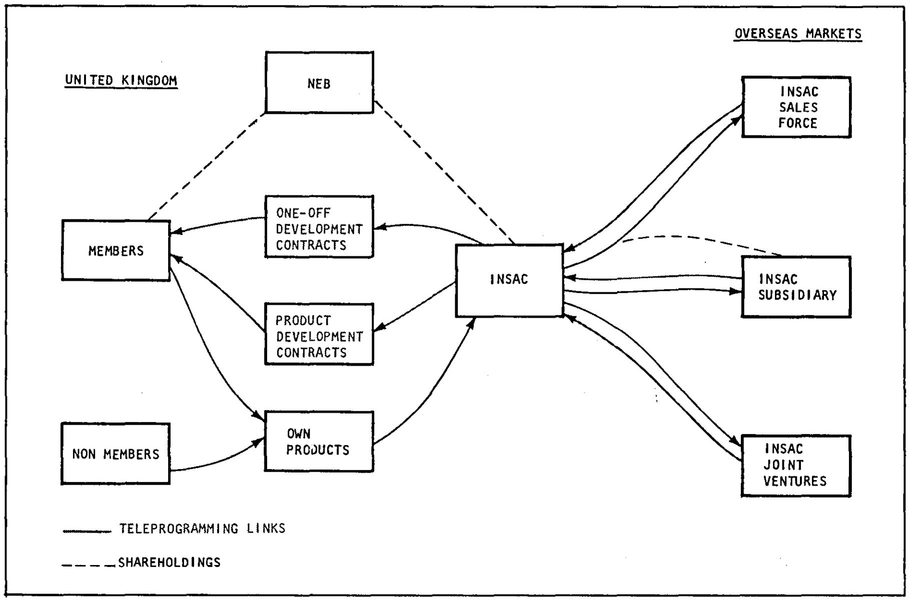
The NEB is a public corporation formed in 1975 to provide funds for industrial investment and to breathe new life into various sectors of U.K. industry. It has sunk $52 million into INSAC to cover its first five years. Pearce sees his initial membership consisting of about 10 firms doing some $70 million.

Membership is by invitation, and the NEB acquires a 26% interest in the firms. Some $18 million of the $52 million has been set aside to acquire the stock.

JOHN PEARCE
Putting U.K. software supply in touch with world demand

Pearce's plan was to get three or four firms by the end of this year, and to have boosted it to the 10 by the end of 1978. Nearly $2 million already has been spent getting 30% of the shares of two leading firms, and another deal was being finalized in late August. The two are CAP U.K., one of Britain's top software houses, and Systime, one of the leading houses specializing in turnkey applications. SPL International is another candidate. SPL and CAP do more than $18 million in business between them. Other firms, such as Logica and Arbat that already are working successfully in New York, are likely to be approached.

—Ralph Emmett



HOW INSAC WORKS: Britain's National Electronics Board would have an interest in U.K. software firms belonging to INSAC. These firms would get business from overseas INSAC sales force, joint ventures, and subsidiaries.

BENCHMARKS . . .

A New Twist: Greyhound Computer Corp.'s antitrust trial against IBM, cut off in 1972 in Phoenix when Judge Walter E. Craig issued a directed verdict in favor of IBM before the case could go to the jury, has been ordered retried by a U.S. Court of Appeals in San Francisco. While the court agreed with the judge that IBM hadn't breached a contract with Greyhound, it did agree there was sufficient evidence in the Greyhound case for a jury to determine if IBM had violated the Sherman Antitrust Act. "There was evidence from which the jury could reasonably infer that IBM possessed monopoly power in the leasing of general purpose commercial computers," the court ruled. A new trial is expected to be held in Phoenix. Meanwhile, California Computer Products, whose $102 million antitrust suit against IBM earlier this year ended also in a directed verdict, filed its brief in late August asking for a new trial. Calcomp's trial lawyer, Maxwell M. Blecher, said the ruling "changes the whole perspective," and that Calcomp will get a new trial also. In late August, IBM said it was "confident that given the opportunity to present our case, we will prevail on the merits."

Mohawk in Preliminary Talks: Mohawk Data Sciences Corp., the data entry firm, said in early August it was discussing an acquisition or merger with unidentified major shareholders of Keuffel and Esser Co., which makes a broad line of instruments for the engineering profession and certain other specialized fields. Mohawk's chairman Ralph H. O'Brien said the talks were "informal" and another spokesman for Mohawk said he felt "various aspects of their business . . . may be complementary to Mohawk." Keuffel, headquartered in Morristown, N.J., had sales of $82.8 million in 1976, and Mohawk, of Parsippany, N.J., had total revenues of $146 million.

Flexible Xerox: After its Diablo Systems subsidiary ran into trouble making a flexible disc drive for its Ranger small business system, Xerox turned around and signed a letter of intent to acquire the king of the floppy market, Shugart Associates, the privately owned Sunnyvale, Calif., firm. Shugart, formed in 1973 by former IBM and Memorex engineers, headed by Al Shugart, last June shipped its 70,000th diskette drive, and is estimated to be turning out about 6,000 drives a month. Diablo's Series 10 diskette drive was withdrawn from marketing more than a year ago and the Xerox subsidiary is buying Shugart floppy drives for its small business system, marketed by Shasta General Systems, Burlingame, as the Shasta 3200. The two companies said they expected a final agreement by mid-October and for the transaction to be completed by the end of the year.

Microdata in Europe: Microdata Corp., the Irvine, Calif., manufacturer of small business computers and peripheral equipment, said it will offer $11 million in cash, debentures, and stock to acquire Computer Machinery Co., a group that operates in nine European companies. Microdata said it will sell its Reality and still-to-be-completed Express computer systems and its peripherals through the CMC companies, and also launch manufacturing operations in CMC's U.K. and French plants. The companies formerly were owned by Computer Machinery Corp., the data entry firm, which sold them before being acquired by Pertec Corp. Sycor Corp. of Ann Arbor, Mich., recently signed a distribution agreement with CMC for the companies to market its model 400 clustered intelligent terminal systems, along with an agreement of understanding to acquire part of the companies. But it later withdrew the acquisition agreement. Sycor officials said in early August that CMC's price was too high, but declined to disclose it. If the Microdata deal goes through, it will be a distributor for Sycor equipment—a situation that does not disturb Sycor's v.p. of marketing Paul LaVoie because Sycor has never competed against Microdata in the U.S.

High Speed Printer: Itel Corp., San Francisco, which has been selling IBM-compatible peripherals and cpu's, now will begin marketing a high speed nonimpact laser printer subsystem that also is compatible with IBM's 3800 printer announced two years ago. Itel has entered into an agreement with the West German firm, Siemens A. G., to jointly develop the system in which Itel will use the ND-2 laser printer, a product made by Siemens. Itel said it will install the printer at its technical support center in Palo Alto for demonstrations and benchmarks by year end.

He Guessed The Price: Thomas W. Cook (right), an engineer with Mobil Oil Co. in Dallas, receives congratulations from Al Vaughn, a Hazeltine Corp. sales representative on his winning of a Hazeltine-sponsored "Guess the Price" contest at the June National Computer Conference. Cook's prize was a Hazeltine Modular One terminal. In late August he still hadn't received it, but a Hazeltine spokesman assured it "will be shipped momentarily." Cook said he'll probably run it for awhile at Mobil, then put it up for sale. In the contest, participants were asked to guess correct oem and end user prices for two new terminals shown by Hazeltine at the NCC, the 1510 and the 1520. One or more correct guesses qualified an entry

THOMAS W. COOK
"Those turkeys haven't sent me anything yet!"

for a drawing held in early August at Hazeltine headquarters. Fifty contestants qualified and Cook was the lucky winner, or so he was hoping in late August.

For Self Assessment: The Data Processing Management Assn. (DPMA) has formed a self-assessment project task group with William A. Paling, director, Information Services, Transco Companies, Inc., Houston, as chairman. The group will be part of DPMA's Education Foundation, founded in 1975 as an independent not-for-profit organization whose primary purpose is to expand educational opportunities for data processing professionals. The self-assessment project, DPMA said, "seeks to develop a program for the evaluation of management skills for managers in the data processing field." The organization said the project will be performed in two phases: a pilot to culminate in a sample test to be administered at DPMA's international conference and business exposition next month, and a development project to formulate and administer the broad scope of a self-assessment program.

Word Processing: There will be 792,000 automatic text editing typewriters installed in the U.S. by 1981, compared with the 327,500 that had been installed last year, and the 114,000 units at the end of 1973. Creative Strategies, Inc., a San Jose market research firm, said the most dynamic market segment will be in display-based word processing typewriters: 73,000 of them to be shipped by 1981, valued at $234 million. The company's study, *The Word Processing Typewriter Industry*, also reports that IBM will remain the dominant force in the industry; a market shakeout is underway; rapid growth will peak in 1980 when saturation is reached in large businesses; and card storage will lose ground to tape and disc media. (The study is sold for $595 by the company, 4340 Stevens Creek Blvd., San Jose, Calif. 95129.) ❊

LOOK AHEAD

(Continued from p. 16)

It's understood the company has had the device for some time, and that it has been shown to prospects. But it's delayed announcement pending market studies that may confirm the company's feeling that the BCM's, which are expandable in 32KB units to 8MB, can see many other uses besides as fixed disc replacements. Shipments, it's understood, will begin in the first quarter of '78.

GETTING THE LAST BUG OUT

The audience laughed at a personal computing session at the recent NCC when speaker Bruce Venetta of IMSAI, which sells personal computers, said, "I don't know if the general user is aware of it, but it costs money to get the last bug out of a piece of hardware and there are a couple of interesting ways you can get (it done)--you can ship it at some point in the design cycle." Then, he added, the money starts flowing in and you have hundreds of technicians out there working on your board. "You go through your morning mail and do your engineering that way." Venetta said all the companies in the personal computer market have done this, although the five or six largest don't do it anymore.

The principals of CCW Data Systems, Oakland, Calif., had they been there, probably wouldn't have joined in the laughter. CCW last March filed suit against IMSAI and Kentucky Fried Computers, a Berkeley computer store. They charged breach of warranty and fraud, arising from Kentucky Fried Computers selling CCW an IMSAI floppy disc drive that was "not capable of performing the mass storage and retrieval functions it was intended for." It asks for damages from both and $5,000 in punitive damages from IMSAI for fraud. The suit states that the plaintiffs were justified in believing IMSAI's claims due to the company's "superior knowledge" and "because plaintiff had previously purchased some products made by IMS Associates, Inc. (IMSAI's former name), which were not defective in design or manufacture." The various causes for action took place during 1976. CCW said it suspects the case may not go to trial for at least a year.

DISTRIBUTION MANAGEMENT SYSTEM FOR SERIES/1

A distribution management system built around the IBM Series/1 minicomputer and incorporating a DMS operating system may be announced soon by Distribution Management Systems, Inc., Bedford, Mass. The company, which specializes in systems for controlling distribution functions, is headed by Pete Peterson who left the presidency of SofTech last fall to take over the company when it was known as Codon, a distributed processing pioneer. The tall, thin, energetic ex-crewman brought in new financial, marketing, and technical management, and then hit the sales trail.

First new product, we hear, is a random locator system for warehouse inventory control, to be followed by a distribution management system that can incorporate any of the newer DEC machines (Condon's system was built around the PDP-8). Then the Series/1 product. Peterson feels there's no viable IBM distribution management system in his price/performance range, and happily plans to fill the vacuum for that sizable crowd of people who hanker for IBM gear.

RUMORS AND RAW RANDOM DATA

IBM is quarreling with the British Post Office over who will maintain the 3750 PABX on the telephone network -- IBM wants to maintain its own system, but the BPO insists on handling the task. The two already have clashed openly, notably at the London Transport, and the quarrel is scaring away other buyers.

Turning a profit in turnkey systems:

If your business is selling turnkey computer systems, using the right computer can be the key to making more sales—profitably.

You need a computer that's easy to use—and adaptable to many uses so you can get more customers. And you want a computer that's priced to sell, at a margin that's profitable.

You want a computer that can really protect your proprietary software—keep it safe, and saleable, sale after sale. And you need a better way of supporting your software than having to visit sites.

You need a computer with proven reliability, so there'll be fewer service problems. And you want a fast, dependable service network when there are.

Needs and wants met here

For all this, the one computer you want is the one we make: The BTI 4000 Interactive Timesharing System.

It's a ready-to-go system with 10 megabytes of storage, magnetic tape drive, and 8 ports—just add terminals. And it's easily expandable—add disk storage to 400 megabytes, increase user capacity to 32 ports, add peripherals like industry-compatible magnetic tape and a line printer.

The BTI 4000 is designed, manufactured and supported by Basic Timesharing Inc. We're the manufacturer with timeshare experience. Which has helped us produce a computer uniquely right for multi-user applications.

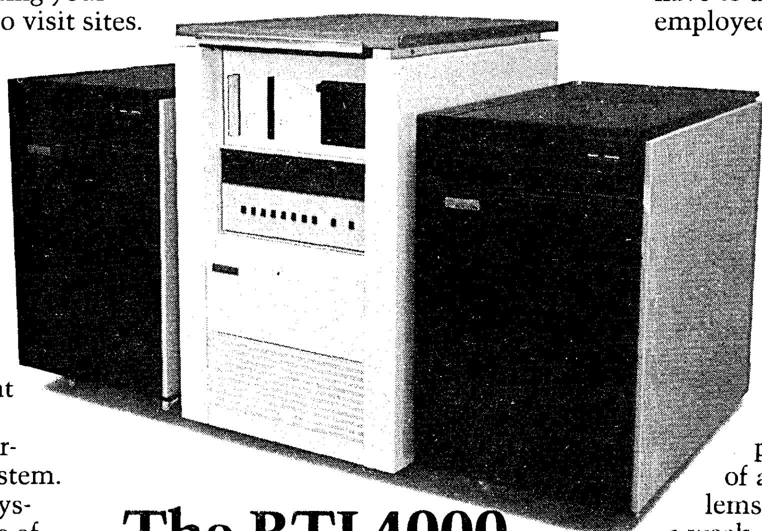
A dedicated performer

The BTI 4000 has been proven in all kinds of applications—general accounting, dealer inventory control, entertainment ticketing, text publishing, school administration, and more.

What's more, the BTI 4000 is proving its reliability at locations in 39 states, in 5 provinces of Canada, and in Europe, too.

Things you'll like

The BTI 4000 uses BASIC-X, an unusually powerful extension of BASIC. With the features you need to get your software up—quickly, efficiently. So you can start selling sooner.



The BTI 4000 Means Business.

Especially important to you, the BTI 4000 protects your proprietary software. So you can count on selling it again, and again. Without losing control of it. And with the convenience of dialup access, so you can support it without the cost of site visits.

Things your customers will like

The BTI 4000 is a true timesharing system. It allows doing any mix of tasks, all at the same time, from any number of locations.

Your customers will enjoy faster response, because the BTI 4000 implements many of your application program operations in firmware.

The system also offers continuous availability, because software backups, updates, and other housekeeping activities can be performed locally, remotely or programmatically, with users on the system.

And the BTI 4000 is so easy to manage, your customer won't have to add a specially-trained employee just to run it.

Service—good and fast

In the packaged systems business, service can have a real impact on your success.

That's why service is such an important part of our business.

The BTI 4000 is designed for over-the-phone, on-line diagnosis of actual and potential problems. 24 hours a day, 7 days a week, we're ready to help. If a BTI 4000 ever needs on-site service, we have a network of field specialists to provide just that.

Priced to please

A single BTI 4000 costs $35,950. There are attractive quantity discounts—like $28,760 each for a quantity of 10.

For that price you get all the features and support benefits mentioned above, not a scaled-down version.

You can get complete information at your BTI regional office, listed below.

The BTI 4000. It could be your key to turning more profit in your turnkey installations.

Basic Timesharing Inc., 870 W. Maude Ave., Sunnyvale, CA 94086. Sales Offices: East: Cherry Hill, NJ (609) 662-1122; Midwest: Minneapolis, MN (612) 854-1122, Chicago, IL (312) 298-1177; South: Dallas, TX (214) 630-2431; West: Sunnyvale, CA (408) 733-1122, Anaheim, CA (714) 533-7161

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The perfect editing terminal for transaction processing must be more than a little bit smart. It has to be wise like our OWL-1200. With features that assure high accuracy source data entry, fast data editing, simplified host computer programming, and reduced host computer loading.

Our OWL gives you all the human engineering features you get with our FOX-1100, plus a lot more. And the price is right. Just $1496 in quantities of 25.

Check the comparison chart of editing terminals to see all the reasons why the OWL-1200 is simply "incomparable."

		PERKIN-ELMER	HAZEL-TINE	LEAR SIEGLER		ADDS
USER REQUIREMENT	FEATURES	OWL-1200	MOD. 1 EDITING	ADM-1A	ADM-2	980
High Operator Data Entry Accuracy	Protected fields	Yes	Yes	Yes	Yes	Yes
	Low-intensity fields	Yes	Yes	Partial	Partial	Partial
	Numeric only fields	Yes	Yes	No	No	No
	Inverse video fields	Yes	Yes	No	No	No
	Blink fields	Yes	Yes	No	Yes	Yes
	Line drawing capability	Yes	No	No	No	Yes
Simple, Fast Editing of Data	Insert/delete character	Yes	Yes	Partial[1]	Yes	Yes
	Insert/delete line	Yes	Yes	Partial[1]	Yes	Yes
Minimized Loading on Host Computer	Host programmable send keys: send all data, send only unprotected data, send only data modified by operator, send only a "request to send" header.	Yes	No	No	No	No
Simplified Programming	Ability of host CPU to read device status	Yes	No	No	No	No
	Ability of host CPU to read device mode key settings and communication option straps	Yes	No	No	No	No
	Program override on mode key settings	Yes	No	No	Yes	No
Simplified Program Debugging	Transparent mode permits all characters to be displayed	Yes	No	No	No	No
Cost Effectiveness	OEM price in quantities of 25*	$1496	$1670	~~$1795~~ *$1595	~~$2395~~ *$2095	$1995

*When unit includes editing capabilities, 24 x 80 display, numeric pad, and upper/lower case characters.

[1]No Key. Requires Two Key Code.

* Just announced price changes

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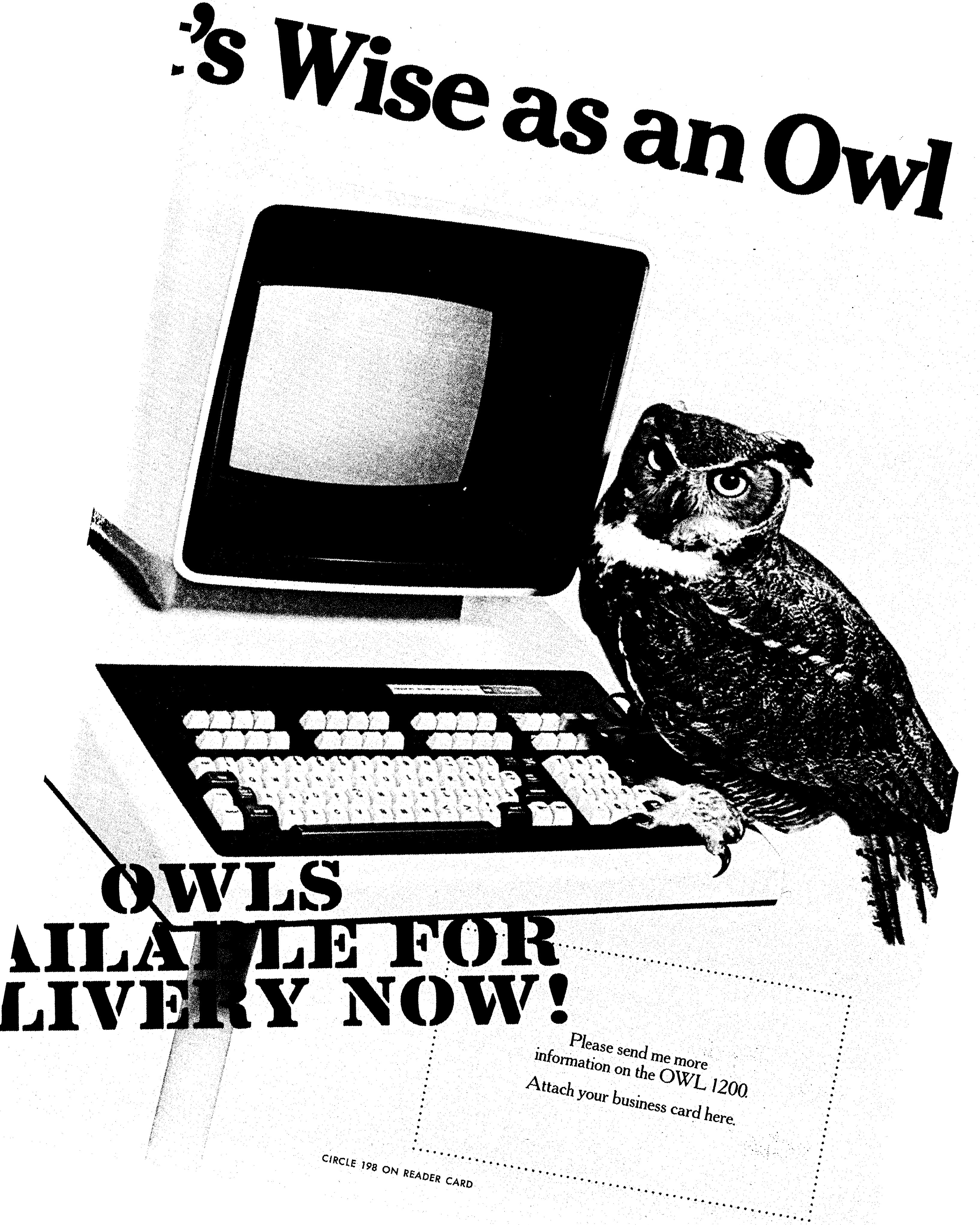

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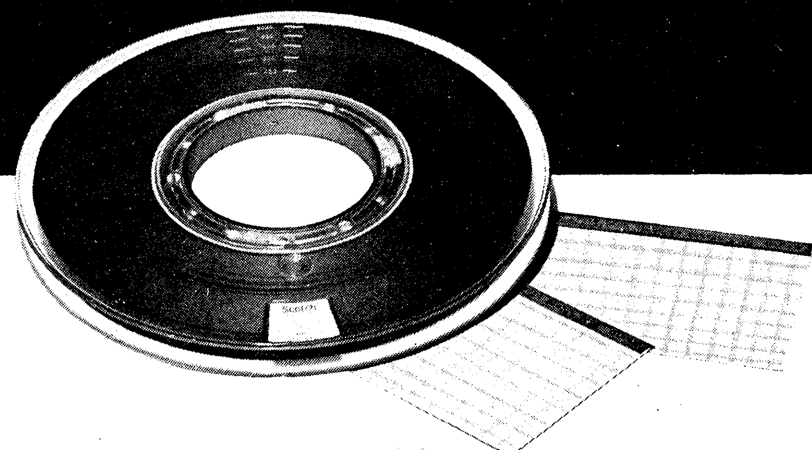
Attach your business card here.
CIRCLE 198 ON READER CARD

Nobody turns COM data into sound business decisions the way 3M can.



Only 3M Beta System offers programmable COM with the big plus of business graphics—to make your COM output more useful to your company's decision makers!

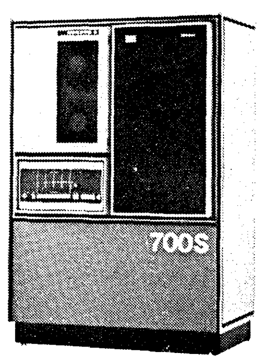
With 3M Beta COM, you make data easier to interpret, decisions easier to make in either of two ways:

Highlight the data. The 3M Beta System gives you underlines, italics, bold face, 8 different character sizes through simple operator-entered instructions. No host computer modification needed!

Graph the data. Reduce complicated numbers to easy-to-scan pie charts, graphs, tables. The 3M Beta System includes the software needed for graphic presentation of data.

But making business decisions easier is only the first step. Beta System makes your job easier, too. From software innovations to installation and operator training programs to field and home base service nobody offers you the unique total system suppórt approach 3M can.

So whether you're interested in business graphics or want to move up to programmable COM, move COM in-house or expand your operation, let 3M show you the way. Call your local 3M Business Products Center or write Microfilm Products Division, 3M Company, St. Paul, MN 55101.



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The Dangers of Egalitarianism

by Aaron J. Brenner

Is the computer undermining management? Can we avoid disaster? Who was Vic Prynne?

We are indeed fortunate that this seminal speech has been brought to our attention by Dr. Arthur M. Lesk so that we may publish it here. In addition to sitting through after-dinner speeches, Dr. Lesk is now with the MRC Laboratories of Molecular Biology in Cambridge, England.

It is a great pleasure to have the opportunity to address you tonight on a subject that has claimed my professional interest for almost three years—an interest that is just beginning to bear fruit. I am deeply honored by this award, of course, and can only hope that I can continue to be worthy of it. As Vic himself was fond of saying: "It is not the title that does honor to the man, but the man who does honor to the title."

My subject tonight is "The Dangers of Egalitarianism." My object is to alert those of you who have not yet recognized it to the threat which modern computer technology poses to all that we managers and advisors to managers hold dear; and to describe, in a humble way, some of the weapons that we are developing in defense of our own profession.

I am sure there is consensus in this room that egalitarianism—treating everyone alike—is anathema to modern American industry. As Vic used to say: "It takes motivation to wind up tight the rubber band of productivity."

Where exactly lies the threat? Here: compare the world of two programmers—one a novice, the second a senior member of the staff. Suppose that each of them submits a FORTRAN program containing a statement with three left parentheses and two right parentheses, and compare the response of a typical compiler to each: the first slide (Fig. 1) shows the response to the novice:

```
IGI 0131  SYNTAX ERROR: UN-
   MATCHED PARENTHESES
```

Fig. 1

The next slide (Fig. 2) shows the response to the senior member of the staff:

```
IGI 1031  SYNTAX ERROR: UN-
   MATCHED PARENTHESES
```

Fig. 2

These are, as you will have noticed, the same.

The same!

This, gentlemen, is our problem. If everyone is treated the same, how can anyone be motivated to better himself?

Now you will perhaps say that there are already ample distinctions, that the ordinary perquisites of rank—higher salary, larger offices, private secretary—are sufficient. But this comment fails for two reasons. First of all, I can bring you a sheaf of statistics that *prove* that giving people raises costs money. Second, and nearly as important, the standard perquisites of rank do absolutely nothing to defend against the creeping egalitarianism of the monitor system itself.

You will say that you could give senior people higher priority on the system—a larger time slice—or allot to them more storage space on the disc. All these things are certainly being tried. And I do not say that they should not be tried. But they are in the province of the technicians, and irrelevant to yours and mine. A man's ego is not stroked by giving him an extra cylinder or two. As long as we must employ human labor, we must reward it in the coin of the human realm. (Of course I speak metaphorically.)

Well, this is the problem I faced: how can we modify current practice in managing data processors, at minimal cost, to improve productivity. Tonight I shall report to you on three of our lines of attack.

To illustrate each of these ideas, let us consider three basic "types": the novice trainee, the junior-level career staff man, and the senior executive. Our first project involved the shocking uniformity of discourse by monitor systems, of which I gave you an example earlier. (See Figs. 1 and 2).

There is no reason why messages from the monitor system need to be the same for all classes of user.

Our staff is going through the Message and Code book line by line to create appropriate versions of each message for each user class. Let me cite examples. Consider again the case of the FORTRAN program containing a statement bearing an unmatched parenthesis. There are three versions of the diagnostic message. For the lowest rank:

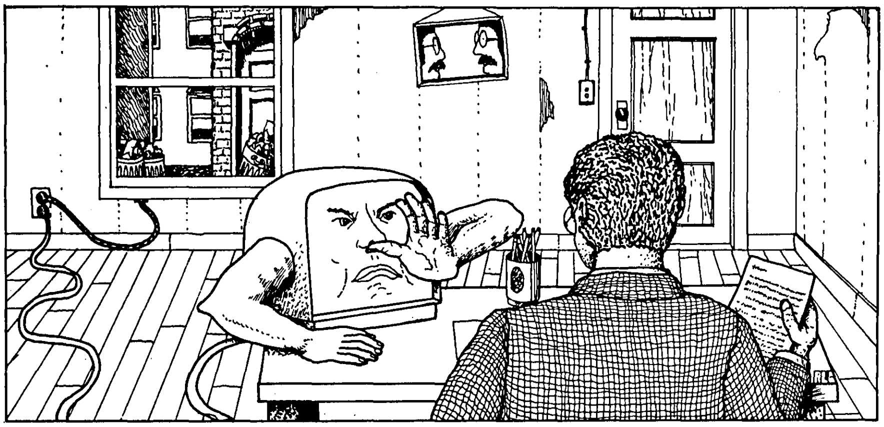
"Sorry sonny, your program finished out of the money. This time, mismatched parentheses." As you see, no sense of respect is communicated.

For an intermediate rank:

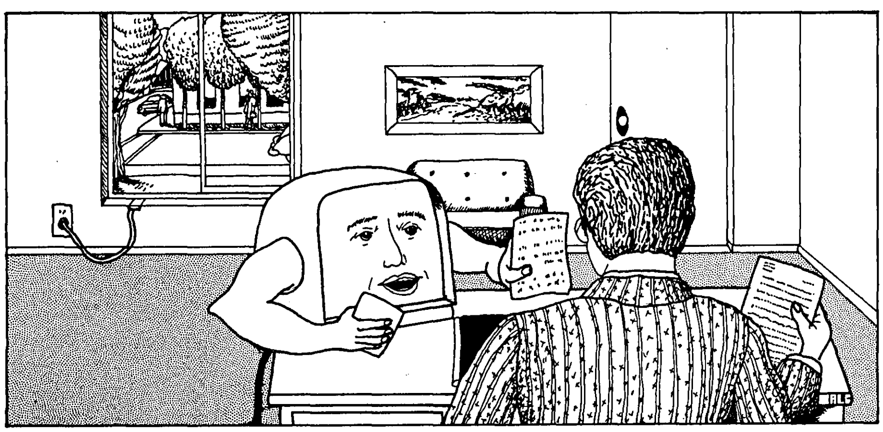
"This program contains serious errors: *viz.,* mismatched parentheses. Correct and resubmit." A sincere, but unflattering, statement of fact.

But for the executive we propose the following, appropriate to his position:

"Sir, the compiler is unable to decide precisely what you had in mind in line



"Again you had to go and ruin it . . ."



"Program encountered EOF on unit . . ."

14. There does seem to be an imbalance in the number of right and left parentheses. Would you kindly enlighten us?"

Now suppose, on the other hand, that a program attempting to read data encounters an end-of-file. Our suggested messages:

For the novice:

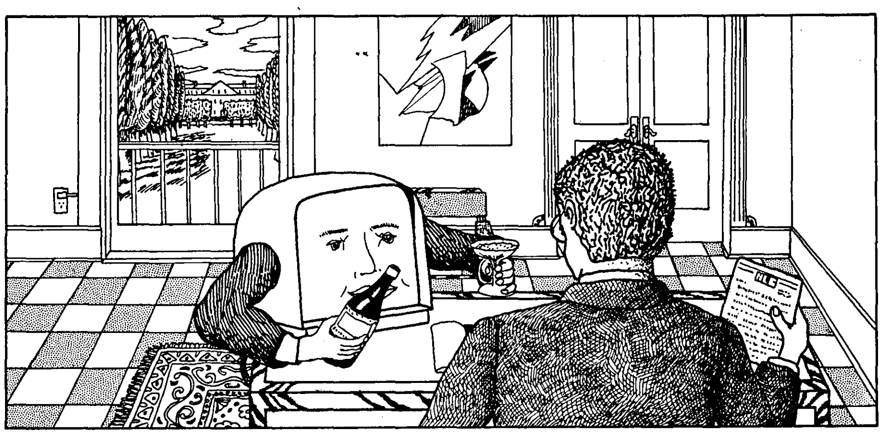
"Again you had to go and ruin it. We ran off the end of input unit: . . . . (unit number)"

For the intermediate rank:

"Program encountered EOF on unit. . . ."

And for the executive:

"Sir, a project as ambitious as yours



"Sir, a project as ambitious as yours . . . "

begs for additional data. Please supply!"

Our second project deals with the type fonts appearing on different employees' terminals. Currently, the physical appearance of the actual letters is the same for all; but with modern graphics terminals this need not continue. We have designed a character set for the lowest rank of programmer that resembles the handwriting of a second grade child who has just learned to print. The intermediate level man will read a perfectly serviceable, standard, sans serif text; but senior personnel will receive their output at terminal displayed by elegant fonts described by lengthy stroke and arc tables.

The third suggestion, perhaps the most far-reaching of all, was developed jointly with a firm of architects in connection with planning a large corporate research center. The specific problem was that it was impossible to provide everyone with a window. But there is a growing body of evidence that factors in the working environment—including light and monotony—have important psychological and physiological effects on productivity.

Our resolution of this dilemma makes use of the new technologies of computer graphics. Each office will be equipped with one wall containing a 3 x 5-foot display screen connected to a computer capable of generating and animating three-dimensional, full color, lifelike images. Each employee will believe he is looking out a window at the world outside.

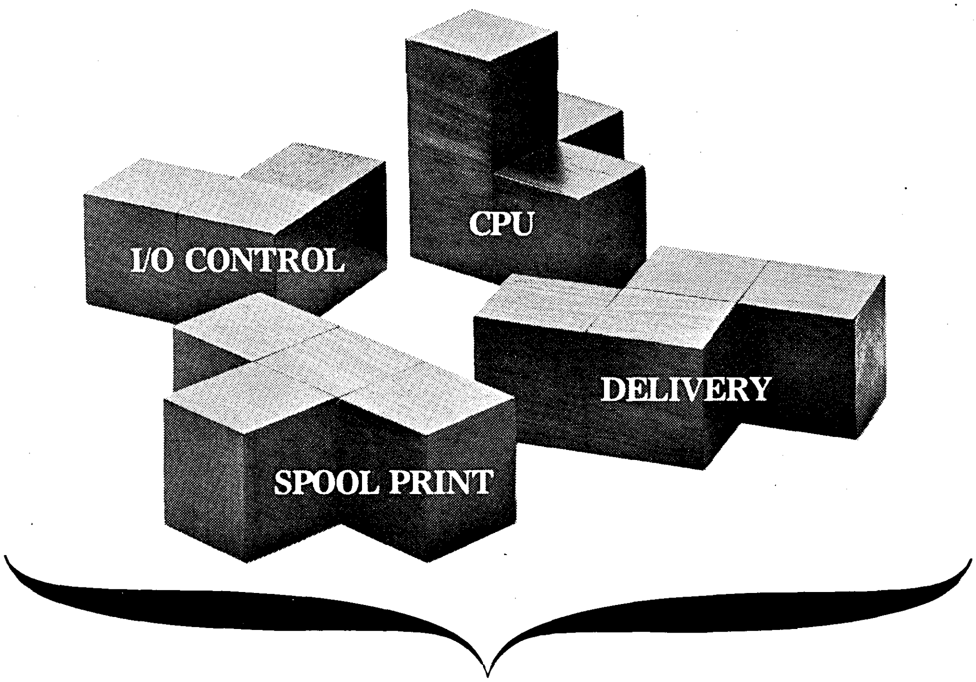
Now, this was as far as the technical people had gotten when the plans reached our hands. We sensed immediately, of course, that the architects had missed a golden opportunity. They had suggested the creation of software to display ordinary street scenes: people walking their dogs, women pushing baby carriages, etc.—an electronic Norman Rockwell—to create a sense of satisfaction for everyone. Again, you notice, the theme of egalitarianism. And a particularly intolerable example of it, too.

My suggestion will come as no surprise to anyone in this room: *we have designed a software package with the option of displaying many different socioeconomic environments.*

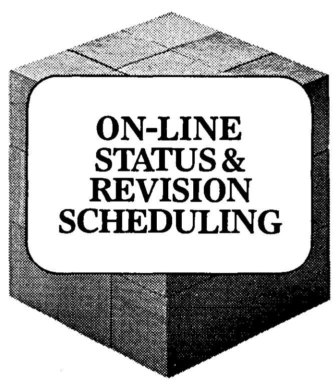
In terms of our three types, the novice will look out—and up—at an alley. Prominent garbage cans, fire escapes, sleeping winos, a fire hydrant—intermittent dogs. For the intermediate rank: here the street scene as originally suggested, or perhaps a country road. Nothing unpleasant, but definitely nothing that anyone would go out of his way to visit. But for the executive: a view of formal gardens, à la Versailles.

From this, the next step was to real-

On-Line Job Status Throughout Your Entire Data Center.



INQUIRY
- Job Status
- Abended Jobs
- Entire Network Status
- Overall Production Status



PROMPTING
- Job Starting Late
- Predecessor Job Abended
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ize that this design allows us to push the Hawthorne effect—that productivity increases in response to *any* change in working conditions (for better or for worse)—to its limit. Our current recommendation is that employees who have earned it be rewarded during the summer with a trip to "The Resort." That is, for a week the ordinary display sequences in their offices would be replaced by a view of a lake or a beach—without the employee's having to leave so much as his desk. These employees would be encouraged to change into suitable clothing upon arrival at work.

Pilot tests of this idea show that not only does productivity of an employee so treated increase to an unusual and unanticipated extent during this time period, but personnel will even tolerate uncomfortably hot ambient temperatures, leading to savings on air conditioning bills. An extension to the winter is under development; here we may confidently anticipate savings on heating bills.

Our current estimate is that this design will recoup its extra initial costs many times over in a very short time.

In conclusion, let us recall the original problem: how can we divert the dangerous tendency towards egalitarianism inherent in modern technology. I like to think that Vic Prynne would have been pleased by the fact that not only have we met the enemy and made him ours, but that we have licked him with the weapons raided from his own arsenal. I thank you. ❄

Aaron J. Brenner is a native of New York City. In 1966, he left his position as personnel development manager at the Katz Pajama Company of Brookfield, Conn., to form his own management consulting firm, specializing in data processing. He was the recipient this year of an honorary D.H.B.A. degree from Chelm Univ.

The token of his present award, a lapel pin, is inscribed on the reverse: "1977 Victor I. Prynne award for creative Achievement in human-software management: Aaron J. Brenner."

WANG'S PCS-II

THE END OF THE LINE FOR INTELLIGENT TERMINALS.

Wang's PCS-II. The small business computer that makes intelligent terminals obsolete. And introduces a whole new world of Distributed Data Processing.

Endowed with commercial BASIC and exclusive Wang minidiskette storage, the PCS-II delivers direct access data processing capabilities no ordinary terminal can. And with Wang's programmerless "EASYFORM" forms building and data-entry language, the PCS-II is a hands-on winner in any data-entry or forms-processing environment.

Wang modularity lets you expand memory, communications or peripherals as your needs grow. Or new technologies as they develop. Directly at the operator site.

The PCS-II even gives you a price tag no intelligent terminal can match—just $6,200. With 50K memory, dual minidiskette drives and bisynchronous 2780/3780 communications it's still only $9,200.

Hungry for more intelligence? Call your local Wang office or mail this coupon to PCS-II Product Sales, Dept. DDP, Wang Laboratories, Inc., One Industrial Ave., Lowell, Massachusetts 01851.

I'm hungry. Send me information on Wang's PCS-II.

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DP72/D97

hardware

Off-line

A message processing center developed by the Air Force System Command's Electronic Systems Div. was used for the first time during a joint services operational effectiveness demonstration at Shaw Air Force Base, S.C. Part of a joint service program called TACS/TADS (Tactical Air Control Systems/Tactical Air Defense Systems Interface), the equipment allows five tactical data systems used by the Air Force, Army, Navy, and Marine Corps to "talk" directly to each other. "By tying these systems together with a message processing center, surveillance information can be immediately exchanged among the military services," explains Patrick M. Shanley, TACS/TADS project engineer. This means that a display console operator at any site has access to aircraft tracks maintained within any other system's tactical data base. Hughes Aircraft is under contract to build the message processing centers. System Development Corp. performed system testing, and the MITRE Corp. provided system engineering support.

Training for the first of three Multi-Access Airline Agent Reservation System (MAARS) pilot projects has begun at the New York City world headquarters of the American Society of Travel Agents, Inc. (ASTA). The pilot project is "the initial step in creating an unbiased computerized reservations system that will maintain freedom of choice both for the travel agent and for the traveler," according to Ray N. Smith, ASTA v.p. Incoterm/Videcom supplies the computer equipment.

Electronic Memories and Magnetics announced that Digital Equipment Corp. recently filed a patent infringement suit in an attempt to block sales of EM&M's SECS-11/1 minicomputer. EM&M maintains that although the SECS-11/1 can emulate PDP-11/34 and 11/35 minis, its hardware is the product of independent original design work and differs radically from the DEC machine. EM&M further states that its customers will be protected under its patent indemnity clause.

370 Emulator

Taking advantage of the similarities between Interdata's 7/32 processor and the IBM 370, this vendor has implemented in firmware the additional functions that will let the processor execute the 370's BAL instruction set. Additional firmware for the scientific and commercial instruction sets is anticipated.

Installation of the 370 firmware does not preclude executing Interdata object code. A bit in the program status word tells the processor which instruction set is in use. Interdata's operating system is used to control the system. Since the 370's privileged instructions haven't been coded, IBM operating systems aren't available on the Duo 70.

For existing 7/32 installations, the firmware for Duo 70 sells for $15,000. The vendor will also sell the 7/32 and firmware as a package. Maintenance is available through Interdata. THE KARDIOS SYSTEMS CORP., Randallstown, Md.

FOR DATA CIRCLE 458 ON READER CARD

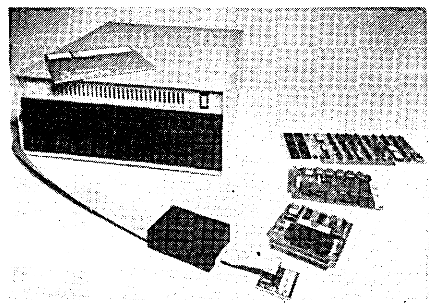
Intelligent Terminal

The 8080 microprocessor-based 8035 Intelligent Terminal System comprises a crt terminal, IBM 3740-compatible dual flexible disc subsystem, operating system software, and an RS232C interface. The first in this vendor's Designer Series, the 8035 is totally user-programmable; all functions of the system are under software control. The terminal can support from 20K to 64K of RAM for storing operating software. FDOS, the operating system, includes an editor, assembler, and debugger. FDOS also includes file management routines to handle file creation, deletion, and modification. The diskette subsystem can store half a megabyte of data and programs. A 120 cps printer optionally may be connected to the 8035. Transmission rates range up to 9600 bps. Single unit prices start at $7,200, depending on configuration. Delivery is quoted at 60 days. OMRON ELECTRONICS, INC., Information Products Div., Sunnyvale, Calif.

FOR DATA CIRCLE 460 ON READER CARD

Micro Development System

Combining a special assembler and a memory emulation module, this Z80-based development system can help users prepare applications for many different microprocessors, including the 8080, 6800, and 6502. The user can load the assembler's symbol table with the information appropriate to his target microprocessor and generate code into the emulator memory space where it can be executed by the target processor. Multibyte instructions, such as those used with the Z80, are supported. A buffered connector plugs into the target micro's 2708 EPROM socket; any target machine that runs off standard 2708s can be programmed and debugged using breakpoints. Up to 4KB of 2708 control store can be emulated.



An advantage of the system especially attractive to users developing systems for several different micros is that only one editor, one operating system, one assembler, and one set of utilities need be learned. The development/emulator system, including Z80 cpu, 32KB of RAM, 4KB of emulator RAM, and dual single-density diskette drive, sells for $5,995. Deliveries take 30 to 60 days. Digital Systems will handle manufacturing and marketing for the product's developers. M & E ASSOCIATES, Cupertino, Calif.

FOR DATA CIRCLE 450 ON READER CARD

Portable Crt

Small enough to fit under an airplane seat, the P-1881 contains a seven inch crt, ASCII keyboard with upper and lower case, editing features, and a 8,000 character buffer memory. The buffer memory can retain data for as long as 24 hours after removing line power. The P-1881 sells for $3,995; deliveries take 10 to 12 weeks. TELERAM COMMUNICATIONS CORP., Mamaroneck, N.Y.

FOR DATA CIRCLE 461 ON READER CARD

Series/1 System

Packaging hardware and software, this vendor offers a Series/1 turnkey system. The basic Series/1 offered consists of a 64KB processor, 9.3 MB fixed disc, 512K diskette, 120 cps printer, and a crt with a 1,920-character screen for input and inquiry.

hardware

The initial library of applications programs will duplicate some of the vendor's turnkey products based on DEC hardware. An enhanced operating system running COBOL programs will complement the packaged application programs. Generalized applications include: order processing, billing, inventory control, accounts receivable, accounts payable, payroll, and general ledger. Specialized packages will be offered for accountants, fuel oil dealers, food distributors, and others. A basic Series/1 computer with applications programs for accounting systems and on-premises training start at $41,000 or $870/month lease. Software also will be offered for purchase separately. Maintenance of the Series/1 is provided directly by IBM through its nearest local service office. COMPUDATA SYSTEMS, INC., Westport, Conn.
FOR DATA CIRCLE 459 ON READER CARD

Off-Line Printing
The DOC-TPS tape-to-print system uses up to four of this vendor's high-speed line printers to provide print speeds ranging from 1,250 lpm to 9,000 lpm on a single system. The system operates with one to four industry-compatible tape drives connected to a single central controller. Compatible with tapes prepared on IBM, Burroughs, and Honeywell mainframes, the system has top of forms restart and forms and line counting for job accounting records. Deliveries are said to take between 30 and 45 days. Twelve different configurations are available with lease rates ranging from about $2,600 to $9,573 per month. DOCUMATION INC., Melbourne, Fla.
FOR DATA CIRCLE 457 ON READER CARD

Instrument Interface
Users of the popular PDP-11 can interface to IEEE Standard 488-1975 General Purpose Interface Bus-compatible devices using this vendor's GPIB11-1 interface. The GPIB11-1 (a single quad-height card) plugs into a small peripheral controller (SPC) slot, allowing as many as 14 GPIB-compatible instruments to be connected to the PDP-11's UNIBUS. Utility and driver programs are furnished as macro source files which may be assembled as FORTRAN, BASIC, or macro-callable subroutines. A single GPIB11-1, including a two-meter cable with a standard bus connector, sells for $1,495. Quantity discounts are offered. NATIONAL INSTRUMENTS, Austin, Texas.
FOR DATA CIRCLE 455 ON READER CARD

Terminal
The QT-P55 uses a Qume daisywheel print mechanism to produce "letter quality" output at 55 cps. Transmission rates include 600 bps and 1200 bps to take full advantage of the 55 cps print speed. The keyboard-printer model QT-P55 sells for $4,450; a re-

ceive-only model, the QT-R55 sells for $4,200. Options include a roll-around stand ($180), and floppy disc systems for off-line editing and buffering high-speed communications. A single floppy editing unit adds $3,560 to the terminal's price; a dual diskette intelligent drive, including BASIC language programming capability adds $6,940 to the terminal's price. Other options include IBM code conversion and a crt display. Delivery takes two to four weeks. QUALTERM TERMINALS, Mountain View, Calif.
FOR DATA CIRCLE 447 ON READER CARD

Computers
The System 88 consists of three separate series of computer systems, all based on Interdata's 7/32 32-bit processor. The main differences between the Series 1, Series 2, and Series 3 are the disc, communications, and printer subsystems.

The System 88 Series 1 consists of a cpu with 131,072 bytes of main memory, 20MB of on-line disc storage (two drives), two crt terminals, and a 300 lpm printer. Series 1 sells for $58,900.

Series 2 has 196,608 bytes of main memory, 134 MB of disc storage on two drives, two 9-track tape drives,

product spotlight

Color Plotting
A 15,625-color plotting system? That's the number of different shades users can get using this three-color ink-spitting color plotter system. Just as a color television produces its wide range of colors by combining the three primary colors—red, yellow, and blue—this plotter uses three ink supplies to generate colors.

The color plotting system operates off-line, and is capable of generating a full-color 22 x 34-inch image on paper, overhead transparency film, or other media. A full-sized plot takes at least 8½ minutes. The resolution is five points per millimeter (127 points per inch) produced by constant sized spots from each of the three ink jets.

Input tapes to the plotting system are generated with a set of FORTRAN-callable subroutines for making maps and charts as well as handling direct input from raster-scan devices. Written in ANSI FORTRAN IV, the software is designed to run on most mini and mainframe computers. There are two levels to the software system: Basic Software and Application Software. Basic Software handles fundamental graphics, such as plotting points, lines, circles, polygons, text, and backgrounds. Application Software handles charting, mapping, and three-dimensional projections.

First deliveries of the color plotting system are slated for next month. The system, including plotter and tape unit, sells for $45,000. APPLICON INC., Burlington, Mass.
FOR DATA CIRCLE 442 ON READER CARD

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CIRCLE 20 ON READER CARD

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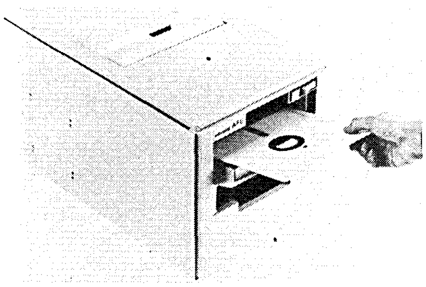
State/Country ______________ Zip ______________ four crt's, and a 600 lpm printer, with a price of $110,000.

The $192,600 Series 3 has 262,144 bytes of main memory, two disc drives providing 512MB of on-line storage, two 800/1600 bpi selectable tape drives, eight crt's, and a 1,000 lpm printer.

Planned for growth, System 88 is intended to expand as the user's requirements grow. The vendor says it is committed to the concept of modular expansion of the original system rather than replacing it with a larger model. System 88 is aimed at the low to medium 360/370 market, as well as the System/3 Model 15 market. Firmware to emulate the 370 instruction set is available, as is the TOTAL data base management system. The vendor also offers application software support. COMPUTER SYSTEMS AND SERVICES, INC., Springfield, Ohio.
FOR DATA CIRCLE 449 ON READER CARD

Auto-Load Diskette Drive

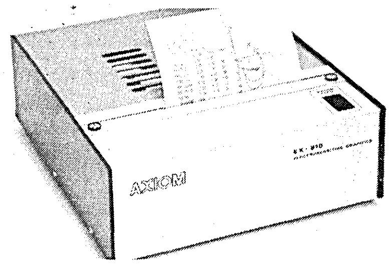
The Automatic Floppy Disc Unit is billed as an enhancement to this vendor's line of systems products. Beside its on-line uses, the unit is expected to appeal to the media conversion market. IBM 3740-compatible, the unit consists of an automatic loader, dual floppy disc units, and a power supply. Holding a maximum of 20 dis-



kettes, the unit performs its automatic loading cycle in roughly 5½ seconds. In a conversion application, data from various diskette recording stations can be pooled on the unit and converted to mag tape for processing by a mainframe. Pricing starts at $4,560. OLIVETTI CORP. OF AMERICA, New York, N.Y.
FOR DATA CIRCLE 448 ON READER CARD

Printer/Plotter

The EX-810 is a graphics plotter that can print 8,192 dots per second with as many as 512 dots per row. Functioning as an 80-column alphanumeric printer, it can print at 160 cps. A TTL-compatible controller takes care of all timing functions needed to drive the printhead and advance the paper. The EX-810 prints on five-inch wide electrosensitive paper. Single unit price is $795, with oem discounts available.



Delivery is 30 days. AXIOM CORP., Glendale, Calif.
FOR DATA CIRCLE 453 ON READER CARD

Terminal Interface

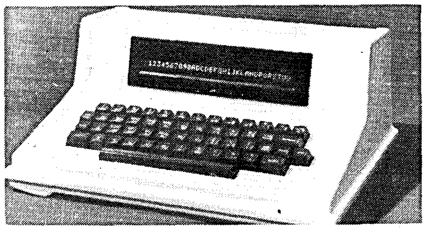
The QuadrAsync/c gives PDP-11 users four asynchronous 20ma current loop communications channels, but presents only one load on the processor's UNIBUS. Each channel is said to be equivalent to the channel provided by DEC's DL-11c. The QuadrAsync/c comprises one quad board and four DEC-compatible Berg Connectors. Both full and half-duplex operation is supported. There are seven independently selectable transmission rates per channel, ranging from 110 bps to 9600 bps; each channel's transmitter and receiver operate at the same rate. A single QuadrAsync/c sells for $1,600; quantity discounts are offered. Delivery takes 30 days. ABLE COMPUTER TECHNOLOGY, Santa Ana, Calif.
FOR DATA CIRCLE 452 ON READER CARD

Synchronous Modem

The 2400 LSI is a 2400/1200 bps synchronous modem designed for operation over two or four-wire dedicated or dial networks. Conforming to CCITT Type A or B four-phase modulating techniques, the 2400 LSI is compatible with Bell System 201B or C data sets, most other phase shift keying modems and Bell's 801 Automatic Calling Unit. The modem has an equalizer that is strappable in either the transmit or receive sections. Strap options can select transmitter output levels, carrier detect level, internal or external clock, carrier detector response time, RTS/CTS delays, and equalization. When operating over the DDD network, automatic answer circuits allow unattended call answering when connected via a Type CBS or CBT data coupler. Integral local digital and analog loopback circuitry reduces the time required to localize system malfunctions. A built-in test pattern generator and receiver pattern detector assist in both on- and off-line testing and trouble-shooting. In single quantities, a dedicated-line version of the

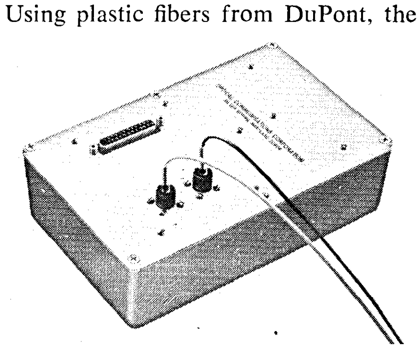
2400 LSI sells for $789. PENRIL CORP., Rockville, Md.
FOR DATA CIRCLE 441 ON READER CARD

Terminal
Consisting of a single-line, 32-character gas discharge display and a 53-key tty-style keyboard, the Transactor I Data Terminal can connect to most computers via an RS232 or 20 ma current loop interface. Switches let the user select operating modes including 110 bps to 9600 bps data rates, full or half duplex, even/odd/no parity, and one or two stop bits. The Transactor comes in an aluminum case measuring 6 x 15 x 11-inches. A stylized molded case also is available.



The standard Transactor I sells for $595 in quantities of 100, the single unit price is $750. Deliveries take 60 to 90 days. COMPUTERWISE, INC., Grandview, Mo.
FOR DATA CIRCLE 462 ON READER CARD

Fiber Optic Data Set
Users seeking to exploit the advantages of fiber optics — resistance to interference, overload safety, elimination of ground loops, signal emission security, and so on—can use the model FD-10K data set. The unit interfaces RS 232C or CCITT-compatible devices to the fiber optic communications link. Using plastic fibers from DuPont, the

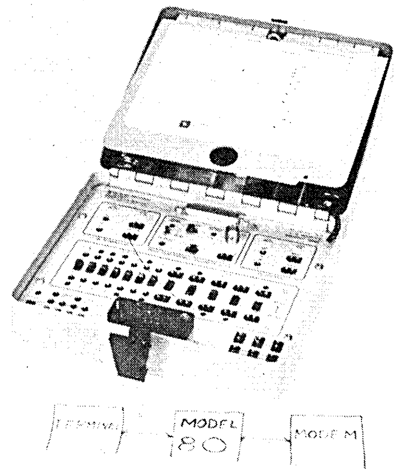


data link may be 150 feet long; 1,200 foot links are possible when using toughened silica fibers. The maximum data rate is 9600 bps for the standard unit, with optional speeds of up to 50K bps. A pair of FD-10Ks sells for $675 in quantities of 250 pairs. Optical fibers are priced separately. OPTICAL COMMUNICATIONS CORP., Silver Spring, Md.
FOR DATA CIRCLE 440 ON READER CARD

Communications tester
The Model 80 CCITT V.35 Interface Breakout Panel is a battery-powered, hand-held instrument designed to

hardware

monitor and break out a standard CCITT V.35 interface between a modem and a terminal. The user plugs the Model 80 into the circuit between the modem and the terminal to gain access to all 17 signal conductors specified by the V.35 or Bell 306 interfacing specifications. The on or off

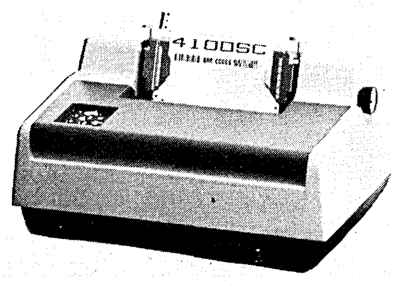


state of each conductor is indicated by an LED. Switches allow interruption of interface signals for testing and monitoring. A pulse trap senses any spurious transition on the signal lines. The Model 80 sells for $990. Delivery is 30 days. INTERNATIONAL DATA SCIENCES, INC., Providence, R.I.
FOR DATA CIRCLE 444 ON READER CARD

Terminal Interfaces
The 2031 series of asynchronous line interfaces allows users to interface their PDP-11s to terminals operating at any popular transmission rate. Data rates, address selection, and operating mode are all DIP switch-selectable. An appropriate cable connector selects EIA voltage level or current loop operation. The 2031 series is said to be hardware and software compatible with the DEC processor, capable of replacing DEC's DL-11 series of interfaces The 2031-01 replaces DEC's DL-11A and C 20ma current loop interfaces. Model 2031-02 offers full data set control and EIA voltage level or current loop operation to replace DEC's DL-11-A, B, C, D, and E. Standard transmission rates range from 75bps to 9600bps (or any externally supplied rate); special rates can be accommodated. The 2031-01 sells for $525; the 2031-02 sells for $575. Shipment is from stock. GEN/COMP INC., Canton, Mass.
FOR DATA CIRCLE 451 ON READER CARD

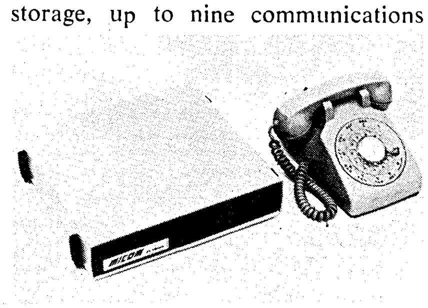
Data Access Arrangements
Instead of renting Data Access Arrangements (DAA's) from the phone company, modem users can purchase them from this vendor. Users will still have to pay Ma Bell for a data jack, but that's only a one-time charge of roughly $20, the vendor notes. A single channel VA851 DAA sells for $135; the dual unit VA852 is $215. The phone company is said to charge from $4 to $8 per month for its DAA's. VADIC, Mountain View, Calif.
FOR DATA CIRCLE 445 ON READER CARD

Printer
The 4100SC is plug-compatible with IBM's 328X printers for use with 3270 systems. It can print characters from a tenth of an inch to seven-tenths of



an inch high, as well as printing bar codes. For normal sized characters, the 4100SC prints 120 cps. The 4100SC sells for $6,400, with quantity discounts available. Delivery is 90 days. INTERFACE SYSTEMS, INC., Ann Arbor, Mich.
FOR DATA CIRCLE 454 ON READER CARD

Communications Processor
The 20 Series Communications Processor, built around the Z80 microprocessor, is suited to the implementation of concentrators or contention units with four or eight channels and single channel converter systems between different communications protocols. The unit consists of a Z80 processor, up to 19K of RAM buffer storage, up to 8K of PROM control storage, up to nine communications



interfaces, and an integral operator's console. Normally supplied in a turnkey fashion, tailored to the user's requirements, the unit is also available with a program development system for oem's. Prices for the unit start at $880 for a two-channel unit. Quantity discounts are offered. Delivery takes 45 days. MICOM SYSTEMS, INC., Chatsworth, Calif.
FOR DATA CIRCLE 443 ON READER CARD

Add-on Memory

DEC System 10 users in need of more memory may find the 512K word ARM-10L of interest. The ARM-10L is said to be compatible with the System 10's hardware and software. The add-on memory will lower expansion costs for users of the KI and KL models of the System 10, according to the manufacturer. The core memory is equipped with two- or four-way internal interleaving, and can be fitted with up to eight ports (in two port increments). Typical access time is 500 nsec with a maximum of 520 nsec. Cycle time is typically 750 nsec with a maximum of 770 nsec. Available 30 days ARO, the 512K word ARM-10L sells for $175,000. AMPEX CORP., El Segundo, Calif.
FOR DATA CIRCLE 456 ON READER CARD

Audio Alarm

The Hawkeye Sentry attaches to IBM's System/32, sounding an audible alarm when the computer needs its operator's attention. The Sentry summons the operator when the computer is in an Interactive Data Entry Mode and no one has entered data in a significant amount of time, when a system detected "blinking" error occurs, or when the System/32 is in a READY state. The alarm repeats every fifteen seconds until the operator acknowledges that he is correcting the situation. Pressing STOP on the system control panel tells the alarm that the system is to be validly idle for a time. Two month deliveries are quoted for the $285 Hawkeye Sentry. The unit is user-installable. IOTA COMPUTER SERVICES, INC., Provo, Utah.
FOR DATA CIRCLE 463 ON READER CARD

Basic Extension

The Fast BASIC III ROM lets HP 9830 users avoid the 256-per-side array dimension limit. With this ROM, users can dimension, sort, and search any size array that will fit in available memory. Other capabilities in the ROM

provide 10KB/sec. I/O transfer rates for control and instrumentation, quasi-live keyboard, and more. Fast BASIC III sells for $525; price breaks are offered when the ROM is purchased with other ROM's in the product line. INFOTEK SYSTEMS, Anaheim, Calif.
FOR DATA CIRCLE 446 ON READER CARD

Back to Our Roots

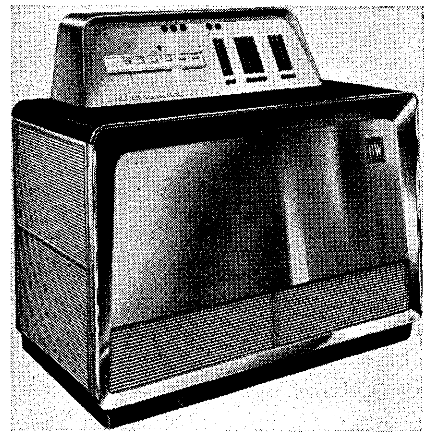
For the past several years, "getting back to one's roots" has been a fashionable undertaking. A number of popular musicians have done it, some with critical acclaim. Alex Haley did it and wound up with a best-selling book and a fantastically popular television special. And now, on our twentieth anniversary, DATAMATION gets back to its roots with these product announcements from our October, November, and December 1957, issues. Some have been shortened by deleting whole sentences and paragraphs, but aside from that, not a word has been changed. ❋

Digital data system

BJ Electronics, Borg-Warner Corp., 3300 Newport Blvd., Santa Ana, Calif., has introduced a new digital data processing and recording system, known at the S-100, that is capable of sampling inputs from one to 100 vibroton digital transducers at rates of up to 100 per second. Measurement input is delivered as directly-digital information, either sequentially or upon demand.

Etched circuitry is employed throughout the component groups with plug-in type fabrication used to facilitate system maintenance with minimum operating interruptions. Pressure variations are measured by vibroton pressure transducers. Temperature data and inputs from other measurement instrumentation are also accepted by the system.

Measurement data received are transferred to the storage register until

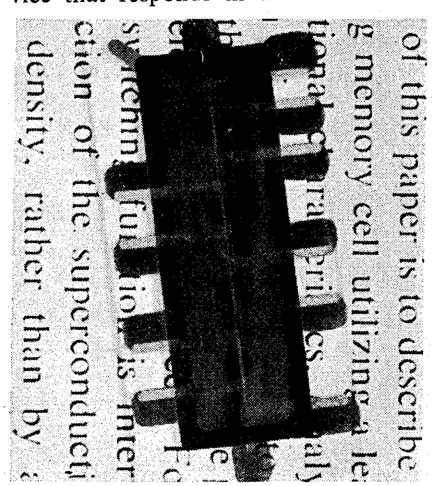


demanded by a data recording system. Information from the buffer storage register may be programmed by the system operator and routed to the appropriate output equipment.

System outputs include visual readout, tabulations, punched cards, tape, and other output media. Output provisions for process monitoring and control may also be incorporated. Power requirements: 115v, 60 cycle.

Minute memory cell

International Business Machines Corp., 590 Madison Ave., New York 22, has announced the development of a super-high-speed "memory" device that responds in a hundred-mil-



lionth of a second. The device, which utilizes a miniature printed circuit of metallic lead at temperatures close to absolute zero (—459.7° F.), is believed to hold great promise for use in high-speed, high-capacity electronic computers of the future.

Machine tool control system

Wang Laboratories, Inc., 37 Hurley St., Cambridge 41, Mass., has announced the design, development, and completion of the first Weditrol, a numerically controlled machine tool control system. The Weditrol gets its command from a punched paper tape and develops the control. All the programmings are generated internally, and require no special computers to generate the pulses.

Long-wear magnetic tapes

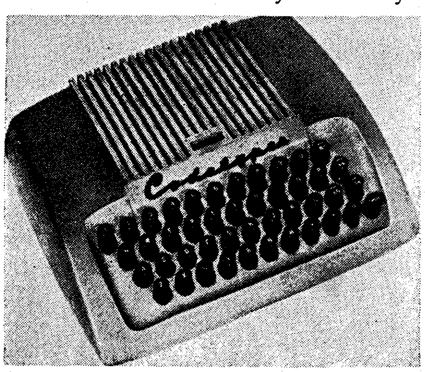
Minnesota Mining & Mfg. Co., 900 Bush St., St. Paul 6, Minn., has introduced two new long-wearing magnetic tapes for instrumentation use that outwear conventional " Scotch" brand instrumentation tapes by an average of 6 to 1, yet increase short wave length response by 3.5 db.

Key to the superior wear characteristics of the new tapes is a new, more durable binder construction which minimizes problems of oxide rub-off and deposit on the machine heads. The tapes contain no more than one drop-out per 2,500′ roll.

Both tapes are available in standard widths of ¼, ½, ⅝, ¾, and 1″, and are hermetically sealed in plastic bags to protect the tape from contamination by dust or moisture during shipment or storage.

Miniature computer

Codetyper Laboratories, 1027 Casa Vista Dr., Pomona, Calif., has announced a new, low-cost Model EBC3 Codetyper that will automatically key a radio transmitter as any of the keys



on the typewriter-like keyboard are touched. No trained operator is needed in an emergency. Speed is continually adjustable from 10 to 75 wpm. Containing only 12 miniature tubes, the unit is smaller and lighter than a portable typewriter.

New IBM System

Data Processing Div. of IBM has announced the 705-III, one of the most powerful electronic systems on the market for the processing of business data. It is the latest addition to the IBM 700-series of large-scale electronic data processing systems now at work in scores of business, scientific, and government installations.

One of the features of the new system is a completely-transistorized magnetic tape unit with an input-output rate fast enough to read or write the equivalent of a full-length novel once every 15 seconds. This ultra-high speed tape unit, the IBM 729 Model 3, can read or write business information at the rate of 60,000 characters per second, automatically checking the information for validity and readability at the same time.

The system also utilizes the new 767 Data Synchronizer which controls magnetic tape input and output so that the 705-III can read problem data, compute, and write answers simultaneously.

Magnetic tape transport

ElectroData Div. of Burroughs Corp., 460 Sierra Madre Villa, Pasadena, Calif., has announced a 10-speed magnetic tape transport for electronic data processing systems known as Model 546-53368 Digital Magnetic Tape Transport. A speed ratio of 60:1 is available with this transport. Three-quarter-inch tape is used, wound on two 10½″ reels. ※

software & services

Updates

The ACM's Special Interest Group on Documentation (SIGDOC) has began a review of the ANS X3.5-1970 flowchart standard. It's been more than five years since the last review, and existing standards may need updating to reflect such changes in the industry as the growing use of COM and intelligent terminals, says Ned Chapin, flowchart committee chairman. The committee solicits written comments and suggestions for the improvement, modification, or change of the current standard. Or, if the existing standard is adequate, please say so. Direct your comments to Ned Chapin, Flowchart Committee Chairman, InfoSci Inc., Box 7117, Menlo Park, Calif. 94025.

Designed to locate chemical compounds on the basis of their structural characteristics, the NIH/EPA Substructure Search System (SSS) is being offered jointly by Tymshare and Fein-Marquart Associates. The on-line, interactive SSS uses structural characteristics as keys to search through a number of data bases. Some data bases are derived from regulatory and governmental operations on certain classes of chemicals, such as pesticides or industrial chemicals. Other data bases are collections of compounds having some common attribute, such as the set of compounds in the Merck index.

Several training courses have recently come to our attention. The Edutronics Group, Kansas City, Mo., has added a multimedia "Report Writer" module to its COBOL Efficiencies curriculum. The firm also introduced "POWER/VS," an addition to its Disc Operating System curriculum.

Hewlett-Packard released a completely revised "Digital Troubleshooting" video tape program, said to cover as much as a two-day live seminar.

Informatics announced an audio cassette course covering the capabilities of the MARK IV Extended Segment Processing special feature. The firm also said it has graduated its 20,000th student in its Basic MARK IV course.

And Dylakor Software Systems created a Test Run for DYL-260 software programmer training. The package, available to 360/370 shops on a 30-day free trial basis, comes with a test program and three problems.

Series/1 Commo

The IBM Series/1 is about the best thing to happen to software houses in years. The machine may some day become the most popular mini, and there's precious little software available for it, considering all it can do. The 3270 BSC System should help matters. It basically allows a Series/1 mini to replace an IBM 3271 mod 2 controller and 3277 mod 2 display terminals and provide distributed processing capabilities. The package enables the mini to communicate in bisynch, and supports both point-to-point and multipoint communications. Up to 16 display terminals in a 3270-compatible system are supported; 64 terminals if modifications are acceptable. (The feeling is that most sales will involve customization, and a "certain amount" of it is included in the price. And the price is: $5K for the operating system and another $5K for the bisynch. The packages are coded in assembler. CONVERSATIONAL SYSTEMS CORP., New York, N.Y.
FOR DATA CIRCLE 475 ON READER CARD

PDP-8 Simulator

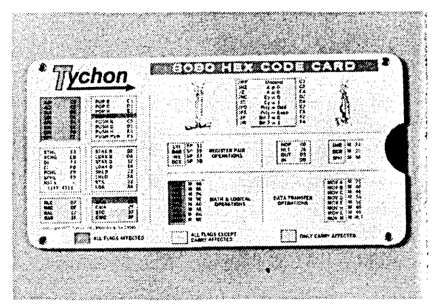
Requiring at least 12K of memory and a terminal, the Simul8tor PDP-8 simulator will run on any 8080- or Z80-based microcomputer. Simul8tor provides exact simulation of the PDP-8, (with the exception of timing), a virtual "software front panel," dynamic display of PDP-8 data on the micro's console lights, support for console-less micro's (such as PolyMorphic Systems) with a simple patch, and the ability to run existing PDP-8 programs. A loader for use with DEC's "BIN" format paper tapes, documentation, and information on DEC's user group and its library of programs are included in the Simul8tor Package. The vendor is quite candid in pointing out two possible limitations of the Simul8tor: execution speed is degraded due to simulation so programs such as CINET BASIC and FOCAL may be annoyingly slow; and most PDP-8 software comes on paper tape which may inconvenience some users. On the other hand, Simul8tor opens the door on the vast library of software for the PDP-8, which includes FORTRAN II, ALGOL, LISP, editors, assemblers, and floating point packages (available from DEC or its user group at modest prices). The Simul8tor, supplied on Tarbell Cassette or paper tape, sells for $20 plus $3 for each cassette. Quantity discounts are offered. THE AMIDE CORP., Sag Harbor, N. Y.
FOR DATA CIRCLE 474 ON READER CARD

Queue Sharing

At $7,500, the price for a perpetual license to O*SHARE might seem like a lot of money. But consider what the modification to IBM's POWER/VS spooler enables users to *not* do: dedicate unit record devices for each memory-resident copy of POWER/VS—the same cpu can control all unit record and I/O devices. The immediate benefits are fairly obvious, being greater flexibility in scheduling, increased throughput, and cost reductions. It's claimed that O*SHARE installs in minutes, and that the operation of POWER/VS will appear to function just as it did before installation of the new package. (No JCL changes are required.) Lease and rental arrangements also are available. LABYRINTH SYSTEMS LTD., Great Neck, N.Y.
FOR DATA CIRCLE 472 ON READER CARD

8080 Programming Aid

The 8080 Hex Code Card is a slide rule-like aid for programming and debugging 8080 assembler programs. It contains all mnemonics (color coded to indicate which flags are affected) and their corresponding hexa-



decimal codes. The back of the card has a table of ASCII codes plus the 8080 status word and register pair codes. The card sells for $2.95 postpaid. Quantity discounts start at 10 units, and custom printing is offered. TYCHON, INC., Blacksburg, Va.
FOR DATA CIRCLE 468 ON READER CARD

BMDP Statistics Package

Retaining most of the FORTRAN code from the original BMDP Statistical Package (developed by the Health Sciences Computing Facility at UCLA for 360s and 370s), this version of BMDP for DEC PDP-11s consists of all 26 programs and features described in

software & services

the BMDP Manual. Several coding changes were made to improve efficiency and ease of use on the mini, but no significant modifications have been made to the statistical algorithms themselves.

The conversion was made under RSTS/E, and the package is completely compatible with both the RSX and IAS operating systems. Minimum systems requirements are 28K of user space and a 132-column output device. If all programs in the package are to be on-line at one time, at least 5,000 blocks of disc are required. Although floating point hardware is strongly recommended, it is not required.

The only limitation of the package stems from address space limitations on the PDP-11. The internal array space has been reduced to about one-third of the default size of the original IBM-based programs. An informal survey of users taken by UCLA indicates that more than 75% of the problems being solved with BMDP are small enough to run on the PDP-11.

Distributed on a 9-track, 800 bpi tape the BMDP package has a one-time license fee of $500, discounted to $150 for educational institutions. SOFTWARE DEVELOPMENT INC., Middlebury College, Middlebury, Vt.
FOR DATA CIRCLE 467 ON READER CARD

Mailing Lists

The Micro-Label system is a general purpose mailing label program designed to run on 8080-based microcomputers. The package handles creation and maintenance of mailing lists and similar label applications. Additions, changes, and deletions are applied to the master file via crt. Micro-Label prints labels on a 132-column, pin or tractor feed printer. File storage must be on dual North Star—compatible minifloppy discs. Options include custom record formats, custom sorts, and custom label height.

software spotlight

Cost Estimating

Once there was a programming project manager who was handed his own head on a silver platter when his $20,000 project came in slightly over budget at $75,000. Our manager friend might still be in one piece if he had used the PRICE S model for estimating the budget for software development projects.

PRICE S can help managers prepare budgets and schedules. A parametric model using regression techniques, PRICE S operates in interactive mode, requiring the user to input less than a coding sheet of project descriptors, and returning results in a matter of minutes (on a lightly used time-sharing system at about 6:30 p.m., we saw PRICE S gave nearly instantaneous results). The user inputs the data and the system calculates the missing values; for instance, if the user knows how much money is available, the model can tell him how complex a system he can expect to implement and still remain within budget. The model has internal checks on its input, and will print warnings when it detects possible inconsistencies. One such warning said we may have underestimated the complexity of the project by a factor of nearly four. PRICE S was warning that the number and mix of peripherals were inconsistent with the level of complexity specified.

PRICE S produces cost break-outs for five categories in each of three overlapping development phases—engineering, design, implementation, and test and integration. The five cost categories comprise systems engineering, programming, configuration control, documentation, and program management. Possible variances also are calculated. PRICE S operates in three modes: normal operation, for projecting budgets and schedules; ECIRP (PRICE spelled backward) which runs the model in "reverse," calculating PRICE empirical factors from known project costs (useful in tuning the model for each specific user); and GEOSYN, which uses specified costs to compute typical program sizes and project schedules. The system also includes escalation factors (back to 1946) to account for inflationary variations in the economy (useful in long-term projects and when running in ECIRP mode).

PRICE S can be assessed on several time-sharing services. The vendor charges $30,000 per year for access by one terminal ($20,000 each for two through five, $15,000 each for six to ten, and $10,000 for each additional terminal). Additionally, users must pay time-sharing charges, estimated to be $2,500 to $5,000 per 1,000 PRICE S runs. A three-day training program goes for $600 per trainee. RCA GOVERNMENT SYSTEMS DIV., PRICE Systems, Morristown, N. J.
FOR DATA CIRCLE 470 ON READER CARD

The Micro-Label System, which can print labels one inch high and up to 132 columns wide, sells for $500 on a North Star-compatible diskette. Options are $40 each. TYLOG SYSTEMS INC., Miami, Fla.
FOR DATA CIRCLE 469 ON READER CARD

Cross Assembler

This vendor's cross-assembler lets the user define the assembly language syntax and target machine code forms, effectively providing as many assemblers as the user has definitions. Macro and conditional assembly features may be included in the assembler definition. Additionally, since it runs on 360s and 370s under OS or DOS, the user can take advantage of the host's editor and utility programs. The package features an unlimited number of operation codes, relocatable symbols and expressions, free form input, decimal, octal, and hexadecimal constant forms, choice of hex or octal assembly listing, and generalized expressions with 12 operations and seven levels of hierarchy. The package also produces a cross-reference listing. The cross-assembler has a price of $6,000. PACIFIC PROGRAMMING SERVICES, Los Angeles, Calif.
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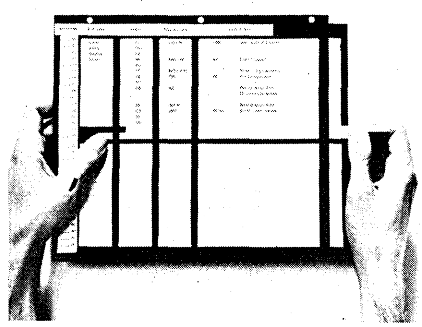
Programming Aid

The BOPA (basic operational programming aid) comes with 32 removable slats on which a programmer can write his assembly language code. Users can move code around, insert instructions or delete lines easily. The frame which holds the slats has mem-



ory addresses, in hex, running down its left side and column headings across the top. When the programmer is satisfied with his work, he can Xerox it for documentation or input. A single-card BOPA with space for 32 entries sells for $11.95, an eight-card set sells for $74.95 and has room for 256 lines of code. The manufacturer intends to market the BOPA through computer stores and through the mail. VAMP INC., Los Angeles, Calif.
FOR DATA CIRCLE 465 ON READER CARD

Assembler to COBOL

IBM 360/370 users with applications written in assembler may wish to use this firm's assembler to ANS COBOL translator to make their programs more readable and easier to maintain. Capable of handling 360/370 (DOS or OS) assembler and Mod 20 BAL assembler, the translator generates COBOL source statements and standard DOS and OS macro calls. The translator is said to perform a 90%+ conversion. Original data and procedure names are used when possible and a side-by-side listing is produced. The translator also generates a cross reference listing. "Conversion aid" notations assist the programmer in completing an accurate translation. The translator is written in ANS COBOL for 360s and 370s and takes about 100K of memory. Lease and purchase "rights of use" go for $4,000 per month (six month minimum) and $40,000, respectively. The vendor will also perform conversions on a service basis. DATAWARE INC., Tonawanda, N. Y.
FOR DATA CIRCLE 466 ON READER CARD

Hardware Basic

It's too bad this manufacturer had to temper the announcement of a hardware BASIC interpreter chip for the ubiquitous Intel 8080 microprocessor with claims that it's the first "solid-state" software. But that might be all that's wrong with the development—the price is certainly attractive. For $95, the user gets the two EA3200 ROM's containing 4K eight-bit words each, assembler listing, and user's guide in quantities of 1 to 24. The BASIC interpreter takes up 6K on the two chips and is complete with floating point arithmetic, tty I/O, memory check, and monitor routines. ELECTRONIC ARRAYS, INC., Mountain View, Calif.
FOR DATA CIRCLE 473 ON READER CARD

Plotting

This vendor has developed an integrated software and hardware off-line plotting system for use with Control Data's 6000 and Cyber series of large scale number-crunchers. Running under SCOPE 3.4 or NOS/BE, either of two software packages will prepare tapes for off-line plotting. The programs are written in FORTRAN-extended and Compass assembly language.

The first of the two Versaplot-07 software packages is known as the Pen Plotter Emulation Program (PPEP). PPEP offers a set of optimized subroutines call-compatible with basic pen plotter programs. The second package, Electrostatic Plotter Software, is an extension of PPEP which uses special electrostatic plotting capabilities through GRID and TONE subroutines. With GRID, users can plot horizontal and vertical grid patterns simultaneously with data. Any specific polygonal region may be shaded with any tone pattern—dots, lines, symbols, screens, or solid blacks—with a call to TONE.

The hardware part of the system consists of one of 34 of the vendor's electrostatic plotters and a raster processor unit with read-only tape drive. Complete plotting systems, including software, raster processor, and plotter are priced from $20,550. The software, available in object code or complete source code, carries prices ranging from $3,500 to $5,500. VERSATEC, Santa Clara, Calif.
FOR DATA CIRCLE 480 ON READER CARD

Micro Conversion

One of the Z80 microprocessor's selling points is that it can execute Intel 8080 object code. However, this compatibility isn't present at the assembly language level, so this vendor has prepared a program that translates 8080 assembler source code into Z80 assembler source code. That means an 8080 user can switch over to a Z80, translate his programs at the assembler level, and perform modifications taking advantage of the Z80's larger instruction set. The translator is written in ANSI FORTRAN and will run on any computer, regardless of word length. Purchased by itself, the translator is $300; when purchased with the vendor's Z80 assembler, the translator is $50. MICROTEC, Sunnyvale, Calif.
FOR DATA CIRCLE 481 ON READER CARD

3790 Communications

The VTAM Batch Communications Program sends and receives data between IBM 370 computers using DOS/VS, OS/VS1, OS/VS2, and 3790 Communications Systems. With the program it is possible to communicate with an unlimited number of 3790 systems over switched or dedicated lines. Users can take advantage of the enhanced communications facilities available under IBM's Systems Network Architecture (SNA) and Synchronous Data Link Control (SDLC) protocol. The program provides a 3790 building block for VTAM communications. By using VTAM to control all telecommunications activity, TP users can increase throughput and receive the advantages of IBM's SNA and Network Control Program, according to the vendor. A perpetual license is $7,000. COMPUTER DYNAMICS, INC., New York, N.Y. ❊
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This forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

the forum

The Dimensions of Complexity

In his now classic paper, "Structured Programming" (Rome NATO Conference, October 1969), Edsger Dijkstra explained that his concern is with "intrinsically large programs" and that "the leading question [is whether it is] possible to increase our programming ability by an order of magnitude." He concludes that it is possible and implies that it is necessary to achieve such a gain.

But "intrinsically large programs," no matter how complex they may be, in Prof. Dijkstra's judgment never require more than a small number of people during the course of their construction. That is, he confines his domain of interest to the consideration of intellectual complexity. He does not deal with organizational complexity except to deny its necessary existence, at least with respect to programming.

Beginning with reports of the activities of Harlan Mills, various accounts of productivity gains have appeared in literature. Much credit is given to Dijkstra (perhaps more than he would like), but the proclaimed improvements are also ascribed to the Chief Programmer Team organization, which is Mills' concept.

It is my contention that, while Dijkstra has ignored it, Mills has not dealt meaningfully with organizational complexity. Fred Brooks, in his satirical treatment of the Chief Programmer Team concept, points out the same thing. The problem is to improve the productivity of somewhat larger organizations, composed of real people, operating in real environments. And it is important to agree that the gains also are "real." It is the need for agreement which makes it difficult to find suitable universal measures.

What has been demonstrated so far is that small groups of competent people can apply the ideas of Dijkstra (and others) to the construction of reasonably complex programs and produce them better and cheaper than, tradition has it, had been the case in the past. What has also been demonstrated is that the gains (which have been confined largely to new programs) usually are measured in terms of lines of code produced per mythical man-month.

Lines of code produced per unit of human energy is certainly a measure. In some cases it may be a good measure; in others a bad or even useless one. But what it

can never be is a universal measure.

(Please note that this is not the same thing as saying that we should not know the number of lines of code in every system by component and module, along with whatever additional engineering data we find (locally) meaningful. Failure rates, cost histories, projected vs. actual sizes, error-days, schedule and delivery histories, by module, by component, by system, by team, by programmer, by department, etc.)

I question the wisdom of attempting to discover universal measures for problems which are, perhaps inherently and certainly practically, local in character. A universal measure is, by definition, a measure which is acceptable to the members of the concerned universe. Many people seeking improved productivity of systems and data processing organizations will not accept, nor should they accept, lines of code as a meaningful measure. But there must be measures and there must be agreement as to what they are. For those reasons, the productivity problem is a local one.

The productivity problem is also a systems problem. It is my opinion that for a sizable organization it is probably a more difficult systems problem than any of the other problems the organization is attacking. That is definitely not the case for small organizations. The reasons have to do with the dimensions of complexity, and a tendency on the part of many people not to take organizational complexity seriously enough.

Let's restate the productivity problem as follows:

Problem: To improve the productivity of a particular organization by a factor of, say, 10% per year, with the gain to be compounded annually for a period of several years.

Constraint: The gain must be expressed in terms which are understandable and acceptable to people beyond those whose productivity is being improved. For example, it is more important for senior management and the local using community to agree that the projected gains have been made than it is for people outside the local environment to concur with that judgment.

True, at the rate of 10% per year it will take us about seven years to double the productivity of a particular organization, and 25 years to reach the goal set forth by Dijkstra. But we have already spent 25 years wallowing in complexity . . . oceans of complexity . . . ever-expanding oceans with ever-higher tides. And despite our continuing technical achievements, the situation remains out of control. The problem transcends the work going on in software engineering which is largely confined to the intellectual dimension.

Dealing with organizational complexity is, in part, an intellectual problem which should be structured by someone I shall call an "architect." It is also a management problem. The idea that manager and architect are either interchangeable roles or simply two sides of a single person is a concept whose value is a decreasing function of the size of the organization. It stems from the heavy emphasis placed on individual excellence, particularly in higher education. The result is that by the time we have finished our formal education, we know little or nothing about organizational complexity, except that it is there. (We continue to concentrate on intellectual complexity in universities where, partly because of our failure to deal properly with organizational complexity, the student/teacher ratio and the student/administrator ratio are approximately equal!)

In any case, while the "manager is the architect" concept is valid for first line managers—professors, surgeons, leaders of small technical efforts, chief programmers, etc.—it

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has considerably less value if the problem is to design and implement a productivity improvement program for a sizable organization. There is no way that the top manager can be his own architect. He simply does not have the time to design a productivity improvement program which will have the required payoff.

Further, he may not have anyone in his department who has both the time and the capability to come up with the "architecture." Almost by definition, that person must have a deep insight into what is involved in managing a large organization. People with that sort of insight are likely to be managing departments and unavailable to serve as architects even if they could qualify.

I have used the term "architect" very loosely. To be more precise, there is really no such person as an architect. There are only architects with respect to certain problems, or classes of problems. If the problem is to improve the productivity of a particular organization, then an architect who can design an improvement program must be found. And both architect and architecture must be managed. In time I believe that we will come to depend upon architects of more traditional bents.

Defining, building, and installing a productivity improvement program for a reasonably large (100 to 1,000 people) organization is neither an intellectual exercise nor a seat of the pants management task. And it can not be waved away as a "team-of-teams" kind of thing, which is what some of those who have had success with small groups recommend. Neither is it a by-product of the installation of good technical practices, although that certainly is to be encouraged. It is a difficult systems problem and must be treated as such. Despite all of the talk about systems life cycle methodologies, most organizations simply do not deal with the productivity problem in a systematic way.

I conclude that:

1. Management must recognize that the productivity problem, for nontrivial organizations, is both intellectually and organizationally complex; to attack it on only one axis is a fatal mistake.
2. The productivity problem must be treated as a local problem with locally defined measures of success. Global measures have value only to the extent that they are acceptable locally.
3. It must be understood that an architecture is required, and that manager and architect have distinct responsibilities.
4. The training of productivity improvement architects is, itself, a nontrivial problem.
5. The problem of improving the productivity of a very large organization probably cannot be solved in a strictly top-down way. My feeling is that the way to attack such a problem is by systematically improving the components of the organization, subject to the constraint that a "component" can be no larger than, say, 1,000 people.

Finally, it seems that the invariant in building systems, whether we use the old or the new technology, is user unhappiness. (See "Data for Rent," May, p. 167 for another assessment of the famous *New York Times* project.) I think that this situation can be traced to our preoccupation with universal measures of productivity which, in turn, is a result of our failure to understand the nature of organizational complexity.

—Alonzo G. Grace, Jr.

Mr. Grace is president of his own company, A. G. Grace and Co., based in Glastonbury, Conn. His motto, as reflected in this Forum and appearing on his stationery, is "rational thought for all seasons."

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