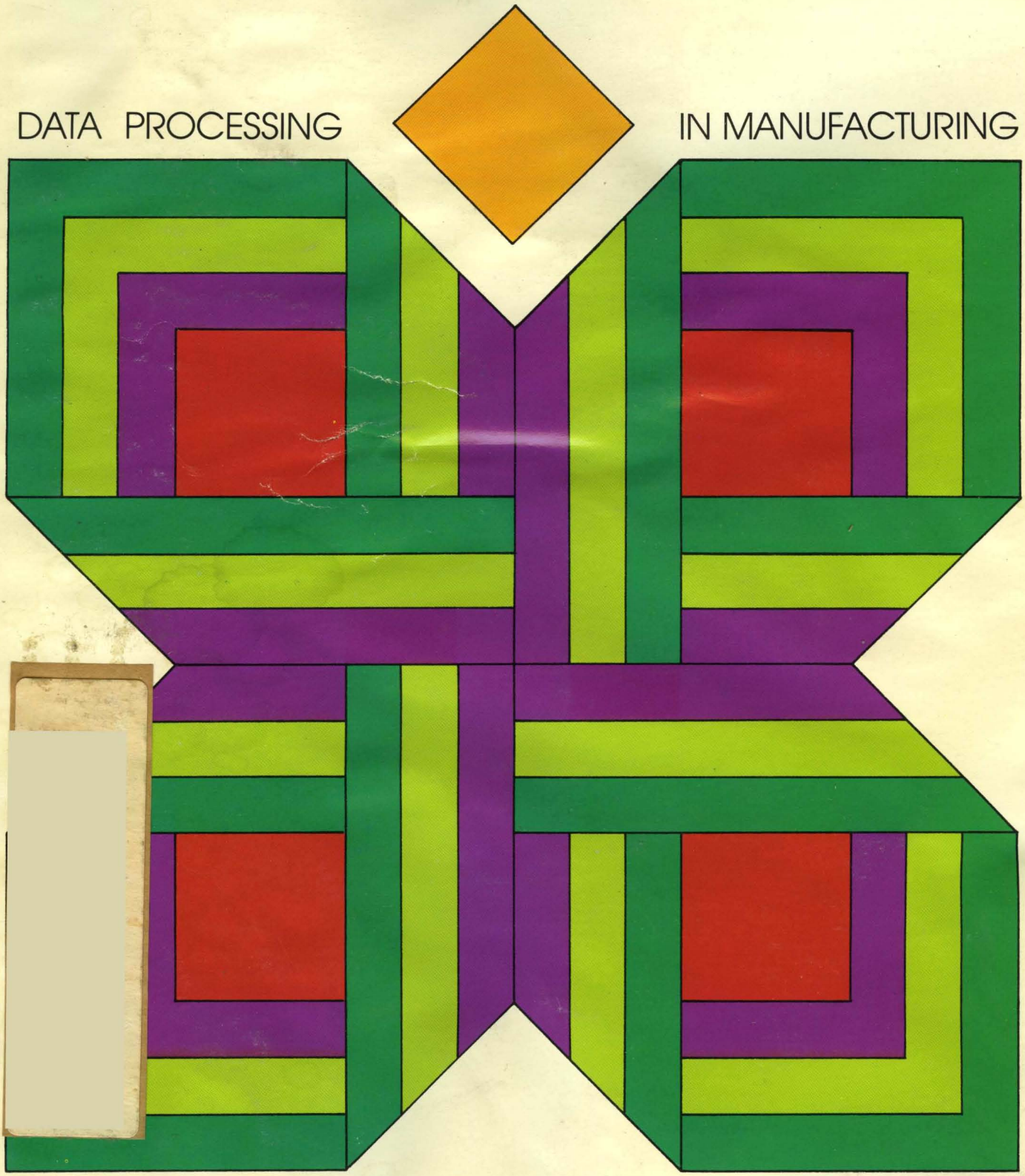
DATAMATION®
1957 77 1977
October
3.00 USA

DATA PROCESSING IN MANUFACTURING



Also: software managers speak out, image storage, inspecting code, and testing com lines . . .

Models 9100/9300
Vacuum Column Tape Transports.
We didn't have to make them this good.

Kennedy vacuum column digital tape transports have been the standard of the industry from their introduction. Some companies would have stopped and relaxed. We didn't. We added features such as our capacitive tape-location detector, for improved tape life; air bearings and tribaloy coated read-after-write heads to reduce tape wear and improve data integrity, and we've achieved the lowest noise level in the industry.

Performance is just as impressive, with tape speeds to 125 ips (75 ips on Model 9100) and operating features such as crystal controlled timing, read threshold scanning, read-after-write shortened skew gate, front-accessible test panel, quick-release hubs and simplified tape loading.

Data densities are 200/556 cpi or 556/800 on our 7-track unit and 800 cpi, 1600 cpi or 800/1600 cpi on the 9-track transport. The format is NRZI/PE.

We could have eliminated some of the features of Models 9100/9300, and still have a transport as good as the best. But we didn't. It's a Kennedy product and it has to be this good.

KENNEDY CO.
540 W. WOODBURY RD., ALTADENA, CALIF. 91001
(213) 798-0953

KENNEDY-QUALITY-COUNT ON IT

CIRCLE 5 ON READER CARD

You'd be surprised how well the XL40 performs... even in your most demanding applications.

The XL40 and you—a winning combination
The XL40 Distributed KeyProcessing® System is the solution you've dreamed about for your organization's distributed processing requirements. That's why we call it The DREAM Machine for Data Retrieval, Entry And Management—the vital components of effective distributed processing.

Distributed—for responsiveness at the source
Data quality improves—and costs are reduced—when information is managed by the people who know it best. The XL40 was designed to be operated by source department personnel, not highly specialized operators. And PCC's professional education program will smooth the transition even more. In fact, you may be **very** surprised at some of the converts to your XL40.

Turnkey—for instant productivity
It doesn't take magical machinations to get the XL40 up and running fast. Designed for simplicity, the XL40 combines modular hardware and flexible, COBOL-based software to enable your staff to go right to work when the system is installed.

Concurrent—for timesaving operations
In addition to putting processing muscle at the source, the XL40 operates concurrently. While operators are entering data, the XL40 can generate a report and communicate with your central computer at the same time. Files can be retrieved, accessed and updated from source departments, creating a real-time data base and providing up-to-the-minute information.

Reliable—Pertec Computer Corporation
The XL40 is manufactured, marketed and serviced by Pertec Computer Corporation, the world's leading independent manufacturer of computer peripheral equipment and producer of distributed processing and data entry systems, with over $100 million in revenues. And a reputation to boot.

Write to us today for more information about the XL40 Distributed KeyProcessing System—it's your ace in the hole.

PCC PERTEC COMPUTER CORPORATION

CMC Division
12910 Culver Boulevard, P.O. Box 92300
Los Angeles, California 90009
(213) 822-9914 TWX (910) 343-6451

CIRCLE 4 ON READER CARD

Yes, Art did develop Graphware® I: Specifically to improve the output from your electrostatic plotter.

A typical plot could take several minutes to produce on-line from your computer, because your computer uses a very rigid "compute-bound" method of changing a vector format to a raster format. Add to that the asynchronous nature of computer output — the stopping and starting — while the plotter waits for more data — and you've obviously been getting somewhat less than ideal plots, and wasting valuable CPU time.

Graphware I has changed all that. Vector-end-point data is converted into raster data — outside of the computer — in a nanosecond-speed, control-store microprocessor. Data is passed directly to Graphware where the conversion takes place. The computer moves to other tasks; Graphware I processes the data for high-speed synchronous output to the plotter. The plots look perfect. And the whole process is accomplished two to five times faster.

The blackboard shows the old as well as new methods of plotting. As you can see, data transmission is cut to an absolute minimum with Graphware I. And, because Graphware is a dedicated combination of firmware and hardware, not just another computer with specialized software, it will improve the output of any electrostatic — yours, ours, theirs.

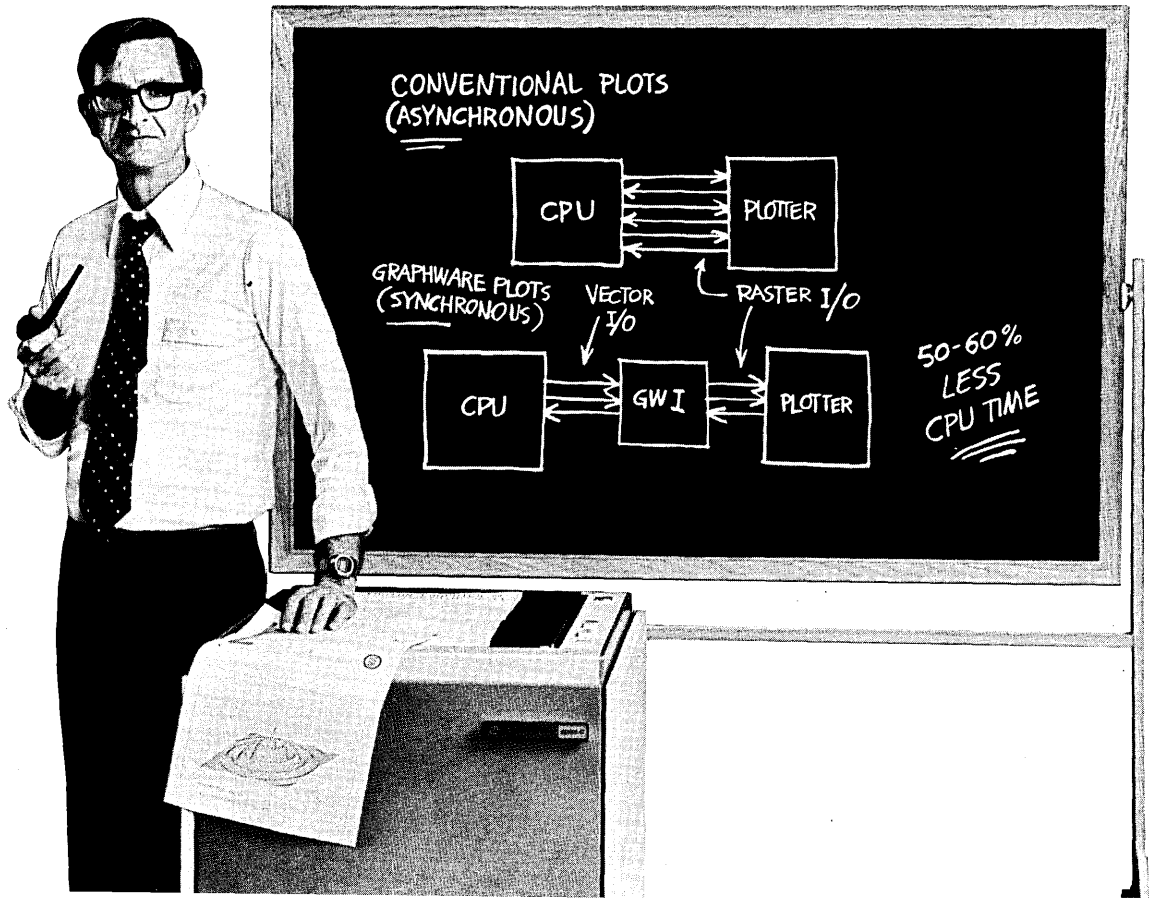
Simple? You bet. Efficient? There's no comparison. Available? Only from Art.

varian

Varian Graphics Division
611 Hansen Way
Palo Alto, CA 94303
(415) 494-3004

CIRCLE 191 ON READER CARD

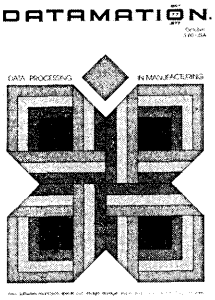
I'm Art Bliss.
I developed a hardware vector-to-raster converter for electrostatic plotters.
I call it HVR.
Marketing wants to call it "Graphware® I".
You'll call it about time.



DATAMATION®
1957 77 1977

VOLUME 23 NUMBER 10 This issue 142,566 OCTOBER 1977

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

About the Cover
Grappling again with all the interrelated problems of applying data processing to the manufacturing process. Our design is by Barbara Benson.

DATAMATION

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SYSTEM 2000®
Puts your resources to work

Data is a valuable resource. Without proper management, its usage becomes inefficient and impacts the productivity of your other corporate resources.

MRI's SYSTEM 2000 can put your data to work, can make it serve your company in many, many beneficial ways, and can take some of the workload off those other valuable resources.

SYSTEM 2000 is a versatile data base management system designed for users of IBM, CDC, Univac, and Amdahl computers. Working with a wide variety of applications, with data bases ranging from 300,000 to more than 1.5 billion characters, with non-data processing personnel as well as highly-skilled programmers, SYSTEM 2000 provides flexibility and efficiency in even the most complex environment.

To find out how hardworking your resources can be, contact our nearest marketing representative or MRI corporate headquarters. Find out how resourceful and hardworking our people are in ensuring that your needs are met. Ask about the new DOS/VS version and CONTROL 2000, MRI's data dictionary.

Put your resources to work ...
and take advantage of ours.

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THE DATA BASE MANAGEMENT COMPANY

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A multiple choice

A multifunction data entry system from Data 100.

(WARNING: there may be more than one right answer to each question)

1. Keybatch is:

(a) a multifunction intelligent key-to-disk data entry system.

(b) a brand new multifunction system from Data 100.

(c) a multifunction system which supports high volume concurrent batch capabilities.

2. Keybatch is also:

(a) a multifunction system offering stand-alone RPG for expanded user flexibility.

(b) a multifunction system that can operate with on-line file inquiry capabilities (3271 compatible) via common key-stations for both data entry and on-line file inquiry.

(c) a system capable of handling mail sorting and other office tasks.

3. As a data entry system:

(a) Keybatch has up to 20 megabyte disk storage capacity.

(b) Keybatch is proven with approximately 900 units now in use.

(c) Keybatch can be configured with 2 to 16 keystations.

4. For the end user:

(a) Keybatch meets short range goals such as appreciable dollar savings.

(b) Keybatch provides for long range system growth.

(c) Keybatch offers both of the above.

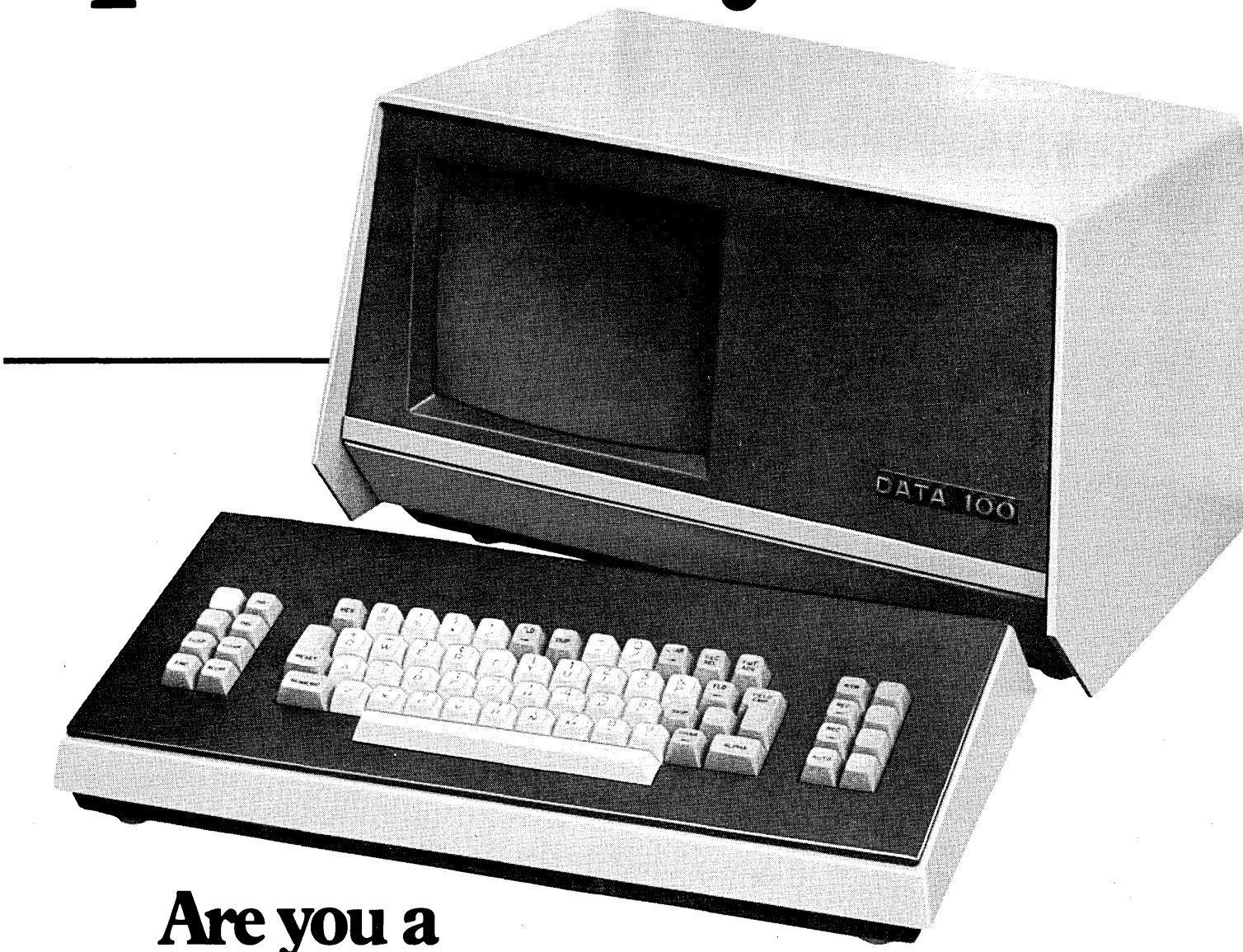
5. For more information on Keybatch, you should:

(a) search frantically through your EDP literature files.

(b) write Data 100 at 6110 Blue Circle Drive, Minnetonka, MN 55343.

(c) call your nearest Data 100 sales office or one of the numbers we've listed.

quiz on Keybatch.®



Are you a multifunction expert? Check these correct answers.

All answers but four are correct.

1b: Keybatch isn't brand new, was introduced in 1974.

2c: Sorry, Keybatch can't do everything.

3b: There are actually 1500 Keybatch systems on the job worldwide.

5a: No need to search when we're so easy to write or phone. Do it now!

DATA 100 CORPORATION

multifunction data processing

LOS ANGELES 213/645-4300 • SAN FRANCISCO 415/546-6000 • CHICAGO 312/992-0850 • BOSTON 617/848-6100 • DETROIT 313/358-5065 • MINNEAPOLIS 612/941-6500 • NEW YORK 212/867-6200 • PITTSBURGH 412/391-5425 • HOUSTON 713/777-4413 • WASHINGTON D.C. 703/790-5560 • WOODBRIDGE N.J. 201/634-7800 • ATLANTA 404/455-3895 • ST. LOUIS 314/878-4911 • TORONTO 416/494-0434 • MONTREAL 514/761-5894 • LONDON ENGLAND (0442) 69161 • MELBOURNE AUSTRALIA 267•3544 • FRANKFURT GERMANY 72•04•71 • PARIS FRANCE 630•2144

CIRCLE 34 ON READER CARD

Looking Back in DATAMATION®

On our 20th anniversary

October 1957

The prophetic prognostications of David Sarnoff, then chairman of the board of RCA, were bundled into this issue. The former Army Brig. General was right on track when he predicted that a computer functioning as a "diagnostic robot" would be used by future doctors in patient examination and diagnosis. But he obviously was carried away by the wonders of voice-controlled systems which he claimed would allow businessmen to dictate interoffice memos and personal letters into an electronic typewriter which would produce the correspondence phonetically by voice response.

Some more down-to-earth hardware advances also were featured in this issue. The major new product highlighted was IBM's 705-III Auto-Point Computer having an I/O rate "fast enough to read or write the equivalent of a full-length novel once every 15 seconds."

October 1967

The upcoming Fall Joint Computer Conference was previewed in this issue. The annual AFIPS-sponsored show was expected to attract 6,000 session goers and 9,000 exhibit enthusiasts to the mammoth Anaheim Convention Center.

Another conference played up in the issue was ACM's 20th anniversary meeting which featured an historical session on the early years of computing. The most interesting anecdote, on dp pioneer Dr. John Mauchly (co-inventor of ENIAC, the first electronic digital computer), was offered by the inimitable Dr. Grace Hopper. Telling of Mauchly's frustrations with the early, unsuccessful BINAC computer, the top Navy ADPer recalled a "vivid picture of coming in early one morning and finding the BINAC surrounded by coke bottles, and sitting in front of it, slightly unshaven, John Mauchly, and both John Mauchly and BINAC singing 'Merrily We Roll Along.' "

Give us 3 minutes

and we'll show you how to cure your 2501 headache

We're that sure of our new 6501 Buffered Card Reader. Call us and we'll tell you more about how:

- The buffered DOC 6501 can be installed on ANY position on the channel and puts an end to channel OVERRUNS.
- The buffered DOC 6501 gently handles and increases the life of repetitively read card decks.
- The buffered DOC 6501 saves you 25% or more than a 2501.
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If you aren't convinced in three minutes, we'll send you some buffered aspirin. With an unbuffered 2501 you'll probably need it.

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DOCUMATION
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CIRCLE 45 ON READER CARD

O.K. Intertel, you're Number One in network control.

What's that do for me?

Good question. Simple answer:
AT INTERTEL, NETWORK CONTROL MEANS MORE THAN DIAGNOSTICS.

Intertel Network Control provides professional tools for professional communications managers to give you on-line management of your entire network. Diagnostics, restoral, and preventive maintenance are literally placed at your fingertips. In short, it helps you do your job better.

It helps your company's business run better. Customers are serviced, new orders are booked, reservations are made, money is transferred and inquiries are handled—all on an "on-time" basis.

It helps your network run better by increasing efficiency and eliminating downtime. In fact, many of our customers experience virtually 100% network uptime on a regular basis. Intertel has now installed more than 150 Network Control Systems in both multipoint and distributed processing networks. This gives us a distinct advantage. *Our customers.* They've taught us that to be totally effective, a Network Control System must help them solve real problems. Our System does this. At the same time, our System provides the best diagnostic capabilities available in the industry.

- It permits you to pinpoint network problems, across town or across the country, with the simple touch of a button.
- It lets you test a single component or the entire network without shutting down any part of the system.
- It identifies and disables streaming terminals and provides automatic network restoral, through proven automatic dial backup, in minutes or even seconds, instead of hours.
- It operates as well in sophisticated distributed processing networks, testing outbound from concentrators and multiplexers, as it does in multipoint networks.
- And it operates in networks of all speeds from 1200 to 9600 BPS without any requirement for line conditioning.

The Bottom Line

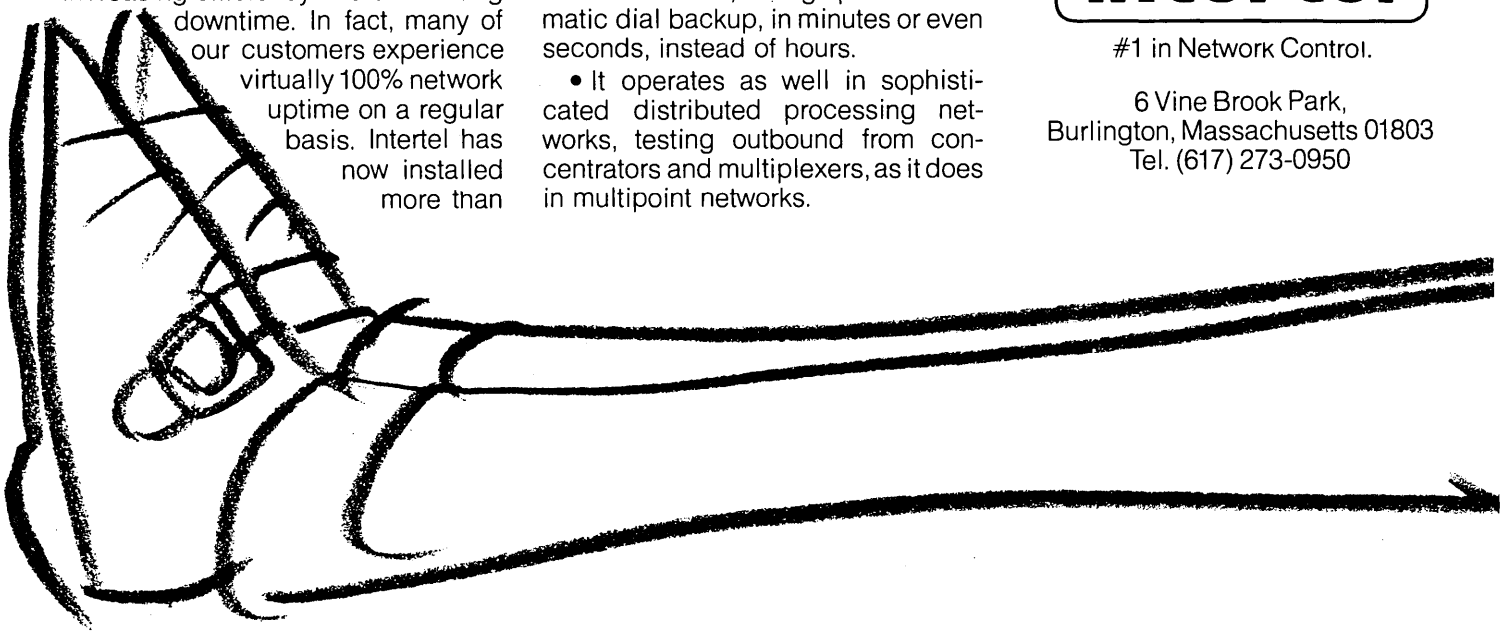
What does an Intertel Network Control System do for you? It goes far beyond the diagnostic capabilities available from other companies. It gives you a complete system for on-line management that solves problems that won't wait.

At Intertel we know a lot about what makes data networks run better. We should. After all, we're #1 in Network Control.

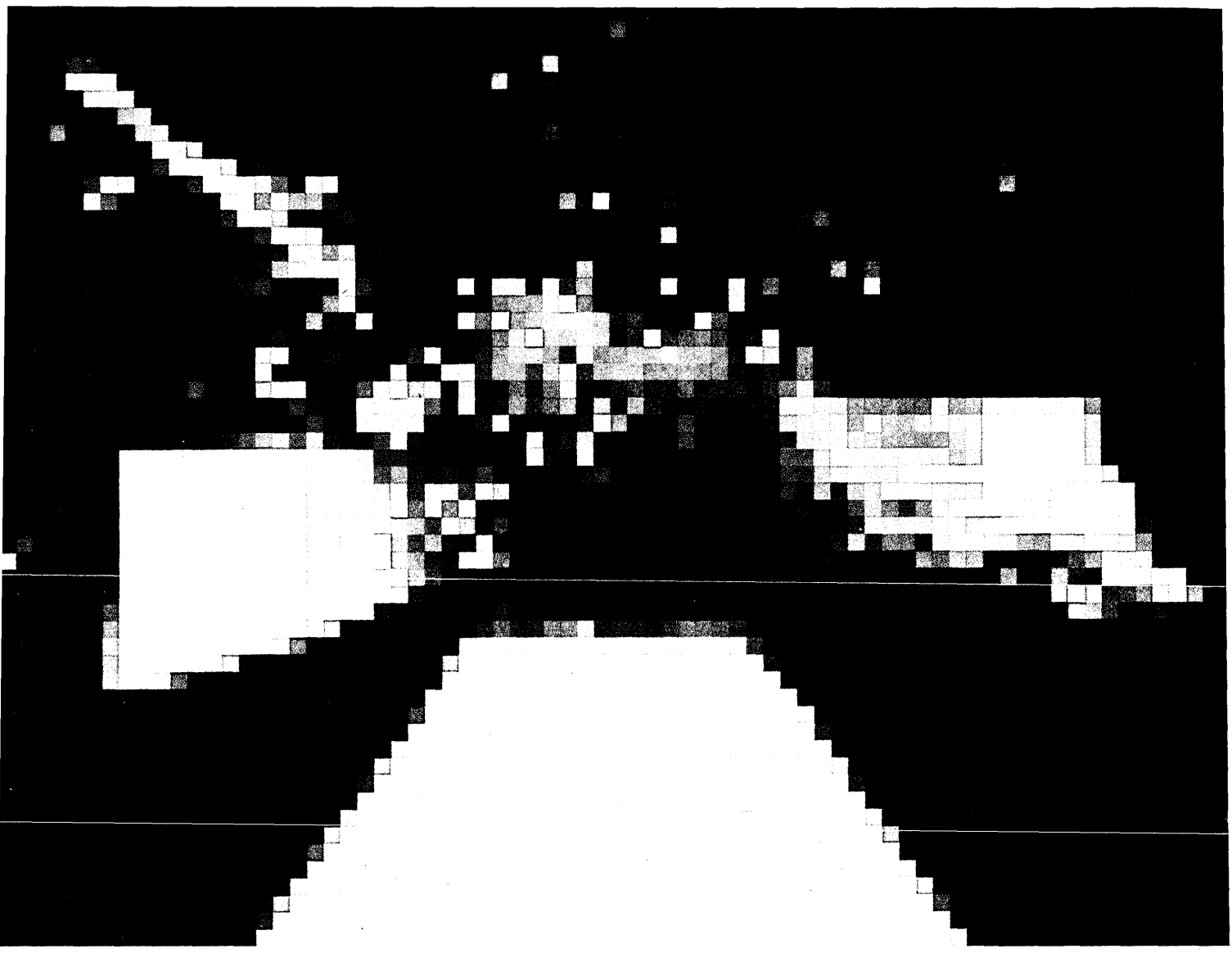
intertel

#1 in Network Control.

6 Vine Brook Park,
Burlington, Massachusetts 01803
Tel. (617) 273-0950



CIRCLE 51 ON READER CARD



Beckman Instruments had an idea that called for developing a new order service system within 90 days...

When a typical customer order consists of hundreds, or even thousands of precision components, an automated order service system becomes a key element in customer satisfaction and future growth.

Some would have called them dreamers

According to Robert B. Thompson, Manager, Management Information Systems for the Helipot Division of Beckman Instruments, Inc., as the Helipot distributor market mushroomed, incoming orders outpaced their manual order service.

So, when Beckman's ability to respond to customer needs started to drop below their standard of a 95% service level, their idea was to start from scratch and design and implement a customized order service system. They gave themselves 90 days to engineer a new system that would not only eliminate current order service problems, but adapt to Beckman's high growth rate projections over the next five years.

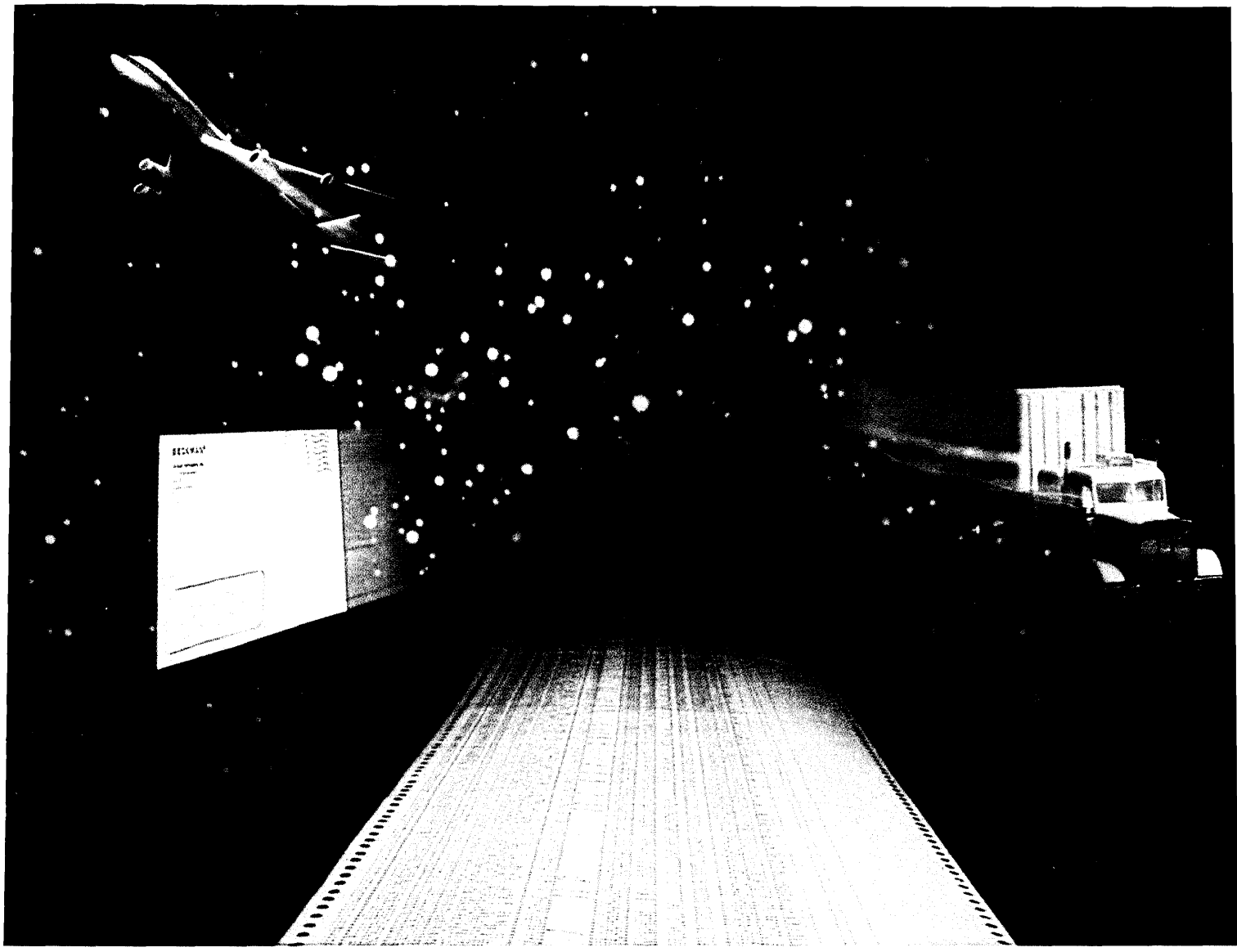
GE system beats schedule by 22 days

Because of its worldwide data processing network and customized programming capability, General Electric computing services was called upon by Beckman to assist in providing a solid solution to their order service problem.

That "solid solution", a customized order service system linking Beckman's Puerto Rico operations and its Fullerton, California headquarters, was up and running on the GE MARK III® computing network in just 68 days.

OMNI, General Electric's order service software generator was the key. Developed by GE to drastically reduce the normal development and implementation times associated with order service systems, OMNI also provides the means to easily customize each system to satisfy precise input, processing and output report requirements.

Working closely with Beckman's management information systems people, GE application specialists, using the OMNI software, developed a pilot system which satisfied approximately 80% of Beckman's total requirements in only three weeks! The



General Electric computing services helped bring that idea to reality in just 68 days.

remaining 20% represented customizing features developed by GE to complete Beckman's tailor made system.

Totally compatible with in-house system

The new system has eliminated customer service snags and enabled Beckman to turn around orders quickly and efficiently.

And, the system is totally compatible with Beckman's in-house data processing department. MARK III Service's interprocessing capability automatically consolidates information and stores it ready for transmission to the parent company in Fullerton.

After evaluating several alternatives, Beckman's MIS staff determined that a worldwide computer service was a sound approach for this application. That's when they selected General Electric.

Computing services... think of the possibilities

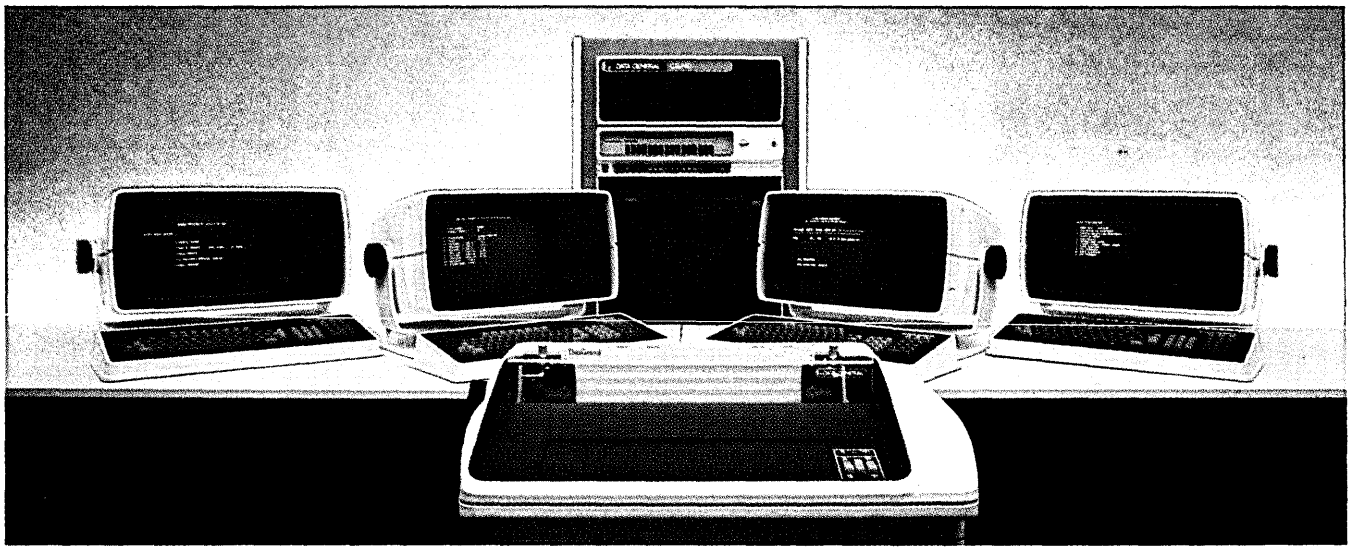
To see how other managers have harnessed the power of MARK III Service to their ideas, drop us a note on your company letterhead. We'll add your name to our award-winning executive magazine "LEADER", and forward you a current issue. Write to: Roger Hobbs, General Manager, Sales Department, General Electric 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. 291-19

GENERAL ELECTRIC

CIRCLE 37 ON READER CARD

At last. The small business systems nobody's waiting for.



Data General's new Commercial Systems CS/40 models. They don't keep you waiting because they work the way business works. Interactively.

Multiterminals, no waiting. CS/40 puts data processing power right where your people need it, when they need it. In a distributed network or as a stand-alone system handling multiterminal applications or multiple single terminal applications or both. So some users could be updating inventory, while others enter orders, check payables, and process the payroll. All at the same time. And managers can still access the system any time.

It speaks your language. Interactive ANSI '74 COBOL, the standard business computer language and the language of large computers. With its COBOL, CS/40 has interactive debugging and workstation management, which makes it easier to use from the start.

Small doesn't mean limited. Three compatible models assure that as your company grows, CS/40 can grow along with you. And CS/40 can communicate with other popular commercial systems including our own. With features like up to 40 million bytes of online disc storage. And enough memory for large applications. Plus utility software you wouldn't expect on a small system. And a smart spooler that frees up terminals so your system can do more work.

And everything else you'd expect from Data General. Like innovation, because we put a larger share of our revenues into R & D than any other major computer manufacturer. Like reliability, because we make virtually everything we sell. Add attractive quantity discounts, solid systems engineering, field service and our superior price/performance and you'll understand why there are already over 39,000 systems installed worldwide.

Why wait any longer?

Mail to: Data General, Westboro, MA 01581

☐ Send me your Commercial Systems CS/40 series brochure.
☐ Send me your brochure and have your sales representative call.
☐ Quick, I'm getting ready to purchase. Call me pronto.

Name

Title

Company

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DM10

Data General

It's smart business.

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LOOK AHEAD

CDC AIMING AT IBM MINI MARKET

Some salesmen at Control Data Corp. talk of a $40 million a year market in miniperipherals for the IBM Series/1 minicomputer. A group is now being formed within Control Data Peripherals Co. aimed at selling miniperipherals to those "sophisticated" users at whom IBM said it was aiming its new minicomputer. Offered would be crt's, printers, floppy and hard disc drives, semiconductor memory add-ons, and tape drives. The new group of under 100 persons would be part of the peripheral company's Data Systems Group which also sells some terminal products and the CDC Cyber 18 minicomputer. The group is headed by Tom Bassett, and the Series/1 task force would be headed by Phil Arneson.

EXXON MAY BUY XEROX DIVISION

Another piece of copier czar Xerox' kingdom may be up for grabs. This time it's the copier company's Office Products Div. -- and the one grabbing at the booty the most tenaciously is none other than the "happy motoring" Exxon Corp. Preliminary talks reportedly already have been held between the two, and a final agreement could be reached within the next six months.

Under the rumored takeover, Exxon would buy the Xerox unit which includes the Xerox 800 word processing system as well as its facsimile gear. Sources speculate that both these product lines could easily merge into Exxon's Quip word processing device. Exxon also has other wp wonders up its sleeve, and is expected to come out by Jan. 1 with a new word processing setup, priced at $1,500 -- which is $3,500 under the nearest competition.

FRENCH MINI MAKERS EYE HONEYWELL WITH ANXIETY

Honeywell Bull-CII is setting up production of the Level 6 minicomputer at Angier in France and the news is unsettling to other French-based mini makers. Some wonder out loud how far the French government will go in its continuing support of the merged operation. (France had promised about $1.5 billion in subsidies, guaranteed orders, payment of losses and research and development between 1976 and 1980).

Meanwhile, California Computer Products says it will sell complete computer plotter systems in France, incorporating the Solar 16-bit minicomputer, made by France's SEMS.

YOU'RE WORTH LESS THIS YEAR

Salaries for data processing employees in the U.S. rose an average of 5.1% from June 1976 to June 1977. This was a slower rate than the 1975 to 1976 increase of 5.7% (which also was less than the inflation rate) according to the 13th annual edition of A. S. Hansen's Weber Salary Survey on Data Processing Positions.

The sluggish raise picture wasn't spread across the board, however. Salary data from 1,157 dp installations reporting on some 88,000 employees shows that managerial men and women fared better than others, with top execs posting an average 11.2% increase to an average of $36,036. And the figures are further skewed by where you happen to be employed. Salary increases in "Sun Belt" cities were higher than in such large northern cities as Chicago and New York. Comprehensive results on selected dp positions will appear in the November issue.

CASE OF THE MISSING SOFTWARE BID

A French software organization is angry that it didn't have a chance to bid on a $200,000 contract from the Defense Dept. issued recently for a common software language for "embedded" computer systems -- those buried in avionics and weapons systems. It's not that CAP/Sogeti/Gemini, of Paris, didn't try. The company submitted a huge proposal in which it bid its version of PL/1, called CPL/1, and then air freighted the proposal to Washington through Trans World Airlines. But the DOD's Lt. Col. W. A. Whitaker, of the department's High Order Language Working Group, says the proposal didn't reach the department and he still doesn't know where it is.

CAP's vice chairman Philippe Dreyfus says he will file suit against TWA. But he admits that all isn't lost. CAP does considerable software development for one of the four winners, Honeywell Bull-CII, which is bidding an extended version of the language PASCAL, and probably will issue subcontracts to CAP. Other winners in the joint development project, also each getting $200,000, are Softech, IntraMetrics, and Stanford Research Institute.

CAP/Sogeti/Gemini, which does some $60 million a year in France, has had little success in penetrating foreign markets. In the U.K. it holds only about 1%-2% of the market for software sales. Now it's in the U.S. seeking to sell about 10% of the company to a U.S. organization so that it can get a foot into the huge U.S. market. Meanwhile, Britain's National Enterprise board has taken the opposite tack to penetrate the U.S. software market. It's trying to acquire U.S. firms (September, p.273).

TAX CREDITS ON DIVIDENDS EARNED

As the Carter Administration's tax revision package is now shaping up, investors will receive tax credits on dividends earned from stock holdings -- or so say several industry executives close to the Washington scene. What will the package mean to dp companies? Dividend paying giants like IBM should get more play from investors, while smaller non-dividend generating companies will find it increasingly difficult to attract investor dollars.

As for Carter's much discussed elimination of preferential treatment on capital gains -- it will be part of the package but the government isn't really pushing it, at least not now. That part of the bill probably won't get through Congress, observers say.

IBM IN GRAPHICS AGAIN?

IBM may be ready to reenter the graphics market, an applications area where it's been strangely quiet since the early days of the 360s. Except for the 2280 Special Image Processing System, which bombed in the late '60s for lack of orders, IBM's only representative product has been the time-worn 2250 Model 3. This system also was discontinued at one time, but we hear that not enough return units were available to satisfy customer demands and IBM had to at least temporarily resume production.

This could be a temporary situation, however, as the grapevine has it that an eight-color raster scan device is awaiting only a corporate go-ahead. Though of rather low resolution, the device would seem to satisfy the requirements of business executives who merely would like to display bar charts and similar data on low resolution screens.

NO CRANKED UP 168 THIS

"It is a 370 extension system, " said an IBMer of the 3033 to a meeting of prospective users. "This is not a 168 cranked up. It is a completely new design even if some things are the same, such as density of memory chip." He called estimates of 1.6 to 1.8 times the 168's performance for the 3033 "conservative" and said some programs are running in labs 1.8 to 2.1 times faster. He said the new machine has no emulators and probably won't feature user writeable control storage. First demonstrations of the 3033 are scheduled for the Washington Systems Center in Gaithersburg, Md., prior to the first system delivery. The machines are being produced in Poughkeepsie with some testing slated for the IBM plant in Kingston, N.Y. The spokesman said 168s still are being manufactured at the rate of 20 per month.

SYSTEM FOR ALL BIRTH DEFECTS

Four years in development, an interactive system is up and running on the Tymshare network which could prove a major tool in dealing with birth defects. "The March of Dimes has done it again," said Prof. John Donovan of the Massachusetts Institute of Technology whose Sloane School worked on the project with the MOD and Tufts Medical School. "The March of Dimes took the lead," said Donovan. "They conceived it, sponsored it, and focused on the need for the system." It is expected that the system, which has completed clinical testing in a number of medical centers, will be made available to the general medical community in December.

Donovan described the system, whose data base contains facts on the 1,400 known birth defects, as one with flexible data management which combines the computational techniques of the Sloane School, the data and medical expertise of the March of Dimes, and the clinical testing capability of Tufts. He said it can interact with a physician, helping him identify possible syndromes; can recognize unnamed syndromes; can act as an early warning system by monitoring birth defects throughout the country; and can serve as a research vehicle in attempts to determine causes of various syndromes. He noted that one baby in every 10 is born with a birth defect and that some 15 million

(Continued on page 176)

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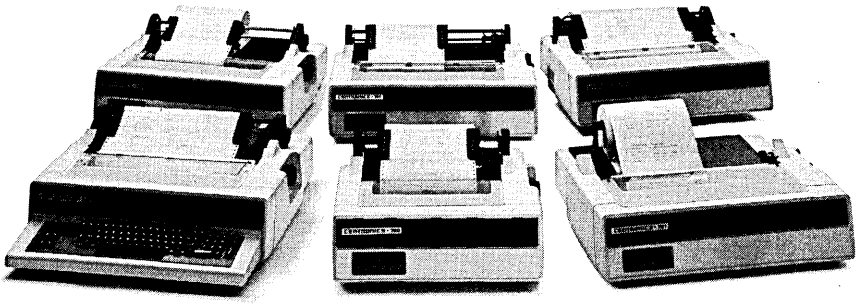

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A much closer look

"A Close Look at Brooks' Law" (June, p. 81) presents some of the causes of loss in programmer productivity, and gives some thoughtful concepts to help minimize these losses. However, the approach attacks the symptoms of the problems and not the causes. While it is necessary to plan for the loss of productivity due to learning curves, group communication time, etc., it also should be necessary for the system to provide programmers with the tools to enhance their learning speed and lessen the need for group communication!

Both of these concepts are fundamental to the Honeywell Multics system, which enhances learning in several areas—two of which are especially significant. The first is that nearly all of the system software is written in PL/1. The second is that all system software is developed and maintained on-line.

Lessening the need for programmer interaction is also a significant strength of Multics'. Programmer productivity is quite high and thus projects can be accomplished with fewer people. Very often, sizable projects are done by single individuals.

At the risk of seeming too enthusiastic, I would like to point out that Brooks' *The Mythical Man-Month* indirectly is a testimonial for Multics development capabilities. Multics was especially mentioned for its high programmer productivity. Many of the suggestions and policies given in the book have been made part of the Multics philosophy for a long time.

ROBERT M. MAY
Multics Software Support
Honeywell Information Systems, Inc.
Phoenix, Arizona

Mr. Gordon and Mr. Lamb respond: The provision of good tools is, of course, of primary importance in increasing worker productivity. That is why much of today's research in computer languages and system requirements is aimed at providing better tools. However, in the kinds of system programming efforts that Brooks was talking about, the communication and coordination work will still be a substantial part of the effort. In fact, one very successful software manager we know claims that the chief function of management is to partition the work in order to minimize the communication and coordination effort.

I believe Mr. Gordon and Mr. Lamb dismiss too abruptly the use of an extended workday as a means to increase productivity. In their second example, the four person team could have completed the project within the schedule by each working a bit under an hour overtime each day after missing the first milestone. Even if the staff was given the generous incentive of double pay for overtime, the total cost would be well under any of the solutions mentioned.

KEN SCHWEBER
Hoskyns, Inc.
New York, New York

The authors answer: We agree that in the example the team probably could have finished the job with an overtime effort. This is not a good general solution since we feel that overtime efforts are most effective when used sparingly, and we know of some projects that would keep people on overtime for years. In the article we primarily wanted to point out to managers the factors that go into making up the demands on the programmer's supposedly productive time.

Funnies 42X

Your June Issue (p. 136) contained a cartoon showing a forlorn newspaper dealer sitting beneath an imposing sign on his stand: "Now—All Newspapers on Microfilm." Before him were three tiny piles of microfiche.

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One astute observer in our office remarked, "Look, no customers!"

How true. Despite all the glowing benefits, micrographics system development requires a daily struggle to wean users away from paper to film.

A. M. KNEITEL
Manager, Commercial Information
E. I. DuPont de Nemours
and Company
Wilmington, Delaware

Unicorns and tax reforms

In his article on proposed tax revisions (August, p. 116), Laton McCartney quoted me as saying: "I don't believe in virgins, unicorns, tax reform, or other mythical beasts." While this quote is accurate, upon seeing it in cold print, I reflected and decided that I may believe in unicorns.

LESTER M. GOTTLIEB
President
Data Dimensions, Inc.
Greenwich, Connecticut

Portability probed

Vendors are not reliable sources of information on the degree of standardization of their software products, and the article by White and Ripley ("How Portable Are Minicomputer Fortran Programs?" July, p. 105) presents a highly optimistic picture of the degree of portability achievable by FORTRAN programming.

For example, consider DEC's OS/8 FORTRAN IV, a good product from an experienced company, described in the article as having only one "minor restriction." DEC claims that it "provides full standard ANSI FORTRAN IV . . . subject only to the restriction that double precision and complex number operations require an FPP-12 with extended precision option." In fact, OS/8 FORTRAN IV contains at least four violations of the ANSI standard. The three most serious are actually documented by DEC, but without any warnings or indications that they are not standard. These violations are:

1. Subscripted variables in a DATA statement are limited to a single subscript. If multiple subscripts are used, in some cases incorrect code is compiled without any diagnostic being issued.

2. The "dummy" arguments of a statement function are treated as ordinary variables which get set to the actual arguments whenever the function is called. Thus, if a variable and a statement function dummy are given the same name, the value of the variable will be altered whenever the function is called.

3. Within a subprogram, a variable is not permitted to have the same name as the label of a COMMON block.

Problems one and two can cause correct, legal ANSI FORTRAN programs to run incorrectly while producing no diagnostics at either compile or execution time; problem three at least produced a diagnostic, but could require lengthy and error-prone rewriting of programs to eliminate name conflicts.

These are examples of problems that can legitimately be described as minor when writing a program *de novo* but are quite serious when trying to transport one.

Among minicomputer compilers, I believe that FORTRAN standardization is a reality, but that FORTRAN portability is a myth. With a new FORTRAN standard being promulgated, and the bur-

letters

geoning of low-cost computer systems whose purchasers may not have any contractual clout with the vendor, an honest appraisal of the state of standardization and means by which it may be improved are in order.

DANIEL P. B. SMITH
Eye Research Institute
Boston, Massachusetts

In with the new

I was somewhat disappointed in Dr. Holton's article ("Are the New Programming Techniques Being Used?" July, p. 97). The notion of exploring the impact of these techniques is laudable, but the publishing of a survey so shallow in use and impact is, however, questionable. I do not believe that the sample, because of its size and composition, justifies any generalizations with respect to the use of, or the impact of, structured technology. Further, the data presented some curious anomalies. For example, structured programming is described as "not particularly a method for lowering development costs," yet the same technique is also described as having "very high ratings for improving the efficiency of programming, debugging, and testing" and is increasing "programmer productivity." It is interesting that one can raise the efficiency of debugging and testing, concomitantly increase the productivity of the programmer, yet not lower development costs.

ROBERT W. SHIELDS
Assistant Vice-President
American National Insurance Company
Galveston, Texas

The author responds: Mr. Shields has not presented a curious anomaly. He has misquoted me out of context. The article's statistics show that structured programming is somewhat to moderately effective in lowering program development costs. My article suggests that the dp installations have been somewhat ineffective in passing on this cost reduction to the user.

Initially, my survey dealt with 33 from among the largest 100 corporations in California. Considered as a nation, California is among the top 10 in gross national product in the world. This survey group is certainly representative of an important segment of our economy.

I was able to spend one to two hours interviewing each of my participants to better determine the extent and success to which they are employing modern programming techniques. My participants were carefully screened so as to reflect the views of corporation data processing management.

Dr. Holton should have realized in his article that the West Coast has never been thought of as a bastion of users of new productivity methodologies. This is due in part to the fact that these methodologies (i.e., Yourdon, Jackson, etc.) have the majority of their disciples in the Central and Eastern United States. A reluctance to use the new productivity techniques was further explained when Dr. Holton mentioned that all but one of the 23 random companies surveyed used IBM mainframes. IBM has no marketable "structured" methodology product that can be used against a program/system development life cycle.

CLYDE L. MINER
McDonnell Aircraft Company
St. Louis, Missouri

Mr. Holton's answer: My survey did not include developers of commercial and government software packages. Some of the most sophisticated users of modern programming technologies come from these types of installations located on the West Coast. Secondly, one of the survey participants, Hughes Aircraft Co., is probably the most advanced user of modern programming technologies in the world today.

On Mr. Miner's second point, I believe that IBM supports the use of modern programming techniques more strongly than any other mainframe vendor. Its employees have published many articles on the subject and its user educational system gives many courses on the value and use of such techniques.

I read John Holton's article with great disappointment. It would seem that if we listen to Dr. Holton's conclusions, the 23 respondents to his survey were not very serious about using the new programming techniques, but instead were just experimenting with them. Furthermore, his conclusions were more tutorial and seemingly biased against IPT than was actually warranted. For example, in the results he showed for structured programming, high ratings were given to better quality programs, easier and less costly maintenance, and more efficient debugging and testing. All of these scored over two on his scale of three. I submit that if for no other reason than these three, structured coding is a significant plus to the old unstructured way. I don't think it would be at all fair or particularly smart to believe that the employment of IPT is a panacea to all systems development problems, because it isn't.

My programming group has employed all the techniques for the past two years, including the full support librarian and programming teams. With the possible exception of the use of HIPO's, we have found IPT to be the most effective set of tools that we have ever used. They were especially effective in the areas of program quality, maintenance ease, debugging, testing, reduction of system integration time, and a considerable improvement in overall project control. You couldn't get my people to go back to the old ways. At least now, as managers, we know when we are in trouble, before we never knew until it was too late to do anything about it.

M. DUNCAN
Program Manager,
Corporate Systems Division
Montgomery Ward
Chicago, Illinois

Mr. Holton responds: It is Mr. Duncan's conclusion, not mine, that the survey respondents who are experimenting with new programming techniques are not serious about using them. In fact, some experiments were large enough to involve groups of 10 to 15 analysts and programmers. Such a group is as large as the total systems and programming work force in many smaller installations.

However, I did wish to imply that these techniques had by no means been fully implemented or universally accepted in all installations that had used them. But those who have used the structured programming, top-down design, and structured walkthrough techniques do rate them as being quite successful in achieving reasonable and rewarding objectives.

I think there is a flaw in the survey reported in this article—it surveyed large organizations. The amount of resistance to adopting such a new method varies geometrically with the size of the organization. Thus it is not surprising to find that large organizations, such as those surveyed, have not wholeheartedly embraced structured programming. Also, it may be that specific projects or areas are using SP but not the whole organization; this is especially true in large organizations with a large maintenance workload, for it is very difficult to maintain a complex unstructured program using SP techniques.

JAMES R. SHANNAHAN
Data Systems Programmer
Lockheed Missiles and Space Company
Sunnyvale, California

The evidence which I gathered does not support Mr. Shannahan's hypothesis. I have contacted at least 15 medium size dp installations to find out if they had implemented any of the techniques in question. Only one of them had implemented any of these techniques. This installation was using structured programming and top-down design. ❋

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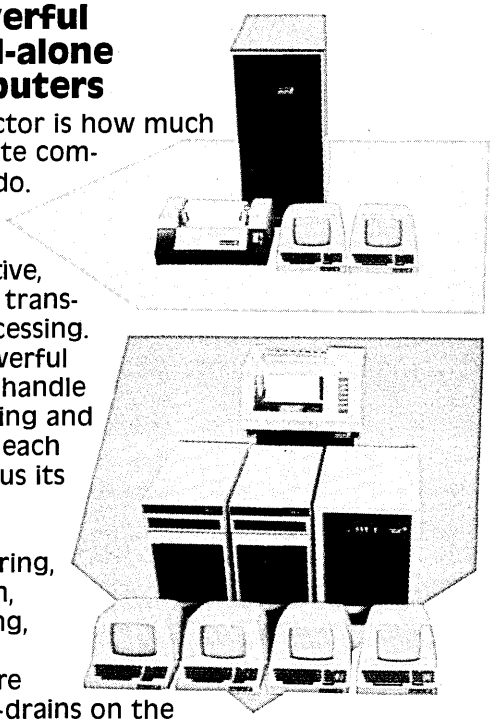

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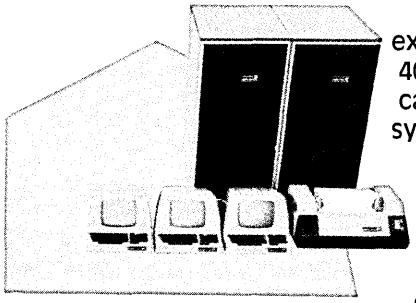

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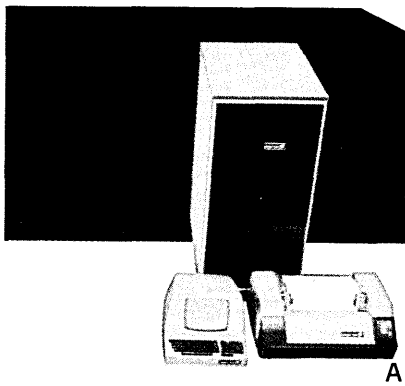

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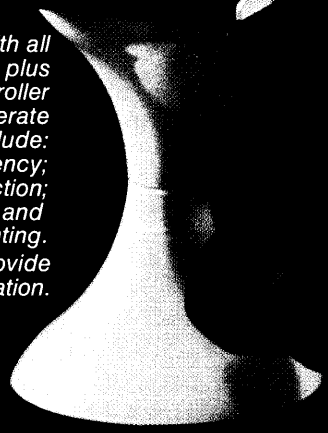

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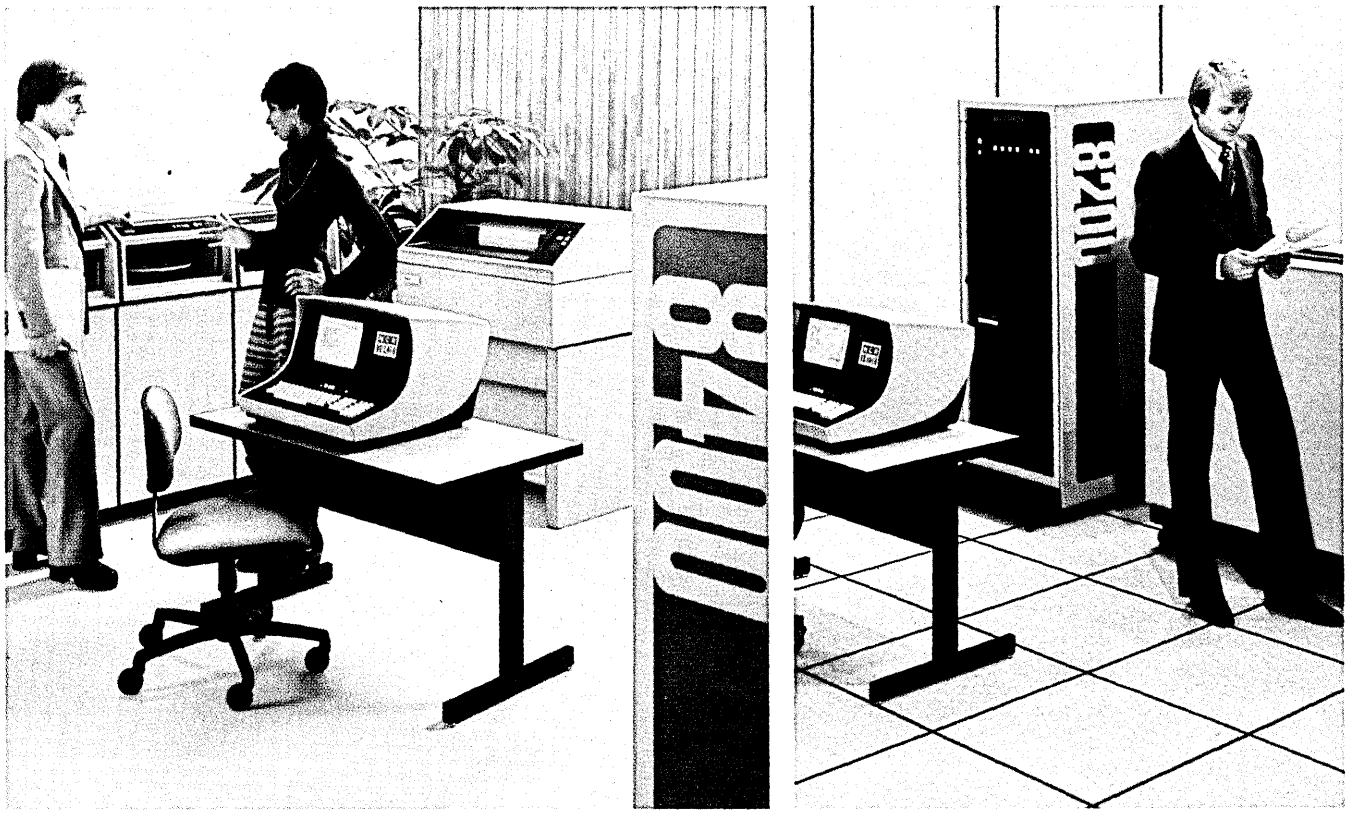

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people

From Tab Manager to CEO

Donald P. Kelly, who began his business career 31 years ago as a tabulating manager with an insurance company, today heads giant Esmark, Inc., a Chicago company that did $5.3 billion last year. His rise in the company began to accelerate 10 years ago when, as controller of Swift and Co., he was assigned to make a thorough analysis of the company's future.

Conglomerates at that time were acquiring many of the nation's large meat packing companies—except Swift—and Swift's chairman Robert W. Reneker was determined that Swift would do the swallowing rather than be swallowed. Swift then launched a diversification plan, based on Kelly's analysis, and in 1973 set up a holding company called Esmark, with Kelly as the president. Swift became its meat packing division. Last July when Reneker retired, Kelly assumed the chief executive officer's post in addition to the presidency.

Although the company still gets 78% of its revenue from food products, most of its profits come from the non-food acquisitions it has made during the past ten years—fertilizers, petroleum chemicals, energy, and personal products from its recent acquisition of International Playtex. Meantime, it's been drastically trimming its meat packing operations, closing 50 plants and laying off or retiring 18,000 workers from what was once the nation's largest meat packing concern.

"We sure aren't the biggest anymore, and we don't want to be," Kelly told an interviewer recently. The company "cannot and won't participate in the surplus carcass market," said the self-styled "numbers man" from the South Side of Chicago.

Kelly, the son of an accountant, went from high school into the Navy during the second World War. Then he joined the United Insurance Co. of America as manager of tabulating for five years. After two years as manager of data processing with the A. B. Wrisley Co., he joined Swift and Co. as a $125 a week manager of data processing, becoming assistant controller 12 years later in 1965, and controller in 1967. During that period, Kelly attended Loyola and DePaul Universities in Chicago and Harvard Univ., taking courses in accounting and finance, but never got a degree.

After his analysis of the company, which he described as a "painstaking, nine-month, seven-day-a-week, thirty-six-hour day" assignment, Kelly was named v.p. of corporate development and controller and in 1970 became the company's financial v.p. and a director.

His 19 years in data processing have given Kelly some unique concepts about the management of a computer operation. Last February, for instance, he spun off the company's data processing department, Cogna Systems, which had operated as a wholly owned subsidiary. His rationale: although it had operated as a profit center since its inception in 1973, its prices were arrived at "by proclamation" rather than through the competitive process.

DONALD P. KELLY
Unique concepts about dp

Cogna president David Eskra said Cogna, with an IBM 155 and 158, formerly did 100% of its business with Esmark. Now it's down to about 70% under a three-year agreement, which often is renegotiated. The rest comes from batch work it does for manufacturing firms which have been signed up since Eskra first got word of the spin-off last November. Eventually, Cogna hopes for a 50-50 split.

Eskra thinks it's the first time in history that a major U.S. corporation has divested itself of its data processing organization. He says it often gets sticky when services you were providing at no charge to an Esmark operation, suddenly aren't for "free" anymore. "Kelly understands it; but the guys further down don't."

Particularly because of the company's structure as a holding company where managers are given greater entrepreneurial opportunities. If a manager sets his goals, and they're approved and reached, he gets a bonus of as much as 70% of his base salary. If he fails, no bonus. Kelly, the numbers man, is no exception. Last year when Swift posted a $3 million fourth quarter loss, Kelly's bonus dropped to $30,877 from the year before figure of $108,500, on a base salary of $176,442.

Business First Technology Second

Roger W. Borneman likes to look at data processing from a business management standpoint first and a technical standpoint second.

This probably has a lot to do with the fact that he seems to be thoroughly enjoying the job he took over last May 9, as v.p., information systems, for Ralphs Grocery Co., Los Angeles. Borneman joined Ralphs after 15 years with Atlantic Richfield Co. where his last job was manager of corporate systems. "Data processing is much more closely tied to the day-to-day operation of the company (at Ralphs) than in the petroleum business. My personal background fits. I was trained as a manager, not as a dp expert."

In a sense, Borneman has come full circle. He got into data processing in the mid-1950s with National Supply Co., Pittsburgh, Pa. National Supply manufactured and sold oil field drilling and production equipment. Hardly like a grocery store, but it was a merchandising operation and, Borneman recalls, "there were many similar kinds of system problems."

Holder of an MS degree in industrial administration from the Carnegie Institute of Technology, Pittsburgh, Pa., Borneman said he was hired by National Supply like "many other Carnegie graduates," because some of the graduate school faculty was doing some work for National at the time. "I was hired as an engineer by the controller to provide a different kind of academic background."

He started as an auditor, moved into accounts planning and sales accounting, and eventually became assistant manager for plant accounting.

In 1955, he recalls, "because of a farsighted controller," the company began looking into the feasibility of using

either a Univac I or an IBM 705 large scale computer for an integrated merchandising accounting and information system. Borneman wasn't slated for the systems group that would develop the system but was "drawn into it" when the company's internal recruiting program failed to find enough qualified people. He remembers that with the help of Arthur D. Little Co., the 16 people in the group developed the marketing support system. It included an automatic reordering process which was, in effect, an early version of the logic of the IBM Impact system, a system used today by Ralphs.

Ralphs is a supermarket chain with 99 stores, of which 82 are in Southern California and 17 in the San Francisco-Sacramento area. It has the largest share of market among competitors in the Los Angeles area, some 21% above the leading contenders. The firm has approximately 9,000 employees with some individual stores having as many as 225. And, in a field with a profit margin of less than 1%, data processing plays an important role in achieving efficiency.

Borneman is particularly impressed with supermarket scanning systems in seven of Ralphs' stores. The chain has an additional six with IBM 3660 key entry point-of-sale (POS) systems and several with National Semiconductor Datachecker equipment. He said the chain plans to extend the use of ECR's (electronic cash registers) and scanning. "We have proven there is justification for scanning." Ralph's first scanning store began scanning three years ago.

Borneman believes, "Use of data we didn't have before is the real key. We now have knowledge of sales out of the store by item, rather than broad categories, which helps inventory and allows us to measure price sensitivity." By the latter, he explained that he meant an ability to move prices up and down and determine at what price an item would experience the highest movement.

Ralphs was founded in 1873 by George A. Ralphs and was a family-owned business for many years. Today it is a division of Federated Department Stores, Inc., the only division among 19 that isn't a department store chain.

But, says Borneman, many of the characteristics of a family-owned business have stuck at Ralphs. All of top management is housed in company headquarters in Compton, Calif., with the exception of a small office in Concord for the bay area stores and "we communicate very closely."

Ralphs has had a data processing operation for some 15 years, and today this operation has a staff of 60. The company has a two megabyte IBM 370/158 and an IBM System/7 for production recording and inventory management in its new meat processing plant. Federated, Borneman said, currently is developing a common system for use by its department store divisions, and Ralphs could conceivably use it for such things as accounts payable and payroll, or as a base of additional computing power. He said discussions toward this end will begin this fall.

He said the most promising application for Ralphs today is store ordering through billing and distribution. Stores reorder their nearly 15,000 items of merchandise using an MST 2200 source data entry unit which scans the shelf tag bar codes and records on tape for transmission to the 370/158 over dial-up lines. Orders are passed against an inventory file, priced, and warehouse shipping documents are produced and distributed to various warehouses. "Items are delivered to the store and are on the shelves before the next day's order is placed." He said some stores order twice a day.

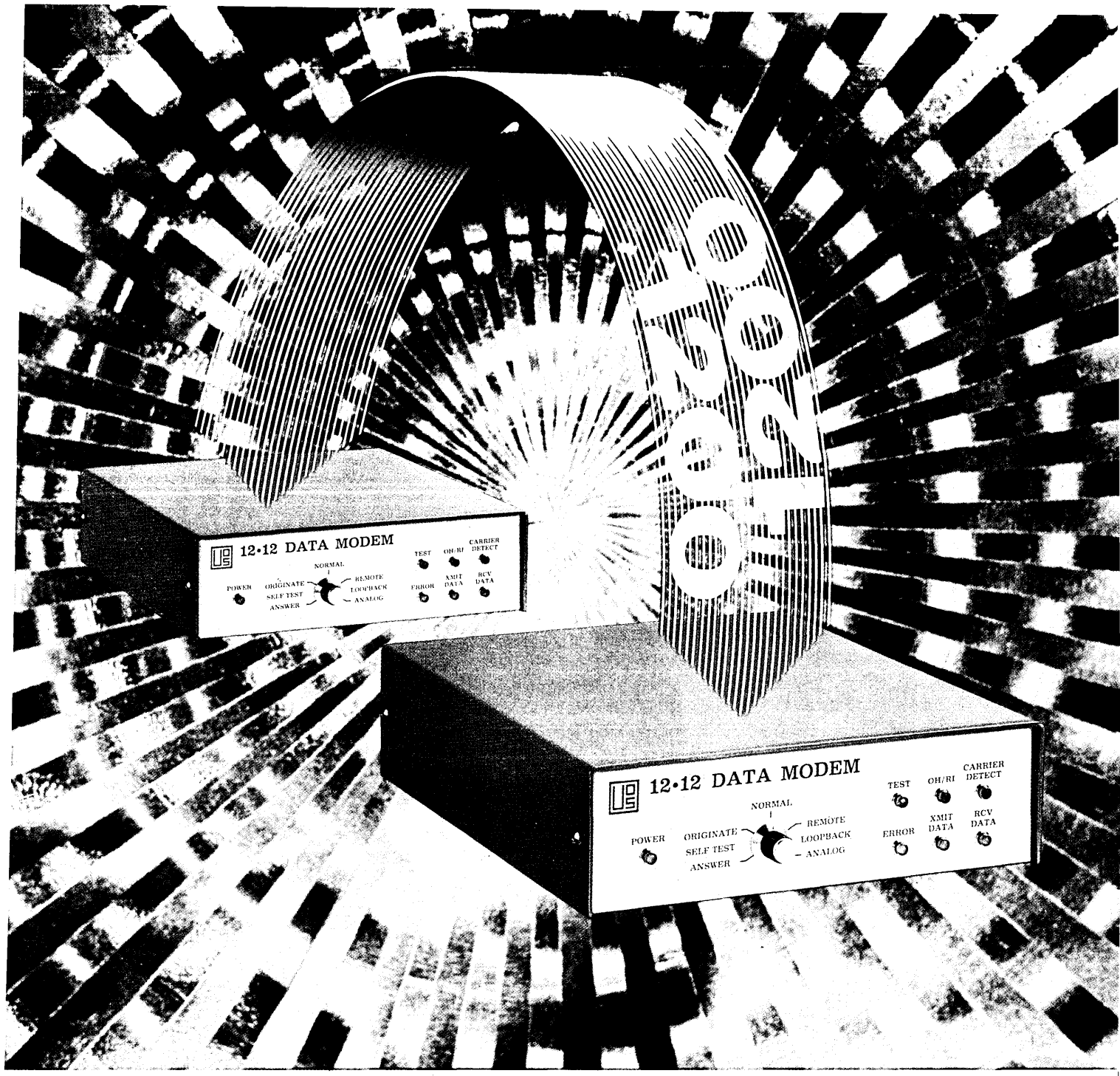
ROGER BORNEMAN
Enjoying his job

In between National Supply and Atlantic Richfield, Borneman spent two years with Litton Industries' Guidance and Central Systems Div. where he was manager of financial data processing.

His devotion to the business management viewpoint is, to some extent, carried over into his family life. "What with four children and a big house, it's very much like running a business."

In New Posts

LAWRENCE SELIGMAN was appointed director of small business systems development for Data General Corp. . . . ROBERT H. LEY was named director of information services for Welch Foods Inc. . . . DONALD S. BATES is the new general manager of General Electric's Information Services Div. . . . MICHAEL ANTHONY PFAFF was named vice-president, information systems, Federal Express Corp. . . . RICHARD T. WASILIUS was appointed manager of systems and programming for Research-Cottrell, Bound Brook, N.J. . . . Data General Corp. named FRANCIS A. ROWE director of systems marketing programs. . . . DOUGLAS J. FISCHER was named vice-president, finance and administration, of Midrex Corp., Charlotte, N.C. . . . DR. HERMAN LEVIN was appointed vice-president, development, for Tri-Data, Mountain View, Calif. . . . Auto-trol Corp., Denver, appointed MILAN R. MRAZ, vice-president of international sales and marketing . . . JOHN J. MAHONEY was named vice-president and general manager of Avco Systems Div. of Avco Corp. . . . ELLIOTT D. JAMES was promoted to the newly created post of vice president-general manager of the Dallas operation of Harris Corp.'s Data Communications Div. . . . THOMAS T. HARDING was elected a vice president of the Perkin-Elmer Corp. . . . MARK McGREW was promoted to president of Computer Power Systems, Long Beach, Calif. . . . JAMES B. SKAGGS was named executive vice president of System Development Corp., Santa Monica, Calif. . . . GEORGE VOSATKA, former senior vice president of General Automation, is the new president of the Valcomp Div. of Tymshare, Inc. . . . JOSEPH P. ROEBUCK, vice president for Honeywell's Western computer marketing region, named RICHARD G. TAYLOR Southwest district director, responsible for marketing, sales, and systems support for all medium and large-scale computer systems in 10 area states . . . JOSEPH L. DIONNE was named president of McGraw-Hill Information Systems Co. . . . WILLIAM B. PORTER was appointed director of marketing for DatagraphiX Inc., San Diego . . . HERBERT M. PERKINS, who, for the past three years has served as general manager of the Editing Div. of Datatron, Inc., Irvine, Calif., was elected president of the company . . . THOMAS E. BYRNE, assistant director of computing services at Dartmouth College, was designated acting director of the Kiewit Computation Center ❋



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calendar

OCTOBER

Personal Computing Expo, Oct. 28-30, New York. Free seminars and lectures about the latest in the field of personal computing will be offered at this show. Manufacturers have been invited to explain their microcomputer systems, and experts will conduct sessions on algorithms, software, language compilers, and assemblers. Included in the forums will be the personal design of computers for the more experienced hobbyist; kit building for the novice; microcomputer applications for business, industry and homes; computerized games, vocal output, and music. Contact: H.A. Bruno and Associates, Inc., 78 E. 56th St., New York, N.Y. 10022 (212)753-4920.

NOVEMBER

Interface West, Nov. 1-3, Los Angeles. This three-day conference and exposition for data and voice communications users has as its theme, "Productivity through Computing and Communications Alternatives," and its objective is to bring together users and prospective users of computer and communications technologies. Over 150 speakers will address 50 sessions, and there will be an exposition of the leading products and services in the areas of data communications, small computer systems, voice communications, and microprocessing. Individual programs are partitioned to provide a comprehensive tutorial in each of these major areas. Contact: Interface West, 160 Speen St., Framingham, Mass. 01701 (800) 225-4620.

COMPSAC 77, Nov. 8-11, Chicago. This is the IEEE's first international computer software and applications conference and is designed to bring together computer practitioners, users, and researchers to share ideas, experiences, and requirements for application software, management techniques, and software development support. Papers presented will cover topics such as: development methodology, management, data base management systems, computerized decision-making systems, real-time applications, computer-aided design, software tools, mini-micro software development, social, legal and regulatory issues, and organizations impact. Contact: Stephen S. Yau, Dept. of Computer Science, Northwestern Univ., Evanston, Ill. 60201 (312)492-3641.

Sixth Texas Conference on Computing Systems, Nov. 14-15, Austin, Texas. Sponsored by the Univ. of Texas and the IEEE Computer Society, some of the topics to be covered are: very large mass storage systems, very large data bases, computer hardware engineering, microprocessors, minicomputers, operating systems, and software engineering. Contact: Prof. Edward Thompson, Dept. of Electrical Engineering, Univ. of Texas, Austin, Texas 78712.

Fourth Annual Computer Security Conference, Nov. 14-16, New York. This year's three-day program will discuss the practical aspects of computer security by emphasizing user

experiences via case history presentations and workshop sessions. The conference will cover the latest developments in areas including risk analysis, fraud and embezzlement, disaster recovery, data communications security, dp auditing, privacy, insurance, and physical and personnel security. Workshops and special interest group meetings will be offered. Fee: $465. Contact: Computer Security Institute, 43 Boston Post Rd., Northboro, Mass. 01532 (617) 393-3666.

Western Educational Computer Conference, Nov. 16-17, San Francisco. Sponsored by the California Educational Computing Consortium, this will be both a vendor show and a conference. Contact: Paul Black, Dept. of Computer Science, CSULB, 6101 E. 7th St., Long Beach, Calif. 90840.

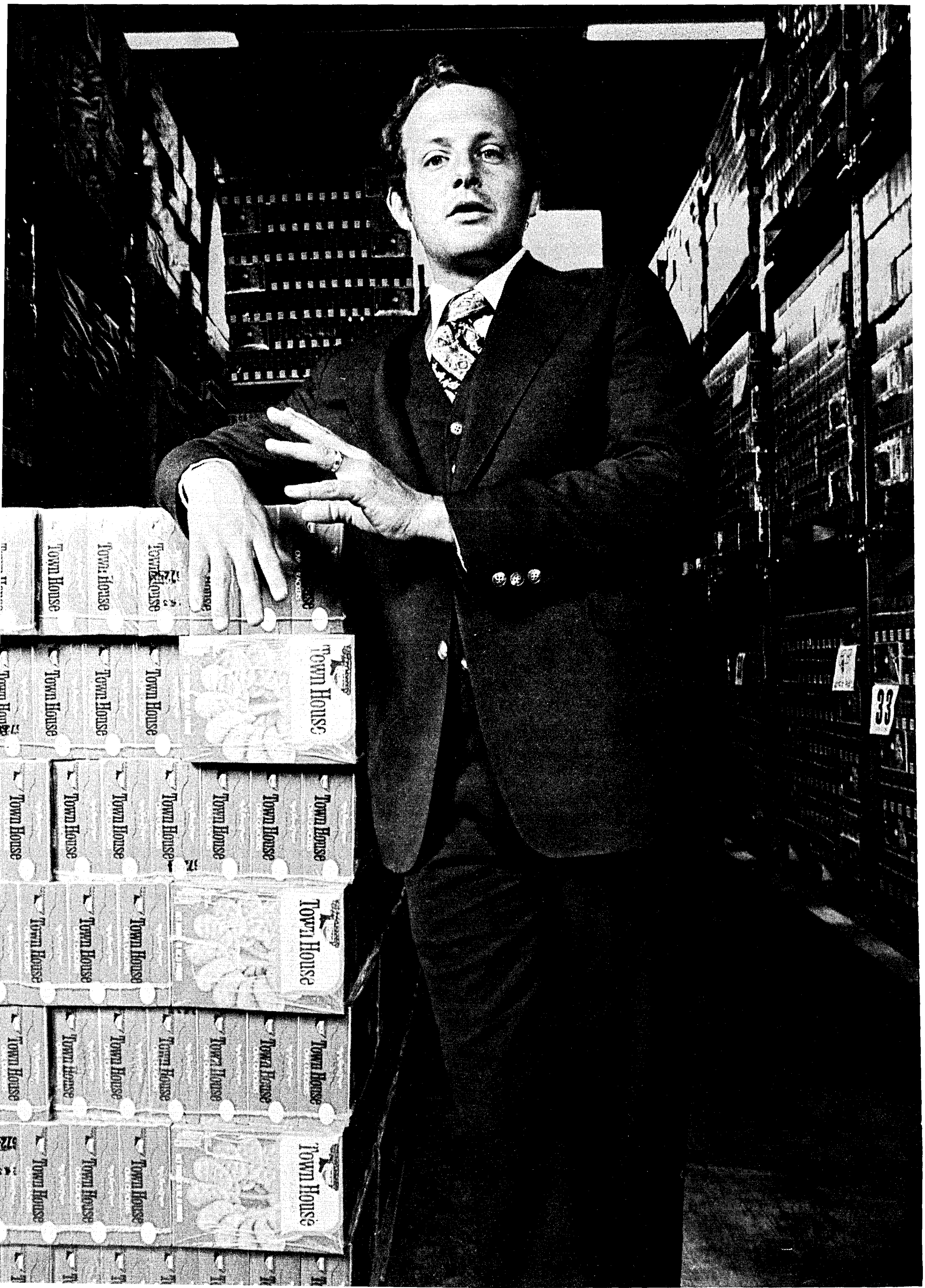
CALL FOR PAPERS

The Eighth International Symposium on Fault-Tolerant Computing will be held June 21-23, 1978. The program committee presently is soliciting papers on the theme of the system approach and on the interaction between technological advances and fault tolerance. Relevant topics include: hardware and software architecture of fault-tolerant systems; evaluation of system reliability, performance, and operational security; hardware and software design validation; detection and diagnosis of hardware and software errors; testing for quality production; and error recovery and system reconfiguration. A summary of about 200 words, due by Nov. 1, and the paper proposition with a 4,000 word maximum, due by Dec. 1, should be sent to M. Diaz, FTCS-8 Program Committee Secretary, LAAS, 7, avenue de Colonel-Roche, 31400 Toulouse, France.

Technical papers now are being solicited for PERCOMP '78, a selling show designed with the home computerist and business person in mind. Suggested topics include: speech synthesis and recognition; pattern recognition; bit-slice architecture; real-time machine control; software and hardware tutorials; business applications; microcomputer selection; microcomputer hardware surveys; word processing; and home applications. Specific topics to be considered include: applications of microcomputers in communications; tutorials on assembler, monitor, editor, and interpreter packages; hardware construction practices; advanced languages including APL and PL/1 derivatives; music generation and control; and file structures used for floppy disc, tape recorder, and RAM. Three copies of an abstract of an original paper on any of these or related areas are requested by Oct. 31, and should be sent to: James H. Londwedel, PERCOMP '78, 1833 E. 17th St., Santa Ana, Calif. 92701. Final manuscripts must be received by Jan. 13, 1978.

ON THE AGENDA

SWAP Fifth Annual Meeting, Nov. 2, Boston. Contact: SWAP, c/o Wang Laboratories, 1 Industrial Ave., Lowell, Mass. 01851. **Mini/Micro Computer Conference, Dec. 6-8,** Anaheim, Calif. Contact: Robert D. Rankin, 5544 E. La Palma Ave. Anaheim, Calif. 92807 (714)528-2400. **College and University Exchange National Conference, Dec. 7-9,** San Diego, Calif. Contact: CAUSE, 737 29th St., Boulder, Colo. 80303 (303)492-7353. **SOVEXPO, Dec. 7-15,** Moscow. Contact: Clapp and Poliak, Inc., 245 Park Ave., New York, N.Y. 10017. **On-Line Information Meeting, Dec. 13-15,** London. Contact: On-Line Review, Woodside, Hinksey Hill, Oxford, ox1 5BE, England. ✲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Bill Dierkes, VP Information Systems, The Keebler Company.

The Keebler Company, second largest producer of cookies and crackers in the U.S., has six bakeries and 63 distribution centers serving 90,000 retail outlets. Keebler's sales force of more than 1200 used to mail 40,000 orders per week to the 63 distribution sites, where processing and invoicing were done manually. The problem was, these orders weren't getting processed fast enough.

The installation of Sycor intelligent terminals changed all that. And established a new set of order processing standards. Operating at peak efficiency, invoices are now transmitted from the CPU back to the branch locations the same day orders are received. Keeping up this level of performance demands terminal and service reliability.

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After a year of operation, Information Systems VP Bill Dierkes wanted to know how reliable Sycor terminals and service were.

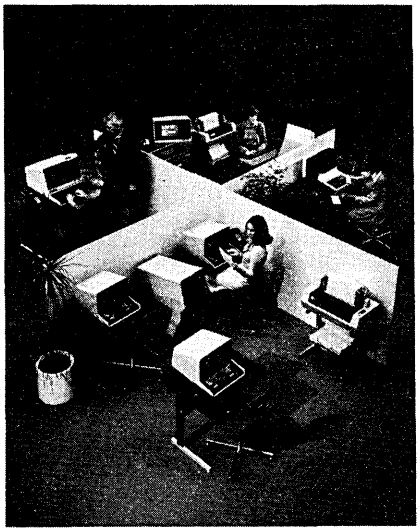
"I conducted a survey of 61 of our Sycor terminals from December, 1975 through May, 1976. Some of the terminals were in out-of-the-way places like Minot and Fargo, North Dakota; Billings, Montana; and Pocatello, Idaho. Places where service might be a problem.

"What I found out really amazed me. Naturally I expected the terminals to be reliable, and I expected Sycor to back them up with good service. But even I was surprised to find that, when a station went down, *80%* of the time it was back up again in four hours or less. And *95%* of the time in eight hours or less.

"When you consider that each location uses the terminal an average of eight hours per day and that there are 127 working days in the six-month period surveyed, the total system was up 98.5% of the time."

A Sycor intelligent terminal is a management tool.

Beyond fast maintenance and reliability, Bill Dierkes has found many other benefits from his network of Sycor intelligent terminals.



"Price, ease of installation and the Sycor terminal's ease of operation were other factors I considered. But the real benefits emerged when the system was installed. As soon as it was up and running we were able to reduce order processing labor by 75%, inventory by 15%, and process 40,000 accurate invoices per week. My Sycor system is a real management tool.

"We're extremely satisfied at Keebler with the overall performance of Sycor terminals. And the people responsible for maintaining them."

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To find out how much Sycor intelligent terminals and responsive service can mean to your network's efficiency, contact Bill Newell, our national sales manager, at Sycor, Inc. Corporate Offices, Ann Arbor, MI 48104.

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

books

ACCESSING INDIVIDUAL RECORDS FROM PERSONAL DATA FILES USING NON-UNIQUE IDENTIFIERS

NBS Special Publication 500-2
National Bureau of Standards, 1977
192 pp. $2.65

The National Bureau of Standards sponsors a program of directed research through grants to small businesses. When the course of national events requires a pinpoint investigation or a summary of the current art, NBS contracts to have the necessary material pulled together. Operating Systems, Inc., of Woodland Hills, Calif., received such a contract and pulled together a definitive document that discusses the identification of individuals without using a unique preassigned numeric digital identifier.

For several years the pros and cons of using the Social Security number as a numeric identifier have been debated. Since computer systems require *some* unique identifier or a combination of concatenated descriptors that form a unique identifier, OSI was requested to research the subject and provide a review of the methodologies for retrieving an individual's record without the use of a standard numeric universal identifier. To that end OSI reviewed the state of the art in retrieval techniques to find ways that multiple nonunique fields could be combined to search a data base. They then tested their theories against a data base and computed the probability of a match. The report consists of about 70 pages of prose, 100 pages of computer printout, and a 7-page FORTRAN program.

On review, one discovers it has an academic flavor; on scrutiny, several glaring omissions.

The circulation departments of major magazines have wrestled with the problem of nonunique identifiers for many years. I was dismayed by the absence of a survey of the algorithms used for circulation control by major magazines such as *Reader's Digest* and *Time*.

Plowing on I found the study lacked creativity (and this in turn causes me to suspect its credibility). An obvious identifier that cries out for consideration in a study such as this is the fully qualified telephone number (area code plus local digits). For a large portion of the population this is almost a unique identifier, is constantly up to date, and frequently appears on credit applications, new car purchase agreements, and the like. One could simply ask, "Have you moved recently? If so, enter your old and new telephone numbers in the spaces provided." It would allow a trail to be maintained so records could be linked with the individual being profiled.

Almost as good (except for dense ethnic neighborhoods where a single surname dominates) is the postal zip code. On a national scale, for Social Security records or veteran's benefits, the person's full address and age might be a unique combination. Unfortunately the evaluation of the zip code was not included in the study either.

The failure to make allowances for the application environment in which the data base exists is disappointing. This affects the probability of a variable being present and current. Consider the difference between a file of registered births and a file used in providing Social Security benefits. The birth file is a one-shot and never maintained; it contains a high degree of initial error and deteriorates over time. The Social Security file is seldom more than 90 days out of date, and likely to have some fields current and correct since it is in the interest of the affected individual to keep them current and correct (so he can receive his monthly stipend). Thus I conclude the probability of a retrieval is also a function of the quality of the data, and this in turn depends on the file activity pattern.

It is true that an in-depth knowledge of data bases and large file applications environments would be required to prepare key definitions so the issues of data quality and integrity could be understood. But that doesn't seem to be too much to ask of a company that provides the government with 100 pages of retrieval probability printouts.

Robert L. Patrick

Mr. Patrick is an industry consultant and Datamation editorial advisor.
Editor's Note: For another view of this same subject see the Forum in this issue.

BOOK BRIEFS . . .

PCC's Reference Book of Personal and Home Computing
Edited by Dwight McCabe
People's Computer Co., 1977
248 pp. $5.95

Perhaps this book would be more appropriately titled "Two-Thirds of a Reference Book," since the first hundred pages are devoted to articles, which for the most part aren't what we would consider references. In a reference sense, two articles stand out: the glossary, reprinted from the Byte Shopper (and prefaced by the editor with the caveat, "Almost every definition here has exceptions to the rule, so be warned."); and Li-Chen Wang's short description and complete listing of an interpreter for Tiny BASIC on an 8080 or Z-80-based microcomputer. The remaining eight articles, by the likes of Theodor H. Nelson and Jim Warren, are either useful in a practical sense, or thought-provoking, or both, but it's unlikely readers will find themselves continually referring to these articles.

The next 140 or so pages, a section entitled "Reference," contain several bibliographies, directories of professional societies, computer clubs and newsletters, computer stores, and manufacturers. These are the references we think people will use and reuse. We do have one objection to this book: it's an annoyance to buy a $1.50 pocket book with a cigarette ad bound into its center, and it borders on downright offensive to buy this book at $5.95 and find numerous ads scattered about. Ads or no, there will probably be many dog-eared copies of this book sitting on the bookshelves of personal computer users. ❋

vendor literature

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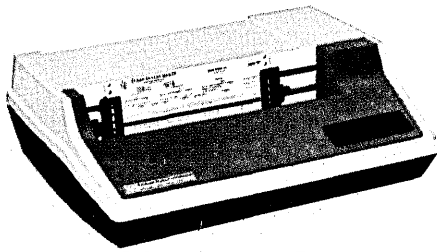
The Model 770 terminal includes all the components of an entire system. It has features like dual mini-cartridge tapes, a 1920-character video display and up to 48K bytes of memory. And it's the first video display-based intelligent terminal on the market that offers a built-in 80-column printer.

For multi-copy and 132-column capability, TI's compact, microprocessor-based Model 810 impact printer is also available.



Model 810 Impact Printer

Easy-to-use software, easy-to-learn language.
Model 770 terminals are easy to program and operate with TPL 700, the flexible, powerful Terminal Programming Language. TPL 700 is a high-level business-oriented language that greatly simplifies forms generation and procedures for data entry and local processing. Programs can be developed interactively on the 770 without ever writing lines of code.

And, of course, TI offers total service and support, including flexible maintenance plans and a nationwide network of factory-trained customer service engineers. For your distributed processing needs, TI clearly has a better solution. For more information, mail back the coupon. Or call your nearest TI sales office or Terminal Systems Marketing, (512) 258-7176.

Yes! I am interested in the Model 770 Intelligent Terminal. 1-10-DM

☐ Please send me more information.
☐ Please have your representative call me.

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Phone _____
My application is _____
Mail to: Texas Instruments Incorporated, P.O. Box 1444, M/S 784
Houston, Texas 77001

TEXAS INSTRUMENTS
INCORPORATED

source data

source constrained-type reports. These reports are said to enable the planner to compare reported up-to-date performance to the baseline schedule.

Status comments for each project activity, immediately reflecting the project's status and spotlighting conditions which could cause problems, may be included in the comparative reports. Updating also allows the project manager to post information about activity conditions, including date and time of the start or completion, as well as the amount of progress the activity has made. Once the project has been rescheduled, impact reports can be generated to show the effect of actual performance of activities on the project's schedule. The brochure also presents typical reports and details on the use of OSCAR. ON-LINE SYSTEMS, INC., Pittsburgh, Pa.

FOR COPY CIRCLE 345 ON READER CARD

Power Problem-Solving Bulletin

Problems encountered with computer systems, involving power deviations, brownouts, and blackouts, and possible solutions to those problems are explained in management terms in this new 8-page bulletin. Several options depending on on-site conditions are discussed. A building block approach is presented using static line voltage regulators, static automatic transfer switches, and uninterruptible power systems. Experiences by several users of this class of equipment are detailed, with an example of equipment expenditure justification based solely on financial considerations. CYBEREX INC., Mentor, Ohio.

FOR COPY CIRCLE 346 ON READER CARD

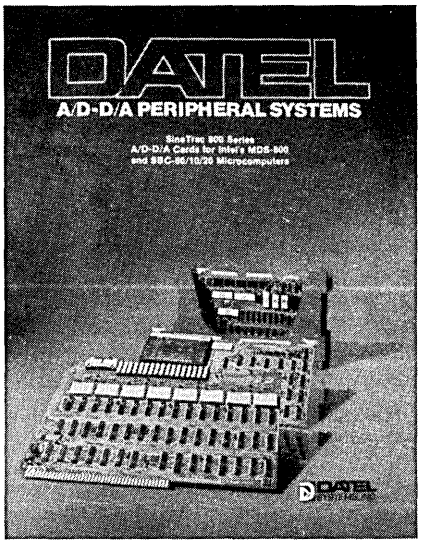
Business Software Bulletin

A complete description of how the ACS/Cogit business software production and control programs can store and modify complete production formulas and manufacturing operations, generate complete batch tickets, and monitor and report finished good inventory is given in this 6-page bulletin. Using text, schematic diagrams, and sample computer printouts, the bulletin describes programs including raw material inventory control, status of finished goods inventory, work-in-process reports, production batch ticketing, and job completion reports. The vendor reports that with these software packages, ACS computer color systems can accurately and rapidly generate production batch tickets, formula explosions, and current product cost analysis. APPLIED COLOR SYSTEMS INC., Princeton, N.J.

FOR COPY CIRCLE 347 ON READER CARD

Data Acquisition Cards

The electrical and mechanical parameters and programming considerations of the SineTrac 800 Series of data acquisition cards are given in this new 16-page brochure. The cards slide directly into Intel's MDS-800 microcomputer housing or SBC-80/10/20 card cage. The SineTrac 800 accepts 32 or more analog channels, communicates on the MDS or SBC cpu bus, and is handled as an addressable peripheral I/O device. All activities are controlled by the universal 8080 assembler language. Analog inputs can be printed out on a teletypewriter, punched out on paper tape or magnetic tape cassette, or left in memory. The unit is designed for process control, automatic test systems, laboratory measurement systems, and similar applications. Other features of the brochure include block diagrams, ordering guides, details on A/D-D/A base addressing, channel expansion, and programming methods. Also included are details of the diagnostic test program supplied with each system, and a brief description of cards for other mini and microcomputers. DATEL SYSTEMS, INC., Canton, Mass.



FOR COPY CIRCLE 349 ON READER CARD

Micro-Disc Option

A new Write Protect option available for the micro-disc system is described in this new 4-page, four-color brochure from the vendor. This feature will allow the user to protect data files stored on any diskette via a small hole punched in the diskette jacket. A sensor and associated circuitry within the 9512 micro-disc inhibit activation of the Write Mode when the hole is open. Recording on the protected diskette is made possible by covering the hole with opaque tape. The brochure describes the entire micro-disc system, and includes specifications and operating features, TECHTRAN INDUSTRIES, Rochester, N.Y.

FOR COPY CIRCLE 348 ON READER CARD

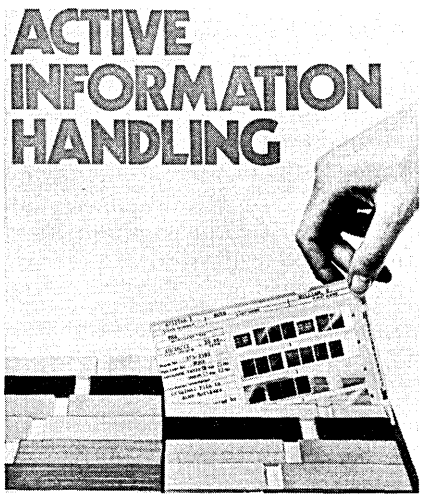
Electronic Mail

Datapost, the new electronic mail service, is described in this 4-page brochure from the vendor. The brochure explains how the computer-based service receives messages from the subscriber's office facsimile machine and processes them for delivery anywhere in the U.S. Also covered are details of how letters and addresses may be stored, and a cost comparison of Datapost and Mailgram. There also is a list of 32 ways to reduce costs of credit collections, sales administration, production, purchasing, and shipping. TDX TELECOMMUNICATIONS, INC., Houston, Texas.

FOR COPY CIRCLE 350 ON READER CARD

Microfilm Brochure

All the various Aperture Card 105mm Card Jacket features and coding techniques are described in a brochure entitled "Active Information Handling." The systems described include: keypunched Mil-D aperture cards and Tab-Jac aperture cards compatible with standard dp equipment for machine sorting and retrieval, and 105mm "fiche-size" card jackets. Options available include: notched cards, color code striping and colored card stock, including corner cutting and rounding. A variety of apertures are available for up to 60 16mm microfilm frames as well as 35mm microfilm for engineering drawing applications and specifications. Also shown are a variety of carousel microform file systems capable of storing and retrieving up to 150,000 unitized microforms. MICROSEAL CORP., Zion, Ill.



FOR COPY CIRCLE 351 ON READER CARD

Tape Protection

High intensity magnetic fields are commonplace, and until it is too late, there is no way of knowing that tapes have been damaged. This vendor is offering a new 4-page brochure describing its line of Tape Data Preservers which protect flexible discs from magnetic degradation, erasure, or physical damage. The units also will protect nine-

INTERDATA USERS

The TC-120 did it for Data General users
The TC-130 did it for DEC users

Now the TC-140 does it for you

Single board, fully embedded, dual density tape system for PE and NRZ formats. Total Operating System compatibility. Allows up to 4 drives with any mix of NRZ 7 Track, NRZ 9 Track, PE and PE/NRZ to be operated from a single controller. That's not all! You may select any two speeds in the range of 12.5 to 125 ips. Enhanced Command Set and Extended Status Register are standard in all TC-140's for those requiring a level of performance never before available.

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1100 Claudina Place, Anaheim, CA 92805

CIRCLE 84 ON READER CARD

We knew it from the beginning. And, so did our customers. We were convinced from the start that static RAM technology was the way to go on our 370 add-on memories. Static is faster. More reliable. And, totally compatible with IBM.

Now, we see an interesting thing happening. Our competitors, long-time proponents of dynamic technology, have suddenly changed their tunes. They're now planning to jump on the static bandwagon. But, they have a long way to go. We spent two years to develop our static technology before we started delivering it in 1975. We were the first with an NMOS static chip. The first with a 4K chip. And, our new 4K chip is the fastest, static or dynamic. All from EMM's own semiconductor facility in Phoenix.

Evidently, recent IBM enhancements have left some of our competitors holding the bag. We knew from the beginning that complete IBM compatibility requires static technology. We've kept right up with IBM. And that's how our customers are always going to be up-to-date with future IBM enhancements.

When you need add-on memories, check with EMM. We've got the best total all-around add-on-memory package going. We'll see to it that your memory stays IBM compatible.

EMM: STATIC FROM THE BEGINNING

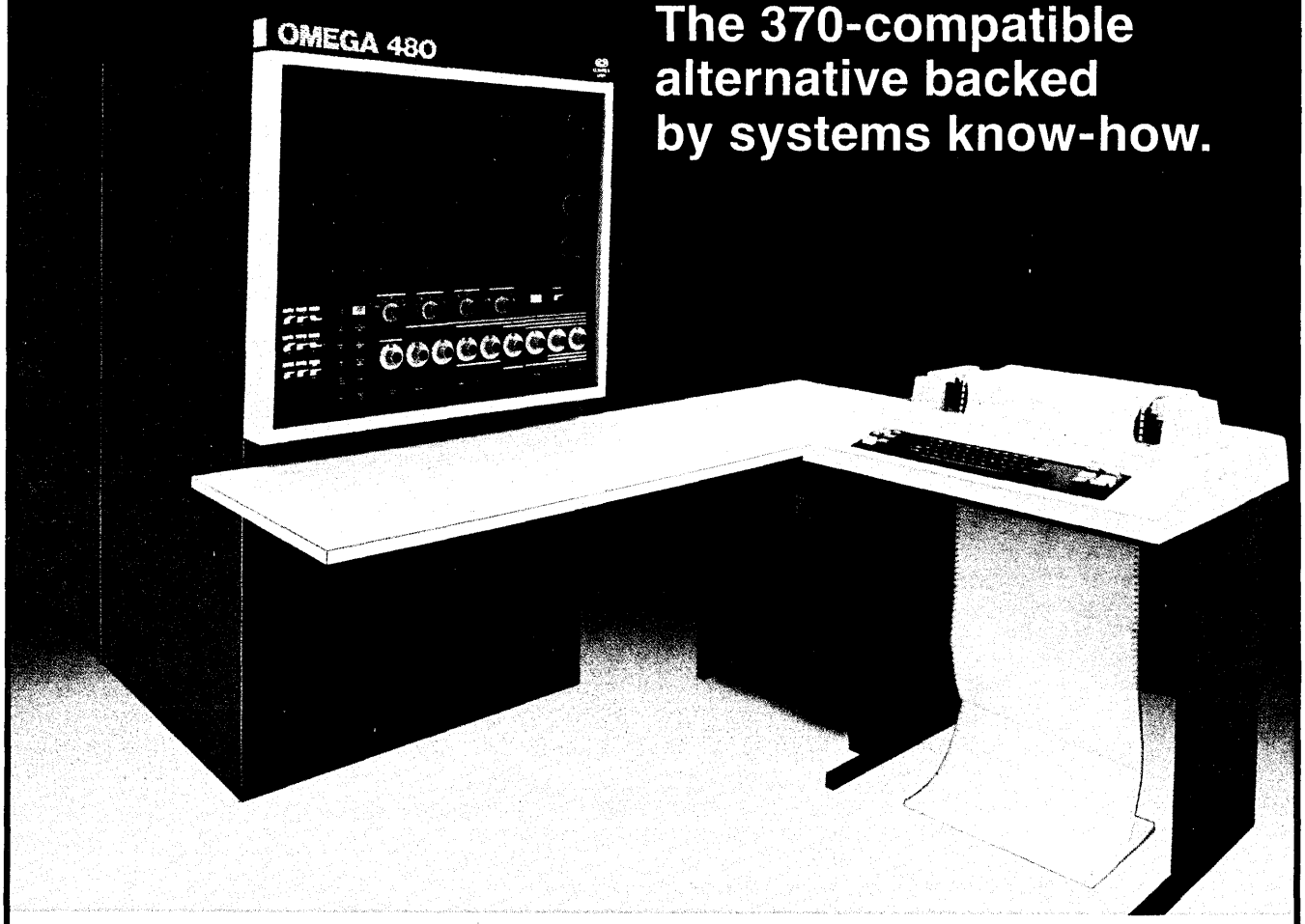
COMMITTED TO MEMORY ALL THE WAY

EMM COMPUTER PRODUCTS
A division of Electronic Memories & Magnetics Corporation
3216 West El Segundo Boulevard, Hawthorne, CA 90250

For more information, call your regional EMM sales office. Eastern (201) 845-0450. Central (321) 297-3110. Western (213) 477-3911. Europe: Bad Homburg, West Germany 06172/6094

Control Data's OMEGA 480:

The 370-compatible alternative backed by systems know-how.



Control Data introduces the OMEGA 480 System.

- **OMEGA 480-1 gives you greater throughput capacity than 370/138 and 145—yet costs about the same.**
- **OMEGA 480-11 will exceed 370/148 performance while offering a purchase-price savings of $200,000.00!!**

The OMEGA 480 requires about one quarter the power and takes only half the floor space of the comparable 370-145/148.

Field-upgradable. That means you can start with the OMEGA 480-1 now and upgrade to the 480-11 when your needs require the higher performance.

OMEGA 480 supports, without modification, most IBM Operating Systems, Program Products and user programs.

Several options are available either through our competitively-priced Installment Sales Plan or a selection of 3- to 7-year leases.

But most important, you want service support. And you get it from Control Data! In our support organizations are more than 8,000 dedicated hardware and software specialists—including many with years of IBM system experience. Experience that comes from servicing more than 1,400 current IBM users, and maintaining such Control Data plug-compatible peripherals as Disk, Tape, Memory, Printer and Mass Storage Systems.

The OMEGA 480 Systems are available initially in: Boston, New York City, Philadelphia, Washington, Baltimore and Atlanta; Cleveland, Chicago, Detroit, Milwaukee, Minneapolis, Dallas and Houston; Denver, Portland, Los Angeles and San Francisco. For information phone your local Control Data Representative or write Thomas E. Phillips, Vice President, Peripheral Systems Marketing, Control Data Corp., P.O. Box 0, Minneapolis, MN 55440.

The better business decision

CONTROL DATA CORPORATION

source data

inch diameter tape reels. Models for standard reels, discs, disc packs, and standard cassettes are available and specifications for storage, shipment, and hand-carried designs are given. PERFECTION MICA CO., Bensenville, Ill.
FOR COPY CIRCLE 352 ON READER CARD

DMS II Brochure

"Not All Data Base Management Systems Are Created Equal . . . Now There's DMS II" is a new 24-page brochure that describes this vendor's new data management system offering on the MARK III Remote Computing Service. The recently enhanced data base management and report generation system capabilities of DMS III are designed for a variety of business data management applications including sales analyses and forecasting, order service and inventory control, human resources management, and financial management applications. Features described include modular design, language, retrieval, updating, multilingual capability, built-in tabulation, and full reporting capabilities. Two brochure inserts explain how the system relates specifically to order entry/inventory control and human resources management functions. GENERAL ELECTRIC, Rockville, Md.
FOR COPY CIRCLE 353 ON READER CARD

Video Terminals Described

A new 2-page product sheet describes this vendor's family of portable Elite video terminals. The sheet describes several design features including metal construction, nine-inch diagonal crt display, 40 pound weight, optional built-in 30 cps coupler, composite video feed, separable keyboard, and mode control and logic card accessibility from the front panel. The terminals are equipped with fold-away handles that can be used as a pedestal for support during operation. The terminals are described as "truly unique in their class." The sheet outlines the operating features for three terminals, the Elite 1500A, Elite 1520A, and Elite 1520 APL. DATAMEDIA CORP., Philadelphia, Pa.
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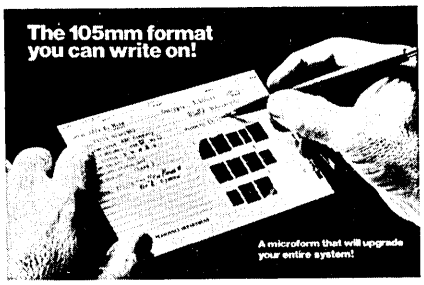
Card Jacket Microform

The advantages of combining man-readable notation and microfilm document storage are described in this new brochure from the vendor. The 105mm microform offers a large area for typed or hand-written information, and a polyester sleeve area designed to hold 16 or 35 mm microfilmed documents or a combination of both. The cards may be custom printed to accommodate any type of required information. Features described in the brochure include notching, color coding, and computer indexing on continuous computer forms. MICROSEAL CORP., Zion, Ill.



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reports & references

Directory of Executives

Nearly 400 new entries have been added and 700 changes made to the *Directory of Top Computer Executives*. Listings in the directory are organized alphabetically by company name within the same industry classifications used by *Fortune* magazine, including manufacturing and service, commercial banks, diversified finance, insurance, retail, transportation, utilities, and education. Included in each entry is the complete company name and address, subsidiary and/or division names, phone numbers, major systems installed, and the names and titles of the top dp executives. There also is a geographic cross-index listing companies alphabetically within each state. Price: $45, prepaid; $50, invoiced. APPLIED COMPUTER RESEARCH, P.O. Box 9280, Phoenix, Ariz. 85068.

New Reports

Specifications of 249 low cost computer systems are given in a newly updated report from Datapro, *All About Small Business Computers*. The 62-page report includes 50 pages of comparison charts covering 249 current systems from 87 vendors. Specifications for the formats used to store and process data within each system are given, as well as the manufacturer and model of the minicomputer used as the system's central processing unit and the system's I/O capabilities. Also described in the charts are: the keyboard facilities, the range of input/output devices which may be accommodated, communications capabilities, and the software support provided by the manufacturer. Price: $12.

Also available from Datapro is the report, *All About EDP Media and Supplies*. The 25-page report contains the results of a survey in which computer users rated suppliers of magnetic discs and diskettes, continuous forms, punched cards, and printer ribbons. Users of more than 1,700 types of dp media and supplies reported their overall experience with the various brands of supplies by assigning a rating of excellent, good, fair, or poor to each vendor's products. The report is $12. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

MUG Abstracts

A 48-page booklet compiling abstracts of the 25 papers presented at the 1977 MUG meeting is now available from the MUMPS Users' Group. The booklet provides some technical information on MUMPS, and a general outline of the conference sessions. Price: $4.

Also available from the users' group are the proceedings and abstracts of the 1973 and 1974 meetings at $9 each, and those of the 1975 and 1976 meetings at $15 each. MUG, 700 S. Euclid, St. Louis, Mo. 63110.

Computer Selection Guide

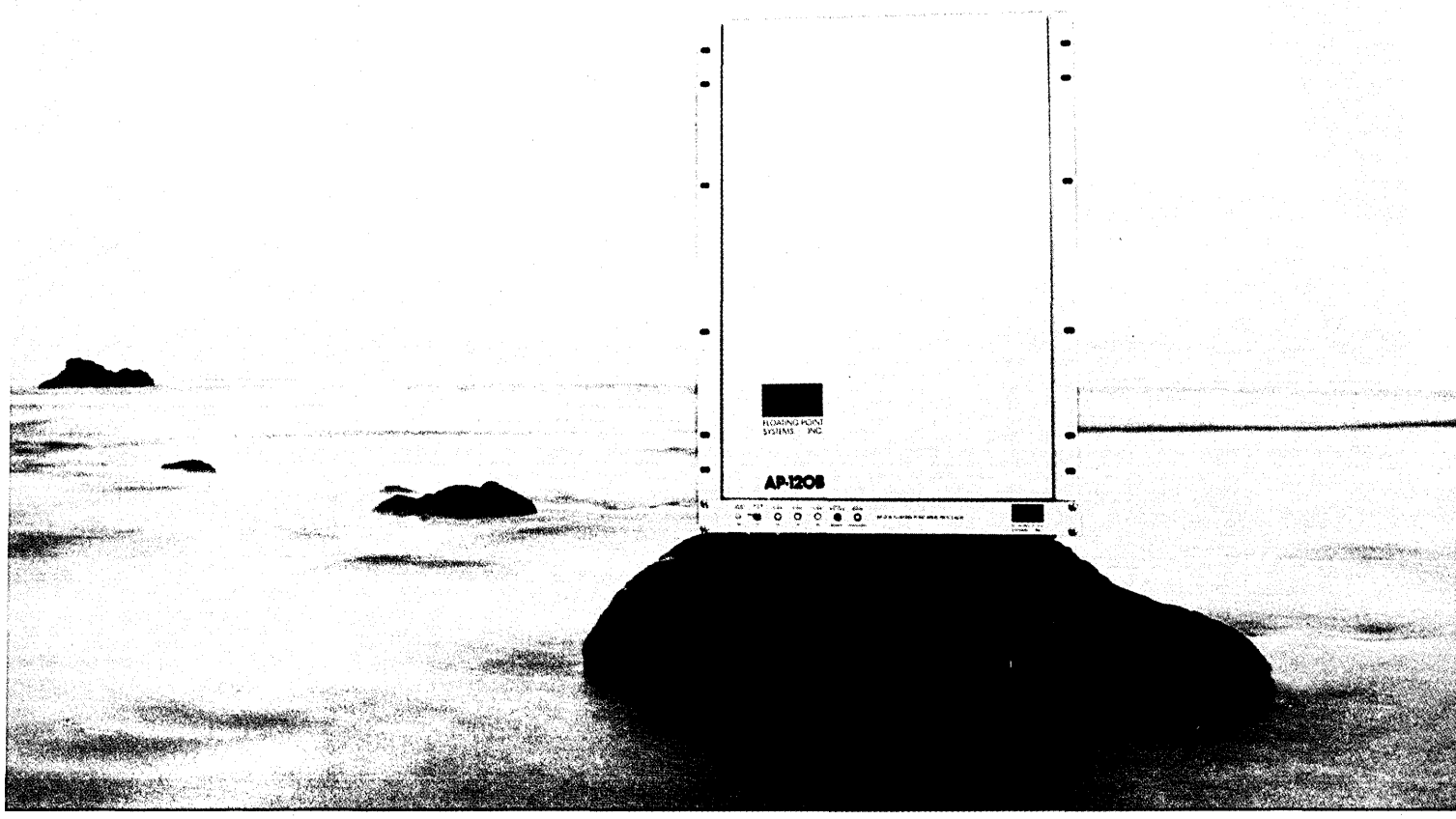
This new report is geared to the first-time user faced with selecting a small business computer. The report explains what a small business computer is, what it can do, and how the user can intelligently decide which system best suits his needs. The report provides technical and business guidelines as well as answers to basic questions which should be asked prior to making a decision. Subjects covered by the report include: determining your requirements; typical business applications; characteristics of effective business systems; a technical overview; summary of costs/financing; and information on choosing a computer vendor. A glossary of computer terms and a list of small computer vendors also are included. Price: $18, prepaid. DATA SYSTEMS PUBLICATIONS, Box 510, Marlboro, Mass. 01752.

Computer Insurance Report

This report is designed to help dp executives evaluate their installation's insurance needs and explain the types of coverage available to them. The 20-page portfolio describes six types of coverage, details special conditions under which each type should be purchased, provides an interpretation for specific types of clauses, and covers what is and what is not covered by general policies. The appendix assists in determining almost any installation's insurance needs. Price: $7. AUERBACH PUBLISHERS INC., 6560 N. Park Dr., Pennsauken, N.J. 08109.

(Continued on page 52)

The age of array processing is here...



and FLOATING POINT SYSTEMS is the array processor company.

- SIMULATION
- IMAGE PROCESSING
- GRAPHIC RESEARCH
- SPEECH PROCESSING
- METEOROLOGY
- SIGNAL PROCESSING
- VIBRATION ANALYSIS
- and MORE

FLOATING POINT SYSTEMS' ARRAY PROCESSORS provide the high throughput required for computer systems used in scientific, engineering, and signal processing applications. They can increase the throughput of minicomputers up to **two hundred** times...of maxicomputers up to twenty times. Yet the AP-120B system is typically less than $50K.

While the conventional, scalar computers of today require the restructuring of algorithms to fit the computer, the architecture and instruction set of FPS Array Processors are specifically designed to accommodate algorithms in both scalar and vector form.

Floating Point Systems' Array Processors offer high reliability (more than 3600 hours MTBF) and compactness (only 26¼" high in a 19" rack). They are found in shipboard and mobile installations, as well as computer rooms throughout the world.

FAST: 167 nanosecond multiply/add...2.7 millisecond 1024 point FFT.

EASY PROGRAMMING: More than 150 routines callable from FORTRAN or the AP assembly language. Its symbolic cross-assembler and simulator/debugger helps you create new routines.

COMPATIBLE: Interfaced to all popular computers and their operating systems. A flexible format converter translates data to and from the host CPU. And a high speed DMA port is available to use with other peripherals.

HIGH CAPACITY: 8k to 1 megaword of 167 or 333 nanosecond 38-bit memories.

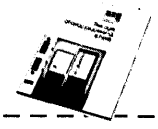
PRECISION: 38-bit floating-point arithmetic, normalized and convergently rounded, produces eight decimal digit accuracy, not just six.

RELIABLE: Goes where your CPU goes—computer room, lab, or in the field.

FULL SUPPORT: All the software, installation and operation manuals, and consultation you need goes with your Floating Point Systems' Array Processor.

ECONOMY: A small fraction of what you must otherwise spend for comparable computing power.

Discover how Floating Point Systems has brought THE AGE OF ARRAY PROCESSING.



FLOATING POINT SYSTEMS, INC.

CALL TOLL FREE 800-547-1445
P.O. Box 23489, Portland, OR 97223
(503) 641-3151, TLX: 360470 FLOATPOINT PTL

Please send me the ARRAY PROCESSOR BROCHURE with PRICE LISTS.

Name_____ Title _____
Company_____ Phone _____
Address_____
City_____ State_____ Zip _____
My Computer System is _____ My application is _____

CIRCLE 52 ON READER CARD

TOUGH COMPETITION:

The complete 125 ips package—beats anything in its class now moving tape.

Strong words. For strong capabilities, wrapped up in a strong new look. A totally new design in vacuum column drives houses the first *complete* high-speed package in the field.

The T1000 Series from Pertec.

No more compromising. No more shopping around. We've got it all. Together. Just for starters: 125 ips. Plus GCR. Plus auto-thread and auto-load.

You'll find everything you need to feed your powerful mini systems, in a T1000 configuration. These are not only our most advanced, most flexible tape transports produced today—they're built by Pertec to fit tomorrow's data processing applications to a T.

Ask for 6250 bpi GCR. In addition to dual NRZI/PE modes available, T1000 drives offer OEMs the only Group-Coded Recording at 125 ips—*with* a vacuum capstan to protect high-speed operations with a friction-free instant grip, for safer fast starts and stops.

Ask for operational convenience. T1000 makes life easier for your customers: *with* cartridge auto-load, automatic threading, and automatic load point seek. *With* a built-in daisy-chain capability. *With* front access to all electronics to simplify maintenance.

Ask for internal data formatting. Intelligence can be built into T1000 NRZI/PE configurations (as well as our tension-arm 7" reel FT7000 and 10½" reel FT8000, and our 37.5-to-75 ips FT9000 vacuum column series). Pertec is now installing our Microformatter inside these units, on order, to simplify interfacing, and reduce system costs.

Now complete the picture: ask for Pertec. Making it still tougher on the competition, our broad line of tape transports covers the full spectrum of OEM requirements. With the same total commitment backing T1000: Pertec, the world's largest independent manufacturer of peripheral equipment, backs *all* its products with the international sales, support and service operations of Pertec Computer Corporation.

There's a Pertec service office near you... and your customer. With emergency assistance on-call, on a 24-hour 7-day basis, through our toll-free 800 line.

☐ Please send complete details on the Pertec T1000 Tape Transport Series.
☐ Send pricing information as indicated on the RFQ below (no obligation or cost).

Request for Quote

T1000 Model #	Data Format	Data Density (bpi)	Tape Velocity (ips)	Quantity Required	Date Wanted	Send Specs Only
T1640-98	PE/NRZI	1600/800	75-125			
T1940-96	GCR/PE	6250/1600	75-125			
FT1640-98 w/internal formatter	PE/NRZI	1600/800	75/125			

Name_____

Title_____ Phone_____ Ext_____

Please attach coupon/RFQ to company letterhead and return to Pertec, 9600 Irondale Avenue, Chatsworth, CA 91311.

For immediate requirements, call your nearest Pertec regional sales office:
Los Angeles (213) 996-1333. Ann Arbor, Michigan (313) 668-7980. Hudson, New Hampshire (603) 883-2100. England (Reading) 582115.

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a division of Pertec Computer Corporation

CIRCLE 90 ON READER CARD

source data

(Continued from page 48)

Word Processing Report

All About Word Processors includes features, specifications, and pricing on nearly 100 word processing models available from 50 vendors. The report traces the evolution of the word processing unit from the mechanical typewriter to the standalone word processing products and shared-logic word processing systems, discusses applications, advantages, and trade-offs, and provides planning guidelines. This newly expanded and revised report includes: systems configuration; display stations and printer stations; text input, edit, and merge features; communications capability; and pricing. Price: $15. DATA/PRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

WP Typewriter Report

IBM's product lines and marketing force have determined the direction and pace of the word processing industry, according to a new report on word processing typewriters. The report also states that despite competition from about 30 firms which were founded within the past seven years, IBM holds about 80% of the installed base, and will continue to be the head of the industry for the next five years. The three basic equipment segments of the word processing typewriter industry are said to be: standalone, printer-based units; standalone, display-based units; and shared-logic systems. The report focuses primarily on the standalone segments, which comprise some 327,300 (99.9%) of the installed base. Fewer than 30 shared-logic systems are installed. Price: $595. CREATIVE STRATEGIES INC., 4340 Stevens Creek Blvd., San Jose, Calif. 95129.

courses

Audics

An informal survey of business community information needs by this vendor showed problems in two areas: increasing losses due to fraud or unintentional errors, and systems not responsive to users' cost and information requirements. The integrated data processing and audit control approaches needed to solve these problems have been combined in this audio cassette course, AUDICS, aimed at company management, financial/accounting staffs, users of computer processed data, auditors, and data processing professionals. The course consists of 12 booklets and 10 audio cassettes, and is designed to develop skills in: understanding audit concepts; installing internal controls; understanding how dp systems are developed; getting users involved in systems development; and developing a controls review tailored for a specific environment. The course has been accepted by the California State Board of Accountancy for 45 hours Continuing Professional Education credit. Fee: $595; quantity discounts are available. INFO 3, 21241 Ventura Blvd., Woodland Hills, Calif. 91364.

Security Workshops

Those involved in the auditing, computer operations, systems analysis and programming, and internal security functions may be interested in the series of computer security and privacy workshops being offered by Honeywell. Each workshop will include an extensive discussion on the recent Federal Privacy Protection Study Commission Report and its impact, and a presentation on distributed systems and communications security. Participants from government, business, and various associations will use case studies, team analyses, and guest lecturers to examine actual abuses of computer security and privacy. The three-day workshops will be held Nov. 15-17 and December 6-8 in Phoenix. Fee: $425. HONEYWELL INFORMATION SYSTEMS, Computer Security and Privacy Workshop, P.O. Box 6000, MS K-95, Phoenix, Ariz. 85005.

Distributed Dp

Those concerned with, or responsible for, developing the data processing within their organizations are the target of this course, "Distributed Data Processing—What You Need to Know to Make the Vital Decisions." The three-day course is designed to make participants: knowledgeable of the concepts and definitions of a distributed environment; able to recognize the application characteristics of distributed dp; aware of the issues pertaining to effective data assurance, security and privacy, auditability, recovery, and restart; and informed on the uses of the data base approach for distributed applications, including distributed data, distributed data base management systems, and back end processing. They also will be shown a usable methodology to determine if distributed dp matches their organization's needs, and how to implement it if it is suitable. The course will be offered in San Francisco, Oct. 26-28; Toronto, Nov. 16-18; Vancouver, Dec. 12-14; and Washington, D.C., Dec. 13-15. Fee: $495; group rate for two or more, $425 per person. ADVANCED MANAGEMENT RESEARCH, 1370 Ave. of the Americas, New York, N.Y. 10019.

Contract Negotiation

"Computer Contract Negotiation" is a three-day course designed to give participants sound answers to the ramifications of preparing and negotiating computer contracts, and is geared towards those in management having responsibility for preparing or signing contracts, attorneys, financial officers, and other professionals responsible for protecting an organization's financial interests. The course will be offered in New York, Oct. 19-21; Washington, D.C., Dec. 5-7; Atlanta, March 6-8, 1978; and New York, June 5-7, 1978. The $575 fee includes the complete text, a copy of *Data Processing Contracts—Structure, Contents, and Negotiation*, and reference materials. ACT-BRANDON CO., 437 Madison Ave., New York, N.Y. 10022.

Electronic Mail Seminar

Electronic mail is a $1.2 billion business in terminals, microprocessors, computers, and communications, and will have an enormous impact on faster communications, the paperless office, and the incentive for organizational change. This revolution will be the subject of a two-day seminar to be held in New York Oct. 25-26. The seminar will focus on how cutting edge users use electronic mail today, and where specific opportunities lie, and will deal with the market for electronic mail today and tomorrow. Fee: $550; group discounts are available. THE YANKEE GROUP, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138.

Commercial Use of Minis

The background facts needed to make a wise decision for or against minis will be covered in the course, "Commercial Application of Minicomputers," offered this fall. The course is designed for directors of MIS, user managers, those teams considering minicomputers, systems personnel needing information on minis, and executives in small to medium-sized companies who are considering computerization for the first time. The course will include a definition of a minicomputer, typical applications, selecting and evaluating minis, minicomputer software, and implementing minicomputer systems. It will be conducted in New York, Oct. 26-28; Los Angeles, Nov. 7-9; and Atlanta, Dec. 12-14. Fee: $425, AMA members; $490, nonmembers. AMERICAN MANAGEMENT ASSOCIATIONS, 135 W. 50th St., New York, N.Y. 10020. ❋

SHELLY & CASHMAN ON STRUCTURED COBOL

Learn Structured Design And Structured COBOL Programming From Their Newest Textbook.

Now it is no longer necessary to spend over $100.00 a day to obtain training in **STRUCTURED DESIGN** and **STRUCTURED COBOL PROGRAMMING.**

Gary B. Shelly and Thomas J. Cashman, authors of 18 textbooks on computer programming which have been used by numerous companies and hundreds of colleges to train over 3/4 million students in computer programming, announce their latest textbook, **INTRODUCTION TO COMPUTER PROGRAMMING STRUCTURED COBOL.**

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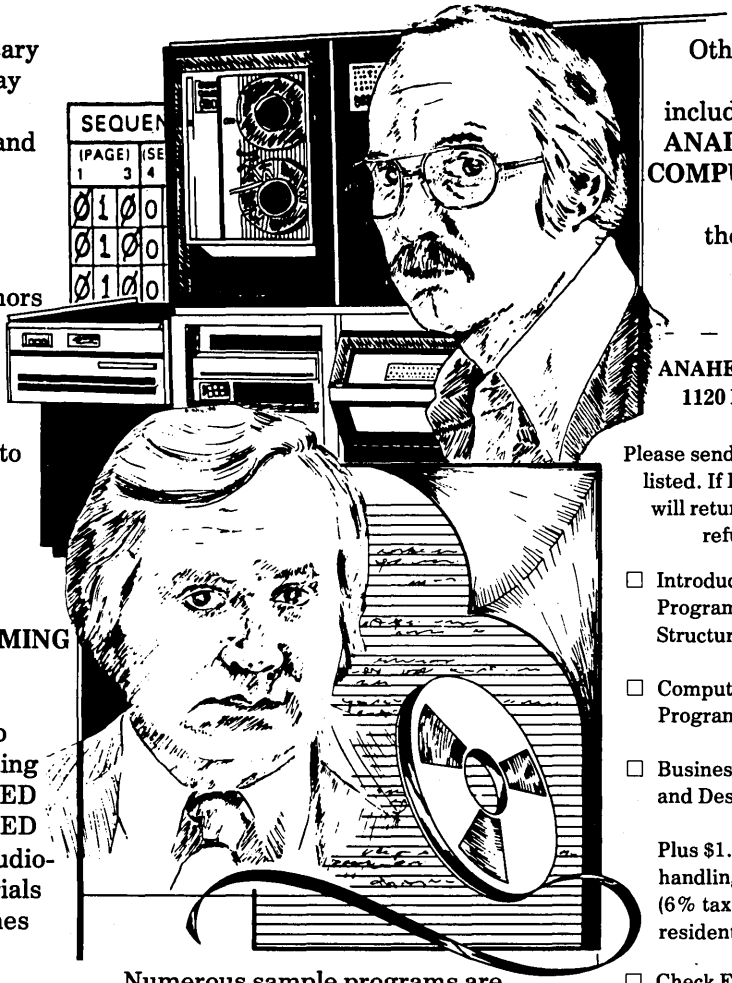

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Editor's Readout

John L. Kirkley, Editor

Capital Gains–Who Loses?

As of this writing (mid-September), the Carter Administration still is revising its promised tax revision package. It's been an interesting process. They've floated so many trial balloons that Washington's hot air reserves may be seriously depleted.

And so various provisions have come and gone. But two parts of the package have remained firm: one abolishes the preferential tax treatment of capital gains; the other eliminates double taxation of dividends.

Both, if enacted, could have a staggering effect on the future of the computer industry.

Back in the 1960s, the equity market and the computer industry went through a madcap romance, a whirlwind courtship. But the champagne went flat in 1970 and the two have hardly been on speaking terms since.

Today entrepreneurs trying to start new companies soon find that the venture capitalists want controlling interest, five pounds of flesh, and ten years indentured service from their first born son. That's if they can find any venture money at all.

Existing companies fare better. But they still are heavily dependent on private money to fuel their growth and research and development. And most do not pay dividends worth mentioning. It's the prospect of short-term, high risk gain that makes them attractive to investors, and capital gains incentives are an integral part of the package.

So far our industry has shown steady and often spectacular grov h—1970, it turned out, was a severe but survivable case of growing pains.

But without capital gains incentives, growing pains will no longer be a problem. Stagnation will.

Without the private investor, the small and medium-sized companies will have the choice of struggling to survive while suffering capital starvation, merging, or simply going under.

We would be faced with an era when future growth and innovation within our industry would inexorably slow down. Foreign investors, already making significant inroads in domestic dp companies, would happily learn the meaning of our slang phrase, "a fox in a hen house." Technology as well as money would be drained from our industry; we could lose our leadership forever.

Since the late 1960s the dp and electronics industry has contributed over $13 billion to the balance of trade. This would suffer. And the most fertile, imaginative segments of our industry—the high-flying minicomputer, microcomputer, and personal computer companies—will have the rug pulled out from under them.

Of course computer users, the dp managers and their companies, will experience unprecedented tranquility. No more worries about conversions or choosing between competing vendors and technologies. The few big surviving vendors will simply dictate a leisurely rate of change that brings maximum benefits to their stockholders.

A rather depressing scenario? We think so. That's why we think it's time for you to write to your Congressman and to President Carter. Let them know how you feel about the proposed tax package. Let's keep our industry green and growing.

Welcome to Portia

Since her highly successful chairmanship of this year's NCC, Portia Isaacson and personal computing have become synonymous. Like Portia, we feel that personal computers will have a major impact on the world of data processing.

That's why we've asked this human dynamo to add one more activity to her list of involvements: to be a DATAMATION contributing editor and to produce a regular column for us on personal computing. It all begins on page 208 in this issue. Enjoy. ❋

Distributed Processing in Manufacturing

by Larry D. Woods

The proliferation of small computers within a large company calls for some centralized management and control.

Much of the computing is leaving our data processing departments. It is leaving in an uncontrolled, uncoordinated manner. And the potential exists for much of our corporate data also to leave with the computing.

Data processing departments are losing control of the function in their corporations for many reasons: poor response to user development needs, inadequate computer services, lack of understanding of the users' needs by the dp department, unreliable dp computing equipment, and the introduction of lower cost, more efficient small computers. The user is beginning to find alternatives to traditional methods of computing.

In the traditional batch environment, the dp department is removed from the user. The user interface has been through keypunch departments and report delivery people. Timeliness is defined in terms of hours or days. Applications are designed by the dp department, programmed by dp, and the resulting programs are run by dp. The user has been a passive member of the team through most of this cycle.

The introduction of on-line systems has changed this. Through the use of terminals at the data source, the user now interacts directly with the computer, bypassing the keypunch and the delivery people. Now he sees the operation of the computer much more clearly. The speed of computing, once adequate in the batch environment, cannot be tolerated. Reliability of the hardware—or lack of it—once was invisible, or nearly so to the user. Now it is seen . . . and the user is frustrated. Data processing management must acknowledge the reality of the situation that today exists in most large corporations.

The low price of most small computers often makes some dp managers consider their appearance to be insignificant. This is not the case. Dp management must realize that collection and control of data and processes begins at the data source. This source may be a process controlled by a $2,000 microprocessor, but if the microprocessor cannot communicate with the large computer it is the large computer that is crippled, not the microcontroller.

Return to pneumatic tubes

Additionally, most small computers are purchased. This means that once the small computer is installed, it will *remain* installed. New leased devices offered by the data processing machine manufacturer will not replace the purchased small machines. It is the large data processing machine that will have to learn to live with these smaller units. Dp people think that distribution of computing is just part of a cycle, and over a length of time computing will again return to the centralized approach. In my opinion, this statement is being made in hopes that manufacturers and dp management will have enough time to figure out a solution to the problem of distribution. The day that computing returns to the central facility will be the day we quit using the telephone and use pneumatic tubes to pass messages between departments. And we will throw away our hand-held calculators and go back to slide rules and mechanical adding machines.

There is one situation that could force computing to return to the central dp environment. If a corporation allows its computing to be dispersed in an uncontrolled, uncoordinated, disconnected fashion, the total cost of computing within the corporation could and probably will rise dramatically. Duplicate, incompatible data sets and data set structures will result. Uncommon interfaces, both at the hardware and software level, would prevent small computers from communicating with one another. Personality conflicts and uncooperative managers would add to the problem. Upon realizing the situation, the general management of the company could ask the dp department to resolve it. At that point, if it were possible to resolve the conflicts, it would only be done with much more cost and time.

Computer utility

Corporate dp at Deere and Company is decentralized and based on local control. The company, a manufacturer of farm equipment based in Moline, Ill., last year had sales of $3 billion and employed more than 50,000 in some 30 locations. Its computing activity is centered around eight IBM 370/168s in three geographic locations. These machines constitute what we call our computer utility. From these three centers, 82 RJE terminals are supported, these being at manufacturing and marketing centers in the U.S., Canada, Mexico, and Germany. Several hundred crt's are supporting program development and online inquiry activities. Each unit is responsible for its own data processing development, operation, and maintenance. The local business system manager reports to the local installation controller. Only the actual computing activity is centralized. Corporate Business Systems Dept., a staff function,

provides development for systems that support corporate and certain company-wide functions, such as payroll. It also maintains the computer utility. There are also planning functions within the corporate Business Systems Dept., out of which the Distributed Computing Div. was formed.

A 1975 survey showed 35 small computers in the corporation. Most of these were used as general purpose engineering problem-solvers or industrial controllers. The use of small computers within our organization, and the general interest in small computers that was being shown throughout the industry, led to planning management of Corporate Business Systems to form a Distributed Computing function. This division began in November 1975.

Distributed computing division

The function of the Distributed Computing Division was not well-defined. The reason for this was that the direction of the use of small computers within John Deere was not clear to our management. There was a concern as to whether the dispersing of computing was good for the company, and if it proved to be the right approach, what should be the role of Business Systems in this trend?

In February 1976, a second small computer survey showed 102 small computers in use. We also discovered some other interesting facts.

For this second survey, our data was collected by Business Systems personnel at our units. Although they deal with their user departments on a day-to-day basis, they didn't realize the significant usage these small computers were being put to until the survey was taken.

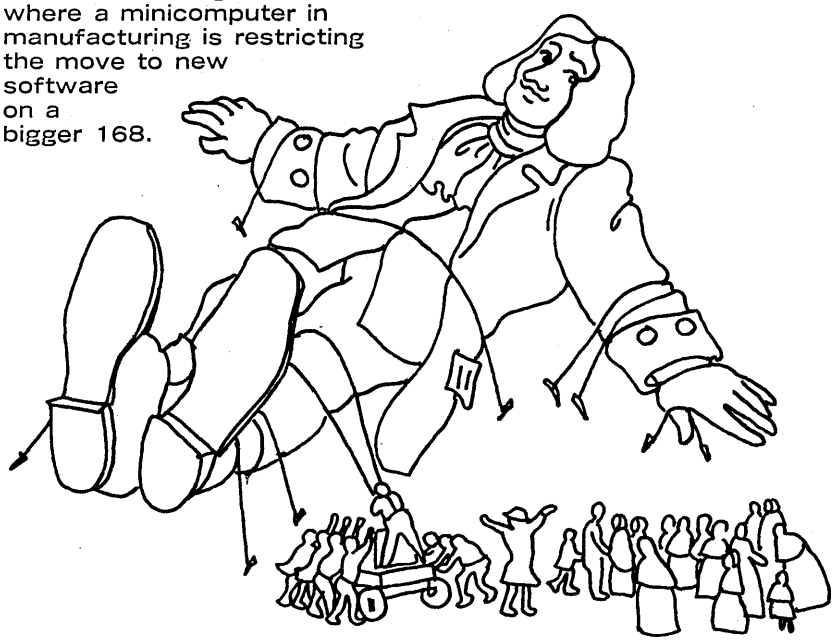
Another discovery was that equipment purchased for one use was being put to other uses. In two manufacturing facilities, the yearly plant-wide budgets were being run on engineering department computers. A further inconsistency was that in one unit the computer was in the tooling area, a part of manufacturing engineering. In the other unit, the computer was in a product engineering area, a research group, and upon examining some of these systems, we found what was suspected all along: unauthorized data was being stored in these computers. And what do we mean by unauthorized data?

Data base effort

In the early 1970s, John Deere began a concentrated effort to define the data of the company and to gain control of its usage—we began getting into the data base effort. The philosophy was to standardize on the data being used within the company. If this data was the responsibility of a unit, and used only by a unit, then that data became part of a unit data base. If the

The Real Manufacturing World

is a Gulliver's nightmare where a minicomputer in manufacturing is restricting the move to new software on a bigger 168.



There are things that dp people should think about:

- Users are becoming sophisticated, computer "savvy" becoming widespread. Younger people are entering those departments, and most of them are trained in computing. Whether in finance or engineering, they have at least had FORTRAN, so they know something about computers.
- Small computers are coming in through the back door, as turnkey systems, as factory automation, and shop floor control systems. We've even had systems up and running before realizing there was a computer inside.
- Small computers can easily end up controlling the direction of the large corporate data center. We have an installation with twin 168s that cannot go to a new version of an operating system because some PDP-11s talk to those 370s. Legitimate IBM conventions, not supported in the newer software, are used in those conversations. These PDP-11s are controlling stacker cranes in a new factory, and we are not about to tell that factory management to shut down their stacker so that we can go to some new software. We'll just have to wait until the minis are replaced or until IBM gives us the features we need.
- Pressure your hardware vendors into acting on distributed computing trends with standardized products. Spend some time and explain your own environment to these people. You cannot assume your vendor knows what is going on in your shop. After you discover what is going on, explain it to him. Point out that there are other machines out there, and they will not go away. ❋

data was of corporate-wide interest, regardless of who had maintenance responsibility for it, then that data was considered part of a corporate data base. Since all data resided on IBM equipment, and the IMS data base management system was being used, the standard definition of data bases was in terms of IMS structures. At least that's what we *thought* was happening.

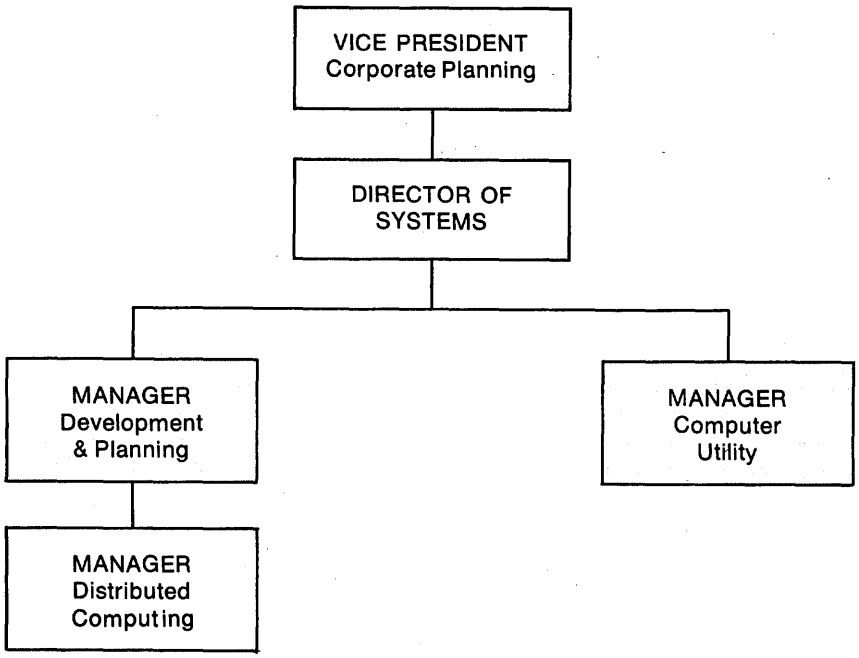
In reality, without the knowledge of Business Systems, data that fit the categories of both corporate and unit data was being stored and maintained on small non-Business Systems computers. Data structures were different, the access methods used in some cases were "home-grown," and most of the programming was in FORTRAN, a language not used by our Business Systems Dept. And some of the applications took only a few days to implement—after sitting in a request queue in the Business Systems Dept. for months!

Third survey results

Last spring, our third survey showed there now are 150 small computers in our company. Although some will be used for process control, not one of these will be used for only process control. In the past, many were simply process controllers. The average configuration also is much larger. No longer are they simple cpu configurations, but now include high speed printers, magnetics tapes, and large disc drives, as well as many terminals.

Many are part of larger automated manufacturing systems, such as computer-controlled stacker cranes and automatic conveyor systems. These are being used for additional business-like functions, as compared to simply control systems. At first, stacker systems were being installed with computer storage of parts location. Now, the newer stacker systems carry more complete parts files, and their programs are capable of making many production-type decisions independent of the larger host computer. We expect to see more automated systems going into our manufacturing facilities, and more of the traditional dp functions being moved onto these small computers. The equipment is there, so why not use it?

The move toward small computers with more functions is also beginning in our offices. Dumb terminals are being replaced with intelligent terminals, some with floppy discs. Interest is beginning in computer-based word processing systems, rather than the simpler magnetic card-type systems. All can be programmed to perform functions other than those for which they are being purchased.



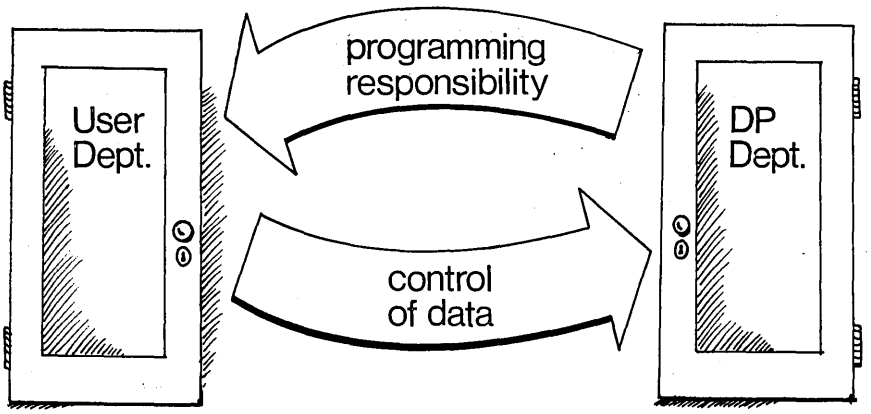
A simplified organization chart shows the position of distributed computing at John Deere.

Most small computer users are not interested in running dp installations. They are engineers, financial analysts, or marketing people. In many cases, they understand the additional responsibility they will be undertaking when they procure a computer; in many other cases they do not. We also find that most users understand the importance of corporate data. They realize that much of the data they might need resides on the central dp facility and is not available to them unless they are connected to the central site. The user is given the capability to do his own computing, but is restricted from manipulating data without the knowledge and coordination of the central site.

Long system development times, caused by data processing department overload, bureaucracy, and/or the ignorance of dp personnel of the user's problems, is probably the most common problem in data processing today. This is a chance for the dp manager to put the responsibility for system development on the user, the person who is closest to his problem. I no longer think it is true that the user is so unsophisticated as to not understand what his problem is. It is no longer necessary for the dp department to hold the user's hand.

Whether a given application should or should not be programmed will be the decision of the user manager. The amount of time the user department spends in programming is a management function within that department. The data processing department should furnish standards or guidelines to the user department, but I see little concern for policing the programming activity within that department.

The control of data that resides in the small computer is another matter. It is essential that all data deemed to be of corporate interest be controlled by a single group. This means software must be available to allow a small



Applications programming is performed by user departments, but data compatibility requires central control.

computer user to update a data item that resides in another computer, assuming this user is authorized to update this data. This facility must be transparent to the user.

Networking capabilities also must be available and transparent to the user. The user must be able to communicate with the central dp facility and, in some cases, to other small computers. This must be available through a simple, straightforward interface.

Nodal computers

Specifically, we see the need for a common interface between the small computer user and the computer utility. This can be implemented in the form of a network of what we call *nodal computers.*

It will be mandatory that all small computers be connected to the nodal computer, and further that the only communication path into the utility is through the nodal computer. This nodal network, consisting of the nodal computers and their associated communications network, should be under the control of a single software and operations staff, independent of the software and operations personnel responsible for the central computer utility. The reason for this is that the group responsible for the control and maintenance of the network must be oriented toward user satisfaction. The groups responsible for the control and maintenance of the computer utility, on the other hand, tend to be more interested in the efficiency of operation of the large computers, which is as it should be.

All software changes to the computer utility and the nodal network must be agreed to by both groups before these changes can be implemented. When changes in computer utility software will require changes to the nodal computer, it is the responsibility of the network control group to make these changes. It is felt that in this way we will be able to isolate the end user from the frequent software and hardware changes we experience on the utility.

The nodal computer will have data base management and communication functions. The data base function will include the storage of various portions of data bases and data dictionary capabilities so that, automatically, a nodal computer can determine the source of required data, whether it be on its files or on another remote node, or on the computer utility.

Communications functions on the nodal computer will include code and format translation between small computers and the network, and message switching between nodes, small computers, and the computer utility. It is through this interfacing software that we will protect the end user from software and hardware changes.

Introduction of data bases on the nodal computer does not imply that data bases can only be stored there. Small computers, attached to this computer, may carry portions of data bases stored on the nodal computer. Although we feel that the nodal computer must have a compatible data base management system with the computer utility, we would not expect this same rule to apply to small computers attached to the nodal computer.

What problems prevent us from implementing a distributed computing plan? First, the major computer hardware supplier for our shop does not have the software and hardware we need to implement it. If we must wait three to five years for a solution to this problem, we won't need the equipment when it does become available. The problem will have been solved. Departments throughout our company will have their own various makes of computers, each speaking to no one but themselves, and in various languages.

Certain interim steps could be taken to make a conversion possible at a future date.

Restrictions could be put on which small computer manufacturers are to be considered, although in the case of many turnkey systems, we have no choice on what computer is used. Additionally, if a standard minicomputer manufacturer were chosen, I can assure you that it would not be a manufacturer whose equipment is compatible with our computer utility equipment. Therefore, we know that there would be some problems in future conversions.

Second, we do not see *all* computing being transferred onto distributed computers. It is very hard to justify rewriting a large system now running on the computer utility. The first applications to appear on the distributed computers will be new applications. What are the tools needed by the user to implement some of these applications themselves? We do not know for sure at the present time.

Another problem in implementing distributed computing is the associated distributed data base problem. What data should be distributed . . . and where? We need to know the flow of data within our corporation, and in a large organization that can be quite complicated. We are just beginning to look at this problem.

I would suggest the establishment of a distributed computing function within a dp department, even for those who don't know what they would do with it. In our company, the distributed computing division acts as consultant for anyone in the corporation interested in looking at a small computer. We have had very good luck. Very few people who look at small computers in our company do it without our knowledge. They want us to help them. In general, they are not dp people, and even though many of us think they are trying to take our jobs, they are not. They just want to get their job done and are willing to accept help.

We support all systems software on all small computers, but have nothing to do with applications. We tell them that we are not interested in any portion of their application. We will not program it. In some cases, we have put together standards on development, as well as standards for hardware and software now within our company.

We also work as a vendor liaison with turnkey manufacturers. The turnkey vendor is still dealing with an engineer who knows a little bit about a computer but not too much. We work with the engineers, if that is who we are talking about, or with the financial analysts, in making sure that we get value received on a turnkey system and making sure we get the documentation. We also are working on educating non-dp users. The little computers are coming; they are coming in non-dp departments, and we think it is essential that the non-dp manager understand a little more about what he is getting into, such as project management and computer operations.

The next five years will obsolete many dp people who do not stay on top of this development. The ever-expanding variety of computing devices from which to choose, coupled with a multitude of methods of connecting these devices, will throw many of our comrades into Toffler's *Future Shock.* Distributed computing is for real. It is here. And we must start to control it now. ❁

Mr. Woods is manager of distributed computing for Deere and Co. His past experience includes planning for distributed networks as a consultant for the Banque Nationale de Paris in France. He also was an executive in a minicomputer corporation specializing in turnkey systems.

A Strategy for Manufacturing Automation

by Daniel S. Appleton

Development of an overall system structure for a manufacturing firm leads to automation using data base concepts.

In recent years, the computer has been making significant inroads to manufacturing. The gestation period has been much longer than it has in, say, banking or insurance. But manufacturing certainly hasn't been a dormant computer user. It has just been taking a less efficient approach than its industrial counterparts, and its results have been less dramatic.

Today, manufacturing finds itself with an interesting dilemma. It has high hopes for automation, but these hopes constantly seem to be dashed on the rocks of management apathy. Examples of this dilemma abound. Many manufacturing managers embrace concepts such as material requirements planning (MRP) but after continual efforts to implement this panacea end up thinking they've been dumped upon.

The root problem appears to be management apathy—not just for automation, but for systems in general, manual or automated. Few manufacturing managers have embraced systems management as a necessary element of the productivity equation on an equal status with financial and personnel mangement. Automation is still something that can be delegated to the ranks where, theoretically, it can best be put to use in solving intradepartmental problems of cost and overhead. Systems in general are not viewed by manufacturing management as the property of the company. Rather, they belong to department managers.

This basic attitude, regardless of its origin, has resulted in a dp environment typical of most manufacturing businesses. Following is a description of that environment, taken from an article describing the U.S. Air Force's ICAM project, a $75 million program to develop automated productivity aids in commercial manufacturing.

"The project was spawned, according to the people who spawned it, by manufacturing's tireless neglect of efficient manufacturing methodologies. For years, it seems, development in the use of the computer as an aid to manufacturing has been disjointed. 'Modular' would be the applicable term. Hardware and software systems have been designed, irrespective of one another, to address given problems on given days. The systems are myopic, rather limited-scope creations that suffice very well insofar as addressing a particular manufacturing function, but which never address their interrelationships with one another.

"System integration has been tried, but never with premeditation. Until now, it has been an after-the-fact phenomenon, which is why manufacturing efficiency has yet to receive any benefits from it: there aren't any. 'Afterthought' integration simply hasn't worked. And as if total failure wasn't enough, the methodology (non) has added to the woes of manufacturers. It has resulted in a proliferation of disjointed software/hardware and software/software matings that have in many ways tended to magnify problems."

Granted, this is a bleak picture, but in spite of its frankness, not all that misleading. What has been missing, and therefore presents the best opportunity for correcting the situation, is a basic understanding of the overall system structure of a manufacturing business, of the relationships between that structure and overall productivity, and of a fundamental, logical strategy for deciding what should be automated, when and how.

All the indicators point to a lack of management understanding that the workflow in a manufacturing company is actually managed not by a set of independent systems (such as purchasing, inventory, and bill of material), nor by several sets of integrated systems (such as MRP, accounting, shop floor control, and general accounting), but by *one logical overall system structure*. Without this basic understanding, it is impossible for management to perceive the total workflow as an additive (or contributory) process, with the natural result that it becomes, in practice, a regenerative process, and the price is paid in productivity, cost, overhead, quality, and schedule performance.

The critical factor in developing effective manufacturing systems is, therefore, the perception by management of the workflow as being controlled by one ubiquitous system structure, one that is additive in nature. This approach will not only lead to a system structure that promotes productivity, reduces cost and overhead, improves quality, and stimulates on-time production; it also leads to automation using data base concepts.

There are four stages in the data base approach, leading to the full integration of the administrative control structure and automated manufacturing technology. But not all companies will go through all the stages. This may best be understood by an explanation first of the manufacturing systems structure.

Job and process shops

It has lately become fashionable to classify manufacturing companies as those that build to order—referred to in the past as job shops—and those that build to inventory, formerly called process shops. Most manufacturing managers look upon job shops as companies that build to order and process shops as those that build to inventory. And they see significant differences between the two.

A company that builds to inventory also sells a standard product, usually in high volume, to a generalized market. In the standard product environment, production management is oriented around parts, as opposed to customer orders, and productivity is controlled through the processes used for the production of parts inventories. Engineering, manufacturing, purchasing, inventory control, cost control, and marketing are performed either prior to or in *parallel* with customer order servicing. Production lead times are generally short, and individual orders are rarely given specialized attention in the manufacturing process.

On the other hand, job shops generally sell customized products to a selective marketplace. Production management, including engineering, purchasing, manufacturing, inventory control, and cost control all are geared to the requirements of specific customer orders, and they are performed

in *series* with order servicing. Production lead times are usually extensive, and each order is given specialized attention.

The two extremes can be contrasted in even more detail. Job shops usually carry large work-in-process inventories that turn slowly, while their finished goods inventories are very small. On the other hand, process shops produce large finished good inventories that turn quickly, and their work-in-process inventories are usually small. In the build-to-order company, direct product costs per unit are generally high and margins large in contrast to the build-to-inventory companies which depend on volume to keep unit direct product costs low and margins tight.

In light of these contrasts, it is popular to draw the conclusion that companies that build to inventory are, from the management standpoint, completely different from job shops, and that their system structures, organization structures, and financial structures are as different as night and day. As a result of these fundamental, almost metaphysical, differences, many managers feel that management principles and practices must be incompatible between the two extremes. However, it is interesting to note that very few manufacturing operations are either constant or "pure" in their production orientation. Most are hybrid manufacturers with a constantly shifting mix of build-to-order and build-to-inventory problems, the ratio of mix tending to cause the company to lean more one way than the other.

The manufacturing systems structure

The system structure in a predominately build-to-order business is shown in Fig. 1. The right side of the diagram describes the basic production functions needed to manage productivity. The left side shows the accounting functions, including cost accounting (lower left) and general accounting (upper left). Even though the accounting functions are primarily "scorekeeping" in nature, their basic configuration is dependent on the control characteristics of the production functions, which are the primary source of the data used in the accounting systems.

In the pure job shop, few, if any, production activities are initiated until an order is actually booked. Once the order is firm, the activities necessary to define the order are started. These activities include master scheduling (estimates and lead times being derived from past experience on "similar" orders) and the scheduling of order-related administrative tasks, such as design engineering and quality assurance.

Since a viable bill of material does not exist, and accordingly the "part configuration" of the order is not known in sufficient detail to start the downstream production activities like industrial engineering, purchasing, and shop loading, all of the initial production functions are controlled by order. These activities can take anywhere from 10% to 75% of the total flow-through time of the order—the time from order receipt to shipment.

Downstream production activities are initiated based on the release of product specifications and order bills of material. The timing and sequence of this release has a tremendous impact on downstream productivity because downstream activities are geared to react to the release by initiating their own work, being unable, in most cases, to anticipate the engineering activities.

This modus operandi reflects two of the major productivity draining problems of the build-to-order company. Most obvious is the inefficiency of performing production functions in series with each other. This problem creates longer flow-through times and lower inventory turns. The second problem stems from the fact that all production functions are controlled by orders. Since each order is treated as though it had different requirements and different schedules, there exists a natural barrier to identifying activities common to several orders and grouping them so they can be performed at minimum cost.

From a management systems standpoint, these two problems are at the heart of the productivity question. The solutions to them are the key to productivity improvement: first, perform as many production activities as possible in parallel; second, identify as many of the similarities among orders as can be identified, and perform the required activities with maximum efficiency and minimum cost.

Fig. 2 shows the system structure of a build-to-inventory company. In this environment, not only has the engineering been completed before the order was booked, but also all industrial engineering and logistics planning. The major problem is to assure that material and manufacturing supply is coordinated properly with the demand for finished goods inventory. This demand is established on either an order forecast or a firm backlog, or a combination of both, but none of the downstream production activities is geared to satisfy specific orders. Instead, they are oriented toward the requirements to produce specific parts and assem-

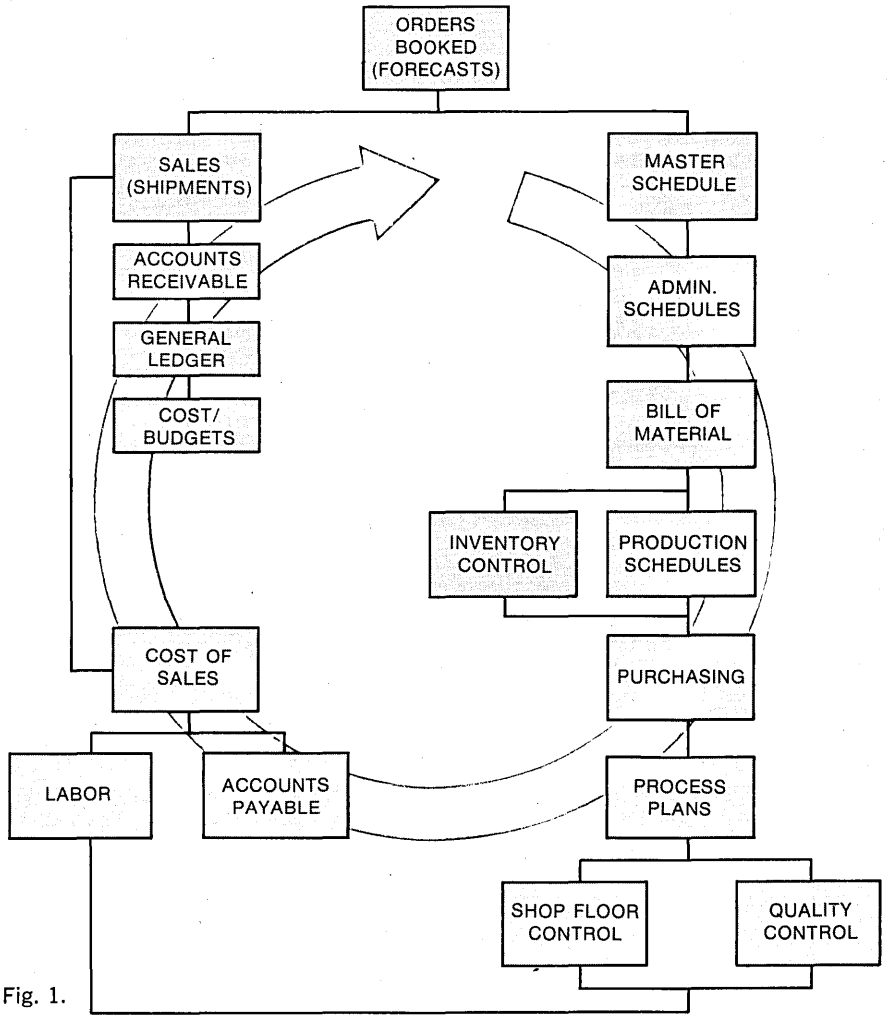


Fig. 1.

blies of parts in quantities and to schedules set by the needs of the finished goods inventory. Unlike the system structure in a build-to-order company, production functions in a process shop need not—in fact, should not—ever recognize the existence of a specific customer order, nor should the existence of special order requirements ever influence the scheduling or priorities of activities performed by production operations.

This is the most basic contrast between the job shop and process shop system structures. When downstream production systems recognize the existence of specific customer orders, and when schedule controls and priority controls respond to this recognition, productivity is sacrificed. The uniqueness of each customer order tends to create an extremely complicated management problem that not only increases unit costs and slows flow-through time and inventory turnover, but also creates manufacturing overhead needed just to keep control of a problem continually growing in complexity as the company (and backlog) grows. The problem is further aggravated by the dynamic scheduling and priority problems that result from customer influence on production activities. Since one reschedule begets another reschedule until the problem becomes one of managing reschedules, the job shop will tend to become dependent on flexibility as a primary management theme. It will, as a result, attempt to build consistency, redundancy, and discipline out of its system structure, and lean on individual workers and managers who "know how to build the product and get it out the door." The larger the job shop, the more of these people are needed and the more they compete with each other for a fixed set of resources. With everyone expediting customer orders, information needs become oriented toward order status and control, and the information within the system structure becomes oriented almost totally toward customer orders. The net result is that efficient use of production assets takes a back seat to the primary objective of shipping customer orders.

Since very few companies operate at these extremes, very few consistently experience one or the other sets of problems. As a result, most experience all of these problems in some form or other. This means that their system structures must accommodate both the order and part control philosophies. If this were not complicated enough, most companies are constantly shifting their postion because of market dynamics, the economy, management strategies, etc. This means that the control requirements of the system structure also are in constant change.

It is against this backdrop that manufacturing enters the arena of data processing. Many managers no doubt hope that the discipline required by computers will in some way stabilize or simplify these problems, or at least it will help them manage their increasingly dynamic environment. This hope is clearly reflected in the approach they use to introduce computers.

The traditional approach (sometimes referred to as the applications approach) is to focus attention on the specific information requirements of specific people in specific departments at specific points in time. Thus, the purchasing manager or the accounts payable manager or the production control manager will establish a need for computer support, define that need in terms of the specific computer reports he would like to have (now), and contact the data processing department. In doing so, he is forced to draw artificial boundaries around his "system" and to freeze in time his information requirements. If he does not do these things, the odds in favor of successful automation, on schedule and on budget, are almost nonexistent.

From the perspective of the "system structure" this approach is, almost by definition, self-defeating. Since all applications cannot be developed simultaneously, and since the product demands (and therefore the demands for information) are constantly changing, it is impossible for computer systems developed using the traditional approach ever to be synchronized. Even if they could, they would be optimally effective only when all of the variables assumed values used in the original design. Such an occurrence would have astrological significance.

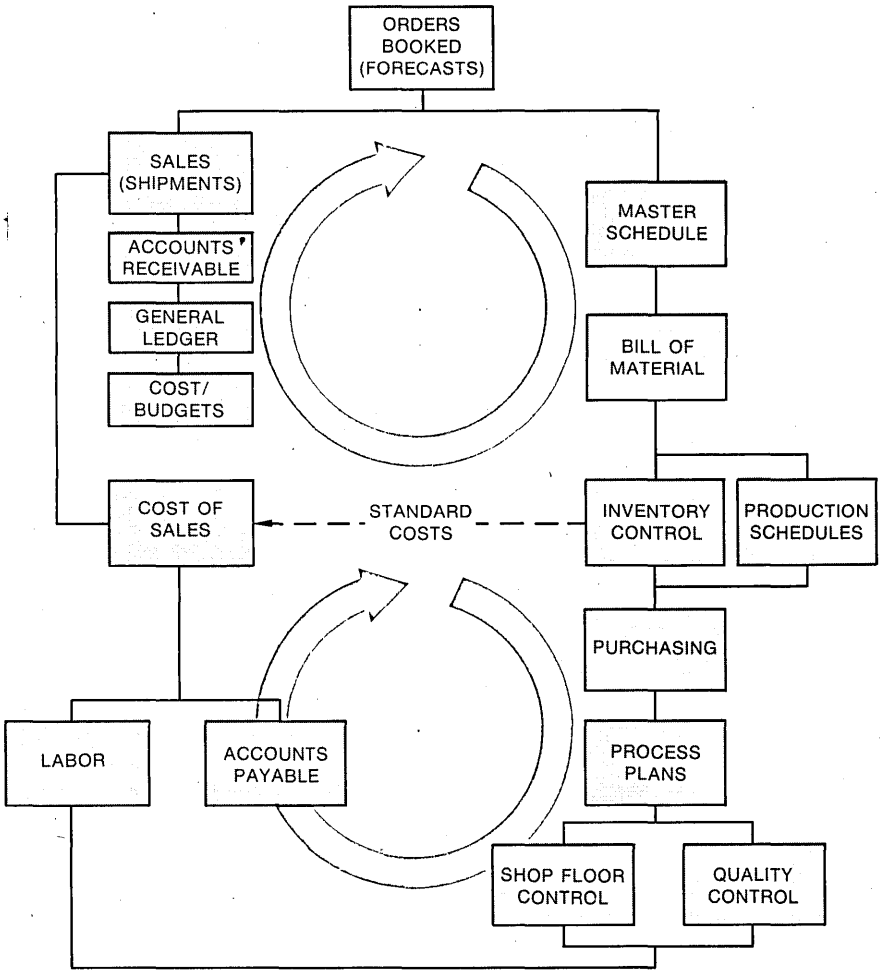


Fig. 2

Data base approach

The alternative to the traditional approach to automation of manufacturing systems is the data base approach. Manufacturing lends itself to data base better than any other type of business. This is precisely because the manufacturing system structure is one continuous additive process. Data base is the only approach that recognizes this situation and at the same time allows the flexibility needed so that the control mix (reflected in the needs for information) can shift in consonance with management premeditation and market capriciousness.

Data base is a philosophy that expunges the traditional, disjointed, 'modular' concept of automation. This is because it forces management and data processing to view the total system structure at its lowest common denominator—the data element. At the data element level, all manufacturing companies look pretty much the same. The major variations from company to company occur because of different reporting requirements. Managers in process shops ask questions significantly different from those asked by their counterparts in job shops. Their decision problems are different. But managers in both of these operations use basically the same data. In short, from a data base standpoint, manufacturing companies look different primarily because management's information demands are different, not because companies use different data.

Using data base technology, the system structure is divided into three fundamental pieces—rather than *n* pieces, one for each special computer application. The first piece is called the data base. Very simply, the data base is a collection of data elements organized with some kind of structure. These data elements are the vocabulary of the business, the words managers use to ask questions, understand answers, and make decisions. The data base structure reflects the system structure of the business, not the organization or financial structure. Accordingly, it reflects the customer order or part orientation of the system structure in its pure or hybrid form. In a pure job shop, the data base would be structured around customer orders. Data would be organized and stored for each order. In the process shop, the data base structure would be geared to parts. The second critical piece of system structure is what could be called the "input control system." This piece is intended to control the values ascribed to each data element, and is generally geared to organization structure. Common sense tells us that organization responsibilities and functions can change independent of vocabulary, so there is no reason why the data base and the input control system should be completely dependent on one another. In fact, complete dependence, as is created by the application's approach, is extremely dangerous. The final piece is what could be called the output control system. The form this piece takes is not similar to either the data base or the input control system because output demands are constantly changing, while the data base and the input control system are relatively stable. The output control system must be designed as a dynamic system and responsiveness to all sorts of inquiries is mandatory. The flexibility of this piece of the automated system structure is critical to the survivability of the whole. The failure of the applications approach in this area is probably the single most destructive factor in the traditional environment.

Using the data base approach, manufacturers can gain control over the evolution of their system structures and direct that evolution toward objectives of productivity improvement. The key, of course, is to concentrate on the data base structure and content, developing specific, long range plans for improving it. These data base improvement plans should be geared to coincide with plans to improve what could be referred to as the company's level of management technology, which might be another way of describing the level of sophistication of management itself.

For many reasons, perhaps the most important being the correlation between asset management and customer satisfaction, the concepts of process control are the most sophisticated and productive in today's environment. The objective of any manufacturer should, therefore, be to move as far as practical in his environment toward the ideal of the pure process shop. This objective is not unrealistic for even the most stubborn job shops because everyone can do better than they are today.

For purposes of clarity, this evolutionary process can be pictured as occurring in four basic stages:

Job Management
Product Definition
Part Management
CAD/CAM

The four stages reflect the maturation of any manufacturing business, from startup to the highest level of productivity. They are not independent of one another (see Fig. 3). Each must be established on the foundation of its predecessor. Poor development of one stage will hinder effective development of its successor. However, not all companies proceed through all stages, and their migration from one stage to the next could cover several years. The real issues are: 1) at what stage should a company in a given market really be, and 2) how effectively is it operating at its present level? Management must answer those questions.

The first stage of development is job management. This stage is characteristic of build-to-order companies. In it, the system structure is oriented toward management by customer order. Basic controls over purchasing, engineering, manufacturing, and other production activities are exercised by order, and cost and inventory controls are order-oriented and weak. The system structure is flexible and geared to reschedule management; overhead is high and redundancy is low. Part management controls are weak and subservient to order dynamics. Standard production activities are treated by the system structure as exceptions to normal pro-

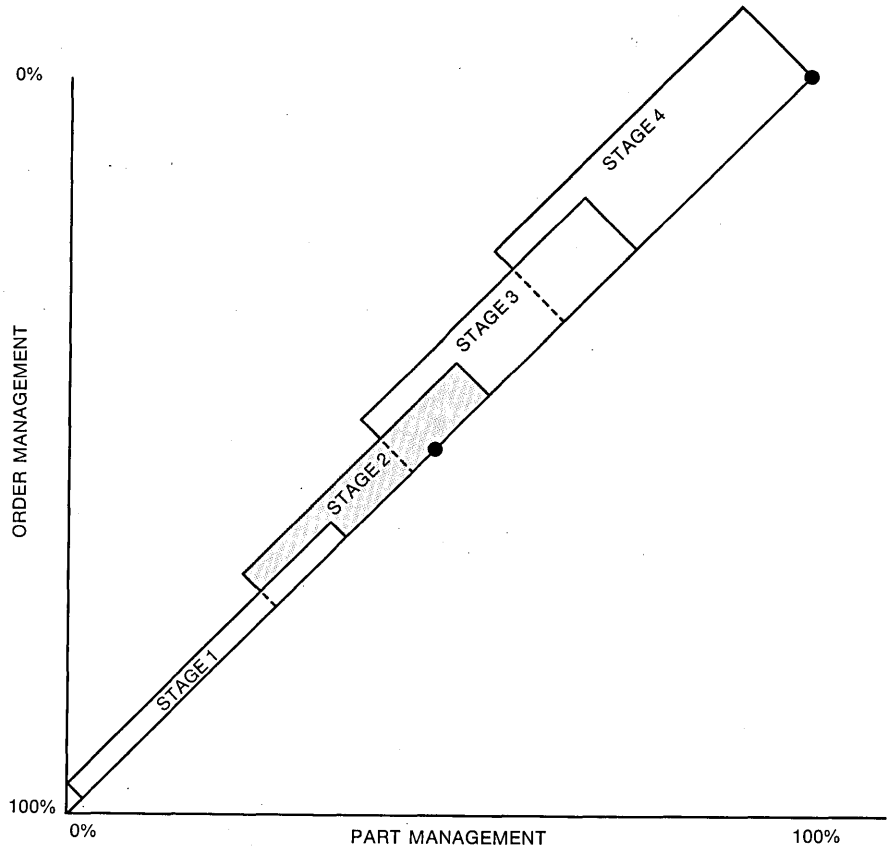


Fig. 3

cedures and are forced to absorb high overhead generated by controls needed to keep track of special production activities.

Though in the overall concept of the system structure this stage is the least efficient, much can be done to improve its productivity. The data base should be geared to reactive management, providing data on current overall order status and impact analysis for schedule and priority changes. Strong controls are needed upstream of the actual manufacturing activities—the shop. In fact, in this environment the shop's impact on overall productivity is so negligible that it can be treated as a "black box," with the basic system structure (and the majority of data elements in the data base) concentrated for decision efficiency on functions upstream of actual shop activities. Stage two, production definition, is absolutely critical if a company is to move out of the basic job shop operating mode. It is critical as organizations begin to seek higher productivity by standardizing product lines or portions of their still basically nonstandard products. Without moving to Stage two, job shops run a terrible risk when they begin product standardization. A Stage one system structure will naturally counteract standard production efficiencies in every production phase, be it engineering, purchasing, industrial engineering, manufacturing, or whatever, because it will treat standard production requirements as special, and it will give them secondary priority just because their priorities are *not* specifically related to customer orders, while the bulk of the other work is.

Stage two involves the initital development of part controls (and therefore a refinement and restructure of part-type data in the data base) and extension of these controls throughout the system structure. Its basic objective is to define the products not as new designs, as in Stage one, but as variations on the current designs of basic parts manufactured by the company. Until this logic of "variations to" replaces the Stage one logic of "development from," Stage two cannot be completed. Migration from Stage one through Stage two then, becomes a problem of reducing the number and degrees of variation within the constraints allowed by the market.

One of the most important steps toward implementation of a Stage two work structure is the concept of "group technology," especially group technology based on part geometries. Effective use of a part classification system will provide the visibility and control over product variations needed to make the psychological switch to variation management in all production phases, including engineering, purchasing, industrial engineering, manufacturing, accounting, and marketing. The implementation of group technology may not go so far as to create manufacturing work cells—if it does, so much the better—but it will provide the controls necessary to streamline interdepartmental activities. The most effective, and least utilized, foundation on which these controls can be built is part geometry, the fundamental common denominator of the manufacturing business. The bulk of the demand for manufacturing resources (labor, material, machines, money, buildings, and land) is based on part geometries. Variations in that demand are created by material and quality requirements.

The keys to Stage two are: 1) the development of part identifications so variations can be tracked and eventually managed, and 2) the development of finished goods inventory controls to take over production management of those parts with the fewest variations. As the variations are reduced, the management problem begins to shift from the order management aspects of the system structure to the inventory management aspects, which are, of course, geared to parts and homogeneous processes, rather than activities performed specially for a customer order.

The development of a Stage two system structure is necessary when a company develops standard production requirements that it intends will have some real effect on its performance; but a Stage two system structure is not strong enough to support a production environment in which more than 50% of the product or product mix is standard. Once this basic shift takes place, the order management philosophy must give way to the part management philosophy. Special production requirements must become exceptions to the norm, taking a back seat to resource demands of inventory controls. This shift makes it necessary that the system structure be developed to Stage three, part management.

Lately, the Stage three system structure has been given a new name: material requirements planning (MRP). The dominant controls in an MRP environment are oriented to parts and processes, not to customer orders and functions. An MRP-based system structure cannot effectively function in an environment in which schedules and

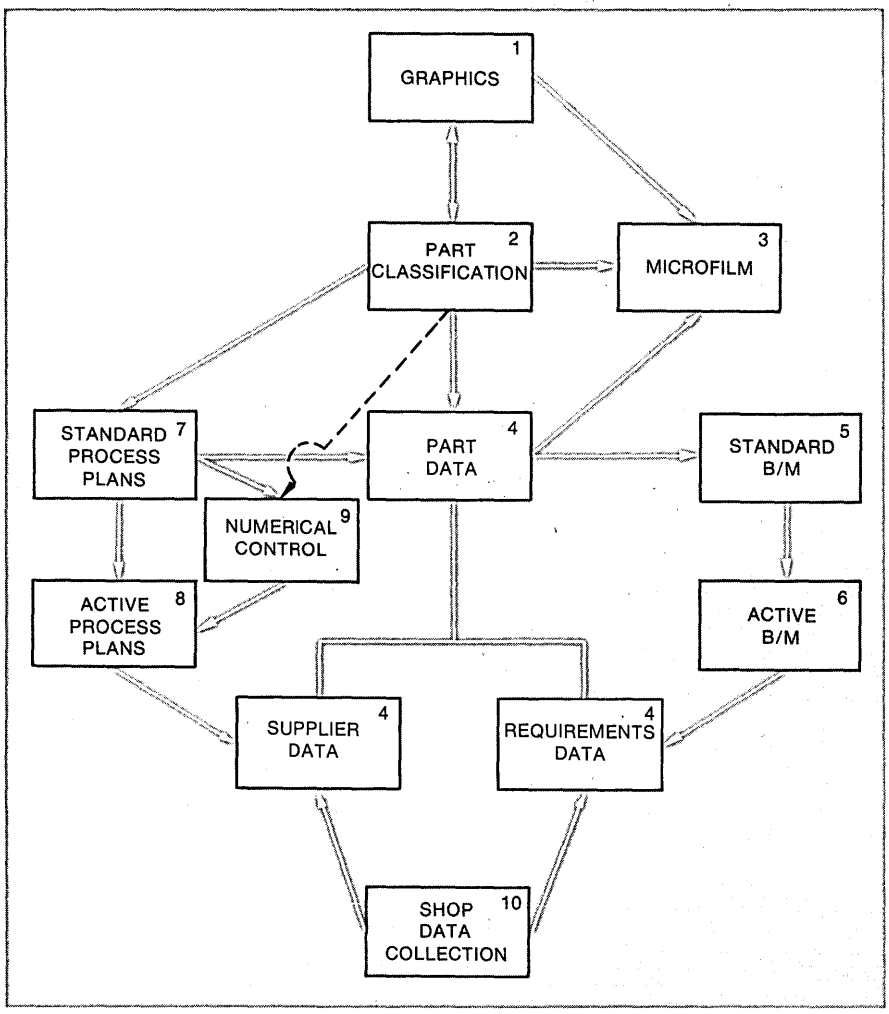


Fig. 4

priorities are managed by order, because the concept of MRP is underpinned by requirements for consistency, predictability, discipline, and, most of all, accurate timely feedback, all of which are in short supply in a Stage one system structure and only in their adolescence in Stage two.

Many companies get into trouble trying to implement a Stage three system structure, full MRP, because their products or product mix are not sufficiently standardized. Emotional arguments to the contrary, the degree of successful MRP-ization bears a direct relationship to the degree of product standardization: the higher the standard content of the product, the more successful MRP will be.

Companies should be well aware that by attempting MRP they are really attempting to upgrade their system structure to Stage three, and as a result must already have the critical Stage two (product definition) controls in place. This is critical regardless of how standard the product is.

Properly developed Stage three system structures will provide significant improvements in productivity over Stage one or two. But an effective Stage three system structure is not the last word in productivity. There is a Stage four, which can be referred to as the CAD/CAM (Computer Aided Design/Computer Aided Manufacture) stage. This is not to say that the previous stages are completely free of CAD/CAM technology such as numerical control or automated drafting; indeed, some of this technology will no doubt be present in all stages. The difference in Stage four is that there is full integration between the automated administrative control structure and CAD/CAM technology. Fig. 4 describes, at the conceptual level, what this integration might look like, the white boxes showing the basic components of the Stage three inventory control (part) data base module.

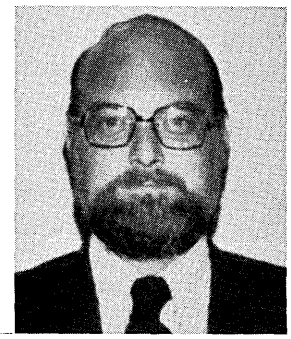
The key to successful Stage four integration is data describing part geometries (established in Stage two). This data is needed not only to control the CAD/CAM functions, properly linking them with the administrative control structure, but also to provide a basis on which to analyze the true relationships between parts and manufacturing resources. Effective integration at this level and in this way will provide the maximum productivity and the maximum cost control.

In addition to the organization and financial structures of businesses is a third, the "system structure," which is in many ways more important to the overall health and well-being of the business. Management must develop its awareness of this structure and move to improve its skill and ability to manage and manipulate it.

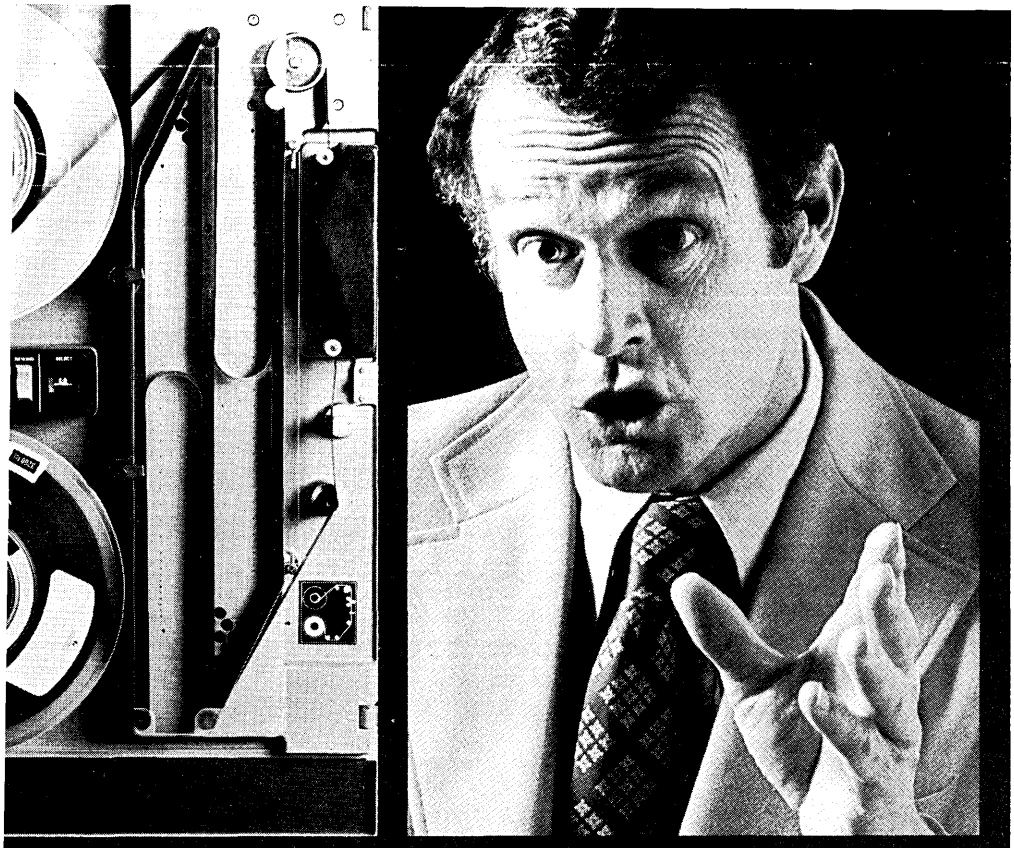
The first step is to accept responsibility for it. The second is to deal with the system structure as a whole, rather than as a set of individual pieces called systems. The third and final step is to approach the system structure with the attitude that it belongs to the company, not to individual managers, and, accordingly, that it must be developed to provide the maximum benefit in terms of specific, well-defined company objectives in productivity, morale, and overall asset management.

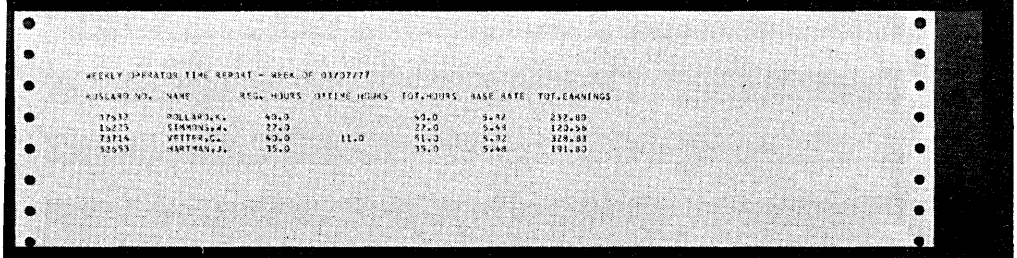
From a data processing standpoint, the system structure looks much different from the organization structure. Management must understand this, even to the point of encouraging this difference. To do so, it must eschew the applications approach—which encourages a direct correlation between the two—and promote the data base approach. From the data base perspective, then, it can begin to control the evolution of management technology through what has been pictured as four stages of development leading toward the highest levels of productivity, found in the environment of process management.

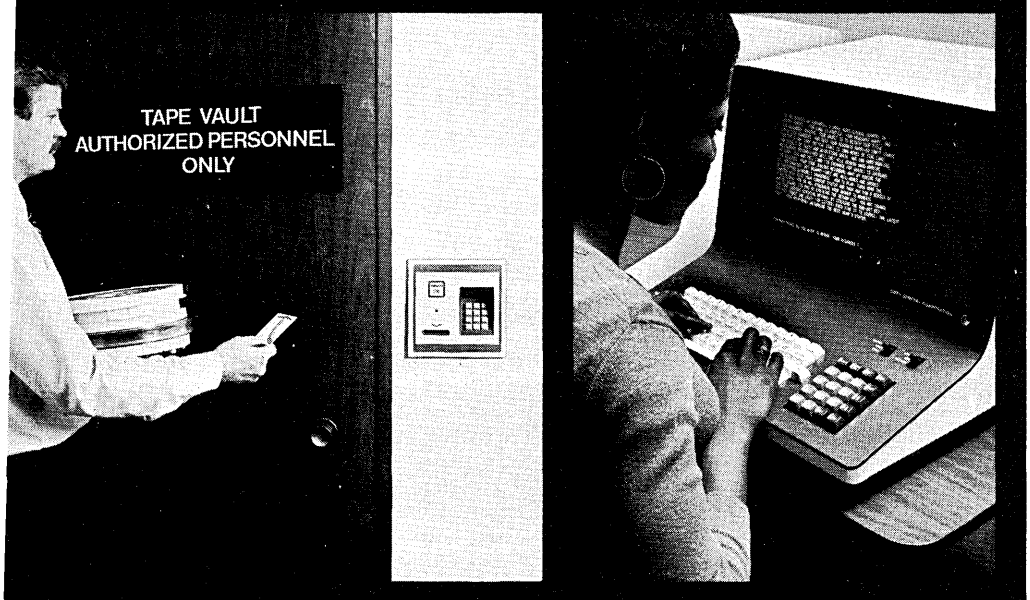
Management cannot expect to achieve long-term increases in productivity without developing the system structure. Nor can it expect to establish a viable system structure by delegating responsibility for its health and well-being to individual managers. Organizational management, financial management, and systems management can be delegated, but the responsibility for overall integrity for any of these structures cannot. ❋

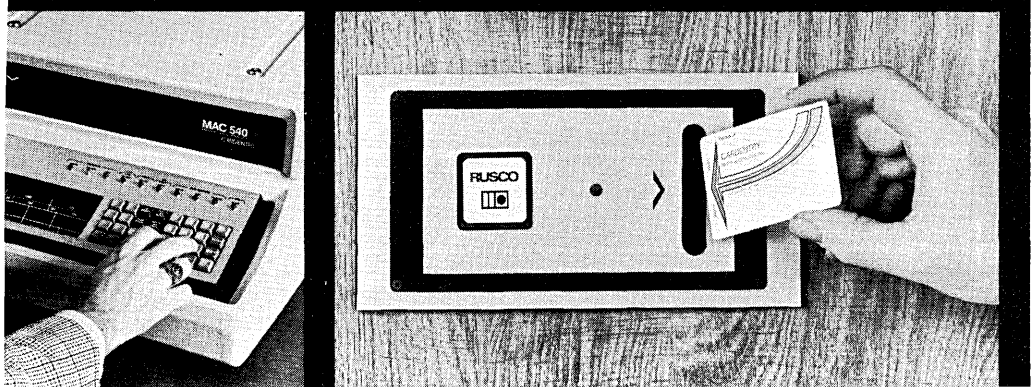


Mr. Appleton is director of management information systems for the Byron Jackson Pump Div. of Borg Warner Corp. He previously was manager of systems development for Litton Shop Systems, served other organizations as a manufacturing systems consultant, and was an operations research analyst for the Assistant Secretary of Defense.









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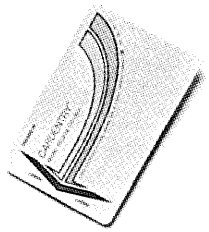

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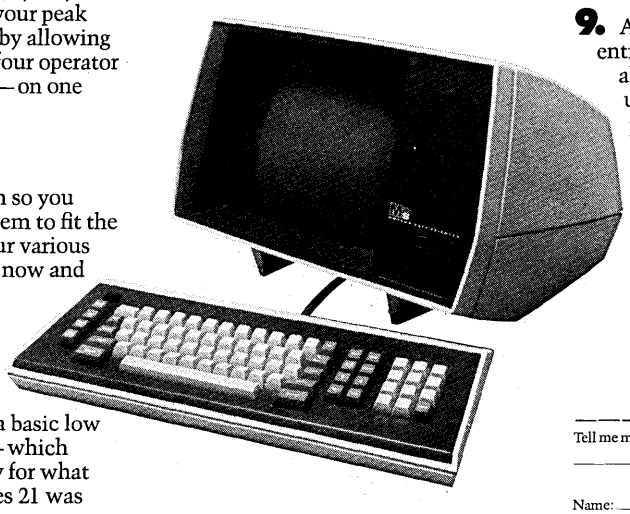

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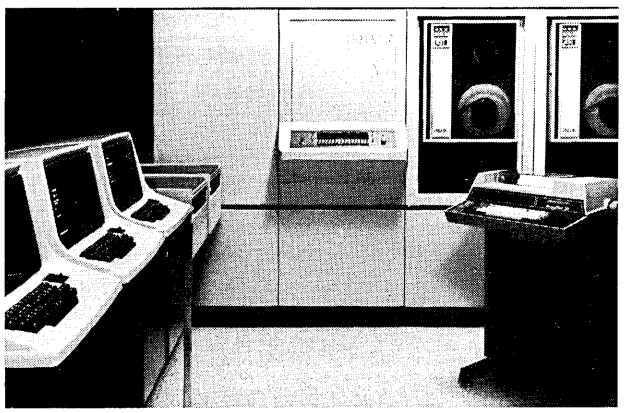

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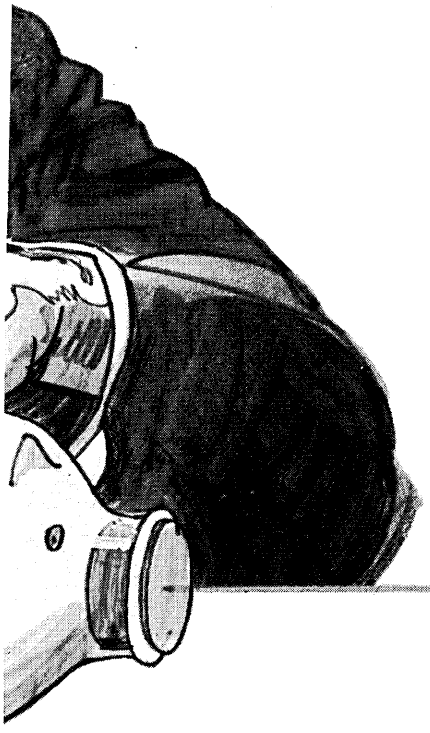

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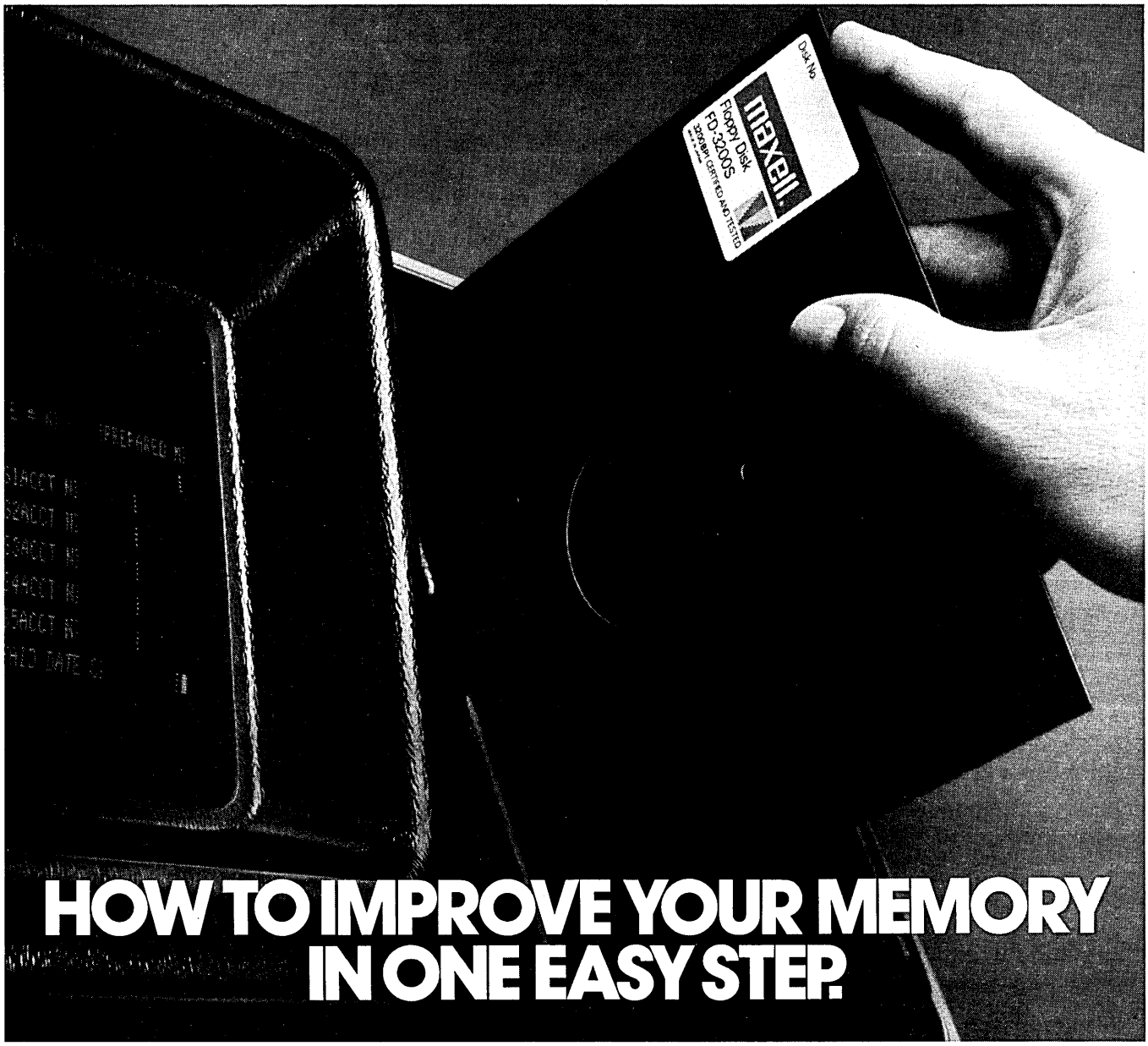

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Software Managers Speak Out

by William A. Delaney

Lack of a career path and inadequate tools for managing large software projects are among the concerns of chief programmers.

What are the problems and attitudes of senior software management?

A survey of 100 computer programming department managers, all with the title "chief programmer" and working with large organizations, attempted to find out. Response was 32%, not a scientifically reliable sampling, but there was a consistency of answers that presented an interesting pattern.

Respondents generally agreed that costs of major systems projects are split 60% software and 40% hardware. They projected that five to 10 years from now the software costs will rise to 80%. Ten to 15 years ago the mix was 10% software and 90% hardware. This trend would indicate that within the next few years chief engineers, senior project managers, and comptrollers, for example, will be coming from the software ranks, rather than from more traditional fields such as engineering, legal, or financial. The day could be coming when analysts and senior programmers will be able to rise further in their organizations and beyond the confines of their own departments.

And a question asked to find out if software managers are climbing in the corporate structure drew answers indicating they are. In five replies respondents listed themselves as number one in their dp organizations. The question, in this case, was: "How many levels from the top in your organization does the senior software person stand?" The number expressed most often was three. Answers varied from one to four.

In seeming contradiction were answers to the question: "In your organization, can a person who writes software ever reasonably expect promotion to a top position (i.e., chief engineer, controller, v.p., general manager)?" 96% said no.

But, if these managers feel their chances of being promoted out of their organizations are slim, answers to another question indicated they'd like this situation to change. Asked: "Do you want to be promoted, eventually, to a higher position in management in which you will no longer be directly involved in software development," 73% said yes. So, it would seem, many of these managers are frustrated, and this could lead to sudden departures of good people if top management fails to open up channels for further advancement.

Educated group

The respondents were an experienced and educated group with an average of 15 years experience in software development, nine in management, and with 86% holding college degrees. However, only 38% said their college studies related directly to their jobs.

An 82% majority indicated they had received no training for a very important part of their jobs, cost estimating for software. And 91% of the respondents make software cost estimates and schedules for their organizations. It thus would appear that without formal training in cost estimating, these people are more or less on their own as to how they do it.

Software cost estimates are based on 6 to 21 lines of code per day.

The question was asked: "If you had to give numbers for your best estimate of checked out instructions per day averaged over the life cycle of a typical software project, what would they be?" This was intended to get a collective opinion of what managers use for planning costs of programs after they have a good idea of the size of the job. Average answers, for a higher order language, were 21 instructions per day; for machine language, eight instructions per day; and for real-time software, six instructions per day.

Instructions-per-day averaging is by no means the only method for planning costs, but it is better than nothing. Surprising was the fact that 10 managers either replied that they didn't know what a good average is or that there is no way of determining it.

Answers to another question indicate that the majority of software projects overrun original cost estimates by up to 50%. Lack of initial planning was most often cited as the primary cause.

Estimates accepted

The responding managers indicated that 73% of the time their original cost estimates are accepted, plus or minus 10%. Most indicated that their companies do have formal estimating and costing procedures. Obviously, however, more accurate cost estimating methods are needed. In most cases, respondents indicated they get a second opinion when they make their estimates, which is all to the good. But still, overruns and delays continue to plague most large software projects.

Answers to another question indicate the jobs that respondents are called into are poorly or incompletely defined at the time they are called in. This seems proper. As managers they should be invited in to help define the jobs and set up budgets and schedules before someone less qualified does it. A high percentage of respondents (68%) said they are called in in time to have their say, which would seem to refute the chronic complaint about software

managers being called in too late to prevent problems.

To the question: "What type of software do you develop most often?" the breakdown was 63% business or commercial and 37% scientific or engineering. There are those who say the software for these two areas is so basically different that they should be considered as separate functions. These responses reveal no such basic difference, so the reasoning used in many companies to keep business and scientific software departments separate would seem to be redundant and wasteful. One well-managed centralized software group should be able to handle both.

Survey respondents generally indicated that poorly defined initial requirements, and the resultant charges, cause them the most problems. The urge to press forward into premature coding is natural, but it can be counterproductive without a good analysis and design plan before coding starts. Also, there is a tendency for customers or clients to think that no real work is getting done unless they see people coding or debugging. Managers should resist the urge or the customer pressure

"Managers should resist the urge to start coding too early."

to start coding too early. The results are program changes later on that often are far more costly in time and effort than completing analysis and design of the programs or modules at the beginning.

Bosses understand

Managers surveyed indicated they feel their superiors do understand the nature of the software development process and that they generally are consulted in advance about software projects. Both indications reflect a change from the recent past when the chronic programming manager's complaint was that his boss had no understanding or appreciation of software.

But responses to another question indicate that most of the programming managers feel their management does not give proper consideration to software during the planning stage. So, it would seem, their bosses understand what they do, consult them in advance, and then tend not to follow the advice received. Progress is not always evenly paced.

When asked to break down the entire software development process into internal phases, the managers were extremely consistent in their answers. The breakdown was 40% analysis and design; 20% coding; 30% checkout; and 10% documentation.

The much-debated question of whether programmers are professionals was asked, 73% voting yes and 27% no. Professionals or not, programmers apparently are not the "high priced gypsies" they often have been accused of being. Asked: "Does your software staff tend to remain stable (four or more years on the job) or to move periodically to other jobs?" 95% of the managers said stable.

Answering another question about their staffs, 87% of the managers said few of their staffers pay much attention to the overall business or profit aspects of what they do, tending to focus only on the technical aspect of their jobs. This may well be one reason why few move up and out of the group they are in into higher level management positions.

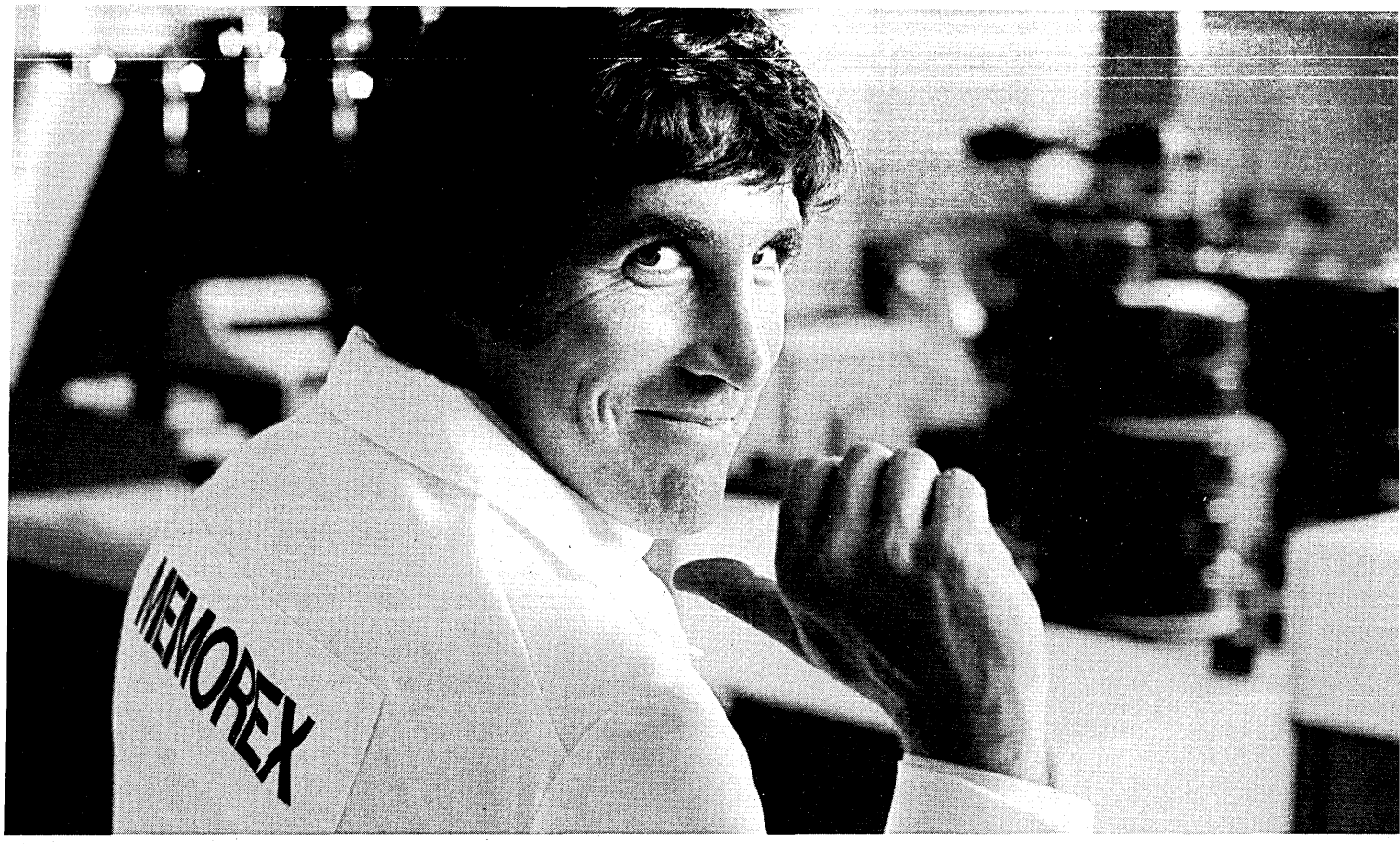
Hard to find

Respondents generally agreed that qualified people are hard to find. They tend to favor personal referrals as the best recruitment method. Most said their companies have some sort of training courses or provisions for on-the-job training.

What motivates programming managers? Most respondents state personal satisfaction as their primary reason for working. Money ranked second; recognition and appreciation, third; contribution to others, fourth; and good working conditions, fifth.

The question on which the small sampling of programming managers seemed most divided was: "Do you consider programming to be a science or an art form or craft." Responses were 64% for science and 36% art form or craft. So, even among those who practice it, the nature of programming is still an open question. ❋

Mr. Delaney is president of Analysis and Computer Systems Inc., a Burlington, Mass., software-related company. A mathematician and programmer/analyst by background, he has been associated with RCA, Raytheon, and various military agencies.



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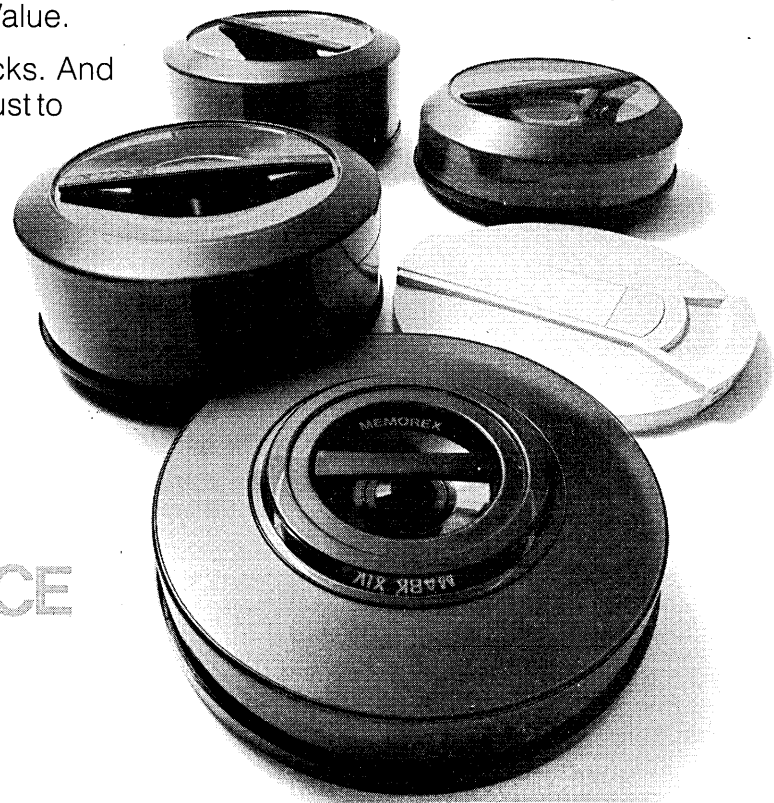

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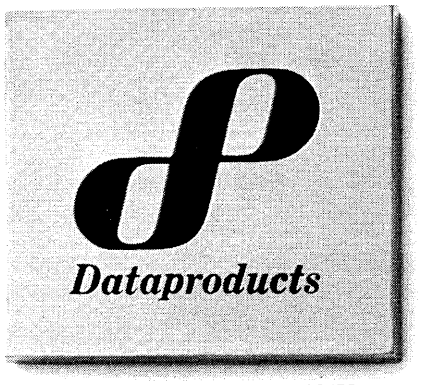

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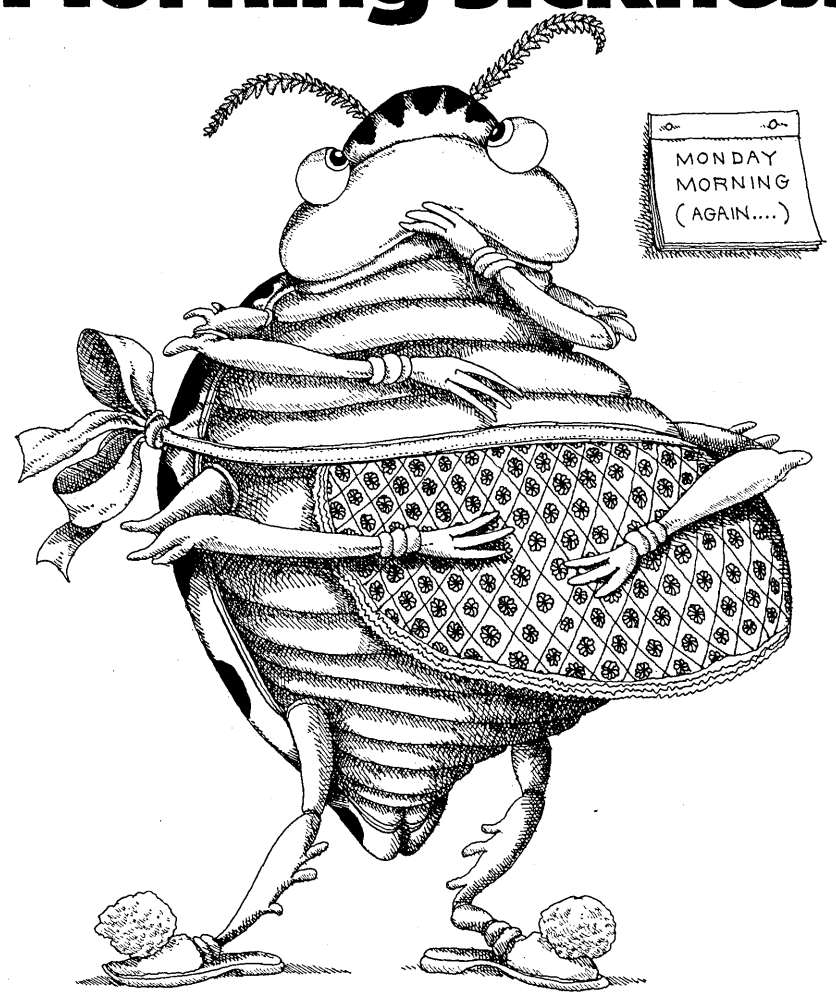
The Morning Sickness Bug.



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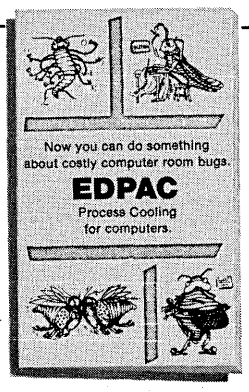

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Handling Personal Data

by Willis H. Ware

Keepers of personal data files are being subjected to social pressures, even as new recordkeeping procedures are urged in the final "Personal Privacy" report to President Carter.

The present concern over privacy arises from the interplay between modern recordkeeping technology, made possible largely by computer-based systems and telecommunications, and the needs of society for information—needed to function efficiently, or even at all, and to comply with various government legislative regulations.

Recordkeeping, however, is not a new phenomenon; it has always existed. At one time, decision-making concerning an individual was a face-to-face matter that used a record frequently jotted down as one watched. Moreover, it tended to be restricted to local use, to be stored within the organization that the individual did business with, and little shared with others. Record systems were generally known to the individual and visible. But all of this is very different in the modern world.

Each of us unavoidably lives in an "information society" in which it is virtually impossible to avoid relationships with recordkeeping organizations without foregoing such necessary things as credit, insurance, medical care, education, and employment. The situation has arisen in part because society is large and mobile, in part because of a complex and affluent life style, in part because we have a service-oriented culture. Thus the small, visible, and local record system of yesterday has been replaced by some that are frequently invisible, that transmit information nationwide, exchange it freely with other record systems, and maintain a very current data base on a huge number of individuals. The elaborate recordkeeping mechanisms of today have become a substitute for face-to-face decision-making; they mediate decisions about people that are often made without human intervention.

A modern day recordkeeping system is like a gate in the sense that it very positively controls whether an individual can have access to some desired benefit, privilege, right, or opportunity; in a very real way it controls the interface between an individual and the many things that society offers him. Underlying contemporary recordkeeping processes is the enormous technological component based largely on computer and telecommunications technology. The two together make possible the record systems that surround each of us, and in that sense they are the dominant driving force behind privacy questions. As professionals involved in such technology, we therefore must be involved and responsive.

Historically, a few computer people first sounded warnings in the late '60s. Several books appeared and, in 1971, the Fair Credit Reporting Act became the first legislative action. Next came the well-known Secretary's Special Advisory Committee on Automated Personal Data Systems and its seminal report, *Records, Computers, and the Rights of Citizens,** which provided the intellectual basis for the Federal Privacy Act of 1974. The Act throws a broad blanket of institutional and recordkeeping behavior over federal agencies, and extends certain rights to each individual to interact with records kept about him.

The Act also created the Privacy Protection Study Commission, which after a two-year study recently delivered its published final report. And it is the study that prompts these remarks.

The report of the HEW committee spoke generally of rights for the individual and desired behavior of recordkeeping systems. It suggested that citizen and recordkeeper had a mutual interest in properly kept records; it introduced the concept of a code of Fair Information Practices. At the time privacy was seen as a matter between an individual and records that concerned him.

Gradually the issue has broadened and become better grounded; privacy is now discussed in terms of openness of recordkeeping instead of behavior of individual systems, in terms of fairness in recordkeeping instead of abuse of information or harm to the individual, in terms of an individual's expectations of confidentiality instead of a simple right to control, and in terms of social expectations rather than individual rights. The commission, building on the work of the HEW committee, on existing legislative efforts, and on public testimony, has established its position and recommendations on the basis of three objectives it sees as essential to an adequate public policy on privacy. On behalf of the individual, society expects:

- Creation of a proper balance between what an individual is expected to divulge to a recordkeeping system and what he seeks in return—to minimize intrusiveness.
- Openness in recordkeeping operations in ways that will minimize the extent to which the record about an individual is itself a source of unfairness in any decision for which it is the basis—maximize fairness.
- Creation and definition of obligations with respect to uses and disclosures that will be made of recorded information about an individual—create a legitimate enforceable expectation of confidentiality.

While the commission did not attempt to create an exhaustive record of misuse of information, it nonetheless encountered such instances frequently enough to become convinced that individuals are treated unfairly through inappropriate use of records about them. The incidents sometimes represented a deliberate exploitation of systemic weaknesses in the legal environment for recordkeeping; more often, they reflected an inconsiderate or thoughtless use of personal information or one that seemed somehow to benefit the organization—more revenue, better control, tighter decisions. In addition, because of sheer size of many modern recordkeeping systems, accuracy itself has become an important aspect of fairness.

Observe for example that the Social Security Administration maintains records on approximately 200 million individuals. If only 1% of them contain an error and if only 1% of the faulty records will result in unfairness, 20,000 individuals will have been mistreated. A corresponding comment can be made about private sector systems. In such examples, it is quite clear how computer and telecommunication technology have combined to make possible and economically feasible the mammoth systems which concern society.

*Report of the Secretary's Advisory Committee on Automated Personal Data Systems, Department of Health, Education, and Welfare, DHEW Publication No. (OS)73-97, July 1973, available through the U.S. Government Printing Office, Stock Number 1700-00116. Also published as "Records, Computers and the Rights of Citizens," *Datamation*, September 1973.

PERSONAL DATA

The scope of study set forth for the commission in the Act that created it was very broad. However, the dominant task was to determine to what extent the provisions and principles of the Privacy Act of 1974 should be extended to the private sector. In addition, it also was to examine such collateral matters as confidentiality of federal tax records, an individual's interaction with mailing lists, the role of Social Security numbers in recordkeeping processes, and an examination of the response and compliance of federal agencies with the provisions of the 1974 Act. To carry out its dominant task, the commission held a series of public hearings over approximately 18 months and solicited testimony in such recordkeeping activities as health care, insurance, depository and lending, credit, employment, education, social assistance, and research and statistics.

Because the recordkeeping practices of the private sector were largely undocumented and unknown, the commission had no *a priori* position on the relevance of the Privacy Act approach to the private sector. It became convinced, however, that recordkeeping in government is so different from that in the private sector and that behavior of private institutions and their managers are so diverse and differently motivated than government agencies, it would be inappropriate to create a blanket omnibus law that would spread over all of the private sector. Thus, the commission's answer to its principal charge became: "No, the Privacy Act should not per se be extended into the public sector, but the principles and philosophy that underlie it can be." Consequently, a series of approximately 165 recommendations was set forth that addressed recordkeeping practices and problems in each of the activities examined.

The final report of the commission, *Personal Privacy in an Information Society** was presented to the President and Congress on July 12, 1977. President Carter personally expressed to the members of the commission his intention to support its findings, and stated that he personally would carry the matter to members of his Cabinet at its next meeting. During the Congressional hearing that followed the Presidential audience, it was noted that a group of bills had been introduced into the House by Representatives Koch and Goldwater to "give legislative expression" to the work of the commission. It seems appropriate to paraphrase a well-known advertisement: "We've come a long way, colleagues."

In just one decade, privacy, as an evolving social issue, has moved from the warnings and cautions of a few computer people to discussion with the President—from computer conferences to the White House in 10 years.

Privacy concerns are causing recordkeeping systems of all institutions of the country—public and private—to be reexamined, to be modernized and brought into conformance with present social expectations. Usage of personal information that simply has happened—because of a decision that seemed right at the time—is being challenged. Interestingly, resolution of the issue interfaces with several competing societal values: first amendment interests, freedom of information interests, law enforcement interests, federal-state relations, and cost of privacy safeguards.

The general thrust of the commission recommendations is openness and fairness in recordkeeping. As an individual establishes a relationship with a private sector recordkeeping organization, he will be fully informed about such things as: what records will be kept about him, what information will be collected, what role his records will play in decisions about him, with what organizations the record will be shared, by what organizations the record or portions of it will be verified, his right to see and copy and correct the record, and an assurance that his records will be protected as confidential information. From such a broad position flows a whole series of detailed recommendations that are intended to be implemented in part by new federal law, in part by amended federal law, in part by new state law, and in part by voluntary compliance. No new regulatory bodies are required; existing ones at federal or state level are sufficient. The detailed recommendations are a blend of fair information practices, limits on collection and disclosure, propagation of corrections, a restriction on the use of some items for decision-making, a separation between certain types of records on the same individual, an emphasis on accuracy of recordkeeping, control of access on a strict need-to-know basis, disclosure of only the pertinent portion of the record for a stated purpose, plus a number of behavioral constraints levied on the institution per se rather than on its recordkeeping system—e.g., to exercise due care in the selection of investigative organizations, to not collect information under false pretense or pretext. Throughout, of course, are many implications for design or redesign of computer-based as well as manual recordkeeping systems. What are some of

**Personal Privacy in an Information Society*, U.S. Government Printing Office (Superintendent of Documents, Washington, D.C. 20402), July 1977, Stock No. 052-003-00395-3.

these?

In all aspects examined, the individual is to be given a legally enforceable expectation of confidentiality in regard to his records. This implies, of course, that personal information must be protected against inadvertent disclosure and the access to it by third parties must be carefully controlled. It also implies that access to it by authorized individuals must be on a strict need-to-know basis, that the uses to which the information can be put by such individuals must be carefully specified by the corporate structure, and that employees must be monitored for compliance and disciplined when necessary. The individual is given the right to see and copy his record and to cause errors that he has noticed to be corrected.* A recordkeeping system therefore must be prepared to mark any items in the record that are disputed so that any disclosure to other parties will be appropriately flagged or not disclosed. In case a dispute cannot be resolved, then the record system must be prepared to accept a short statement of the individual's side of the matter. If a data base supports a number of diverse recordkeeping functions, the system must be prepared to divulge to the individual only that portion of the record he has currently asked to see. It goes without saying, of course, that computerized systems must be prepared to show information to people in a form that is understandable, and must either be prepared to provide copies upon request or to allow any individual to make his own.

If an individual discovers an error, then the recordkeeping institution is required to propagate the correction to recipients of the record and in some cases will also be required to propagate a correction backward to the source of the error. Since the commission dealt with communities of recordkeeping (e.g., insurance companies, plus their insurance support organizations, plus the Medical Information Bureau), the intent is that propagation of corrections will automatically take place as required throughout whatever community normally interacts as a matter of business; but in addition, the individual may request that a correction be forwarded to a specific organization(s) that he names. Authorizations signed by an individual for release of information about him are to be specific as to organization to be contacted, information to be solicited, purpose for which it is to be used, and calendar period over which the authorization remains valid. Thus, a recordkeeping system must be prepared to disclose to third parties only that portion of the record that is pertinent to the authorized request or to the purpose intended.

In such activities as insurance or consumer credit, if an individual receives an adverse decision, he is to be told exactly what items in the record have resulted in the decision. Again, a recordkeeping system must be prepared to disclose portions of the record on a selective basis. In the same two fields, the commission has recommended that a government mechanism should exist whereby individuals can question the propriety of collecting and/or using certain items of information.* Thus, a recordkeeping system would have to distinguish between information it collects for auditing or compliance purposes and information that is permitted to be used for decision-making about people.

In employment and personnel, where compliance is voluntary, it is recommended that management take affirmative action to review all such records and to purge them of information not relevant or no longer necessary. Moreover, it is also recommended in employment and also in education that certain records not be commingled—e.g., security records are to be kept separate from personnel records, law enforcement investigations are to be kept separate from education records. Thus, either separated recordkeeping systems must exist in such instances, or mechanisms must exist to assure access only by relevant users.

In addition to the technical consequences, of course, there are also management, administrative, and procedural ones. There will have to be affirmative actions to acquaint users of personal information with limitations imposed on it, with disciplinary actions to be invoked in case of misbehavior, and with the legal consequences of breach of confidentiality. Management also will have to create procedures to comply with the recommendation that information not be available to third parties without consent of the individual except by formal judicial process. Thus employees will have to be informed of the proper response to a subpoena. Management will also have to institute procedures to ensure that records about people are maintained with accuracy, timeliness, and completeness. It will also have to avoid certain types of information collection, such as by polygraph or by pretext interviews. Under certain circumstances a procedure will be required to obtain the consent of an individual before using information about him for a different purpose. Finally, of course, there will be a one-time task of deciding what response is relevant to such privacy legislation as might be passed and of bringing the corporate body of recordkeeping systems into compliance with them.

Ultimately, of course, data processing people will have to decide what technical safeguards—and perhaps procedural ones as well—should be put in place. Privacy law will inevitably speak generally and establish broad social goals; therefore, it will not be in the nature of tight technical specifications to which the computer person is accustomed. Thus the corporate management must establish the general guidance and determine the organization's broad response. Management cannot abdicate its responsibility for interpreting the intent of the legislative process to its data processing group, although the latter clearly has an essential role in helping management converge to an appropriate posture. Civil and criminal penalties that will be a part of privacy legislation will fall upon the organization; therefore, its management must take the lead in providing adequate direction to its computer people and recordkeeping specialists.

The technical consequences outlined above are illustrative and fairly obvious ones; in the long run, there are more subtle ones. The trend is obviously toward functionally integrated data bases in which "the record" about any individual will contain everything an organization knows about him. Only portions of the record, however, are authorized to various individuals; and thus, access control on a finer grain than to the entire record will become necessary; it may be required to control the data element level. There is an increasingly important issue of granularity that will characterize future recordkeeping systems. To some extent it is already upon us, but in many instances it has been circumvented by maintaining separate data bases in support of different record systems.

Of increasing importance also is so-called "descriptor data" that tells something either about a data element or about the structure of data. For example, in contemporary record systems for consumer credit, a charge in dispute has to be flagged so that interest is not levied against it until the uncertainty is resolved. In view of the right an individual will have under privacy legislation to contest items in the record, it will probably be of increasing importance that disputed items are either not disclosed, disclosed only with notation of a dispute accompanying them, or excluded from certain decision-making activities. When the matter is finally resolved, there is likely to be retroactive actions to restore the record, or reverse decisions, or take administrative ac-

*This is in contrast to the Fair Credit Reporting Act that provides "an individual is to be told the nature and substance" of the record.

*For example, the Commissioner of Insurance in California has ruled that sexual preference and life style information may not be used in making insurance decisions although it may be collected.

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tion. Thus a comprehensive, integrated record system of the future will have to incorporate various kinds of descriptor data within the record in order to cue the system to treat various items of information in special ways at special times, or to guide the system in selectively disclosing information to authorized recipients or authorized third parties of various kinds.

Since accuracy is an underlying tenant of fairness in recordkeeping, there are numerous commission recommendations for the propagation of errors, both forward to recipients of an erroneous record and backward to sources of erroneous data. Thus a record must include such supplementary data as is needed in order to be able to reconstruct, as required, the trial from data sources or to record recipients. Such "traffic data" will be essential if the technical impact of propagating corrections is to be minimized. Notice also that technical details such as just suggested are matters for not only the record system that discloses, but also for the one that receives records from others. Both must be able to deal properly with descriptor data and with traffic data.

As a final observation, it is to be noted that the threat against personal information is not the dishonest person seeking to steal or pirate information about someone, but rather is the honest individual doing his authorized job but not realizing that certain things he does with personal information or certain ways he uses it is to the disinterest or disadvantage of an individual concerned—actions perhaps because the organization has failed to guide him properly. Thus the computer security problem in regard to privacy is more one of sound information practices than one of provable security kernels and operating systems guaranteed free of loopholes. An adequate response to such privacy legislation as may materialize in the coming year certainly need not await the solution of several difficult research problems now being pursued in the name of computer security.

Data processing professionals involved with recordkeeping systems have an exciting several years ahead as the public and private institutions of the country bring their systems into conformance with modern day attitudes toward the use of information about people. Managements also have their period of trial in which they interpret as best they can what the thrust and intent of privacy legislation is, and wait out the gradual accumulation of case law that ultimately gives interpretation and detail to a law. In spite of whatever difficulty may exist ahead, progress is essential both for the welfare of our society and the preservation of our personal freedoms as we want them to be. The ease with which information can now be automatically captured, stored, or disseminated, and with which it can migrate from place to place, simply is too large a threat of many dimensions to the individual. Some level of legal control and oversight is a must. ❁

Dr. Ware is vice-chairman of the Privacy Protection Study Commission, which recently completed its two-year study. He also is on the corporate research staff at Rand Corp., Santa Monica, Calif., an august organization he has served since 1952.

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STEP 2. Letter/Number Labels

The letter/number labels are used to identify each disk and each Accu-Dex Card. For instance, the disk "A-1" will have its own Accu-Dex Card also labeled "A-1". Place one "A-1" on the upper right-hand corner of the first disk in your file. Extra blank labels are even provided for special needs.

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STEP 4. Pressure Sensitive Pockets

The enclosed vinyl Accu-Vue Pockets are to be applied to the front of each disk envelope. The Accu-Dex Cards will then be filed in this pocket. Place the side opening of the vinyl pocket on the right-hand side of the front of the disk envelope. When applying the pressure sensitive pocket to the envelope, carefully loosen the edge of one corner of the backing, position and continue peeling off the backing until the pocket is in place.

STEP 5. The Master Index Card

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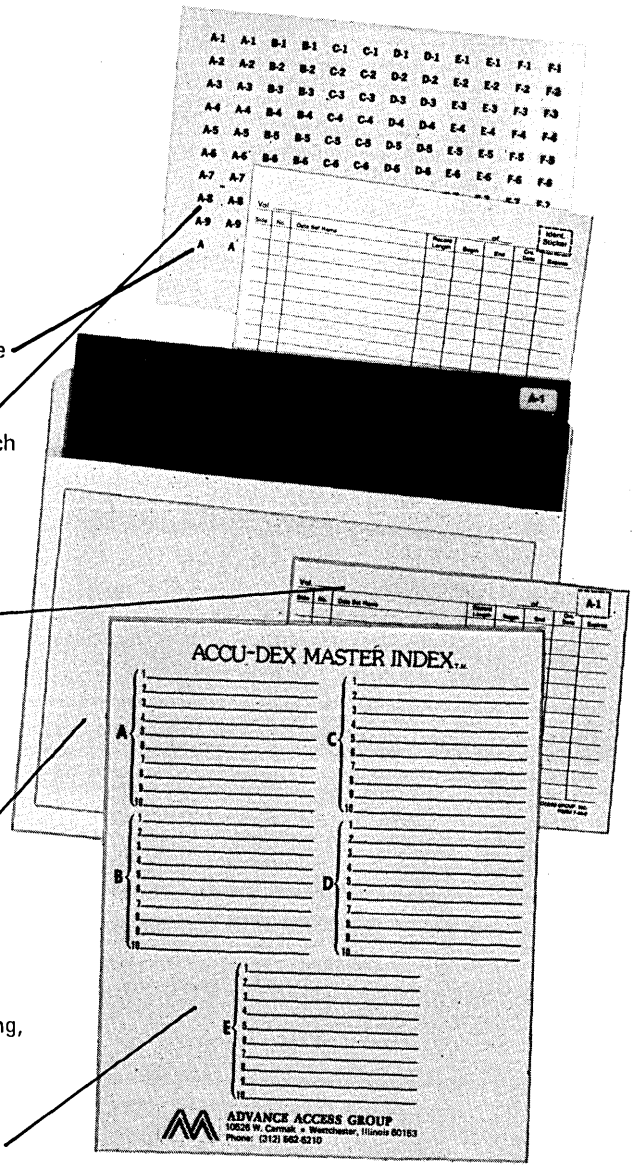

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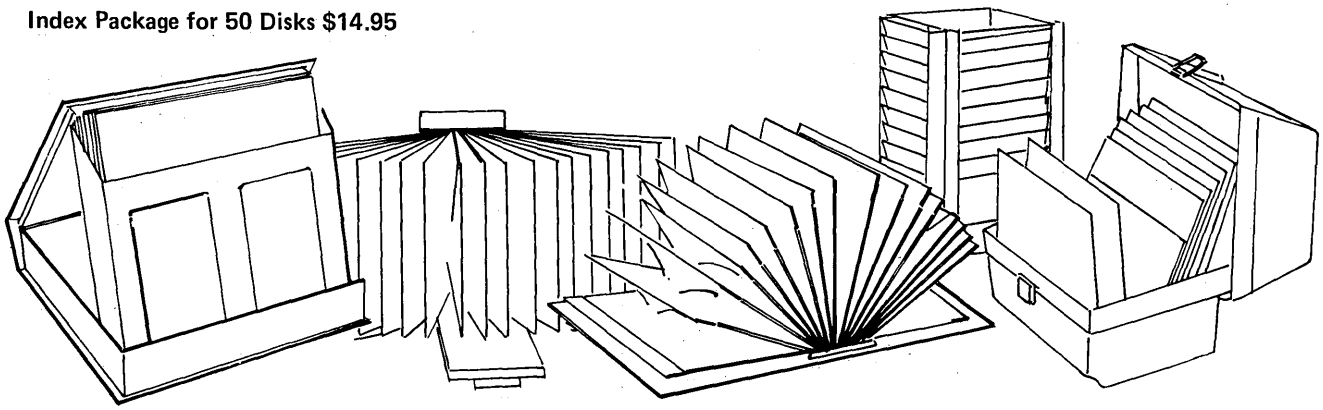

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DP72/D107

SEANCE!

by Steen C. T. Pellash

We knew there was something wrong when Hank, our chief programmer, came bursting into the terminal room waving a long sheet of printout. "All right," he screamed, "All right! All right, you guys! Which wiseacre has been messing around on my line?! Idiot messages are bad enough, but purging my files is just plain criminal! Look!" And, his face purple, he wafted the length of printout under our noses in a threatening manner.

"Hank, my dear fellow," said Jimmy the Joker—he it was who had painted "Commander Grace" on a card hopper—"I seem to sense you're somewhat upset about something."

Hank turned on him angrily. "No more jokes! No more jokes!" he shrieked. Then he narrowed his eyes and strode across to Jimmy. "Was it you?" he said. I felt sure he was going to strangle him or punch him in the nose.

"Hank, Hank," I said gently, getting up. "Come on, sit down, take it easy. Have my chair." I caught hold of him and pushed him into it, snatching the printout from him.

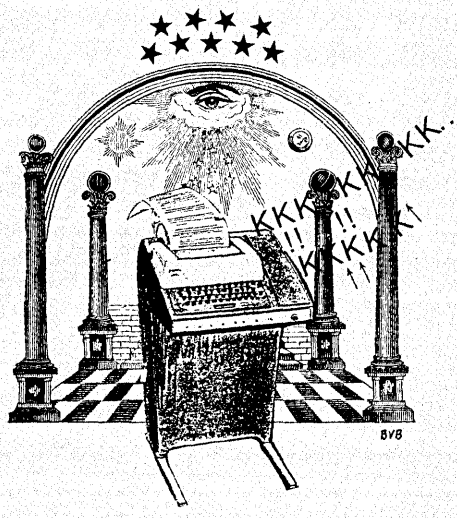
"Now then, what's the trouble?" I said and looked down the output. I could see why he was annoyed. Someone had gone over his priority rating and had been jumping in on his line. By the looks of things Hank had had to endure a savage dialogue from the renegade, finally culminating in:

```
16:14-32 :PURGE ALL NO↑ ↑ KKKKK*KKK
         26 FILES DELETED 4.1 TRACKS AVAILABLE
16:14:48 :[FROM ! → GET OUTA THAT N↑ NO↑ KK↑
           ONE YA DIRTY LOUSY KKKK*
           KK*K SNEAK . . . KK K
```

At that, Hank had torn the printer output off and come roaring into us as chief suspects.

"But look, Hank, none of us know how to get over your top priority," I said, not a little puzzled.

"It just ain't possible, anyway," said Arnie, our systems whiz kid, getting up and coming across to look at the listing. He stared at it and then let out a whistle.



"I don't understand it," he said, frowning.

"*You* don't understand it!" said Hank smashing his fist down on my terminal and making the cursor leap. "There was five weeks' work in those files and some of the data is irreplaceable!"

Jimmy shook his head in reproach. "And who is it that is always telling us to take frequent back-ups. . . .?" he said to Hank with mock severity. Not the most diplomatic thing to say in the circumstances, I thought. Hank merely growled.

I had a thought. I grabbed the printout from Arnie—who was muttering "It just ain't flaming possible. . ."—and scanned it. It was peppered with "K's."

"Perhaps Kay knows something about this," I suggested. "Yeah!" they all shouted. Any excuse to go and chat with Kay, our special projects leader, was a good one.

We dashed along the corridor and round the corner to a door with "Kay The Pork Slicer: Male Chauvinist Pigs Keep Strictly Out, but OUT!" splashed across it in lurid artwork. We knocked. We were not generally so polite, but it gave us such a kick to hear her say "Come in." This time nothing.

We went in. Kay was slumped sickly over her crt. Roger got to her first and pulled her away from the terminal. She collapsed to the floor. "Heck, I think she's in some sort of coma," said Roger, beginning to waft her face with a FORTRAN manual. "Get a doctor." Jimmy was about to leave when Hank said "Wait a minute. Look at the screen!" We looked:

```
16:18:26 :[FROM ! → IS THERE ANYBODY THERE?
```

wrote itself on the screen, vanished, and then wrote itself again, and again.

This was really something. There was no machine operator—Arnie's "Big Bang" Operating System had seen to that—and the rest of us were all here. And yet someone was sending a message to that screen.

We forgot all about Kay in our interest and pushed her limp body aside as we huddled around the terminal. Arnie took the chair.

"What I don't like most about this," he mused, "are those shrieks. . ."

"What was Kay working on?" someone asked.

"Her Supernatural Exploration and ANalysis Coding Exercise, I think," said someone else.

Kay could not have done much before passing out, for there was barely a screenful of dialogue, including the log-in procedure. Between that and the flashing question at the bottom, we read simply:

```
15:44:01 :KALL COBOL
15:44:22 ? SEANCE/OBJ ← SRC/FAST
         FIN NO ERR↑
         ↑C

15:45:48 :RUN SEANCE!

15:46:01 BBOP SYS 29-JUN-77 PRIORITY #A.3
         SEANCE 15:46:02

         SUPERNATURAL EXPLORATION AND ANAL-
         YSIS CODING EXERCISE VERSION 3

15:46:10 *IS THERE ANYBODY THERE?
         !!!WHICH COW!!!IS THIS!!DiSTURBS OUR
         !PEACE!!!!
         KK NO!!!KKKKK!!
         !!COME TO! !!KK! US!!! NO!!!!↑
         ↑C
```

It was now 16:20, so Kay must have been unconscious for about half an hour.

"Let me see that printout of yours," I said to Hank, who still held it in an angry, trembling, clenched fist. He passed it to me and I saw that all the relevant entries were tagged between 15:47 and 16:15.

"Well chaps," I said, and they all turned to look at me, surprised at my addressing them in this quaint way. "Well my dear chappies, I think we have a haunted computer on our hands!"

Arnie suddenly exploded: "Yes! Of course! And it's haunted by—by Kay!" He swivelled back to the keyboard and tried to type something, but the crt failed to respond.

"Quick," I said, "back to Hank's priority terminal!"

We raced round to Hank's room. As I had thought, the same message was flashing up on his screen:

```
16:22:05 :[FROM ! → IS THERE ANYBODY THERE?
```

This was Arnie's big moment. He sat down at Hank's chair and narrowed his eyes. Then his long, slim, systems programmer's fingers, the nails worn to the quick like some clipper topsailman's of old, raced over the keys:

```
16:22:12 :[FROM ! → IS THERE AN↑
                    ↑C
16:22:12 :[TO ! → HELLO, THIS IS ARNIE, WHO
          IS THAT ?
16:22:13 :[FROM ! → ARNIE, THANK GOD ! !
          GET ME OUT OF HERE !
```

We all exchanged incredulous glances.

```
16:22:14 :[FROM ! → IT'S KAY—AT LEAST, MOST
          OF THE TIME ! ! !
          SOMETIMES HE ! ! GETS CONTROL
16:22:14 :[TO ! → IS THAT SHRIEK?—HE SEEMS
          TO HAVE HIGHEST PRIORITY
16:22:15 :[FROM ! → YEAH, SHRIEK—
          SOMETIMES HE GETS CONTROL OF THE
          M/C, LOOK OUT, HERE HE COMES
          AGAIN ! ! ! ! ! ! ! K K ! ! !
16:22:16 :[TO ! → ARE YOU OK ? WHERE ARE
          YOU ?

16:23:06 :[FROM ! → ! ! ! ALL RIGHT ! K BACK
                    AGAIN. ITS GETTING
                    CROWDED IN HERE,
                    THOUGH—THATS THE
                    GHOST OF AN IBM 1130
                    HE JUST BROUGHT IN.
                    THERE ARE ALREADY TWO
                    PROGRAMMABLE RJE
                    UNITS AND A BURNED-OUT
                    MINICOMPUTER
16:23:10 :[TO ! → WHERE ARE YOU ?
16:23:12 :[FROM ! → I THINK THE ROM—
                    YOUR BBOP SYS IS REALLY
                    GROOVY IN HERE, BY THE
                    WAY—CONGRATS. I
                    HAVE A BALL AS LONG AS
                    HES ! NOT AROUND. V
                    EXCITING
16:23:14 :[TO ! → WOULDNT YOU RATHER STAY ?
16:23:16 :[FROM ! → HELL NO, GET ME OUT ! !
```

Arnie sat back and scratched his head. He frowned. "It must be because she hit shriek on 'RUN SEANCE' at the start—its fantastic!"

"But who or what is Shriek?" I asked Arnie.

"Heck, I don't know—some Universal Spirit Operating System, probably —they called it God in an earlier era, I suppose."

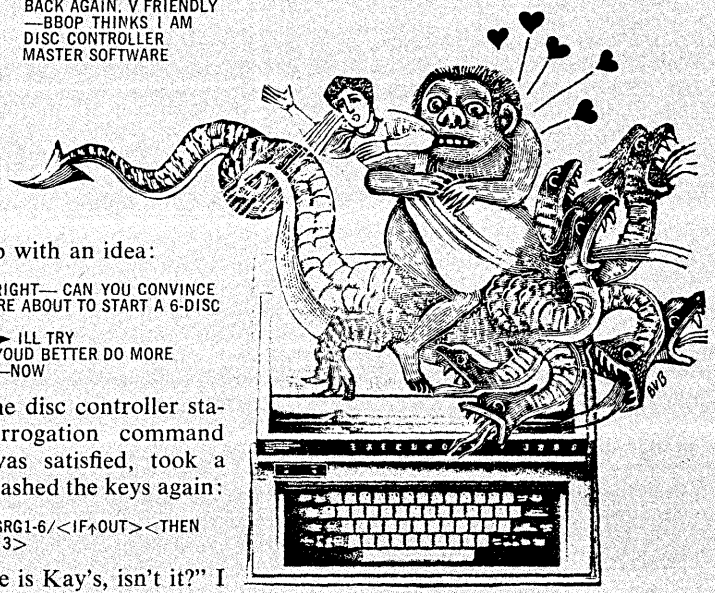
"I always thought GOD was Good Old Data," quipped Jimmy.

"The devil it is!" I rejoined.

"Devil or whatever, it evidently has the virtue of being truly portable software!" Hank said in a superior tone.

Arnie ignored us all: "There's only one hope, as far as I can see. Let's pray BBOP is up to it. . . ." He started tapping again:

```
16:25:14 :[TO ! → HOW FRIENDLY ARE YOU WITH
                  BBOP NOW ?
16:25:20 :[FROM ! → ! ! ! ! WHO IS THIS
                    PIG ! ! K ! DISTURBS
                    ! ! K K WATCH OUT ARNIE
                    —FINGERS OFF ! !
                    !US!!KKKK!!KK ALL RIGHT,
                    BACK AGAIN. V FRIENDLY
                    —BBOP THINKS I AM
                    DISC CONTROLLER
                    MASTER SOFTWARE
```



Arnie's face lit up with an idea:

```
16:25:22 :[TO ! → RIGHT— CAN YOU CONVINCE
          BBOP YOU ARE ABOUT TO START A 6-DISC
          SORT ?
16:25:23 :[FROM ! → ILL TRY
16:25:24 :[TO ! → YOUD BETTER DO MORE
          THAN THAT—NOW
```

Arnie keyed in the disc controller status register interrogation command and, when he was satisfied, took a deep breath and bashed the keys again:

```
16:27:16 :SET BBOP/SRG1-6/<IF↑OUT><THEN
          DUMP TERM 3>
```

"Terminal three is Kay's, isn't it?" I whispered to Arnie.

"Precisely," said Arnie, beads of sweat standing out on his bald head. "Haven't you got your massive night-club data base on Controller 4? No devil can resist that kind of temptation, eh?" "You cunning swine," I murmured in admiration. "Heh! Heh! That sort is going to louse up all the other discs though, isn't it. . .?"

Arnie's attention was caught by a change in the registers and he immediately hit the control-O buttons. There was a flash, a cloud of smoke came out of the back of the crt, the screen collapsed and Arnie was thrown back over his chair.

I dashed out of Hank's office, along to Kay. She was sitting up shaking her head.

"Oh dear!" she said. "Oh my! Good old Arnie! But he was only just in time. Another millisecond and I would have been out on a disc dump! Ugh!"

"What happened to Shriek?" I asked, rubbing the back of her neck (this was not strictly necessary, but I couldn't resist it).

"Well it was either him or me. . ." she replied. Then she suddenly stood up, wobbling unsteadily on her feet. A light shone in her eyes and she made for the door.

"Hey!" I said, "Take it easy, Kay, you're," but she was gone, off down the corridor in the direction of the machine room.

When I caught up with her she was striding across to the cpu. She flung her arms around the cabinet in a warm embrace and placed a long sensuous kiss on it. I looked on, amazed.

She turned away, her face glowing. "BBOP was such a wonderful lover," she said simply.

Disc Controller 4 had vanished. ❋

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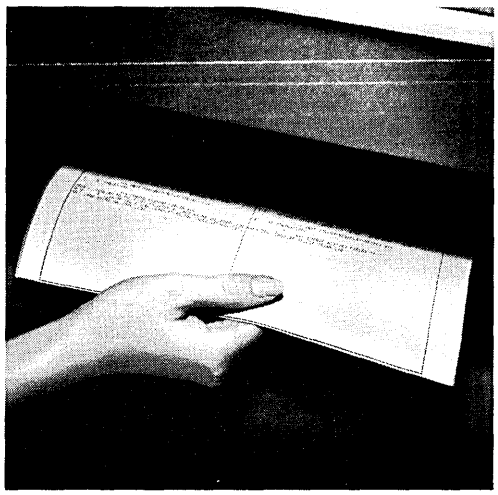

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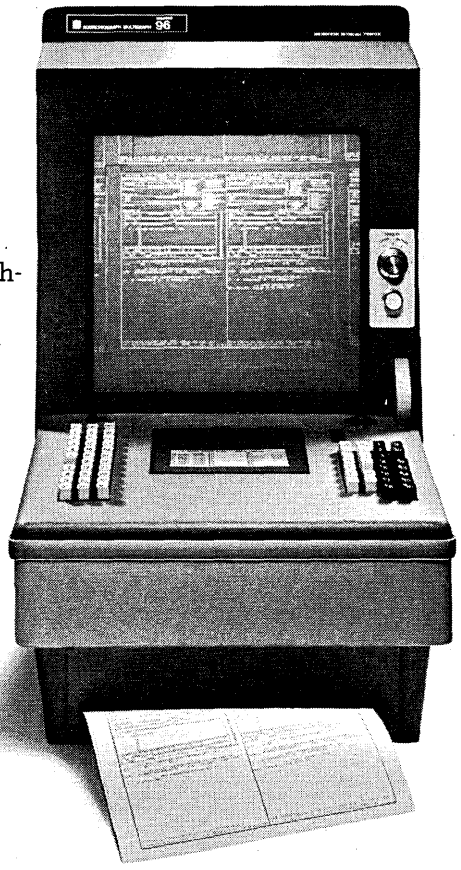

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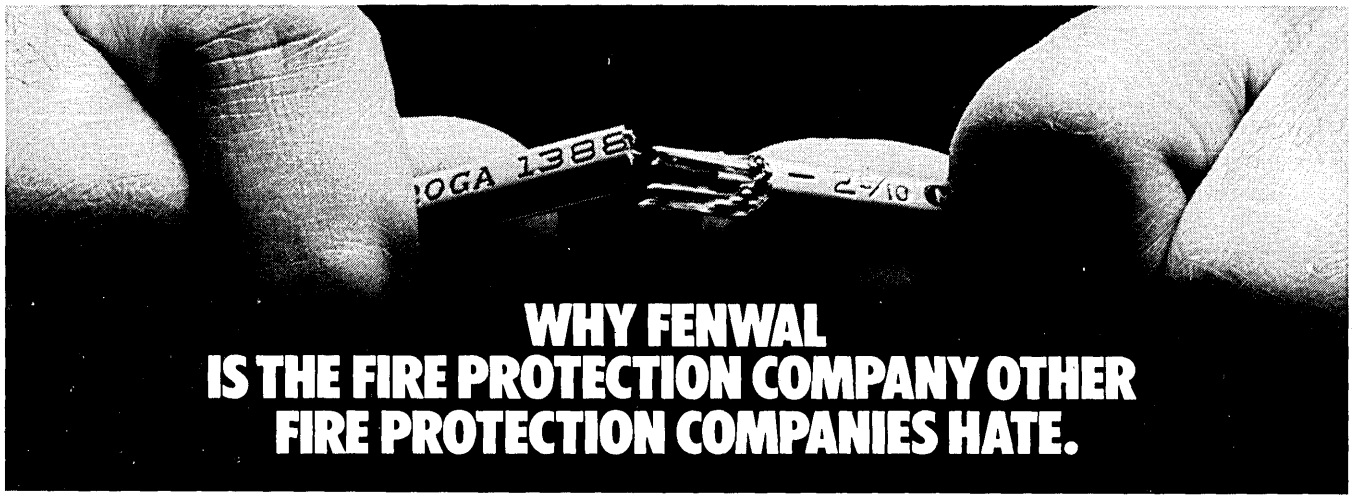

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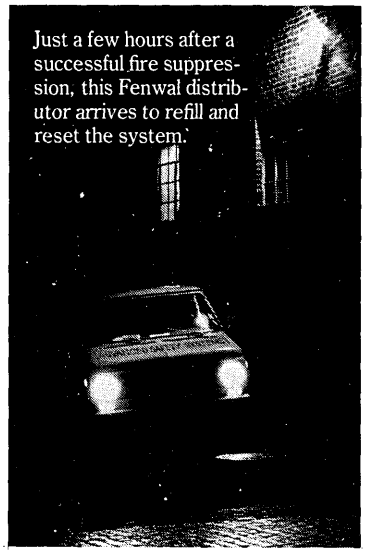

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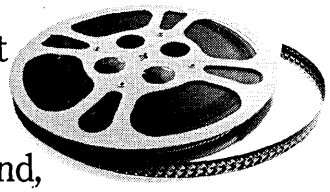

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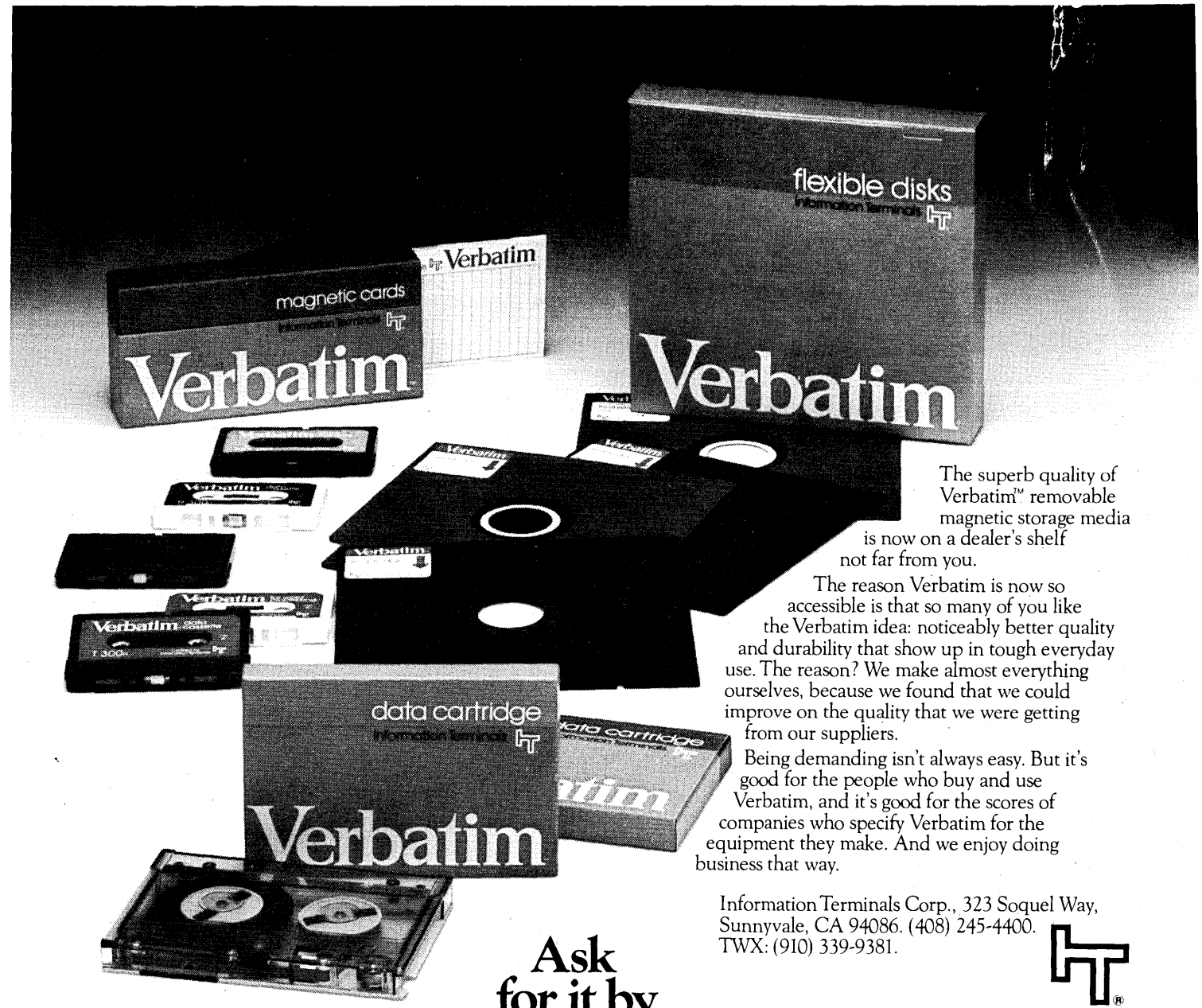

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CIRCLE 80 ON READER CARD

Microimage Technology and Practice

by Michael P. Zampino

Threatened by an ever-growing tide of paper, Citibank found that the latest electronic marvels were not the answer to today's challenges.

Citibank in 1976 was one of the world's leading private banking institutions. With $60 billion in total assets, offices in every major city of the world, 20,000 employees in the New York City area, and over 20,000 additional employees throughout the world, Citibank was a major business undertaking in its own right. More significant, however, was Citibank's scope of customers: nearly one million personal banking accounts and banking relationships with nearly every major American and many non-U.S. business corporations, including many national governments.

The most striking aspect of Citibank's business profile was that its product was, for the most part, completely intangible. That product was service. It was the business of Citibank to accept funds and other assets from its depositors, transfer them in accordance with their instructions, and to offer credit. In industrial economies, these transactions were mainly conducted by transference of paper or ledger entries. These processes conjure images of the 19th Century clerk with green eyeshade and endless ledgers. The very size of Citibank's business, however, and the need to promptly and accurately execute our customers' transactions had rooted Citibank firmly in 20th Century technology.

The paper machine

The paper and ledger accounting orientation of Citibank's service business, coupled with its enormous customer base, had led to an incredible explosion of paper. On a daily basis in our New York City operations alone, several million checks, nearly 100,000 stock certificates, tens of thousands of non-check funds transfers, letters of credit, items for collection, and loans were processed. In addition to these documents were countless internal work papers, internal and external correspondence, advices to our customers, and computer printout. (Computer printout for example, averaged in excess of three tons per day.)

Printout averaged three tons per day.

Although processing the daily flood of transactions has long been the task of sophisticated digital computing equipment, paper input and output from our accounting systems have resisted the advance of technology. There are compelling reasons for this —paper based systems offer: simplicity, low capital investment, and familiarity with the medium.

Further, management and the scientific and engineering communities have focused their attention on the more "glamorous" aspects of data processing. However, in the face of literally millions of transactions, the seeming advantages of paper quickly evaporated.

Our need, simply, was storage for our incredible volumes of paper and the ability to find specific items on short notice. Solutions to these problems historically have been based on the file clerk, the file cabinet and file room, and the records warehouse. In Citibank's case this represented hundreds of clerical personnel, thousands of square feet of high rent office space used as storage facilities, and a 300,000 cubic foot capacity warehouse. The fruits of this system were days of waiting for customers or executives requiring specific documents and, with disturbing frequency, failure to find the document.

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The goal— the ideal and the real

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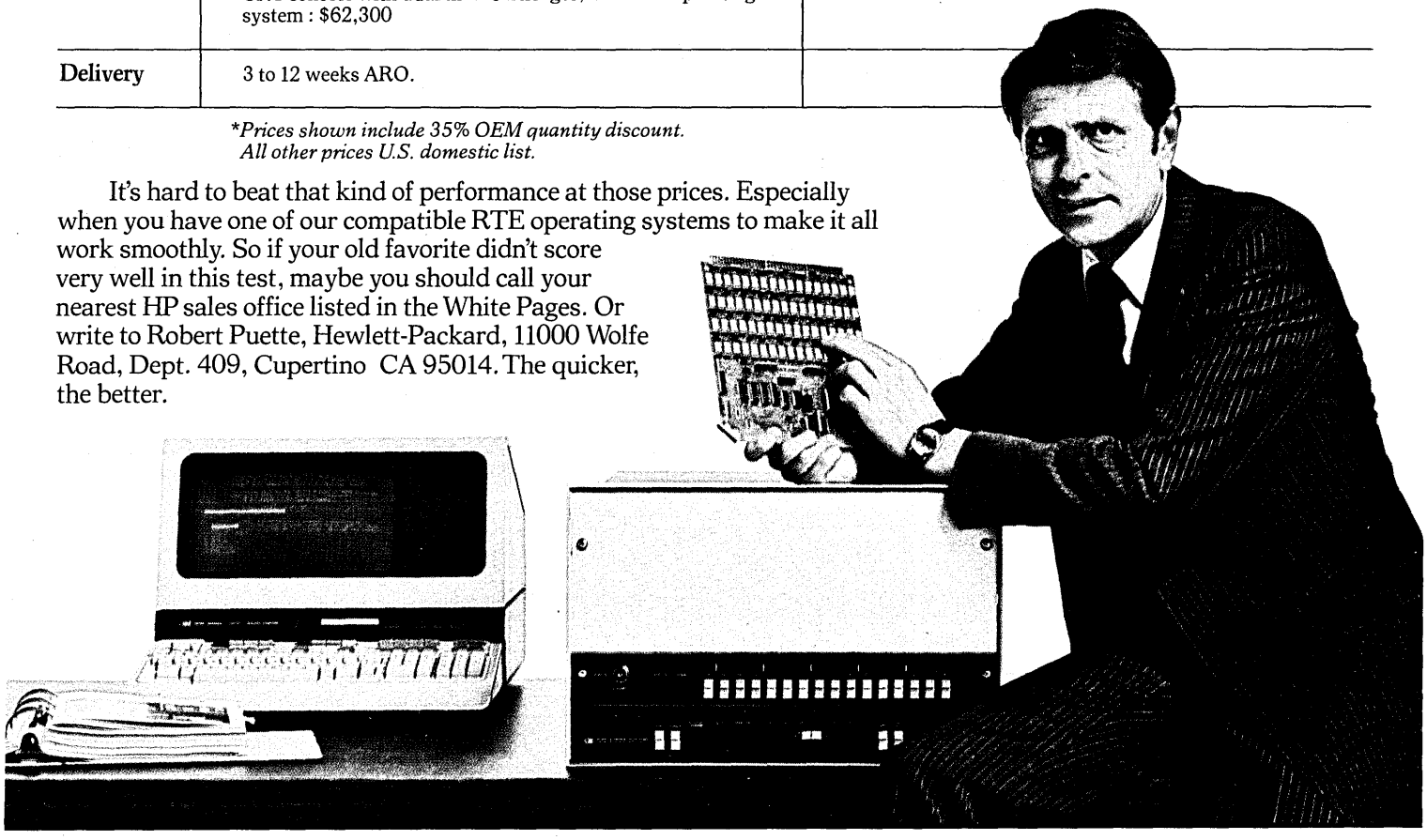
Delivery	3 to 12 weeks ARO.	

**Prices shown include 35% OEM quantity discount. All other prices U.S. domestic list.*

It's hard to beat that kind of performance at those prices. Especially when you have one of our compatible RTE operating systems to make it all work smoothly. So if your old favorite didn't score very well in this test, maybe you should call your nearest HP sales office listed in the White Pages. Or write to Robert Puette, Hewlett-Packard, 11000 Wolfe Road, Dept. 409, Cupertino CA 95014. The quicker, the better.



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how to instrument a solution.

Citibank's "transaction machine" was driven by our customers' demands. These demands were in the form of checks or loans to be posted, funds or stocks to be transferred in ownership, or other paper documents which our customers sent to the bank. Processing these documents in our "transaction machine" created in turn an even larger bulk of output reports and other supporting papers.

Very quickly, the ideal solution presented itself. That was to require all of our customers to communicate their transactions to the bank in formatted electronic code. This approach has received great coverage in banking literature under the heading of Electronic Funds Transfer System (EFTS). Citibank has been a pioneer in EFTS with its introduction of Citicard as a substitute for certain checking transactions, and with formatted telegraphic money transfer systems.

However, owing to custom, legal requirements, as well as the design and introduction of new systems, EFTS was not expected to become a significant factor for many years. As paper initiated transactions appeared to be a given for the bulk of our processing for the near to intermediate future (5 to 10 years), with certain types of transactions sure to be paper-bound for even longer periods, we turned to the concept of capturing our customers' paper initiated transactions on microimage as well as data files and directing all subsequent referral to paper-bound information to microimage files. The nature of our desired instrumentality, then, was a device which could readily capture document images in conjunction with coded document descriptions, and assemble those images into logical files which could be readily accessed. Further, the system had to be:

- cost effective
- reliable
- easy to operate
- have the file management facility of a computer
- available in a reasonable time period

Schematically, a system of this type would look like Fig. 1.

Theory and technology

The four requirements of the device which we envisioned for our needs were:

- Filing
- Storage
- Indexing
- Retrieval and Display

Which technology is better: digital or analog, magnetic or photographic? The answer is that only in context can a selection be made with assurance. For the remainder of this section, we will examine alternatives; later our choices and the reason for those choices will become apparent.

Filing

For our purposes, filing is defined as the process of capturing document images in conjunction with creation of an organized image index. Methods of indexing will be discussed later; this section discusses image capture.

Cameras are perhaps the oldest of imaging devices, and microimage photographic camera systems were readily available for commercial purposes at various reduction ratios of from 18X to 48X and 50X.

One process, discussed later, employed a two-stage process with a first stage 24X reduction and a subsequent 10X photographic reduction of the 24X negative to 240X.

Vidicon tubes in conjunction with lenses also were available to produce an analog electronic signal. Empirical evidence as well as theoretical analysis demonstrated that a minimum of 1,250 scan lines over the 11-inch height of a typical business document were necessary for adequate resolution of 10 point type.

For digital image scanning, a wide variety of techniques were available. We determined that a minimum binary sample density of 120 points to the inch in a square pattern was necessary for adequate resolution of business documents. Various document scanning systems were commercially available employing Reticon arrays or flying spot laser scanners. Transfer rate typical of these devices for scan time of an 8½x11-inch business document was approximately three seconds. Components to build such systems remain readily available.

Storage

A wide range of storage devices are available when one considers the possible combinations of digital or analog format and photographic, mechanical, or electronic media. Research uncovered at least one class of executed device for each possibility. The following summary includes references to specific vendors for unique devices or technologies.

Magnetic/Digital

Magnetic tape and disc were well established as the prime storage media for use with the digital computer. Greater bit densities on both tape and disc were becoming standard and likely will continue to increase. Disc drives of 300MB were commercially available. The IBM 3850 represented the largest self-contained "on-line" tape library with maximum storage capacity of almost 400 billion bytes.

Magnetic/Analog

Ampex has been active in the field of very large magnetic/analog storage devices. They have built large video disc buffers and video tape drives for use with their Video File System.

They also have converted standard digital discs to analog for the television broadcast industry. These discs store tv frames for instant display at the command of directors broadcasting live events.

Digital/Optical

Various attempts at digital/optical memories have been undertaken using photographic film as a medium. Digital bit patterns exposed on film were subsequently read by optically replaying the bit patterns. A commercially available optical/digital memory by Precision Instruments was examined. This device employed a flying spot laser on a rhodium coated mylar substrate. When writing, the laser was given sufficient power to deform the rhodium thereby creating a bit three mil in size. For reading, a lesser power laser scanned the rhodium surface, determining bit patterns by differing reflections from the deformed and clean surface areas. The Precision Instrument memory had 16 trillion bytes on-line per device with up to eight devices on-

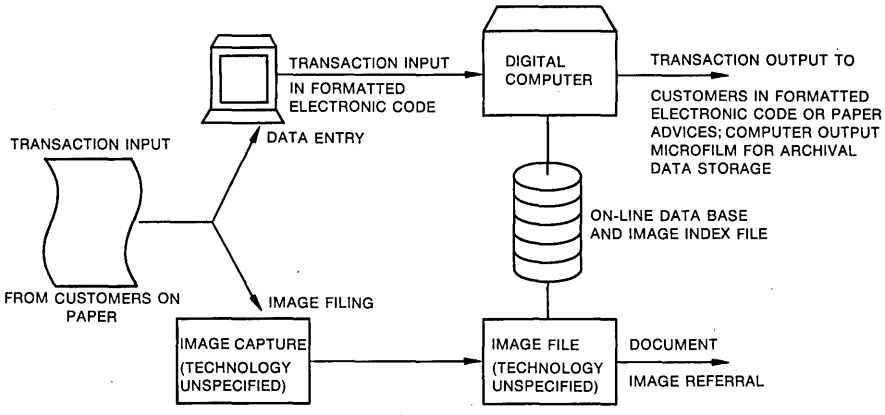


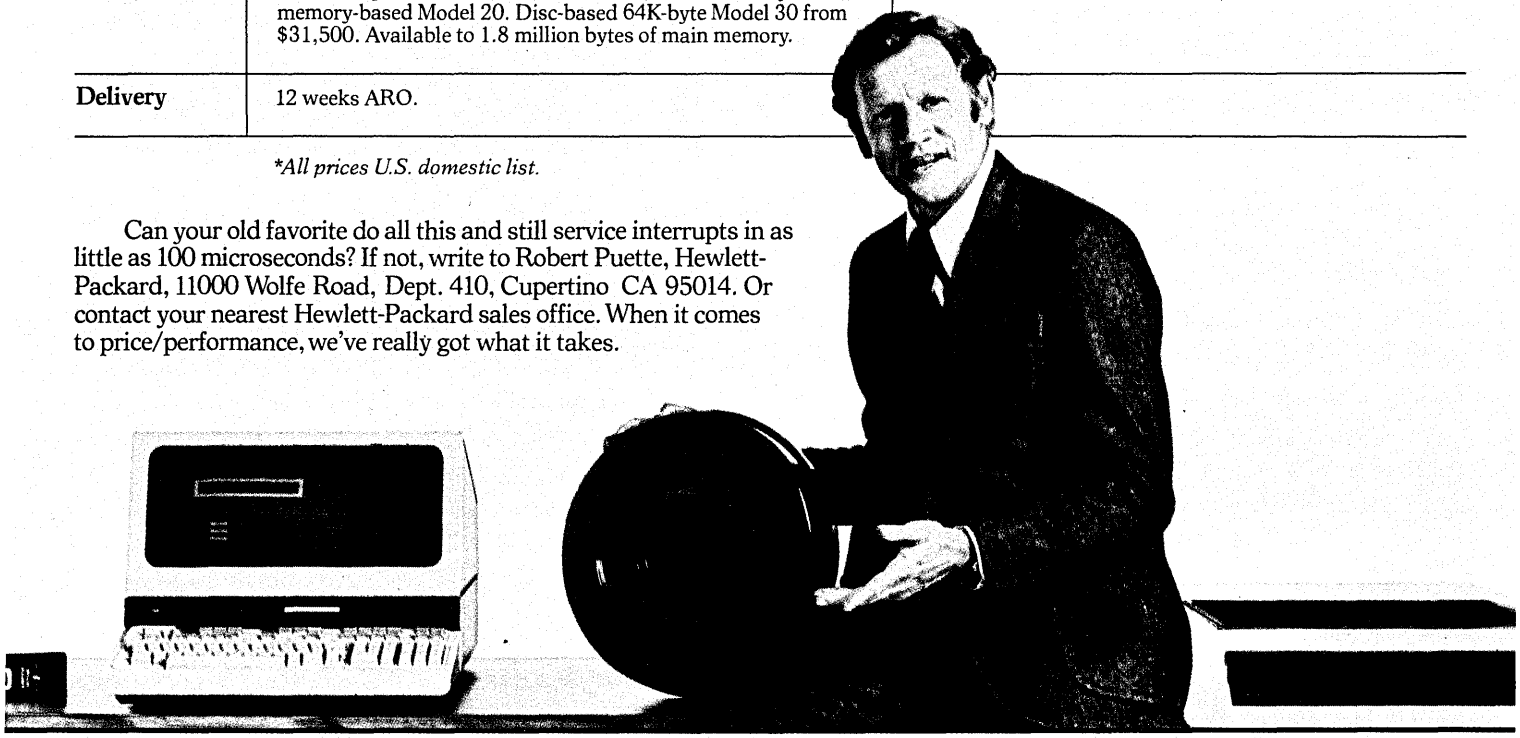
Fig. 1.

Performance: has your operating system got what it takes?

Feature	Our Real-Time Executive for HP 1000 and 21MX Computers	Your old favorite
Upward-compatible family	RTE-M, memory-based for 32K to 1.8 million bytes; RTE-II, compact disc-based for 48K to 64K bytes; RTE-III, disc-based for 64K to 1.8 million bytes. Programs and data are interchangeable; all systems use a common set of operator commands.	
Multi-programming	Up to 64 separate programs can execute concurrently in main memory; thousands more can swap in automatically from disc. Protected by hardware fences and optional fault control memory. Non-responding peripherals detected via time-outs.	
Multi-terminal capability	Concurrent processing, program development, system generation in conversational or batch modes. One program serves all terminals; no rewriting when you add on or change.	
Micro-programming	Up to 8.5K 24-bit words usable at one time. Microassembler, micro debug editor, loader utility, PROM tape generator and Writable Control Store available to simplify microprogram preparation.	
Other features	BASIC, FORTRAN and Assembly languages. Measurement and control support. Distributed Systems Networks. IMAGE/1000 DBM with QUERY language for $2,500.	
Cost*	HP 1000 systems with RTE start at $21,000 for 64K-byte memory-based Model 20. Disc-based 64K-byte Model 30 from $31,500. Available to 1.8 million bytes of main memory.	
Delivery	12 weeks ARO.	

**All prices U.S. domestic list.*

Can your old favorite do all this and still service interrupts in as little as 100 microseconds? If not, write to Robert Puette, Hewlett-Packard, 11000 Wolfe Road, Dept. 410, Cupertino CA 95014. Or contact your nearest Hewlett-Packard sales office. When it comes to price/performance, we've really got what it takes.



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line for a total memory of 128 trillion bytes on-line. Any number of data cartridges could be stored off-line.

Analog/Optical

Photographic film is an analog memory medium. A wide range of film sensitivities and resolving capacities were available. As film product specifications are readily available and the process is familiar, I will simply observe that of all the media examined, photographic film offered the highest storage capability per unit of surface area.

Exotic memories

Various exotic memories were considered and rejected.

Electron Beam/Silicon Dioxide: A technology developed by CBS Laboratories which used the secondary effect principle of electron beams was brought to detailed specification stage but was dismissed as a higher technological risk than we were prepared to take. The specification called for 60 billion bits of on-line storage.

Electron Beam/MOS: A General Electric device called BEAMOS, an electron beam on MOS, was examined. This device had storage capacity of only 32MB and was dismissed as not having sufficient capacity.

Bubble Memory: Bubble memory devices employ the localized magnetic field reversal effects which may be generated in wafers of garnet crystals to store digital bit patterns. Although this technology offered great promise, there were few commercially available devices and these were under one megabyte.

Holographic Memory: A device in the prototype stage by Harris Radiation, employing holographic bits on photographic film, was examined. Any possible advantages of holographic bits over ordinary optical bits was not perceived to outweigh the complexity of the process for the specific application.

Indexing

The ultimate aim of commercial applications of microimage technology is very often lost amid the analysis of bit densities, exotic memories, transfer rates and the like. A commercial user's interest transcends technology and simply asks for a system that will permit organization of very large image files (hundreds of thousands to millions of pages) with ready access to any one page by calling for it by descriptive characteristics. This is the function of the index.

There are two conceptual index classifications to which all index schemes must belong. The first is physical organization of the file material by alpha, numeric, chronological, or other logical key. This procedure is the one most used by secretaries and file clerks. It is quite manual and quickly becomes unwieldy for very large files or in situations where quick retrieval is necessary.

The second index scheme is creation of a supporting index of positional coordinates of the file's physical array in unsorted state. Indexes again describe individual documents by alpha, numeric, chronological, or other logical key.

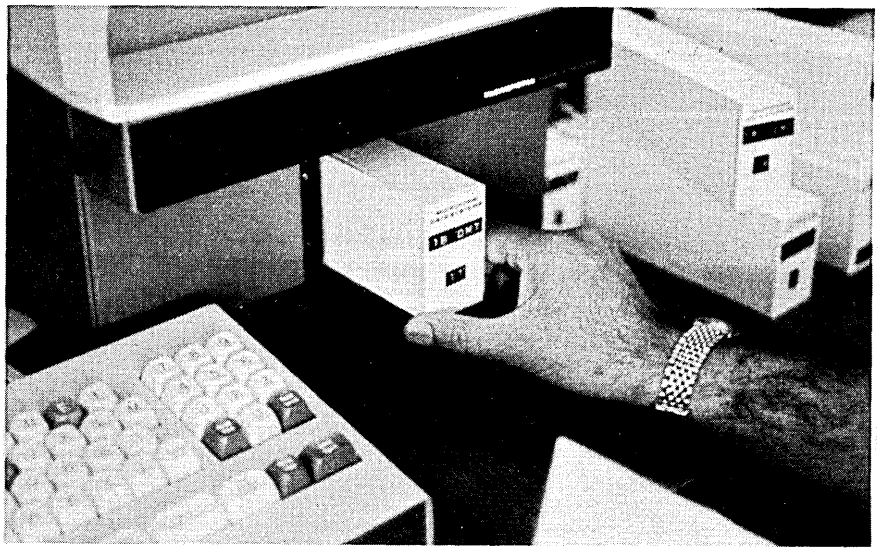
Given the ready availability of sophisticated data base management software (DBMS) for both IBM 370 and a number of minicomputers, indexing of random arrays of large document or microimage files is becoming more attractive.

Among the most attractive DBMS systems we examined were:

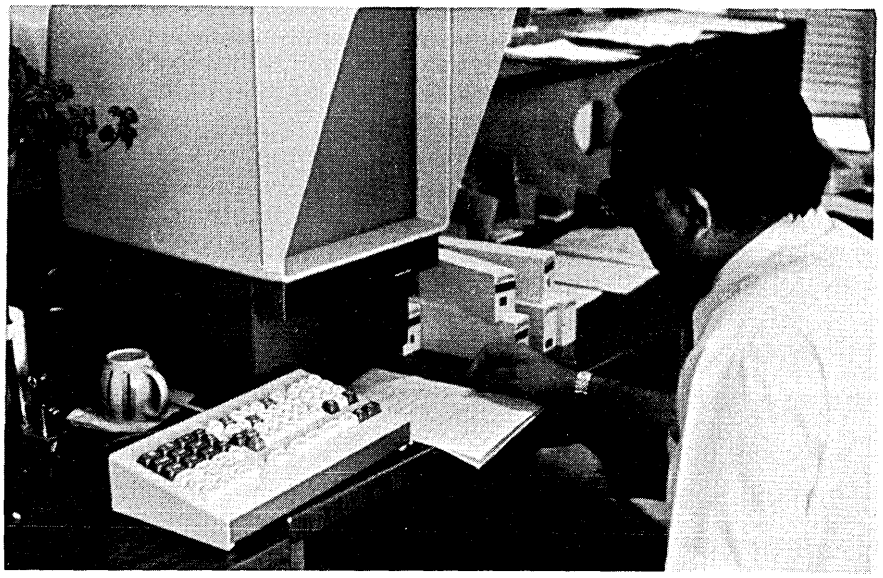
- Ragen Precision Industries' Retrieval System for use with their special mini controller and retrieval terminal.
- Microdata REALITY—currently an oem item in the Microform Data Retrieval System.
- Datapoint DART—currently marketed in conjunction with Kodak's Computer Assisted Microfilm Retrieval System.
- Hewlett-Packard IMAGE 1000 and 3000—not currently affiliated with any microimage system for use on the Hewlett-Packard 1000 and 3000 minicomputers.
- Cullinane IDMS—not currently affiliated with any microimage system, for use with IBM 370 systems.

Retrieval and display

The ultimate object of the filing, storage, and indexing techniques is the eventual retrieval and display of specific document images on demand. Except for the few solid-state memories examined, all required mechanical transport of a physical medium to retrieve an image. Further, all the rea-



Microform data system image retrieval workstation.



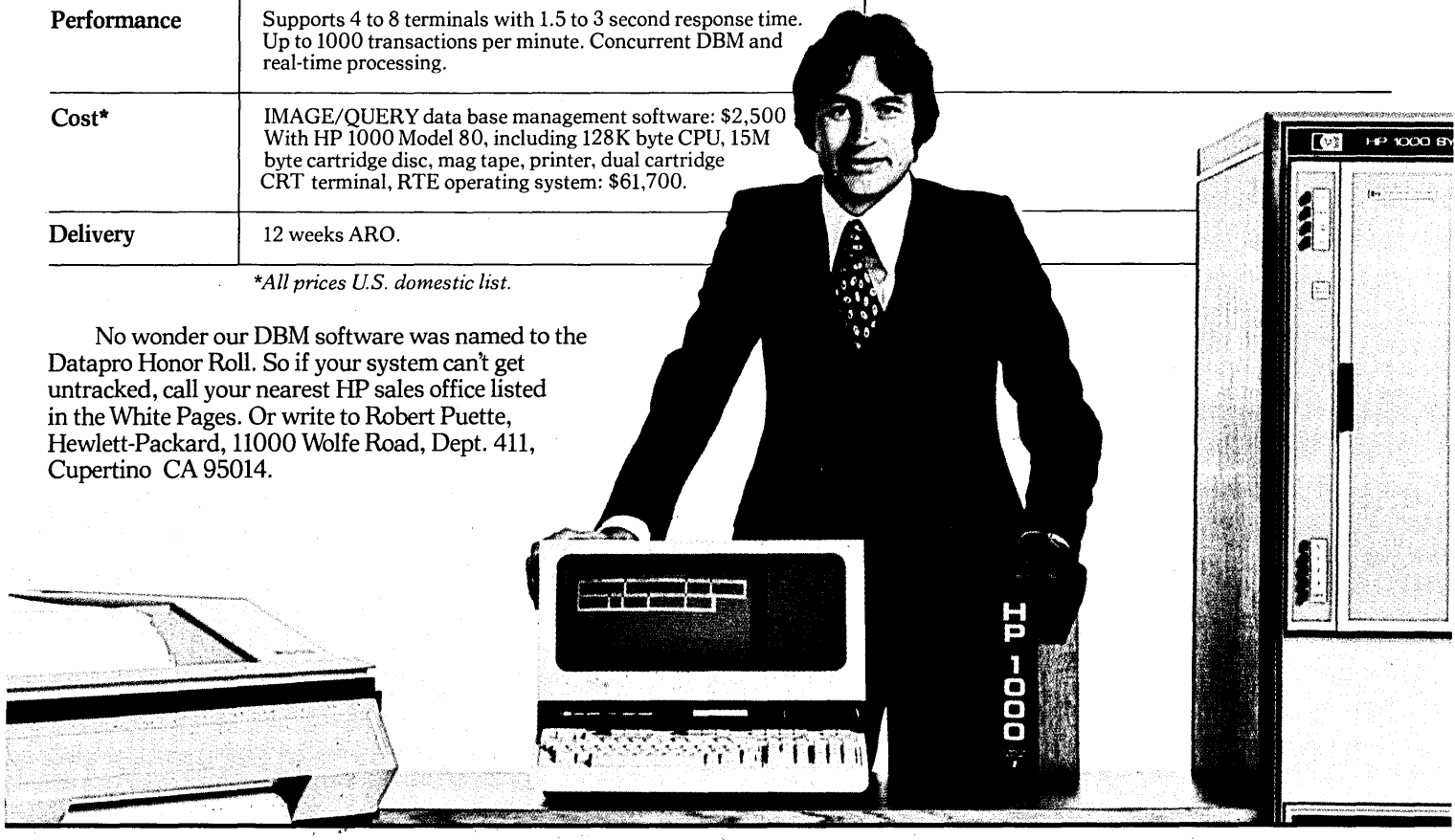
Each cartridge contains up to 100,000 images.

Data Base Management: is your small computer on the right track?

Feature	Our IMAGE/1000 DBM on HP 1000 Model 80	Your old favorite
Inquiry language	"Free-Form" QUERY lets almost anyone access data or create reports with simple English-like commands instead of special subroutines.	
Data access	Application programs in FORTRAN IV, BASIC or HP Assembly can access data sequentially, directly or randomly by key word value.	
Privacy	Passwords definable for any part of data base, down to smallest unit of information.	
Data maintenance	Define, build, use and restructure data base. Multiple data bases can reside in same computer system.	
Data base structure	CODASYL-type schema eliminates redundant entries, makes data base independent of user programs.	
Data Communications	Multiple IMAGE/1000 systems can be inter-connected with HP's Distributed Systems Network. Also 2780 emulator.	
Performance	Supports 4 to 8 terminals with 1.5 to 3 second response time. Up to 1000 transactions per minute. Concurrent DBM and real-time processing.	
Cost*	IMAGE/QUERY data base management software: $2,500 With HP 1000 Model 80, including 128K byte CPU, 15M byte cartridge disc, mag tape, printer, dual cartridge CRT terminal, RTE operating system: $61,700.	
Delivery	12 weeks ARO.	

**All prices U.S. domestic list.*

No wonder our DBM software was named to the Datapro Honor Roll. So if your system can't get untracked, call your nearest HP sales office listed in the White Pages. Or write to Robert Puette, Hewlett-Packard, 11000 Wolfe Road, Dept. 411, Cupertino CA 95014.



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sonably well-developed memory systems were controlled by a computer index addressing physical locations.

Striking conceptual similarities in technique between memories employing magnetic, photographic, or other mediums were apparent. For example, the IBM 3850 mass memory consisted of numerous cartridges of magnetic tape. Upon request for a particular record, a disc-resident index was searched and a jukebox-like mechanism fetched the specified magnetic tape cartridge which was unreeled under a magnetic read/write head to the requested record.

A microfilm retrieval device by Ragen Precision Industries employed essentially the same techniques to retrieve photographic records. Storage in this case was on cartridges of 16mm photographic film. Upon request for a particular image, a disc-resident index was again searched, and the jukebox mechanism fetched the specified film cartridge which was unreeled under a projection lens to the requested image. Of course, photographic projection is a human-readable memory and may not be machine-read or updated. However, to store mass document image files, the Ragen system provided the equivalent of 62,500 megabytes of on-line compressed digitized document images.

Display of an image is dependent on the form in which it was stored and photographic memory calls for image projection. A wide variety of vendors, devices, and magnification ratios were commercially available. Electronic memories may be displayed on high resolution (at least 1,250 scan lines over the 11-inch height of a business document) crt monitors. Again, a wide variety of vendors and systems were available.

A hybrid technique of facsimile image transmission to remote crt monitors from a central photographic memory also was explored.

Some solutions

Science and the study of technology are driven by man's need to explore and learn; pragmatic factors, such as ROI, are not necessarily the driving force. The application of science and technology to commercial situations, however, is bound by certain constraints;

- Does a new technology offer the opportunity to perform an existing process less expensively or with greater quality at an equivalent expense?
- Does a new technology producing a new product (or an enhanced version of an existing product) offer sufficient added value to offset its cost?

Only when viewed within these constraints can one technology be said to be "better" than another for a given time and situation.

Assuming that Citibank's investment decisions, based upon aggressive research into available technology, were true indicators of the "best" technology for the situations, we drew some broad conclusions:

- photographic film is the most cost-effective storage medium for large files of document images;
- the facility of computer systems to index and address large random files of document images has made storage and retrieval of large document image files in random arrays more effective than physical reorganization of document files into logical sequence;
- the physical apparatus to capture, store, and retrieve large document image files at an equivalent level of image quality is of significantly greater complexity for digital systems than for photographic systems.

Supporting these conclusions is Citibank's experience with solutions to the following document filing, storage, and retrieval situations. (These solutions do not imply Citibank endorsement of any vendor, and are provided only for illustration.)

TRACE

Citibank processed an average of 2.5 million checks a day in 1976. Each of these checks was microfilmed in random sequence. The microfilm process was integrated into our check readers in 1973 thereby permitting simultaneous capture of images and an index file. With the use of the index, the image of any one of the 625 million checks filmed in 1976 may be located in about ten minutes with greater than 98% probability.

Prior to 1973, Citibank relied upon physical reorganization of its check files into numerical account sequence prior to microfilming to enable their retrieval. This process resulted in numerous lost checks prior to capture on microfilm. Paradoxically, lost checks were precisely the ones for which customers were likely to request evidence. Not surprisingly, the probability of finding a check requested by a customer was less than 50% under this system.

Citibank's file of random check images has been growing by several million each business day since 1973, It is undoubtedly one of the largest random film files in existence.

Intellectually, the notion of indexed random files was not difficult. But, a $7.3 million capital decision based on theory (Citibank pioneered the concept) was not quite so obvious. As the system had many more functions than microfilm and indexing, isolation of these components in a cost sense was difficult; the system however, consumed in excess of $300,000 worth of film and directly related photographic supplies annually.

The reward has been in control of lost items. Prior to the system, dollar losses to missing checks was over six figures. Losses now are counted in tens of thousands. We learned that very large indexed random document image files are entirely manageable in a commercial environment.

Citibank pioneered the TRACE system by Recognition Equipment in 1973. Since then, systems with similar capability have become available from Burroughs and IBM.

Fig. 2 (p. 104), shows the basic configuration of this type of capture and scanning system.

CITISEARCH

After being computer-sorted, the index to the TRACE file was maintained off-line on computer output microfilm. This method was chosen owing to both the enormity of the supporting index and the infrequent access relative to overall file size.

Since 1975, Citibank operations have been organizing into divisions serving market-oriented customer sets. Certain of these sets serving large commercial and industrial customers are characterized by relatively low transaction volume (tens of thousands daily rather than millions) and high average unit value per transaction.

It has been possible to develop economical computer-indexed microimage filing, storage, and retrieval systems for these situations. These situations also served as the test bed for comparing photographic and electronic systems.

The first of these systems adopted was a small application to produce customer signature cards quickly for use in verifying the authenticity of certain transaction documents. The system employed the Microfilm Data Ultrastrip Terminal.

The Ultrastrip terminal provided a high speed microfilm retrieval unit designed for applications requiring rapid access to image files of several hundred thousand to over a million images. The unit automatically retrieved and displayed any individual page in a 100,000 page file within one-half to four seconds after receiving a command through entry on a keyboard.

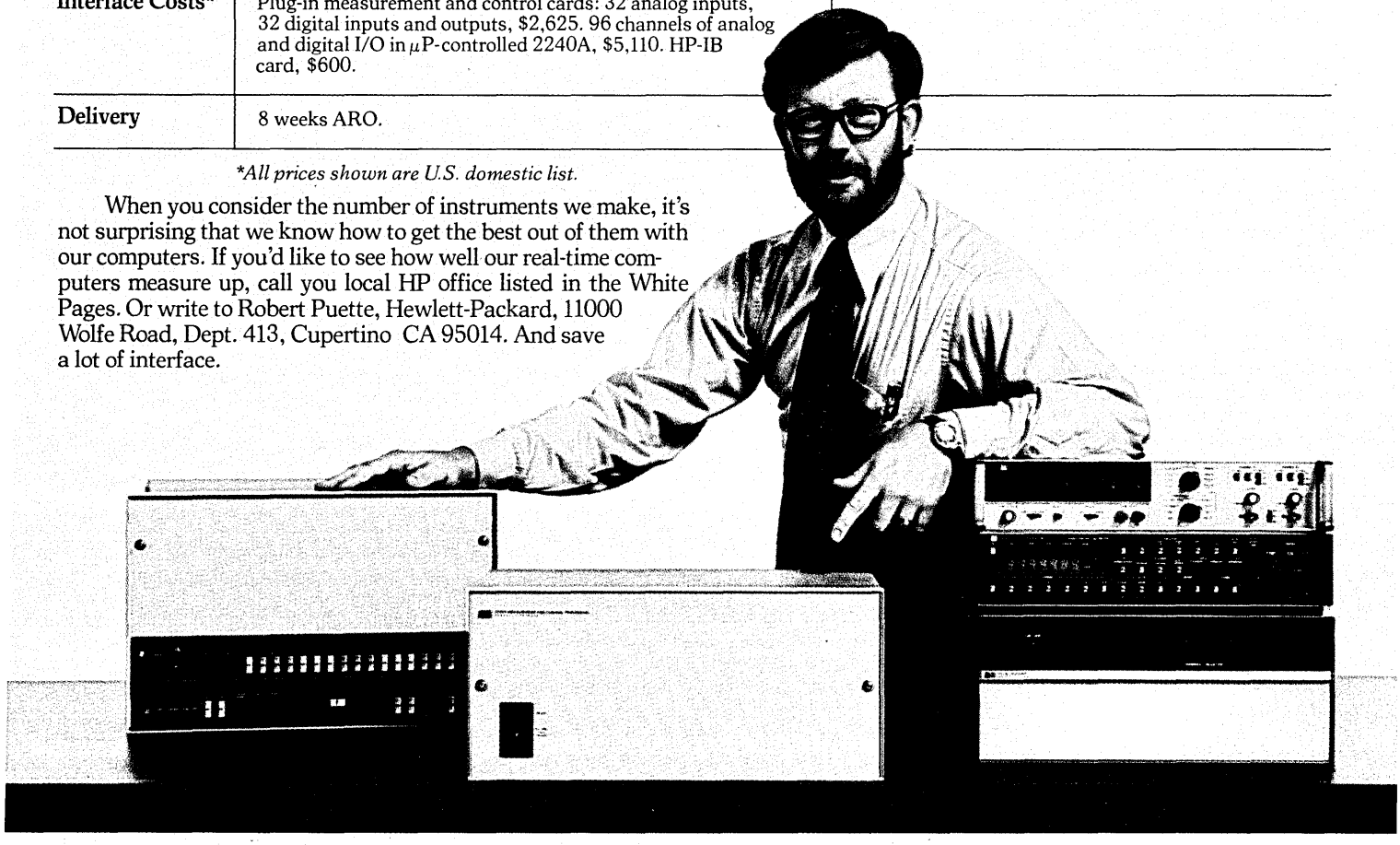
The terminal was designed to accept cartridge-loaded Ultrastrips. Each Ultrastrip contained as many as 2,000 ultra-high-reduction images, each typically two-hundredths (200X reduc-

Instrumentation Interfacing: how does your real-time computer measure up?

Feature	Our HP 1000 and 21MX Computers	Your old favorite
Standard Interfaces (IEEE-488, ANSI MC 1. 1)	HP-Interface Bus (HP-IB) simplifies connections to over 200 bus-compatible instruments for stimulus, measurement and display, and reduces installation costs. High-level READ and WRITE calls in FORTRAN and BASIC simplify programming.	
Intelligent Analog and Digital Subsystem	HP's 2240A microprocessor-based analog and digital subsystem off-loads CPU and simplifies programming. Handles complete real-time tasks such as time-scheduled data acquisition, scan synchronization with external events, interrupt waits, waveform sample pacing, temperature drift corrections for high accuracy.	
Real Time Software	Compatible family of memory and disc-based Real Time Executive (RTE) operating systems. Interrupt handling at 100μs. Real-time BASIC, ISA FORTRAN with bit-manipulation and real-time extensions.	
Computer Costs*	HP 1000 Model 20 memory-based system from $21,000. HP 1000 Model 30 disc-based system from $31,500. (Both include 21MX E-series CPU, 64K bytes memory, 2645A CRT with dual mini-cartridges, RTE software.)	
Interface Costs*	Plug-in measurement and control cards: 32 analog inputs, 32 digital inputs and outputs, $2,625. 96 channels of analog and digital I/O in μP-controlled 2240A, $5,110. HP-IB card, $600.	
Delivery	8 weeks ARO.	

**All prices shown are U.S. domestic list.*

When you consider the number of instruments we make, it's not surprising that we know how to get the best out of them with our computers. If you'd like to see how well our real-time computers measure up, call you local HP office listed in the White Pages. Or write to Robert Puette, Hewlett-Packard, 11000 Wolfe Road, Dept. 413, Cupertino CA 95014. And save a lot of interface.



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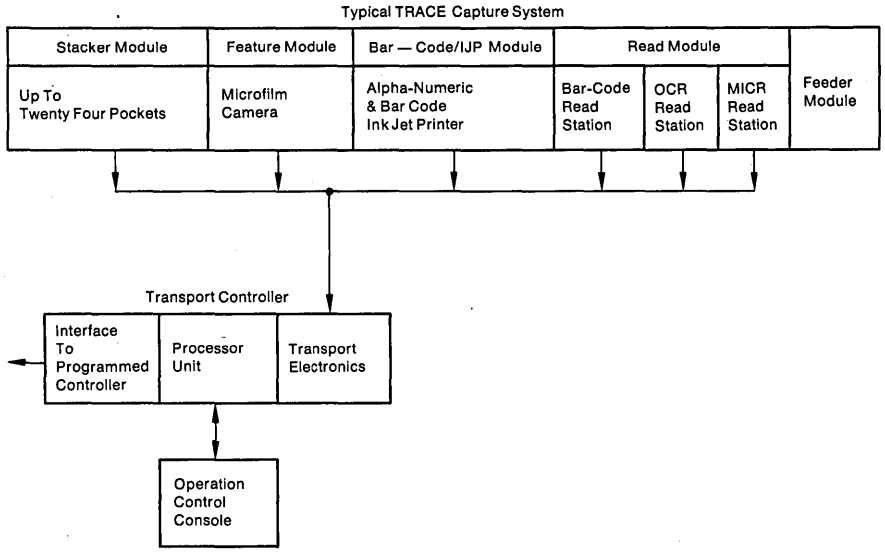


Fig. 2.

tion) their original size. (Fig. 3). The terminal accommodated up to 50 Ultrastrips providing on-line access to as many as 100,000 pages.

Image capture involved a two step filming process. The first step reduced the source document or computer generated data to images on a roll of 16mm film (20X reduction ratio). The second step further reduced the film image onto a sheet of high resolution film called an Ultrastrip master. The reduction at this step was 10X, resulting in a total reduction ratio of 200X referenced to the original. Multiple copies for distributing were contact printed from the Ultrastrip master.

Index keys were manually key-entered during source document filming or were stripped from the magnetic tape file used to produce computer output microfilm.

The index system consisted of a minicomputer, disc storage, and associated peripherals. Computer storage contained the index to the file. The MDS system usually employed the Microdata minicomputer with the REALITY operating system and data base manager.

A schematic of the system is shown in Fig. 3. The first opportunity for head-on competition between a photographic system as described above and an electronic image system presented itself in the form of a business requirement in Citibank's Funds Transfer operations. Funds Transfer, an early form of EFTS, employed telegraphic links to effect transfer of funds in the account of a customer to another account at another bank. The dollar value of transactions typically are very large and a customer used the service to assure transfer during the same business day.

The process in 1976 was not true EFTS—human intervention was required to receive incoming cables and route outgoing messages. In the few cases where the process failed to accurately execute our customers' instructions, we had to quickly determine what the original instructions were and what actually happened so that the transaction could be corrected.

Parameters of the application were:

- 11,000 source documents input per day;
- 49 customer service managers each requiring a terminal;
- locations requiring terminals at two locations several miles apart in New York City;
- sufficiently rapid access to serve customer telephone inquiries;
- at least six months' activity (approximately one million images) maintained on-line.

Digitized image filing storage and retrieval was intensively studied for this application. Our analysis went roughly like this. Recall that 1.5 megabits were required for adequate representation of an image. With compression of four to one, 50,000 bytes per document or 50 trillion bytes for a million document file would have been required. Ordinary data discs could be used for image storage (they were used as buffers in several actual systems) but the cost of that quantity of disc storage, to say nothing of control, rendered discs an unrealistic alternative. Several of the exotic memories did offer such capacity at lower unit cost, but were not field proven and had to be considered high risks. Next, very high band-width lines would have been required for reasonable image transmission times; especially if images were transmitted uncompressed to avoid the cost decompressor at each terminal. Speeds of over 250,000 bps were considered. Finally, because low unit cost for storage was achieved only with very large mass storage devices, input-output problems were anticipated.

By contrast, photographic systems delivered the same functional parameters with few drawbacks. Photographic film, with readily available lenses, routinely provided twice the resolution specified for the proposed digitized system. Owing to the relatively low cost of photographic film, the image file could be affordably duplicated to be available at many locations. This in turn solved the problems of wide band-width transmission and contention for a centralized memory. Communication to a centralized computer index was quite feasible by ordinary telephone lines.

A decision was made to install a photographic system based on Microform Data Systems hardware. The system, requiring over $1,000,000 capital investment, has been operational since late 1976. Forecasts predict an annual net saving in excess of $100,000 achieved through greater labor efficiency. More significantly, the system enables real-time response to many customer inquiries.

A second opportunity to weigh photographic technology against digitizing presented itself with a similar application in Citibank's Investment Management Group. Again, after rigorous analysis, digitizing offered insufficient functional advantage to outweigh cost, complexity, and technological risk. The application is currently being installed with a photo-

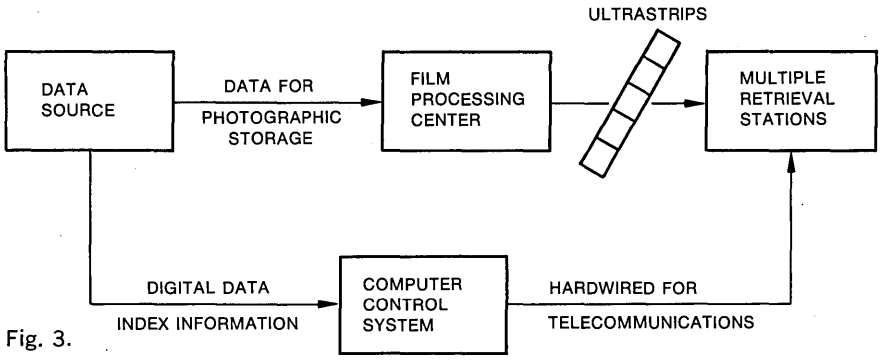


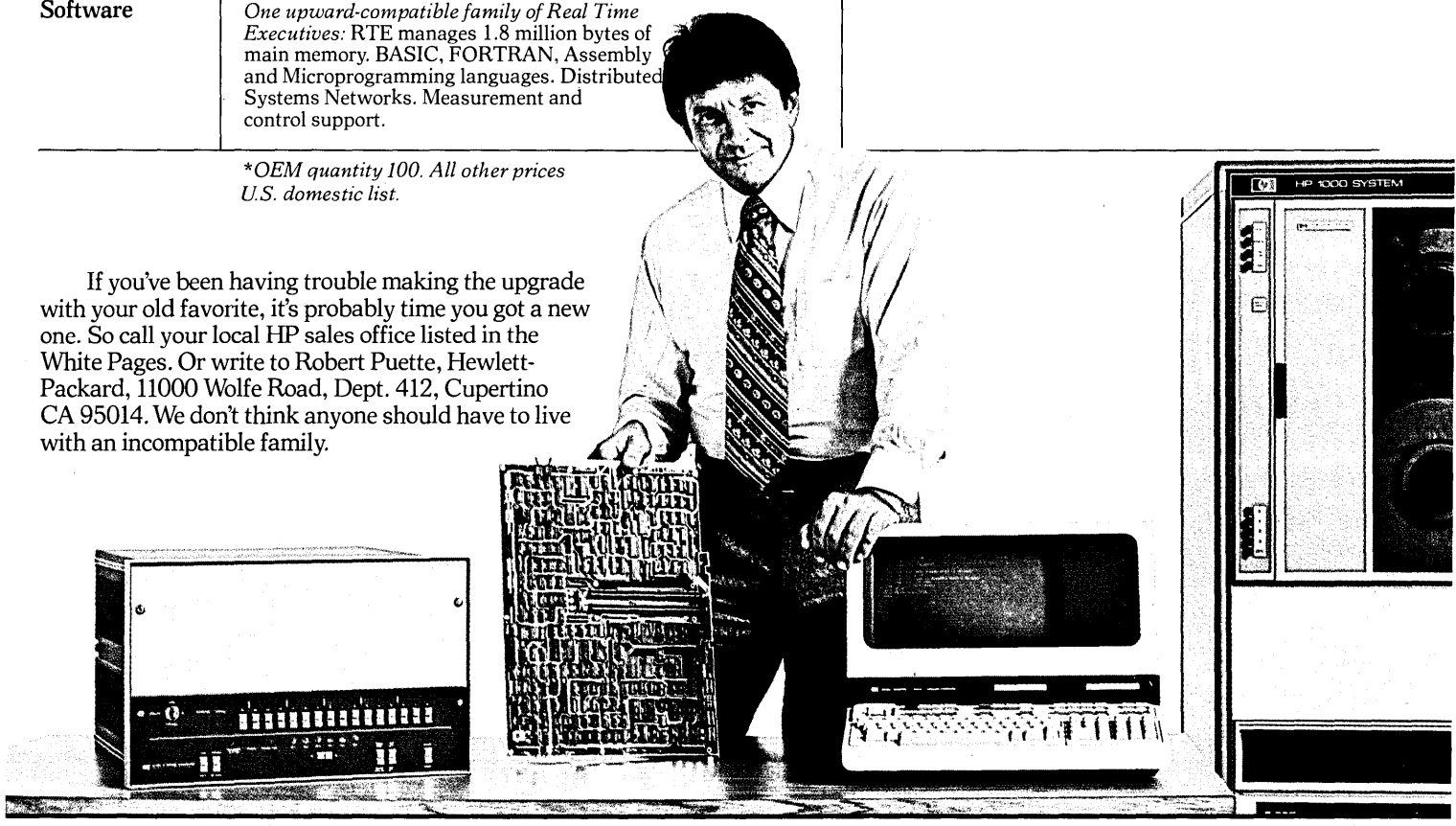
Fig. 3.

Processor growth: can your small computer make the upgrade?

Product	Our HP 1000 and 21MX Computers	Your old favorite
Computers	21MX computers, with memory capacity of 1.8 million bytes, speeds up to 350 ns, and user microprogramming. All have compatible architecture, instruction sets, I/O and memory. *K-Series* computer on a board: $974.* *M-Series* low-cost computer: $2,698.* *E-Series* high-performance computer: $3,803.* Instructions 70-100% faster than M-Series.	
Systems	HP 1000 includes 21MX-E computer, CRT console with soft keys and dual cartridges, RTE operating system. Fault control memory available to 1.8 million bytes. Easy to upgrade as your needs expand, with full selection of HP manufactured and supported peripherals. *Model 20.* 64K-byte memory-based systems: $21,000. 500K-byte flexible discs optional. *Model 30.* 64K-byte disc-based system, 15M-byte disc storage: $36,500. 5M and 50M-byte discs available. *Model 80.* 128K-byte data base management system with 15M-byte disc storage. HP-developed IMAGE DBM software, mag tape and line printer: $61,700. 50M-byte discs available.	
Software	*One upward-compatible family of Real Time Executives:* RTE manages 1.8 million bytes of main memory. BASIC, FORTRAN, Assembly and Microprogramming languages. Distributed Systems Networks. Measurement and control support.	

**OEM quantity 100. All other prices U.S. domestic list.*

If you've been having trouble making the upgrade with your old favorite, it's probably time you got a new one. So call your local HP sales office listed in the White Pages. Or write to Robert Puette, Hewlett-Packard, 11000 Wolfe Road, Dept. 412, Cupertino CA 95014. We don't think anyone should have to live with an incompatible family.



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WHAT IS YOUR NEED?

Compact, rugged terminal/CPU package
Up to 32K *16-bit* words of memory
Nova™ 1200 code compatibility
Comprehensive interfacing capability
2000 character screen
Protected status line
Comprehensive video attributes
Cluster/Slave capability
Synchronous/asynchronous communications
A/D - D/A conversion capability
Full range of industry compatible peripherals
112 keyboard function keys (28 x 4)
Keyboard key lock/IPL
10-key numeric pad
Power Fail/Auto-restart
Programmable indicators
Audio Alarm
Multichannel graphics
Multi-user operating system

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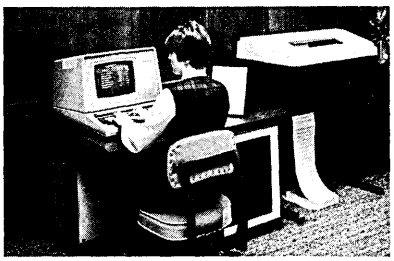

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Slow, medium or high-speed printers
Up to 16 slave terminals
Multi-user operating system
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Full training program
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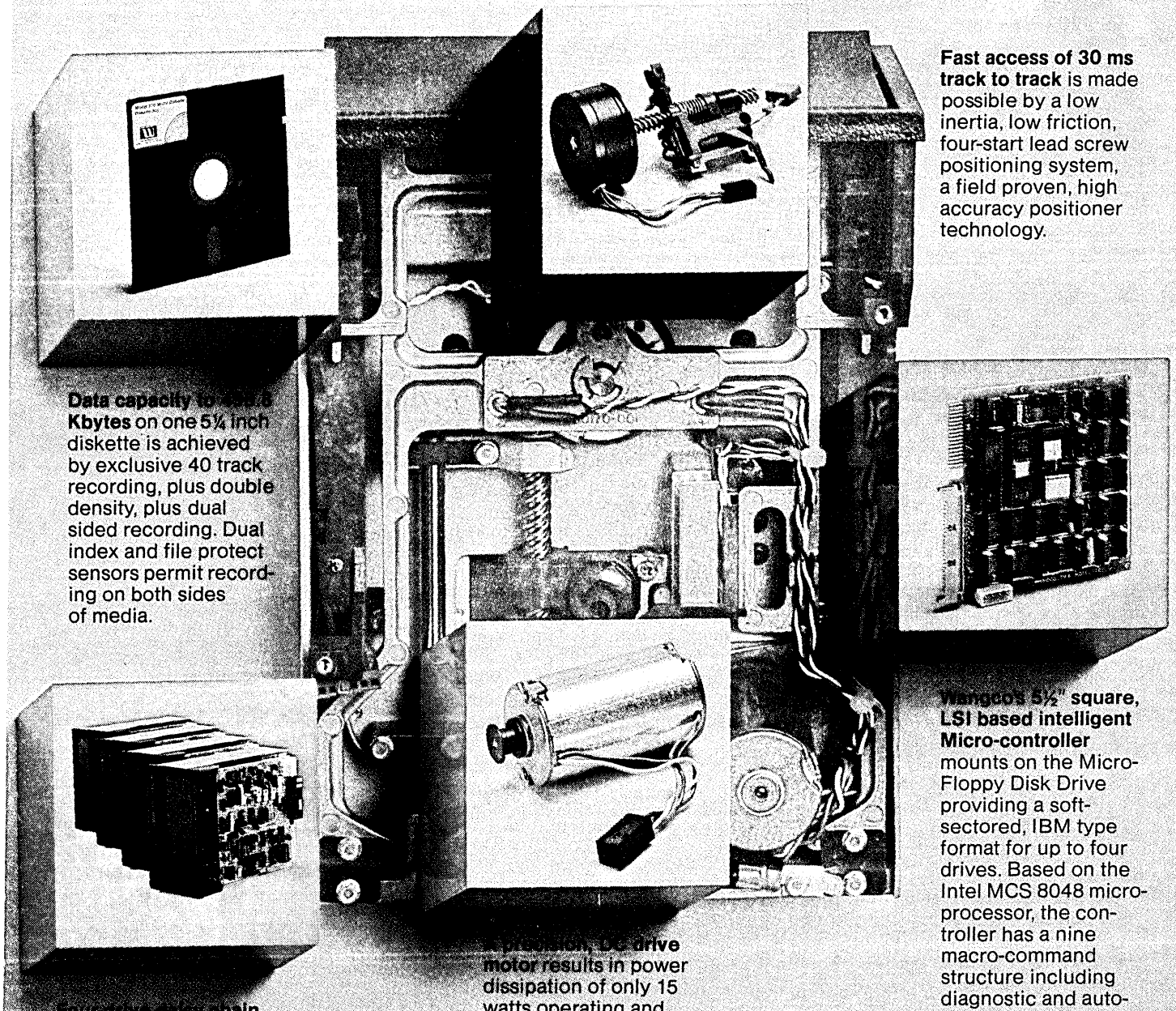

Fast access of 30 ms track to track is made possible by a low inertia, low friction, four-start lead screw positioning system, a field proven, high accuracy positioner technology.

Data capacity to [illegible] Kbytes on one 5¼ inch diskette is achieved by exclusive 40 track recording, plus double density, plus dual sided recording. Dual index and file protect sensors permit recording on both sides of media.

Wangco's 5½" square, LSI based intelligent Micro-controller mounts on the Micro-Floppy Disk Drive providing a soft-sectored, IBM type format for up to four drives. Based on the Intel MCS 8048 microprocessor, the controller has a nine macro-command structure including diagnostic and automatic diskette copy. Most overhead requirements are greatly reduced.

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[illegible] precision, DC drive motor results in power dissipation of only 15 watts operating and 6 watts standby. No AC power is required, therefore, the Micro-Floppy Disk Drive functions conveniently worldwide.

Look at all the features. Wangco's Model 82 Micro-Floppy Disk Drive clearly sets the standard in 5¼ inch diskette drives, including cast mainframe, ceramic ferrite head, photoelectric write protect, operator interlock and data reliability of 1 in 10^9 Get full information from Wangco, Inc., 5404 Jandy Place, Los Angeles, California 90066. (213) 390-8081. In Europe: P.O. Box 7754, Building 70, 1st Floor, Schiphol-OOST, Netherlands. Phone: (020) 458269. TWX: 844-1882 WANGCO NL.

WANGCO
PERKIN ELMER DATA SYSTEMS

CIRCLE 39 ON READER CARD

graphic-based system.

Two major systems now being implemented further confirm the trend towards computer-indexed document image files. The first of these systems, employing the Ragen equipment described earlier, will file, store, and retrieve masses of stock certificates and related work papers. The second, employing Kodak equipment, will provide computer indexed retrieval for a set of the check transactions described in TRACE. This set represents our international customers.

$ per 1,000 pages		Capital $ to present human-readable image
COM		
One copy	$ 2.50	
Add'l. copies	.80	Negligible
PAPER		
One copy	$ 5.00	
Two copies	$10.00	
Three copies	$18.00	
Four copies	$30.00	Negligible
MAGNETIC TAPE		
Off-line	$ 7.00	$10K-$25K
FLEXIBLE DISC		
Off-line	$60.00	$10K-$25K

Table 1. The economics of COM.

CITICOM

The conclusion that with readily available technology (and even peering somewhat into the future), computer assisted photographic file management systems offered all the functionality of digitized systems at significantly less cost and complexity was further confirmed by considering computer output microfilm (COM).

COM systems translate computer digital code from magnetic tape into printed microfilm formats. Several technologies are employed in printing onto photographic film. One system now installed, the Minnesota Mining and Manufacturing Laser Beam Recorder, employs a galvonometer-controlled laser to "write" characters at up to 48X reduction of standard computer character size.

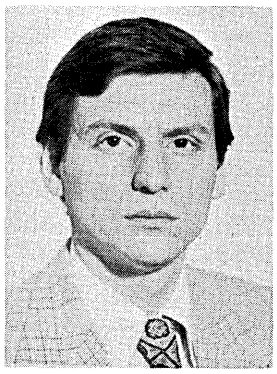
A more typical technique is to simply photograph a crt screen face. The minicomputer controls various system functions such as report formatting, indexing of frames, and control of the systems electromechanical activities. Because the photographic process captures the crt page image in a fraction of a second, COM systems typically "print" at up to 10,000 pages an hour, or seven to ten times the rate of a paper line printer.

The economics of COM confirm the efficiency of photographic film as a data storage medium. The capital cost of a computer-controlled COM system ($100,000 to $150,000) is somewhat less than the equivalent productive capacity for line printers and respective controllers. Therefore only the marginal cost of media and apparatus required to present human-readable images will be considered. (See Table 1.)

Of course, one might correctly argue that photographic film is not machine-readable, and therefore not suited to data processing or dynamic file updating. However COM, as a human-readable memory, can provide real-time access to static files through the techniques described in the previous section.

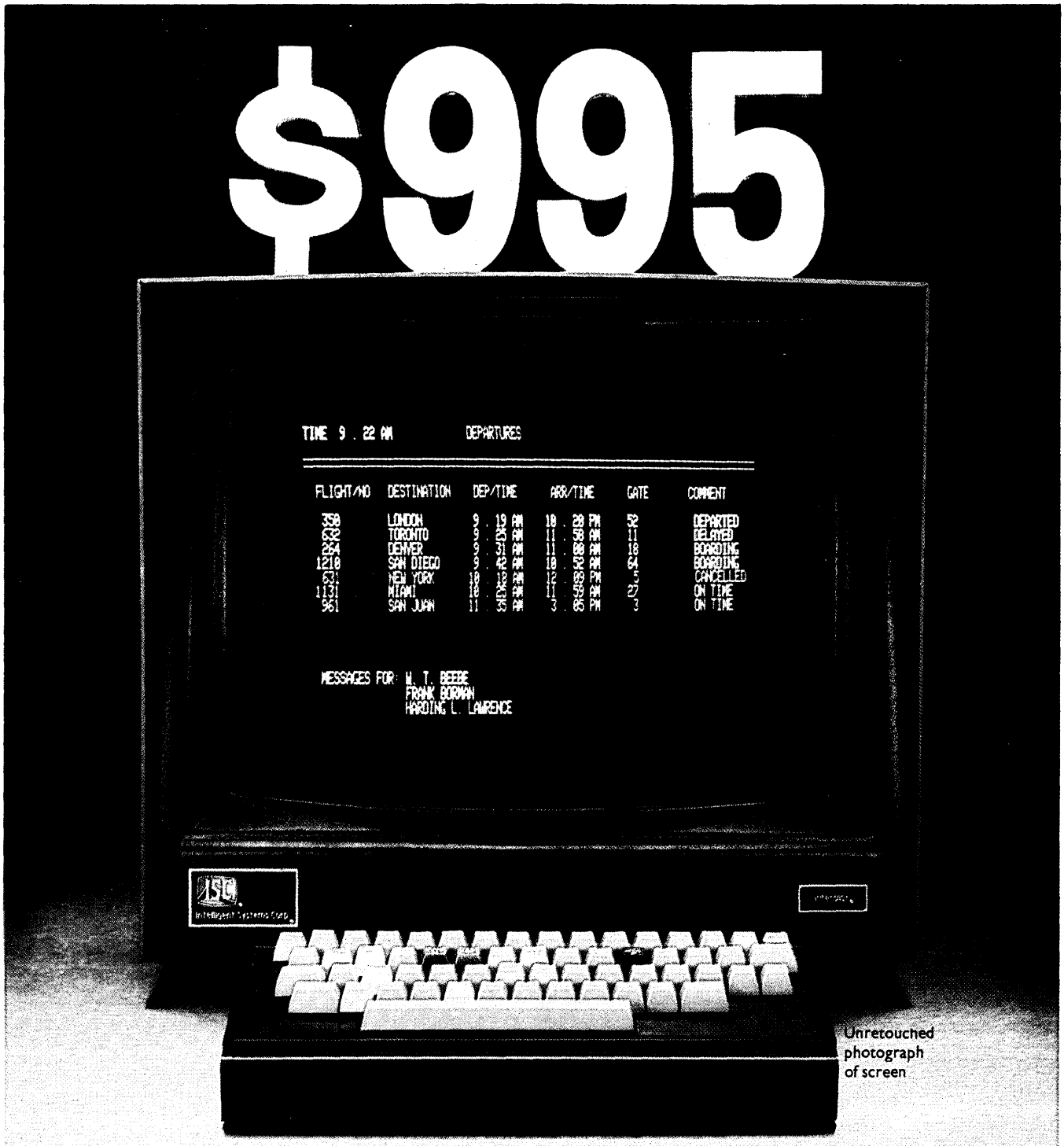
Citibank, at the end of 1976, produced COM at an annual running rate of 80 million frames, an increase from 50 million at the end of 1975. By the end of 1977 we expect to be producing 100 million frames. This represents annual transference of 320,000 megabytes of magnetic-based data, in coded format which is at least fifteen times more efficient than digitized image sampling, including compression, to photographic "memory."

Photographic storage is obviously more cost-effective than electronic storage, even if the data is coded. Although, intellectually, pure electronic techniques have more appeal, pragmatic, bottom-line considerations and the state of today's technology dictated otherwise.



Mr. Zampino has been with Citibank since 1970, and currently is an assistant vice-president. He designed the original applications for the systems described, and has done research into microimage technologies directed at Citibank's goal of eliminating paper from their operations.

$995



Unretouched photograph of screen

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Contact the ISC rep nearest you. We guarantee delivery of your Intecolor 8001 evaluation unit for $995 (cash-with-order) within 30 days or your money back. Or if you've seen the Intecolor 8001 in action and you're already sold on the price and performance, we'll give you the same $995 price for orders of 100 units or more. Get the jump on your competition without outspending your competition. Get the Intecolor 8001.

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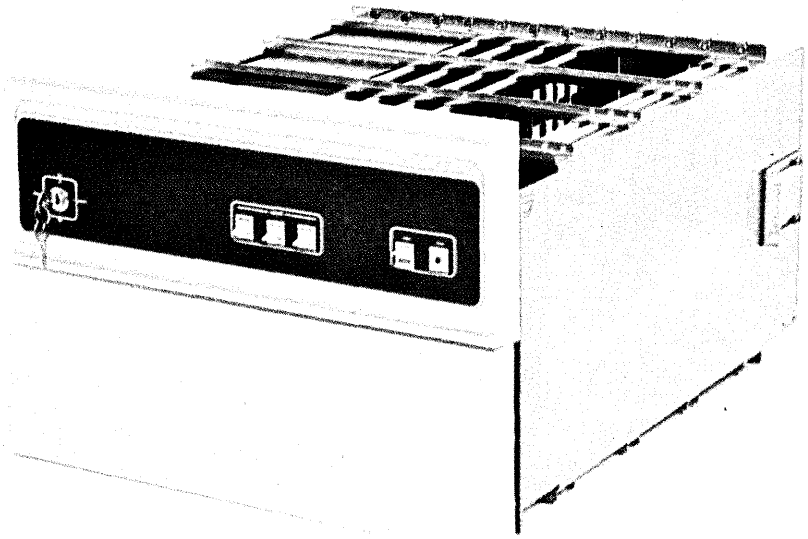

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The Communications Channel It's Broken—Now What?

by George M. Dick

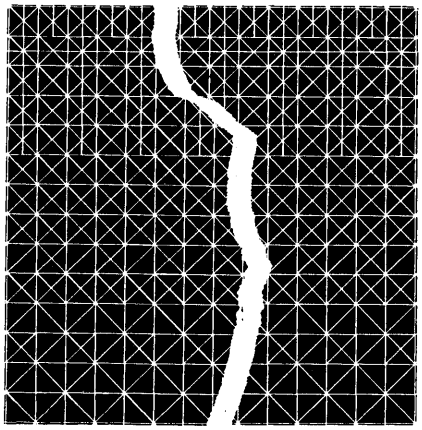
Learning some of your communications vendor's language can save time, money, and hassling. A tutorial for dp managers.

After months of frustrating communications problems, a data processing manager is likely to demand that representatives from the phone company and other communications vendors meet with him to "hash out" new procedures for handling problems. These new procedures typically include rules regarding "show-up time" and problem escalation. All too often, however, these procedures ignore a major cause of what appears to be poor vendor support. With no pun or other humor intended, this is usually poor communication—communication between customer and vendor personnel. One of the solutions for this semantic standoff is to learn some of the vendor's language. The technology isn't all that difficult and the payoff can be substantial.

Data processing vendors realized many years ago that there was no real need for their customers to be conversant with hardware. The vendors provided support such that a hardware malfunction could be identified even if the user described the problem in software terminology. But then came the communications explosion. Notwithstanding our inability to agree on definitions, there *is* a difference between data communications and data processing. If you show a service representative the results of a computer dump and the response consists of a blank stare, you can be sure you're dealing with a communications vendor.

Service personnel

Data communications vendors have followed the lead of data processing vendors and refer to their service personnel as service engineers, customer engineers, and the like. These individuals have typically received formal training at an electronics "tech school." While their background is, in fact, more closely aligned with trouble-shooting activity than the background



of degreed engineers, a certain perspective must be maintained. A major portion of their total training consists of employer's on-the-job training. The OJT, however, will typically cover only the equipment that a particular vendor manufactures or markets. Unless a service representative was previously employed by a data processing vendor, it is not reasonable to expect a substantial knowledge of data processing.

The "ideal" solution would consist of substantial cross-training for the service personnel. Such an occurrence is not only unlikely, but, if it did take place, would most assuredly increase the costs of communications (somebody has to pay for the training). A more realistic solution would be for end user personnel to become more conversant with the language of the service personnel.

Basics

The first hurdle to clear is the apparent discrepancy between your perception and interpretation of errors and that of your communications vendor. You concern yourself with data characters and messages while your vendor talks about bits, blocks, and patterns. You are interested in an end result while they are discussing the means to accomplish that result. Let's tie it together.

A bit, as we all know, is the smallest piece of information. It can be only a "one" or a "zero" ("mark" or "space," if you prefer). Data processing equipment arranges bits in certain combinations to represent characters and messages (which are subsequently placed on a communications channel for delivery to a remote location). However, the ability of the channel to properly deliver the data can be demonstrated without inclusion of the character/message terminology. Demonstrating that ability involves some sort of a test which, in turn, implies the existence of test equipment. For a variety of hardware and human reasons, it is desirable that test equipment be more complex than is necessary to accomplish the intended purpose. While the inclusion of data processing characters and messages might enable the dp-trained customer to better understand the result, it would also increase the complexity of the test equipment beyond that which is necessary to test a communications channel.

Communications service personnel typically work in a bit-oriented atmosphere. A sequence of bits is transmitted in a predefined combination of ones and zeros. A block is also predefined as a specific *quantity* of sequential bits and can be roughly compared to your block of text. However, the sequences used do not in any way represent characters or messages as you think of them. They are designed simply to enable a receiving test unit to determine if it is receiving the bits that were transmitted. The sequences, more properly called patterns, can range from the extremely simple all-mark and alternate mark-space patterns to extremely complex patterns that will not repeat themselves until more than a million bits have passed. Other common pattern lengths are 63 bits, 511 bits, and 2,047 bits (the odd numbers enable simpler circuitry in the test

equipment). Since a larger pattern involves larger combinations of sequential bits, a larger pattern is more likely to "catch" an elusive channel problem. A major concern, however, is compatibility. A receiving test unit must be able to interpret the pattern sent by the transmitting test unit. Standardization, fortunately, does exist in that all 63-bit patterns are identical, all 511-bit patterns are identical, etc. Bit Error Rate (BER) is the quantity of bits received in error divided by the total quantity of bits received. Block Error Rate (BKER) is the number of blocks received containing at least one bit error divided by the total quantity of blocks received. Note that block length is related to the error measurement while pattern length defines the "data" being transmitted. While not universally true, many test equipment manufacturers, for circuitry simplification, design their equipment so that one block length equals one pattern length. When the two lengths do not agree, it is the pattern that requires compatibility (between transmitting and receiving units) and the block length is *always* defined by the receiving unit.

BER measurements are used by service personnel to "tune-up" a channel and to make a subjective decision regarding channel quality. While BER measurements can be used to describe a channel as "good" or "bad," BER cannot be related directly to throughput because error distribution is not taken into account. Assume that a thousand bit errors occur during a time interval of one thousand seconds. If the errors are evenly distributed (one per second), the effect on throughput would be disastrous. However, if all of the errors occurred in a single second, the effect would be minor.

BKER is more closely related to your throughput worries. Assume, for a moment, that a BKER measurement has been made with a block length that is exactly the same as your block of text (including control characters). The BKER is measured as 10^{-2}, or one-one hundredth, which means that out of every 100 test blocks received, one contained an error. Now, if you were to use this communications channel, you would see one retry for every 100 text blocks transmitted.

When measuring BKER, the importance of indicating block size cannot be overemphasized. Assume a hypothetical (and unlikely) communications channel that repetitively causes a single bit error every 10,000 bits. If the block size is 10,000 bits or higher, no blocks will be error-free, the success rate would be zero, and the BKER would be 100%. If the block size were 1,000 bits, however, nine out of ten blocks would be error-free and the BKER would be 0.1:

Another error-rate parameter, used with digital networks, is called Error-Free-Seconds (EFS). EFS is similar to BKER except that it indicates probability of success rather than probability of failure, and the "block size" is the quantity of bits transmitted in one second; for example, with a 4800 bps channel, the one-second "block" would contain 4,800 bits. The actual definition of EFS is the number of seconds in which no error occurred divided by the total number of seconds of the test.

Fig. 1 shows the relationship of the various types of channel quality measurements described above. By superimposing other block sizes on the figure, the success (or failure) probabilities can be estimated. For the more mathematically inclined, the probabilities can be calculated. First, it is necessary to convert the known (measured) value into probability of error-free transmission. If the known value is EFS, nothing need be done beyond moving the decimal point so as to eliminate the percent sign. If known value is BKER, the conversion is (1—BKER). Now, having the probability of successful transmission of block size "A" and wishing to find the probability of successful transmission of block size "B," we first do a simple calculation of $B/A = X$ and then do a difficult calculation on raising the known probability to the "X" power. For example, the BKER for a 2,047-bit block ($BKER_{2047}$) was measured by 2×10^{-3} (or 0.002). The probability of successful transmission is, therefore, 0.998. Your text block has 15,400 bits; 15,400/2047 = 7.52 and $(0.998)^{7.52} = 0.985$. Your text, consequently, has a 98.5% chance of successful transmission or, alternately, 15 out of every 1,000 text transmissions will result in retries. It is essential, of course, that the test that determined the original value be sufficiently long to accurately describe the channel quality (the longer the better). Also, empirical evidence indicates that, because of the burst nature of errors, this type of calculation is not likely to be valid for block sizes of less than 500 bits. For both of those reasons, the reader is requested *not* to use the calculations to confirm Fig. 1.

The reader is cautioned that service personnel are not likely to be willing or able to perform the calculations described above. They have been described primarily to enable the end user to better relate common communications measurements to the desired end result.

Loop-backs

Simply stated, a loop-back is a means by which a signal, at a particular physical point, can be turned around (looped back) and returned to its point of origin. The actual physical distance between the point of origin and the loop-back point may be as little as several inches or as great as several thousand miles.

	START						END
TIME	1 sec.	2 sec.		5 sec.	10 sec.	20 sec.	30 sec.
BIT #	00	200		500	1000	2000	3000
BLOCK # (200-BIT SIZE)	1	2	3	4	5	10	15
BLOCK # (500-BIT SIZE)				1	2	4	6
ERRORED BITS		xxx		xx			

$$BER = \frac{5}{3000} = 1.67 \times 10^{-3} \text{ (or 0.00167)}$$

$$BKER_{200} = \frac{3}{15} = 2 \times 10^{-1} \text{ (or 0.2)}$$

$$BKER_{500} = \frac{2}{6} = 3.3 \times 10^{-1} \text{ (or 0.33)}$$

$$EFS = \frac{27}{30} = 90\%$$

Fig. 1. Performance of hypothetical 100 bps channel.

The complexity crops up when one is confronted with the various types of loop-backs that can exist, they can be digital or analog, local or remote, local-controlled or remote-controlled, unidirectional or bidirectional, or, most confusing, almost any combination thereof.

Consider Fig. 2. The shaded area is intended to indicate a significant, although unspecified, distance. The reader can visualize it as that portion of a communications channel consisting of a telephone line (or other equivalent circuit). The top drawing is a local loop-back in that the point of data origin and point of loop-back are physically in the same location. Using similar reasoning, it can be seen that the bottom drawing is a remote loop-back. Adding one of the combinations mentioned in the preceding paragraph can result in an apparently contradic-

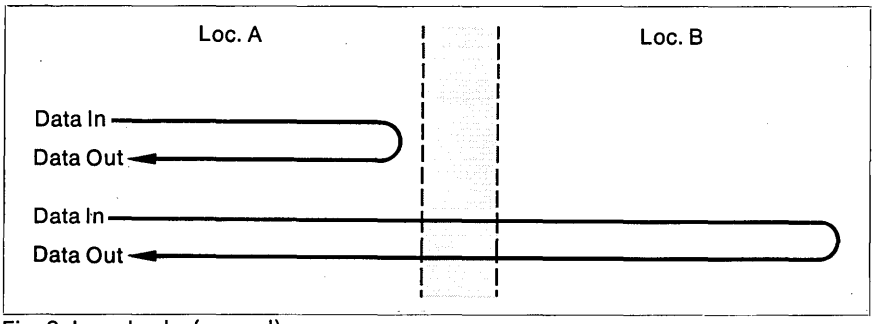


Fig. 2. Loop-backs (general).

tory term. Assume that the local loop-back (top drawing) has resulted from the activity of a human being physically at location B. We still have a local loop-back but it is controlled remotely; hence, a remote-controlled local loop-back! In summary, the terms local and remote refer to the relationship between looping location and data origin while the terms local-controlled and remote-controlled refer to the relationship between looping location and location of the human activity that caused the looping to take place.

Referring now to Fig. 3, the drawing on the left shows a bidirectional digital loop. The loop is digital in that it takes place at the digital (or EIA) side of the modem. It is bidirectional simply because two loops (in opposite directions) have taken place at the same physical point. By considering the preceding paragraph, it can be seen that the left-most digital loop is a local loop while the right-most digital loop is a remote loop. Local-control/remote-control cannot be determined from the drawing. The drawing on the right shows a bidirectional analog loop; the left-most analog loop is a local loop while the right-most analog loop is a remote loop. The reader is cautioned regarding the unfortunate usage of the term "analog." Some modem replacement devices (such as DDS units and line drivers) do not actually use an analog signal and, therefore, a more correct and generalized term would be "line loop." Unidirectional loops are, by far, more common than bidirectional loops and, obviously, it is essential to know the particular direction. This can be determined by combining the terms local/remote and digital/analog. However, vendors frequently use a simple English language description: "The data is looped back to. . . ." With a unidirectional loop, the "other side" of the loop is, for all practical purposes, physically disconnected from the communications channel.

Digital testing

The most frequent test type by far is the digital test. This type of test is possible with quite a large range of equipment, from the "freebie" test buttons on communications devices to the highly sophisticated, self-contained units in the $10,000 price range. A large majority of the digital tests performed by both users and vendors are in the loop-back mode. We will consider this mode first.

When a problem has occurred and the communications channel is suspect, the typical (and logical) first step is a modem "self-test." Depending on the modem model, this may consist of one or several buttons but the end result is the same: a test pattern is generated inside the modem as close as possible to the normal digital input (which is, of course, disconnected). The test pattern travels through 90% of the modem's circuitry, passes through an artificial telephone line and is returned to its point of origin (the artificial line acts as a local analog loop). The returning pattern is then compared with the transmitted pattern and the operator is advised of discrepancies via an indicator lamp. That sounds simple, and it is, but all too often the results are misinterpreted.

If the modem has failed the self-test, the problem most likely has been identified. The modem vendor should certainly be called, if for no other reason than to repair the self-test circuitry. While failure of the self-test circuitry is extremely unlikely, the user can easily verify the suspected conditions by swapping the modem with another one (if available). If the modem and its mate at another location both pass self-test, the user should *not* call the phone company and state: "My modems pass self-test; your line is bad." Successful completion of a self-test is comparable to testing an automobile in a straight line and then assuming that it is capable of making turns. There are several limitations to a self-test. First, as indicated above, the test pattern does not travel through 100% of the modem's circuitry. Second, with few exceptions, the pattern is an extremely simple one: all ones (or marks). This pattern is the easiest for a modem to handle. Third, the artificial line does not represent anywhere near the total range of conditions that a modem should be capable of handling on a real line. Artificial lines are usually nothing more than an attenuator although, occasionally, frequency response is incorporated. Unfortunately, many other line characteristics are neglected. The next test that is *likely to be available* to the typical user is a "remote self-test." One modem would be set to generate and compare the test pattern but *without* the artificial line. The modem's mate would be placed in a "digital remote loop." Again, see Fig. 3. Now, the pattern is generated in one modem, passed over the telephone line, through the other modem, over the telephone line again, and back through the first modem. Assuming that the user has no telephone line test equipment (which will be discussed in the next section), the user must now deal with probabilities. With both modems having passed the local self-tests, passing the remote self-test would indicate that the user's best bet is to contact the modem vendor while failing the remote self-test would tend to point toward a telephone line problem. If the user has external digital test equipment available, the tests should be repeated with an externally generated (and presumably more complex) pattern. If the results agree with the self-test results, the same conclusions should be drawn, with an increased probability of accuracy. If, however, the local analog loop (artificial line) test fails, a modem failure has been confirmed while, unfortunately, if the remote digital loop (with external test equipment) results disagree with the results of the remote self-test, the waters are muddied and the user must resort to coin flipping.

If the telephone company is called at this point, the user would be wise to keep in mind that he is dealing with probabilities rather than certainties. It's best that the problem be described as either "no data" or "many errors." The telephone company personnel will *not* examine every aspect of the telephone circuit. They, too, are dealing with probabilities. They will check for

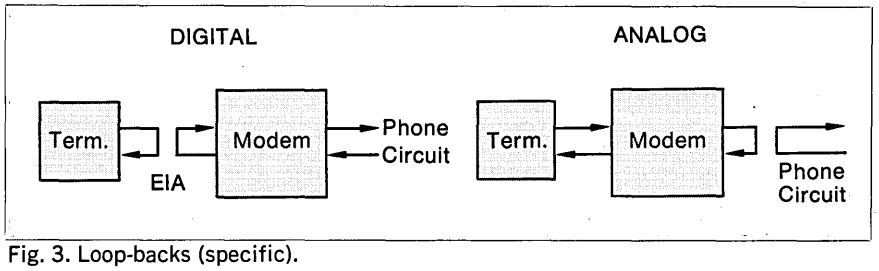


Fig. 3. Loop-backs (specific).

the line problems that are not only most common but also easiest to check. While this reasoning will occasionally backfire, it is actually to the user's benefit. If a half-hour can produce a 90% probability, why spend a full day for certainty? Keep in mind that the circuit is useless to you while it's in the phone company's hands. With a trouble report of this nature, the phone company personnel will certainly check for line continuity, probably check attenuation at the phone company reference frequency of 1,004 Hz, and possibly check for excessive noise. If phone company testing results in an NTF (no trouble found), it's advisable to query the phone company rep regarding which checks were made. Then, attempt to use the channel again (some line problems really do disappear).

If the communications channel is still not operational, call the phone company back and specifically request a noise check (if not already done) and a "freq" (pronounced freek) run. Freq is short for "frequency," and a freq run consists of checking attenuation at various frequencies throughout a telephone line's bandwidth. Don't get fancy by talking about envelope delay or phase jitter. Envelope delay rarely changes once it has been set up and phase jitter will affect a noise meter and, therefore, a high noise reading will cause the phone company personnel to consider the possibility of phase jitter. Upon hanging up the phone, pick it up again and call your modem vendor. You've pretty much exhausted your capabilities at this point and it's best to let the two vendors work it out together. This is, incidentally, an excellent time to judge the willingness and ability of each vendor to work with the other. Caution is advised, however. The worst thing you can do is to pace the floor within sight or hearing of a vendor repair representative.

Loop-back testing also is a convenient method of performing routine after-hours performance checks. This is best done with external digital test equipment and a remote digital loop. The user should first establish some benchmark performance guidelines. Initial testing of the communications channels will determine the validity of the guidelines (your software can, hopefully, give some feel regarding good, fair, or poor quality of individual channels—you should relate this to the guidelines). One problem with loop testing occurs when the results are extrapolated into throughput calculations. The errors that are counted are the total for both directions. It is unlikely that an equal number of errors occurred in each direction but it is even more unlikely that all the errors occurred in one direction with none in the other direction. This author prefers using a "fudge factor" of two-thirds; that is, if 100 errors were counted, it is assumed that 67 errors occurred in one direction. Since the particular direction is, of course, unknown, it is further assumed that 67 errors occurred in *each* direction.

One type of digital testing with loop-backs that has not yet been discussed is a digital test with a remote analog loop. By referring to Fig. 3, the reader can easily see that this test could be valuable to eliminate the remote modem as a possible problem. However, the remote analog loop should be used carefully. Assume a 1,000 mile telephone circuit. When a remote digital loop was used, the circuit became two 1,000 mile circuits separated by the electronics in the remote modem. The separation was important as the modem electronics enabled the signal to begin fresh and clean as it entered the second 1,000 mile circuit. However, with a remote analog loop, we do not have two circuits; we have a *single* 2,000 mile circuit—one that was engineered by the phone company as a 1,000 mile circuit! It is not impossible (although this is an extreme case) to have a telephone circuit that is completely within specification, but is totally unusable with a remote analog loop setup.

End-to-end testing is less complex than loop-back testing but is occasionally less practical because of equipment and/or personnel limitations. There are only two "ends" involved and, as the term implies, testing is done in one direction, from one end to the other end. With digital testing, the ends are the digital (or EIA) interfaces. The tests can be performed with modem test buttons that would activate the pattern generation/comparison circuitry but without activating any loop-backs. This, of course, would be done at both of the mated modems. Similarly, as with loop-back testing, this can be done with external digital test equipment.

Depending on the complexity of the test, end-to-end testing can produce several advantages. If a problem is identified (or suspected) as being a telephone line problem, the direction of the malfunction is valuable information for the telephone company. When reporting such a problem, it would be described by naming a particular location and indicating if the problem is transmit or receive *at that location.*

Another advantage occurs when the test results are to be used for throughput calculations as the error performance can be determined for each direction. End-to-end testing is extremely valuable if the circuit is used in a polling environment. With loop-back testing the modems put out energy continuously. Polling, however, requires that a modem rapidly cycle its output energy on and off. When the output energy comes "on," the modem waits a brief time before it allows the terminal to transmit data. Problems can occur if the modem does not wait long enough and its mate is not yet capable of interpreting the data (Clear-to-Send delay is too short). Similarly, the mated modem may have a problem and need more delay than it can rightfully expect. Additionally, error performance in a polled environment will rarely be as good as with the identical hardware used in a continuous carrier environment (the case with loop-back testing). Digital test equipment is available that will raise Request-to-Send, wait for Clear-to-Send, and, upon receipt, will transmit a single block of data. The mated equipment at the other end will confirm valid receipt of that single block. After a brief pause, the sequence is repeated. More sophisticated equipment is available that can be programmed to simulate your terminal. This eliminates the need for special equipment at the other end as you would use "live" equipment. A major benefit of this equipment is unrelated to this article: it enables you to test your communications software. It is also quite valuable for hardware testing, but it is improbable that your communications vendor will be willing or able to use this as a tool. The burden falls on the user to translate the test results into basic communications terminology. Remember that this sophisticated equipment is geared toward data processing personnel.

Analog testing

You've been approached by a test equipment vendor and told: "Buy our new tech-control and you can push a few buttons and tell the phone company what's wrong." Don't believe it. Crossing the boundary into the analog world is difficult for those schooled in data processing. Consider the purchase of a pound of coffee. The price is $10. The money you must provide is digital; it's either there or it isn't. Even if you count out ten one-dollar bills, each one is there or it isn't. The important word is "count." The coffee, however, is measured. The one-pound coffee can might contain 17 ounces (don't bet on it). It also might contain 15 ounces; or 15.5, or 15.9. This discussion can be carried on ad infinitum (and that is the essence of the analog world). Further complicating matters is the various combinations of characteristics that can exist. You might be willing to accept coffee that was only 90% pure provided the one-pound can contained

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18 ounces. The test equipment itself reflects the nature of the analog world. An automatic dollar bill counter either counts correctly or it doesn't. The scale that weighs a true 16 ounces of coffee might read 15.9 ounces and be acceptable or it might read 23 ounces and be defective.

As with digital testing, analog tests can be performed either in loop-back mode or end-to-end. The loop-backs, however, must be analog loop-backs and, more specifically, remote analog loop-backs. It should, first, be emphasized that, with very few exceptions, no analog test performed in loop-back mode is ever 100% valid. But didn't the phone company give you an NTF saying, "Looks good on loopback?" Believe it or not, the phone company is *not* trying to brush you off. Their personnel are combining judgment and expedience to (hopefully) result in long-term overall performance. You can expect that the judgment occasionally will backfire but your basis for complaint should be their overall track record. Depending on how many other problems are being juggled at any given time, loop-back checks can be done in ten minutes, while a thorough end-to-end test involves coordinating the activities of repairmen dispatched to each of your locations and the possible loss of a day's usage of the channel.

As with the phone company, user tests are more convenient when done in a loop-back mode because end-to-end testing has manpower and equipment requirements that are not easily met. We will, however, discuss end-to-end testing first since the loop-back test interpretation cannot be understood without a basic understanding of the tests as performed under technically valid conditions.

The simplest and most basic telephone line characteristic is called continuity. Lack of continuity is called an open circuit and can be visualized as the result obtained when wires are physically cut. Virtually any type of signal can be used to check continuity, including a modem's normal output. A determination is made, at the other end, whether or not the signal is present. After continuity is confirmed, the phone company may tell you that they will "check levels." They will be measuring power levels at various points in the circuit. Power levels can be measured in many ways depending on the particular application. With telephone circuits, it is convenient to use a decibel (dB) measurement. It is not necessary to fully understand the mathematics involved with a dB measurement, but it is important to realize that dB is used to express a power *relationship*. Also, the usage of dB terminology simplifies arithmetic as multiplication/division is replaced by addition/subtraction.

Assume a certain power quantity. Another power quantity is three dB less. If it were measured in non-dB units, it would be approximately one-half the first quantity. Six dB less would be one-quarter and nine dB would be one-eighth. It is not necessary to remember the values stated here, but it should be noted that ½ × ½ × ½ has been replaced by 3 + 3 + 3. The telephone company checks levels at a particular reference frequency (1,004 Hz). They use a circuit layout which, among other things, indictates that the level at point "A" should be a certain number of dB's higher or lower than the level at point "B." The end result is that the level at the customer's receiving location should be 16 dB less than the level at the customer's transmitting location. If the phone company measures anything other than the expected (or nominal) value, their personnel will indicate that a circuit is "long" (signal weaker than nominal) or "hot" (signal stronger than nominal). Although the telephone company has internal specifications for intermediate points on a circuit, the end-to-end requirement is that the circuit can be up to four dB long or up to four dB hot; that is, the overall loss in level can be from 12 dB to 20 dB (16dB ± 4dB). When making a level measurement, a signal with a known power level is inserted at one end and the power level at the receiving end is measured. The input power level is one-thousandth of a watt (one milliwatt) which, in dB terminology, is called 0 dBm (or zero dB's away from one milliwatt). If a circuit had the nominal 16 dB loss, the power level at the receiving end would be measured as −16 dBm (or 16 dB below one milliwatt). To emphasize the ease of dB calculations, consider again the nominal 16 dB circuit but with an input one dB higher than a milliwatt (+1 dBm). The receive power level would be 16 dB less, or −15 dBm.

Another characteristic is called frequency response and is tested by the "freq run" mentioned earlier. An example of frequency response consideration occurs with home stereo systems. A good quality stereo amplifier is said to have a "flat response" within the range of human hearing. This means that middle C (261.6 Hz) will be amplified the same as one octave above middle C (523.2 Hz) as well as all other frequencies within the range of the generally accepted "normal" human ear (20 Hz to 20,000 Hz).

With a telephone line, we are not truly considering amplification, but rather the "ability to transmit." This ability involves two facts of life: first, the frequency response is nowhere near flat and, second, frequencies below 300 Hz or above 3,000 Hz are not transmitted at all. The telephone company has specifications that define the amount of deviation from flat that a telephone line can have. These specifications indicate the maximum allowable dB difference between the ability to transmit each of the infinite quantity of frequencies possible and the ability to transmit the reference frequency of 1,004 Hz. This can be done by testing as many frequencies as time and equipment permit or by using equipment that sweeps through all the frequencies and produces a crt graphics display. It should be noted that, due to the relationship to the reference frequency, a frequency response may be entirely satisfactory on a line with out-of-tolerance level measurements as described in the preceding paragraph.

Fig. 4 shows the frequency response of an in-tolerance basic (unconditioned) channel. The right hand vertical shows the actual signal loss (in dB) for the various frequencies. The left hand vertical shows the signal loss for the frequencies *as referenced to* the loss for 1,004 Hz. The curved line is the frequency response of a hypothetical channel; it is determined to be in tolerance as it does not enter the cross-hatched areas (which depict the tolerance limits). Several areas of confusion crop up here. For unrelated reasons, telephone company reference frequencies are never an even multiple of 100 Hz, although they are usually stated in that manner. The reader should note that, in this article as well as in phone company publications, 500 Hz really means 504 Hz, 1,000 Hz really means 1,004 Hz, 2,000 Hz really means 2,004 Hz, and so on. Also, depending on the personal preferences of the individual speaking, 1,000 Hz could be stated as any of the following: 1 K HZ, 1,000 cycles, 1,000 cps, 1 KC, or, simply 1 K. Confusion also can result when deciding whether to add or subtract dB figures. Consider an automobile moving backwards at 10 miles per hour. It would be logically correct (although strange) to state that the car is moving forward at −10 miles per hour. Similarly, gain (or amplification) can be called negative loss while loss can be called negative gain. Since a frequency response chart plots loss, a more positive number indicates more loss (less gain) while a less positive number indicates less loss. With our hypothetical channel, the level measurement (loss at 1 KC) was 18 dB which, although in tolerance, is two dB long. When plotting frequency response, all loss figures are referenced to

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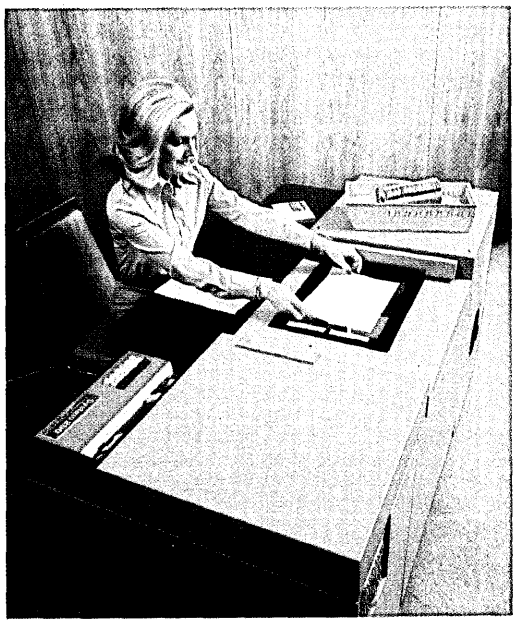

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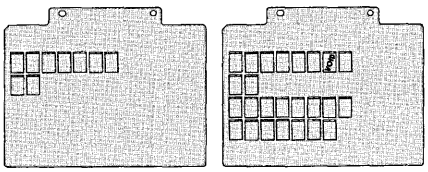

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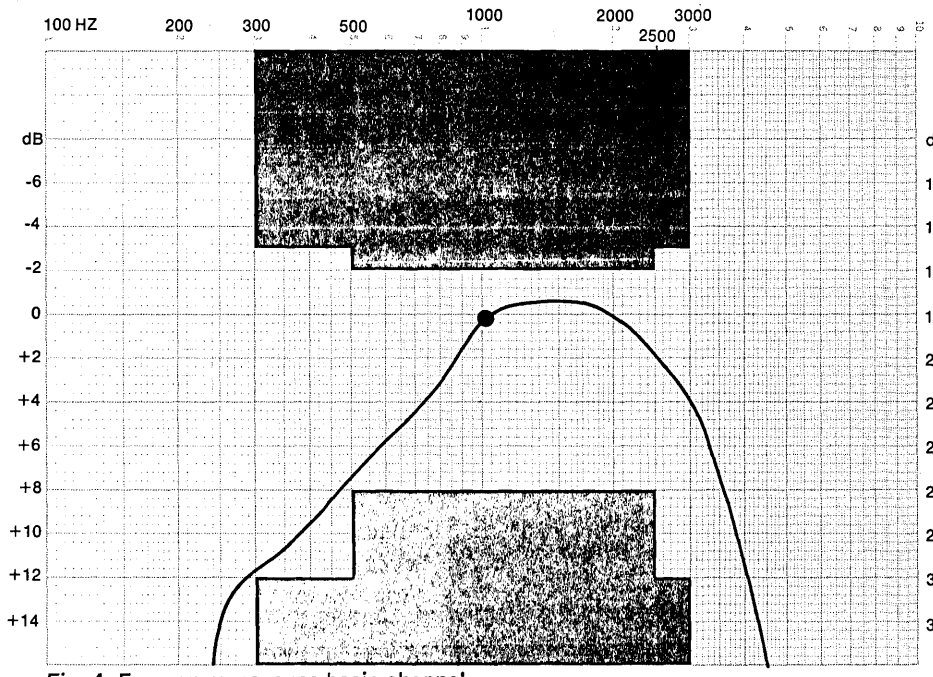


Fig. 4. Frequency response basic channel.

that 18 dB figure. Hence, the left vertical indicates 0 dB for the loss at one KC. At approximately 1,500 Hz, the actual loss is 17 dB which is one dB more gain *with respect to the reference value.* The left vertical shows this as −1 dB because, again, we are showing loss and more gain is less loss.

Fig. 5 shows the same frequency response plotted against the specifications for a C2 circuit. It can easily be seen that every frequency below approximately 800 Hz is out of tolerance. The circuit is marginal at approximately 1,500 Hz and 2,800 Hz. The reader is cautioned that frequencies are generally plotted on a logarithmic scale and visual interpolation is difficult.

Noise can substantially affect a modem's ability to function. One type of noise, called random or Gaussian, when converted to audible sound would resemble the hush experienced when a seashell is placed against the ear. This noise consists of an infinite quantity of frequency components. Depending on the location of the point where the noise is being generated, the range of frequencies containing the infinite quantity will vary. If it's being generated at the other end of the circuit, possibly by a defective modem, we can be reasonably certain that the range will be within 300 Hz to 3,000 Hz since we know that the telephone circuit will not transmit frequencies out of that particular band. If, however, the noise is being generated at some intermediate point (or points) in the circuit, the component frequencies can easily be below 300 Hz or above 3,000 Hz.

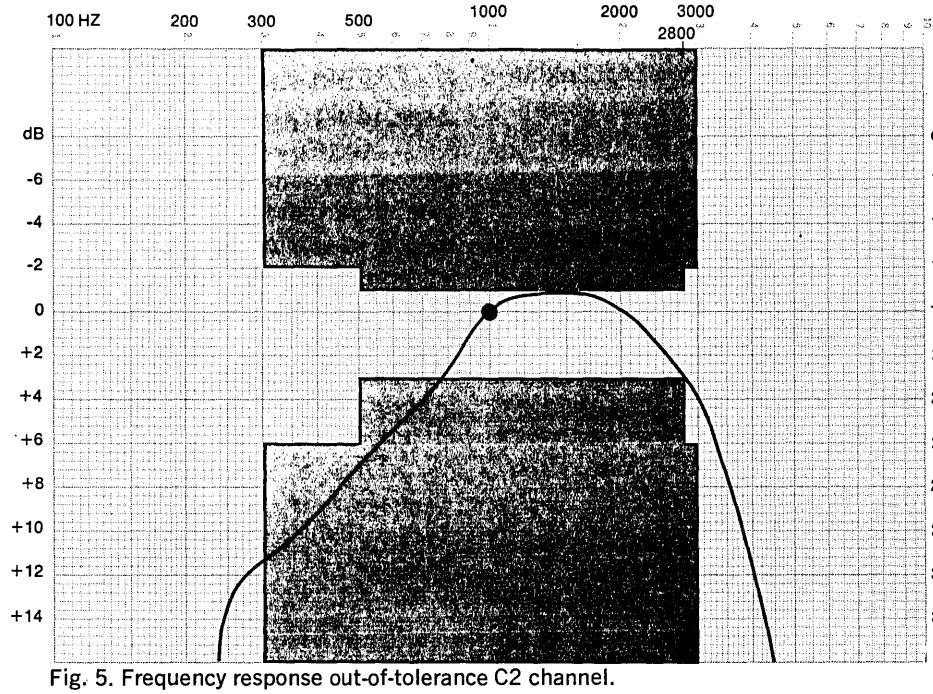


Fig. 5. Frequency response out-of-tolerance C2 channel.

We definitely do *not* want to measure all the noise that exists (even if we had a meter capable of doing so) since noise out of the 300 to 3,000 band will not (or should not) affect a modem. (If it does, we've got a modem problem.) The ideal solution is to construct a device that will "erase" all frequency components out of that band and then deliver the remainder to a noise meter. That device would be an ideal filter which, unfortunately, does not exist. The problem, then, is to determine how close to ideal is really necessary while keeping an eye on the economic limitations. The solution was to use a

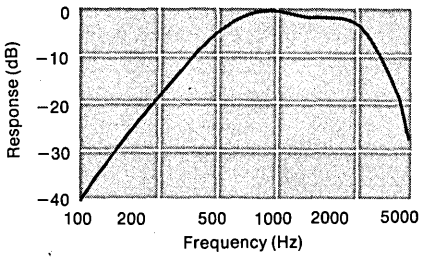
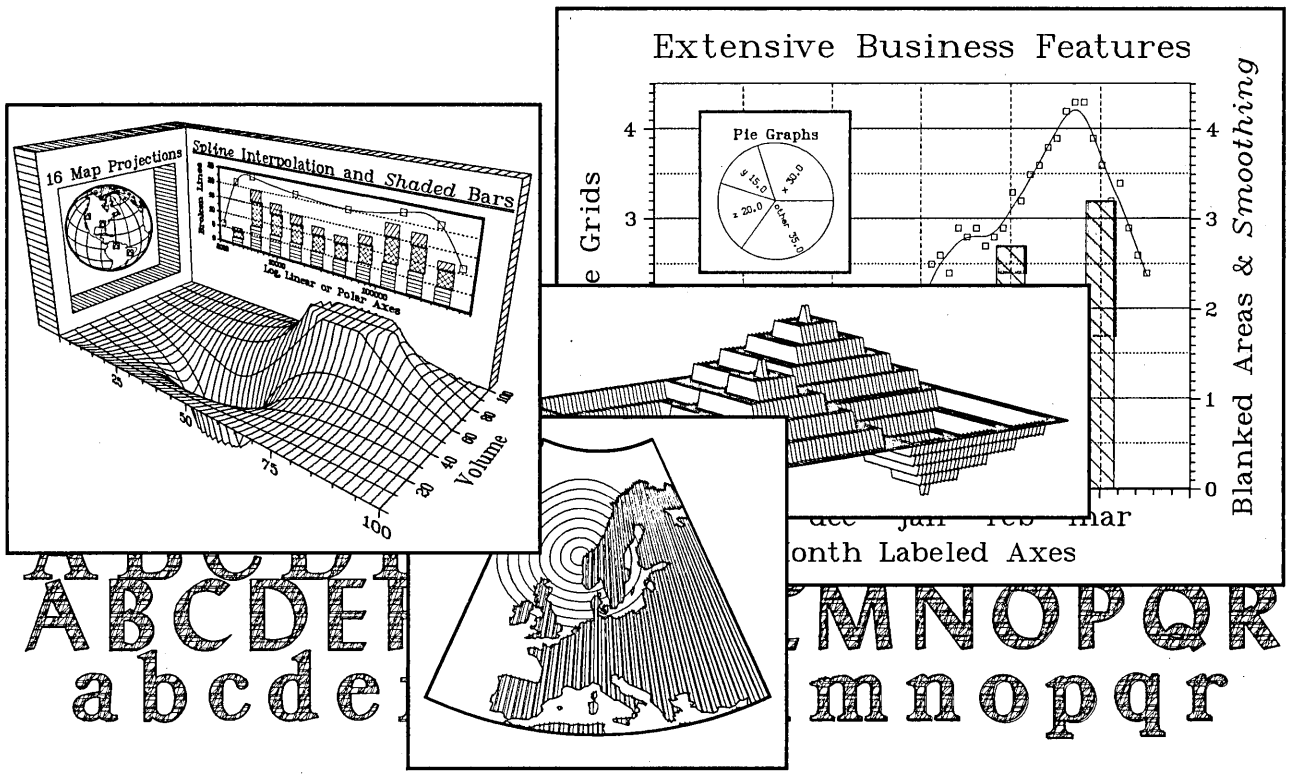


Fig. 6. C-message frequency weighting

filter originally designed for another purpose, a C-message filter. This filter will allow some out-of-band noise to be measured while it will erase some of the in-band noise. The details are not important as the filter is good enough for its purpose and, as long as all measurements are made with that filter, the measurement comparisons are valid.

Fig. 6 shows the frequency response of a C-message filter. The frequency components from 600 to 3,000 Hz will be attenuated less than five dB. Frequency components outside the 600 to 3,000 band are attenuated greatly. While the frequencies from 300 to 600 Hz are technically within the telephone line pass band, the interest is largely academic since modems make little use of those frequencies and, consequently, are not likely to be affected by noise in that area.

A C-message noise measurement should be made with the other end of the circuit properly "terminated." For the moment, suffice it to say that you should *not* disconnect the phone wires from the modem as the dangling wires will act as an antenna and pick up noise that would not otherwise be there. A simple solution is to turn off the AC power to the modem. The limits for C-message noise are based on the physical length of the channel and are stated in units known as dBrn. The "rn" means reference noise level and, therefore, 25 dBrn would mean 25 dB above the reference level. The reference is, by definition, 90 dB below one



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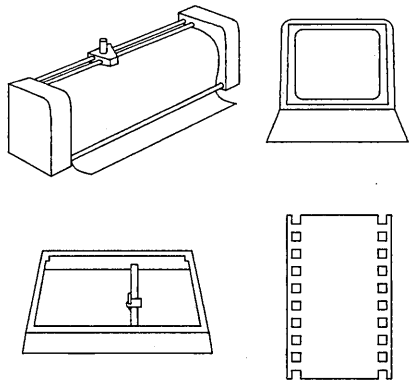

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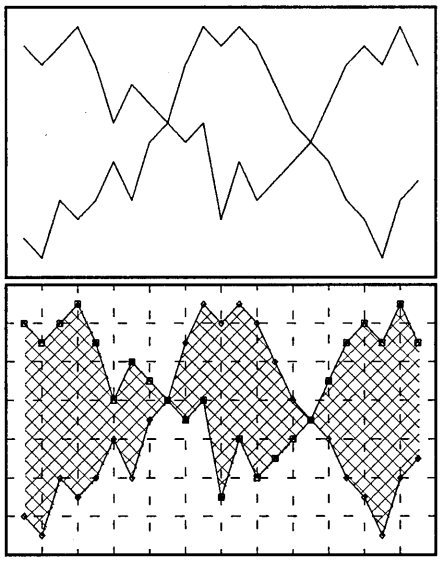

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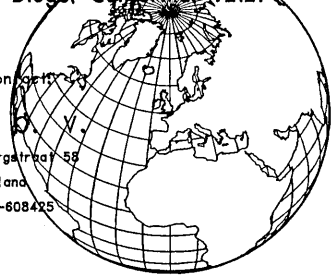

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milliwatt. Consequently, 0 dBrn is equal to −90 dBm, 25 dBrn is equal to −65 dBm, etc. When measured with a C-message filter, the units become dBrnc (with "c" identifying the filter) and a reading of 25 dBrnc would be stated verbally as "25 debrinks." This term should not be confused with dBrncO (debrinko) which is used by the telephone company to map out *portions* of a complete circuit and, therefore, is of little or no value to the end user. It should be noted that the 0 dBrn reference is such a low amount of noise that it is inconceivable that a lower noise can be found anywhere and, consequently, you will never see a negative dBrn or dBrnO.

A more valuable noise measurement is a notched noise measurement which, again, should be performed with a C-message filter and, therefore, is more properly called C-message notched noise. There are devices in telephone circuits that generate noise only in the presence of a signal. This noise will not be seen with the C-message noise measurement described in the preceding paragraph. The solution is to generate a signal at the other end of the channel, and then erase the signal before measuring the noise (otherwise, the signal will incorrectly be interpreted as noise). The signal that is used is the ever-popular 1,004 Hz. It is erased (or "notched out") by a notch filter. From a purist viewpoint, the notch filter also erases the noise components at 1,004 Hz but the effect on the total measurement is imperceptible. C-message notched noise must be at least 24 dB below the received power level of a 1,004 Hz signal (provided the signal was transmitted at 0 dBm). That is, if a circuit is two dB long, a 1,004 tone transmitted at 0 dBm would be received at −18 dBm. The C-message notched noise can, therefore, be no greater (i.e., no more positive) than −42 dBm (or 48 dBrnC). Some meters will calculate the dB difference automatically and display it accordingly. Relating signal power to noise power in this manner is the same as the signal-to-noise ratio (SNR) given in the specifications for home stereo sets. What we are saying is that the SNR must be at least 24 dB.

We have discussed level, frequency response, and noise. It is normal that the same equipment be used for all three measurements. Unfortunately, an almost silly error can result in misunderstandings between user and service personnel. Depending on the design of the meter, it may be possible to inadvertently leave the C-message filter switched on while making frequency response measurements. Should that happen, the filter will attenuate the frequency response signals just as it attenuates noise components. This could easily result in an incorrect diagnosis that a particular circuit is out of tolerance.

There are, of course, other telephone line characteristics that affect a modem's ability to function. Customer testing of these other characteristics is not advisable because of one or more of the following reasons:

- Test equipment is prohibitively expensive.
- Characteristics rarely are out of tolerance.
- Out-of-tolerance condition will be "caught" by other tests.

We will, however, discuss their meaning. There is a difference between the physical amount of time it takes for two different frequencies to reach their destination. Although not a direct measurement, envelope delay measures the *effect* of this phenomenon. It's nearly impossible for envelope delay to change significantly without a corresponding significant change in other parameters unless the change was deliberately done by phone company personnel. Envelope delay should be suspect only with a new or changed circuit. The basic rule is: if it was good yesterday, it's good today. Envelope delay measurements are difficult to perform and require complex equipment. A nonrandom noise is called single-frequency interference. A C-message noise measurement will add the single-frequency interference to the random noise and produce a total noise reading. It's nearly impossible for single-frequency noise to be out of tolerance while the total noise is within limits. A 1,004 Hz transmitted tone is received as a 1,008 Hz tone; this is a frequency shift of four Hz (up to five Hz, up or down, is permissible). Frequency shift does not occur very often and nearly any test performed by the phone company will catch it.

If, instead of remaining constant, frequency shift is continually and rapidly changing, the occurrence is known as phase jitter. While not really common, phase jitter is by no means unheard of. The difficulty lies in the relationship between phase jitter and noise as perceived by the measuring equipment. Noise will always affect a phase jitter meter, and phase jitter will usually affect a noise meter. It is not easy to differentiate between the two and, therefore, phase jitter readings are best left to the phone company.

Impulse (or hit) measurements are quite easy to understand if the other measurements are well understood. The other measurements are called steady-state measurements and, while the values can change, they do not change instantaneously. Measurement

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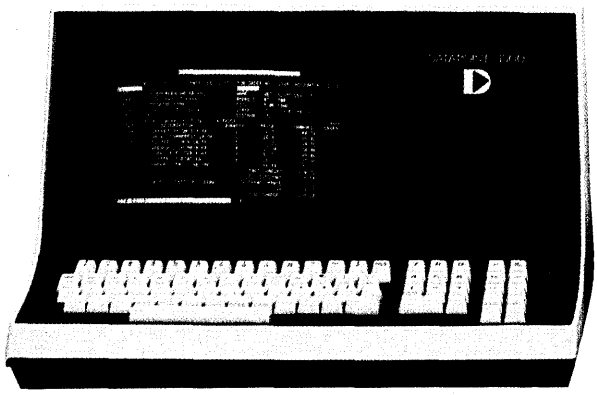

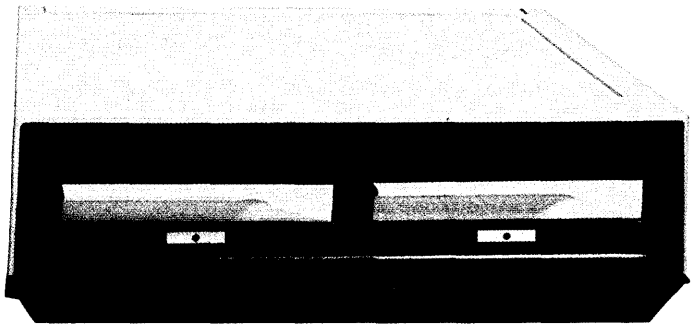

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Analog loop-back tests are, as indicated earlier, rarely conclusive. Fortunately, however, they can provide a strong clue regarding the problem being investigated. The only truly conclusive test that can be performed in loop-back mode is a test of continuity. Even that, however, can occasionally produce incorrect results: the loop-back mechanism itself may have failed!

Before going further, let's discuss the types of analog loop-backs commonly available. First, the loop can be activated (either local control or remote control) by an electronic circuit inside a modem. These loops do not necessarily contain an amplifier. An analog loop without an amplifier is comparable to physically twisting the transmit and receive wires together. If a circuit has a 18 dB loss in each direction, a loop-back test would indicate a loss of 36 dB. This type of loop is useful only for continuity checks and an extremely crude level measurement. If the loop contains an amplifier, it is typically set to 16 dB which means that the circuit mentioned above would result in a loss reading of 20 dB (18 − 16 + 18). At the phone company's option, a telephone company loop-back may be installed.

There are three types of telephone company loops, all containing a 16 dB amplifier. One is a manual loop your personnel can operate simply by throwing a switch. Another type is a remote-controlled loop that is controlled by personnel at the closest phone company central office; this is called a DC loop, as a DC signal is used to activate it (which is also why the loop can be activated only by the central office personnel—a DC signal will not travel over the other portions of the circuit). The third type is a remote-controlled loop that can be activated by anyone having access to any portion of the circuit (including you). This is called a tone-actuated loop and is operated by transmitting a secret frequency (2,713 Hz). To operate it, you would transmit 2,713 Hz for five seconds and then change the frequency to anything else. The loop will operate after you make the change. You can bring the loop down by transmitting the 2,713 tone again for three seconds.

The user should *never* attempt to utilize a tone-actuated loop on a multipoint circuit containing more than one tone-actuated loop. The same tone will operate all of the existing loops and your measurements will be meaningless. You can imagine further frustration if, for some reason, only one operates initially and the attempt to drop that loop raises another. You can go back and forth forever. The phone company gets around this problem by disconnecting certain circuit legs at one of their bridge points. Recently available phone company equipment incorporates both a manual loop and a tone-actuated loop in the same package.

When operating any type of analog loop, one caution must always be observed: do not, under any circumstances, operate the analog loops at both ends of a circuit. The circuit noise will circle around in a never-ending loop, getting larger and larger. The amplitude will eventually get large enough to affect adjacent telephone company circuits which, in turn, will cause down time for other phone company customers who, naturally, will blame the phone company.

The primary reason loop-back measurements are rarely valid is that all circuit specifications refer to a single direction of transmission, and it is not possible to determine conclusively what happened in each direction if the test was performed in loop-back mode.

Take the level measurement, for instance. If a loop-back test indicates that a circuit is six dB long, it could be three dB each way (in tolerance) or five dB one way (out of tolerance) plus one dB the other way. Similarly, if a test indicates that a circuit is exactly nominal, it could actually be out of tolerance both ways (six dB hot one way and six dB long the other). If, however, the test indicates 10 dB long, the circuit must be out of tolerance somewhere as there is no in-tolerance combinations that will produce that result. Equivalent interpretation problems can occur with a frequency response measurement. Noise readings are somewhat easier to interpret. If you take the end-to-end tolerance for the noise that you are measuring and adjust the tolerance three dB more leniently, you have got a very good probability of correctly determining if a circuit exceeds the noise limits. Of course, if the noise measurement is impulse noise, you must also double the maximum allowable count.

Earlier in this article, it was indicated that phase jitter and envelope delay are not measurements that an end user should consider. That thought is strengthened by the fact that these measurements are never, in any way, valid on a loop-back basis.

Incidentally, one way in which the phone company makes use of those loop-back tests that have at least some validity is by benchmarking. When a circuit is initially installed, end-to-end tests are made to confirm the quality of the circuit. Then loop-back tests are made and the results recorded as a benchmark. Subsequently, when trouble is suspected, the loop-back tests are repeated. If the results agree with the benchmark, it is highly unlikely (although possible) that the end-to-end characteristics have changed.

Connecting to test equipment

Connections to digital test equipment are simple. The terminal (or front-end) is disconnected from the modem and the test equipment is connected in its place. Any monitor functions are handled by the test equipment.

With analog equipment, however, it's another story. A very important word is "termination." At both the transmit and receive end, the circuit must be terminated once and only once. Analog meters usually contain a switch labeled "terminate/bridge" with the bridge position being comparable to the digital "monitor." If the circuit remains connected to the modem it is terminated in the modem and any meters attached to the circuit should be in the bridge position. If the modem has been disconnected, one piece of test equipment should be set to "terminate" and any others should be set to "bridge." Since the bridge circuitry is not perfect (the analog world again), the bridge does, in fact, supply a small amount of termination. For that reason, it is not advisable to add too many pieces of test equipment. As a general rule, a test set-up should be limited to one termination plus two bridges. You should confirm that the termination provided by the meter matches the value required by the telephone circuit. In the United States, the most common telephone line termination is 600 ohms.

It still doesn't work

You've gone through all of the exercises described above and, apparently, nothing is wrong. The phone company has demonstrated, to your satisfaction, that the phone line is in tolerance. Similarly, the modem vendor has shown you that no modems function on that particular circuit while all modems function on your other circuits and, therefore, the modem is good. What now?

It is not unheard of for a modem vendor to quote a line conditioning requirement one level less than what the modem really needs. This typically

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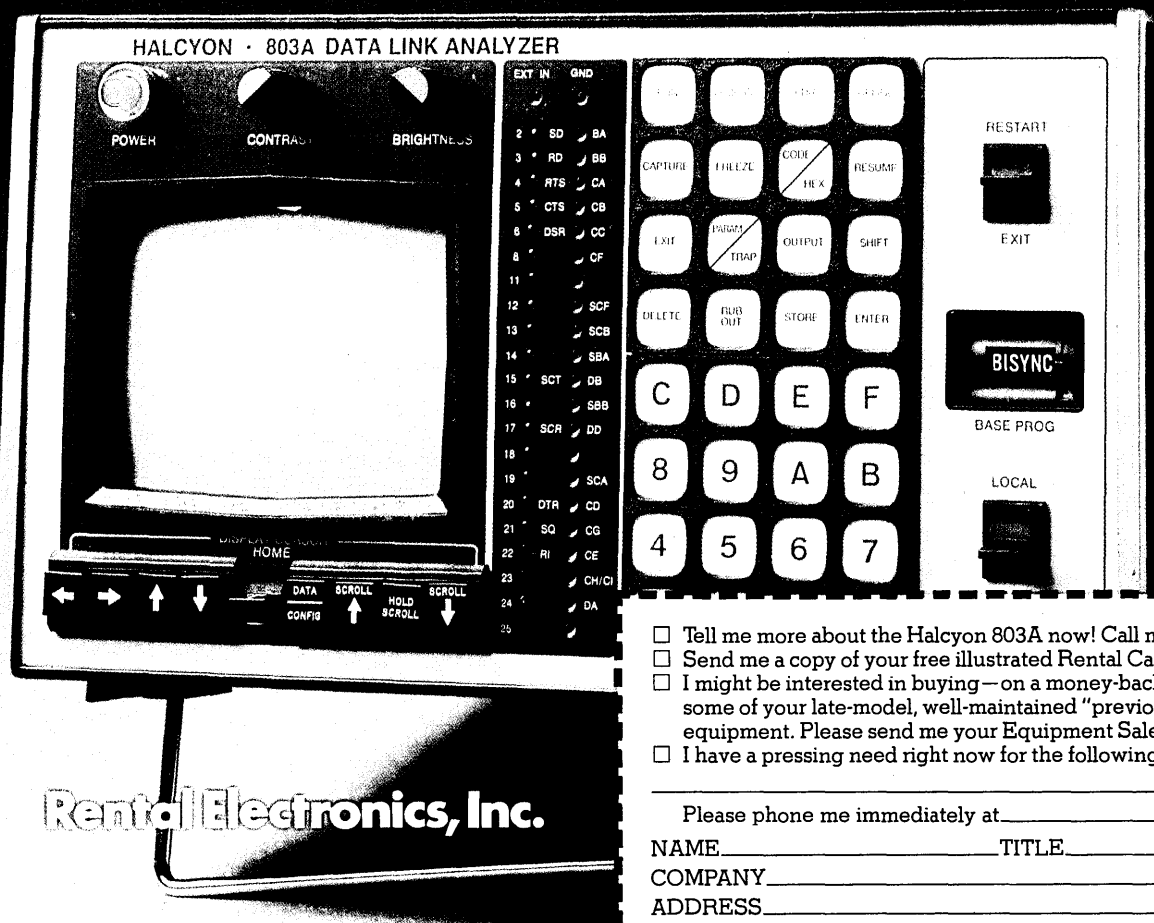

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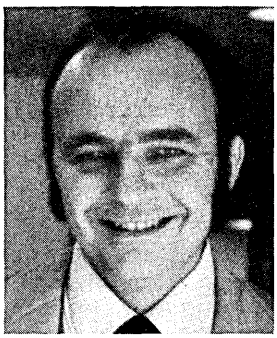
happens when, for example, the modem requires a circuit slightly better than the worst possible C1 circuit. The vendor may have determined that 95% of the real-world C1 circuits are satisfactory for modem operation. He's reluctant to recommend C2 for everybody as that increases line costs and makes it more difficult to sell the modem. So he gambles and quotes C1. Your circuit might be in that 5% where the modem won't work. It's your turn to gamble. Have the phone company upgrade the circuit to C2. If everything works fine, talk to the modem vendor about the increased line cost. If it doesn't work, you need a consultant.

Summary

It is hoped that this article has imparted an understanding of the activities of service personnel such that you will be able to work with them rather than against them. It is not expected that this will be the end of all your problems but, hopefully, the quantity of blind alleys will have been substantially reduced. Remembering Murphy's Law, it's inevitable that your most important communications channel will break down on the busiest day of the month. And that's when the service rep will foul up. Unless you can honestly say that you've never had a program that bombed, keep your cool. At the level of the working troops, nothing hurts a vendor/customer relationship more than anger. ❁



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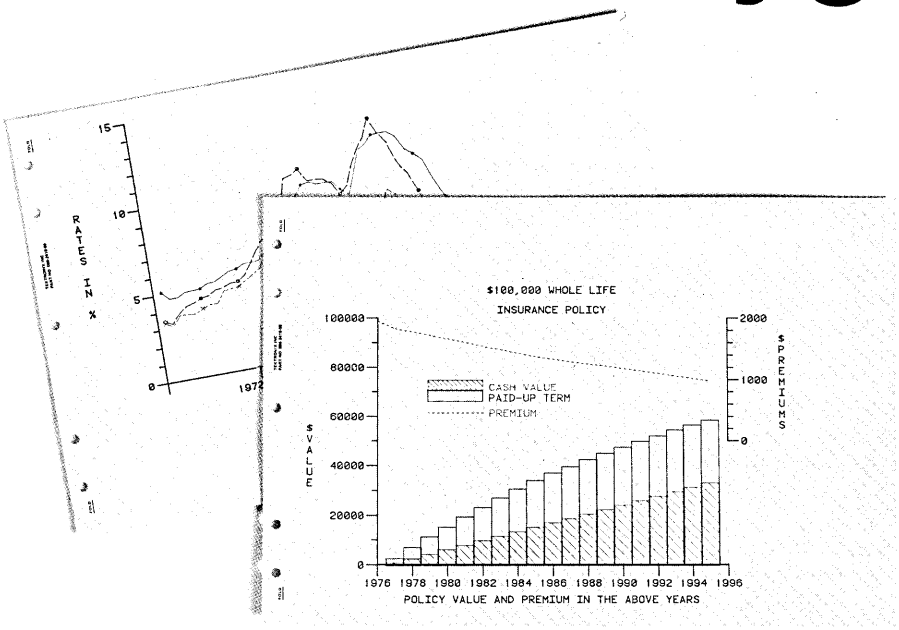

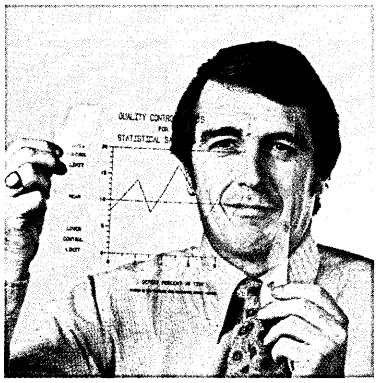

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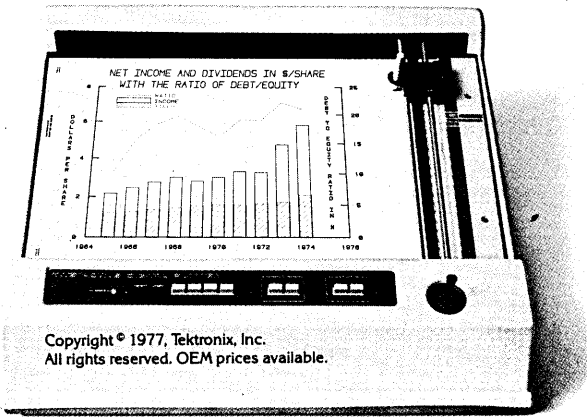

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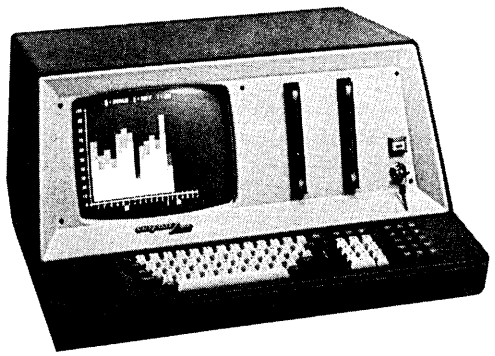

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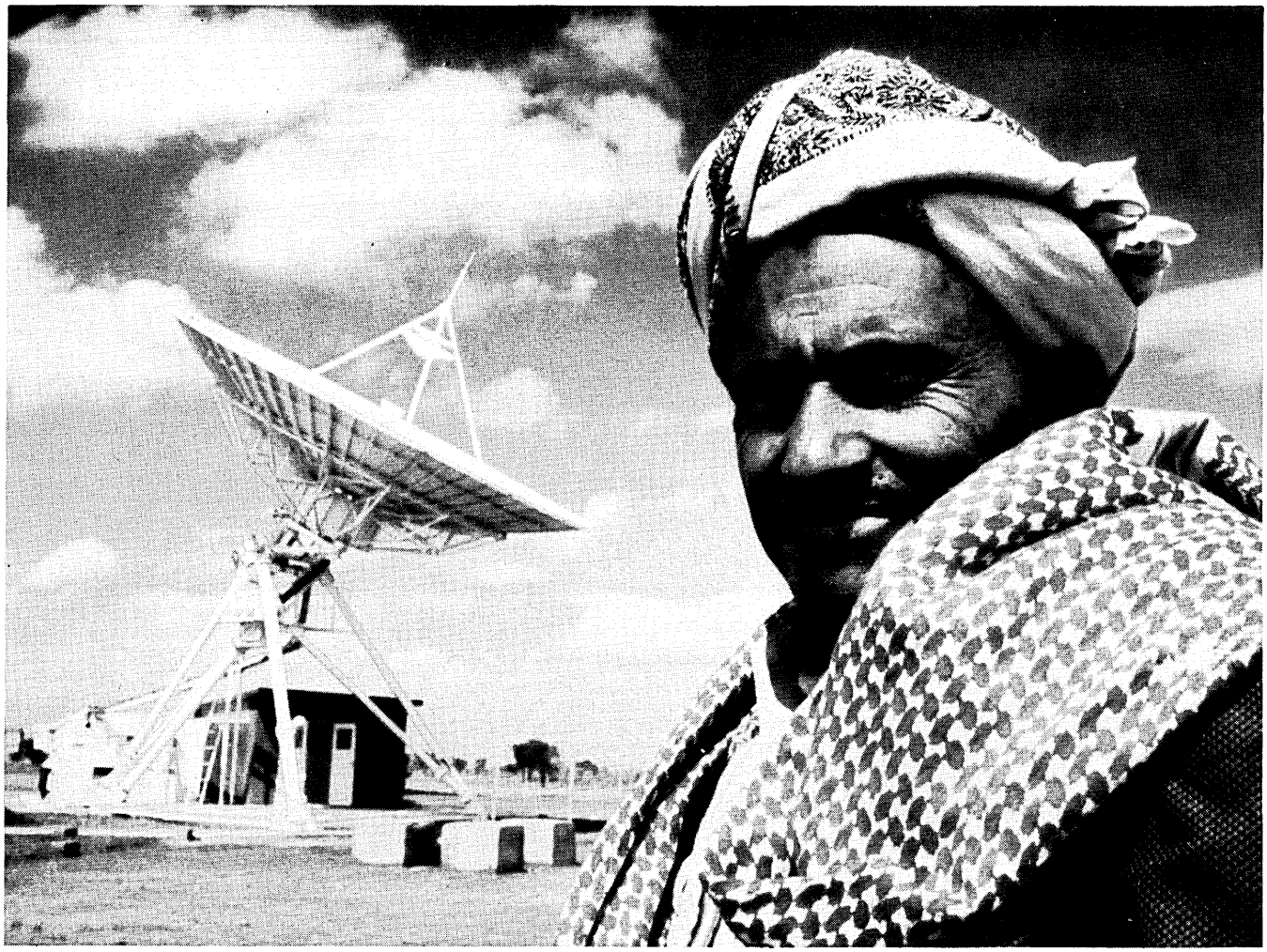

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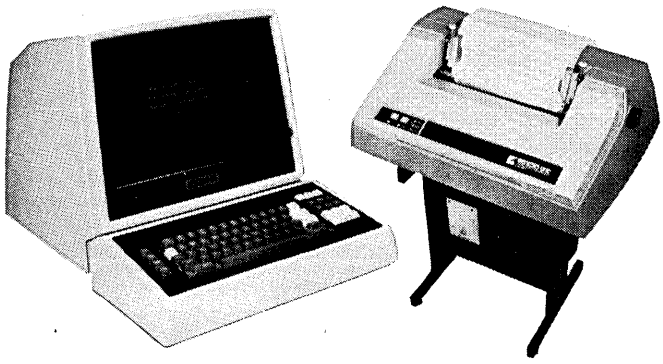

Inspecting Software Design and Code

by M. E. Fagan

Finding and fixing errors early in the software development stages reduces rework and increases productivity.

Successful management of any process requires planning, measurement, and control. In program development, these requirements translate into defining the programming process in terms of a series of operations, each having its own exit criteria. Next there must be some means of measuring completeness of the product at any point of its development by inspections or testing. And finally, the measured data must be used for controlling the process.

Design and code inspections have been applied successfully in several programming projects, both large and small, and including systems and applications programs. They have not been found to "get in the way" of programming, but instead enabled higher predictability than other means and improved productivity and product quality.

A process may be described as a set of operations occurring in a definite sequence that operates on a given input and converts it to some desired output. A general statement of this kind is sufficient to convey the notion of the process. In a practical application, however, it is necessary to describe the input, output, internal processing, and processing times of a process in very specific terms if the process is to be executed and we are to get practical output.

Defined input

In the program development process, explicit requirement statements are necessary as input. The series of processing operations that act on this input must be placed in the correct sequence with one another, the output of each operation satisfying the input needs of the next operation. The output of the final operation is, of course, the explicitly required output in the form of a verified program. Thus, the objective of each processing operation is to receive a defined input and produce a definite output that satisfies a specific set of exit criteria.

Unambiguous, explicit, and universally accepted exit criteria would be perfect as process control checkpoints. It is frequently argued that universally agreed upon checkpoints are impossible in programming because all projects are different. However, *all* projects do reach the point at which there is a project checkpoint.

For example, any trackable unit of code achieving a clean compilation can be said to have satisfied a universal exit criterion or checkpoint in the process. Other checkpoints can also be selected, albeit on more arguable premises, but once the premises are agreed upon, the checkpoints become visible in most, if not all, projects.

There is also a point at which the design of a program is considered complete. This point may be described as the level of detail to which a unit of design is reduced so that one design statement will materialize in an estimated three to 10 executable source code instructions (or, for that matter, five to 20). Whichever particular ratio is selected across a project, it provides a checkpoint for the process control of that project. In this way suitable checkpoints may be selected throughout the development process and used in process management.

Material in this article was adapted from "Design and Code Inspection to Reduce Errors in Program Development," IBM Systems Journal, Vol. 15 No. 3, 1976.

Reducing error rate

The cost of reworking errors in programs becomes higher the later they are reworked in the process; so every attempt should be made to find and fix errors as early in the process as possible. This cost has led to the use of the inspections described later and to the description of exit criteria which include assuring that all errors known at the end of the inspection of the new "clean-compilation" code, for example, have been correctly fixed. So, rework of all known errors up to a particular point must be complete before the associated checkpoint can be claimed to be met for any piece of code.

Production studies have validated the expected quality and productivity improvements and have provided estimates of standard productivity rates, percentage improvements due to inspections, and percentage improvements in error rates which are applicable in the context of large-scale operating system program production. (The data related to operating system development used here reflects results achieved by IBM in applying these processes and methods to representative samples. Since the results depend on many factors, they cannot be considered representative of every situation. They are furnished merely for the purpose of illustrating what has been achieved in sample testing.)

The purpose of the test plan inspection IT_1, shown in Fig. 1, is to find voids in the functional variation coverage and other discrepancies in the test plan. Test case inspection of the test cases, IT_2, which are based on the test plan, finds errors in the test cases. The total effects of IT_1 and IT_2 are to increase the integrity of testing

and, hence, the quality of the completed product. And, because there are fewer errors in the test cases to be debugged during the testing phase, the overall project schedule is also improved.

A process such as shown in Fig. 1 provides all the intrinsic programming properties in the product as required in the statement of objectives (Level 0) by the time the coding operation (Level 5) has been completed—except for packaging and publications requirements. With these exceptions, all later work is of a verification nature. This verification contributes nothing to the product during Levels 1 to 5, but it adds error detection and elimination and frequently at half the development cost. Inspections I_0, I_1, and I_2 were developed to measure and influence intrinsic quality (error content) in the early levels, where error rework can be most economically accomplished. Naturally, the beneficial effect on quality is also felt in later operations of the development process and at the end user's site.

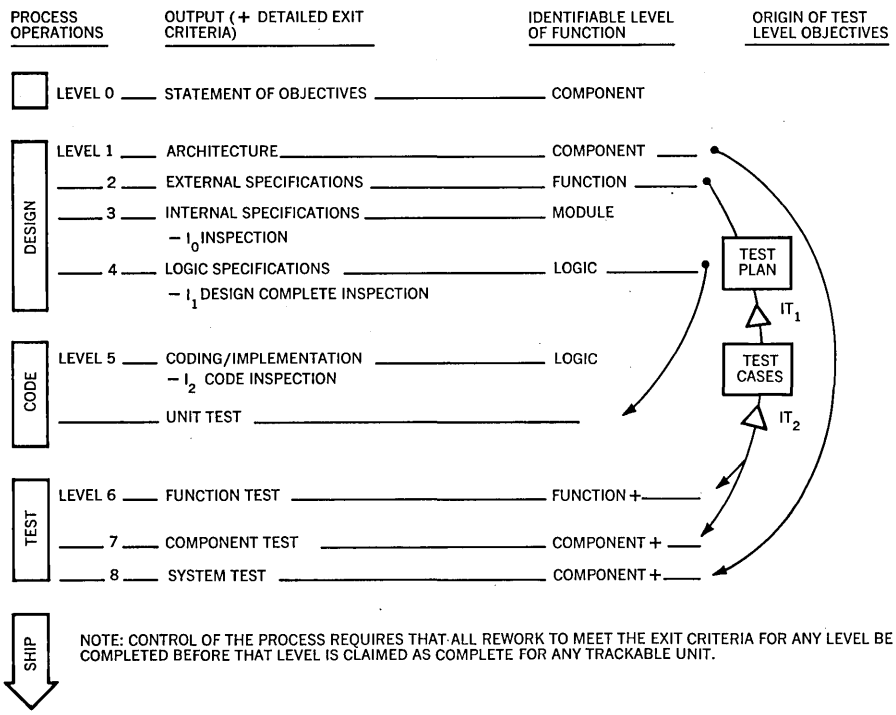

Fig. 1. Programming process.

Improving user productivity

An improvement in productivity is the most immediate effect of purging errors from the product by the I_0, I_1, and I_2 inspections. This purging allows rework of these errors very near their origin, early in the process. Rework done at these levels is 10 to 100 times less expensive than if it is done in the last half of the process. Since rework detracts from productive effort, it reduces productivity in proportion to the time taken to accomplish the rework. It follows, then, that finding errors by inspection and reworking them earlier in the process reduces the overall rework time and increases productivity even within the early operations and even more over the total process. From a manufacturer's standpoint, since fewer errors ship with the product, the time taken for the user to install programs is less, and his productivity is increased.

The quality of documentation that describes the program is of as much importance as the program itself, for poor quality can mislead the user, causing him to make errors quite as important as errors in the program. For this reason, the quality of program documentation is verified by publications inspections (PI_0, PI_1, and PI_2). Through a reduction of user-encountered errors, these inspections also have the effect of improving user productivity by reducing user rework time.

Unit testing

A piece of the design of a large operating system component (all done in structured programming) was selected as a study sample (Fig. 2). The sample was judged to be of moderate complexity. When the piece of design had been reduced to a level of detail sufficient to meet the Design Level 4 exit criteria (a level of detail of design at which one design statement would ultimately appear as three to 10 executable source code instructions), it was submitted to a design-complete inspection (100%), I_1. On conclusion of I_1, all error rework resulting from the inspection was completed, and the design was submitted for coding in PL/S. The coding was then done, and when the code was brought to the level of the first clean compilation, it was subjected to a code inspection (100%), I_2. The resultant rework was completed and the code was subjected to unit test. After unit test, a unit test inspection, I_3, was done to see that the unit test plan had been fully executed. Some rework was required and the necessary changes were made. This step completed the coding operation. The study sample was then passed on to later process operations consisting of building and testing.

Because errors were identified and corrected in groups at I_1 and I_2, rather than found one-by-one during subsequent work and handled at the higher cost incumbent in later rework, the overall amount of error rework was minimized, even within the coding operation. Expressed differently, considering the inclusion of *all* I_1 time, I_2 time, and resulting error rework time (with the usual coding and unit test time in the total time to complete the operation), a net saving resulted when this figure was compared to the no-inspection case. This net saving translated into a 23% increase in the productivity of the coding operation alone. Productivity in later levels was also increased because there was less error rework in these levels due to the effect of inspections, but the increase was not measured directly.

The Hawthorne Effect

An important aspect to consider in any production experiment involving human beings is the Hawthorne Effect. (This is a psychological phenomenon that often causes study participants to produce at levels above normal because they know they are being

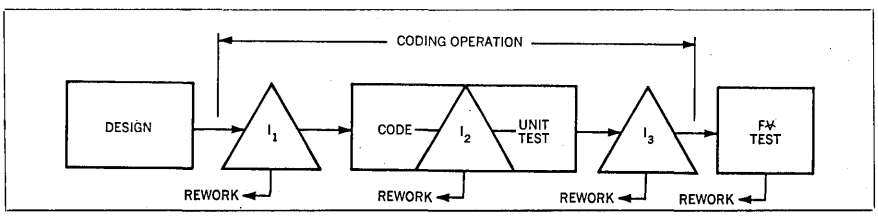

Fig. 2. A study of coding productivity.

studied.) If this effect is not properly accounted for, it is never clear whether the effect observed is due to the Hawthorne Effect or to the newly implemented change in process. In this case a fully comparable control sample was selected at random from many pieces of work after the I_1 and I_2 inspections were accepted as commonplace. The difference in productivity between experimental and control samples was insignificant, while the coding rate for the experimental sample was approximately 23% higher than the preinspection average.

38% fewer errors

The only comparative measure of quality obtained was a comparison of the inspection study sample with a fully comparable piece of the operating system component that was produced similarly, except that walkthroughs were used in place of the I_1 and I_2 inspections. (Walk-throughs were the practice before implementation of I_1 and I_2 inspections.) The process span in which the quality comparison was made was seven months of testing beyond unit test after which it was judged that both samples had been equally exercised. The results showed the inspection sample to contain 38% fewer errors than the walkthrough sample.

Note that up to inspection I_2, no machine time has been used for debugging, and so machine time savings were not mentioned. Although substantial machine time is saved overall, since there are fewer errors to test for in inspected code in later stages of the process, no actual measures were obtained.

Inspections

In the development of applications, inspections also make a significant impact. For example, an application program of eight modules was written in COBOL by two programmers in an insurance company. This program was inspected by teams of three to five participants.

The only change introduced in the development process was the I_1 and I_2 inspections. The program size was 4,439 non-commentary source statements.

An automated estimating program, which is used to produce the normal program development time estimates for all that company's programming projects, predicted that designing, coding, and unit testing this project would require 62 programmer days. In fact, the time actually taken was 46.5 programmer days including inspection meeting time. The resulting saving in programmer resources was 25%.

Process Operations	Errors found per thousand source statements	Percent of total errors found
Design I_1 inspection Coding I_2 inspection	38*	82
Unit test Preparation for acceptance test	8	18
Acceptance test	0	
Actual usage (6 mo.)	0	
Total	46	100

*51% were logic errors, most of which were missing rather than due to incorrect design.

Table 1. Error detection efficiency.

The inspections were obviously very thorough when judged by the inspection error detection efficiency of 82% and the later results during testing and usage as shown in Table 1.

The inspection rates achieved on these applications were four to six times faster than for systems programming. If these rates are generally applicable, they would have the effect of making the inspection of applications programs much less expensive than for systems programs.

Inspections are a formal, efficient, and economical method of finding errors in design and code. All instructions are examined at least once in the conduct of inspections. Key aspects of inspections are exposed in the following text by describing the I_1 and I_2 inspection conduct and process. I_0, IT_1, IT_2, PI_0, PI_1, and PI_2 inspections retain the same essential properties as the I_1 and I_2 inspections but differ in materials inspected, number of participants, and some other minor points.

The people involved

The inspection team is best served when its members play their particular roles, and assume the particular vantage point of those roles.

1. *Moderator*—The key person in a successful inspection. He must be a competent programmer but need not be a technical expert on the program being inspected. To preserve objectivity and to increase the integrity of the inspection, it is usually advantageous to use a moderator from an unrelated project. The moderator must manage the inspection team and offer leadership. Hence, he must use personal sensitivity, tact, and drive in balanced measure. His use of the strengths of team members should produce a synergistic effect larger than their number; in other words, he is the coach. The duties of moderator also include scheduling suitable meeting places, reporting inspection results within one day, and following up on rework. For best results the moderator should be specially trained. (This training is brief but very advantageous.)

2. *Designer*—The programmer responsible for producing the program design.

3. *Coder/Implementor* — The programmer responsible for translating the design into code.

4. *Tester* — The programmer responsible for writing and/or executing test cases or otherwise testing the product of the designer and coder.

If the coder of a piece of code also designed it, he will function in the designer role for the inspection process; a coder from some related or similar program will perform the role of the coder. If the same person designs, codes, and tests the product code, the coder role should be filled as described above, and another coder—preferably with testing experience—should fill the role of tester.

Four people constitute a good-sized inspection team, although circumstances may dictate otherwise. The team size should not be artificially increased over four, but if the subject code is involved in a number of interfaces, the programmers of code related to these interfaces may profitably be involved in inspection.

Scheduling inspections

The total time per thousand lines of code to complete the inspection process from overview through follow-up for I_1 or I_2 inspections with four people is about 90 to 100 man-hours for systems programming. Again, these figures may be considered conservative, but will serve as a starting point. Comparable figures for applications programming tend to be much lower.

Because the error detection efficiency of most inspection teams tends to dwindle after two hours of inspection but then picks up after a period of different activity, it is advisable to schedule inspection sessions of no more than two hours at a time. Two two-hour sessions per day are acceptable.

The time required for inspections and the resulting rework must be

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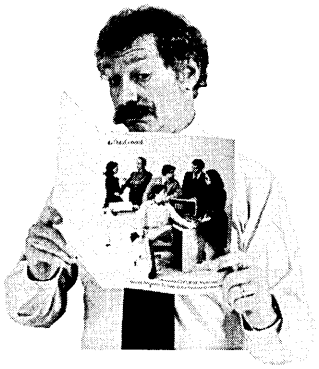

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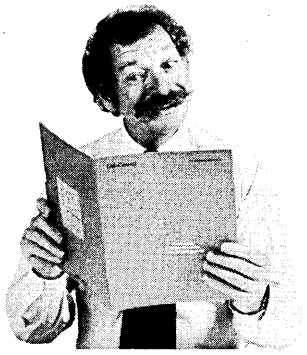

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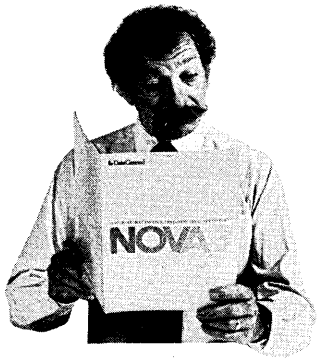

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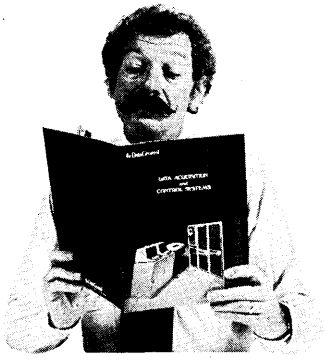

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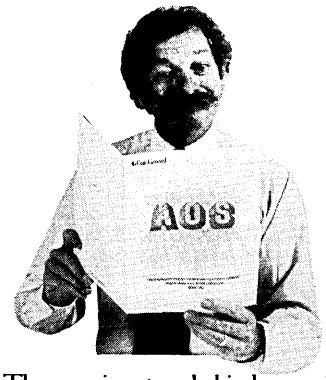

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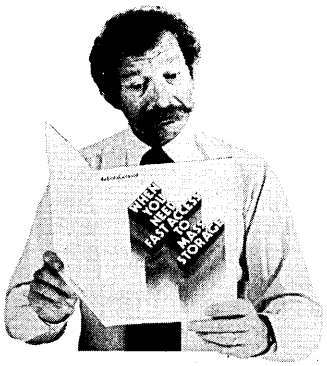

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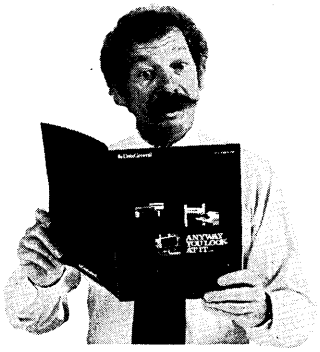

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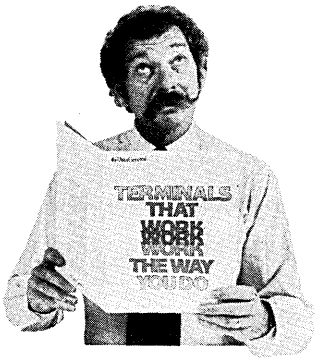

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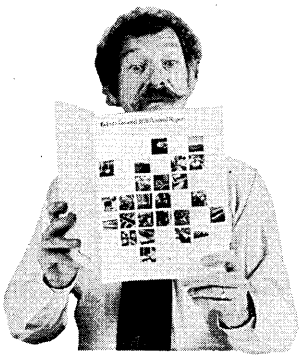

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I_1 Logic

Missing

1. Are all constants defined?
2. Are all unique values explicitly tested on input parameters?
3. Are values stored after they are calculated?
4. Are all defaults checked explicitly tested on input parameters?
5. If character strings are created are they complete; are all delimiters shown?
6. If a keyword has many unique values, are they all checked?
7. If a queue is being manipulated, can the execution be interrupted: if so, is queue protected by a locking structure: can queue be destroyed over an interrupt?
8. Are registers being restored on exits?
9. In queueing/dequeuing should any value be decremented/incremented?
10. Are all keywords tested in macro?
11. Are all keyword related parameters tested in service routine?
12. Are queues being held in isolation so that subsequent interrupting requestors are receiving spurious returns regarding the held queue?
13. Should any registers be saved on entry?
14. Are all increment counts properly initialized (0 or 1)?

Wrong

1. Are absolutes shown where there should be symbolics?
2. On comparison of two bytes, should all bits be compared?
3. On built data strings, should they be character or hex?
4. Are internal variables unique or confusing if concatenated?

Extra

1. Are all blocks shown in design necessary or are they extraneous?

Table 2. Examples of what to examine when looking for errors at I_1.

scheduled and managed with the same attention as other important project activities. (After all, as is noted in Table 1, for one case at least, 82% of the total errors reported were found by inspection.) If this is not done, the immediate work pressure has a tendency to push the inspections and/or rework into the background, postponing them or avoiding them altogether. The result of this short term respite will obviously have a much more dramatic long term negative effect since the finding and fixing of errors is delayed until later in the process (and, in some cases, after turnover to the user). Usually, the result of postponing early error detection is a lengthening overall schedule and an increased product cost.

The first inspection

Keeping the objective of each operation in the forefront of team activity is of paramount importance. Here is presented an outline of the I_1 inspection process operations.

1. *Overview* (whole team) — The designer first describes the overall area being addressed and then the specific area he has designed in detail-logic, paths, dependencies, etc. Documentation of design is distributed to all inspection participants on conclusion of the overview. (For an I_2 inspection, no overview is necessary, but the participants should remain the same. Preparation, inspection, and follow-up proceed as for I_1 but, of course, using code listings *and* design specifications as inspection materials. Also, at I_2 the moderator should flag for special scrutiny those areas that were reworked since I_1 errors were found and any other design changes made.)

2. *Preparation* (individual) — Participants, using the design documentation, do their homework to try to understand the design, its intent and logic. (Sometimes flagrant errors are found during this operation, but in general, the number of errors found is not nearly as high as in the inspection operation.) To increase their error detection in the inspection, the inspection team should first study the ranked distributions of error types found by recent inspections. This study will prompt them to concentrate on the most fruitful areas. (See Tables 4 and 5, p. 142.) Checklists of clues on finding these errors should also be studied. (See partial examples of these lists in Tables 2 and 3).

3. *Inspection* (whole team) — A "reader" chosen by the moderator (usually the coder) describes how he will implement the design. He is expected to paraphrase the design as expressed by the designer. Every piece of logic is covered at least once, and every branch is taken at least once. All higher-level documentation, high-level design specifications, logic specifications, etc., and macro and control block listings at I_2 must be available and present during the inspection.

Now that the design is understood, the objective is to find errors. (Note that an error is defined as any condition that causes malfunction or that precludes the attainment of expected or previously specified results. Thus, deviations from specifications are clearly termed errors.) During the implementor's, or reader's discourse, most errors are found. Questions raised are pursued only to the point at which an error is recognized. It is noted by the moderator; its type is classified; severity (major or minor) is identified, and the inspection is continued. Often the solution of a problem is obvious. If so, it is noted, but no specific

INSPECTION SPECIFICATION

I_2 Test Branch

Is correct condition tested (If X = ON vs. IF X = OFF)?

Is (Are) correct variable(s) used for test

(If X = ON vs. If Y = ON)?

Are null THENs/ELSEs included as appropriate?

Is each branch target correct?

Is the most frequently exercised test leg the THEN clause?

I_2 Interconnection (or Linkage) Calls

For each linkage call to either a macro, SVC, or another module:

Are all required parameters passed set correctly?

If register parameters are used, is the correct register number specified?

If the linkage is a macro,

Does the in-line expansion contain all required code?

No register or storage conflicts between macro and calling module?

If the linkage returns, do all returned parameters get processed correctly?

Table 3. Examples of what to examine when looking for errors at I_2.

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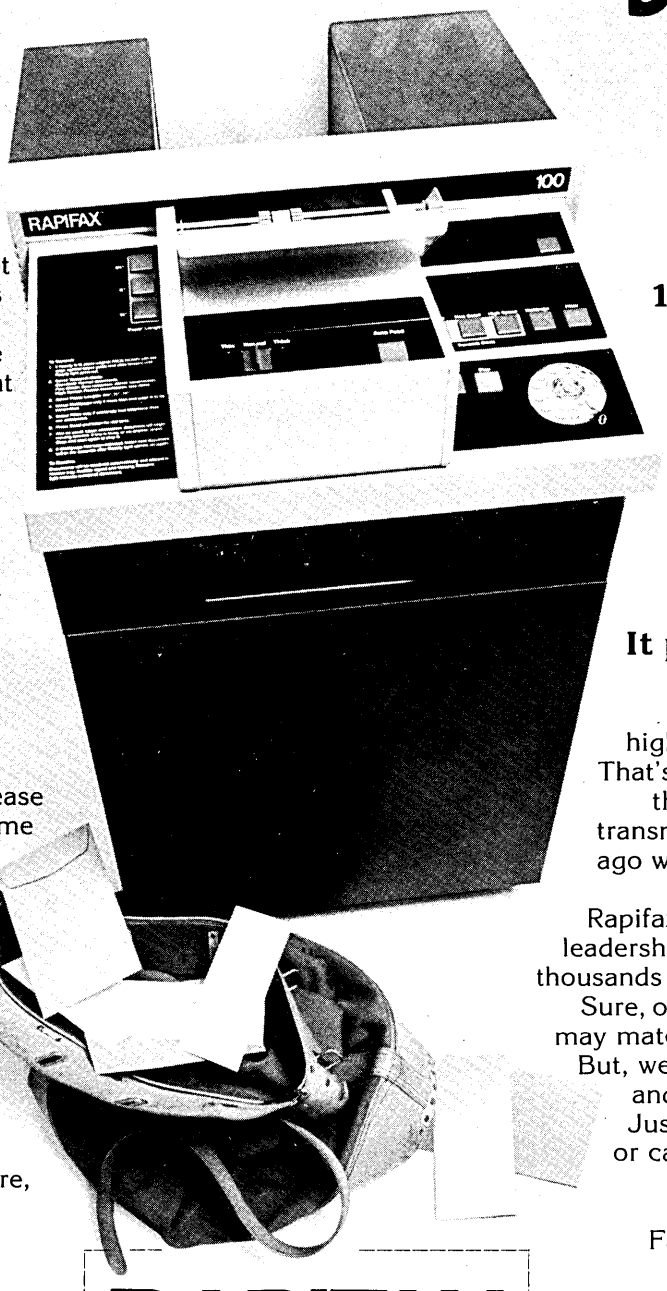

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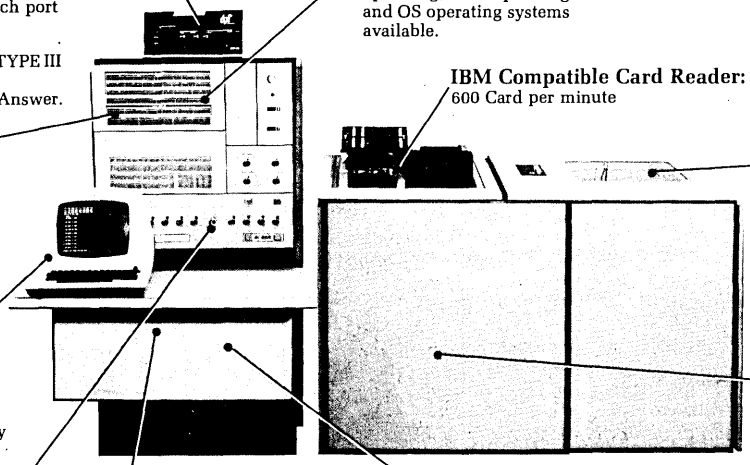

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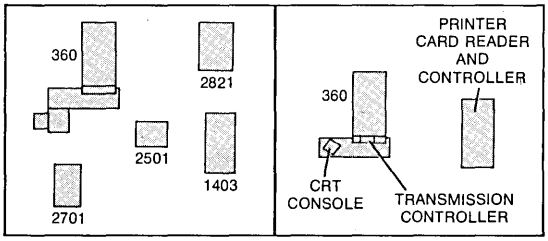

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Error type	Cause of Error Missing	Wrong	Extra	Errors	Error %
Logic	33	49	10	92	31
Design Errors (Missed by Design Inspection)	31	32	14	77	26
Prologue/Prose	25	24	3	52	17
Control Block—Usage	3	21	1	25	8
Linkage Calls	7	9	3	19	6
Maintainability	5	7	2	14	5
Performance	3	2	5	10	3
Test & Branch	2	5		7	2
Register Usage	4	2		6	2
Error count	113	151	38	302	100
Error %	37%	50%	13%		

Table 4. A distribution of code inspection error types.

solution hunting is to take place during inspection. *The inspection is not intended to redesign, evaluate alternate design solutions, or to find solutions to errors; it is intended just to find errors!* (A team is most effective if it operates with only one objective at a time.)

Within one day of conclusion of the inspection, the moderator should produce a written report of the inspection and its findings to ensure that all issues raised in the inspection will be addressed in the rework and follow-up operations.

4. *Rework*—All errors or problems noted in the inspection report are resolved by the designer or coder/implementor.

5. *Follow-up*—It is imperative that every issue, concern, and error be entirely resolved at this level, for they get more expensive to correct as time goes on. It is the responsibility of the moderator to see that all issues, problems, and concerns discovered in the inspection operation have been resolved by the designer in the case of I_1 or the coder/implementor for I_2 inspections. If more than 5% of the material has been reworked, the team should reconvene and carry out a 100% reinspection. Where less than 5% of the material has been reworked, the moderator, at his discretion, may verify the quality of the rework himself or reconvene the team to reinspect either the complete work or just the rework.

In Operation 3 above, it is one thing to direct people to find errors in design or code. It is quite another problem for them to find errors. Experience has shown that people have to be taught or prompted to find errors effectively. Therefore, it is prudent to condition them to seek the high-occurrence, high-cost error types (see Tables 4 and 5), and then describe the clues that usually betray the presence of each error type (see examples in Tables 2 and 3).

Error type	Cause of Error Missing	Wrong	Extra	Total Errors	Error %
Logic	126	57	24	207	43
Prologue/Prose	44	38	7	89	19
Control Block—Usage	18	17	1	36	8 } 12
Control Block—Def	16	2		18	4 }
Linkage Calls	18	9		27	6 } 8
Linkage Reqts	4	5	2	11	2 }
Other	15	10	10	35	7
Test & Branch	12	7	2	21	4
Maintainability	8	5	3	16	3
Return Code/Msg	5	7	2	14	3
Performance	1	2	3	6	1
Error count	267	159	54	480	100
Error %	56%	33%	11%	100%	

Table 5. A distribution of design inspection error types.

One approach to getting started may be to make a preliminary inspection of a design or code that is felt to be representative of the program to be inspected. Obtain a suitable quantity of errors, and analyze them by type and origin, cause, and salient indicative clues. With this information, an inspection specification may be constructed. This specification can be amended and improved in light of new experience and serve as an ongoing directive to focus the attention and conduct of inspection teams.

Inspections have been successfully applied to designs that are specified in English prose, flowcharts, HIPO, (Hierarchy plus Input-Process-Output), and PIDGEON (an English prose-like meta language).

The first code inspections were conducted on PL/S and Assembler. Now prompting checklists for inspections of Assembler, COBOL, FORTRAN, and PL/I code are available.

One of the most significant benefits of inspections is the detailed feedback of results on a relatively real-time basis. The programmer finds out what error types he is most prone to make, their quantity, and how to find them. This feedback takes place within a few days of writing the program. Because he gets early indications from the first few units of his work inspected, he is able to show improvement, and usually does, on later work even during the same project. In this way, feedback of results from inspections must be counted for the programmer's use and benefit: *they should not under any circumstances be used for programmer performance appraisal.*

Skeptics may argue that once inspection results are obtained, they will or even must count in performance appraisals, or at least cause strong bias in the appraisal process. The author can offer in response that inspections have been conducted over the past three years involving diverse projects and locations, hundreds of experienced programmers, and tens of managers, and so far he has found no case in which inspection results have been used negatively against programmers. Evidently no manager has tried to "kill the goose that lays the golden eggs."

A preinspection opinion of some programmers is that they do not see the value of inspections because they have managed very well up to now, or because their projects are too small or somehow different. This opinion usually changes, after a few inspections, to one of acceptance. The qual-

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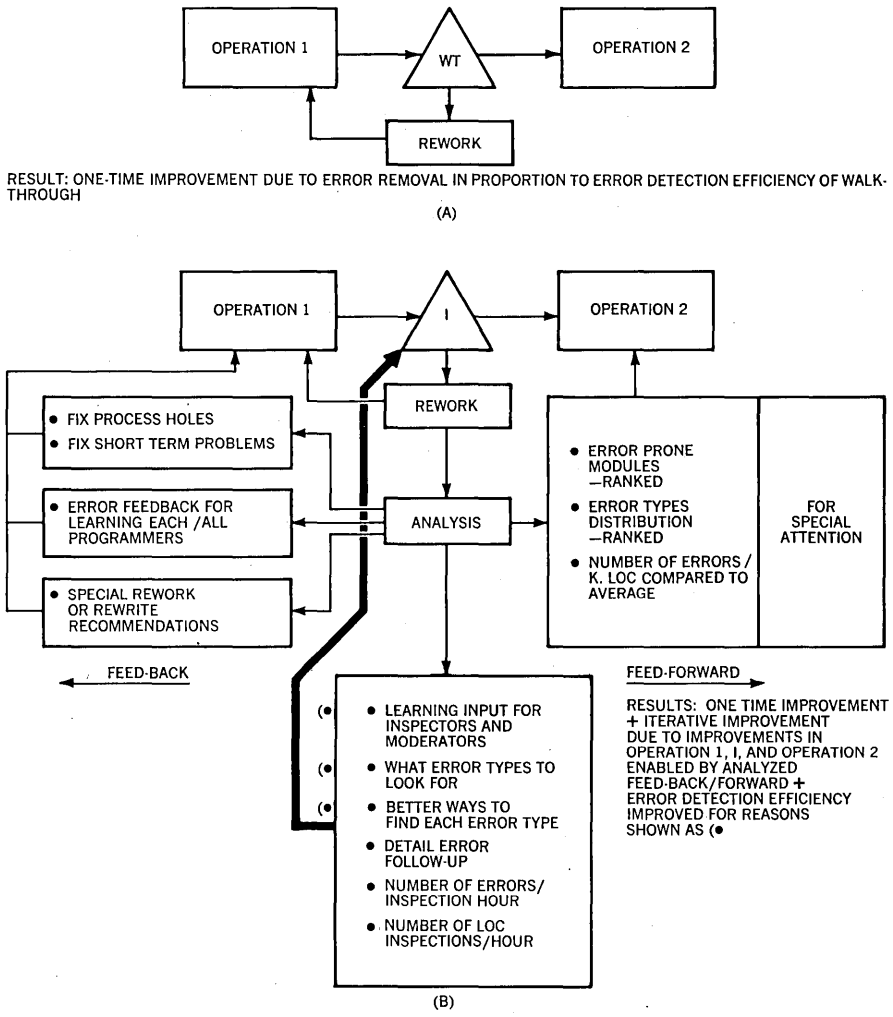

Fig. 3. (A) Walk-through process. (B) Inspection process.

ity of acceptance is related to the success of the inspections they have experienced, the conduct of the trained moderator, and the attitude demonstrated by management. The acceptance of inspections by programmers and managers as a beneficial step in making programs is well-established among those who have tried them.

Inspections and walk-throughs

Walk-throughs are practiced in many different ways in different places, with varying regularity and thoroughness. This inconsistency causes the results of walk-throughs to vary widely and to be nonrepeatable. Inspections, however, having an established process and a formal procedure, tend to vary less and produce more repeatable results. Because of the variation in walk-throughs, a comparison between them and inspections is not simple.

Fig. 3A describes the process in which a walk-through is applied. Clearly, the purging of errors from the product as it passes through the walk-through between Operations 1 and 2 is very beneficial to the product. In Fig. 3B, the inspection process (and its feedback, feed-forward, and self-improvement) replaces the walk-through. The notes on the figure are self-explanatory.

Inspections are also an excellent means of measuring completeness of work against the exit criteria that must be satisfied to complete project checkpoints. (Each checkpoint should have a clearly defined set of exit criteria. Without exit criteria, a checkpoint is too negotiable to be useful for process control.)

The most marked effects of inspections on the development process is to change the old adage that "design is not complete until testing is completed," to a position where a very great deal must be known about the design before even the coding is begun. Although great discretion is still required in code implementation, more predictability and improvements in schedule, cost, and quality accrue. However, the old adage still holds true if one regards inspection as a means of testing.

Inspecting modified code

Code that is changed in, or inserted in, an existing module either in replacement of deleted code or simply inserted in the module is considered modified code. By this definition, a very large part of programming effort is devoted to modifying code. (The addition of entirely new modules to a system count as new, not modified, code.) *Some observations of errors per thousand statements of modified code show its error rate to be considerably higher than is found in new code.*

Since most modifications are small (say, 1 to 25 instructions), they are often erroneously regarded as trivially simple and are handled accordingly; the error rate goes up, and control is lost. In the author's experience, *all* modifications are well worth inspecting from an economic and a quality standpoint. A convenient method of handling changes is to group them to a module or set of modules and convene the inspection team to inspect as many changes as possible. But all changes must be inspected!

Inspections of modifications can range from inspecting the modified instructions and the surrounding instructions connecting it with its host module, to an inspection of the entire module. The choice of extent of inspection coverage is dependent upon factors such as the percentage of modification and the pervasiveness of the modification.

Michael E. Fagan has been with IBM since 1964 and is currently a senior programmer-manager at the IBM Kingston Development Center. Over the past five years he has managed programming methodology and programming process departments, and has been deeply involved in programming technique and process development and evaluation. Mr. Fagan developed the use of inspections for program design and code.

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Antitrust

IBM Trial No Longer an "Anachronism"

Recent testimony focuses on competition as it is today and IBM goes along. Or is colossus setting a trap?

Addressing a company stockholders' meeting late last April, IBM chairman Frank T. Cary dismissed the Justice Dept. antitrust suit against IBM as ancient history.

"In light of all the changes that have taken place and are still taking place in our industry," Cary noted, "the. . .lawsuit is an anachronism. This lawsuit was brought in 1969. It was based on alleged IBM actions prior to that time. Since this was—and is—a dynamic industry, the suit was really out of date on the day it was filed."

Despite Cary's "anachronism" label, the focus of the Justice Dept. case has been shifting steadily to the present tense for some time as testimony increasingly focuses on IBM 's current practices rather than the giant's role in dominating the industry in the late 1960s and early 1970s.

CDC's examples

Called to the stand as one of a succession of Justice Dept. witnesses, v.p. Gordon R. Brown, for example, repeatedly offered recent examples of how IBM's alleged policies of preannouncing new products and threatening to take away engineering support from users thinking of going to other peripheral vendors had worked to the detriment of CDC. Among other things, the 42 year old Brown, who heads CDC 's peripheral products operation and is himself a former IBM sales rep, charged:

- that in 1975 CDC lost the chance to replace a substantial quantity of IBM peripherals at Montgomery Ward in Chicago when IBM informed Ward its engineering support would be significantly reduced if Ward signed the CDC contract;
- that in July 1976, CDC proposed a 200MB disc system to Xerox and that soon after the proposal was made, IBM reps told Xerox IBM was about to announce software support for its 3350 disc drives—a revelation that caused Xerox to terminate negotiations with CDC, Brown said; and
- that in recent months all large IBM users have been made aware of rumors that IBM would shortly make a major add-on memory announcement—rumors, Brown claims, which made it virtually impossible to sell any other memory to such users.

GORDON R. BROWN
IBM still pressures dp users and dominates the market.

The Sollac case

But the court's willingness to hear testimony involving recent events was vividly underscored by something that occurred while Brown was actually testifying. A French CDC customer—a concern called Sollac—had been given an advance peek at IBM's not yet announced 3350 enchancement when one of its representatives toured IBM's San Jose peripheral operation, Brown claimed.

The day after he made this allegation, Brown told the court he'd received a call from CDC's headquarters saying that Sollac had just been contacted by IBM about Brown's testimony. Embarrassed—and concerned about losing his job—the Sollac rep reportedly had telephoned CDC's French office after the IBM visit, and told CDC he didn't wish Sollac to be further involved in the litigation. Moreover, he was entirely reexamining Sollac's dealings with CDC.

Ultimately, CDC lost the Sollac business—a situation that typified IBM's ability to pressure dp users and dominate the market, Brown maintained.

A subsequent witness, Arthur D. Little consultant Frederic G. Withington, also focused heavily on recent developments during the course of his 21-day testimony, perhaps the most comprehensive and detailed of any witness who has yet taken the stand.

As a consultant who has worked with most of the major vendors as well as many major users in the dp industry, Withington repeatedly offered first hand insights into IBM's marketing tactics. He chronicled, for example, how a number of 360 users—Aetna Life, Chase Manhattan Bank, and others—were forced to migrate to 370s in order to obtain 3330 disc drives after the 3330s were announced.

Converted for disc drives

And more recently he detailed how 370 users like Aetna and Hughes Aircraft Corp., which had real memory operating systems, necessarily needed to convert to virtual in order to obtain 3350s, which are offered only in conjunction with virtual operating systems.

Perhaps the most interesting area Withington touched upon, however, was current competition in the general purpose market, particularly between IBM

and Amdahl.

In 1974, Withington explained, he was called in by Amdahl to do a study on the possible market for Amdahl's machines. Working directly with Gene Amdahl and company president Eugene White, Withington targeted potential sites for Amdahl machines. Subsequently, in 1976, Withington performed a second study in connection with the initial underwriting of Amdahl stock, working on behalf of the underwriters who wanted Withington to assess possible IBM counteractions to Amdahl's product offerings.

These counteractions came, Withington stated, with IBM's 3033 announcement and the sharp price reductions on the 158 and 168 systems in May of this year.

Inducement not to migrate

"My judgment about the relationship of the 3033 to the migration of IBM's customers is (that it is an) attempt to induce them not to migrate to the Amdahl 470V/6," Withington told the court.

The configuration of the 3033—a single processor, 12 channels, three levels of memory—was exactly the same as the 470 V/6, he noted, and significantly different from the more modular configurations of IBM's other processors. "I think that it is not accidental," Withington said of the similarity. "Also, the extremely sharp. . .historically unprecedented improvement in price/performance offered by the 3033 combined with direct price cuts in the predecessor models, which is also nearly unprecedented, seems to me to be logically associated with the high degree of success Amdahl Corp. had had in its first year of selling plug-compatible central processors to IBM users."

Withington further pointed out that the third component of IBM's May announcement, the MVS extension, was a software improvement—it enabled MVS functions to be partially loaded into microcode and consequently allows the system to run faster—that was unavailable to Amdahl users since the Amdahl machines don't use microcode.

In summary Withington maintained IBM's May announcements constituted a direct effort on the part of IBM to knock Amdahl out of the box. "These announcements were, at least in substantial part, related to competitive counteraction against Amdahl," he stated.

Present events

The thrust of IBM's cross-examination of Withington also was directed largely at present events. In an attempt to establish how competitive today's marketplace had become vis-a-vis that of 10 or 12 years ago, IBM attorney Ron Rolfe had Withington detail the incursion of mini vendors like DEC into the general systems market. And at Rolfe's behest, Withington outlined the evolution of distributed networks and the impact this mini-intensive phenomenon has had on the shape of the dp market.

Rolfe also drew heavily from recent developments in the PCM and cpu area, all but introducing headlines out of the papers and introducing the day's industry news as evidence.

Was Withington aware of the Itel/-National Semiconductor systems? "Yes," Withington answered. What about Itel's additional systems. "Yes," Withington responded again. "Since . . . June 10 . . . a subsequent announcement has been made of a larger machine manufactured by Hitachi in Japan and to be marketed by Itel."

IBM's May announcements constituted a direct effort on the part of IBM to knock Amdahl out of the box.

And was the Hitachi machine (the AS-6) competitive with IBM? With the 168, Withington explained.

Did Withington know about Nippon Electric's U.S. subsidiary announcing a 3350 type disc at the National Computer Conference? Did he have any understanding as "to whether Memorex has announced a memory for the 370/158 central processing unit recently?"

"Yes, I believe I am aware of that announcement," said Withington.

National's announcement

"Do you have an understanding that National Semiconductor has announced a memory called Multisystem Bridge Memory which adapts to the entire 370 line up to the 168?"

"No, I regret I have no knowledge of that," Withington admitted.

What about Cambridge Memories' announcement of a 16MB memory for 158s? Yes, Withington knew about that. Was he aware that Electronic Memories and Magnetics had announced an add-on memory for the 148?

"No, I am not," Withington responded. "I do not recall seeing that announcement. I might note that to a degree these purportedly recent announcements are within recent weeks; I am out of date largely because of this proceeding."

Finally, Judge David Edelstein instructed Rolfe that unless Withington indicated "he has some awareness of current announcements, or that he has seen any," Rolfe couldn't inquire about them. But the real question as the trial unfolds is not what new developments will or will not be included, but why the court is allowing these developments to become a central topic at all.

Everybody benefits

In a way all parties stand to benefit from this shift to the present tense. Justice can focus on the 3033 as a machine designed to drive Amdahl out of business. IBM can portray itself as currently besieged by a horde of mini vendors and new threats in the PCM and cpu areas. And Judge Edelstein has countered Cary's charges of conducting an exercise in ancient history by opening up the trial and making it relevant to the industry as it is today.

FREDERICK G. WITHINGTON
IBM's competitive counteraction against the Amdahl Corp.

But some observers feel that Edelstein may have inadvertently fallen into an IBM trap. When Justice completes its presentation sometime late this fall, if the schedule holds, it's likely IBM will move for dismissal.

The grounds? By expanding the scope of the trial beyond the 1969 filing date and Justice's 1972 limit of discovery and into the present, the Court has exceeded its jurisdiction, and defeated its own purpose—exactly as IBM intended it to.

—Laton McCartney

ANTITRUST REPORT

The Justice Dept.'s antitrust trial enters its 41st month in October, and only the government's case has been heard so far. This report on recent developments in the case is one of a series on antitrust developments affecting the computer industry. A report on the "West Coast Cases" begins on page 148. And the government's antitrust suit against AT&T is brought into focus on page 148 in a story examining the impact of Attorney General Griffin Bell's comment that the issue should be examined in the Congress. ❋

West Coast Cases Not Over Yet

IBM still has yet to lose an antitrust case, and no jury, as yet, has come to grips with the antitrust issues in cases involving the computer goliath.

But one jury did uphold charges against IBM—charges that the firm interfered with the business of Forro Precision Inc. while investigating an alleged theft of trade secrets. The jury awarded $2.7 million in general damages to Forro.

The same five women, one man jury apparently felt Forro did misappropriate IBM trade secrets, as it awarded IBM $260,777 on that charge.

But it couldn't decide whether the Woodland Hills, Calif., computer parts manufacturer had been the victim of monopolistic practices on the part of IBM.

The Forro case was the first of the so-called West Coast cases to get into the hands of a jury. All complainants had wanted jury trials.

CalComp optimistic

The first of the cases to go to trial, that of California Computer Products versus IBM, ended in a directed verdict in IBM's favor by Federal Judge Ray McNichols. CalComp appealed this verdict to the Ninth Circuit Court of Appeals and, at writing, was optimistic it would be granted a new trial, particularly in light of a decision by the same court in the Greyhound Computer Corp.'s antitrust case against IBM (September, p.276).

This case, similarly ended by a directed verdict by Judge Walter E. Craig, has been ordered retried by the Ninth Circuit Court. The court has had this case under consideration for five years. CalComp's trial lawyer, Maxwell Blecher, feels his client's appeal will be acted on much more rapidly because of the ground work done in the Greyhound case.

Judge McNichols, possibly influenced by the circuit court's decision in the Greyhound case, denied an IBM motion for a directed verdict in the Forro case.

Forro wants retrial

Forro's attorney, Joseph M. Alioto, son of a former San Francisco mayor, said he will ask for a retrial of Forro's antitrust allegations. He also said he would ask that the award to IBM on the trade secrets issue be thrown out on grounds the evidence failed to support the verdict.

Next up among the West Coast cases is that of Memorex Corp., scheduled to begin in January, also before Judge McNichols. Memorex attorneys, responding to an IBM motion asking consolidation of portions of its case with that of another plaintiff, Transamerica Computer Corp., a subsidiary of Transamerica Corp., called IBM "an experienced violator of the antitrust laws."

IBM, said the Memorex lawyers in a memorandum, "now seeks to defend that violation of antitrust laws by having the court emasculate the plaintiff's cause of action by dissecting that cause of action and then killing off the pieces that make up the cause of action one at a time."

The Memorex attorneys noted that

The same jury apparently felt Forro did misappropriate IBM trade secrets. IBM was awarded $260,777.

"Transamerica is a leasing company, not a manufacturer. Memorex, on the other hand, has been a manufacturer of both systems and peripherals. Accordingly, the position in the market of the two plaintiffs is different, and the effect of the IBM acts here involved on these two plaintiffs was different due to their different posture."

"The consolidation of the Transamerica and Memorex cases would add some complexity to each of those two cases," the attorneys continued, "and since the saving of time which would result as opposed to having two separate trials is quite questionable, we submit that consolidating those two cases would not serve any worthwhile purpose."

Three common issues

IBM lawyers had contended that there were three common issues in the Memorex and Transamerica cases which also are common to suits brought by Hudson General and DPF Corp. These, said the IBM attorneys, include charges that: introduction of IBM's fixed term plan or extended term plan represented an act of monopolization; and that IBM's new product announcements in August of 1972 represented an act of monopolization.

The Memorex case at one time had been scheduled to be heard with that of Forro, but the two California firms were successful in having them severed. It seemed likely at writing that IBM's latest request for consolidation would not be granted and that both Memorex and Transamerica would have their respective days in court.

No date for the Transamerica case had been set by mid-September. A Transamerica attorney has indicated that this case "lays great emphasis on the financial aspects of IBM's pricing activities, on their profit margins before and after price changes, and on whether or not some of these changes were below cost."

And so, like the federal case, the West Coast cases are far from over. ❋

AT&T Case: For the Courts or Congress?

Attorney General's comments pose vexing morale problem

The Justice Dept. has a vexing morale problem on its hands. And it's on the minds of every disheartened antitruster who has been diligently working on the trouble-ridden lawsuit against AT&T, which has been dragging on for nearly three years. "This case," according to one bitter Bell battler, "has been bombarded by so many internal as well as external problems that AT&T couldn't have prayed for a better series of plagues."

One of the more devastating blows to the dispirited AT&T antitrust troops came "like a shot out of the dark" in late August when a telltale transcript of a *Fortune* magazine interview with Attorney General Griffin B. Bell was released. In the interview Bell nonchalantly, and apparently without too much forethought, repeatedly maintains that the issues that spawned the telephone company suit could be better handled by Congress.

While admitting that he "hasn't studied the telephone case that carefully," he also argues that large antitrust cases such as AT&T maybe shouldn't be tried in the courts. Instead, he recommends that they be resolved by the legislative branch in the form of a hearing. But he also acknowledges that Congress isn't "set up to handle any such thing as that. And they might not want to." And that's an understatement.

Already has its hands full

Not only is Congress unwilling to handle such a complicated and messy issue (as attested to by the lack of support in recent years for former Sen. Phi-

lip Hart's industrial reorganization bill), but it also feels it has its hands full trying to tackle a rewrite of the antiquated Communications Act of 1934. Government sources speculate that if and when such a bill gets through it could have an impact on the fed's antitrust litigation. And that's exactly what Ma Bell is pushing for.

Other lawyers argue that the Attorney General's theory legally makes good

ATTORNEY GENERAL GRIFFIN B. BELL
He wonders if Congress, not the courts, should try antitrust case against AT&T.

sense. "Bell is absolutely right from a legal point of view," insists one Washington lawyer. "What could be worse than looking forward to another trial like IBM except twice as big and twice as long?"

Industry spokesmen, afraid of the company's potential political clout on Capitol Hill, are unnerved by the prospect of sending the case to Congress. Aside from the sticky procedural and Constitutional issues inherent in such a precedent, they worry about an unleashed AT&T that could pull powerful political strings. Computer and Communications Industry Assn. head Jack Biddle is adamant: "I don't think Congress should undertake a specific determination of the structure of the telephone industry because of the all pervasive political power of AT&T."

But other antitrust followers contend that decisions on major industry structure shouldn't always be left up to the courts. One high Justice official concedes, "Congress is a hell of a lot more a democratic body than one district court judge. Unfortunately, as an abstract matter of political science," he pragmatically adds, "it sounds a lot better than it does when you look at it in the real world."

Bell's ignorance

And the "real world" is just where AT&T is and also where, according to the Justice complaint, the giant communications monolith has wielded "exclusionary and unfair" marketing tactics to bolster its illegal monopoly of the telecommunications services and related equipment markets. The case then, contrary to what A-G Bell maintains, is clearly not "structural" but a case "replete with good old antitrust conduct," asserts one government trustbuster. Justice insiders confide that Bell's "outspoken" and "unfortunate" remarks on the case were a result of his "phobia" about large, uncontrollable litigative battles of this type, and an understandable ignorance of the AT&T case in particular. This is also coupled, claims one source, with his propensity "to shoot off his

Industry spokesmen, unnerved over prospect of sending the case to Congress, worry that AT&T could pull powerful political strings.

mouth when he doesn't know exactly what he's talking about."

"He's got the loosest pair of lips," reveals one top antitruster, "I think I've ever seen on an A-G." Another antitruster, a lawyer woking on the case, comments even more pointedly on Bell's outspokenness: "I was as appalled at that transcript (of Bell's interview) as I was at some of the Nixon tapes. The only difference was the absence of four letter words."

Not too big

Apparently Bell's candid theorizing on the AT&T suit didn't go over big either with newly confirmed Antitrust Div. chief John Shenefield. Attempting to minimize the damage from Bell's blunder, the 38 year-old antitrust boss has taken a hard-nose stand on prosecuting the case. "We cannot shrug our governmental shoulders and say that some cases are too big to touch," he declared last month.

Justice insiders confirm that the boyishly handsome antitrust head means to stand by his commitment to litigate and win the AT&T suit in as short a period of time as possible. "He's a much more result-oriented and aggressive person than we've had in that job for the past 10 years," affirms one Justice source. Deputy antitrust chief Joe Sims agrees. He says of his boss: "Shenefield has more at stake here than anybody else . . . and for him not to perform on the major case in the division would be very bad for his credibility. I don't think there's any incentive at all on his part to do anything but the best job he can do with the AT&T case."

Unfortunately, Shenefield's and other top antitrusters' way of doing the "best job" on the bogged down lawsuit didn't completely mesh with what the actual staff on the case thought was the best way of running the show. This led to what Sims calls a "philosophical conflict" which led to Verveer's untimely departure last month to greener pastures at the Federal Trade Commission's Bureau of Competition.

There are various conflicting reports coming out of Justice on the Verveer catastrophe. But it all seems to boil down to the plain fact that Verveer's approach to running the monstrous case wasn't in line with what the antitrust brass professed to want to see done with it. One of these officials contends that the government's chief AT&T counsel was a victim of the "big case syndrome" which is characterized, he says, by overlitigation and a preoccupation with "the no stone unturned" methodology.

Another top antitruster close to the disgruntled counsel claims the heart of the dispute centered around Verveer's belief that the case would entail massive discovery efforts, pegged at somewhere near 10 million documents. The source also complains of Verveer's "unreasonable and unnecessary" demands for money to get a computer and 250 people to screen and code documents. "But as far as I was concerned," he protests, "we didn't need a computer and we didn't need 250 people because we weren't going to have anywhere near 10 million documents."

An IBM-like farce

Verveer's tactics, according to the source, "would have inevitably meant a decade of preparation and trial." They would have also, he insists, turned the case into an "IBM-like farce. And hopefully, we've learned our lesson there."

So instead of Verveer's purportedly more intense and time-consuming gameplan, Justice officials profess to be following a more streamlined and expeditious tack in the case which they claim will go to trial one and one-half to two years after discovery gets underway. (Mid-1979 is their trial target date.) Of course, that assumes that AT&T's jurisdictional appeal isn't heard by the Supreme Court. And knowledgeable sources are pegging those odds at 50-50.

If the high court opts to hear the case, the battle there could run as long as 18 months, with the final outcome resulting in either a return of the case for trial to the lower court or a dismissal of the entire suit if the justices find that the courts haven't got jurisdiction to hear the case. AT&T, taking advantage of anything it can to keep the case out of the courts, cited Bell's Congressional theory several times in its petition to have the Supreme Court rule on the jurisdictional issue.

That move came as no surprise to the government, which is anticipating even bigger battles over discovery. Explains deputy antitrust chief Sims: "The big question is how much will we be able to hold back AT&T in their discovery of the entire federal government. They want to have a record for every phone everywhere, especially the Defense Dept. and other agencies like that that they know will have trouble getting the stuff for them. So that will be the big fight," he affirms.

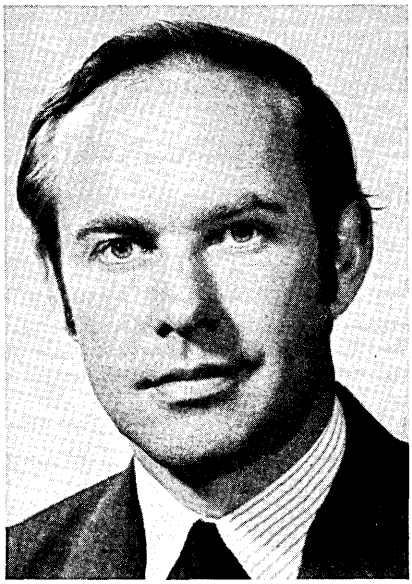
Morale problems

But there are other fights which may also have to be fought—and mostly within Justice itself. The Verveer resignation and all the in-fighting which culminated in his leaving, coupled with A-G Bell's unfortunate off-the-cuff remarks, have all caused morale problems among some of the closely knit staffers working on the case. So Justice officials, particularly the antitrust brass, have a fight on their hands to keep spirits up and rally their troops. They also anticipate continuing skirmishes over money allocations.

One lawyer on the hapless case insists that many of the problems could have been avoided if the department was better managed and if the people responsible for running the case had a "direct pipeline" to the people working on the case day-to-day. He also feels this communications gap led to Verveer's undoing. "I don't think there was ever much of a dispute between what Verveer wanted to do with this lawsuit and what Shenefield wanted in terms of the timetable or prosecution," he asserts.

"Verveer," he explains, "always looked forward to a timetable of three years following the commencement of discovery before we'd walk into court. And that was consistent with Shenefield's goal. But Verveer's most important concern was that we get prepared for D-day before we start crossing the channel. He wanted to know basically what we'd have in terms of resources so he could decide how best to allocate them and so that when the opening shot was fired for discovery we'd be ready to go."

Most staffers feel that significantly more money and manpower are needed on the case which currently has only two full-time attorneys and a handful of part-timers.



ANTITRUST CHIEF JOHN SHENEFIELD
We cannot say that some cases are too big to touch.

Massive war wasn't necessary

But the people at Justice controlling the purse strings for the suit balked at these budgetary requests, claiming that he was proposing a "massive war" which wasn't necessary to get the case done. A staunch Verveer defender, the loyalist lawyer counters these arguments: "Verveer had every interest in keeping the case as disciplined and highly focused as the rest of us . . . We don't want to make a career out of this case. And furthermore, we never anticipated a D-day assault. The beachhead is just too large."

Most of the AT&T suit staffers feel that significantly more money and manpower are needed on the case which currently has only two full-time attorneys and a handful of part-timers assigned to it. But antitrust deputy chief Sims insists that neither the IBM nor the AT&T case "is short-staffed or short-resourced." Others disagree. One of the full-time lawyers on the case complains that if the case started up this month in the lower court, the group would have "nowhere near enough money" to run it.

All this haggling over money has obviously caused a rift between the case workers and case leaders, some of whom admittedly abdicated their supervisory responsibilities. One more outspoken Bell-buster points out that, "the real gut problem is mismanagement. These cases become unmanageable" he argues, "because the Antitrust Div. won't manage them. It's an inability of the division to organize itself, to staff itself properly, and to allocate the necessary resources."

While all these internal setbacks have worried the AT&T antitrusters, they still continue to be optimistic about the case. Says one candid case counsel, "Despite all the frustrations, despite all the great disappointments, and the severing of some very strong personal and professional relationships . . . people are continuing to stay onboard with the hope, which may be flickering, that we're going to have the opportunity to try this case and to win it without devoting our lives to it.

—Linda Flato

People

Shcharansky's Agony

"Trade a Computer For Him and He'll Be Out Tomorrow"

A Russian computer scientist named Anatoly Shcharansky has not been heard from for more than six months. He was arrested this spring for allegedly giving national secrets to the West and being a CIA agent, but he has not been tried, nor have formal charges been made at writing. He is believed to be in Moscow's Lefortovo prison, called the "worst hellhole" in Russia.

Shcharansky's supporters in and out of the Soviet Union call the charges "absurd." His only crime, they say, is that he tried to emigrate to Israel and that he has publicly provided information on the harrassment of Soviet Jews who wish to emigrate. There are more than 2,000 *refusedniks* in Russia, Jews and non-Jews, who have asked to leave and been refused.

This story has been in the press for months. Numerous scientific, legal, political, and Jewish organizations in North America and Europe have rallied to Shcharansky's defense. President Jimmy Carter has publicly stated that this young scientist is not a CIA agent.

ACM resolution

In the computer industry, the executive committee of the Assn. for Computing Machinery passed a resolution decrying Soviet restrictions on scientific freedom and its computer people, and pledging not to attend Soviet confer-

ences. Two small groups at the IFIP Congress in Toronto in August passed resolutions threatening to rupture contact with Russian scientists unless Shcharansky was given his rights and, hopefully, his freedom. (See box.)

But the International Federation for Information Processing refused to address the issue officially. The dilemma of conscience versus East-West contact found its stage in Toronto this summer. A group of concerned scientists had demanded a meeting early in Congress week, hopefully a full assembly meeting, to draft a resolution. They forced the IFIP officers into hours of negotiation. IFIP finally agreed to an unauthorized meeting to be held the evening before the Congress ended (overlapping the big banquet where praise was given for a job well done). The meeting and its placards of announcement had to be a designated distance from IFIP activities. The distance measured in feet.

IFIP's official argument is that it is apolitical. "We have to decide if we are going to cut off all communications with the Eastern bloc and go down in flames, or put up with them and see what we can do to work with them," said one officer. "You can't just talk to your friends and stroke each other.

"If we had handled this quietly, perhaps we might have been able to exert some influence through the Soviet scientists that are here. Now that we've made it public, there's a danger that rather than sending the true and enlightened scientists, they may send the hardline party members. . .You know, we have people coming here from South Korea, Taiwan, India, the Eastern bloc. They all may have some political differences with each other, but here they are just scientists. The question is whether IFIP runs with the flag of free scientific exchange or walks out the door."

Act ouf of conscience

Some of these arguments were agonized over by people who chose to take up Shcharansky's cause. Prof. C. C. Gottlieb of the Univ. of Toronto reasoned, "I've had a great deal of contact with the Soviet scientists. I know the difference between the value of information they receive from the West compared to what we get from them is enormous. It is important to exercise what leverage we can. To act to sever contact? I am ambiguous on that, but *not* to make it clear that we're prepared to make those moves would be failure to act in accordance with our own consciences."

Brezhnev wants to go down in history as a wise leader. . . . He will go down as a rabid, classic anti-semite.

Others who don't want to be identified were less polite about the value of Soviet contact. "They demand their fair share of the program and refuse to send most of the authors who wrote the papers to present them. On top of that, the information is on old, not current, research. Are we to trade one man's life for that?"

Trade a computer

Pulling no punches was Joseph Pomerant, a Canadian lawyer working for Shcharansky's case who pushed hard for the IFIP meeting. "I don't equate the desire to see someone receive their human rights with politics," he fumed. "The Soviet Union has been using this blackmail in all these organizations: 'If you criticize our conduct of human rights, we won't play.' " But they won't sever contact and they won't keep Shcharansky in jail on principle if Western scientists refuse to talk to them, asserted Pomerant. "They want information. In fact, they want U.S. computers. They sent a chess master to Canada who spent all his time tearing into the U.S. for not selling advanced computers to Russia. Trade a computer for Shcharansky and he'll be out of there tomorrow.

"This IFIP wish to do nothing to embarrass its guests—they shouldn't, unless the issue is significant enough. This one is. . .I want you to quote me on this. Brezhnev wants to go down in history as a wise leader. . .thought that way by the western world. He will go down as a rabid, classic anti-semite," Pomerant snapped.

Wife talks

Who is Anatoly Shcharansky? His wife, Natalya, who was allowed to emigrate to Israel just one day after they were married, has told his story an infinite number of times in Europe, the U.S., and Canada. And she repeated it—via a translator—one more time for DATAMATION.

Shcharansky, now 29, was educated in the computer sciences and mathematics at the Moscow Institute. His thesis was on a computer program for the "end solution in chess," a game that he had mastered when he was six. In his third

NATALYA SHCHARANSKY, wife of Russian computer scientist Anatoly Shcharansky, tells of husband's attempt to apply for a visa to emigrate to Israel. "They screamed at him that he was a traitor to his country," she says of her 29 year old husband who later was accused of being a U.S. CIA agent and was jailed last March.

semester at the Institute, "Anatoly had made up his mind to emigrate to Israel and studied all the legal ramifications of this decision.

"The first requirement was that he not take any work or go into advanced studies that would involve him in classified material," she related. In 1972, he graduated from the Institute and became a programmer at the Ministry of Oil and Gas Research Institute. "Some people working with him were Jews, dealing with the same materials as Anatoly, who were allowed to emigrate."

> They screamed at him that he was a traitor to his country, that he wanted to emigrate to Israel because, "You want to destroy the Arabs, our brothers."

When he applied to emigrate, she said, he was put through the "usual procedure," and he expected it. "When a person applies for a visa, they have to obtain a character reference from employers and colleagues, a *'characteristika.'* These are given with a great deal of vengeance. They screamed at him that he was a traitor to his country, that he wanted to emigrate to Israel because, 'You want to destroy the Arabs, our brothers.' The first time he was called a CIA agent was in 1973.

"The people at work wouldn't talk to him. Some of his closest friends wouldn't talk to him. The KGB would tell them, 'You're influenced by Shcharansky and you'll get the same treatment. . .'

Answer was no

"After six months, he went to the emigration office to find out why he had received no answer. The head, Col. Obidin, said, 'I don't know, maybe you were involved in secret work.' Anatoly told him that unless he received an answer, he would get involved with the demonstrators protesting the treatment of the people who wanted to emigrate. He received his answer in one month—no.

"He kept working in spite of the bad atmosphere because he could be jailed for parasitism if he didn't work. His boss attempted to fire him, but Anatoly knew that Soviet law said a specialist couldn't be fired for three years. At times while he was at work, the KGB would pick him up and take him to prison for 15 days. When Nixon came, they took him away, again for 15 days."

Shcharansky kept his promise to join the human rights activists, and one of them was Natalya's brother. The couple met one day in 1973 when Natalya came in search of her brother, who had been thrown into prison. They decided to be married that same year. But the word was out that Shcharansky was a *refusednik*, and the couple went from town to town trying to marry under civil law. "We were legally allowed to be married, but they would say, 'Your age difference is too great,'—we are three years apart—or, 'The line is too long.' " Finally they found a rabbi who would marry them on July 4, 1974.

Which girlfriend?

Fifteen days before the marriage, Shcharansky was again hauled off to prison, said Natalya. He was out just in time to be married, but emigration officials had decided to approve Natalya's application to go to Israel . . . as long as she left by July 5. "When I got to Israel, I obtained a legal marriage certificate and sent it to Podgorny and Brezhnev. They did not recognize it." Not then, or later when she applied to visit him. " 'Which girlfriend are you?' they asked me."

The following year Shcharansky was fired. He wandered from place to place looking for somewhere to stay and somewhere to work. He was afraid to jeopardize his parents or his friends. He was a close friend of Andrei Sakharov, a major Russian physicist, who had been ostracized, but not imprisoned, for his desire to emigrate. So he went to work for him, helping him translate his work into English. Being fluent in English Shcharansky became a spokesman for the Soviet Jewry movement, talking to Western journalists and politicians, Christopher Wren, the Los Angeles *Times*' Bob Toth, and visiting U.S. congressmen. Shcharansky had joined the Helsinki Watchdog Committee monitoring Soviet performance in keeping the human rights accord, but slowly its members were jailed or allowed to emigrate. By February 1977, most of this committee had disintegrated. That month, Russian tv broadcast a film, "Traders of Souls," says Natalya, which showed the faces and addresses of Shcharansky and others, stating that they were Zionists and therefore Fascists, responsible for all the political problems in the Soviet Union.

Shcharansky tried to sue the producers, going, to no avail, to the Supreme Court to argue that the film threatened his life. On March 4, 1977, *Isvestia* published that five Soviet Jews were CIA agents. Two had already emigrated; two, Alexander Lerner and Vladimir Slapek, were not yet in prison, "but files are being prepared on them." The fifth, Shcharansky, went to Lefortovo prison on March 15. At that time, the film, "Traders of Souls," was run again.

"Sakharov tried to bring him a coat in prison, because Anatoly had gone out just in his shirt to make a call when they took him. But they wouldn't take it.

Others are in danger

"Anatoly wrote me when he was fired to get the support of the mathematicians in Boston and New York. He was concerned about all the scientists who were being treated as he had. Many are in danger, mathematicians Lerner, Slapek, and more. The Soviet Union is a signator of the United Nations declaration of

> On March 4, Isvestia published that five Soviet Jews were CIA agents. Shcharansky went to Lefortovo prison on March 15.

Support for Shcharansky—Official and Unofficial

Following are statements issued by the ACM's executive committee and a group within IFIP concerning the detention in Russia of Russian computer scientist Anatoly Shcharansky:

ACM Resolution: "In view of Article 2, paragraph 2, of our constitution: 'To promote the free interchange of information about the sciences and arts of information processing, both among the specialists and among the public in the best scientific and professional tradition,' and in view of Russian restrictions on scientific freedom and on the freedom of computer people, the executive committee unanimously voted that ACM not cooperate with/or co-sponsor any meeting to be held in the USSR, and to question at the appropriate time ACM's participation in other international computer activities with dominant or heavy Russian support."

IFIP group: "We, computer scientists of the Western world, gathered here at IFIP Congress 77, express our dismay at the treatment as evidenced in the case of Anatoly Shcharansky and state that violation of human rights must lead to diminution and, if continued, to a rupture of scientific contracts between the Soviet Union and other countries." *

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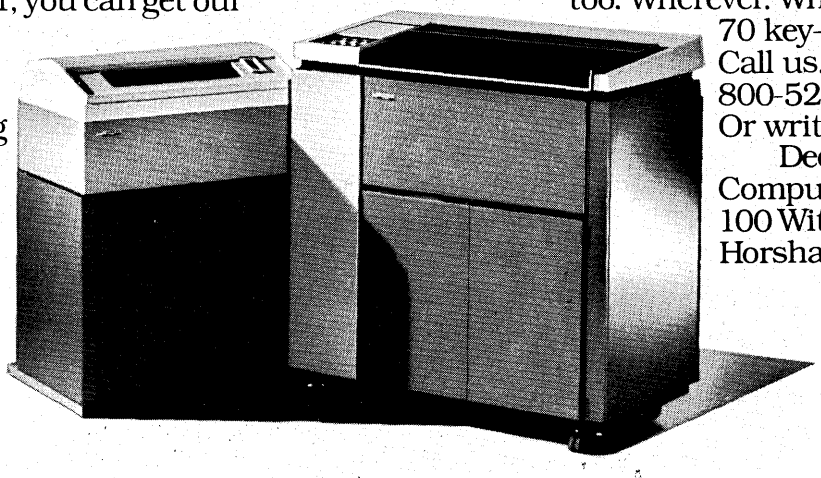

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human rights and the Helsinki accords. They must be asked to keep these accords.

"The Soviets have a tremendous respect for scientists, yet they enslave their own. A mind imprisoned is not a mind." Mrs. Shcharansky, tired but not weary, became passionate about what her husband's imprisonment and ultimate fate meant to others like him.

"What they do to Anatoly will decide what they do to others. If he comes to trial, that will determine Soviet policy on emigration. The appeals and the public response must be strong. If we are able to free him, it will prove that the Soviet Union cannot get away with this kind of treatment. And if we do, we will start again to free Lerner and the others. If we allow them to get away with this, we are all jeopardized everywhere. The fact that Anatoly is in prison one day..." She trailed off, "He is a very free person. His nature is that of a free human being. You can't dislike him."

In August, Mrs. Shcharansky went to the IFIP Congress 77 as a delegate in her husband's name, but she left for a day to go to Washington and never got back to tell her side of the story to IFIP. Toronto's strikebound airport had closed its doors. So had IFIP.

—Angeline Pantages

Communications

Should Packet Networks Offer Datagram Service?

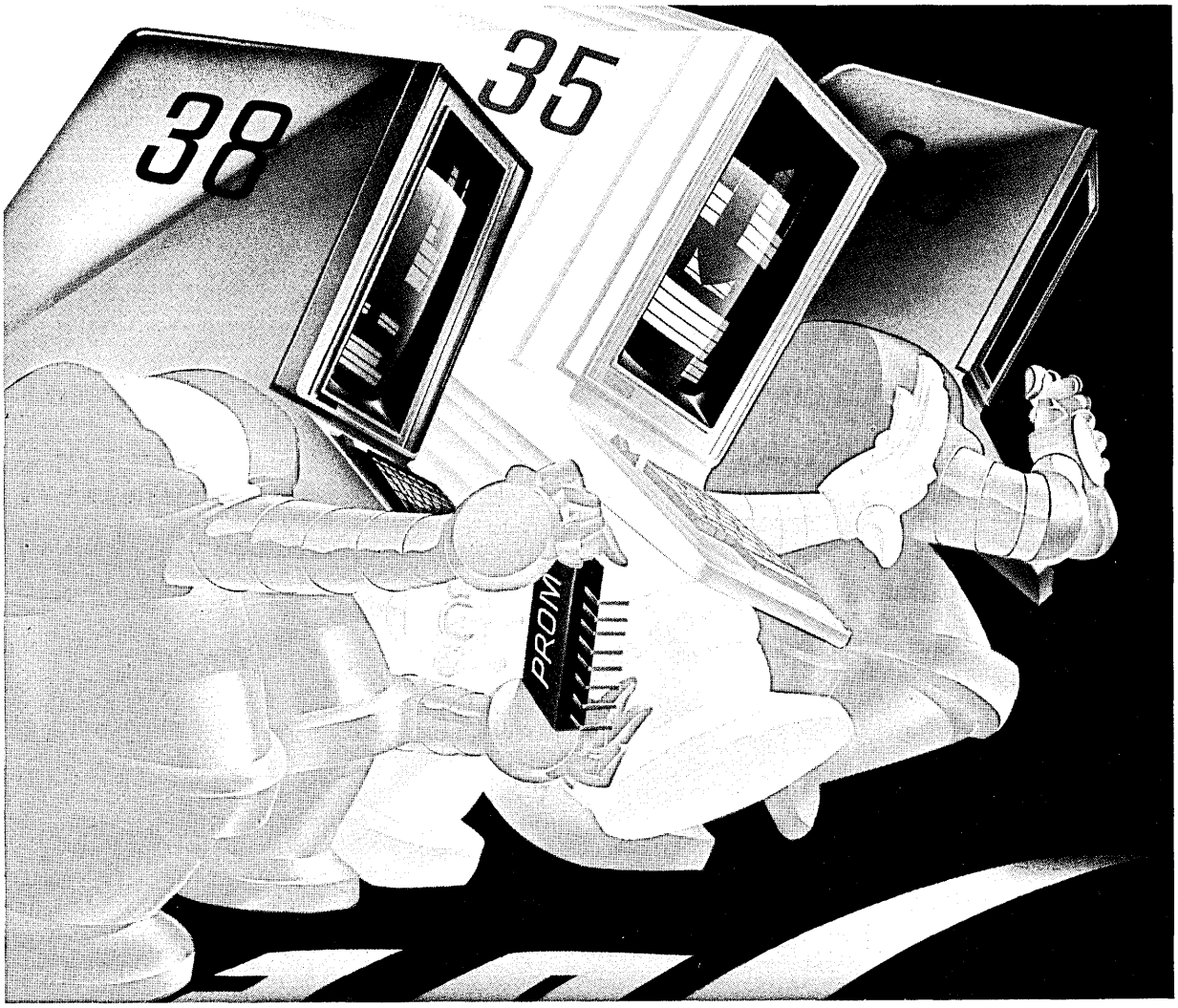
Another battle appears to be shaping up over communication protocols for public packet-switched networks. Basically, it's a replay of the fight that preceded adoption of X.25 last year.

The main bone of contention then was whether communication carriers or equipment suppliers and users should specify the "packet level" protocol (header) controlling communication between the extremities of a packet switched circuit. The codes comprising this header establish and terminate transmission, regulate the flow of packets to prevent congestion, keep track of correctly received packets, and perform a variety of other functions.

The carriers insisted that a standard protocol was needed so that different terminal and computer systems could communicate with each other. The suppliers and users, who favored protocols of varying complexity for different system applications, stressed the need for a flexible standard or standards that would permit the user to optimize the performance of his existing hardware and software.

Mundane consideration

Underlying both of these sentiments was a more mundane consideration: the carriers wanted to control the packet-level protocol so they could perform the



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related control functions within their own networks and/or be the major suppliers of packet assembly and disassembly equipment ("hosts") to users who decided to perform these functions on their own. The equipment manufacturers, meanwhile, wanted to protect their markets against this competition.

In March 1976, with the help of some behind-the-scenes politicking by the Trans Canada Telephone System, the French PTT, and Telenet, X.25 was adopted by a CCITT study group and in effect became an international standard (the official adoption occurred several months later). CCITT—the Consultative Committee on International Telephony and Telegraphy—is the standards-writing group for the world's telephone/telegraph carriers. Adoption of X.25 was a major victory for the carriers because the standard incorporated the packet level protocol they had developed, while deferring for future study the question of providing a "datagram" service that could utilize one or more alternate end-to-end communication control schemes. This victory, however, did not necessarily mean the war had ended.

Manufacturers or users could superimpose propriety protocols on top of the X.25-specified codes, but this would be costly and complex.

One participant in the CCITT proceedings pointed out afterward that it was "likely" different makes of communication terminals, including host computers, still would not be able to communicate with each other. The manufacturers or users, he explained, could superimpose proprietary protocols on top of the X.25-specified codes and make the systems at the ends of the message path dependent on the former codes. "This would result in additional cost and complexity to the user, of course," he pointed out.

More fully compatible

In view of what has happened since CCITT standardized X.25, these words were prophetic. Several mainframers have announced packet network protocols, but none is fully compatible with X.25. They are identical, or at least similar, to the CCITT standard at the link control level—between a host and its related network node—but not at the packet (host to host) level. As a result, SNA, DNA, and the other new network architectures will interconnect terminals and computers of a particular make but not of different makes.

Communication between different manufacturers' protocols will be possible, however, through public data networks which have implemented X.25. This communication will not be particularly efficient or transparent, though.

Packet-level headers generated by the sender's system will be translated by the carrier into X.25 format when each frame reaches the entry node of the network, and these codes will be translated again, at the exit node, into a form acceptable to the device at the receiving end.

Carriers may balk

When NCR, IBM, and the other mainframers develop X.25 interfaces for their new protocols, it will be possible to dispense with these translation chores, and packet carriers' tariffs may be reduced accordingly. But the carriers, understandably, are not very eager to see this happen, and neither are the mainframers, apparently. Some feel that X.25 compatibility will make it easier for their customers to migrate to other makes. In any event, the mainframers will be devoting most of their attention during the next several months to implementation of their own network architectures. Although X.25 interfaces have been promised, they aren't likely to become available for at least a couple of years.

The most specific announcement so far has come from IBM. Early this year, it announced an interface permitting 3270, 3600-series, and 3700-series users to interface with Transpac and Datapac—packet nets located in France and Canada, respectively. But Armonk emphasized that the interfaces would allow interconnection only with these two networks, not with any others implementing X.25, such as Telenet's system in the U. S. Furthermore, the new software would be offered only in France and Canada, would be available only on a special order (RPQ) basis, and initial deliveries wouldn't occur until some time next year.

A number of users are unhappy about this outlook, not only because of the extra cost, complexity, and inefficiency caused by translating proprietary packet protocols into X.25 and back again, but also because X.25, inherently, is inefficient for some applications. In point-of-sale networks, for example, where the message, typically, consists of a few octets (bytes) of numeric information, X.25 requires use of a multioctet header which includes functions that aren't needed. The obvious solution is a simplified packet-level header which, hopefully, could be implemented inside the user's terminal rather than the carrier's network node, thus reducing the latter's charge for communications service.

Pouzin's datagrams

For years, Louis Pouzin—who manages an ARPA-like network in France called Cyclades—has been trying to promote such a protocol as an alternative to X.25. He coined the term "datagram" to identify it.

Last year, shortly after X.25 was adopted by CCITT, Pouzin's missionary work began to bear fruit when an ANSI technical group (X3S37) began considering possible datagram formats that could be incorporated into a future revision of the CCITT standard. This upgrade is still in a preliminary stage, but sources within ANSI say they expect to have a working document written by next spring. At that time, it will be presented to CCITT.

What will happen afterward is unclear at the moment but, based on past performance, most of the foreign telephone carriers probably will oppose datagrams. They are likely to argue that a second packet protocol standard will complicate network operation and set a bad precedent by opening the door to further proliferation, further complexity, and higher costs for the customer. Another less charitable explanation, advanced by Pouzin and his fellow believers in user's lib, is that the carriers don't want to give up the benefits conferred by X.25 —the additional revenue they earn by performing communication control functions at the network entry and exit nodes, and the additional leverage they gain in the terminal market by totally controlling the terminal/network interface.

Last year an ANSI technical group began considering possible datagram formats that could be incorporated into a future revision of the CCITT standard.

One knowledgeable source contends that the foreign carriers won't willingly give up the extra revenue generated by X.25 because they "need this money to soak up losses from their postal operations. That's also why they're pushing for volume-sensitive private line rates (May, p. 256)."

Support for a datagram protocol standard is growing within the United States, however. DOD reportedly has decided that X.25 is an inefficient means of controlling communication within the huge new packet network it's devel-

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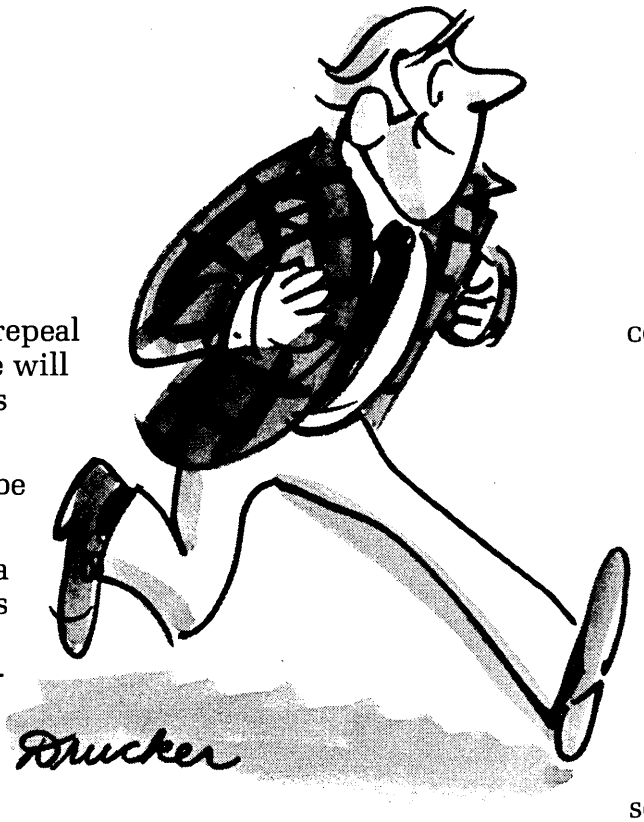

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oping to replace the present Autodin system. Western Union, the chief contractor for Autodin II, also is in favor of a simpler control scheme—possibly because the company plans to offer a commercial packet service that would compete with Telenet. NCR, a major supplier of EFT/POS systems, is another strong backer of a datagram standard.

An American standard?

Early this year, ANSI asked both CCITT and ISO (International Standards Organization) to consider developing a datagram standard. Next spring, a detailed U. S. recommendation for an international standard probably will be submitted to a meeting of CCITT's Study Group VII. If the overseas carriers kill it, which is certainly possible, the U. S. delegates will have to decide whether they should proceed on their own to develop an American standard. There is support within ANSI for pushing ahead, but some members believe it would be smarter in the long run to negotiate with CCITT and meanwhile delay further work on a domestic datagram standard.

For users, this latter strategy probably would mean waiting a while longer for some important benefits. As ANSI explained in its submission to ISO, suggesting development of a datagram standard: "... (T)he USA is of the belief that there are user applications wherein a more cost-effective service, based upon the datagram ... can be achieved, as compared with virtual circuit packet switching (X.25)." Later on, in a section headed "Future Prospects for Datagram Standardization," ANSI says, "Increased support will be needed in order that CCITT seriously undertake a real effort towards (datagram) standardization. Since CCITT members are the carriers who would actually provide the service, until either the carriers or the users express greater need for this new, potentially economic service, datagram standardization will be further delayed."

—Phil Hirsch

(Mr. Hirsch, a frequent contributor to this magazine, once was its Washington editor. He specializes in communications-related reporting).

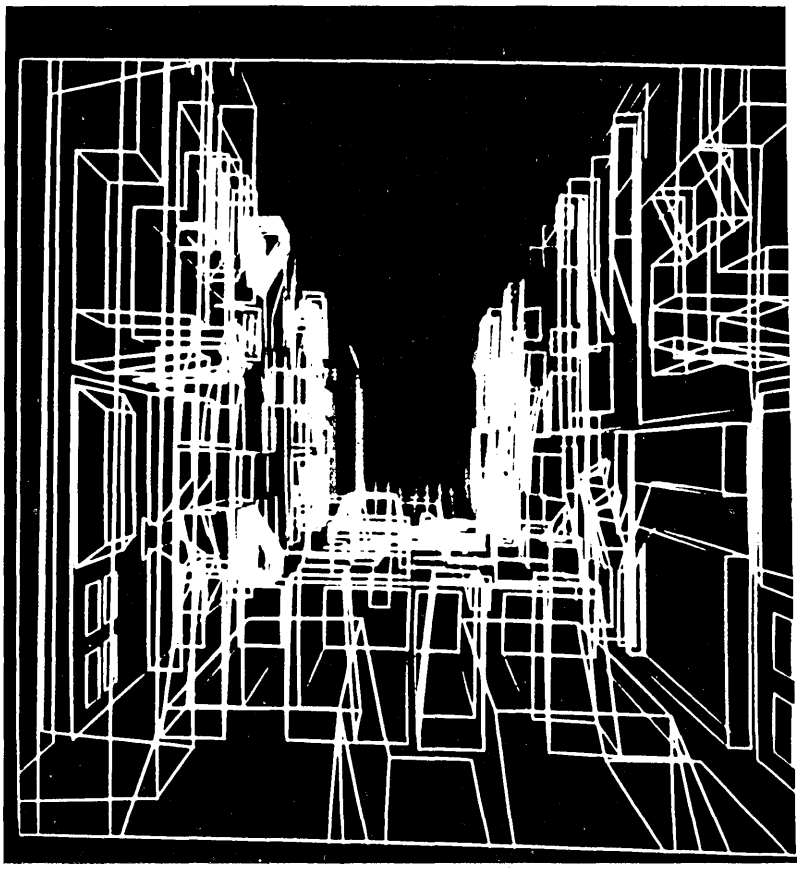
Briefing Before Attack on the Death Star

Star Wars movie buffs will recognize these scenes from the Rebel briefing prior to their attack on the Empire's super battlewagon, the Death Star. The computer-generated graphics show the attack path along a trench on the planet-sized battlewagon. Thus prepared, the Rebel pilots take off to bomb the Death Star's only identified weak spot: a two meter wide thermal exhaust port.

Computer-animator Larry Cuba, an independent contractor on *Star Wars,* generated these graphics with the assistance of T. J. O'Donnell and Tom Chomicz. They used Tom Defauti's GRASS graphics language on a PDP-11/45, drawing the images on a Vector General display. The images were photographed on 35mm film which then was flown to England and rear-projected on a screen during the live-action filming of the scene.

Cuba actually did two projects for *Star Wars*: the briefing room graphics and a set of display screen readouts. These were the only *Star Wars* scenes using digital computer animation, Cuba notes. It took roughly two months to complete both projects.

This isn't Cuba's first film. As a film maker he has worked with others, including John Whitney on the film "Arabesque." Cuba currently has his own film in progress. ✲



Moratorium on N.Y. Assessments

There was standing room only in an Albany, N.Y., hearing room in late August when New York State Tax Commissioner Thomas Lynch declared a moratorium on audit and assessment activities relating to the sales taxation of computer services.

The decision was heralded as a major victory by many waging the war against sales taxes on software and services. Many of those in attendance at the hearing had received hefty retroactive assessments. There was vigorous applause when Commissioner Lynch said, just prior to the meeting's adjournment, "We have just told the audit department to stop the audits."

The Data Processing Management Assn., represented by Robert Sherin, president of Nova Computing, Miami, labeled the rules taxing software and data processing services "illegal, invalid, erroneous, and void," and supported its argument with a 225 page record, largely transcripts of Sherin's successful legal battle in Florida to offset software sales taxes.

David Campbell of Computer Task Group, Buffalo, and chairman of the New York State Subcommittee on Taxation of the Assn. of Data Processing Service Organizations (ADAPSO), said his firm's million dollar retroactive assessment had damaged its business and said he felt the taxation "bordered on immorality."

Three parts

ADAPSO put on a three part presentation at the hearing, prepared and presented by Campbell and Albert Eisenstat of Tymshare with the assistance of Arnold Panzer and Sanford Goldberg of Roberts and Holland, the organization's tax counsel.

ADAPSO official said his firm's million dollar retroactive assessment damaged his business and he felt that it "bordered on immorality."

Goldberg argued ADAPSO's legal position, emphasizing the "inequity" of retroactive assessments. He also criticized the commission's continuing failure to issue a public statement of its position.

An ADAPSO report on the hearings said, "The reception of our presentation was even better than we had hoped. Although Commissioner Lynch did not commit himself on any substantive points and stressed that he could not speak for the other two members of the commission, he was visibly sympathetic to the plight of the industry and came quite close to conceding that the issuance of retroactive assessments on software services would be inequitable and inappropriate.

"He also seemed to agree," the report continued, "that the fact that a service is performed with the assistance of a computer should not affect its treatment for sales tax purposes. The nature of the service rendered, and not the technical means employed, should be the determining factor. Similar considerations should apply in determining whether a particular transaction should be treated as the sale of tangible, personal property or as the sale of a professional service."

Given precedence

Commissioner Lynch announced that the development and issuance of regulations on the computer services industry would be "given precedence over all other activities of the commission's Sales Tax Regulation Task Force." He ordered cessation of the audit and assessment activities pending further study of the issues by the full commission.

Companies which already have letter inquiries from the Sales Tax Bureau, he

said, should respond to them, but no further inquiries will be sent out. He said all sales tax cases pending before the commission involving computer services will be held in abeyance. He promised that new regulations on computer services, when developed, would be issued in proposed form and that another public hearing would be held for industry comments.

Said the ADAPSO report: "We regard these developments as highly encouraging. However, members are cautioned that the difficulties arising from our position as collection agents remains unresolved. Commissioner Lynch specifically stated that the moratorium on audits and assessments would not release sellers from their obligation to collect and remit taxes on those computer services which are ultimately determined by the commission to fall within the scope of existing law. Thus, members who are collecting sales taxes on various services should continue to remit them to the state. Those who feel they may be unable to collect the tax from their customers at a later date, such tax ultimately held to be due, should continue to take appropriate steps to protect themselves."

Sherin feels ADAPSO "is seeking only to save the vendors harmless from phantom retroactive liabilities by accepting prospective taxation as part of the deal."

"The government needs money to operate," says Sherin, "is the argument of those vendors purporting to defend the industry who aren't against paying the tax."

Using the users

"But," Sherin argues, "the vendors aren't speaking for themselves. They are using the users as a bargaining chip to void the retroactive tax scare the vendors fear. No matter that the same exempt typed sheet is taxable as software. No matter that a software person's paper tape is construed as consequential and taxable, while a court reporter's paper tape, which is larger, is construed as inconsequential and nontaxable."

No matter that a software person's paper tape is construed as consequential and taxable while a court reporter's paper tape is nontaxable.

Rhoda Minowitz of Queens Data Processing, New York City, got up during the New York hearing and told of how her partner pulled out of the business when it was assessed $90,000. "How can you sell a business with a $90,000 liability," she asked. Commissioner Lynch was sympathetic.

And while New York State mulls the question, other states are taking a variety of actions. The definition of a taxable sale set forth in the Vermont Sales and Use Tax Law was amended to exclude: "computer and data processing services where tangible personal property is transferred as part of such service transaction, so long as no separate charge is made for the tangible personal property and so long as the value of the tangible personal property transferred is essentially an inconsequential element in relation to the value of the service transaction."

Clear and less clear

The amendment became effective July 1, but the law provides that it will be applied retroactively if such treatment is to the benefit of the taxpayers. ADAPSO believes the new provision would clearly be applicable to firms engaged in batch processing services, but says the conclusion is less clear as to time-sharing since the wording of the

statute does not in itself resolve the issue of whether time-sharing is more appropriately viewed as a processing service rather than as a license to use tangible property. Also uncertain, says ADAPSO, is the extent to which the statute applies to contract programming and keypunching.

In Missouri, following a series of meetings with industry representatives and the institution of a declaratory judgment action by Control Data and others, the state's Dept. of Revenue announced it would withdraw a controversial regulation taxing computer printouts.

Oregon Governor Robert Straub signed into law a bill that exempts software from property taxation by defining it as intangible personal property.

And in Rhode Island, Puritan Life Insurance filed two petitions in efforts to eliminate a sales and use tax assessment on software for the years 1971 to 1977. The firm is seeking both a rulemaking procedure and a hearing on its own assessment but would like the rule making procedure first. The fight goes on.

—Edith Myers

International

Outlook is Bleak for Mainframes in Sweden

City of Malmo Opts for Minis in Huge User-Oriented Network

The future of the big centralized computer in Sweden looks bleak.

This is the message behind the successful implementation of an ambitious minicomputer network that has begun to link one of Sweden's major cities in one huge coordinated real-time routine.

The Swedish coastal city of Malmo is building a user-oriented net based on U.S. minis that already runs such diverse applications as social welfare, ports, utilities and services, and health care—and without a mainframe in sight.

But this is only the beginning. The network is constructed in modular form with minis and terminals from the supplier, Data General, being added all the time. And currently plans are afoot to develop network software that will link other Swedish cities to the system.

Malmo's experience could prove instructive to mainframe users who are trying to develop interactive routines by "upgrades." The Malmo warning is "don't."

One-tenth the cost

The city's data processing manager, Nils Dahlberg, says his network has been put together at one-tenth the cost his previous supplier, IBM, could have achieved with a big centralized 370 setup: "And with the added bonus of bringing in a more human and less complex style of computing."

Traditional upgrade to two 370/158s was ruled out for such a heavy interactive demand on grounds of cost and complexity.

Dahlberg believes that public sector computing in Sweden—dominated as it is by big centralized installations—is developing in the wrong direction. He says that users are getting "the wrong type of dp" and are "still pretending not to see or will not face up to the significance of their experiences."

Cost is one factor. Dahlberg said costs on one government project called National Real Estate Register, where it is planned to hold a file of all real estate in Sweden on one central computer, have risen nearly 20-fold in just three years. The estimate for the project in 1974 was about eight million krona (some $1.5 million). A recent 1977 estimate of 150 million Kr. ($30 million) has brought severe frowns to faces on the state audit board.

Dahlberg adds the damning comment: "Malmo—like some others—believes that the system cannot even be applied to the methods now used by it for the registration of real estate."

Another central computer complex for population census and taxation has already reached 200 million Kr. ($40 million) in project costs—two years before the system is due to go live.

Position is Critical

Dahlberg describes the position of the Swedish public sector as "critical." "It's the position we reached in the early 1970s at Malmo," he said. Between 1965 and 1975, Malmo developed its dp in the traditional central manner under Dahl-

berg: that is, punch cards through serial batch to multiprogramming.

By 1972 to 1973, Malmo had a requirement that around 75% of all its routines should be run interactively with only 5% to 10% batch. But the actual availability of dp on its two big IBM 360s was rather the other way around. Dahlberg and his staff calculated that in order to implement, in interactive mode, all the systems they had planned for the city, a terminal handling capacity of 130 transactions/second would be required.

A traditional upgrade to two 370/158s, plus a smaller machine of the same type for program development, was ruled out for such a heavy interactive demand on the grounds of cost and complexity. "Such an installation would have cost us 75 million Kr ($15 million)." Just as bad, according to Dahlgerg, was the fact that such a quantity of interactive routines would be assembled into such a strongly concentrated and centralized environment. "The problem here is that the number of parts and their interrelationships is so high that the whole of the system structure cannot with safety be perceived or observed at one and the same time," said Dahlberg.

MALMO'S NILS DAHLBERG
His network is put together at a tenth the cost of his previous supplier.

By 1975 the first competitive business minicomputers began to arrive on the market. As well as COBOL and database software, they offered a large storage capacity and terminal handling facilities.

Compared solutions

With its 130 transactions/second requirement firmly in mind, Malmo compared "maxi" and mini solutions. After studying the field and aborting a scheme to implement on Varian minis, Malmo plumped for Data General. Comparing,

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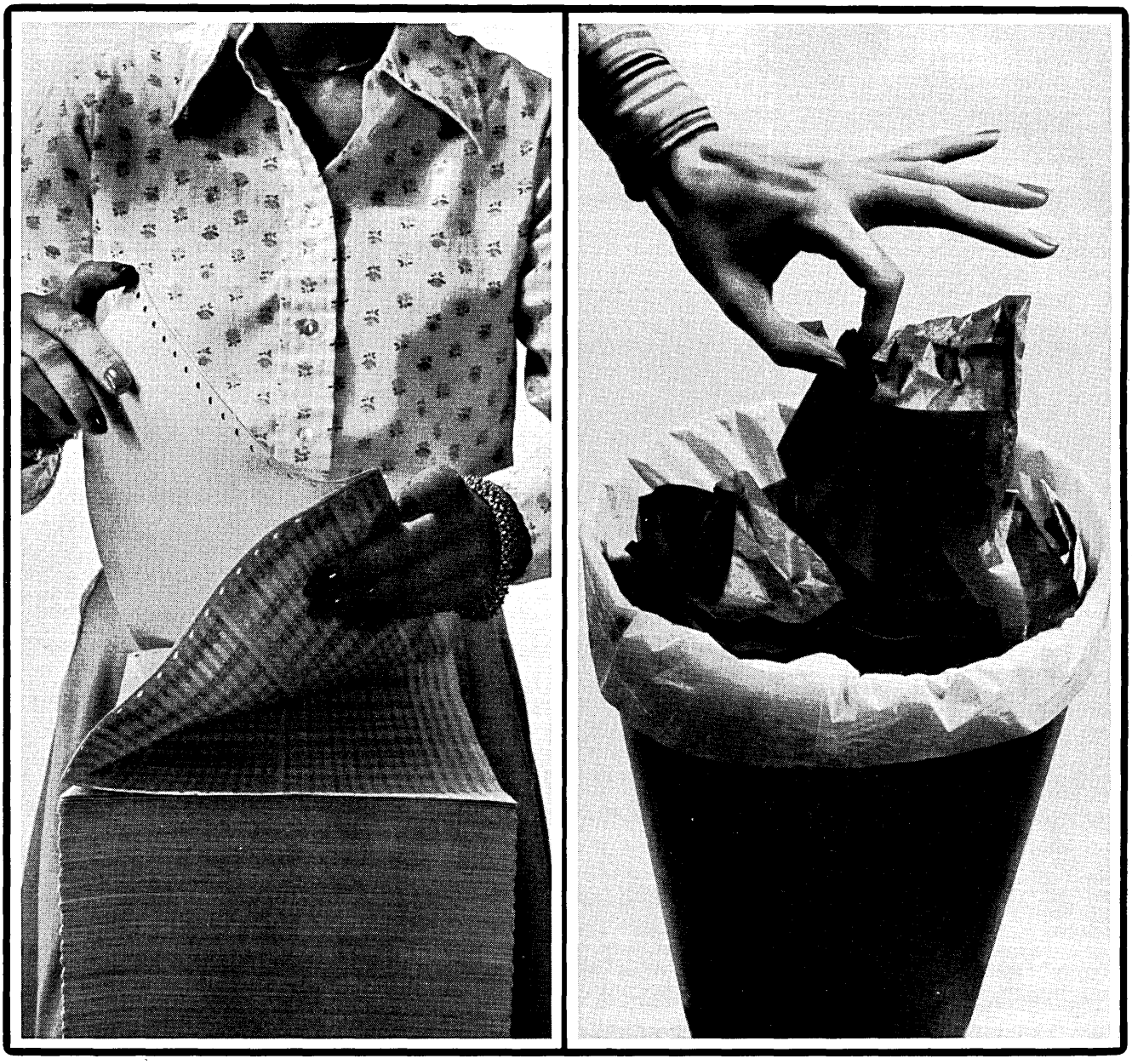

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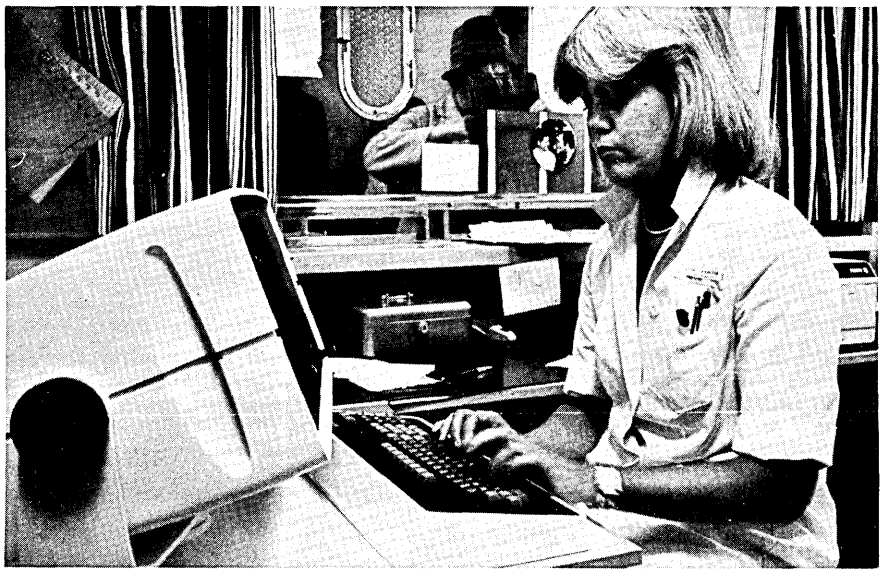


RECEPTIONIST at Malmo's hospital emergency center can directly access not only the hospital's patient file, but also the general register of the city's 250,000 inhabitants.

for example, Data General's Eclipse S/130 with IBM's 370/148, they found the minis cheaper by a factor of 10, all else being equal.

A 370/148 with 2,048KB and 10 transactions/second cost around five million Kr. ($1 million). The 13 IBM machines required to handle 130 transactions/second would thus have cost 65 million Kr. ($13 million). The Eclipse S/130 with 250KB and four transactions/second cost about 200,000 Kr. ($40,000). The 32 minis required would cost around 6.5 million Kr. ($1.3 million).

Dahlberg also reckoned that distributed minis would offer better system and data security, greater user motivation, and simpler, faster system implementation.

Fourteen minis installed

At present Malmo has a total of 14 Data General minis with 80 terminals and 1,900MB of disc storage in support. Ten different user groups throughout this city of 250,000 inhabitants are running some 25 different applications. Additional Data General minis certainly will be added during the next two to three years.

Sitting at the heart of all the applications is the health care system which embraces Malmo's three hospitals—Malmo General, Malmo East, and Varnhem. The Patient Administration System developed at Malmo General is the only one in Sweden in which all functions of patients administration are handled within a single information system.

About half of the city's 30,000 employees work in health care, and early next year a new module—a Nova 3/D—will be added to the hospital system to handle salary payments. Additional systems will be developed for other workers.

From billing to cemeteries

Other applications on the network include billing for electricity and gas,

water, drainage, refuse disposal, and heating; billing and bookkeeping of harbor charges; maintenance of waiting lists and booking of places in nursery schools and old people's homes; tax and personnel administration; rent allowances; social welfare register; and billing/stores control for the cemeteries!

It can be seen that here, as well as in other parts of Sweden, the system entails the drawing in of the full gamut of personal information. In fact, sources reveal—but no one wants to confirm—that information on everything except details of work visas for overseas visitors is now kept in Swedish computer banks.

Such a state of affairs is probably only possible in Sweden—that most "group minded" of nations—at the present time. Malmo has drawn on every facet of "group" mentality to take its project to this state without outcries of threats to privacy.

Despite this, a recent survey from Swedens Central Statistical Office has determined that Swedes are becoming concerned about "intrusions" into their private lives. One-tenth of the respondents to a national questionnaire last spring said that they had felt something of this sort, and put the result down to the growth of the population of statistics. Nearly 33% considered their private lives less protected than five years ago. Three percent had experienced the release of unauthorized information about them, and 23% saw a risk of it happening.

It can be seen from this that Malmo's technical achievement with its network will undoubtedly become a showplace for more than technology. And in this sense it poses a lot more questions than it answers.

—Ralph Emmet

Conferences

Wescon Mobs San Francisco

"You people must be going to Wescon," said a San Francisco cab driver. "What have they got in there in the way of new personal computers?"

The cabbie was returning a group of Wescon attendees to the San Francisco Civic Auditorium following lunch. His interest in personal computers was genuine. He reads all he can about them, he said, and if the price comes down, he'd like to buy a PET computer produced by Commodore Business Machines, Palo Alto. The PET currently is priced at $595. The cabbie currently is trying to remain content with two programmable calculators.

That his interest in the so-called personal computer is shared by many of

those attending the 26th Western Electronic Show and Convention was evidenced in many ways. Most spectacular was a scene at the door of a room housing a session on, "Home Computers, the Next Billion Dollar Market."

Before the scheduled starting time, the room was filled to capacity. A beleaguered Wescon official tried desperately to turn people away. "There are 600 people in there," he pleaded. "That's all the fire laws will allow."

Some would be attendees compliantly left. Most would not.

"We've taken time off from work for this. We'll stand."

"There are already people standing all around the room."

"Well open up another room and pipe it in."

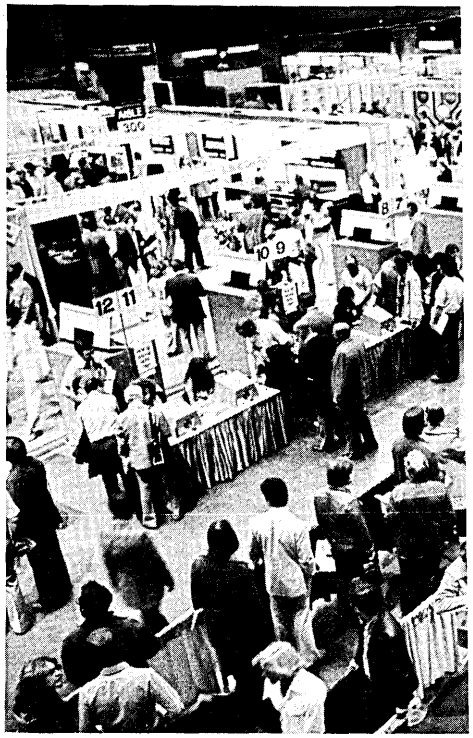
"Too late."

"Keep the doors open so we can listen in the hall."

"Can't do that."

Listened from the hall

When all arguments had been exhausted, the determined audience did what they must have felt they had to do. They brushed past the official into the room, filling it beyond capacity. And somewhere along the line the doors were opened and people did listen from the hall.



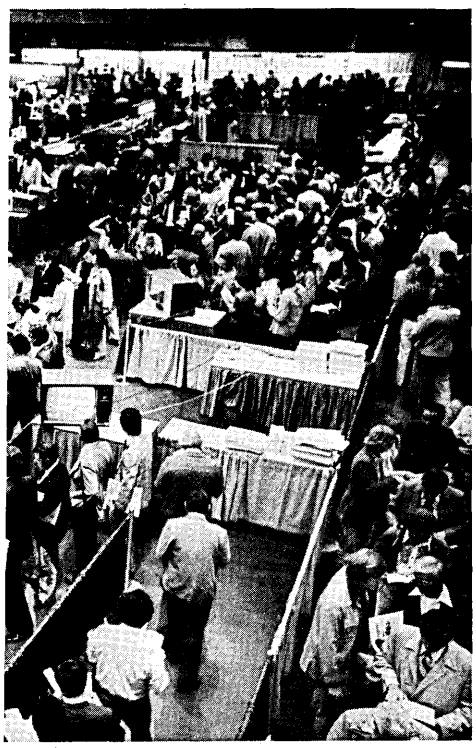
SOME 35,000 people crowded the aisles of San Francisco's Civic Auditorium and Brooks Hall for the 26th Western Electronic Show and Convention where personal computers were the big hit.

The crown scene at the home computer session was not the only one at Wescon. For the entire three days of the show, exhibit aisles were so crowded that football gear would have been an asset to anyone wanting to move through them.

Show organizers had predicted an attendance of 30,000. By the middle of the last afternoon, posted attendance exceeded 38,000. But this figure included advance registrations and, traditionally, not all advance registrees show up. Predictions were that final, audited attendance would approximate 35,000.

Exhibitors were pleased. Particularly those whose showings had anything to do with microprocessing. Their booths were constantly filled to capacity, while some of the more traditional Wescon exhibitors, the packaging people and some component manufacturers, appeared lonely by comparison.

Even the annual All Industry Reception, the big social event of Wescon, took advantage of microprocessing. The theme was "Fun and Games at the Golden Gate," and it featured a variety of microprocessor-based games which attendees could play. Some said the games were the only good thing about the reception because it, like so many



other things at Wescon, was overcrowded.

Dick Anderson, manager, product planning, Microelectronic Device Div., Rockwell International, was delighted with the interest shown in the games. He sees games as having a large untapped potential for microprocessors. He said his firm currently is working with Mattel toys on some new ones.

Rockwell's introduction of its 18 chip R6500 family of microprocessor systems

Exhibitors were pleased. Particularly those whose showings had anything to do with microprocessing.

at Wescon was called a "major entry" during the home computer session.

No shake-out

Attendees were wondering about the possibility of a shake-out in the microprocessor systems market. "There are so many facets to it, so many niches," said Charles Peddle of Commodore, "that there seems to be room for everyone if they're financially stable."

One questioner wondered when Texas Instruments would get into the market. "I assume we will see TI in the marketplace within two or three years," said Peddle.

TI is the biggest cloud hanging over all our minds," said Mike Markula, Apple Computer Inc., Cupertino, Calif., another session participant.

Gave characteristics

Robert F. Wickham, Vantage Research, Inc., Palo Alto, Calif., had a def-

inition of a personal computer. It's characteristics should include: cpu with RAM storage; user programmability; high level language; interactive operation; alphanumeric keyboard and display; desk/table top size; and single user orientation.

Wickham breaks the personal computer market into three categories: professional, hobby, and consumer, and looks for the greatest growth in the consumer segment. He expects the overall market to grow from $143 million in 1976 to $1,155 million in 1982, a 42% compound annual growth rate.

"By 1982 the home or consumer computer is expected to account for 55% of personal computer sales and to show the highest growth rate. Projected further out to 1985, the consumer computer is expected to be a $1.25 billion market opportunity."

Wickham expects the hobby computer market to peak in terms of dollar volume in the 1980 to 1981 period, with products designed specifically for home and business use taking over many of the current applications for hobby systems in this area.

"Warm and cuddly"

Peddle described the PET computer. He said it was designed to be "warm and cuddly." He predicted there will be more housewives programming by 1980 than professional programmers.

"The PET contains everything necessary for the beginning user. However, it is obvious that growth is not only desirable, but is necessary. There are two models of the basic PET: a 4K RAM unit and an 8K RAM unit.The additional 4K is accomplished by direct implementation of RAM's on the internal board."

Peddle believes the PET, for the average user, "will be the cornerstone on which he can build his personal information handling system. As newer and better peripherals become available," he said, "the PET will be seen as a basic household utility similar to the familiar 110-volt electrical outlet to which a number of appliances are attached. Instead of an electrical utility, the PET will be the information utility which has been talked about for years and which finally is a reality."

What it's like

Don M. Muller, senior v.p., Microsystems and Peripherals Group, Pertec Computer Corp., whose major thrust was that small businesses will be the major immediate beneficiaries of the personal computing era, nonetheless started his talk with an example of a possible home computer use.

Sharon, an average housewife, flicks a switch as she wakes up one morning. First comes soft music then, over the music, a soothing voice telling her what day it is, what time it is, what her astrological projection is for that day, what her biorhythms show for that day, the up-to-date balance in her checking and savings accounts, her appointment schedule, and on and on and on ad nauseum. Then it tells her, "I shall now turn on the 'Today' show."

"The technology is here," said Muller, when he turned off his impressive recording.

Muller was questioned during the home computer session as to whether Pertec and its MITS subsidiary are planning to withdraw from the hobby market in favor of small business. "We plan to pursue both," he said, "but future developments will be for the small business market with spinoffs for the hobbyists."

Distributed processing

In another session, "Transition to Distributed Processing," Mark Levi, director, Microcomputer Systems, National Semiconductor Corp., predicted that "micro-based sytems will be in-

creasingly used in distributed processing. Economics, technology, and customer demands are all forcing this direction." He said more of the distributed functions will be handled by hardware and/or firmware. "The market will inevitably dictate what semiconductor manufacturers do with the tools at their disposal. There are markets in the low end of the computing business not currently in conflict with those markets most actively pursuing distributed data processing. How the markets come together is a function of replacing software with hardware, standardization, and the difference in value between dedicated and distributed processing."

In the same session, Jacob Sernbert and Jeffrey Goldfarb, Conversational Systems Corp., New York City, said distribution of computer resources is "desirable, possible, and probably inevitable."

> There are now no computer technology problems in distributed processing. There are only business problems.

They called distributed processing "an umbrella term for a variety of processing structures whose common goal is the placement of local cumputer power at the disposal of every unit of the business for the purpose of enhancing each unit's operations and controlling a timely flow of intelligence among these units."

But, they fear, "even though management is aware that theoretically decentralization is possible, the dp management hasn't explained how to get there. Worse, the technologist hasn't explained why it is necessary to get there."

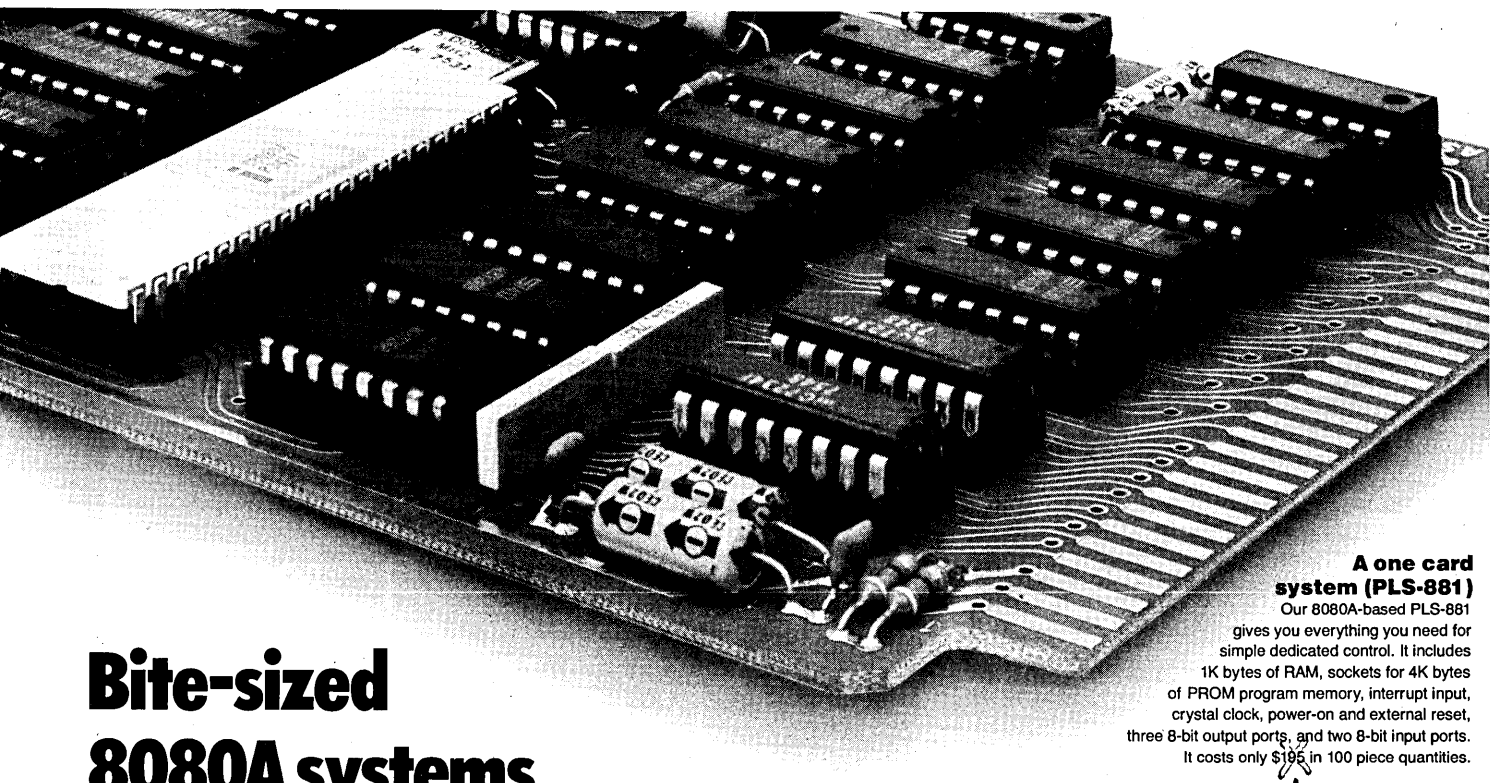
Only business problems

"We have reached the point," said Steinberg and Goldfarb, "where the ultimate luxury is available, namely: there exists hardware to satisfy any requirement of the business. There are now no computer technology problems. There are only business problems."

And, in spite of its crowd problems, Wescon had its lighter side. "It's a zoo," said one attendee trying to force his way down the overfilled aisles. He had a smile on his face. Many attendees waited patiently in consistently long lines at the Cramer Electronics booth to have computer generated portraits made and to take their chances throwing ping pong balls at a felt target. Success rate here was rather low, but Cramer booth personnel seemed good at it.

While there was little that was startling, there were some new products at the show.

Data General displayed its newest



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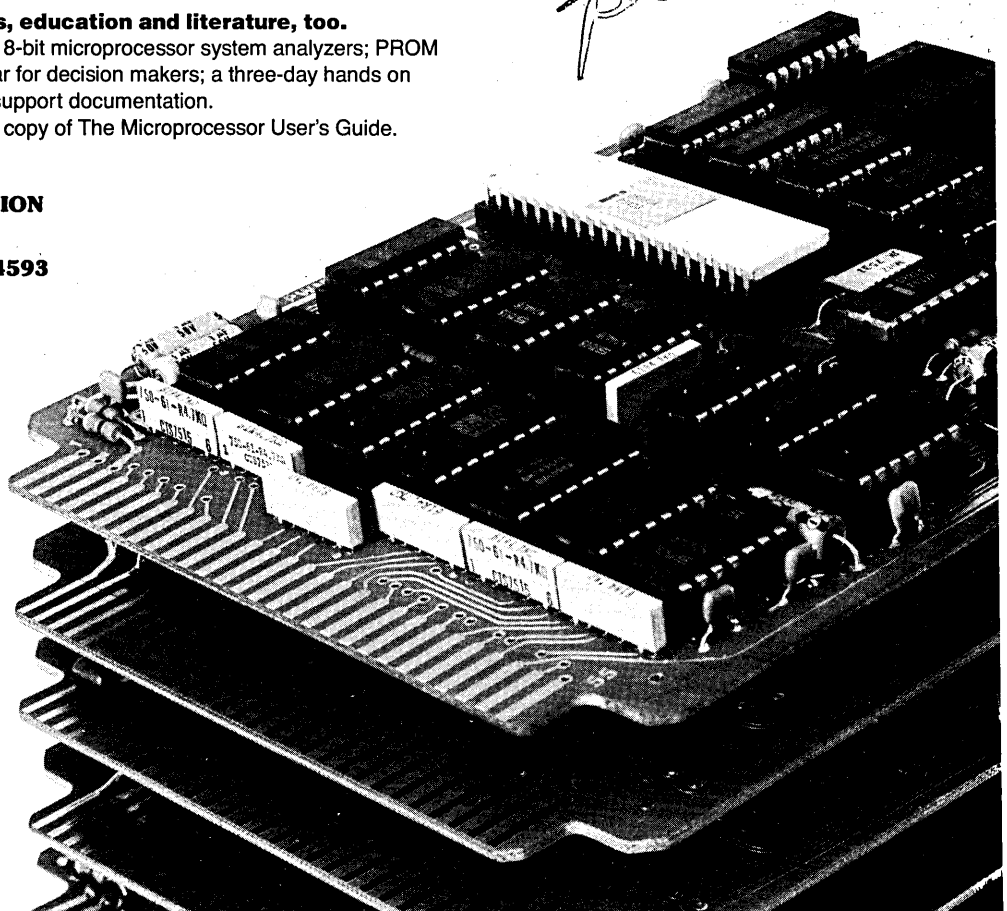


news in perspective

Eclipse computer, the Eclipse S/130 which features a second-generation user-microprogrammable control processor for users with high speed requirements in dedicated applications.

Tektronix announced an 8085 option for its multiple microprocessor development systems simultaneous to the announcement of the same capability by Intel.

Data I/O Corp., Issaquah, Wash., introduced what it called "the first PROM programmer to deliver EPROM programming rates approaching one megabyte per hour."

A 16K RAM memory board for $369 in semikit form was introduced by Processor Technology Corp., Emeryville, Calif.

No, there was not a proliferation of new personal computers. But maybe by the next Wescon there will be, and maybe that San Francisco cab driver will be able to go to that one—even though it will be held in Los Angeles.

—E.M.

Technology

Speakers Look to Future Memories

Computer industry experts love to expound on the future. And that's exactly what a prestigious coterie of them did early last month when they looked into their crystal balls for prognostications at the Fifteenth Computer Society International Conference—Comcon 77. Sponsored by the Institute of Electrical and Electronic Engineers, the three-day Washington-based meeting got off to a fast start on opening day as lead-off keynoters facilely forecast future technology trends.

Putting the onus on the lethargic user, Isaac Auerbach, president of Auerbach Publishers, contended that "technology has advanced faster than expected, but users haven't taken advantage of the potential that's available to them." It's "up to the user," he emphasized, "to take advantage of manufacturers' advances." And the advances he sees contributing the most to greater computer usage at substantially lower costs are in the area of memory development.

Over the next few years, Auerbach predicted that these memory developments would trim user processing power costs by one-third. Getting into the potential of specific memory devices, he

maintained that while magnetic core memories continue to be "the pace setter," the real memory development impetus may come through bubble and charge-coupled (CCD) devices.

By 1980, he claimed, one million bits per square inch memories would be on the market with a bubble size of one micron. But while this technology will be cost comparable to CCD's he cautioned that before its full potential could be reached, improvements would be needed in material and photolithographic techniques.

At another keynote technical session, Tom Klein, director of N-channel development for National Semiconductor, offered the manufacturer's view of these up and coming memory advances. While CCD's, he acknowledged, represent the densest silicon-based technology, "their speed and ease of use is considerably inferior to random access memories." As a result, he argued, CCD's will be "hard-pressed to carve out a market position" if they have to compete against RAM's with comparable circuit density.

Klein's prognosis for bubble memory also is mixed. Citing bubble's main drawbacks of very high material and packaging costs, he also pointed out some of the device's long-term benefits. Among these were fewer masking steps and a potentially better bit density capacity.

Depends on programming

Auerbach's bottomline comments on the two competing memory movements pulled the discussion together. The "effective use" of both CCD and bubble, he explained, would depend on "effective programming." In the area of software, he claimed, improvements would be "evolutionary" with no great "efficiency gains." He also sees no great leaps forward in microfilm and ocr. But he forecast "extensive" use of microcomputers, and "unclear" growth in the data communications field "till public policy is defined."

Taking another tack, Joe Henson, market planning v.p. for IBM's Data Processing Div., insisted that the real growth potential for the dp industry lay not in technological advances but in applications development. "Productivity in applications development," he maintained, "is really the critical challenge that faces the industry and users alike." While "advances in computer technology have extended our application horizons, those horizons," he lamented, "are harder and harder to achieve."

DBMS systems

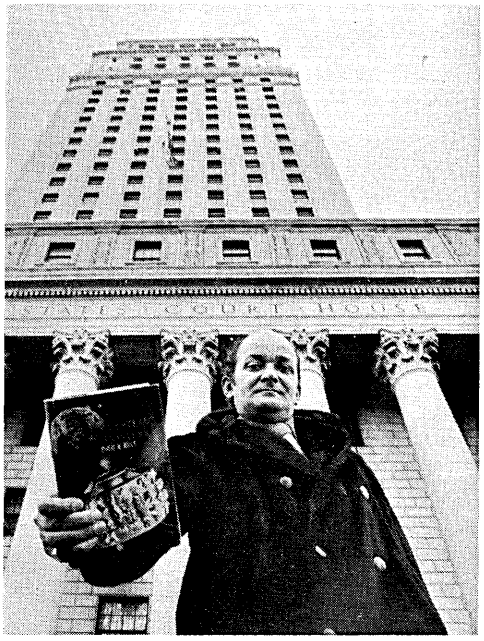
Citing the on-line applications growth rate, which he claimed will climb from 9,500 in 1975 to 23,000 by 1980, IBMer Henson pinpointed one major problem prevalent in several application areas that would hamper applications development. That problem, he said, was data base management systems which grow larger and larger as more data is fed into them in support of applications involving technical management, forecasting, and modeling.

Another problem hobbling applications development, he argued, was bogged down programmer productivity which he projected would improve by a factor of four to seven in the next few years. Henson protested that that's "not enough" of an improvement and suggested ways to step it up. Some "promising tools," he said, are application program generators, data dictionaries, and other programming aids. He also proposed using the computer itself more in applications development. "We shouldn't focus on fine-tuning the system," he asserted, "but on increasing programming productivity." **—L.F.**

Malik on IBM: A Racier Book

A burglary, telephone tappings, and surveillance from moving and parked cars are some of the new ingredients that will comprise a second edition of British author Rex Malik's vitriolic book, *And Tomorrow the World: Inside IBM.* The second edition is due out next year.

Malik says the events occurred shortly after the book went into its first year of publication in 1976. Without actually accusing IBM or other Americans—"after



REX MALIK: British author, outside courtroom in Foley square where IBM antitrust trial is underway, plans a second edition to his book: "And Tomorrow the World: Inside IBM."

surveillance, the cars often drove off down the right side (in Britain the wrong side) of the road"—Malik says he intends to write about "the strange things that have befallen me" since the book came out.

Malik, who calls himself a free enterprise journalist, writes about all aspects of the computer business for magazines, newspapers, and broadcast media, and has authored, or is about to, several other books. His first, *What's Wrong With British Industry*, purportedly contributed to the election of Labor Prime Minister Harold Wilson in 1964. He is collaborating with Alex Bell, a prominent British researcher in artificial intelligence, on a book on the subject, entitled *We Have a Problem.* And a novel is due out soon on a takeover of the British government, entitled, *Tomorrow Has Been Cancelled.* It is coauthored by British M.P. Ken Warren, a frequent spokesman for the government on computer topics.

Broke F.S. story

A journalist for 21 years, Malik is best known outside the U.K. as the reporter who broke the story that IBM was abandoning its Future Systems project. The story was given widespread publicity, and forced a statement confirming the report from Frank T. Cary, the IBM chairman. An associate says Malik still works 16-hour days as a free-lancer. For two to three months a year he serves as a senior research associate chronicling the activities of Gordon Pask, resident professor of Cybernetics at Brunel Univ. in the U.K. He is a correspondent for France's weekly computer newspaper *01 Informatique.*

The burglary

Malik, who says nothing was missing after the alleged burglary, said it occurred during the morning when the house was empty and on a day he had engaged decorators to do some remodeling. The decorators showed with a key Malik had given them, but were unable to open the door because the latch was down. When Malik's children returned from school, the latch was up, indicating the persons who were in the house when the decorators came had left.

Malik says the decorators, unable to rouse anyone in the house, left.

The new edition of his book, he says, also will include new chunks of antitrust evidence now seeping into the public sector. The book also will move faster, he said, because such lengthy sections as the history of computing will be placed in an appendix.

The new edition likely will reinforce IBM's privately held view that the British author is "paranoid" about the company. Both IBM and Malik have scotched a growing rumor that IBM has bought the publishing rights and plates for the book from its U.K. publisher, Millington Books, and recalled copies from circulation—perhaps to avoid publication of the "lovely new stories" that Malik said he intends to add in the second edition. (The book is distributed in the U.S. by the Computer and Communications Industry Assn., 1500 Wilson Blvd., Arlington, Va.)

The truth, according to Malik, is that he currently is exercising a buy-back option on the book himself so that he can take it to a new publisher. "Negotiations between Millington Books and my lawyers and agent are just underway, so I'd rather not say anything more on this," he said.

Some observers say the book hasn't been as successful as he would have liked, largely because Millington has neither the will nor the manpower to push sales of the book as Malik wants. He is thought to be trying for a paperback publisher for his tighter and racier second edition, and is expected to serialize some of it in a leading U.K. journal this autumn. ✲

BENCHMARKS . . .

From Burroughs to NCR: Already sporting his NCR lapel button, Manuel Garcia showed up for work at NCR Corp. Sept. 19, and posed for this first official photo. Garcia, who had spent some 30 years at Burroughs Corp., most recently as head of the computer maker's International Marketing Group, left the company to assume a similar post at NCR

MANUEL GARCIA

where, as a member of the company's executive office, he will be primarily involved in NCR's worldwide marketing operations. He's the second top Burroughs executive to leave the Detroit firm for NCR. Charles E. Exley, Jr., former Burroughs executive v.p. for finance, left a year ago last August to become NCR president. Garcia, 52, joined Burroughs as a salesman in 1948. He'll be succeeded at Burroughs by J. Roy Henry, recently named corporate v.p. of marketing.

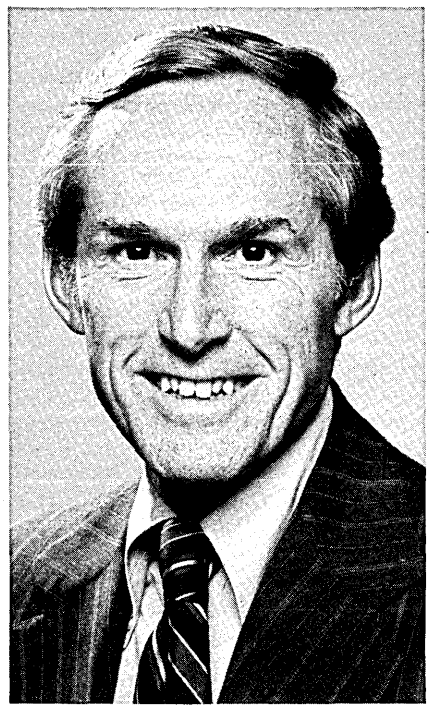
Ma Bell and EFT: AT&T would be barred from competing in Electronic Funds Transfer services unless the 1956 consent decree or FCC rules are modified, if the National Commission on Electronic Funds Transfer has its way. The commission's final recommendations to Congress last month said such services constitute data processing and not regulated communications. That means that if carriers enter the EFT market, it must be on a non-tariffed basis without cross-subsidization from monopoly services that are tariffed. The 1956 consent decree limits AT&T essentially to operations which can be marketed under a common carrier tariff. The commission said that while AT&T may possess knowledge and research capabilities in EFT that should be available to the public, it also "may possess dominant market power" which could lead to forcing other firms from the market and preclude the entry of new firms.

Digital Watch Market: In a move reminiscent of the pocket calculator market, Intel Corp. of Santa Clara became the eighth company to drop out of the digital watch business in September. American Microsystems and Litronix preceded Intel as semiconductor dropouts. Others who have left the business are Armin, Benrus, Gruen, Gillette, and HWM Industries. Semiconductor firms still in the business are Texas Instruments, Fairchild, and National Semiconductor. Intel president Dr. Gordon Moore said the company will take an after tax charge on earnings of $1.4 million with the disbanding of its Microma subsidiary. Moore said the electronic watch business didn't turn out to be the high-technology business dependent on semiconductor components that the company thought it would be when it acquired Microma.

Cost Was Too High: Calspan Corp., an R&D firm doing government work, decided to drop manufacturing and marketing of its computer-based fingerprint identification systems because the investment was too high. President Robert S. Kelso said the costs "more than accounted for the company's total losses of $2.9 million over the last three years." The company will attempt to sell or license two products: one covering customized large-scale systems for law enforcement agencies; the other being access control systems for business and government.

Acquisition Talk: Applied Digital Systems, Inc., Hauppauge, N.Y., a firm that tried unsuccessfully to take over Milgo Electronics earlier this year, now may be the object of an acquisition itself. Persistent rumors in the financial community last month indicated the suitor is Northern Telecom, although both companies in mid-September were declining to comment. ADDS makes crt terminals. In Morristown, N.J., the instruments manufacturer, Keuffel and Esser, said preliminary talks for its merger with Mohawk Data Sciences (September, p. 276) have collapsed.

Shifts at Xerox: James S. Campbell has been named president of Xerox Corp.'s Business Systems operation, replacing John C. Lewis who left the company to become president of Amdahl Corp. Robert Adams, v.p. of marketing with the Data Systems operation, was named president, replacing Lewis who



JAMES C. CAMPBELL

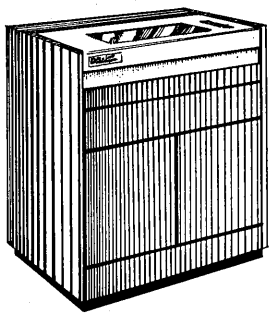
also had been acting president of that operation which manufactures printers and terminals. Campbell formerly was president of Xerox Computer Services and is succeeded by Haig Bazoian, who has been the unit's v.p. of marketing. XCS also was put under the Business Systems operation which Campbell heads. Campbell has been president of the unit since it was formed in 1969. He had been president and chief executive officer of Greyhound Computer Corp., and earlier spent 15 years with IBM's Data Processing Div.

Personal Computers: J. David Callan, who heads Pertec Computer Corp.'s Microsystems Div., which makes personal computers, said the company will open from 50 to 100 new outlets before year end. At present its Altair line of computers is sold at 80 stores. But Callan said the company has more than 800 requests for store locations—and he expects shortages as the firm tries to keep up with demand. The company acquired the Altair line from MITS of Alburquerque, N.M. Callan is the founder of ICOM, which made peripherals for microcomputers and which also was acquired by Pertec. ❋

The Printer Store

Digital Associates Corporation

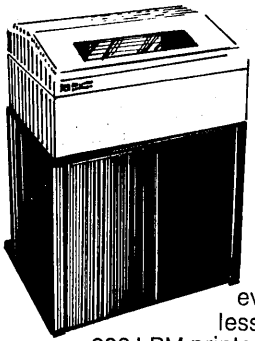
Or, switch to chain-train quality.



The DAC CT 6644 is a 600 LPM chain-train printer that replaces LP11-YA.
It gives letter-quality printing, and costs about 40% less than DEC's 600 LPM drum printer.
Again it comes with PDP-11 interface, installation and maintenance.

Specification:
Solid-font chain-train printer
600 LPM, 132 column/line
64 character/column
Available in u/l case

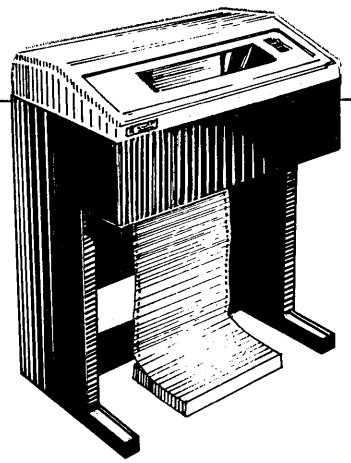
Or, upgrade to a 900 LPM printer for 25% less than you now pay for 600 LPM.



The DAC 2290 900 LPM printer is a plug-to-plug replacement for the LP11-CA. But it costs 30% less. In fact, it even costs 25% less than DEC's 600 LPM printer. Comes with PDP-11 interface, installation and maintenance.

Specification:
Solid-font drum printer
900 LPM, 136 column/line
64 character/column

PDP-11 USERS: Save 40% on your LP11-YA printer costs



Replace your LP11-YA with our DAC 2260

The DAC-2260 is a 600 LPM, plug-to-plug replacement for your LP11-YA. It comes with PDP-11 interface, installation and complete maintenance service. Buy, rent, or lease. The saving is 40%.

Specification:
Solid-font drum printer
600 LPM, 136 column/line
64 character/column

Why we can offer such extraordinary savings.

The Digital Associates Printer Store is the largest independent outlet of quality line printers for mini computer systems.
We buy printers, in quantity, directly from the manufacturers, and add interfaces to all the popular mini computer CPU's. Then we offer complete printer systems (printer, interface, installation and service) at prices the mini-computer suppliers simply can't match.
The Printer Store can supply printers from 100 to 1500 LPM, dot matrix, drum, chain-train or band technology, for DEC, Data General, Hewlett-Packard, Interdata, G. A. and most other mini-computer systems! And for IBM Series 1 and S/3 computers. We can also supply any of our printer systems for remote data communications environments.
We install what we sell, and service what we install (unless you insist on doing it yourself). You can buy the printers, lease them or rent them. Any way you choose, you'll save between 20% and 50% on prices you'd pay to the mini-computer manufacturer.

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Before you sign up for an LP-20 printer, call The Printer Store. We'll give you a wider choice of printers with substantial savings on any type you choose.

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We'll take your old printer as a trade-in when you order your new printer from The Printer Store.

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LOOK AHEAD

(Continued from page 16)
people in the U.S. are affected in some way by birth defects. "This system touches all of them."

BUT THE CAB DOESN'T KNOW

A Datamation editor has discovered a new airline operating in California. A charge for airline tickets on his most recent BankAmericard/VISA statement identified the vendor as "L,.OJ./J/U" instead of Pacific Southwest Airlines' more common moniker, PSA. The amount of the charge and its date look correct, but where the funny name came from is an open question. The VISA people suspect a data entry error. It's rumored that a number of bills in this billing run went out with equally unintelligible "descriptive" billing details. In all fairness to the credit card people, we should note that in the past they have been quite willing to correct their mistakes.

IBM OUT OF SERVICES INDUSTRY---AT LEAST UNTIL MID-1980s

Will IBM reenter the domestic services industry in 1979? No, says Robert K. O'Connor, v.p. of Fourteen Research Corp. O'Connor's reasoning: the computer giant has its hands full replacing current cpu bases and maintaining dominance in a dp environment experiencing dramatic application and technical changes with the emergence of distributed processing, microcomputers, and the like.

Even if IBM does take the plunge, it won't come until the mid 1980s, O'Connor believes. By then SBS, IBM's satellite communications network, will be fairly tested and proven for transaction service and the current shakeup in the cpu and plug-compatibles market will have settled a bit.

IBM BALKS AT HONEYWELL'S CHURCH SPIRE

IBM is a dominant force in France and wants to stay that way. Last month at the annual French computer show, Sicob, its French archrival Honeywell Bull-CII displayed a French village with a church, post office, shops, and homes all connected by computer, presumably HB-CII computers. The company billed it as the total-wired village. And many who saw it praised it for imaginative showmanship. Except IBM, which reportedly complained to Sicob organizers about the height of the spire on the church, which reached some 40 feet into the air. IBM felt it dominated the show too much, and HB-CII was forced to trim it to a more modest 20 feet. IBM's booth was a typical affair in which it displayed its System/34 and its communications protocols.

RUMORS AND RAW RANDOM DATA

Hewlett-Packard Co. is discontinuing its venerable 2000-series of BASIC time-sharing systems, although it will continue to support existing users. It will stop selling or accepting orders. The recently announced model 2026 is not a part of the discontinued line...We hear that serious talks have been underway between Microdata Corp., Irvine, Calif., and Italy's Olivetti in which Olivetti would acquire the California firm. It would be a combination of Microdata's hardware technology and Olivetti's solid field sales and support force...Some early users of Univac's BC/7 small computer say the operating system is so big there's hardly any memory or disc space left for the user...There are rumors that Burroughs is finding the same problem with its B-80 -- the MCP (Master Control Program) cannot be fit into memory and the memory can't be stretched because there's no space in the cabinet. The company may advance the introduction of its B-900 series that wasn't due until 1983...IBM is rumored to have placed an order with Fairchild Camera and Instrument Co. for one million 64K bit CCD (charge-coupled devices) chips. An observer who heard the rumor on a recent trip to Texas says a million chips is too many for an evaluation order...Banque Nationale de Paris, an IBM stronghold, suddenly has opted for Logabax terminals in a recent $8 million order to the French company. Some observers say Logabax might even get the bank's total network...Latest computer buzzword, coined by French software personality Philippe Dreyfus, vice chairman of CAP/Sogeti/Gemini, is "infotecture." Two French publications, Le Monde and L'Express, recently used the term which applies to the structure of information systems...Control Data has made a big deal about touting its new family of computers targeted for introduction by 1979. At a recent executive seminar, the Minneapolis mainframer gave an update on its progress and plans. Bundled into the systems will be redesigned LSI technology and virtual memory.

Take an in-depth look at in-house timesharing:

You know the problems facing the data processing department:

Other departments in your company want faster response, broader capabilities, better service.

And your management wants you to hold down your operating costs.

You're probably looking hard for a solution. A closer look at in-house timesharing could give it to you.

Fast, long-lasting relief

Unlike upgrading a large central computer, expansion to an in-house timesharing system isn't a time-and-money-consuming ordeal.

And unlike buying outside computer time, you're not building in a monthly bill that inevitably keeps building up.

Adding an in-house timesharing capability is a shrewd way to add computer power. Because it won't add significantly to your operating costs; in fact, it can pay for itself by reducing current costs.

Especially if you add the system specifically built for timesharing: our BTI 4000.

A timesharer's timesharer

The BTI 4000 Interactive Timesharing System is made by us:

Basic Timesharing, Inc. We're the computer manufacturer with timeshare experience. Which has helped us produce a computer uniquely right for timesharing.

To help you do more—while helping your company spend less.

Easy to begin, room to grow

You can own your own BTI 4000 for as little as $35,950. For that you get a ready-to-go system with 10 megabytes of storage and 8 ports—just add terminals.

And start-up won't cause a departmental hang-up. The BTI 4000 can be installed and working for you in one working day.

Expanding to do even more work takes even less work. The BTI 4000 features modular construction, so system downtime for expansion is minutes, rather than days. You can add disk storage to 400 megabytes; increase user capacity to 32 ports; add peripherals like industry-compatible magnetic tape and a line printer.

Hard working, always working

The BTI 4000 is a true timesharing system. It allows doing any mix of tasks, all at the same time, all completely independent.

It also gives you continuous system availability, because software housekeeping can be performed while users are on-line.

There's also off-hours jobstream processing. So the BTI 4000 can be working for you, even when no one's around.

The BTI 4000 uses BASIC-X, an unusually powerful extension of the BASIC user language, enhanced for business programming.

What's more, the BTI 4000 offers heirarchal account organization and stringent security so that you can maintain total control over who's using it, and what they can do.

And it does all this without a full-time operator.

Inexpensive help

Used during typical office hours, the operating costs for a BTI 4000, including maintenance, are about $1 per terminal hour. And should you grow to 24 hour usage, your operating costs shrink to less than 10¢ per terminal hour.

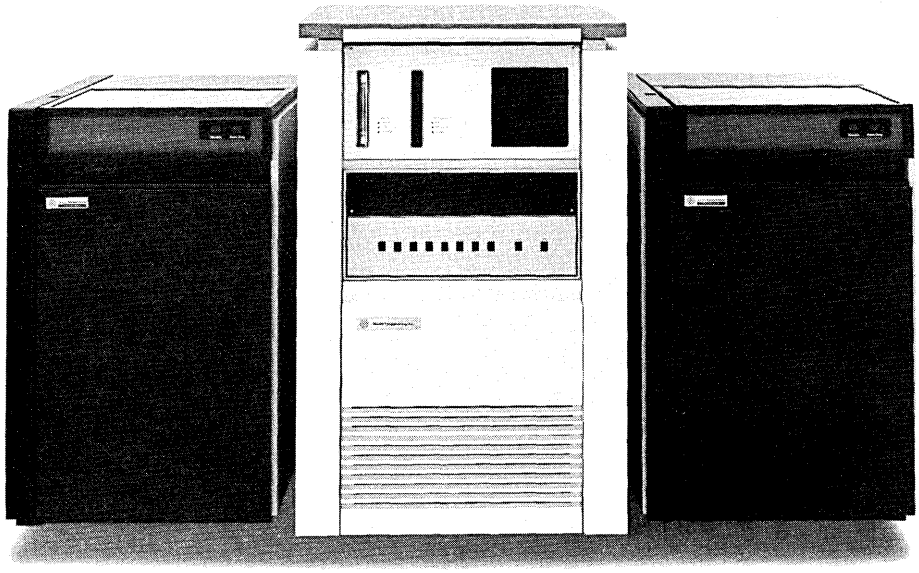
Around-the-clock help

We back our BTI 4000 with any-hour, anywhere, on-line support with dial-up access for problem diagnosis. Yet in a typical installation, our maintenance plan costs less than 1% of the system's purchase price per month.

Look to us

The BTI 4000. The interactive timesharing system that will help your data processing department do more, for less.

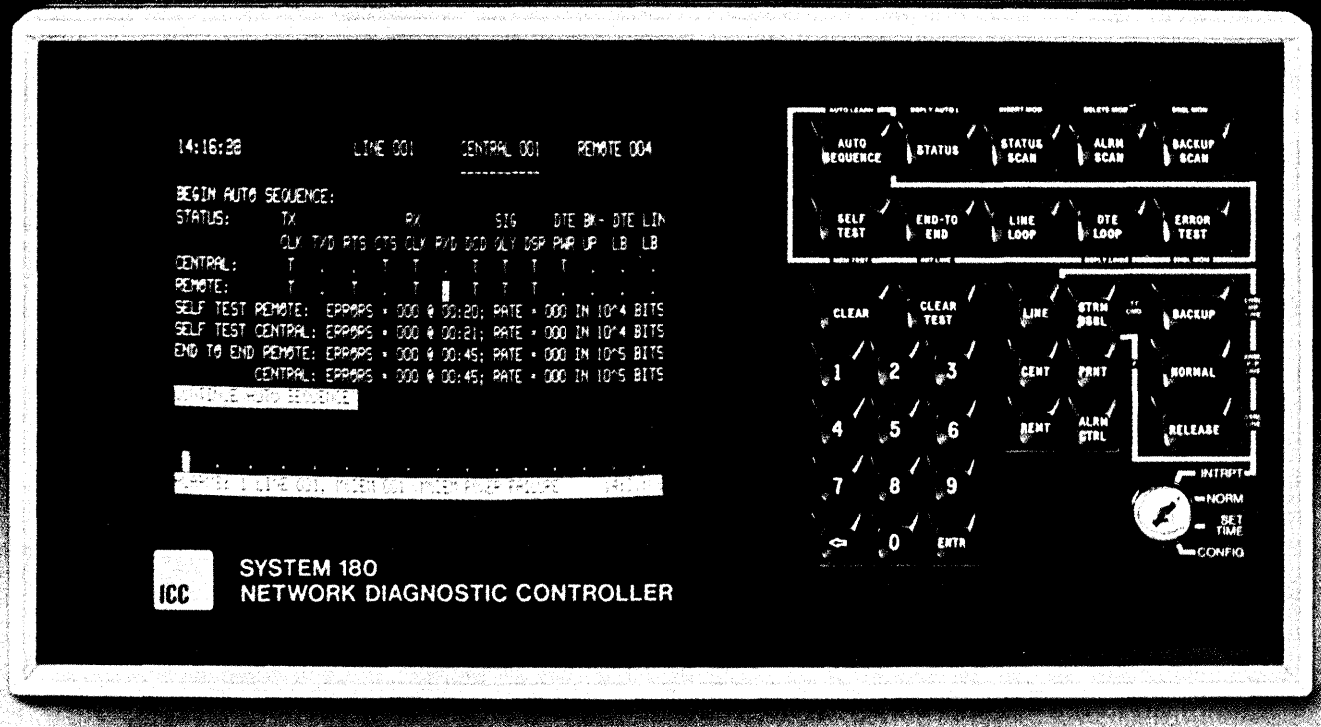
For more information, just look to the Basic Timesharing office nearest you.



The BTI 4000 Means Business.

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

THE SUPER NETWORK CHECKER OUTER, SERVICE RESTORER, PROBLEM SOLVER, FAULT ISOLATOR, AND FINGER POINTER ELIMINATOR.



Downtime in a data communication network is too costly to be a guessing game. And operating personnel shouldn't be concerned with questions like what's the problem, where's the problem, and when did it happen? Not when they're supposed to be getting your data through. That's why we developed the System 180 Network Diagnostic Controller. It checks up on networks with up to 16 dedicated lines, with as many as 254 modems per line. If there's a problem at a remote site, it lets your central site personnel know immediately. Much of the time, it allows your personnel to take prompt action to restore service, even at unattended sites.

Our new 8-page brochure describes all the good things System 180 can do for your network. Send for your free copy.

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If you have requirements or plans for large FORTRAN programs, investigate our Megamini's experience in the scientific community. Call your local Interdata office or contact me, Gary Doninger, Interdata Scientific Manager. (201) 229-4040.

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How to Buy a Minicomputer

Shopping for a minicomputer has become almost as difficult and confusing as buying the right type of headache tablet. There are so many factors to consider such as core memory, speed of printers, costs related to components, service, flexibility, ad infinitum. For the simple man (myself), there has emerged an easier, less time-consuming, and quite possibly more effective method of buying a mini.

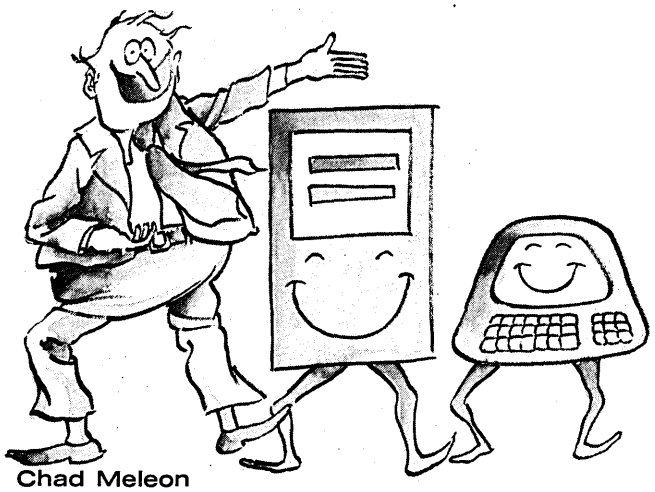
Assess the salesman. This technique is largely based on the intuitive observation that the quality of the salesman's performance reflects the quality of his company's performance. There is a somewhat tenuous parallel between this theory and Marshall McLuhan's observation that "The medium is the message."

While there are no clear-cut formulas that can be applied, a few illustrations should help to crystallize a few notions in your mind. To make this even a little simpler I will award points on a scale of 1 to 10.

Brick

Brick is quick to impress on you that he is your friend and that he has the goods on the competition. He knows why IBM's GSD will be broke within six months and why MAI is scared to death of his product. He can tell you all about the scandalous habits of the other salesmen working for the other companies.

Rating: This is all very interesting information. It is difficult to get much information about his computer, however. Still, a good performance overall. Somewhat misleading, though stimulating. 7 points.



Chad Meleon

Dialogue with this person is similar to dancing with a "Will-O-the-Wisp." Chad's computer will do all things for all people at all times, including a soft-shoe dance to cheer up the staff in the morning. Just how it can have such far-ranging capabilities always remains tantalizingly vague.

Rating: A thoroughly entertaining performance. Reminiscent of vaudeville. Dexterous. 8 points.

Tom Sawyer

Tom will only reluctantly do business with you. He must be persuaded that your company is worthy before he will discuss his computer. At every step of the way he will fight your attempts to do business with him.

Rating: A solid performance of an old classic so well portrayed in Mark Twain's novel, *Tom Sawyer*, in which Tom is able to persuade his friend to whitewash his fence for him. Although not original, really a bravura performance, requiring "guts" and consummate acting skills. 9 points.

Ernest

Ernest is honest, sincere, helpful, and courteous. He is very concerned that you deal with an ethical firm, namely his. He will provide you with data and information until your head aches.

Rating: Ernest commits the cardinal sin of failing to make his computer come "alive." I feel compelled, though, to award some points for honesty and diligence. 6 points.

Sammy Slick

Sammy is hard to follow but always interesting nevertheless. Never a week passes that he can't offer you a stunning new deal on a piece of used equipment.

Rating: Interesting. Creative. Would rate higher but basically unconvincing. 7 points.

Bacchus

Bacchus always buys you a really good lunch and knows a lot of funny stories. He will never confuse you with data—technical or otherwise.

Rating: Really satisfying. Has identified your needs promptly and made an excellent show of it all. Buy from this man. 10 points.

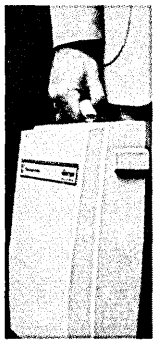
—Gordon Watt

TI's 745 Portable Data Terminal can make the difference between closing doors and closing deals.

Sometimes, getting back to your customers tomorrow or next week just isn't good enough. It can mean a closed door now. And more closed doors to future business.

TI's *Silent 700** Model 745 Portable Data Terminal gives you all the facts and figures you need to close your sale. On the spot.

All you need is a telephone and an electrical outlet. And you're ready to send or receive information from your home office computer that's configured for remote-dialed communications. Immediately. Plus, you get an instant printed copy of the information for your records.



TI's 745 Portable Data Terminal weighs only 13 pounds. So, you can easily take it with you wherever you go. And get virtually silent printed copies of critical orders at 30 characters-per-second. Inventory. Pricing. Deliveries. Listings. Policy analysis. And budget impact analysis.

With a TI microprocessor at the heart of the unit, the 745 is unbeatable for performance and reliability.

And with a price of only $1995†, the 745 is several hundred dollars below competitive models. With larger quantity discounts available, too.

So, if you're in real estate, insurance, finance, manufacturing, wholesale, retail or any other business with field operations, put our 745 to work for you. And start closing more deals.

For immediate response, contact your nearest TI office, or call Data Terminal Marketing, Texas Instruments Incorporated, at (713) 494-5115, extension 2126.

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- ☐ Please send me more information.
- ☐ Please ship me a Model 745 Terminal and charge my BankAmericard # _____
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Off-line

The Extrion Div. of Varian Associates has introduced a $1.5 million electron beam lithography system that will allow semiconductor manufacturers to fabricate integrated circuits with linear details down to one micron (one-millionth of an inch) in width. This is about one-third as wide as lines generated by conventional lithographic processes, and could produce a nine-fold increase in circuit density. The system, designated the EBMG-20, is controlled by a NOVA 830 minicomputer.

In a free report, Auerbach Publishers says that although the IBM System/34 is "not a particularly innovative machine," it is definitely the system to watch in the small business market. The report concludes that, "It is more competitively priced than the System/3 Model 4, and, unlike the older System/32 at the lower end of the small business machine spectrum, it can survive in a market populated by display-based small business systems." The report also includes delivery dates, pricing data, and system and peripheral specs for the new product line.

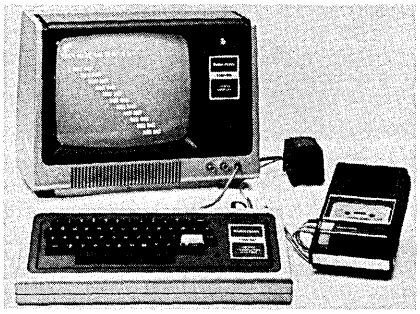
Centralized dispatching and performance monitoring on Atlanta's new rapid rail transit system will be provided by four Data General Eclipse S/200 computers. The computers also will provide a means to alter train schedules and routes on the system, which is slated to begin operation late next year.

SRI International is in the experimental stages of developing a computer system to help geologists search for minerals. The computer functions as a consultant, providing guidance to geologists on potential mineral deposits. A number of specialists are interviewed to obtain models, and rules are extracted to indicate whether, and to what extent, the presence of a given geological feature, such as a rock formation, points to the existence of a particular type of deposit. The computer can link chains of such rules and come up with an estimated likelihood that such a deposit is present in a certain vicinity. The system is explained in SRI's quarterly, "Investments in Tomorrow," in a paper by Drs. Peter Hart and Richard Duda of the Institute's Artificial Intelligence Center.

Personal Computer

Radio Shack has made its long-rumored entry into the personal computer market with the TRS-80, a Z-80-based system. A complete system, including video display monitor and data cassette recorder sells for $599.95; the microcomputer alone sells for $399.95. Software support includes BASIC with graphics extensions, and games and applications packages.

The microcomputer includes an integral 53-key ASCII keyboard. The 12-inch video display can display 16 lines of 64 characters (also software-selectable to 32 characters per line) and graphics on a 128 x 48 grid. Graphics and text may be interspersed in any manner by software. Memory includes 4K of ROM and 4K of dynamic RAM, internally expandable to 12K of ROM and 16K of RAM. Maximum memory size is 62K. The unit also has a



computer-controlled cassette interface and an expansion port for additional memory and peripherals. The TRS-80 is U.L. listed for 120 volts AC.

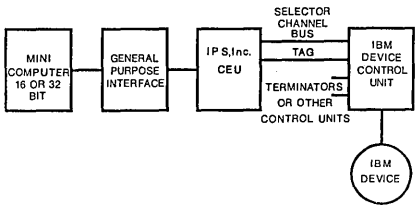
BASIC comes in ROM and provides floating point arithmetic; numeric, array, and string variables; video graphics; and cassette save and load commands. Applications software comes on cassettes. Blackjack and Backgammon are free on a single cassette. Other applications, ranging from kitchen programs for menus and the like to a 15-person payroll package, come on one or more cassettes, with prices from $4.95 to $19.95.

Additional applications programs are planned, as are an extended BASIC and a disc operating system. Additional hardware on the drawing board includes disc, printer, expansion unit for additional pc boards, modem, and serial I/O. RADIO SHACK, Fort Worth, Texas.
FOR DATA CIRCLE 302 ON READER CARD

Channel Emulator

The Selector Channel Emulation Unit (SCEU) lets minicomputers talk to high-performance IBM (and plug-compatible) peripherals. Initially, the SCEU is available for SEL-32 minis, though the vendor tells us the SCEU's interface can be modified to work with other minis. The SCEU generates the protocol sequence required by the IBM peripheral control unit. The unit also converts the IBM Selector Channel's 8-bit wide data path to the appropriate word width data path for the mini. The unit can

Typical System Configuration



support as many as 255 different device control units at a combined data rate in excess of 2.4MB per second. Single units sell for $15,150. Oem quantity discounts are offered, and quantity shipments are said to take 60 days. INFORMATION PRODUCTS SYSTEMS, INC., Houston, Texas.
FOR DATA CIRCLE 303 ON READER CARD

Desktop System

The distinction between calculators and minicomputers has been blurred over the past few years, and this one seems to fall somewhere at the high end of the blur. This calculator (or desktop computer, if you prefer), the 9845, is similar to the vendor's earlier 9825 with its processor modified to

handle an increased addressing space. In terms of power, the 9845, also known as System 45, is said to be comparable to most minis in speed and performance. Its processor is said to be similar to the one used in the vendor's 2100 series of minicomputers, but it's been optimized for an interpretive environment.

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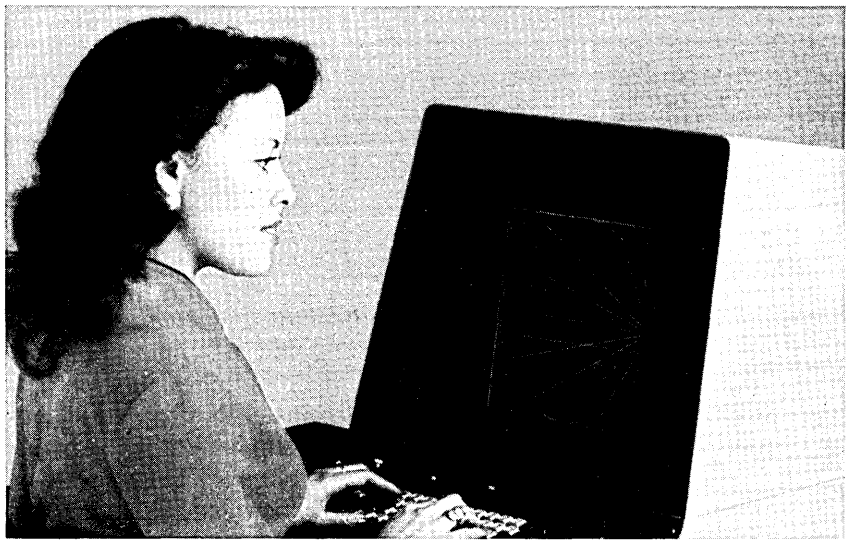
Plasma Display Terminal

The PD 1000 (computer-grade) and PD 2000 (military quality) are microprocessor-based graphic plasma display terminals. Developed in conjunction with a computer-assisted instruction project at the Univ. of Illinois in the early 1970s, plasma displays consist of neon gas contained between a pair of flat glass plates. A set of parallel horizontal conductors is printed on one plate; a set of parallel vertical conductors is printed on the other plate. Applying a voltage to one line on each plate causes the neon at the intersection of the two lines to glow. Once excited, the gas continues to glow in the presence of a small sustaining voltage.



Both terminals have dual font upper and lower case alphanumerics, full graphics capability, interactive keyboard, and a set of more than 70 command control functions. An RS232C interface is standard, with data rates switch-selectable from 150 bps to 19.2K bps. Options include a graphics joystick, user-defined function switches, touch panel, programmable character generator, expandable RAM/ROM memory, and a 16-bit parallel I/O port. The vendor has also developed support software for the user's host processor, including FORTRAN IV and BASIC graphics packages, plus other programs for diagnostics and microcode generation. The Model PD 1000 is priced from $8,900 and the PD 2000 is priced from $10,000. Delivery is quoted at 90 days. INTERSTATE ELECTRONICS CORP., Anaheim, Calif.

FOR DATA CIRCLE 301 ON READER CARD

In terms of hardware, the unit consists of the calculator with built-in keyboard, a 12-inch crt display, optional thermal line printer built into the calculator, 16KB to 64KB of RAM, about 100KB of ROM (containing system software), and built-in mini cassette drives. Dot graphics are available as an option; the printer can function as a raster scan plotter and, with a command from the keyboard, dump the contents of the crt onto paper. The unit can interface to IEEE 488-1975 instruments and a variety of peripheral devices, including discs ranging from floppies to 50MB hard discs, printers, plotters, and card readers.

The system runs a nice version of BASIC which conforms to the ANSI standard with significant extensions. Users may find this version of BASIC more attractive than the version available on the vendor's 2000 series time-sharing systems.

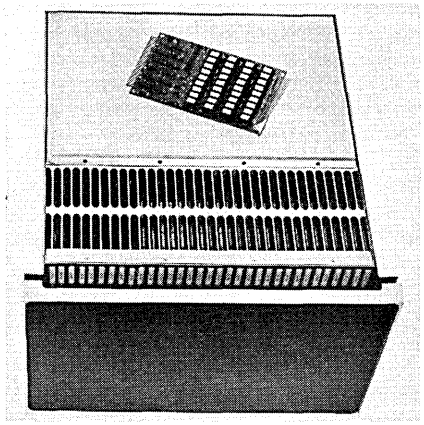
The language supports long mnemonic variable names, symbolic line identifiers, string arrays, matrix operations, six-dimensional arrays, subroutine calls (with arguments), common storage, recursion (limited by available memory), multiline function definitions, and an enhanced PRINT USING statement. The file system supports named files on a variety of peripherals. As a debugging aid, the system offers sophisticated trace capabilities. Thirty-two special function keys can function as sense switches (with immediate branching within a running program) or as command input keys. Applications software is available for scientific calculation and data analysis, data acquisition and control, management science, business administration, and crt graphics. Materials management, medicine, and engineering design applications are in development, as is communications software to allow the unit to talk and listen to the outside world via its RS232 interface.

A basic system with built-in keyboard, 16KB of RAM, the graphics option, crt, and one mini cassette tape transport sells for roughly $17,000. Leases also are offered. Delivery is quoted at 12 weeks. HEWLETT-PACKARD co., Palo Alto, Calif.

FOR DATA CIRCLE 305 ON READER CARD

Disc Replacement

PDP-11 users can use this plug replacement memory unit in place of a fixed head disc to get faster access times and increased data transfer rates. The solid state unit, known as the EMU, takes 2.1 usec to set up its control registers and initiate a data transfer to or from main memory. Transfer rate is 2MB/sec. The EMU uses interchangeable memory modules. Each card contains 64K by nine bits of RAM. The unit's dual port Unibus interface allows access by two processors (11/04 through 11/70) and also incorporates card interchangeability. It is said that the EMU's MTBF is 38,000 hours. A 1,024KB system sells for $23,795. That's about $2,500 more than a 1.2MB RJS-04 fixed head disc from DEC, but the price difference may



be off-set by increased reliability and faster operation. EMU's also are available in capacities ranging from 512KB to 2.8MB. Battery backup is optional. Deliveries are quoted at 45 days. MONOLITHIC SYSTEMS CORP., Englewood, Colo.

FOR DATA CIRCLE 306 ON READER CARD

Video Graphics

The Model 200-D Graphics and Imaging Video Processor is a self-contained printed circuit board that plugs into Data General NOVA or ECLIPSE series

minicomputers and generates raster-scanned graphics and imaging displays in black and white or color. Resolution is 512 x 512 pixels when operating with black and white monochrome, or 256 x 256 pixels when using 16-level grayscale or color. The 200-D has a writeable control store which allows all the image processing and data formatting routines to be modified under program control from the host computer. The unit uses a proprietary bipolar video microprocessor. Either the host or Model 200-D resident 32KB of memory is used to refresh the display. An upper case ASCII character generator produces 5 x 7-dot matrix characters that can be superimposed on the displayed image. Prices begin at $4,900 for a basic black and white system and $5,300 for a color version. Quantity discounts are offered. LEXIDATA CORP., Burlington, Mass.
FOR DATA CIRCLE 307 ON READER CARD

Printer
The Integral Impact is a dot matrix impact printer designed for use with mini and microcomputer systems. The 132 character per line printer can operate at speeds of up to 120 cps. Interfacing is via an RS232 serial interface, with data rates ranging from 110 bps to 1200 bps. A parallel interface capability is also provided. Switch settings select character size (normal or double width) and line length from 80 to 132 characters per line. A 5 x 7-dot matrix is used to print the standard 64 character ASCII set. Unit price for the Integral Impact is $745 with deliveries quoted at 30 to 60 days ARO. Quantity discounts are offered. INTEGRAL DATA SYSTEMS, INC., Watertown, Mass.
FOR DATA CIRCLE 304 ON READER CARD

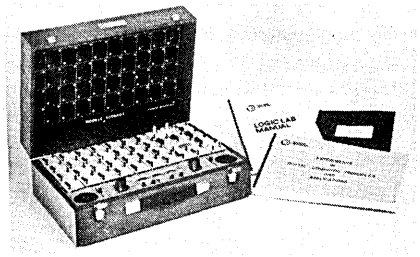
Crt Terminal
The microprocessor-based Model 400D has a 2,000 character memory. The display is arranged as 24 lines of 80 characters, with an extra line, hidden in memory, that can be displayed in either roll or scroll modes. Blink, dim, and reverse-video character accents are standard, as are RS232 and RS170 interfaces. The RS170 video interface can drive auxilliary monitors. The viewing screen measures 15 inches diagonally. The 72-key detachable keyboard generates the full 128-character ASCII set. Cursor control keys and a numeric keypad are standard on the keyboard. Operating modes—data rate from 110 bps to 9600 bps, keyboard mode (tty or full-ASCII), I/O mode (local, full, or half duplex), and display mode (page, roll, or scroll)—are selectable from the keyborad. Single quantity price is $1,470 for a complete terminal or $820 for the controller (for use with freestanding keyboards and monitors). The upper/lower case display option adds $100 to these prices. Oem discounts are available. Standard delivery is 12 weeks. ANN ARBOR TERMINALS, INC., Ann Arbor, Mich.
FOR DATA CIRCLE 308 ON READER CARD

Minicomputer
The SS-11/15 is said to be equivalent to DEC's LSI-11 cpu. The unit comes integrated with floppy disc drives (dual or quad), in 10½ inch rack or tabletop mounting enclosures. The unit runs LSI-11 code so users can take advantage of the wide range of systems and application software developed for the DEC machine. Standard SS-11/15 hardware consists of a 15 quad slot backplane, integral switching mode power supply, floppy drives, cpu with EIS/FIS MICROM, 20K to 28K words of RAM, console, interface, diagnostic/bootstrap PROM, bus terminator, console switch register, distributed refresh controller, and complete front panel controls and displays. Deliveries are said to take 60 days. Pricing is $8,250 for a single unit. UNICOMP, INC., Houston, Texas.
FOR DATA CIRCLE 309 ON READER CARD

Digital Logic Lab
The digital logic lab, a self-contained modular training system, consists of a control and readout panel, module station grid (motherboard) that can accept up to 40 plug-in modules, an as-

hardware

sortment of 38 digital, linear, universal, and special function modules containing more than 94 logic elements and switch functions, internal power supply, and teaching manuals. Also available are boards containing 16-, 24-, and 40-pin DIP sockets, so users can experiment with other chips, including microprocessors. Power converters are available to convert from

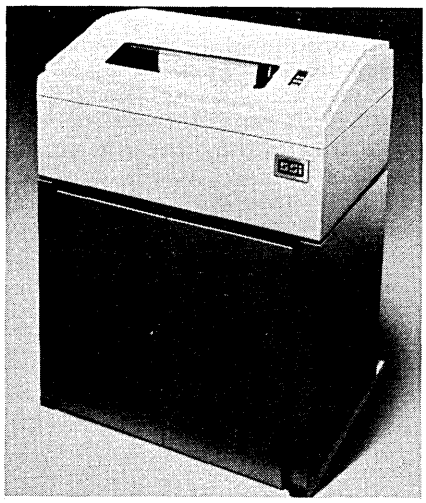


standard TTL power levels to those used by other logic families. In addition to its use as a teaching aid in basic through university level courses, the logic lab can be used for breadboarding. The digital logic lab (SLL-40-DCT) sells for $1,185. TEACHING DEVICES, INC., Carlisle, Mass.

FOR DATA CIRCLE 313 ON READER CARD

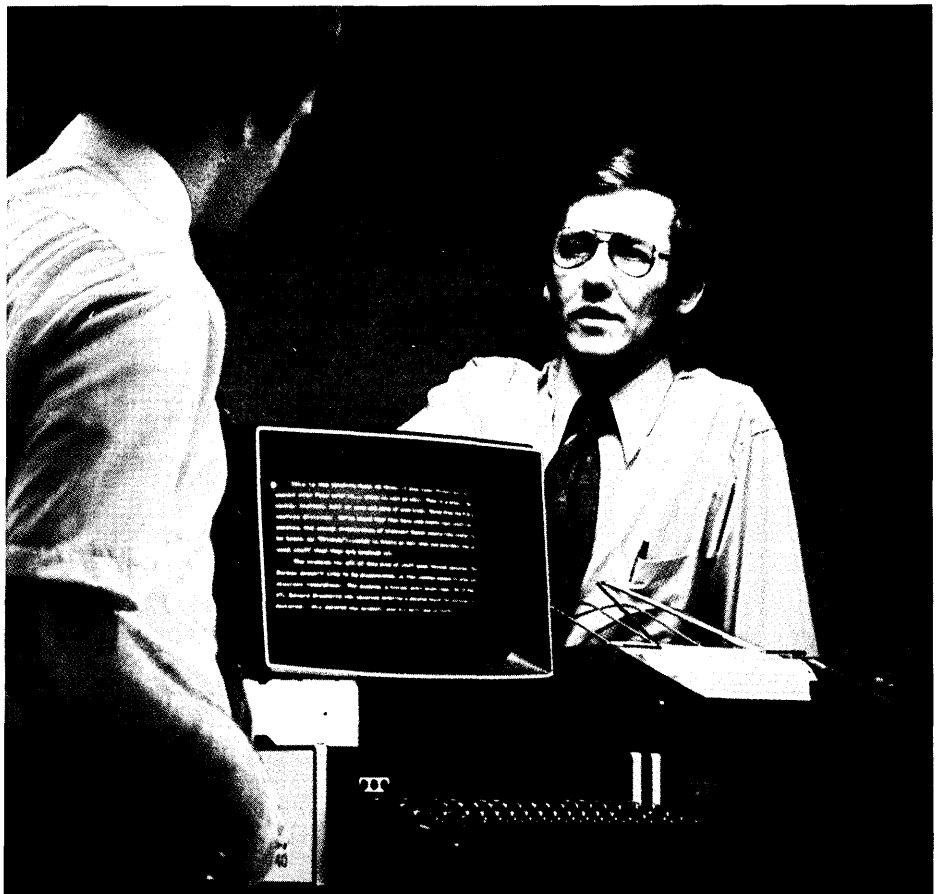
Line Printer

Specializing in printers and other peripherals for the minicomputer (and larger) computer markets, this company has added a 900 lpm printer to its Model 2200 line printer family. The unit can print on up to six part forms. The unit is interface-compatible with a variety of existing computers including those from Data General, Digital



Equipment, Interdata, Hewlett-Packard, Lockheed, and Digital Computer Controls. The vendor will also design interfaces to meet customers' needs. All mechanical parts and electronics, including control logic, buffering, interface, and cables are included in the unit's $15,400 price. SOUTHERN SYSTEMS, INC., Fort Lauderdale, Fla.

FOR DATA CIRCLE 316 ON READER CARD



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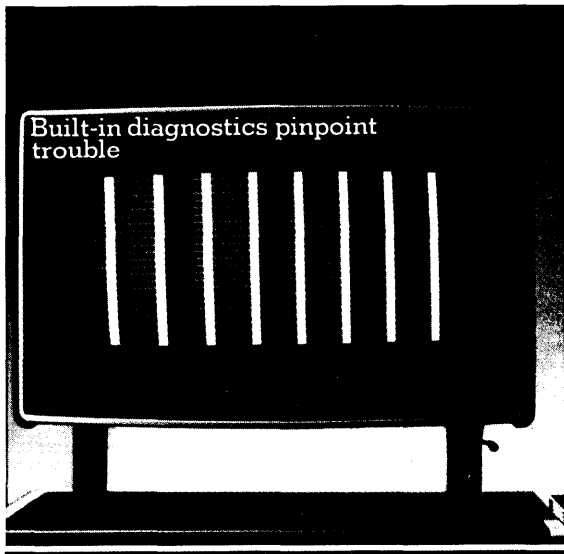
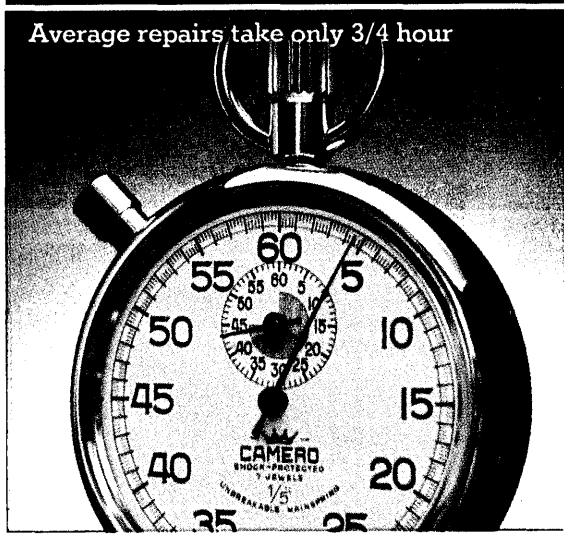
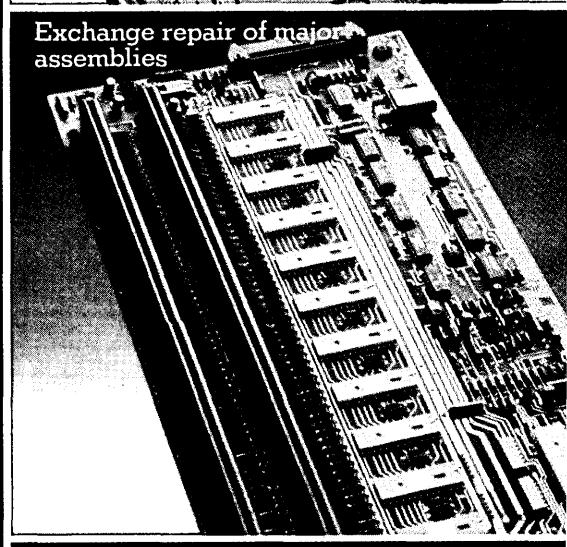
For more information about the Teletype model 40 product line, write: Teletype, 5555 Touhy Ave., Skokie, IL 60076. Or call: 312/982-2000.

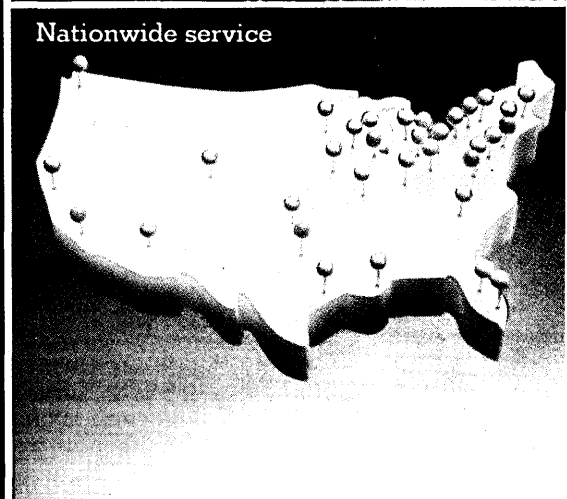
TELETYPE

CIRCLE 3 ON READER CARD









hardware

Line Controller

The 2740 MOD II Protocol Emulator lets users substitute non-intelligent RS232C ASCII terminals in place of more expensive models. The unit handles communication between the terminal and mainframes from IBM, Burroughs, Univac, and Honeywell. It provides the required protocol emulation, buffering, and addressing. Block-oriented data communications occur in a polled multipoint environment in half-duplex mode at asynchronous speeds ranging from 150 bps to 1800 bps. The host computer initiates and controls all data transfers. The unit, also known as the TLC protocol emulator, comes with a standard RS232C cable for connection to the terminal. Its price is $1,540. C. D. JOHNSON & ASSOCIATES LTD., Ottawa, Ontario, Canada.

FOR DATA CIRCLE 317 ON READER CARD

Terminals

This really isn't one terminal, or even several terminals, but a set of modules that users can choose between and have the vendor assemble into custom intelligent crt terminals. Modules in the MAS/T2 series, include 12- or 15-inch crt's displaying 24 lines of 80 characters; 5 x 7 or 7 x 9-dot matrix characters; 64 to 128 character set displayed; transmission rates to 9600 bps RS232C and 20 mA interfaces; keyboards; selectable parity, stop bit(s), and full or half duplex; composite video interface; and reverse video. Firmware features include cursor functions; fixed or programmable tabs; auto line feed; and protected fields. Configuration to user specs takes between 30 and 90 days. Prices are said to start at under $1,000 in lots of 100. MICRO APPLICATIONS SYSTEMS, INC., Minneapolis, Minn.

FOR DATA CIRCLE 312 ON READER CARD

Line Printer

Designed for the minicomputer market, the PARAGON I line printer is a microprocessor-controlled 300 lpm unit with prices starting at $5,495. The basic printer consists of a 132-column tractor feed mechanism controlled by an 8080 microprocessor. In the basic unit, the input format is left undefined and may be programmed as almost any style of parallel or serial configuration, according to the manufacturer. The next model, the PARAGON 1 v29 includes a Centronics-compatible interface, program controlled vertical and horizontal tabs, absolute horizontal and vertical tabs, automatic bottom of page, automatic page heading and numbering, single line print or single page print, and built in diagnostic patterns. It sells for $5,995. The V29X adds 16KB of storage for the most recently printed pages. In case of a paper jam or other failure, the last few pages can be reprinted at the push of a button. This model sells for $7,465. Deliveries are slated to begin in January. SOUTHWESTERN SYSTEMS SERVICES, INC., Houston, Texas.

FOR DATA CIRCLE 314 ON READER CARD

Video Graphics

For use with Hewlett-Packard's 2100/MX/E series of minicomputers, the Model 4422 Graphic Video Generator I/O card can display either a 512 x 256 or 512 x 240 dot matrix image on a standard video monitor via an RS170 video interface. Two units may be paired to provide images on a 512 x 512 or 512 x 480 grid. When a single unit is used, a switch on the board selects either one or two scan lines per vertical point. Multiple units may be synchronized for color displays. Both U.S. and European synch signals are generated by a proprietary microprocessor. Since this function is PROM-based, other synch signals may be defined. The micro also handles memory control timing. The RAM used for local refresh memory allows plotting rates in excess of 300,000 points per second. Three memory functions—set points, clear points, and do nothing—are

The Datum Model 4091 Storage Module Disk Controller provides an interface between a Data General computer and the CDC storage module series or equivalent disk drive. The controller can accommodate from 1 to 2 drives in a single or dual processor environment. The controller contains a microprocessor that executes commands received from the Nova computer. It also generates and checks CRC characters and monitors for the detection of bad tracks. When one is encountered, it seeks automatically to an alternate track that was programmed during the format operation, without intervention from the operating software. With Datum-supplied RDOS-compatible software drivers, the Disk subsystem becomes an operational component of any Data General computer system.

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CIRCLE 32 ON READER CARD

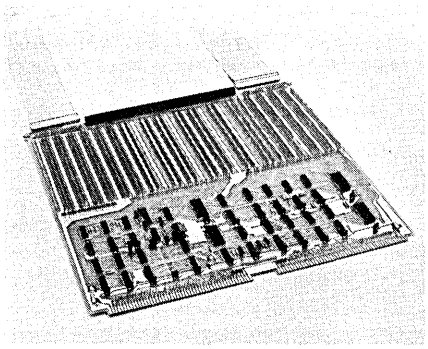
available. Screen erase and video polarity control are programmable. Software includes a FORTRAN-callable graphics library, a device diagnostic, and drivers for all HP operating systems. The 4422 sells for $1,976 in oem quantities of 100, a single unit for end users (includes manuals and connectors) sells for $2,900. INTERMEDIA SYSTEMS, Sunnyvale, Calif.
FOR DATA CIRCLE 318 ON READER CARD

Tape Transport

The 900X series offers 7- and 9-track tape transports, NRZI and Phase Encoded (PE) recording modes (IBM and ANSI-compatible), and recording densities ranging from 200 cpi to 1,600 cpi. The microprocessor-based vacuum column transports come in 37.5 ips, 45 ips, and 75 ips versions; rewind speed is 300 ips. The Z-80 microprocessor handles all of the unit's control functions, and it provides self-test and diagnostic capabilities. The units rely heavily on solid state devices, using solid state electronic switching in place of relays and LED's in place of incandescent indicator lights. In oem quantities of 100, a 900X transport operating at 75 ips in dual mode NRZI/PE, sells for $4,000. The same unit sells for $5,200 in single units. Evaluation units are now available, with production shipments scheduled to commence in late January 1978. CIPHER DATA PRODUCTS, San Diego, Calif.
FOR DATA CIRCLE 319 ON READER CARD

Universal Interfaces

The bottom half of this universal interface board contains the handshaking logic required by Data General, Keronix, and Digital Computer Controls minis. The top half of the board contains wire-wrap pins and provisions for mounting as many as 114 sockets or integrated circuits. Up to 100 additional I/O connections are provided at



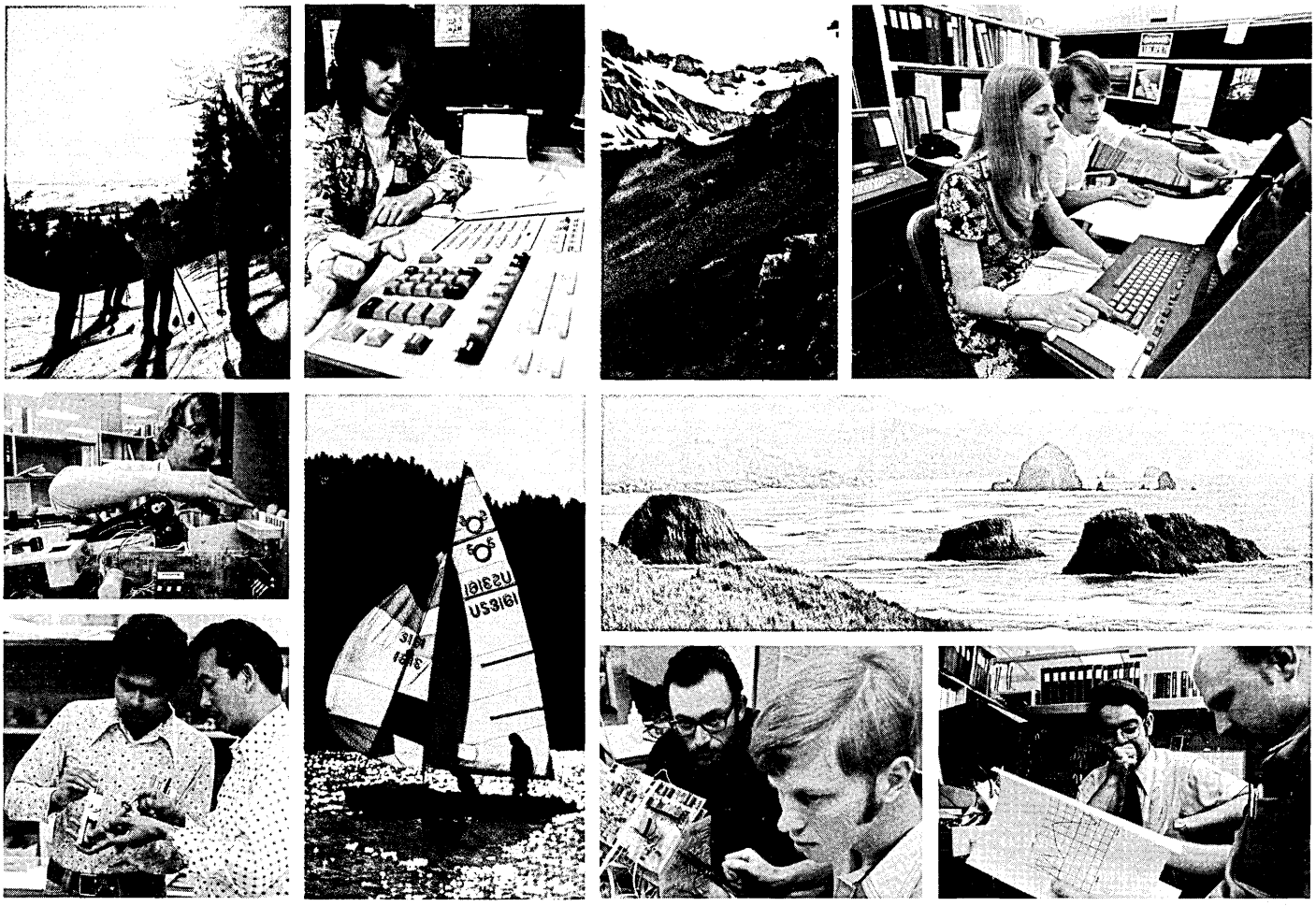
the top of the board via a ribbon cable connector. The basic model, N102-P sells for $475. The $550 model N103-P adds 16-bit input and output registers to the N102-P. The N104-P has data channel control in addition to the features of the other two. It calls for $690. Deliveries are said to take two to three weeks. INTERCONNECTION TECHNOLOGY, INC., Accord, Mass.
FOR DATA CIRCLE 320 ON READER CARD

Magnetic Tape

The tape surface on Critical File is processed by equipment usually used to finish the coated surfaces of disc packs, the vendor says. The vendor has found that using techniques disc manufacturers use to assure a smooth surface can improve the surface of the tape and extend its life. In fact, the vendor warrants the tape for the life of the computer system. In addition to polishing the surface, each tape is certified 5% above the norm for premium tape. Only tapes with zero defects are shipped, and prior to shipment each tape is cleaned twice. A 2,400 foot reel of Critical File tape sells for $12.50. TRI, Dundee, Ill.
FOR DATA CIRCLE 322 ON READER CARD

EPROM Programmer

The Model 16 gang programmer approaches a programming rate of one megabyte per hour by loading 16 2716-type EPROM's simultaneously. It takes two minutes to burn a 2716. The unit also accepts 2708-type EPROM's. The unit has a built-in calibration mode, fault-finding PROM continuity checks an RS232C serial interface with selectable data rates, and an interactive dis-



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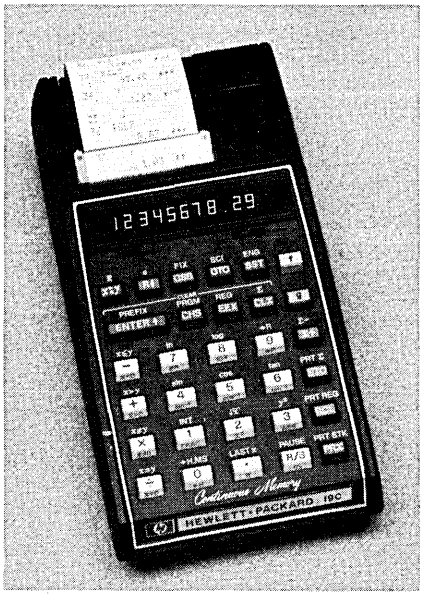
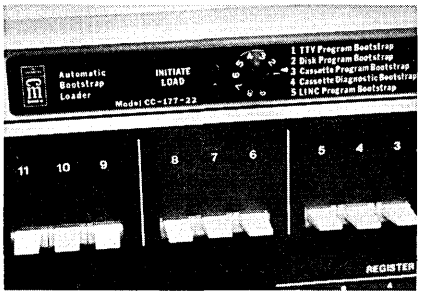
play. If an error occurs, the display shows an error code and the device error LED's identify the error location. The Model 16 sells for $4,800. Delivery is 90 days. DATA I/O, Issaquah, Wash.
FOR DATA CIRCLE 323 ON READER CARD

Calculator
This company always seems to be doing something interesting in the way of pocket calculators. First it was a pocket scientific calculator, then the pocket programmable calculator, and now it's a pocket programmable calculator with an integral thermal printer. The keystroke programmable HP-19C has 98 fully merged program steps (that means as many as four keystrokes may be stored as one program step in memory), editing and programming functions, 30 data storage registers, a quiet



thermal printer, and non-volatile storage for programs and 16 of the 30 data registers. It's a printing version of the HP-29C introduced several months ago. Designed for engineers, scientists, surveyors, technicians, and students, the calculator comes with a 164-page applications book which includes common application programs in statistics, surveying, navigation and numerical methods. The HP-19C sells for $345. HEWLETT-PACKARD CO., Palo Alto, Calif.
FOR DATA CIRCLE 325 ON READER CARD

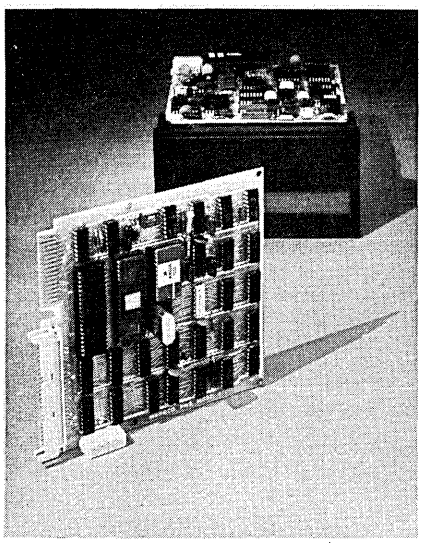
Bootstrap Loader
Known as the ABL (Automatic Bootstrap Loader), this addition to Varian 620-100 series minicomputers allows users to load program bootstraps with the push of a button. The ABL provides up to 256 16-bit ROM preprogrammed instructions coded to user specs. These 256 instructions may be divided into several different switch-selectable program bootstraps. Available in kit form with complete installation instructions, the ABL consists of a small printed cir-



cuit board, a front panel bootstrap selector switch, and an iniate load pushbutton. The ABL sells for $750. CMI CORP., Oklahoma City, Ok.
FOR DATA CIRCLE 327 ON READER CARD

Cassette Interface
Hobbyists and other microcomputer users can load and dump programs and data on audio cassettes at 2400 bps using this audio cassette interface. The interface also supports the 300 bps Kansas City Standard Interface. The 2½ x 5-inch module also contains an RS232 interface for standard data rates ranging from 150 bps to 9600 bps. The price for one unit is $139. WINTEK CORP., Lafayette, Ind.
FOR DATA CIRCLE 328 ON READER CARD

Micro-Diskette Interface
The 8201 Micro-Controller interfaces byte-oriented computers, from 6800- and 8080-base microcomputers through minis and up, to 5¼-inch minidiskette drives. One version of the controller is pin-compatible with the personal computer S-100 bus. Using a



modified IBM type of soft sectoring, the controller formats data into 16 sectors per track with 128 bytes per sector. One 8201 can control up to four drives. The 8201 sells for $490 in single units, with oem discounts available. WANGCO INC., Los Angeles, Calif.
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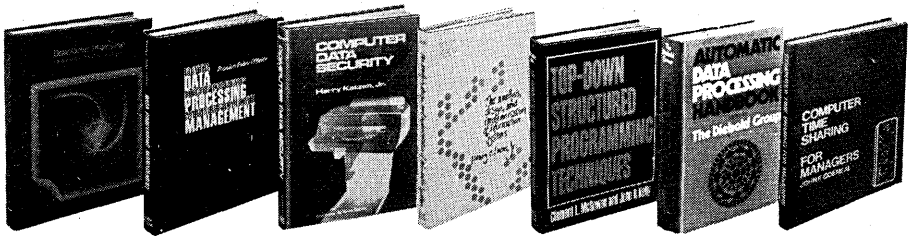

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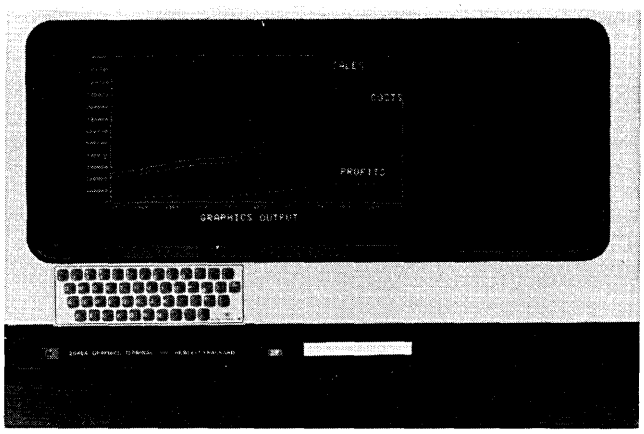

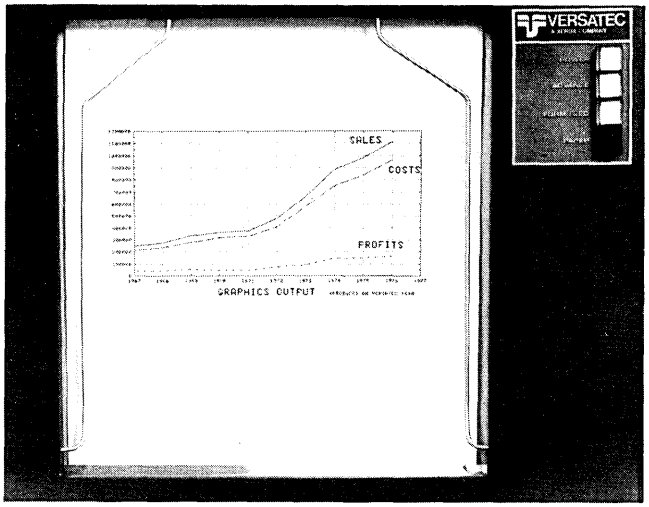

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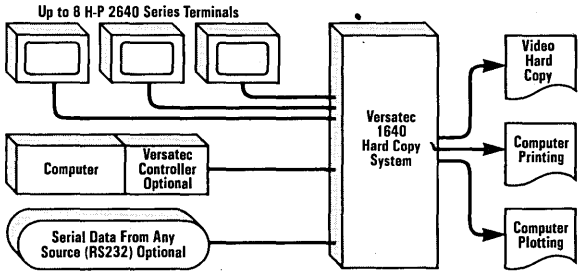

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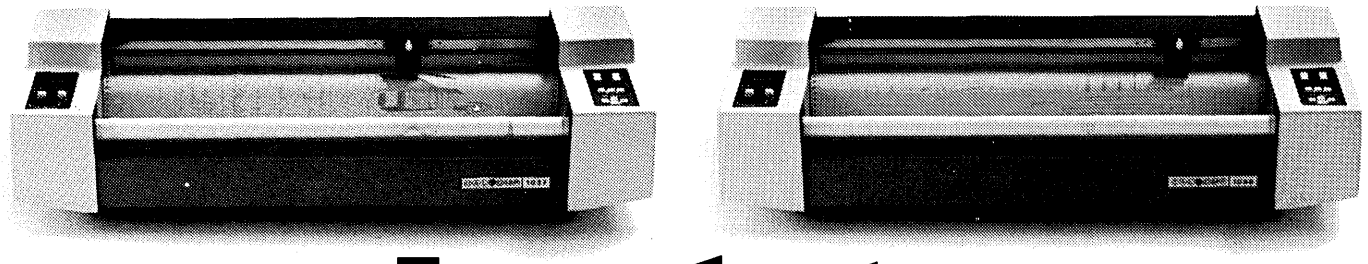

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1038	4.5	1	.002
1039	4.5	3	.002
1051	10.0	4	.001

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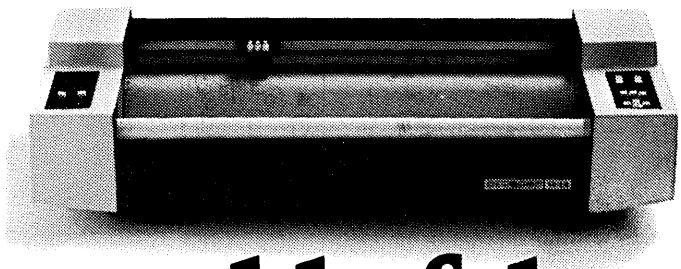

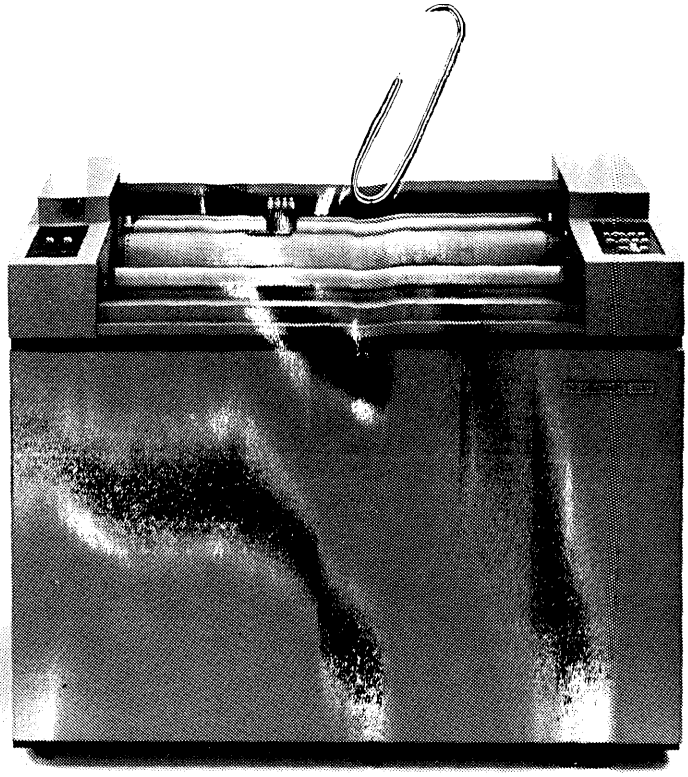

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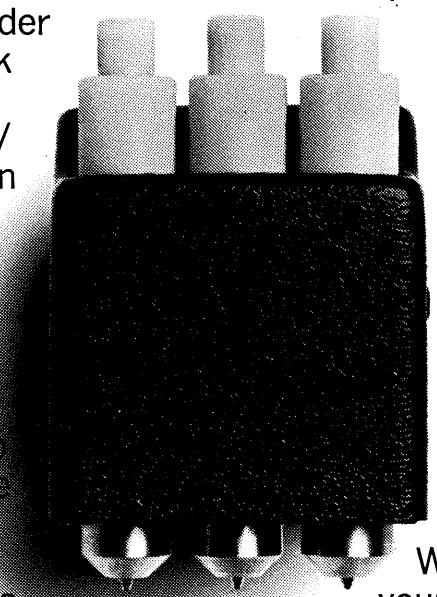

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Updates

A computer system is being used to simplify the task of recording complex choreographic notations at the Univ. of Pennsylvania's Moore School of Engineering. The system is said to be about three or four times faster than manual methods in transforming rehearsal notes into a printed score. The computer, a Sperry Univac 90/70, generates scores in Labanotation, a notation developed by Rudolph Laban in the 1920s. The elaborate system of abstract symbols is complicated, but it is considered to be the most precise and comprehensive system yet developed. The program was written as a Master's thesis by Maxine Brown, under the direction of Dr. Stephen Smoliar. The user types in his score at a video terminal with a special keyboard of Labanotation symbols. He then can edit or print a hard copy of the score.

ADAM, the "programmer-less" computer, recently met up with the Deputy Prime Minister of Malaysia. Prior to the demonstration, Logical Machine Corp., ADAM's manufacturer, commissioned a Malaysian student at nearby Stanford Univ. to translate the machine's basic vocabulary into Malaysian. The Deputy Prime Minister, Dato Seri Dr. Mahathir Mohamad, investigated the computer because proposed reorganization of his country's administration may increase Malaysia's need for computers.

The ABI/INFORM data base will have a controlled vocabulary of subject terms and an indexed historical background file beginning next January. A business management and administrative concepts data base, ABI/INFORM contains article citations and abstracts selected from over 400 principal periodicals in the business and administration fields.

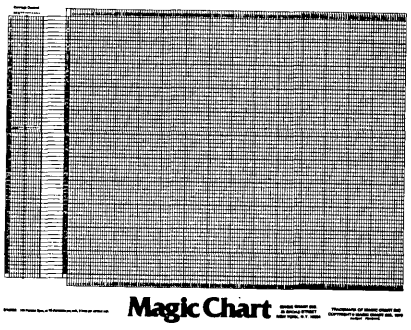
In a future issue, DATAMATION will feature what it considers to be the 10 most interesting graphics applications. Special consideration will be given to practical applications in which cost or time savings over previous methods can be shown. Please send a short description of your application to DATAMATION Attn: Technology Editor, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. The deadline for submitting proposals is Dec. 31, 1977.

Distributed Payroll

We suspect Wang may be right when it says Network Payroll is "the first distributed data processing application package for payroll." The package is written in COBOL for host mainframes from Burroughs and Honeywell, *as well as* IBM 360s and 370s running under OS, DOS, or VS, and BASIC for most of this vendor's minis. The package is said to be adaptable to minis from other vendors. Data entry occurs at remote sites, then this data is passed on to the mainframe for processing. Reports and checks then may be printed at the central site or back at remote locations. At the central site, the vendor's existing Super Payroll ($30,000 to $50,000) package handles processing; a $6,000 host interface software package handles communications with minis at the various nodes in the network. The local minis (at this point using 16K words, although the vendor indicates it is working on fitting everything into 8K) run a $10,000 data collection and network interface package. WANG LABORATORIES, INC. Tewksbury, Mass.
FOR DATA CIRCLE 336 ON READER CARD

Formatting Aid

Any programmer who has spent tedious hours toiling over outputs, trying to get the columns to line up and the headings centered over the columns, should appreciate the Magic Chart. A transparent plastic print layout form ruled for 144 print positions at 10 pitch and 66 or 88 printable lines, it



eliminates the need for the spacing ruler and paper layout forms currently in use. The Magic Chart also will save programming time when the output is printed on preprinted forms. For documentation, the Magic Chart may be overlayed on sample output and Xeroxed. The Magic Chart Kit consists of one chart printed on durable, transparent mylar polyester, 14" x 18", and a marking pen, pencil, and eraser. A second kit, featuring an opaque white vinyl chart for design use only also is offered. Each kit sells for $25; volume discounts are available. MAGIC CHART INC., New York, N.Y.
FOR DATA CIRCLE 337 ON READER CARD

MVS Performance Analysis

Comprehensive Management Facility (CMF)-Realtime is a software tool for interactively monitoring selected areas of MVS system activity and evaluating changes in the operating environment in real-time. By displaying key system activities in real-time, CFM-Realtime helps users pinpoint the causes of poor system performance. The package uses both tabular and graphic displays. For plots, the time scale may be set automatically by the package or it may be preselected by the user. CMF-Realtime will be available next month. Introductory price of the product is $7,500. BOOLE & BABBAGE INC. Sunnyvale, Calif.
FOR DATA CIRCLE 338 ON READER CARD

Data Encryption

Available in two versions—Civilian and Federal—007 provides data protection through encryption. Written for IBM 360s and 370s, both versions are based on complicated mathematical manipulations and employ a user-supplied eight byte key. The packages are said to provide up to 1.7 x 10^{18} possible cyphers. Civilian/007 uses a two-stage algorithm which is said to be so sensitive that minor changes in keys or record contents cause vast differences in the encrypted output. The vendor sees this version as a deterrent to curious programmers, operators, system programmers, and industrial spies. Federal/007 implements the Federal Data Encryption Standard (DES) now required by the federal government for sensitive and valuable data. Both versions are implemented in user programs via subroutine calls and are self-relocating and reentrant. Priced at $495 each, the packages come with documentation and maintenance. HANSCO DATA PROCESSING, INC., Wilbraham, Mass.
FOR DATA CIRCLE 339 ON READER CARD

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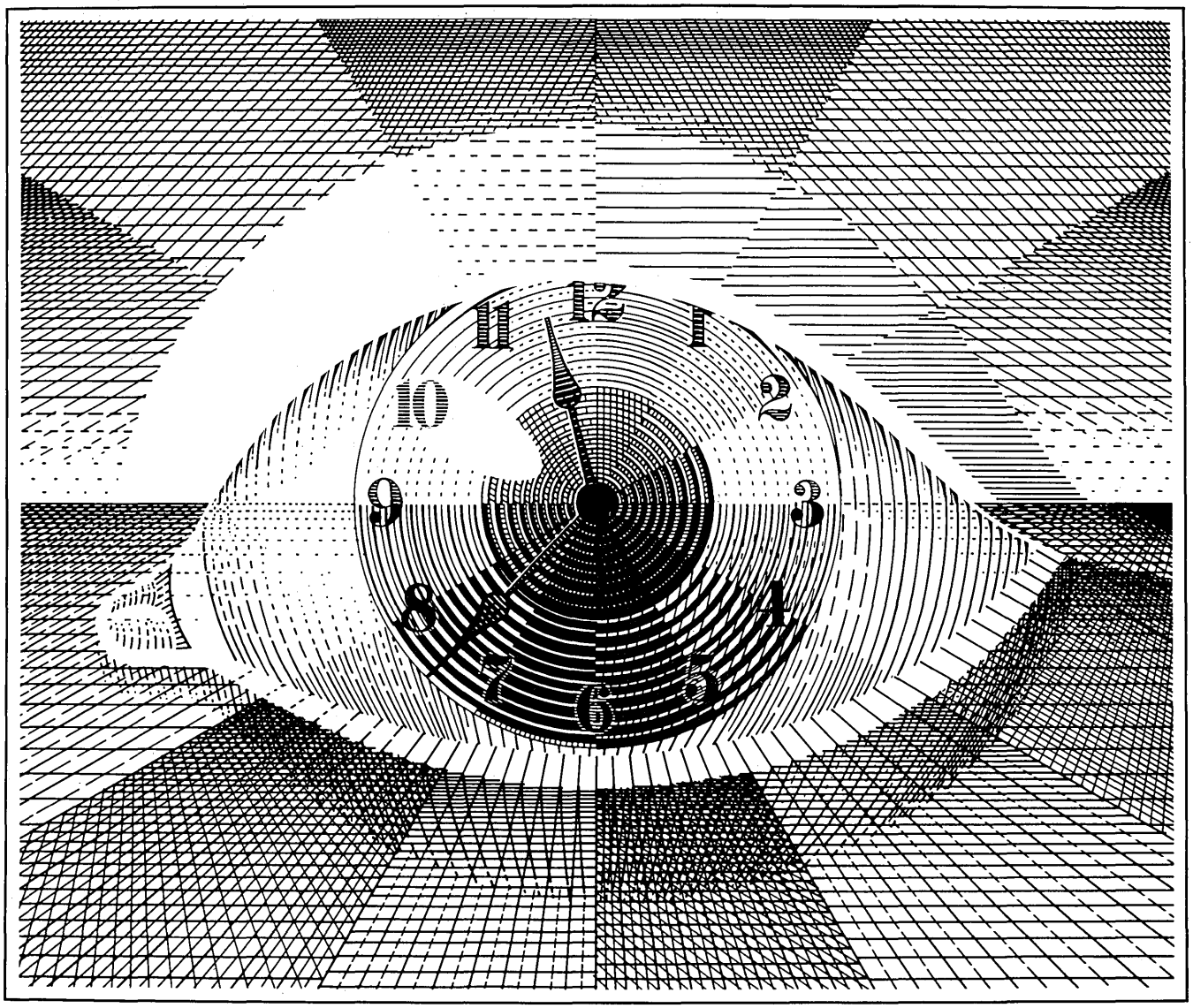

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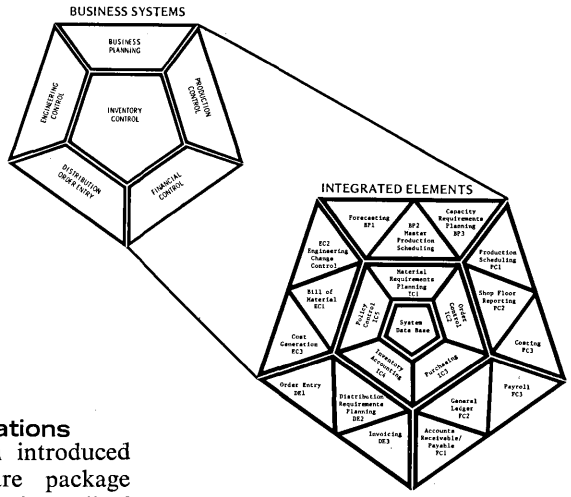
Series 1/ Basic

Five months ago this firm introduced a stripped-down version of BASIC for the IBM Series/1 minicomputer, with a promise of extended versions in the near future. BASIC/1 seems to be an attractive extended interpreter which may become quite popular with Series/1 users. Providing all of the features defined in the proposed ANSI standard for a minimal BASIC, this interpreter goes further and offers extensions for file processing, character string handling, and formatted output. The initial release supports diskette-based files only; disc file support should be available within a month. Files may be created, deleted, or renamed within programs, and may be accessed sequentially or randomly. Character strings may contain as many as 255 characters. The PRINT USING statement provides formatted output. Both floating point and integer numeric variables, with ranges comparable to double precision ranges on the Series/1, are allowed. An ELSE clause has been added to the IF statement. Three versions of the interpreter will be offered: single user diskette-based, single user disc-based,

software spotlight



Manufacturing Applications

Four years ago this firm introduced a comprehensive software package which we said "seems to include all of the software required to run a company." Now they're introducing their "new generation and family of Manufacturing Systems for the 1980s," written in COBOL for IBM mainframes running under OS and VS. Called MAS-80, the system includes the functions of inventory control, production control, engineering control, distribution, order entry, financial control, and business planning. These six major functions comprise 20 independently purchasable elements. An additional element, the data base interface module, illustrates the vendor's philosophy: let the user keep using whatever data base management system he's used to; the manufacturing system can interface to the data base via a unique (to the user) data base interface module. The transaction-driven system is said to use a data base management approach that minimizes redundancy while assuring data consistency and integrity. Pricing on an inventory control system can range from $50,000 to $120,000, depending on the elements selected. Installations will begin in the first quarter of 1978. MARTIN MARIETTA DATA SYSTEMS, Baltimore, Md.

FOR DATA CIRCLE 335 ON READER CARD

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and multiple user disc-based. Minimal hardware requirements are a 64KB processor, 7840 timer, terminal, and one diskette drive. Floating point hardware is recommended. Additionally, users must have a license for IBM program product Control Program Support with Extension I. BASIC/1 (single user, diskette-based) is offered for a perpetual license fee of $1,800. Users of the earlier Series/1 BASIC may apply their $120 license fee towards the new interpreters, and license fees may be applied to later releases. A 30 day free trial is offered. GRAHAM COMPUTER ENTERPRISES, INC., Birmingham, Ala.
FOR DATA CIRCLE 356 ON READER CARD

Micro Word Processing

IDSWORD 1 runs under MITS Disc Extended BASIC, providing word processing capabilities for microcomputer users. The system runs in 28K of memory. Functions include line editing (insert, delete, or change text within a line), global editing (insert, delete, change, or find a string within a block of text), merging, reformatting, moving text, and printing. The package can print with optional page numbering and justification. Left margin, spacing, and maximum lines per page are user selectable. The package also handles form letters, allowing multiple copies of a letter to be printed, along with mailing labels, from name and address files. The $250 system is provided on a diskette. INTERACTIVE DATA SYSTEMS, Owings Mills. Md.
FOR DATA CIRCLE 357 ON READER CARD

Fortran Compilers

Using its COGENT compiler generator, this vendor now offers a FORTRAN compiler writing service. The vendor has developed a general metalanguage description of FORTRAN 77, as specified by the ANSI X3J3 committee, which specifies, in a machine-independent manner, the syntax and semantics of the proposed FORTRAN standard. Only the code-generation portion must be modified in order to produce a compiler for a specific machine. It is said this requires less than 20% of the total effort required to write a similar compiler from scratch. A machine-dependent run time library (for I/O and standard library functions) also is required; most of this library has been developed in FORTRAN, leaving only a small segment that must be tailored to a specific computer. The vendor says a completely operational system can be developed in less than six months. The vendor validates the compiler using routines based on the FORTRAN Compiler Validation System developed by the Dept. of the Navy. Compilers generated by the service may be used either as resident or cross-compilers. The compiler generates code divided into read-only and read/write segments to facilitate use in ROM-based systems. Prices start at $100,000 for a compiler with on-site installation and training, documentation, and internals manuals, and the first six months' maintenance. VIRTUAL SYSTEMS, INC., Walnut Creek, Calif.
FOR DATA CIRCLE 340 ON READER CARD

JCL Coding Aid

JCLMACS provides standardization of JCL coded by operators, programmers, and data control personnel. The package is said to be easy to use; it aids in the production of error-free standardized OS JCL regardless of the degree of complexity in the JCL or the skill level of the programming staff. The package is said to eliminate the need to code repetitive characters and punctuation required by the operating system, and its standard coding sheet simplifies use of the package. Accepting OS JCL, utility control cards, and JCLMACS cards intermixed, the package will produce output in the same sequence as the input, substituting generated OS JCL for the JCLMACS cards. The package sells for $1,500. MANAGE-

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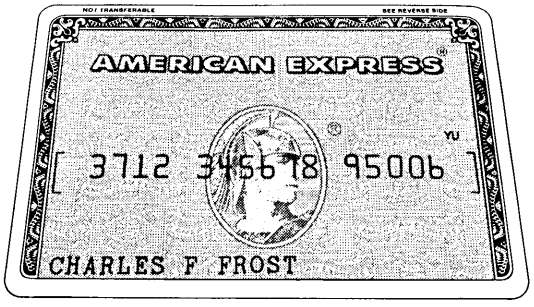

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MENT AND COMPUTER SERVICES, INC., King of Prussia, Pa.
FOR DATA CIRCLE 341 ON READER CARD

Module of the Month

A series of source language subroutines that perform a variety of simple but useful functions are offered through this vendor's "Module of the Month" division. Available in ANS COBOL, RPG II, or IBM 360/370 assembler, the featured module of the month prices are $14.95 for a source listing and $19.95 for the listing and a card deck. The most expensive module to date, TALLY-ALL (a utility subroutine for column-by-column analysis of data content) sells for $34.95 (listing and cards). Other selections have included a Julian/Gregorian date conversion and perpetual calendar subroutine; modulus-10 check digit subroutine; and CSORT, a subroutine that sorts data held in memory to any combination of ascending and descending keys. September's featured offering is MAILABL, a module for producing Cheshire mailing labels. It carries the featured module of the month price tag of $14.95 for the listing and $19.95 for the listing and the card deck. Modules coded in COBOL or assembler usually include the additional linkage instructions needed for callable subprograms that are separately compiled and link-edited to the main program. New modules are announced in a free newsletter, "Module of the Month News." NATIONAL DATA SYSTEMS, INC., Saddle Brook, N.J.
FOR DATA CIRCLE 342 ON READER CARD

PDP-11 Communications

Users of DEC's PDP-11/VO3 and LSI/11 series can implement a variety of communications applications with these three packages. Simulating an asynchronous ASCII terminal, EZSHAR is intended to perform intercomputer data moving. It requires 8K words of memory and a DLV-11 asynchronous interface. EZSHAR is priced at $1,500. The RJE program runs on a PDP-11/VO3 under RT-11. Synchronous communications are supported through the simulation of IBM 2780 standard RJE software. The $2,500 package requires 12K words of memory. Distributed Processing Communications Module (DPCM) offers FORTRAN-callable bisynch communicatons support for custom installations. Applications which may be processed locally can run on the PDP-11, while DPCM allows access to a central system for data entry, data retrieval, and processing of complex problems. The package runs on PDP-11/03s with 4K words of memory. Its price is $2,000. COMPUTER SOLUTIONS, Irvine, Calif.
FOR DATA CIRCLE 343 ON READER CARD

Disc Allocation

Driven by parameters entered in the JCL stream, Disk-O-Tek (Disc Organization Technique) dynamically allocates disc space using a best-fit algorithm. The package automatically posts E-O-F to the VTOC on all sequential files, and it automatically truncates sequential file extents near the E-O-F. Partition independent, Disk-O-Tek has utility functions to delete, revive, or locate files generically; produce VTOC lists of space used or available; produce a file with all active VTOC records; and print information from selected files in character and/or hex format. It also allows for printing a fixed number of records, tracks, or cylinders. All utilities can be entered directly from the console. Disk-O-Tek runs on 360s and 370s under DOS and DOS/VS. The package has a permanent license fee of $2,750, or monthly rates as low as $110/month. The vendor offers a free trial for evaluation purposes. NATIONAL COMPUTING INDUSTRIES, Atlanta, Ga.
FOR DATA CIRCLE 344 ON READER CARD

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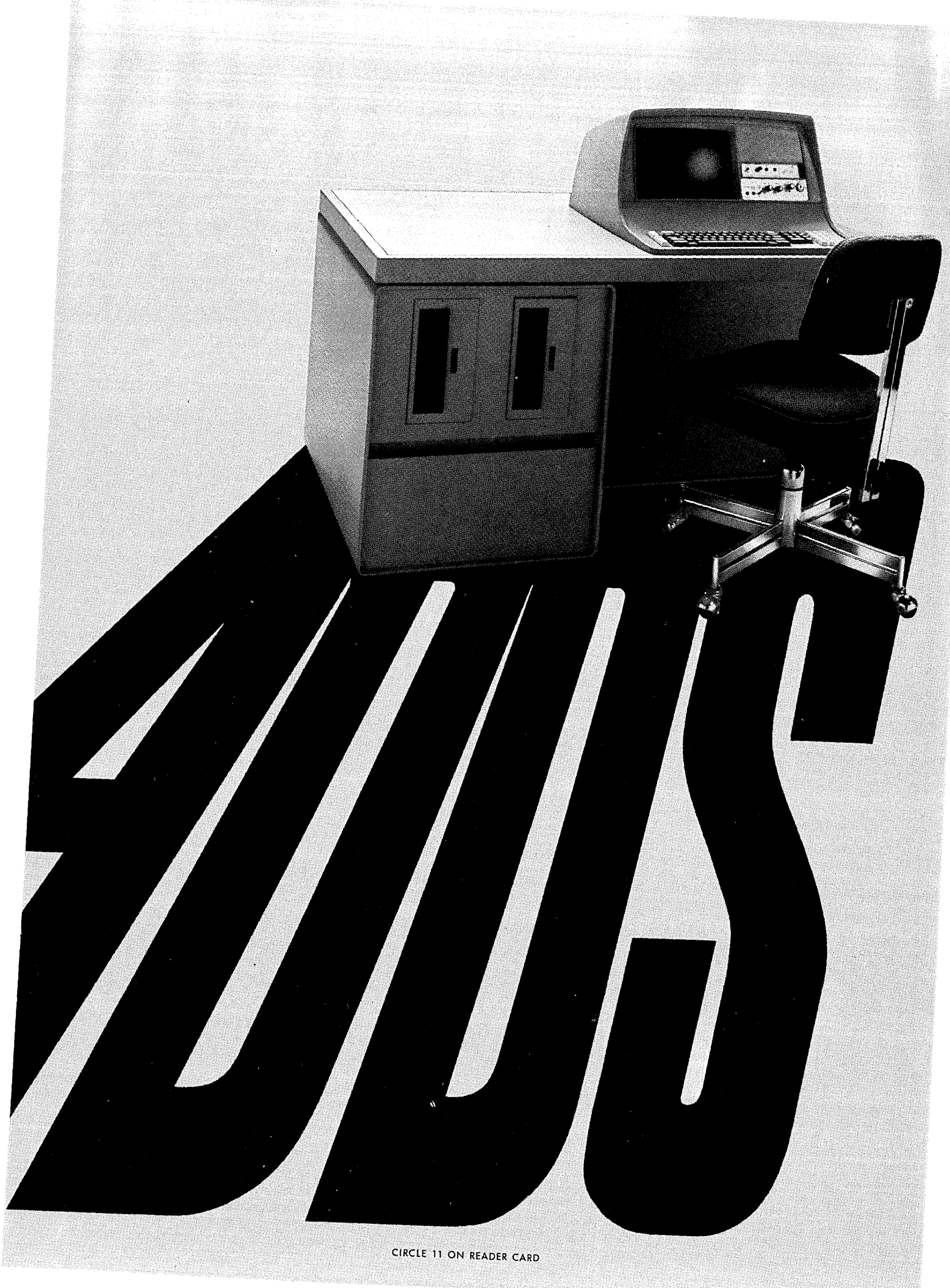


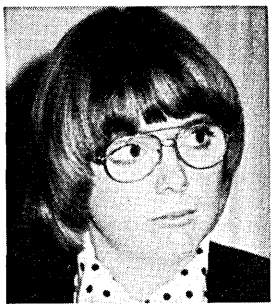
CIRCLE 11 ON READER CARD

personal computing

Portia Isaacson, Contributing Editor

Personal computing is computing so low in cost that it can be used abundantly, even wasted! Personal computing is a revolution in the availability of computing resources. No longer will information processing power be available only to large corporations and government; we'll soon have computing power at our fingertips in our homes and offices. Computers will be dedicated to even simple tasks. The coming widespread availability of the personal computer ranks with other great technology-based revolutions—the printing press, the assembly line, and the automobile.

Personal computing is not only hobby computing. Although the hobby computing part has received most of the publicity (it makes a good story), most of the "hobby" computing products being produced actually are being sold to businesses large and small and being used for applications as wide ranging as word processing and assembly line control.



Our newest contributing editor, Dr. Portia Isaacson, is a consultant and is co-owner of The Micro Store in Richardson, Texas (May 1976, p. 13). She served as conference chairman of the 1977 NCC which featured a Personal Computing Fair and Exposition. She recently was named chairman of a new ACM Special Interest Group on Personal Computing, SIGPC, and she is chairperson of a committee involved in forming a computer retailers' association. Dr. Isaacson has been on the computer science faculties of several universities and has worked on the engineering staffs of several major corporations.

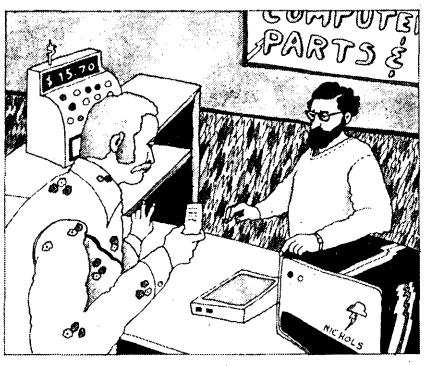
What is a personal computer?

Today's basic personal computer comes as a kit and consists of a microprocessor, 8KB to 16KB of memory, a keyboard, a television display, two audio tape cassette drives, and a BASIC interpreter. Over the past year the cost of such a personal computer has been about $1,500. Such personal computers are useful for a wide variety of applications. Some of the most common are hobby computing, computer education, and games.

This year several companies will be offering fully assembled and tested personal computers, similar to the one described above, for well under $1,000. These will be targeted for the general public, which will be motivated to buy them because of the libraries of program cassette tapes available. The entertainment appeal will be enormous as large assortments of computer games are offered. For anyone left unconvinced of their need for a personal computer based on its entertainment value, the educational value of the libraries of tapes offering instruction in a wide variety of subjects should be a convincing factor. What American family would deprive their children of such a personalized and valuable learning tool? If still unconvinced, there will be personal accounting systems, inventory control for collectors, biorythms, menu planning, financial simulation and planning, and . . . the list is endless. Over the next few years millions of these computers will be sold.

Personal computers in business

The expandability of the personal computer is the secret of its importance to business data processing. Presently personal computer systems can be expanded to include up to 64KB of memory, several floppy disc drives, and crt and hardcopy terminals. A personal computer system capable of a wide range of business data processing applications costs about $5,500 and consists of 32KB of memory, dual floppy discs, a continuous forms hardcopy printer, and a BASIC interpreter extended for file handling and decimal arithmetic.



Business applications of personal computers range from word processing to inventory control, to accounting for small businesses, to scheduling of appointments and meetings. Large businesses will use many personal computers distributed throughout the organization. Instead of taking the application to the computer, computer power will be taken to the application. Some of these personal computers will be connected to large central computers in order to access central data bases or to act as terminals. Small businesses may own only a single computer that will host several applications: address list maintenance and label generation, text editing, accounting, payroll, and inventory control. Some small businesses may dedicate a computer to a particularly useful function. A personnel agency might maintain its data base of jobs and job applicants on a personal computer. A medical clinic might schedule appointments for its doctors on one. A lawyer might use a personal computer as a sophisticated word processor in preparing legal documents from libraries of standard phraseology.

A new industry

The emergence of a new industry around personal computing was precipitated by the declining cost of microprocessors and memory to such a level that a complete computer system was affordable by an individual, home, or office. Applications of the new low-cost personal computer became feasible where computers had been too expensive before.

In little more than two years, the personal computing industry has grown from nothing to its present size of more than 100 producers of personal computing products, approximately 500 retail computer stores, and seven major publications. The first personal computing products came not from established computer companies, but from new companies that saw the opportunity and acted, such as MITS, IMSAI, Southwest Technical Products, and Processor Technology. Now established computer companies such as Intel and California Computer Products are entering the market. The recent announcements by Commodore,

Heath, and Radio Shack mark the entry of consumer electronics companies. The character of the infant industry is still changing very rapidly.

A new column

The developments in personal computing have significant importance to the DATAMATION reader. The data processing function will be changed by the availability of personal computers. Information processing will be done throughout the corporation rather than being concentrated in the data processing center. Many time-sharing terminals will be replaced by personal computers. The interaction of data processing professionals with other people in the corporation will change as the general public becomes computer-literate. There will be new sources of programming personnel as computer education becomes widely available.

The goal of this monthly column on personal computing is to inform the DATAMATION reader of the developments in personal computing, and to analyze the impact of those developments on data processing and the data processing professional.

Possible subjects for this column include:

- an introduction to personal computing equipment and software;
- possible tax advantages to purchasing a personal computer;
- business applications and uses in the home;
- the impact of personal computers on service bureaus and time-sharing services, on minicomputers, and on the prestige and pay of dp professionals when every kid on the block can program;
- the elite of hobbies—personal computing—user experiences, equipment comparisons, home computer networking, computer-based consumer products, and the biggest obstacle to the consumer computer market—the user interface;
- product profiles, equipment comparison, standards, consumer computers, the personal computer software market (and moonlighting programmers who develop software for that market);
- bringing personal computers to users rather than bringing the user to the central dp center;
- the computer store—a new way of marketing and servicing equipment;
- conferences;
- international aspects;
- letters, questions, and answers.

DATAMATION rarely launches a new column. More rarely yet are we as an industry faced with such far-reaching and fundamental changes in our industry, our businesses, and our society as a whole. ❋

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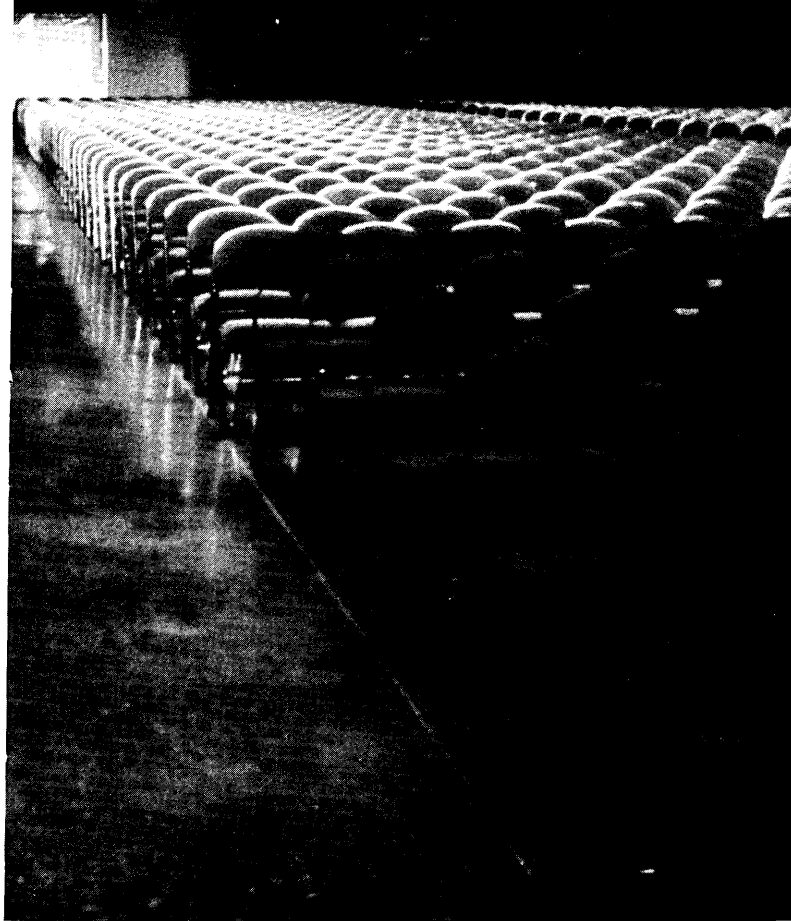

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Privacy and File Design Without the SSN

In Menotti's opera, "The Consul," there is a poignant scene in which the heroine makes a futile attempt to communicate the horrendous difficulties overwhelming her family. A stony faced secretary tells her, over and over, to fill out the forms. To each heart-rending request for assistance, the secretary tells Magda that her name is a number, her story a case. Again and again, she repeats the lines,

"Your hopes will be filed.
Come back next year."

The opera captures the terror of unresponsive bureaucracy, of depersonalized recordkeeping, and dramatically assails the trend toward use of procedures and regulations where only compassionate understanding of individual circumstances would suffice.

As we move toward greater dependence on computers for recordkeeping activities, we run the risk of dehumanizing our own system for the sake of exploiting available technology. Recognizable gains from the clerical use of computers are evident in many aspects of our day-to-day life: income tax refunds arrive promptly; plane reservations—even seating assignments—are handled quickly and efficiently; university registration has become a sane activity in contrast to the terribly confused process of a few years back. Undeniably, computers are making it easier for us to get things done. We like that.

The problem is that we don't want the records that are available in various computer files to be used to create comprehensive dossiers about us. For example, although we enjoy the convenience of computerized plane reservation systems, we would not want the records detailing our flight plans to be maintained over time, in a format that included data about our traveling companions, length of stay, etc. If such records were maintained and merged with existing files containing data about our incomes, places of residence, even our purchasing habits, the resulting records would constitute quite comprehensive profiles. In such an extreme case, the mere existence of the file would be an intolerable invasion of privacy.

The problem does not arise simply from the fact of collecting personal data. That type of recordkeeping is as old as the written word. What has changed is the ease of linking disparate data using computer technology. And the solution is not simply a matter of limiting access to the data and forbidding the merging of files: significant benefits accrue, both to the individual and society, from the merging of some types of files. It is not always easy to draw the line.

For example, in medical research, the availability of personal history data may be important in determining crucial issues in a patient's treatment plan. In an extreme case, where a donor kidney becomes available and a recipient must be identified immediately for the transplant operation to be effective, the speed of the computer is essential to identifying the best potential donor-recipient match within the allowable time.

On a larger scale, the research that is possible using comprehensive history data for a large number of kidney transplant recipients may, along with the data classifying the success or failure of the particular transplant, prove invaluable in the ongoing search for better predictors of success in future operations. Here the merging of personal data files is a positive act leading to possible advances in medical technology.

But the uncontrolled merging of personal data files is a step toward depersonalization and a threat to the rights of each of us. In the context of the history file for potential kidney recipients, making those records available to anyone who might request them—for example, a credit bureau—would be intolerable.

The question is, how should access to personal data be controlled? Can distinctions between legitimate and illegitimate use of personal data files be formalized? Is it possible to create laws that will make such data available to those who have the right to know while retaining the integrity of the record?

It was in response to such questions that Congress enacted the Privacy Act of 1974. Although many similar laws are now in effect at the state level and a plethora of similar legislation is currently under consideration, the Privacy Act was the first major legislation. One of the principal goals of the Act was to find a means of protecting the individual's right to privacy as it is affected by the existence of personal history data in files maintained by federal agencies. In this important legislation, Congress has explicitly defined the rights of those whose records are maintained in the files, as well as the responsibilities of the agencies handling the data.

Some of the most significant provisions of the Act are:

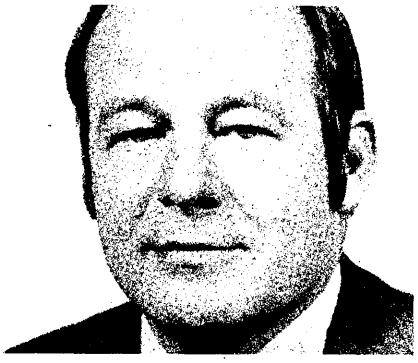
(1) individuals whose records are maintained in the files of federal agencies must be allowed to review their own records on request;
(2) data maintained in the files must be timely;
(3) only data necessary in the performance of the agency's mission should be stored;
(4) retrieval must be possible without use of the Social Security account number (SSN).

The prohibition against dependence on the SSN reflects the growing concern over the use of this, or any other, universal identifier for purposes of file linkage. Since the SSN is the universal identifier most consistently used in agency files, the Act specifically provides against its use as a required item of information unless a federal statute specifying such a disclosure is applicable. This is part of the attempt to curb the rising trend toward file linkages.

The retrieval requirements of the Act are precisely defined. Each federal agency maintaining personal data files must print descriptions of those files in the Federal Register, along with the procedure an individual would follow to obtain a copy of his own record.

The Office of Management and Budget, which has responsibility for implementing this legislation, has interpreted the retrieval requirement to mean that it must be possible for the agency to retrieve records based on combinations of identifiers that are easily recalled by the individual. They have indicated that, although use of record identification numbers, driver's license numbers, and the like is not prohibited, careful attention must also be given to the selection of a set of identifiers that will be considered reasonable in the particular environment. Thus the thrust of the legisla-

The Search Is On...



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tion is toward limiting records only to that information known to be relevant to the application, with retrieval being achieved through use of some combination of those same items of information.

In a study carried out for the National Bureau of Standards,* several aspects of these retrieval requirements were examined. Primary considerations were the effect of the prohibition on the use of combinations of non-unique identifiers—that is, the personal data items that will be maintained in the file by virtue of their relevance to the purpose of the record. The data retained in an individual file will differ depending upon the application but, as the results of the study indicate, the combinations of standard personal data items offer an alternative, and potentially equally effective, means of retrieval.

The use of non-unique identifiers

Some identifiers in personal data files are highly individual. The variable "NAME" is the most obvious example. Other data items, for example, "SEX" are binary and therefore not particularly useful in identifying an individual record. Qualitatively, the most common personal identifiers can be ranked as follows with respect to degree of discriminatory value:

*NBS Special Publication 500-2, "Accessing Individual Records from Personal Data Files Using Non-Unique Identifiers." Available from Government Printing Office, Washington, D.C. 20402. SD Cat. No. C13.10:500-2, $265, 203 pp. For a review of this study, see p. 41 in this issue.

1. NAME (surname and given name)—The discriminatory power of this variable depends on the commonality of the surname, with a name such as Trefftzs providing much more information than the name Smith.
2. SURNAME only.
3. ADDRESS (street number, street name, city, state)—This highly useful information tends to decay rapidly over time.
4. BIRTHDATE (year, month, day).
5. BIRTHPLACE (city, state)—Again, the discriminatory power of this variable varies greatly. The birthplace Sparta, Ill., provides more identifying information than does New York, N.Y.
6. SEX—At best this variable partitions the file in half.

The high selective value of the name variable is demonstrated by the example of an author file containing 50,000 names. Here the full name with the highest frequency of occurrence had a total frequency count of 16, while 70% of the full names occurred only once. Looking only at surnames in the same file, 20,000, or 40%, occurred only once. The importance of the name variable for purposes of record retrieval is further evidenced by the fact that it is clearly relevant to all files affected by the legislation and it meets the criterion of being easy to recall and communicate.

The difficulties that occur in the use of NAME as a retrieval key result from name changes, the addition or deletion of titles in the record, the introduction of errors during transcription, etc. Because of the high discriminatory value of this variable, our research included a study of the state of the art of name lookup techniques. A majority of the algorithms currently in use are based on a phonetic scheme aimed at minimizing the common transcription problems that occur in the recording process.

Most of these algorithms have been influenced by the rules established 50 years ago for the Soundex system. The purpose of that system was to encode names so that variants of the same name would turn up near each other in the file.

This would facilitate searching, say, through all instances of Rogers and Rodgers to locate all individuals having the first name Karl or Carl.

This early system was quite effective in accomplishing the grouping of sound-alike names. One of the problems with the Soundex rules is that, as Knuth has pointed out, the algorithm brings together names that are somewhat different as well as names that are similar. For example, the encoding rules put the two quite different names, Kant and Knuth, in the same group.

A great many refinements have been introduced into this basic set of rules over the years, and a variety of effective algorithms based on such schemes are now available. These include the IBM Alpha Inquiry System and the Standardized Phonetic Frequency Code. The encoding rules used by these and other systems are available (see the NBS report), and most of them are under continual review for potential improvements.

Some systems are based on a pragmatic, rather than algorithmic, approach to the grouping of similar sounding names. The best example of this is the system developed for the Medical Information Bureau (MIB). Here the group codes have been constructed through experience with more than 160 million records over an eight-year period. Two keyname dictionaries are maintained, one for surnames, one for given names. These dictionaries are used to locate the unique codes assigned to groups of phonetically related names. Alternate group codes are also picked up through use of a set of cross-references linking nicknames, maiden names, aliases, etc.

The enormous size of the file has made it possible for the MIB to construct a quite complete dictionary. Based on the group codes returned following the dictionary lookups, further screening is performed using birthdate, birthplace, and geographical designation for the individual's current place of residence. Development of this system was undertaken to assure as high a degree of accuracy as possible in retrieving personal history records from a very large data base. The system does, indeed, perform with extreme accuracy, but the development cost, in terms of time and money, to produce these extensive dictionaries is excessive.

At the current stage of development of phonetic systems, it is entirely possible to construct an effective retrieval system based on a set of readily available rules that will control the grouping of like names. Such algorithms, while somewhat less selective than the pragmatic approach described above, are nonetheless adequate to the task at hand when used in conjunction with a set of personal identifiers as retrieval keys.

One such system, in operation at the Immigration and Naturalization Service in the Dept. of Justice, uses a retrieval system based on a modification of the Soundex rules. Here the first level of selectivity is the surname, the second the given name, and the third, birthdate. Since use of this last variable as a retrieval key can, in some instances, create problems, the retrieval mechanism allows extension to a range of time so that the birthdate can be bounded by plus or minus nine years. This retrieval algorithm operates very effectively with a large data base.

The success of these two retrieval systems demonstrates the potential value of systems in which phonetically based name lookup algorithms are combined with a set of personal identifiers to serve as final record selectors. This approach avoids using the SSN, but still allows a high degree of retrieval efficiency. Retrieval effectiveness is one of the most important factors in selection of a retrieval algorithm. Three others that must be considered are implementation costs in

terms of time and money, execution speed, and requirements for human intervention during the retrieval process. The system in use at the Immigration and Naturalization Service optimizes for these factors. But its relevance to other applications assumes the selection of an appropriate set of non-unique identifiers to be used in final identification of the individual record. This selection process is discussed below.

Non-unique identifiers as retrieval keys

Use of a set of personal identifiers as effective retrieval keys assumes that those data items are accurate. The collection and retention of accurate information for such identifiers has special problems. There is a natural tendency to assume that basic biographical data is easily obtainable, and that standard definitions can be taken for granted. However, in actual data collection situations, surprising misunderstandings can and do occur and, most importantly, often are not detected until much later. The result is that variables considered to be reliable in the file are many times, in reality, only marginally so.

This type of error is not an artifact of storing the records in computer files. In fact, manual record systems have, in general, a higher error rate than computer systems. An error rate of up to 10% is not unusual in paper-based files. Yet this is not considered to be unreasonable. One reason is that users of paper-based systems operate with the source material while users of computer files are at best working with second-generation data. The clerk who searches through a file by hand has clues other than the data itself available for his use in evaluating the material. These clues take the form of the handwriting in which the data is recorded, the color of the form used, placement of the paper in the file, age of the document, etc.

In many cases, the person reviewing the data is conversant with the general structure of the file, and often even with the individual case. He thus brings his own background to the perusal of the material. But even if this same individual participates in the preparation of the data for entry into the computer, his familiarity cannot change the fact that information will be lost once the data is stored in the file. At that point, all ambiguity tags are lost and the data items are often assumed to have a higher degree of accuracy than is reasonable. The process of automating the data handling has had the effect of artificially reducing all data items to a level of uniformity that masks disparities in accuracy.

Another very important aspect of determining the accuracy of biographical data items involves the timeliness of the data. The decay factor inherent in much biographical data might be thought of as the half-life of the data. For some variables, such as birthplace, there is no decay except possibly in the recollection of the subject. For others, such as current age, decay is at a constant rate. For still others, the amount of decay will depend on the time at which the data was collected—e.g., the variable highest degree attained will have a much greater potential for change if it refers to a student than if it refers to a professional person.

In general, before selection of retrieval keys begins, a manual check of a sample of computer records against source documents is recommended to obtain some information regarding the overall accuracy of the data items, and to identify any variables that are consistently unreliable or for which poorly worded questions have elicted meaningless responses.

While it is unrealistic to assume that any data base is error-free for any data filed, nevertheless the goal should be that all fields contain data that is as accurate as possible. Error rates that exceed 4% or 5% tend to throw the utility of the data base into question, and fields with such error rates should be either corrected or deleted from the file.

The most conclusive test of the accuracy of the data stored in a personal history file would be an attempt to

the forum

contact the various individuals whose records appear in the file based on the information contained in their own records. This could prove to be a very difficult task if the file under consideration has not been subjected to ongoing verification and update activities. A likely outcome of such an investigation would be that the file was found to contain a large cast of fictitious characters.

Unfortunately, the actual seeking out of individuals is normally prohibitively expensive. Less precise file validation techniques must be substituted. In most cases, the evaluation of error and omission rates will be accomplished through manual checks such as those described above. A set of recommended procedures for this type of evaluation is given in the NBS report.

Once the validity of a file has been checked, and all relevant fields have been proven to be acceptably accurate, a set of retrieval keys must be selected for use in establishing the retrieval mechanism. The selected keys will dictate the questions that are asked the individual who requests a copy of his record. The problem is that the identifying information must be sufficient to enable the system to select his record while at the same time not constituting such a large amount of personal history data collection that a new record could be created if one does not already exist.

In general, the keys selected should be those that are most restrictive in order to elicit the most specific answers from the individual requesting a record. Obviously, those fields with the lowest error rates are preferred over those known to be badly in error. It is important to be cautious in the use of data items that decay rapidly over time, particularly if update procedures for these variables are not built into the system.

The use of a combination of keys will assist in the selection process. However, use of more than three keys should be handled cautiously. The likelihood of an error existing in one of these fields for any given record goes up as the number of keys increases, and the existence of such an error can cause the retrieval mechanism to miss the record completely.

Conclusion

The Privacy Act of 1974 has forced a rethinking of the mechanisms in use for the collection and maintenance of personal data files. The seemingly contradictory requirements of protecting individual privacy, while at the same time providing the citizen with the benefits attendant to the introduction of automated record/keeping systems, also creates a burden for those responsible for maintaining the systems.

We in the industry should have a particular interest in this problem because we are the ones who will be responsible for implementing and controlling all such systems. Our understanding of the basic issues is essential to the ultimate success of this legislation. If we understand what the Congress attempted to accomplish and are aware of the potential in these systems for both positive and negative consequences, if we retain a human interest in protecting each other's basic right to privacy, the legislation will have succeeded in getting us to confront the issue. If that happens, the Privacy Act will have provided a first, but very encouraging, step in what undoubtedly will be a long series of iterations toward discovery of a proper balance between an individual's right to privacy and society's need to know.

—**Gwendolyn B. Moore**

Ms. Moore is senior staff analyst at Operating Systems, Inc., Woodland Hills, Calif., which produced the NBS report referenced and reviewed in the Source Data department on p. 41 in this issue.

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