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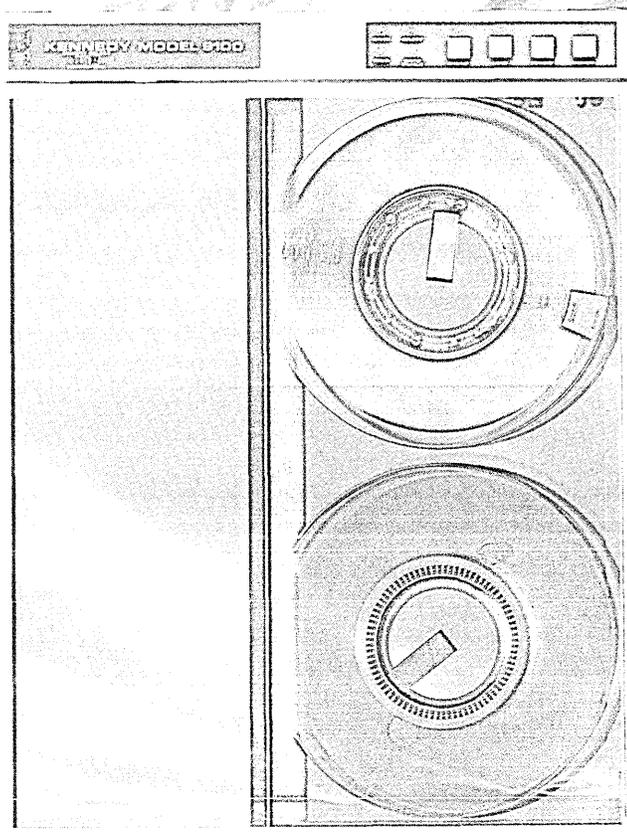
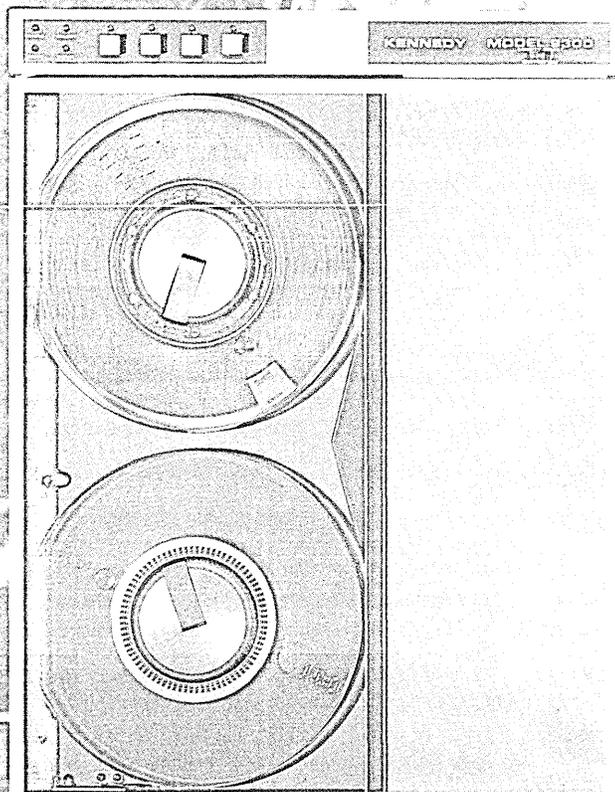
Data densities are 200/556 cpi or 556/1600 cpi and 600 cpi, 1600 cpi or 800/1600 cpi. Formats: NRZ/PE.

Models 9100/9300 offer more features, more performance, and most important, more time-in-the-field than any competitive units.

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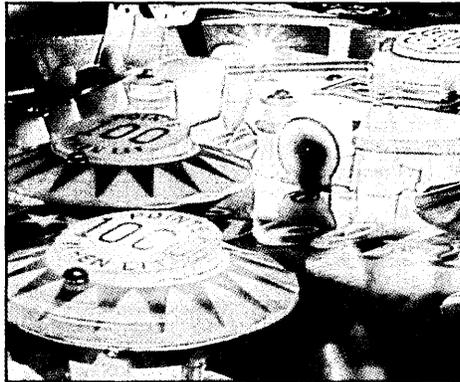
product alternatives. So you can get on and off the CPU quickly, freeing the mainframe for production and freeing yourself from needless frustration.

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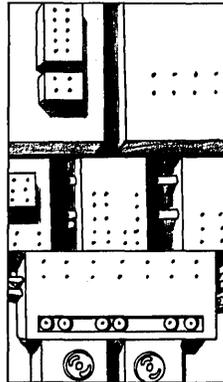
For further information, call Itel Corporation, Program Products at (800) 227-8425. Within California (415) 494-3338.

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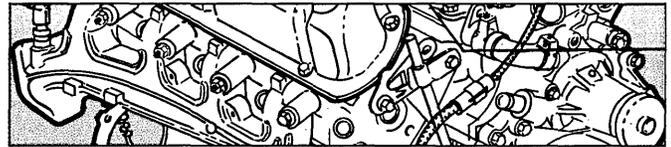
DATA⁷⁹MATION[®]



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ADF appears to offer significant improvements in programmer productivity and IMS program development — but there is a cost to be paid.

COVER

Any number can play the distributed processing game, and it can get as explosive as our lit-up cover. Photography © 1979 by Holly Ahlberg.

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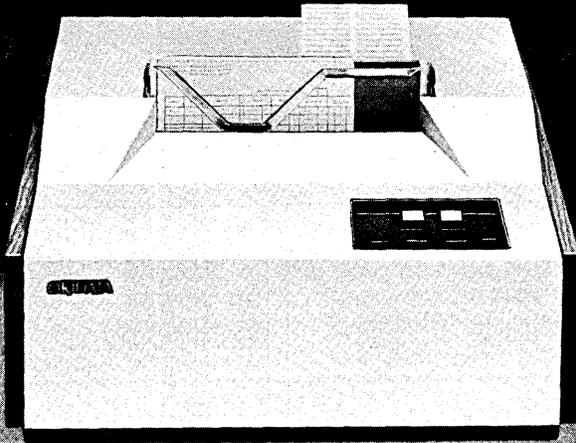
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Okidata Sells Printers That Sell Transaction Systems



Transaction processing typically involves a variety of documents, a station where the transaction takes place and a data base at some remote location. The Okidata CP210 Document/Passbook Printer sells transaction systems, combining unique forms handling flexibility with capabilities for data retrieval, data validation, documentation and verification.

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CIRCLE 87 ON READER CARD

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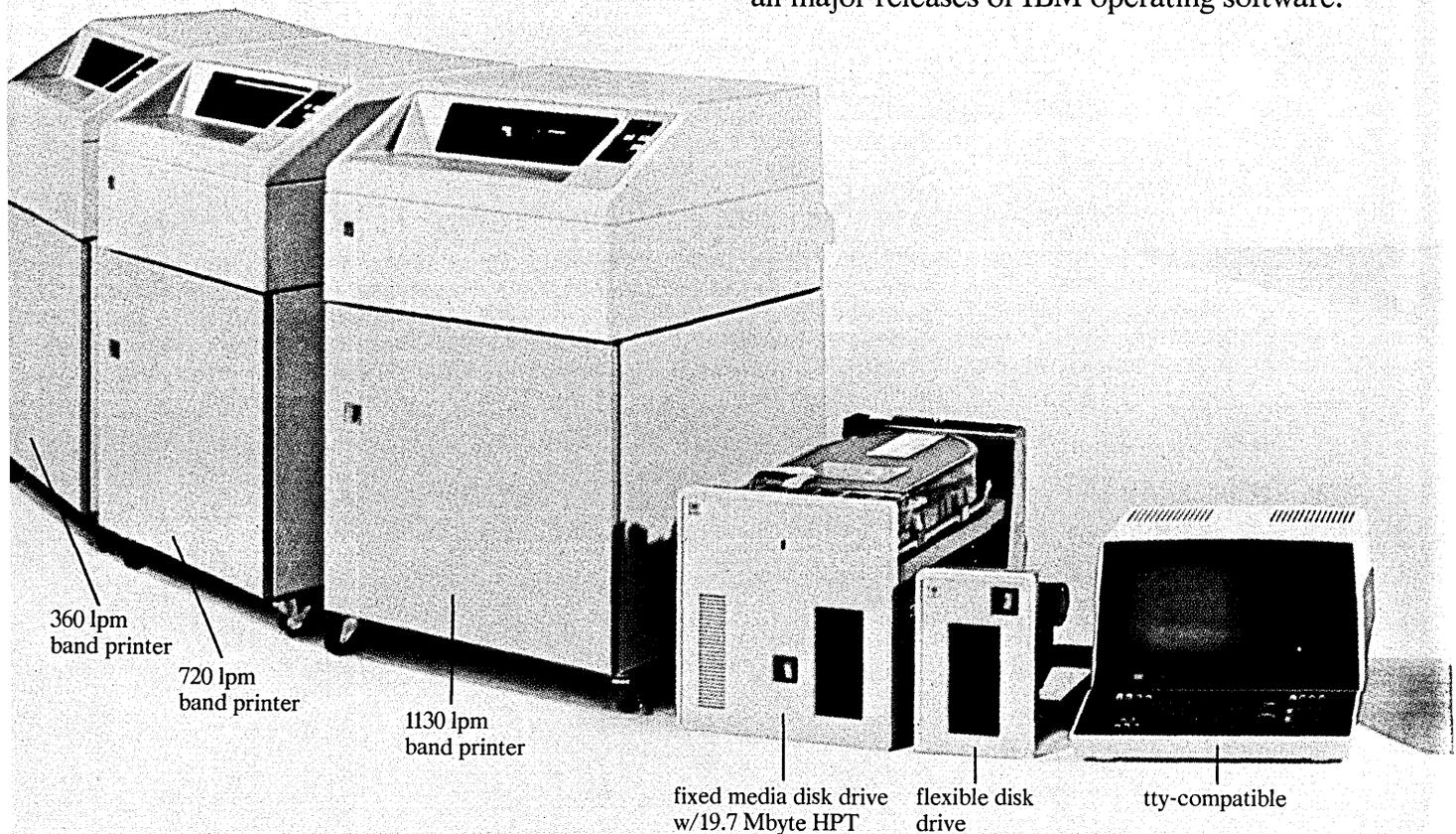
“Now you can add up to 240 Mbytes of removable storage with our Storage Module Drives. Their popular format attaches to the Series/1.

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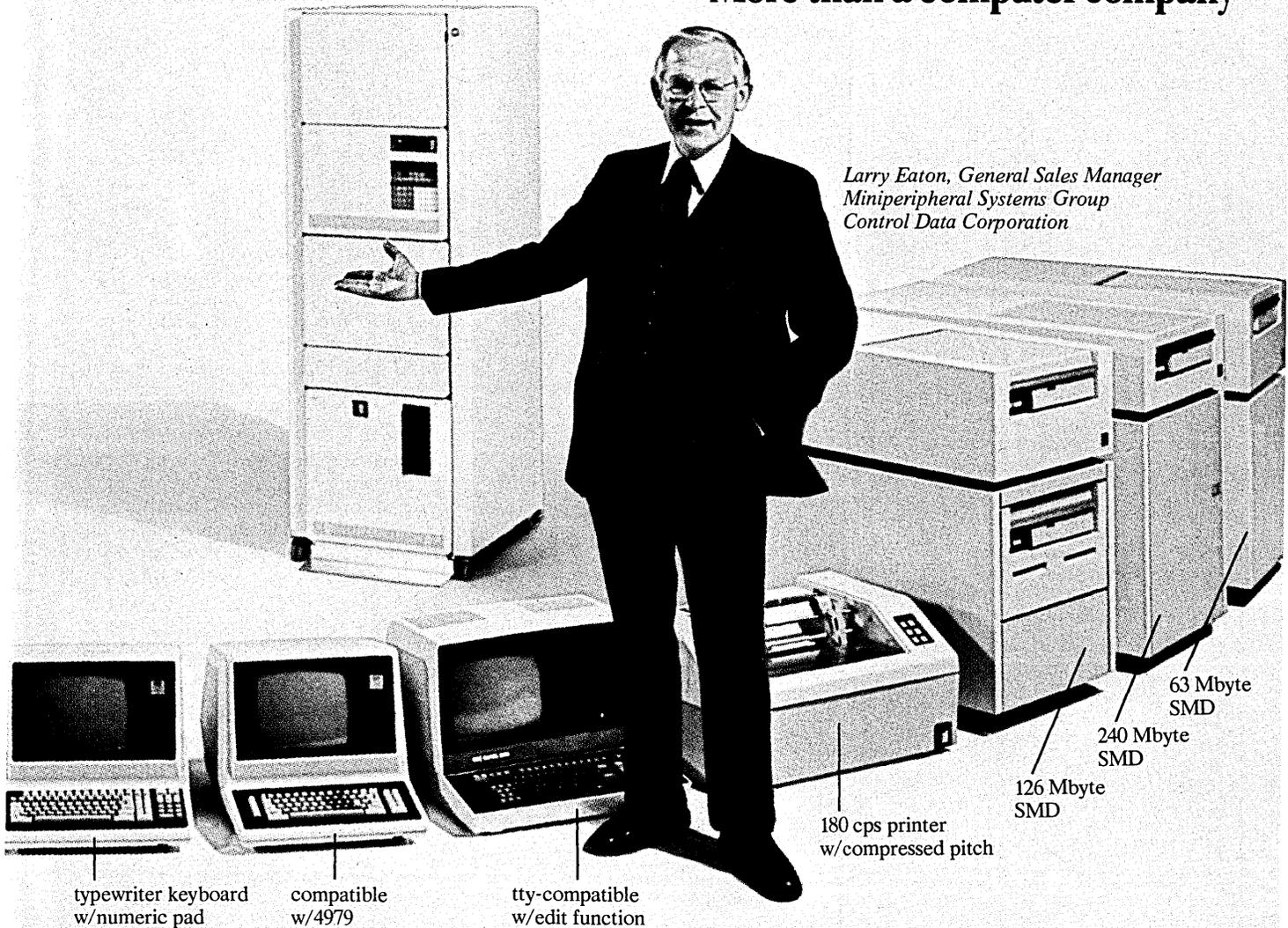
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“Let us show you how our Certainty Series makes the Series/1 even more attractive. For data sheets and more information, call today toll free. 800/328-9565.”

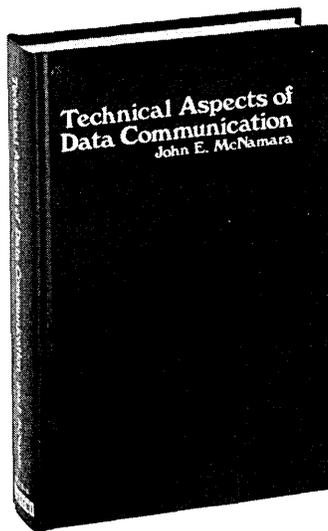
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"This is the best handbook of data communications system technology that this reviewer has yet encountered." — Arvid G. Larson in ACM Computing Reviews, February 1978

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TWENTY YEARS AGO/TEN YEARS AGO

LOOKING BACK

MARCH/APRIL 1959

Tape Drives: IBM introduced a new magnetic tape drive at the Western Joint Computer Conference, the 729 III, featuring a 375,000bps transfer rate, a 555bpi density and 6.7msec interrecord time.

In Britain: Some 100 computers were reported to be at work in Britain, about half in scientific work. Another 100 were on order, mainly for commercial purposes.

Data Input: Western Electric Co. demonstrated a new invention designed for use with the telephone company's Dataphone service, a service for transmission of data over regular telephone connections. The new, unnamed device would provide multiple access, unlimited by distance, to modern, high speed computers. Availability to potential users was not expected for several months.

Games: Comment from the floor at a Western Joint Computer Conference technical session: "I hear that in some of the backward countries of Europe, they're still playing chess by hand."

APRIL 1969

Terminals: A new San Antonio firm, Computer Terminal Corp. (now Datapoint Corp.) was planning to show its first product at the Spring Joint Computer Conference. It was described as a self-contained, solid-state keyboard crt terminal aimed at the time-sharing market and compatible with all T-S services using Teletype terminals.

Peripherals: The General Services Administration (GSA) was preparing a request for proposal (RFP) which would give independent peripheral makers their first opportunity to bid directly on Federal adp systems. Details were worked out in extensive discussions between GSA and peripheral makers. The procurement was to cover a system to be operated by the Commerce Dept. in parallel with an existing installation — either a 360/30 or /40 — acquired entirely from IBM.

Privacy: A bill (S823: Fair Credit Re-

porting Act) was before the Senate Banking and Currency Committee that would require that all information agencies such as credit reporting, personnel reporting and insurance investigating agencies: ensure accuracy of their information, allow individuals access to their records, destroy any records that might constitute an invasion of privacy and ensure confidentiality of records.

IBM Antitrust: "It is difficult to imagine a data processing industry without IBM, and yet there are those attempting to use the judicial process to accomplish this. It is obvious that IBM has made massive contributions to the industry; a breakup of this collective effort would be dangerous if not disastrous." — Dick H. Brandon, in a guest editorial.

SDS/Xerox: The boards of directors of Scientific Data Systems and Xerox Corp. approved the proposed acquisition of SDS by Xerox. Stockholders of both companies were to vote this month.

Air Traffic Control: Univac's Federal Systems Div. won a \$35.4 million contract from the Federal Aviation Administration for the ARTS-III (Automated Radar Terminal Systems) to be used in high density airport terminal areas. Purpose of the system is to display aircraft identity, altitude, and other flight information next to the radar echo of a plane that appears on the air traffic controller's screen.

Reservations: Two major computerized ticket reservations firms landed big contracts. Ticket Reservations Systems Inc. signed up the Los Angeles Dodgers and Computicket, the Baltimore Orioles. And Reservations World, a subsidiary of Diners' Club, Inc., launched a computerized reservations system for the hotel/motel industry based on two RCA Spectra 70/45s.

NCR: NCR expanded its San Diego facilities to accommodate what it called "increased demand" for its Century Series computers. The division manufactures the principal units of the Century family. *

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When you look inside today's small business systems, you tend to find the same components in nearly every one. The same microprocessors. The same printers. The same diskette and disk drives.

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Bursting computer printout by hand is enough to make anyone explode.

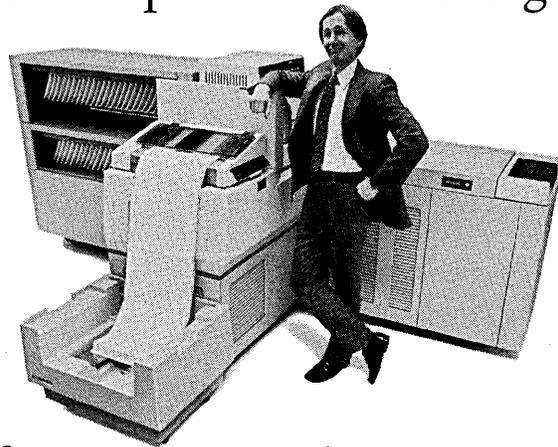
But the Xerox 9400 duplicator, with its continuous forms feeder attachment, lets you make perfect two-sided copies without bursting. Or exploding.

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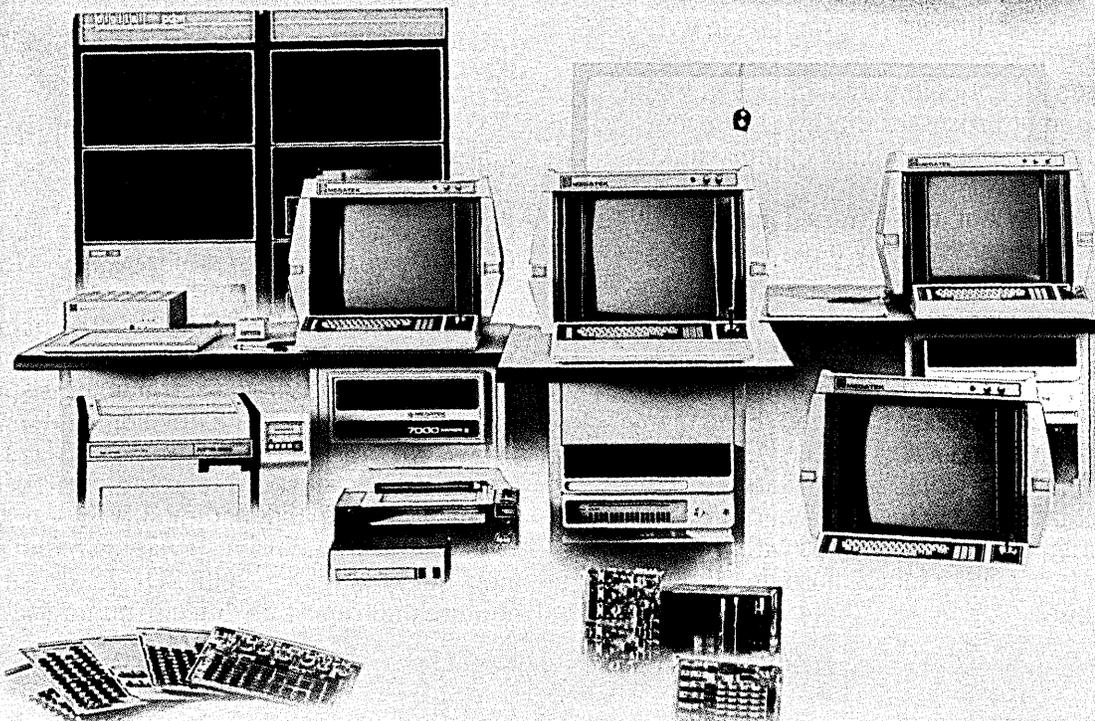
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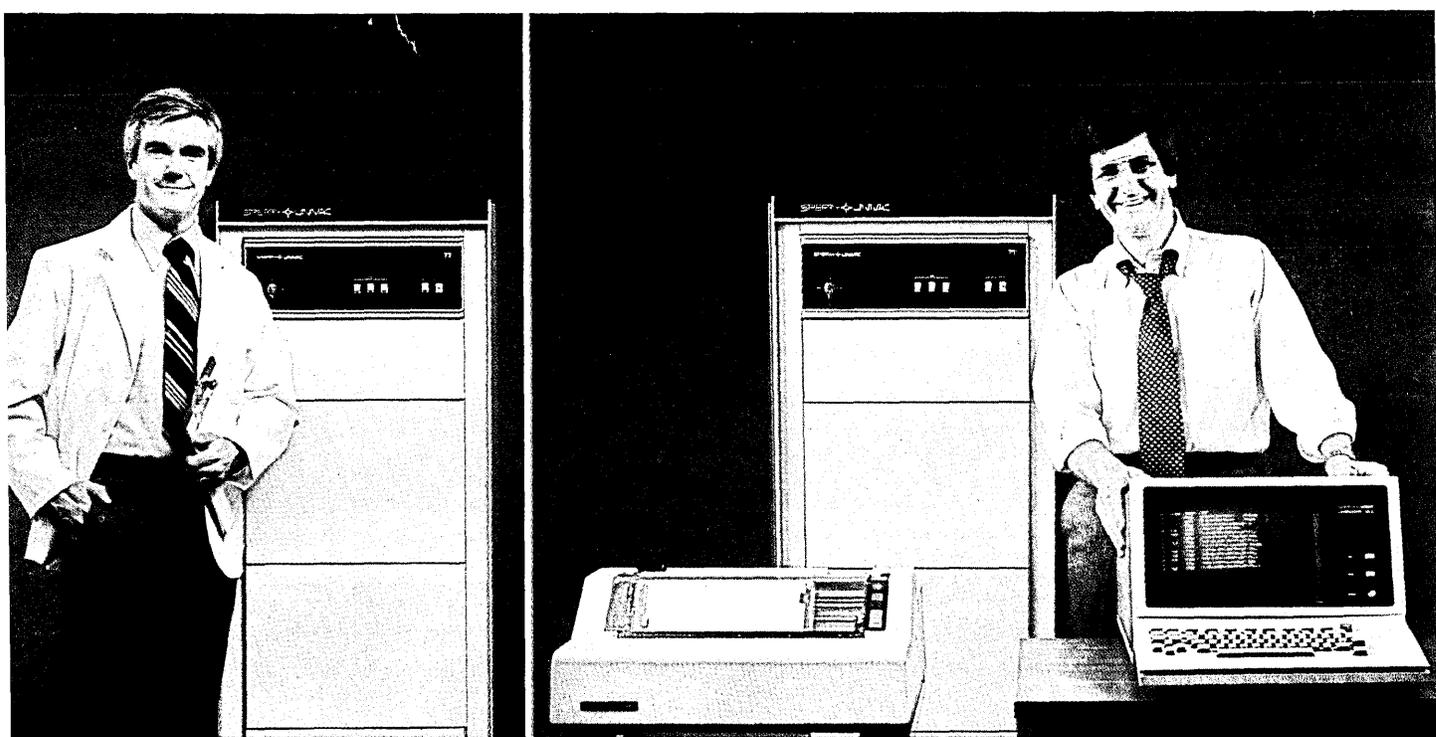
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Naturally, system houses want all the features OEM's do. And more.

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More operating systems, for example. Choose from VORTEX or our new SUMMIT — an interactive, multi-terminal system with transaction processing and data base management. It gives you easy editing, screen formatting, and documentation aids. Plus speedy, comprehensive program development.

System houses also think PASCAL is important. Because it's more efficient, easier to maintain, expand, and modify.

The Miniframe brings systems builders a new query language called QL-77. It features inquire and report facilities. And interfaces



Univac V77-800 Miniframe. of our very best customers.

directly to TOTAL*, the data base management system. So preprocessing and intermediate handling are a thing of the past. Finally, TOTAL also gives you complete data base access and file access security.

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Once again, SUMMIT, our new operating system, helps the end user handle transaction processing. Without any additional, expensive software. It's also the right answer for a multi-tasking, "fully-implemented" distributed processing system.

Finally, the Miniframe supports DCA and conventional protocols. So you can talk to both SPERRY UNIVAC and IBM hosts.

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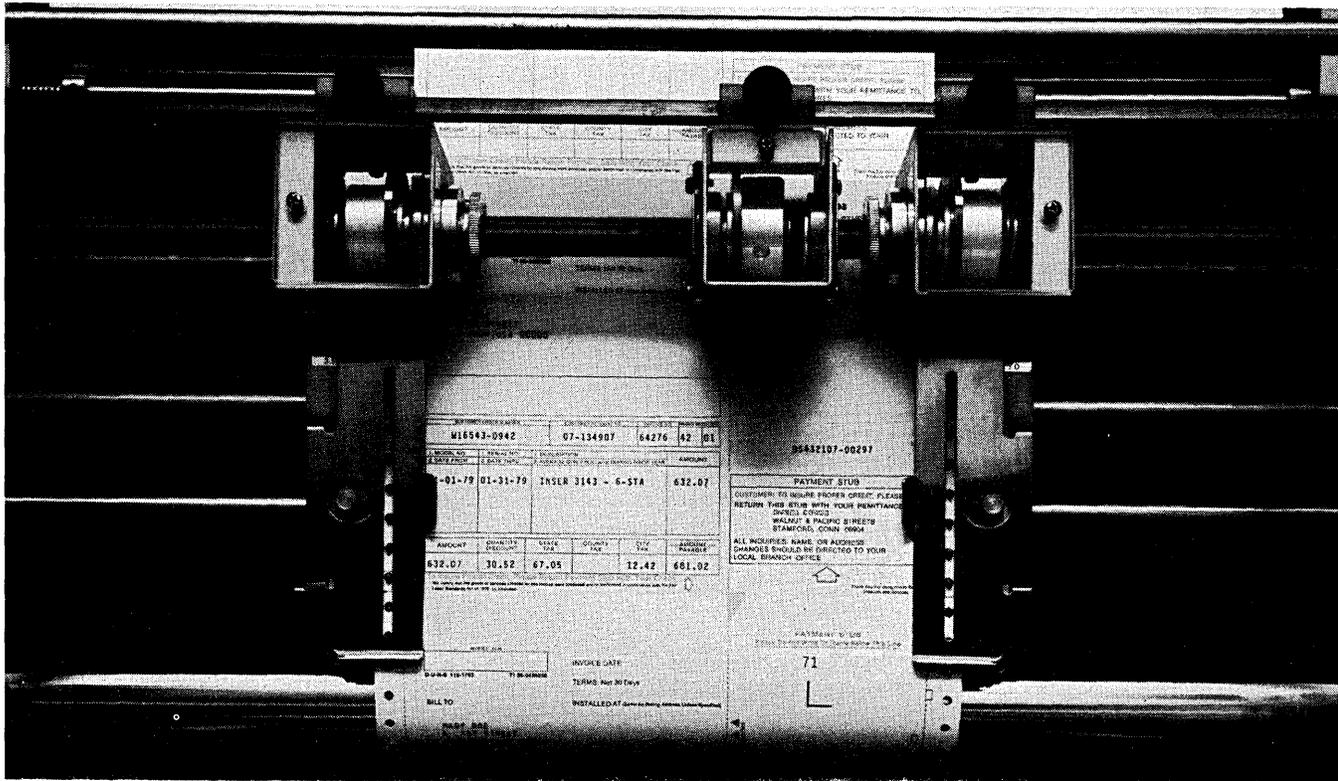
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We're Sperry Univac.

And our new Miniframe is going to solve some very big problems.

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 SPERRY RAND CORPORATION

*TOTAL is a registered trademark of Cincom, Inc.



Minutes ago these bills were in the computer.

Minutes from now they'll be in the mail.

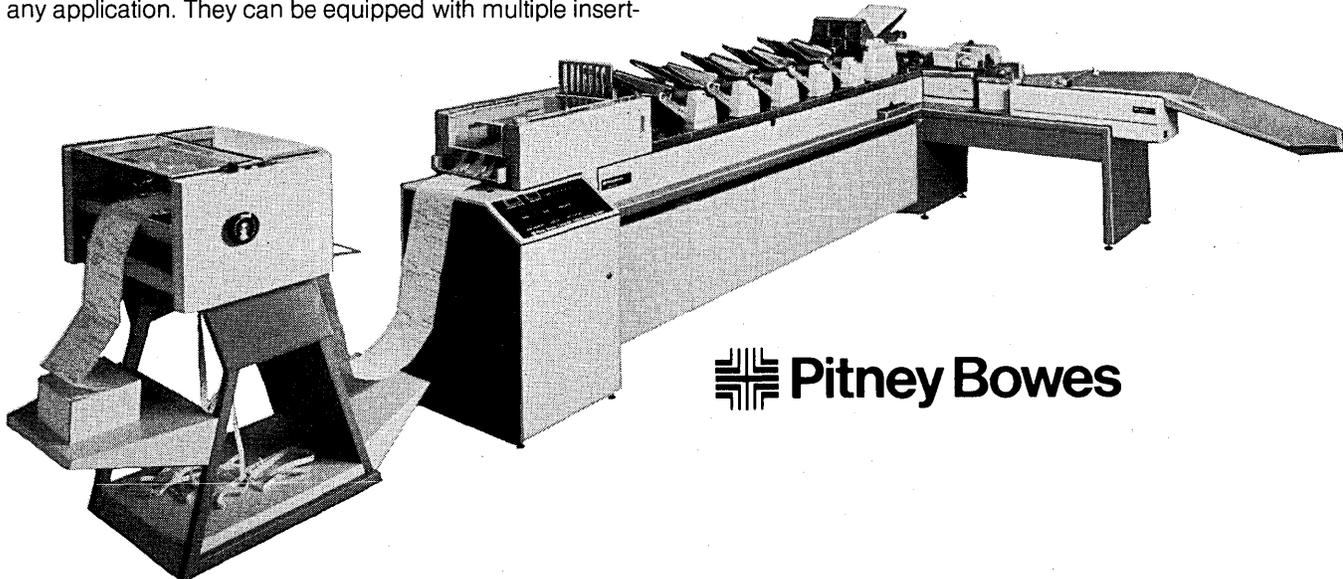
The Pitney Bowes high-speed Computer Output Mailing System takes over where your computer leaves off. It performs an entire range of forms-processing, inserting and mailing steps in one non-stop sequence, completely eliminating the stop-and-go pace that has previously hampered computer-to-mail operations.

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Systems can be custom-assembled to meet virtually any application. They can be equipped with multiple insert-

ing stations, electronic scanning, document verification, group feeding and selective collating. And thanks to the postal service presort discount and the system's zip code sorting options, you can save 2¢ on every invoice or statement you mail first class. In short, everything you need to add real zip to transactional mailings.

For complete facts and figures, write to Pitney Bowes, 2146 Pacific Street, Stamford, CT 06904. Or call toll free anytime 800-243-5000 (in Conn. 1-800-882-5577). Over 600 sales and service points throughout the U.S. and Canada. Postage Meters, Mailing Systems, Copiers, Labeling and Price Marking Systems.



Pitney Bowes

Four for the price of one.

Our new DS990 business systems give you four times the data storage you'd expect for the price.

Now, you can store four times the amount of data that most comparably priced computer systems can handle. Our new DS990 business systems, Models 1 and 2, give you double-sided, double-density diskette storage at prices starting under \$10,000*—about what you'd expect to pay for conventional single-sided, single-density data storage.

Our new systems are ideal for businesses that need small computers for efficient data management. They can serve

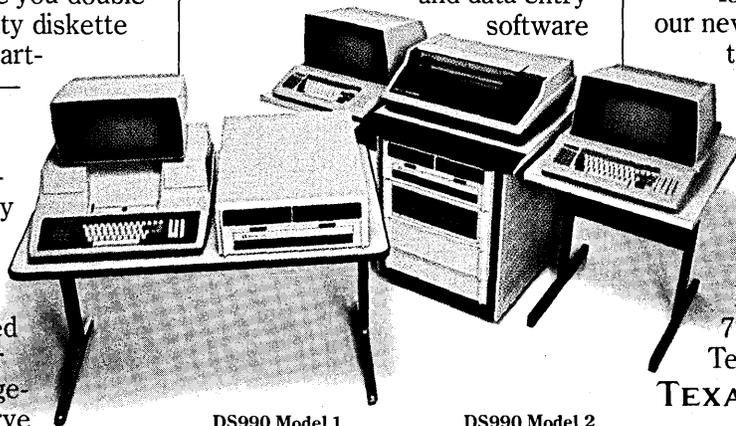
as complete systems today. And, because they're compatible with our full line of larger DS990 computers, they'll expand to meet your needs of tomorrow.

Both the single-station Model 1 and the dual-station Model 2 feature TX BASIC, a powerful business-oriented programming language. The Model 1 also features TPL, the easy-to-use forms generation and data entry software

package found on our Series 700 Distributed Processing Systems.

Like all DS990 products, these new systems are backed by highly trained specialists worldwide. The same service and technology we'll be putting to work at the 1980 Olympic Winter Games, where DS990 and Series 700 systems will provide up-to-the-minute results of each event.

To find out more about how our new DS990 business systems can increase your data storage and save you money, contact the TI sales office nearest you, or write Texas Instruments Incorporated, Digital Systems Division, P.O. Box 1444, M/S 7784, Houston, Texas 77001.



DS990 Model 1

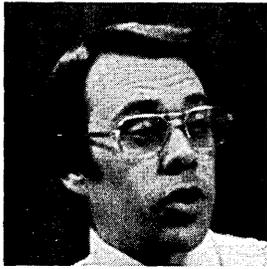
DS990 Model 2

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INCORPORATED

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We put computing within everyone's reach.

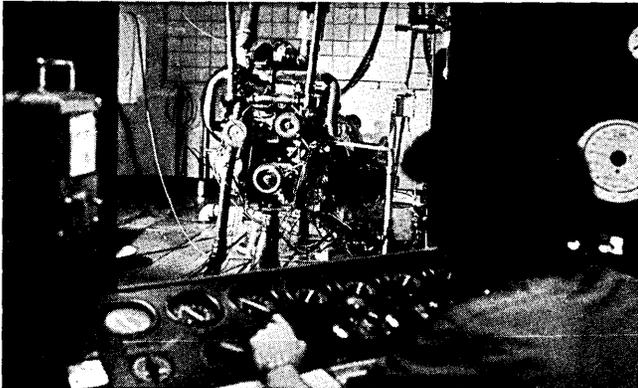


"BEFORE WE COULD BUILD THE WORLD'S LARGEST INDUSTRIAL DATA ACQUISITION SYSTEM, WE NEEDED NETWORK AND SYSTEMS CAPABILITIES WE COULD DEPEND ON."

"ONLY MODCOMP HAD THEM."

Jim Springer, Director of Data Systems,
AVCO Electronics, Huntsville, Ala.

Jim Springer is building what will be the largest industrial data acquisition system in the world. This system will be used for development and testing by one of the world's largest producers of diesel engines.



To implement the system, Jim chose MODCOMP's Classic® Computers, the MAX IV operating and communications system, and the MAXNET IV network extension.

"Network software capability is the key."

"The MAXNET IV network extension integrates all 120 computers in the system. This provides us with the performance characteristics of a stand-alone system, and the economic advantages of network resource sharing.

"In a real-time environment, that's essential."

"MODCOMP gives us the high speed and performance we need — at a cost we can afford."

"The MAX IV operating system is ideal for this type of real-time multi-programming. And with the Classic's extremely fast floating-point processor, we have more than enough speed.

"This is essentially the same system we specified for testing NASA's Space Shuttle. Ordinarily, that kind of superior quality and reliability would be out of reach for industry.

But because of their experience with the NASA system, only MODCOMP could meet the assigned high performance levels at a cost industry can afford."

"MODCOMP's tougher on their equipment than we are."

"Our customer was concerned about equipment reliability in their plant. And with good reason. The temperature can get as high as 120 degrees. But we've seen the Classic perform in worse places. MODCOMP's 'hot room' test facility, for instance. That's 132 degrees."

"Obviously we have a lot of faith in MODCOMP."

"We're just in the first phase of this system. But we have to know that, say, 3 years from now, the hardware will be available and that the software can be implemented or interchanged as needed.

"We recommend MODCOMP because we have a lot of faith in them. In their company, their equipment and their service.

"We know they can deliver. It's as simple as that."

At MODCOMP, we specialize in building real time computer systems and the network software capability to make them work.

Easily. Reliably. Affordably. And with the kind of performance you'd expect to find in the world's largest industrial data acquisition system.

If that's what you're looking for from a computer system supplier, do what Jim Springer did. Call MODCOMP.

MODCOMP
Dedicated to your success

Modular Computer Systems, Inc.
1650 McNab Road, Ft. Lauderdale, FL 33309
(305) 974-1380

LOOK AHEAD

TI'S SPLASHY SMALL BUSINESS SYSTEM

Gearing up for a new marketing plunge, Texas Instruments expects to make one of the splashier announcements at this year's National Computer Conference when it unveils its innovative small business system. Known internally as the SR-70, the new system, developed at TI's Lubbock facility, is based on the company's 16-bit 9900 microprocessor line. Priced at a mere \$5,000, the system is user programmable in TI's own brand of Basic, and it includes a menu-based software setup with six general business application packages. All this software is contained in half a megabyte of read only memory (ROM), making it possibly the largest solid state software system ever developed.

Another first is the system's use of a new type of floppy drive with features borrowed from both Winchester and floppy technologies. Capacity is one megabyte on each of two rigidly encased diskettes. (The package includes flying heads.) TI hopes to up capacity to 16 megabytes per diskette within two years. The company also hopes by 1981 to speed up access time, currently running at 10 times as fast as a floppy, to 100 times.

The system's \$5K price tag is said to include a crt monitor and two printers -- TI's 48-column thermal printer and TI's Omni 810, a 180 cps impact printer. Deliveries are expected to begin in August.

IBM'S SHORTCUT TO RELATIONAL SYSTEMS

If you're a long suffering IMS user or worried about having to upgrade to MVS and IBM's relational data base products, take heart. IBM's researchers are finalizing a new high level language that you just add to your operating system to make any data base look relational -- even IMS! One source close to the company says the software module can be used with IBM's most popular operating system, DOS/VS, for example, so you don't have to migrate to its expensive big brother, MVS, and buy lots of extra hardware like IBM wants you to do. So when will IBM's management kill the new software? Apparently never, says the source. The research boys seem good and sure that IBM will release the software -- and not wrap it up with expensive little black boxes to maximize hardware sales, as you might expect.

This all seems to suggest that IBM isn't as hot to get its user base to MVS as it was. And some leading experts in Europe feel that its VM/370 is more likely to become the flagship operating system for the majority of IBM users in the 1980s. Only about 25% of IBM's users -- those tied into SNA -- will push on to MVS, they feel.

SON OF REWRITE

It isn't just AT&T and data processing equipment vendors who are concerned about the Communications Act of 1978 (July, 1978, p. 173), or the "son of rewrite" as it has been called. Librarians are worried too. Tom Harnish, manager of the OCLC (Ohio College Library Center) Research Department's program on home delivery of library services

LOOK AHEAD

testified at an American Library Assn. forum on the Act, sponsored by the Library and Information Technology Assn. legislation committee. Harnish said his department had made an early decision "based on the computerized and teleprocessing nature of our current OCLC endeavors, to examine only electronic means for delivery" and that he was concerned that the "rewrite of the Communications Act has the...opportunity to nurture development of these technologies...to encourage or impede." Harnish's department is looking into such things as the feasibility of using a Viewdata or teletext system to provide, through libraries, "a number of interesting home information services." He is concerned that over-regulation could "create a whole new series of federal programs for a new social syndrome, the informationally disadvantaged."

INSCI AIMING AT
SMALLER CUSTOMERS

Information Science, Inc. (InSci), the Montvale, N. J. firm which had big plans to sell minicomputer based systems to corporate personnel departments (February '78, p.184) has been shifting its strategy and now will offer employee related processing capabilities as an interactive service. Charges for the service, which keeps track of company compliance with various federal government regulations such as EEO (Equal Employment Opportunity), typically runs at just over \$15,000 a year in a 500-person company. The stand-alone mini InSci had been selling had a much heftier \$50,000 a year price tag. That may have been prohibitive except for big concerns such as Philip Morris, one of InSci's only customers with a mini. InSci, which already has signed on three customers for its service, has gone through a recent management shuffle as well, with InSci marketing v.p. F. Gordon Smith leaving to go to Memorex Corp. and president Dale H. Learn being moved up to vice chairman. The new CEO is William V. Skellinger, who previously had been running one of the firm's divisions.

"SOONER OR LATER"

The "firmware situation" is held a likely candidate for a tv cigar commercial which proclaims "sooner or later we're gonna getcha" by Site Scenes, a newsletter produced for NCR users. "Ask your NCR salesperson what NCR's policy is on reinitializing firmware for an upgrade," urges the publication. It contends it's a simple procedure whether the change is for an NCR or non-NCR upgrade but "the re-initialization is reportedly free for NCR upgrades and costs \$3,000 for a non-NCR upgrade."

RUMORS AND RAW
RANDOM DATA

Might DEC want to sell off its \$200 million business in the System 10 and 20 general purpose market? "Absolutely not," reports DEC spokesman Richard Berube, despite the Wall Street rumor that is being passed on by competitive vendors with solid glee...So many orders poured in for IBM's new 4300 series -- some estimates placed them at 50,000 -- that not all of them could be fed into IBM's internal Advanced Administrative System by the processing deadline originally set for March 2. IBM was forced to extend the deadline several times before the final cutoff on March 16.

"We couldn't live without MARK IV!"



— Pat O'Grady, Secretary-Treasurer, and Fred Hemming,
Director of Data Processing, Transport Indemnity Company
Los Angeles, California

"With 16,000 claims reported annually and \$50,000,000 in annual premiums, Transport Indemnity is one of the largest and busiest truck insurers in the country. To handle this enormous load with ease and efficiency, we use MARK IV. It has reduced our programming time by 75 percent and allowed us to work with a staff one-third the size of what it would be otherwise. It's really unbelievable!

"In 1975, we developed a fully automated and truly revolutionary retrospective claims system under MARK IV, and we're absolutely thrilled with it. Essentially, retrospective claims mean that the insured shares in the lower limits of the loss, with the insured paying in advance for the loss. At year's end, according to the actual experience, additional money is requested or overpayment is refunded.

"This claims process is extremely complex, but MARK IV simplified it and gave us the exacting control we need. All current and cumulative claims information, along with pertinent statistical data, is on one master file. By simply passing our transaction file against it, we spin out all the reports we require.

"We also use MARK IV for an extremely sophisticated self-insurance administration system, and currently 90 percent of our new systems development is scheduled for MARK IV. What we like best is its flexibility.

MARK IV is so responsive that we can answer the changing needs of our insureds through timely production of specialized reports. Our DP people think of MARK IV as a 'language of love'! We couldn't live without it!"

GET THE FACTS ON MARK IV. MARK IV is the most versatile and widely used software product in the world for application implementation, data management and information processing. Six powerful models (prices start at \$12,000) are in daily use on IBM 360/370, Univac 70/90, Siemens 4004, Amdahl 470, and IteI Advanced System computers at over 1,300 installations in 44 countries. Programs in MARK IV require only about one-tenth the statements of Cobol, and users report 60 to 90% cost and time reductions on most MARK IV applications.

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Transport Indemnity is one of the nation's largest companies specializing in motor carrier liability insurance.

AJ introduces the most versatile CRT terminal in its class.



Like our printer terminals, the new AJ 510 is great for timesharing—and a lot of other jobs. Because we designed it with a lot of capability.

User versatility

The AJ 510 excels at interactive timesharing. Data is easy to input and the whole inquiry-response procedure is fast and efficient. It has a full 128-character ASCII set, 16 video enhancements, editing capability, and many more features designed to give the user maximum flexibility.

User convenience

And we made the AJ 510 easy to use—whatever the application. We gave it a typewriter-style keyboard, separate numeric and cursor keypads, a bright 15-inch display, and status indicators—all designed to make the user's life simple.

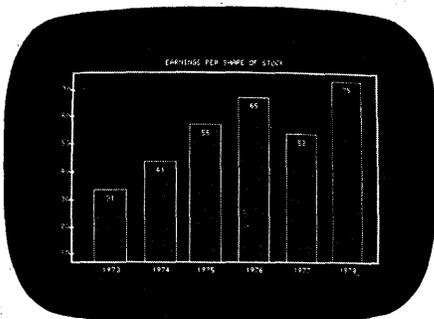
Communications versatility

The AJ 510 has two interfaces so you can connect a coupler/modem and a serial printer. Data rates are switch-selectable up to 9600 bps, in full or half duplex. Transmission can be character, line, or page-at-a-time.

AJ sole-source responsibility

We not only build the AJ 510, we also sell, lease, and service it. Plus the couplers/modems and other AJ devices you may use with it. We take total responsibility for our equipment throughout its lifetime.

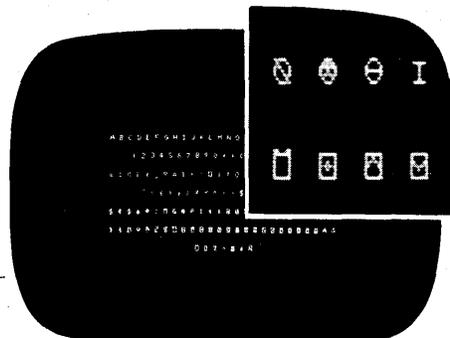
Call your local AJ office for details. Or write Anderson Jacobson, Inc., 521 Charcot Avenue, San Jose, California 95131, (408) 263-8520. Also available through AJ subsidiaries in Ottawa, Ontario, Canada; Paris, France; Shepperton, U.K.; and distributors throughout Europe.



A standard Graphics character set with a wide variety of symbols makes it practical to create forms, charts, and graphs.

ITEM	QUANTITY	PART #	DESCRIPTION	UNIT \$	TOTAL \$
1	200	1-60-002	Shelves, white	\$0.59	\$118.00
2	100	1-93-112	Brackets, brown	\$0.65	\$65.00
3	400	1-78-34	Phillips Screws, 1/2 inch	\$0.02	\$ 8.00
4	LOT	4-95-28	Installation instructions	N/C	N/C
5	12	2-72-48	White paint, in gallons	\$6.25	\$75.00

Format Mode includes protected and numeric-only fields and other features to simplify applications such as data entry.



Optional APL capability includes full APL character set and special keyboard. Inset shows actual size characters.



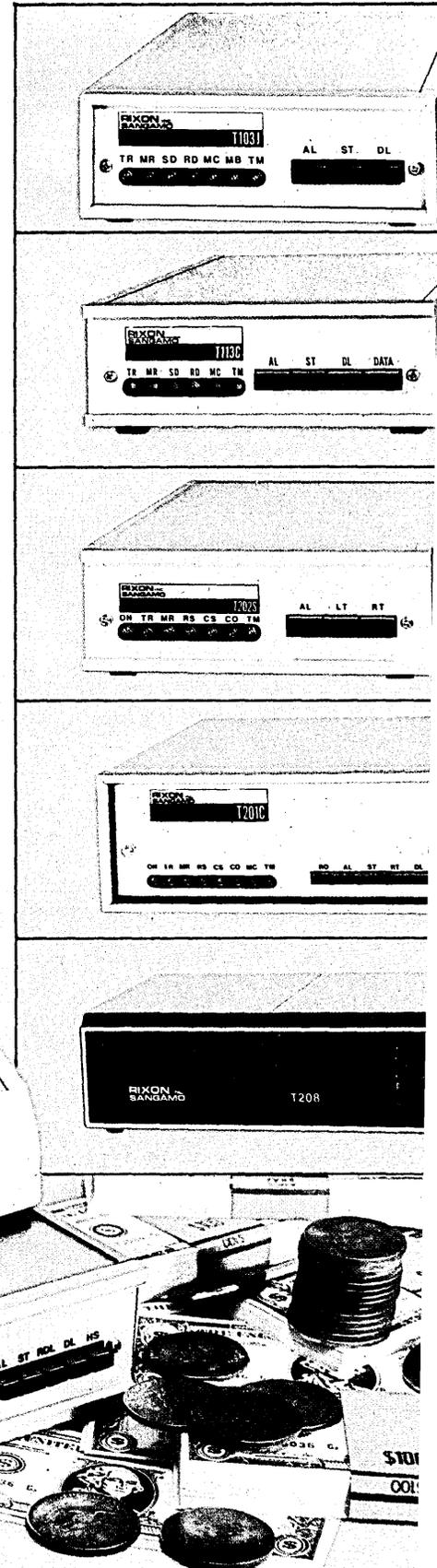
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**Complete Line of FCC Registered
DDD Direct Connect Data Modems
Designed to Save You Money the
Moment You Plug Them In.**

- **DIRECT REPLACEMENT** — Unplug your Bell 103J, 113C, 202S, 201C, 208B or 212A and plug in a Rixon T103J, T113C, T202S, T201C, T208B or T212A replacement. It's that easy.
- **SAVE MONEY** — Compare prices . . . the Rixon Alternative is lower!
- **YOUR CHOICE** — LEASE OR BUY — With Rixon, you can lease with a buy option or buy outright.
- **OTHER Rixon ALTERNATIVES** include . . . dial-up test center . . . exchange/repair program . . . service contract . . . the latest technology and built-in diagnostics.
- **PEACE OF MIND** — For more than two decades, Rixon has served data communications needs with quality products and service.

A satisfied customer is our first consideration.

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with details on our complete line of DDD data modems, a comparison chart on prices, details on our lease and service programs and more.



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VAX Software. Ask any user.

"VAX puts us on the leading edge — with tremendous power and a full-blown operating system."

*Dr. Herb Schwetman,
Assoc. Professor
Dept. of Computer Science
Purdue University
West Lafayette, Indiana*

Purdue's Department of Computer Science is involved in researching operating system performance, programming languages, and computer system security.

Because their experimentation requires heavy interactive use, they needed an alternative system to augment time-sharing on a CDC 6500.

Dr. Herb Schwetman, Associate Professor, explains what made Digital's VAX-11/780 so attractive. "We were intrigued because VAX provided a lot of the features and performance of a central facility — but for a lot less money."

Since Purdue's research involves state-of-the-art technology, VAX's advanced architecture and software were especially

appealing. "The operating system is set up very cleanly," says Dr. Schwetman, "Processes can operate independently. And that's a very good way to do it."

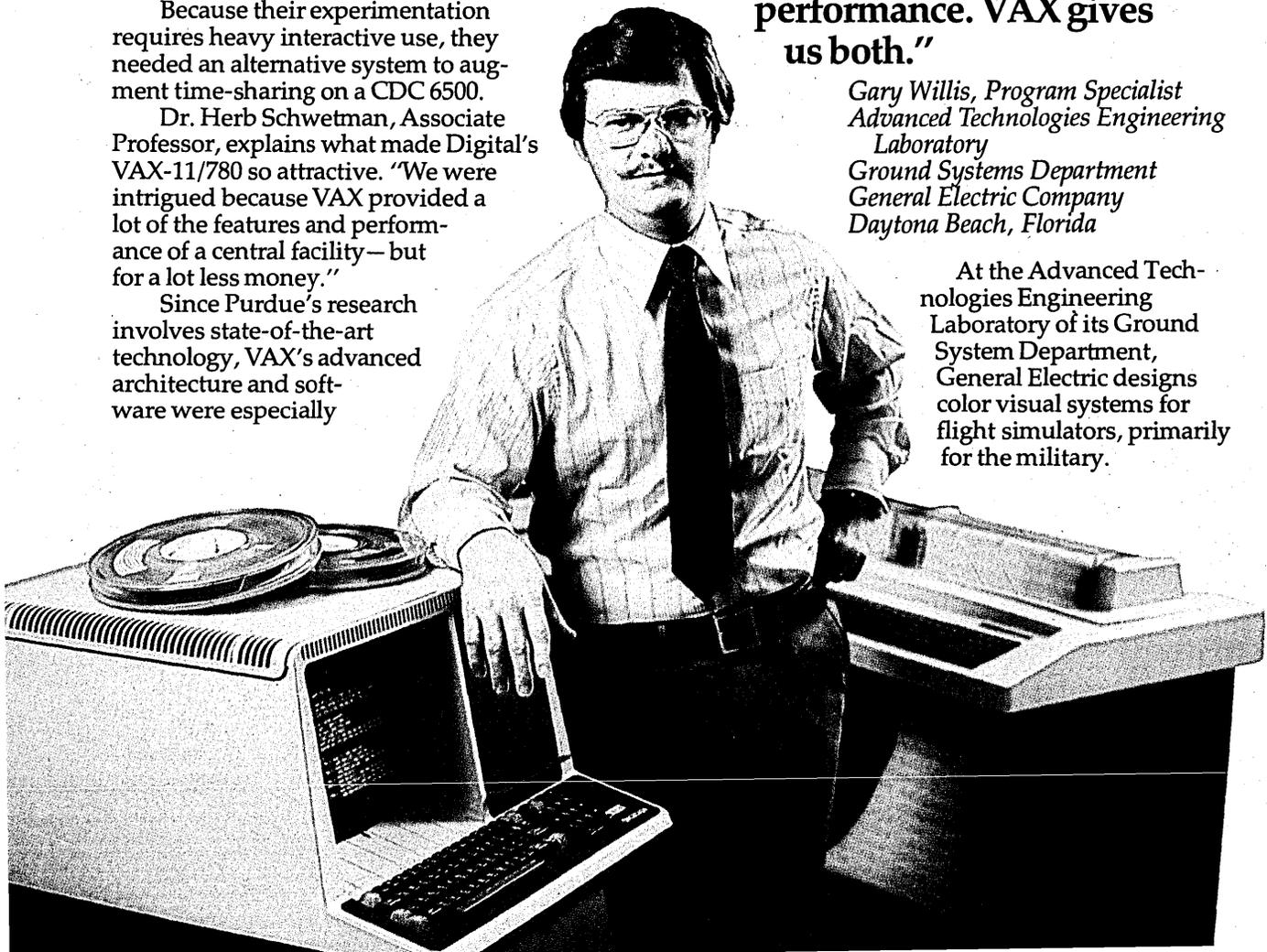
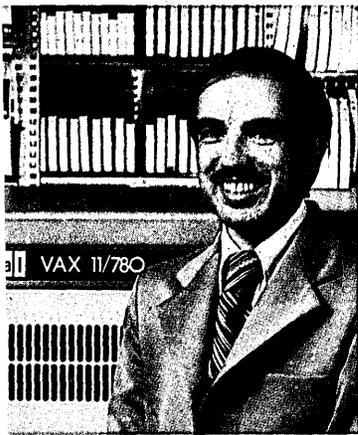
Also, VAX's 32-bit address space and large main memory give the Purdue researchers more flexibility. Dr. Schwetman says, "With VAX, we'll be able to double the size of the problems we can look at. In fact, VAX offers user programs more memory than is available on the big CDC 6500 downstairs."

"It's amazing," Dr. Schwetman concludes, "All this power — in a machine in this price range."

"We needed virtual memory software and fast real-time performance. VAX gives us both."

*Gary Willis, Program Specialist
Advanced Technologies Engineering
Laboratory
Ground Systems Department
General Electric Company
Daytona Beach, Florida*

At the Advanced Technologies Engineering Laboratory of its Ground System Department, General Electric designs color visual systems for flight simulators, primarily for the military.



The application demanded operating system software that could handle static simulation; but real-time performance was important, too. After a number of tests and benchmarks, General Electric decided on VAX.

Gary Willis, Program Specialist, tells us, "If you can imagine emulating a roomful of simulation hardware, you can see why we needed a virtual memory operating system. But since we have to compute a new image every 30th of a second in our real-time application, we also needed a lot of number crunching. VAX gives us both."

The VAX/VMS operating system and real-time dynamic performance are only part of what impressed General Electric. Says Willis: "Most military contracts require FORTRAN, and we're very pleased with what VAX gives us—very fast, very efficient FORTRAN, with super execution times."

According to Willis, VAX software is also getting high marks on ease-of-use.

"Our people are very pleased with how easy it is to translate FORTRAN programs from the PDP-11 series to VAX. Also, our programmers like the HELP command—especially those who are just getting used to Digital equipment."



"We were very impressed with the maturity of the VAX operating system. Everything that's supposed to work, works."

*Harry Hill, Program Manager
Ford Aerospace &
Communications Corp.
Western Development Laboratories
(WDL) Div.
Palo Alto, California*

Ford Aerospace performs large double precision floating point scientific computing for a variety of government projects.

When it was time to move to a larger computer, WDL's Harry Hill, Program Manager,

admits they were apprehensive about committing to a product as new as Digital's VAX-11/780.

"We were originally very leery of the new machine," says Hill, "Because it traditionally takes years to develop maturity. But the price was so good that we went ahead, and it's been very successful."

One feature that made VAX particularly attractive for Hill's application was the powerful virtual memory. He tells us: "By going to VAX, we were able to eliminate memory mapping and let the machine just sit there and crunch numbers. It saves time and cuts down on the chances of messing something up."

Hill is also impressed with VAX's interactive and batch capabilities. "The multi-stream, multi-queue batch is one of the best systems we've ever seen."

The programmers' reaction? Says Hill, "Everybody is amazed."

Digital's VAX-11/780 represents the first truly integrated approach to hardware and software architecture. The result is one of the most advanced systems on the market. Extremely powerful, yet extremely easy to use.

But don't just listen to us. Send for our new brochure. And listen to our customers.

- Please send me the new "VAX—Ask Any User" brochure and detailed Technical Summary.
 Please contact me.

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CALENDAR

APRIL

First Annual International Conference on Computer Capacity Management, April 30-May 2, Washington, D.C.

The conference will focus on specific problems, technical applications and solutions for day-to-day management of computing capacity and performance. Tutorials will be presented on cpu power comparisons, data reduction and analysis, performance reporting, forecasting hardware requirements, and the application of software physics. Fee: \$235. Contact Dave Schumacher or Dave Morley, The Institute for Software Engineering, P.O. Box 637, Palo Alto, CA 94302 (415) 493-0300.

Eleventh Annual ACM Symposium on Theory of Computing, April 30-May 2, Atlanta.

Sponsored by the ACM Special Interest Group on Automata and Computability Theory, with the cooperation of the IEEE Computer Society Technical Committee on Mathematical Foundations of Computing and the Georgia Institute of Technology. Contact Professor W.A. Burkhard, Computer Science Division C-014, Univ. of California, San Diego, La Jolla, CA 92093.

MAY

1979 Southwestern Computer Conference, May 1-3, Oklahoma City.

Sponsored by the OSU Technical Institute in cooperation with the Data Processing Management Assn. and the Assn. for Systems Management. There will be 150 exhibit booths and 60 seminar presentations. Contact E.Z. Million, Conference Chairman, OSU Technical Institute, 900 North Portland, Oklahoma City, OK 73107 (405) 947-4421, ext. 214

Computer Communications Networks, May 7-9, Boston.

Cosponsored by MITRE Corp. and the National Bureau of Standards. Attendees are expected from government, military, industrial and academic communities. Contact Stan Lichtenstein at (301) 921-3181.

West Coast Computer Faire, May 11-13, San Francisco.

The Faire is to focus on low-cost computing power for home, business, and industry. There will be approximately 250 exhibitors. Fee: \$7 in advance, \$9 at the door. Contact the Computer Faire at 333 Swett Road, Woodside, CA 94062 (415) 851-7075.

Micro/Expo '79, May 15-17, Paris.

Fourth annual microcomputer show, billed as the largest in Europe. Organized by SYBEX-Europe. Contact Chris Chambers, SYBEX, Inc., 2020 Milvia St., Berkeley, CA 94704 (415) 848-8233.

International Technical Communication Conference, May 16-19, Los Angeles.

Sponsored by the Society for Technical Communication. Ray Bradbury will give the keynote address, "A Few Thoughts on the Next Billion Years." There will be panels, workshops, a film festival, and exhibit. Contact Ernie Mazzatenta, Program Chairman, 30611 Birchtree Drive, Warren, MI 48093 or Gordon Penharlow, Pacific Multitech, Arcadia, CA (213) 445-1691.

Eighth Mid-Year Meeting of ASIS, May 16-20, Banff.

The theme of the conference is North American Networking. Fee: \$55. Contact Charles H. Davis, Conference Chairman, Faculty of Library Science, The Univ. of Alberta, Edmonton, Canada T6G 2J4 (403) 432-4578.

JUNE

National Computer Conference, June 4-7, New York.

Merlin G. Smith, research staff member in the Computer Sciences Department of IBM's T. J. Watson Research Center, is this year's conference chairman. More than 120 technical and professional program sessions will take place, under the direction of program chairman Dr. Richard E. Merwin, a research professor at George Washington Univ. and a consultant on real-time computer systems and special purpose languages.

There will be prizes this year for the best papers accepted for publication in the NCC '79 Personal Computing Proceedings. The Personal Computing Festival will feature technical sessions, commercial exhibits, and applications demonstrations.

The National Computer Conference is sponsored by the American Federation of Information Processing Societies, Inc., in cooperation with four of its member organizations: the Association for Computing Machinery, the Data Processing Management Association, the IEEE Computer Society, and the Society for Computer Simulation. Contact NCC '79 c/o AFIPS, 210 Summit Ave., Montvale, NJ 07645 (201) 391-9810.

Second Conference on Transnational Data Flows, June 18-20, Washington, D.C.

The focus will be on the economic impacts of transborder data flows on trade, the job market, data base services, and the many facets of the computer industry. Scheduled speakers include William Colby, former director of the CIA, and Hugh Donaghue, vice president, Control Data Corp. Contact Donna S. Ahrend or Mike O'Bryant, Information Gatekeepers, 167 Corey Rd., Brookline, MA 02146 (617) 739-2022.

Forum on Information Resource Management, June 25-26, Chicago.

The theme will be "Information Resource Management in the Years of Change." Sessions are planned on auditing and security, impact of distributed processing and data base management. A panel of MIS directors will present a perspective on the problems and potential of information resource management in their organizations and industries. Contact Ken Burroughs, DBD Systems, 1500 N. Beauregard St., Alexandria, VA 22311 (703) 820-3310.

JULY

Harvard Computer Graphics Week '79, July 15-20, Cambridge.

The conference will focus on currently available cartographic and statistical data bases, graphics hardware, software, and the electronic communication of geographical information. "Highly interactive" special sessions are planned in the areas of technology transfer, remote sensing, the 1980 Census, the new nine-digit postal zip code, thematic map design, and standards. There will be exhibits of hardware and software. Contact Kathleen Quigley, Center for Management Research, 850 Boylston St., Chestnut Hill, MA 02167 (617) 738-5035.



Here's how you can be fully computerized for so much less than you thought

BUSINESS — EDUCATION — ENGINEERING — MANUFACTURING

We are pleased to announce the first professional time-sharing system in the microcomputer field.

Naturally, it's from Cromemco.

This new multi-user system will do all of the tasks you usually associate with much more expensive time-sharing computers. Yet it's priced at an almost unbelievably low figure.

Look at these features:

- You can have up to 7 terminals plus a fast, 132-column line printer
- You can have a large system RAM memory that's expandable to ½ megabyte using the Bank Select feature
- Each user has an independent bank of RAM
- You can have floppy disk storage of up to 1 megabyte
- You have confidentiality between most stations
- And, make no mistake, the system is fast and powerful. You'll want to try its fast execution time yourself.



PROGRAMMERS LOVE OUR BASIC

This new system is based on Cromemco's well-known System Three Computer and our new Multi-User BASIC software package.

Programmers tell us that Cromemco Multi-User BASIC is the best in the field. Here are some of its attractions:

- You can use long variable names and labels up to 31 characters long — names like "material on order" or "calculate speed reduction."
- You get many unusual and helpful commands that simplify programs and execution — commands such as PROTECT, LIST VARIABLES, NOLIST, and many more.

- No round-off error in financial work (because our BASIC uses binary-coded decimal rather than binary operation). And we've still been able to make it FAST.
 - Terminals and printer are interrupt-driven — no additional overhead until key is pressed.
 - The conveniences in this Multi-User BASIC make it much easier to write your own application software.
 - A line editor simplifies changes.
- BENCHMARK IT — NOW**

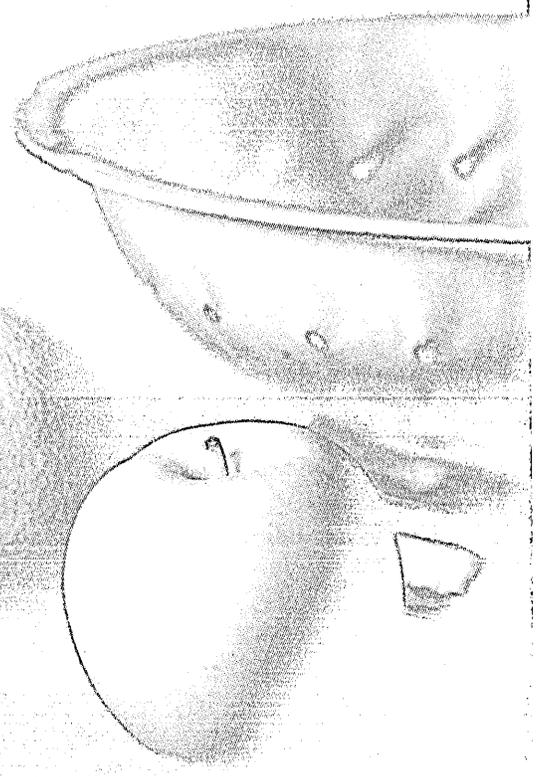
In the final analysis, the thing to do is see this beautiful new system at your dealer. See its rugged professional quality. Evaluate it. Benchmark it for speed with your own routine (you'll be agreeably surprised, we guarantee you).

Find out, too, about Cromemco's reputation for quality and engineering.

Look into it now because you can have the capabilities of a fully computerized operation much quicker and for much less than you ever thought.

Cromemco
i n c o r p o r a t e d
Microcomputer Systems
280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400

CIRCLE 38 ON READER CARD



Out-Think

Comparing a Datapoint ARC™ system to a conventional computer is like comparing apples to oranges.

Datapoint's Attached Resource Computer™ system works like a central processing unit. But it's more. It's as though a big computer's central processing unit had been sliced up into separate functions and spread around the company's offices. The components go where the work is being done, but they are all part of a single computing facility.

This unique architecture gives the ARC system exclusive, extra benefits other types of computer architecture don't offer. That's why it's the perfect example of Datapoint out-thinking its competition to help you out-think yours.

Out-Think No. 1: Building Block Architecture

The ARC system is composed of a number of small, efficient processors. One or more of the processors can be used for file storage and management (file processors). Others can be used to run applications programs (applications processors), or to control peripherals such as printers and communications devices. The system keeps right on working even if one of the components is taken out of service. The processors can be interchangeable. Many applications processors can easily become file processors should the need arise.

Out-Think No. 2: More Productivity

The interprocessor bus (which links all the processors in the system together) coordinates all data transfer, relieving the individual processors from communications overhead. This is another reason why an ARC system's productivity will often exceed that of a large conventional computer, no matter how many separate processors there are, or where they happen to be located. Each component does its assigned task faster and more efficiently because that one job is all it has to do.

Out-Think No. 3: More Efficiency

As an ARC system grows, the information base doesn't have to be divided, partitioned or duplicated. You start with a shared database and simply keep on sharing it. File security is simple to use, yet safe. You can selectively restrict access to parts of the database in a number of ways.

Other components are shared as easily. Printers, for example, can be kept at work full time. The work can be stored, then turned out on whatever priority schedule you want.

Since every user on the system can make use of all the same resources, you can get along with less equipment. And that you have will be used more efficiently.

Out-Think No. 4: Easy Growth

It's easy to add new work functions to an ARC system. You add just as little or as much computing power as you need to handle your current work load. There's no wasted time caused by an

overloaded computer and no wasted, expensive overcapacity.

The ARC software can remain the same no matter how big the system becomes. All Datapoint processors suitable for use in an ARC system can use the same programs. This keeps programming time to a minimum and avoids big retraining costs.

Growth can occur in easy, incremental steps, at predictable, affordable costs.

An ARC system can shrink or expand, be rearranged or readapted to fit your data processing needs exactly. Right now or ten years from now. For a corporate headquarters or a field office. And it can become part of a geographically dispersed network.

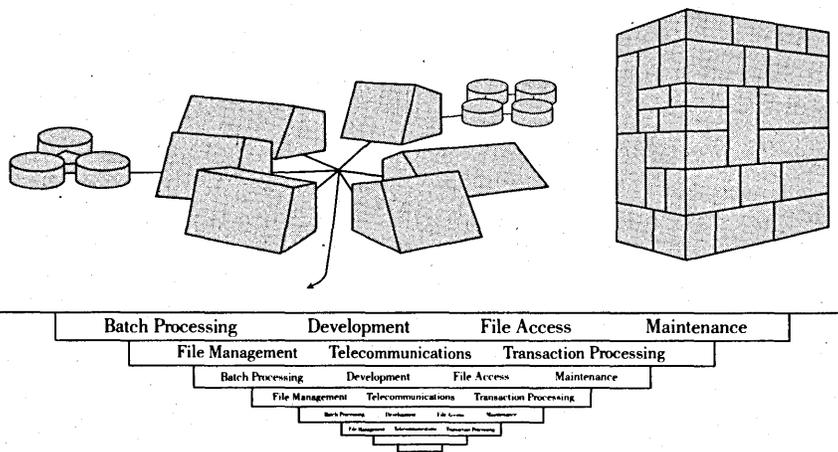
You define the need. A Datapoint ARC system can be shaped to fit it exactly.

Write for More Information

Marketing Communications
Dept. (M-62), Datapoint Corporation,
9725 Datapoint Drive, San Antonio,
Tx. 78284.

ONE ARC™ SYSTEM!

Whether you picture it as a number of smaller computers located throughout your business facility, or as the partitioned CPU of a much larger computer, the end result is the same: just the right amount of computing power and data storage. To suit your needs today and for years to come.



◀The Datapoint ARC system is an entirely new form of computer architecture. We out-think our competition, to help you out-think yours.



DATAPOINT CORPORATION

The leader in dispersed data processing™

CALENDAR

AUGUST

SIGGRAPH '79, August 6-10, Chicago.

Tutorials, technical sessions, and an exposition will be featured at this 6th annual ACM Special Interest Group on Computer Graphics and Interactive Techniques. Contact Maxine D. Brown, SIGGRAPH '79 Exposition, Hewlett-Packard, 19400 Homestead Rd., Cupertino, CA 95014 (415) 326-7300.

SEPTEMBER

Engineering Software, September 4-6, Southampton, England.

Contact Dr. R. Adey, Engsoft, 6 Cranbury Place, Southampton SO2 0LG, England.

Fourth International Conference on Software Engineering, September 17-19, Munich.

Contact Dr. L. Stucki, Boeing Computer Services, P.O. Box 24346, Seattle, WA 98124 (206) 576-5118.

TELECOM 79, September 20-26, Geneva.

Sponsored by ITU, the International Telecommunications Union. There will be an exhibition, book fair, and film festival. Contact Secretariat TELECOM 79, Orgexpo, 18, quai Ernest-Ansermet, Case postale 65, 1211 Geneva 4, Switzerland, Telephone (022) 21 95 33.

International Conference on the Role of Computer in Society, September 24-28, Dubrovnick, Yugoslavia.

Contact R.L. Schiffman, Dept. of Civil, Environmental and Architectural Engineering, Univ. of Colorado, Boulder, CO 80309 (303) 492-7607.

WPOE '79, September 25-27, San Jose.

Word processing and office equipment show and conference. Contact Cartlidge & Associates, Inc., 491 Macara Ave., Suite 1014, Sunnyvale, CA 94086 (408) 245-6870.

MIMI '79, September 26-29, Montreal.

The ninth International Symposium and Exhibition on Mini and Microcomputers. The theme will be "The Evolving Role of Minis and Micros Within Distributed Processing." Contact MIMI '79 Montreal, P.O. Box 2481, Anaheim, CA 92804 (714) 774-6144.

Northeast Computer Show, September 28-30, Boston.

The small computer show will feature both personal and business computing, in separate areas. Contact Northeast Expositions, P.O. Box 678, Brookline Village, MA 02147 (617) 522-4467.

CALLS

Papers are solicited for presentation in the Idea Exchange at the American Institute of Industrial Engineers' Fall Conference, to be held in November in Houston. Session topics will include engineering economy, material handling and warehousing, production planning and control techniques, office automation, contemporary work measurement, energy conservation management programs, managing productivity of dp centers, banking and finance, and distribution requirements planning. Deadline for acceptance of 500 word (or less) abstracts is May 15. Two copies of the abstract should be mailed to 1979 Fall Industrial Engineering Conference, Conference Dept., AIEE, 25 Technology Park/Atlanta, Norcross, GA 30092. *

REORGANIZE DISK VOLUMES

COMPAKTOR eliminates free space fragmentation by placing data sets contiguous on a disk volume. Multi-Extent files are merged into one extent. By using an FDR backup tape, COMPAKTOR reorganizes in place.

DATA SET PLACEMENT

Data sets may be positioned on a pack to user specifications. Using simple control cards a user can configure a disk to reduce head movement.

ALTER VTOC SIZE AND LOCATION

Entries within the VTOC are also compakted reducing data set search time.

FAST DUMP RESTORE

FDR with over 3000 users and nominated to the DATAPRO HONOR ROLL for the 5th consecutive year, has a proven record of RELIABILITY and EFFICIENCY. FDR permits the user more opportunity to backup his files while using significantly less CPU and elapsed time.

FREE 30 DAY TRIAL

COMPAKTOR is licensed by CPU for IBM 360/370 computers running OS, VS or MVS Operating System. COMPAKTOR supports 2314, 3330, 3340 and 3350 type disks. COMPAKTOR is available as an option to FDR.



MEMBER DATAPRO SOFTWARE HONOR ROLL

	FAST DUMP RESTORE
OVERALL SATISFACTION	3.7
EFFICIENCY/EASE OF USE	3.7
EASE OF INSTALLATION	3.6
DOCUMENTATION/ VENDOR TECH SUPPORT	3.2
TRAINING	2.9

For Further Information
Or Free 30 Day Trial, Call or Write...



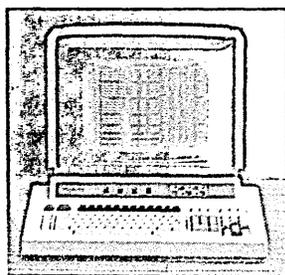
970 Clifton Avenue, Clifton, NJ 07013
201-777-1940

NO ONE CAN REPRODUCE 132 COLUMNS AS SHARPLY AS WE CAN. NOT EVEN THIS MAGAZINE.

We turned this ad sideways so you can see just how large a full-size image on our 132-column display really is.

But even that doesn't allow us to demonstrate the unbelievable clarity of our characters. Because it simply isn't possible to reproduce them in print.

It's all due to our patented Charactron® tube—an amazing device that generates computer page-sized characters so sharp they practically jump off the screen. Characters that don't sacrifice clarity for the sake of 52 extra columns.



Datagraphix

A General Dynamics Subsidiary

Our Model 132A gives you full interactive capabilities, including an upper and lower case 96-character ASCII set. Character and line editing. Scrolling up to 120 lines and 15,840 characters. Tabbing. And dual brightness control.

Model 132B has all that and more. Like an 11-key numeric pad. 12 function keys. Line and page editing. And protected fields.

But the only way to see what we're talking about is to call for a demonstration. You'll agree that our 132-column displays are clearly better.

P.O. Box 82449, San Diego, CA 92138 • (714) 291-9960, Ext. 481, TWX (910) 335-2058 • Charactron and Datagraphix are registered trademarks of Datagraphix, Inc.

REPORT 4

CASH RECEIPTS REPORT BY ADMINISTRATOR

JANUARY 15, 1979

ADMIN	CACC#	CUSTOMER NAME	INV. #	CHECK-REF	TRANSDATE	CASHAMNT	DISCAMNT	ACCT. RECVBLE	AMR #
3	6089	Tri-State Computer Corp.	22528	2575	09 DEC 77	3630.00	0.00	3630.00	1420
3	6089	Tri-State Computer Corp.	22529	2575	09 DEC 77	1086.50	0.00	1086.50	1420
3	6089	Tri-State Computer Corp.	22530	2575	09 DEC 77	1159.50	0.00	1159.50	1420
	###					5856.00	0.00	5856.00	
3	6094	Tri-State Computer Services	25735	145	09 DEC 77	3490.23	0.00	3490.23	1420
3	6094	Tri-State Computer Services	25735	145	09 DEC 77	0.00	33.77	33.77	1420
3	6094	Tri-State Computer Services	22531	145	09 DEC 77	125.35	0.00	125.35	1420
3	6094	Tri-State Computer Services	23342	1452	20 DEC 77	3490.23	0.00	3490.23	1420
3	6094	Tri-State Computer Services	23342	1452	20 DEC 77	0.00	33.77	33.77	1420
	###					7105.81	67.54	7173.35	
3	6103	State Electric Company	24107	771700	28 NOV 77	603.60	0.00	603.60	1420
3	6103	State Electric Company	257574	771700	28 NOV 77	1161.35	0.00	1161.35	1430

The heavyweight 120 cps champ.

A contest between our heavy-duty EDT 1232 teleprinter and other high-speed printers isn't much of a contest.

The EDT 1232 weighs in at 60 lbs. more. As a result, it can operate on a grueling twelve-hour-per-day cycle. That type of continuous operation separates the heavyweights from the lightweights.

And it's fast on its feet—permitting an effective throughput of 120 characters per second. Being tough and nimble makes the EDT 1232 ideal for handling your computer-generated printouts on its 132-print position carriage.

In four rounds you can discover why the EDT 1232 is the champ.

Round 1: Closed-loop buffer.

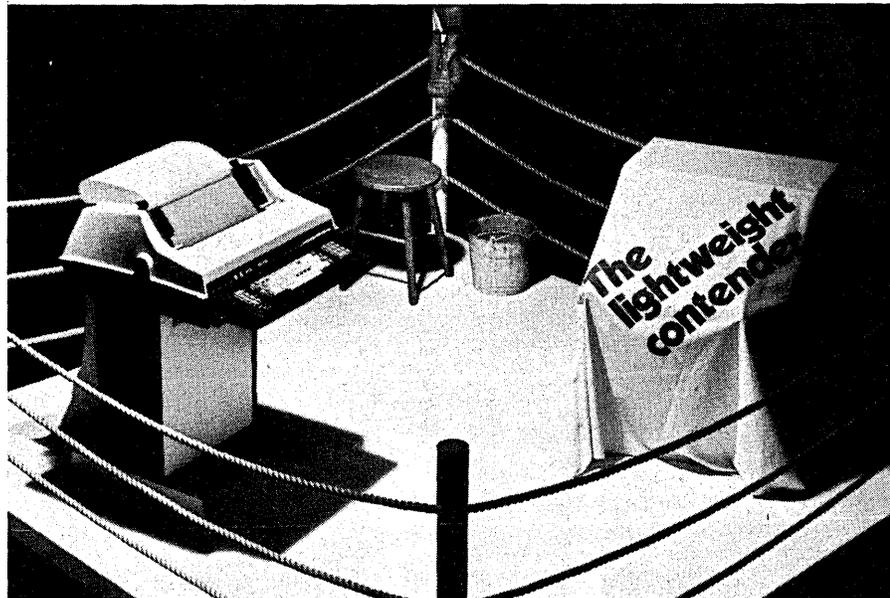
One feature that makes the EDT 1232 a top contender is its 1,024-character, closed-loop buffer. It automatically signals your computer to stop transmitting once its buffer is filled. This way, you won't lose data.

And the buffer automatically signals the computer when it is ready for transmission.

Round 2: Print quality.

Because the EDT 1232 gives you fully formed characters instead of a series of dots, your printouts are more legible. The printing mechanism punches out clear characters, but never jabs holes in the paper on multiple copies.

And like a smart heavyweight, the 1232 pauses between rounds. Its idle line motor control preserves



Our heavy-duty EDT 1232 teleprinter has 60 lbs. more muscle than other high-speed printers.

motor and ribbon life by shutting off when data is not being received.

Round 3: Flexibility.

Our heavyweight also can adapt to a task with a variety of configurations. It is available as a keyboard send/receive (KSR) or as a receive-only teleprinter.

For preparation, editing and local storage of high-volume data, we offer the KSR with our Smarts™ terminal controller and disk unit.

For low-volume applications, the KSR is available with our magnetic tape cassette buffer.

And we offer more than 100 options for your system design needs.

Round 4: Nationwide service.

Like all the terminals in our product line, the EDT 1232 is

backed by our Termicare™ system, a centralized customer-support service, and our nationwide organization of service centers. Customers can report a problem by calling the Termicare Center toll-free. It has a complete history of each terminal stored in its computer and the analysts and equipment to test each terminal remotely.

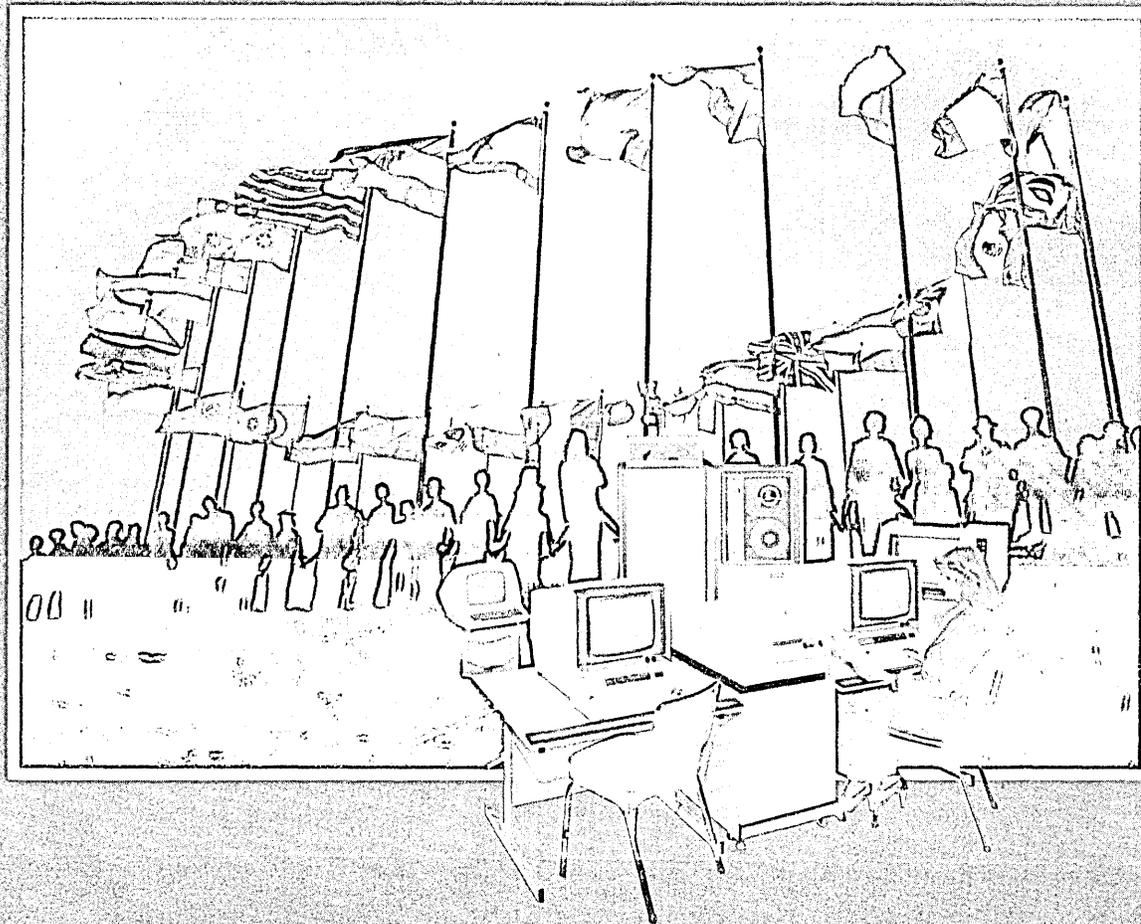
This diagnostic service means that many terminal failures are corrected by Termicare analysts without a service engineer's visit.

For more information on the EDT 1232 teleprinter, or for a copy of our free product catalog, call Bob Roth toll free at 800-631-7050. (In New Jersey, 201-529-1170.)

Or write him at Western Union Data Services, 70 McKee Drive, Mahwah, N.J. 07430.

Western Union Data Services.

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It means "uptime," not downtime. While others are bringing in servicemen, you are beating deadlines. With Autologic APS-19/TFMS (Text and File Management System), you will maintain high performance and cost-efficiency while increasing your document processing capability.

It means dependable customer support. Autologic provides maintenance programs tailored to your needs — and 15 minute contact with a qualified Autologic Customer Engineer, day or night.

To find out more about what Autologic can do for you, visit our booth, #2141, at Graph Expo '79, Chicago. Or write or call us directly.

Because, when it comes to product dependability—

Autologic leads the way.



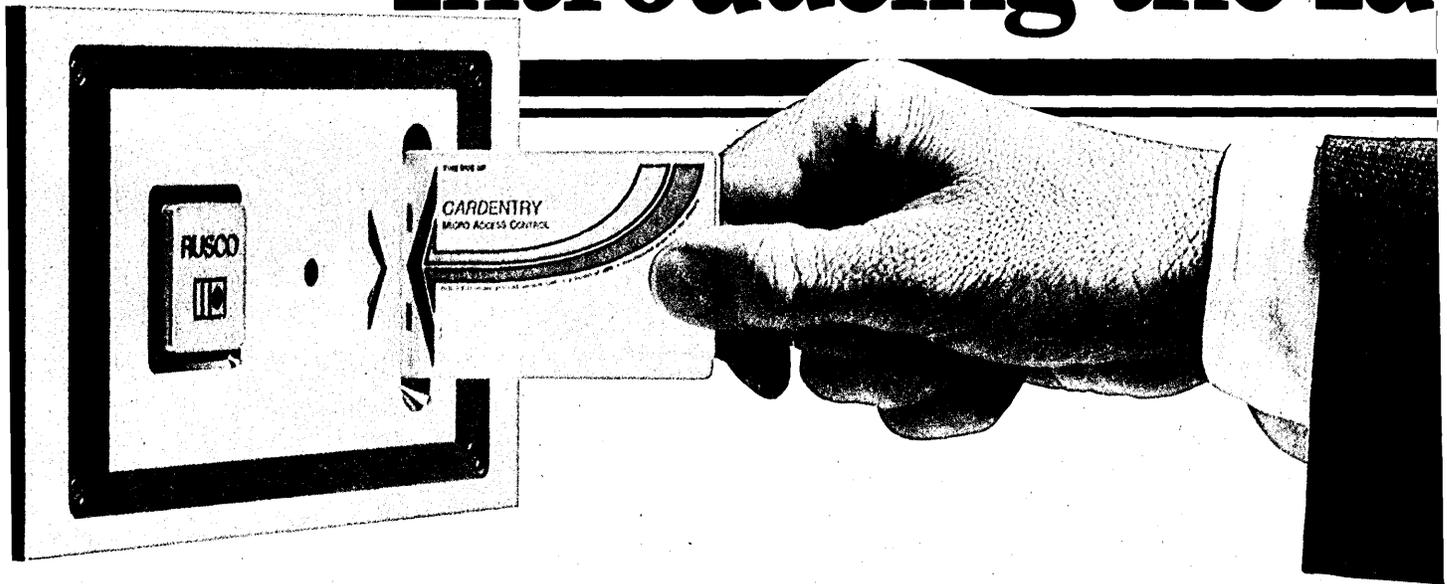
AUTOLOGIC, INCORPORATED

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A Subsidiary of Volt Information Sciences, Inc.

CIRCLE 28 ON READER CARD

Introducing the Id



It brings accounta

From the moment your employees entered the front gate until they left for home, they've always been on their own.

And no matter how dependable they were it's been almost impossible to hold them accountable for their actions and their whereabouts.

At Rusco Electronic Systems, we know all those accountability problems all too well.

And we've eliminated them.

The Identification Network.
When accountability counts.

Until now, no single electronic system could let the right

people in, keep the wrong people out, and give you a detailed record of who, what, where and when.

Accountability was non-existent. But the Identification Network from Rusco Electronic Systems is an amazing new system that makes each employee accountable for access to any room or piece of equipment. Through your facility.

It monitors and reports employee whereabouts and actions. Completely. And gives you an accurate, immediate record of who, what, where and when.

The simple fact is, you can't make knowledgeable business deci-

sions without that knowledge. And the Identification Network gives you all the information you need to make changes that save money.

Accounting for the heretofore unaccountable.

The Identification Network gives you accountability for people and facilities that you never thought possible. In fact, now basic data entry is possible anywhere.

For instance, you can control the locking and unlocking of doors on a pre-programmed time schedule. And

control momentary openings for authorized employees.

Parking lot entrances and exits can be tied

into the Identification Network. So you can always find out if an employee is on the premises.

You can account for use of the copying machine and know how many copies each employee makes.

You can create an electronic time and attendance log of your employees' ins-and-outs for automatic payroll processing.

Identification Network.

Security to your facility.

You can tell who's taking gas from the company gas pump. How much they're taking. And when.

You can even restrict after hours elevator use. For certain key people and certain floors.

Those are just a few examples.

The truth is, our customers are constantly coming up with money-saving control applications that we never dreamed of.

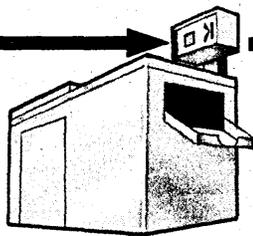
How the Identification Network works.

Each of your employees is issued an Identification Network EntryCard™ with its own personalized code. Each room or piece of equipment that requires

accountability has a single, compact CARDENTRY™ reader.

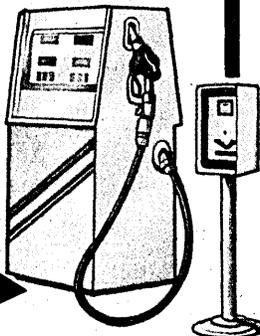
You simply tell the Identification Network which employees are allowed into each room and which employees are authorized to use each piece of equipment.

If someone attempts to enter a room or use a piece of equipment that's



off limits to them, the door will not open or the machinery will not work.

What's more, a central printer will immediately tell your security people that an attempted unauthorized entry has occurred, where it occurred, and what time.



It's that easy to account for (and control) unauthorized access and activities.

And that easy to save money.

The most important control of all.

That, of course, is the ability to control losses.

Until now, that has always been as realistic as perpetual motion and the Loch Ness Monster.

But the simple fact is, if you can account for detailed activities in the areas where you lose money due to theft and misuse of materials, machinery, and information, you can cut those losses dramatically.

And in the final analysis, that's exactly what the Identification Network does.

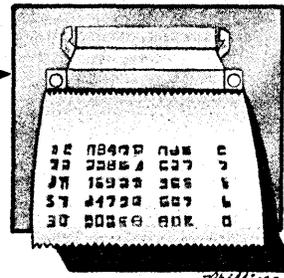
It saves a lot of money.

In a lot of places.

Call or Write:

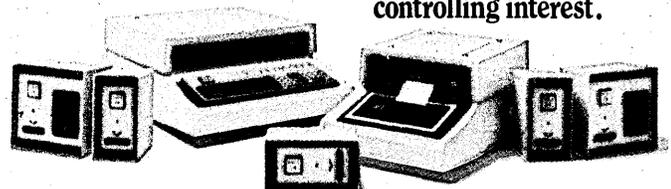
Rusco Electronic Systems, 1840 Victory Blvd., Glendale, CA 91201 1-800-528-6050 ext. 691. In Arizona,

1-602-955-9714, ext. 691.



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We give you controlling interest.



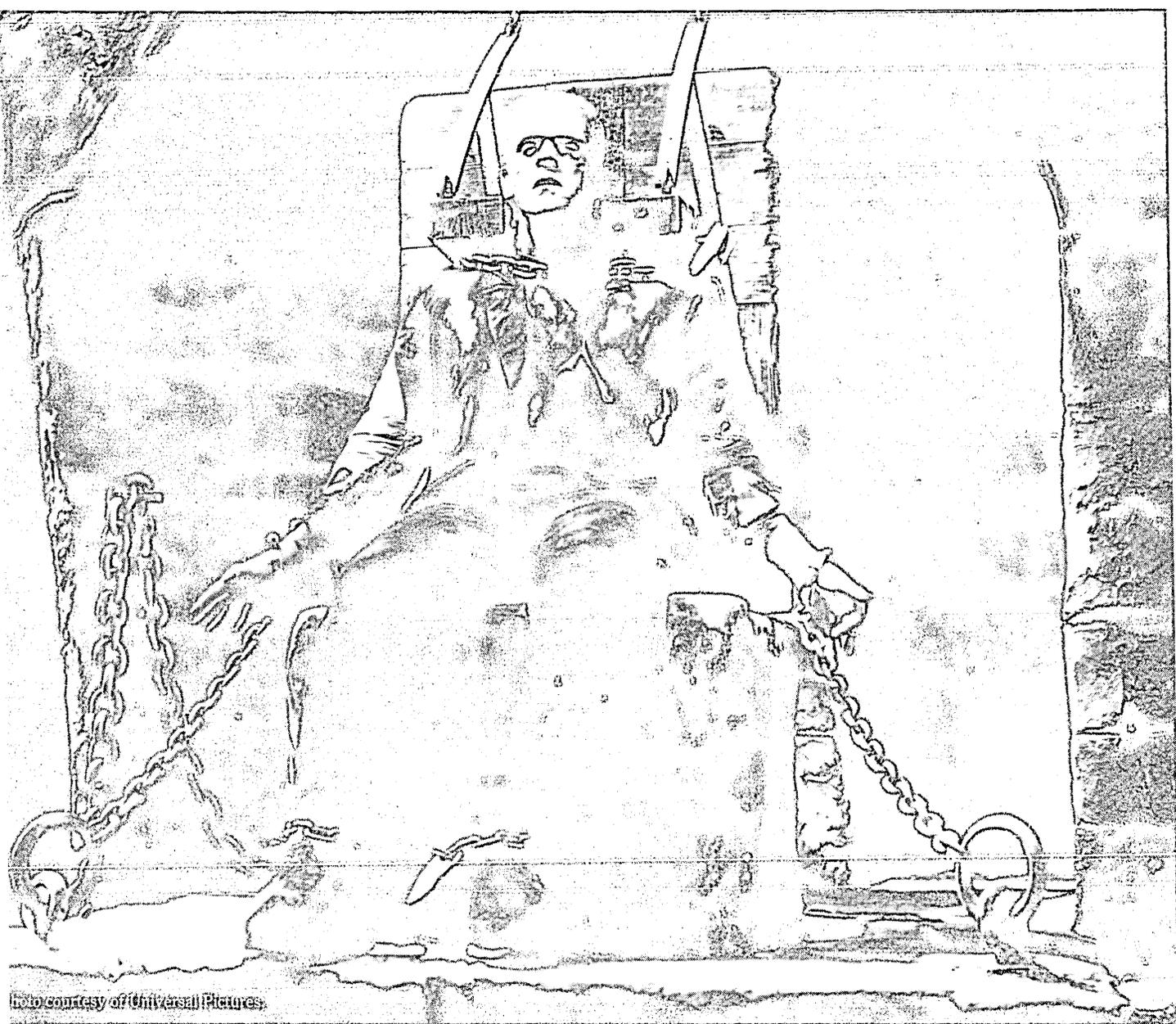


Photo courtesy of Universal Pictures.

CalComp's mini-peripheral sales reps won't ever tie you down to outdated equipment.

Without CalComp in the picture, finding up-to-date peripherals for your DEC or Data General mini can be a monstrous problem.

Because choosing the lesser of two evils is like having no choice at all.

On one hand, you can shackle yourself to peripherals with nameplates that match your mini's.

On the other hand — and like over two-thirds of all DEC and DG-users — you can try digging up some better performing peripherals on your own.

Trouble is, you're apt to uncover a lot more frightening problems in the process. In vital areas like equipment selection, price, delivery, service and support.

Unless, of course, you call CalComp first.

We can provide you with some of the best performing, most reliable DEC and DG-compatible peripherals on the market today.

We can also offer you a selection of peripherals — including 8 line printers, 4 magnetic tape subsystems and 8 disk drives — that's unrivaled by any other single supplier.

Better yet, CalComp mini-peripheral prices won't make your hair stand on end. And our delivery schedule won't keep you in suspense. It's typically 30 days, ARO.

Some final comforting thoughts. All of our service offices are 100%

company-operated. And every peripheral we sell is backed by CalComp's "Maintenance Alert System" service.

Which means you can count on extra on-site help — extra fast — whenever there's a major problem.

So call Roy Davies at (714) 821-2011 and find out why you shouldn't be caught dead with anything less than the best.

When it comes to DEC and DG-compatible peripherals, the horror stories stop right here.

CALCOMP

California Computer Products, Inc.
2411 W. La Palma Avenue, Anaheim, California 92801

CalComp mini-peripherals: Because who knows what evil lurks?

"NCR's VRX is the best software product I've seen," says Stan Trawick of Bassett-Walker.

TRAWICK:

When we went to VRX (NCR's Virtual Resource Executive), our work-scheduling problems simply disappeared. Now, we run what we want to run when we want to run it. It is just a simple statement, but it makes a fantastic difference in the computer room. VRX is the best software product I've seen.

NCR's JOE KEPLEY:

VRX really takes the pressure off your operator. It will actually run up to 35 jobs at one time. It dynamically allocates memory and other resources.

It oversees virtual memory swapping. It watches for memory thrashing and program loops. And adjusts the job mix to eliminate them, if they occur.

TRAWICK:

And VRX gives us Online Program Development, a feature that has increased our programming efficiency tremendously. Recently, I received the print-out produced by a modified program just two hours after I asked for the programming change. That's fast. Before VRX, we'd have needed at least a day.

NCR's KEPLEY:

TRAN-PRO (NCR's transaction processing software) has helped your programmers, too.

TRAWICK:

That's an understatement. When we decided we needed a sophisticated communications system,



Stan Trawick (right) is computer systems manager of Bassett-Walker Knitting Co., Inc., Martinsville, Va. Joe Kepley is an NCR district manager.

our programming staff had no communications background. So we were looking at a period of intensive programmer education. And that would have been followed by another lengthy period devoted to the development of basic communications software. With TRAN-PRO, our staff was able to move through these two stages rapidly and get directly into the application programming.

NCR's KEPLEY:

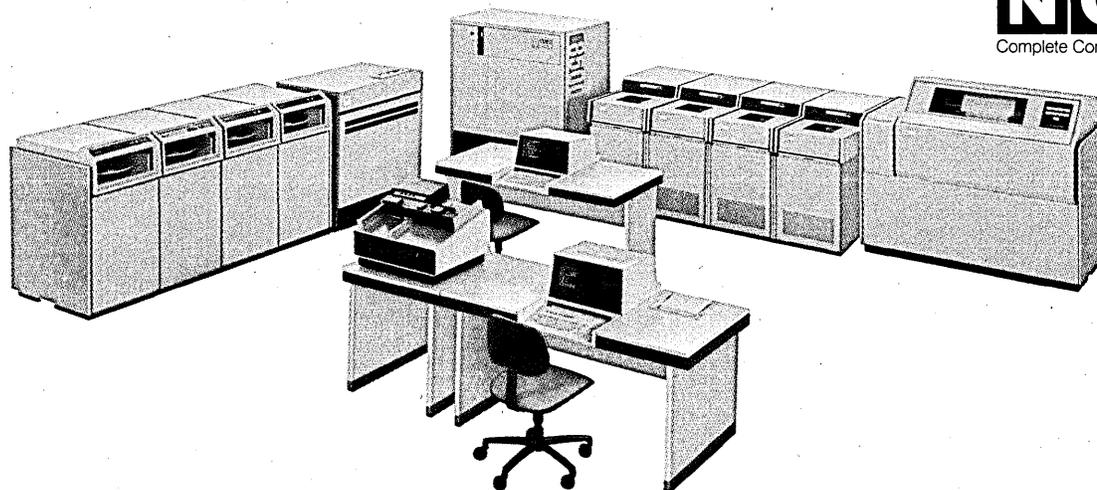
So you were able to sidestep the communications complications as you moved directly into appli-

cation programming. Because TRAN-PRO handled the communications for you.

TRAWICK:

Yes. And it is all part of a larger picture. Our competitive edge in the sportswear industry is our ability to respond quickly to our customers. Because we are online, we can answer a customer's inquiry instantaneously. And we can ship an order within 24 hours of receipt. VRX and TRAN-PRO are real aids.

In the NCR office nearest you, there is an account manager like Joe Kepley who specializes in your industry and knows NCR systems, including VRX and TRAN-PRO. Learn how an NCR system can help you. Phone him at the local NCR office. Or write to EDP Systems, NCR Corporation, Box 606, Dayton, Ohio 45401.

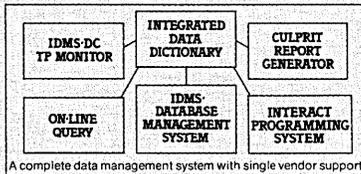


NCR
Complete Computer Systems

IDMS 5.0...The Only High Performance DBMS.



Release 5.0 of IDMS is the only DBMS designed to meet the high volume tele-processing requirements of the future. Initial users have reported dramatic savings using IDMS 5.0.



Throughout a rigorous testing period in over 100 user environments, IDMS

5.0 outperformed expectations:

- terminal response time reduced up to 80%.
- job execution time decreased up to 50%.
- data processing department savings in time and resources.

The completely new IDMS 5.0 architecture accounts for these benefits. Here are some of its features:

- fully reentrant and multi-threaded
- automatic recovery facility with automatic rollback.
- improved journaling and archiving.
- increased integrity through concurrent update prevention.

Learn why our users are saying, "exceptional," "impressive," "fantastic" after using IDMS 5.0 and its new features. For further information call or write Cullinane Corporation, 20 William Street, Wellesley, Mass. 02181. (617) 237-6600.



Database: Cullinane

CIRCLE 18 ON READER CARD

Extended DOS/VS

Still ahead of

DOS/VS Extensions

12-PARTITION SUPPORT

- Permits operation of up to 12 independent partitions, BG, F1 through FB.
- Up to 240 Programmer Logical Units *per* partition

VARIABLE PARTITION SUPPORT

- Dynamically varies partition allocation
- Primary purpose is to maximize storage utilization and the number of jobs which may be executed with the fixed amount of main storage available
- Minimizes fragmentation
- Combinations of fixed and variable partitions allowed
- Inactive partitions do not require memory

EXTENDED OPERATOR CONSOLE SUPPORT

- Multiple outstanding console reads
- Console spooling support
- Message routing facility
- Programmable function keys
- Message pre-answer capability
- End-of-job logging
- System status displays
- Forward/Backward paging
- 1052/3210/3215/3270 support

EXTENDED PROCEDURE LIBRARY SYSTEM

- Logical Test and Branch Facility
- Nested procedures
- Parameter substitution
- Permits cataloging of JCL on a
 - Partitioned Data Set
 - Private Source-Statement Library
 - System Source-Statement Library
- Conditional execution at execute time

PARTITIONED DATA SET SUPPORT

- Partitioned Data Sets contain all forms of data which would normally be stored on cards
- Re-use of space when a member is deleted without requiring a condense
- Data is cataloged with full blank compression

AVAILABLE TODAY

WITH A YEAR'S EXPERIENCE BEHIND IT

- 12 Partitions
- Variable Partitions
- Partitioned Data Sets
- Cataloged Procedures
- Extended Procedures
- Extended LUB Support
- Extended Operator Console
- Extended Spooling Facility
- Extended RJE Support
- Extended Shared Spooling Facility
- Disk Space Management System
- Tape Management System
- Automatic IPL
- Accelerated Linkage Editor
- Device Equates
- Resource Optimization
- Documentation Text Editor
- Cross-Partition User COMREG
- Shared SYSRES
- Transient Monitor
- Automatic Volume Sensing
- Fast Disk Utilities
- Abbreviated Dump
- CPU Balancing
- Resident Transients
- Job Accounting Interface
- Job Accounting Programs
- System/360 Support

Please send full information about EDOS/VS ¹¹

Company _____ CPU _____

Name _____

Title _____

Street _____

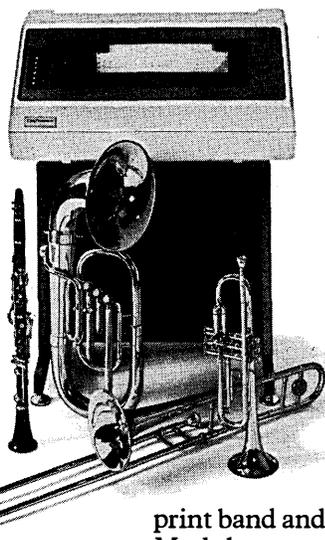
City _____ State _____ Zip _____

Phone _____

 **THE COMPUTER
SOFTWARE COMPANY**

6517 Everglades Drive, Richmond, Virginia 23225
Telephone: 804/276-9200, Telex: 82 83 94

There's no drum in Centronics' band.



Centronics' 6000 Series Band Printers have banished the drum. Forever. That means important savings and simpler operation for you.

An inexpensive changeable band lets you change character sets or type in seconds without disturbing paper or ribbon. No special tools. No expensive drum. No special service calls.

Centronics' horizontally moving print band means crisper print quality and perfect vertical alignment. You get uniform density control regardless of paper stock.

Band printers are faster and less expensive to service too. A single motor drives both the

print band and cassette-enclosed ribbon. Modular construction combined with simplified design minimize downtime. And service is available at more than 100 locations throughout the world.

But that's not all. Centronics' band printers cost less. In fact, thousands of dollars less than comparable drum printers.

Operating flexibility. Easier servicing. Crisper print. Lower cost. Centronics' band printers beat the drum everytime. For information write or call your local authorized Centronics' distributor or Centronics Data Computer Corporation, Hudson, New Hampshire 03051, (603) 883-0111.

CENTRONICS®
The Band Leader



LETTERS

SERIES/1s SPOTTED

Let me say I am concerned about recent Series/1 items in January's Look Ahead.

For example, your headline asks "Who's Really Seen a Series/1?" The answer: all General Systems Division employees engaged in selling, installing or servicing it, as well as our customers, who use Series/1s productively in their business operations.

Series/1 is a new business opportunity for IBM. Our commitment to it is reflected by more than 60 programming and hardware enhancements over the past two years.

In our estimation Series/1 is a successful product. Our users give it high marks. As to its sales success, Series/1 had its best business month in December and that momentum is continuing into 1979.

In brief, Series/1 is an outstanding small system and I would welcome the opportunity to demonstrate to you and to members of your staff what it can do.

W.G. MOUNT
Director of Communications
General Systems Division
IBM Corp.
Atlanta, Georgia

The Systems Guild, Inc. specializes in turnkey systems for small business accounts. For the past nine months, we have worked extensively with IBM Series/1. We currently have four Series/1 systems under contract in various stages of completion, utilizing the EDX Operating System.

My personal experience contradicts your statements that imply that IBM personnel are not taking this product seriously. We work continuously with two General Systems Division branch offices as well as with Regional staff, Boca Raton (the manufacturing location) and Atlanta General Systems Division Headquarters. We find vigorous, enthusiastic support for Series/1. As your column reports, there has been a continuous stream of improvements in both hardware and software.

One of our installations, on Wall Street, includes a Datum tape unit. Both IBM and Datum have fully supported this configuration under EDX. I find no unusual gap in understanding or support of this equipment.

Finally, it is easy for any IBM exec-

utive to see a Series/1. Every local General Systems Division branch in this area has at least one installed for demo and predelivery development. While the marketing concept of the Series/1 allows less support than the traditional product line, it is far from the orphan your comments suggest.

CHARLES B. CHRISS
President
The Systems Guild, Inc.
Briarcliff Manor, New York

LINKING DIFFERENT MACHINES

Take a large computer center (IBM 3033, 158s, 145s); manufacturing plants with DEC 11/34 and 11/70s; research and development locations with Novas, and graphics equipment. Stir well and then add message switching, word and text processing, RJE, a fair amount of TSO, IMS, CICS. Season to taste with some of the more thoughtful technological forecasts, which this journal's readers will be

only too well aware of, and what do you get?

A problem no manufacturer is going to solve.

What we want to do is to be able to link computers from different suppliers that exist on one manufacturing plant site through to our mainframe center, or to data and programs that could be resident at another site. This implies that a terminal attached to a DEC 11/70 could establish a link to an IMS file on the IBM 3033, and initiate a task or retrieve a file. To this end, we would be happy to limit the number of terminal protocols. At some later stage the same terminal might be required to output data which had been routed to it after a task had been processed by a computer at another location.

Of course, one solution is easy. Throw away all your existing equipment (and your freedom of choice in the future), and install SNA or DECnet. It is, however, too late to do that even if we



H. M. Eisen

"Mr. J. Livingston Blackwell
Vice President and Treasurer
Donnawell, Ltd.
Avenue of the Americas
New York, N.Y. 10036

Dear Jason:

Sumer is icumen in,
Lhude sing cucca..."

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What about service ?



Should I buy?

Lease?

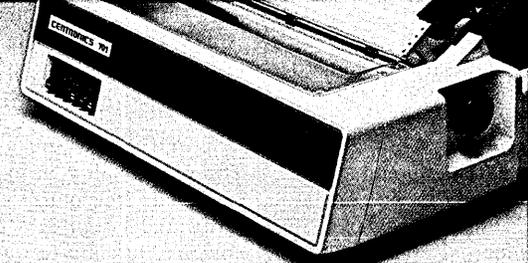


Ear-Siegler?



CRT's ?

Centronics?

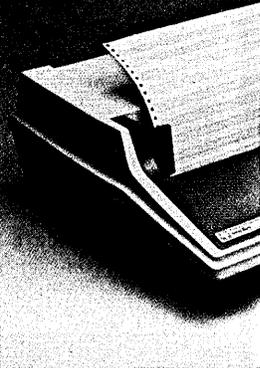


TTY ?

Hazeltine?

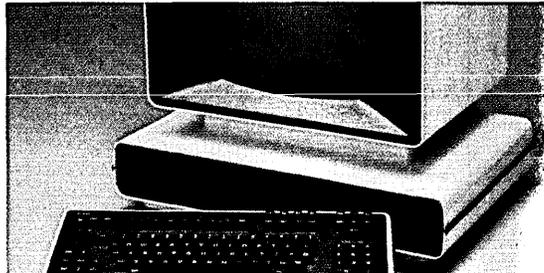
How can I reduce my costs ?

What can renting do for me ?



DEC ?

Texas Instruments ?



We'll put together a package of I/O solutions that works best for you.

It's Friday. You were looking forward to the weekend.

But a couple of your CRT's have whined and stopped in unison. By lunchtime, your 200 CPS printer began to crawl along at 10 CPM. Then suddenly, in comes the biggest stack of unprocessed data you've seen in weeks.

What's the solution?

Get on the phone to Electro Rent fast. We're in the solution business. One of our I/O people will quickly and expertly evaluate your best hardware alternatives. He'll determine whether renting, leasing or buying new equipment is the most efficient plan for you.

Then, to complete the package, he'll see that you get the name-brand hardware and service you need, in

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Call, toll-free **800-423-2337**.
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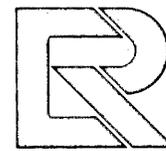
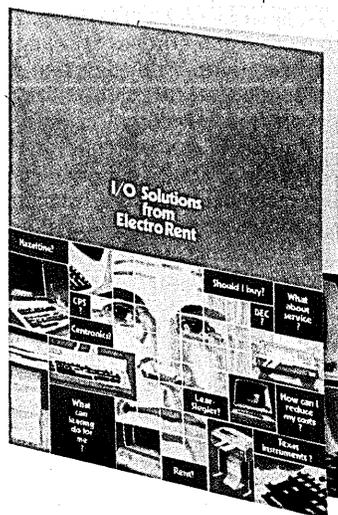
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LETTERS

wanted to, as our mixture of equipment is here today.

There must be DATAMATION readers who have a similar problem and who have solved, or are in the process of solving it. What's your approach?

MICHAEL D. P. COLIN
Manager, Advanced Systems
British Leyland Cars, Ltd.
Redditch, Worcestershire,
United Kingdom

HE HAS SIMPATY

"The Revenge of B B Simp" by C.W. Petersen (December, p. 152) was not only cleverly done but had a definite message for those who still believe that the typical skills inventory is the answer to their manpower planning and career development problems.

Having been involved in many such programs over the past 15 years, I can attest that most skills inventories are overrated. While brilliant in concept, most of them never really work in actual practice. This is not so much because the system is faulty as that personnel people and line management don't know how to use them. Furthermore, asking an employee for his or her skills and relevant work experiences based upon a fixed vocabulary of terms can only lead to spurious results at best. Thus "GIGO."

Petersen's example of the tribulations of Mr. Simpson are largely technical problems which in time could be corrected. However, no one can really calculate the opportunity loss. It took from June 23, 1978 to August 31, 1978 to clearly reaffirm that they were still back at "Square 1" in the manpower selection process. One can only conjecture as to the possible impact of this type of situation on the organization: A territory left unattended, a major project not adequately staffed, a government contract the firm cannot respond to, a disgruntled employee passed over for promotion, filing an employment discrimination charge, etc.

The bottom line is that the software vendors are creating a new market for human resources management consultants. Clients and contractors alike should learn before it is too late that the answer to user requirements lies not so much in the system itself but in the planning, design, and management support such a system gets. So long as the contractors/vendors refuse to recognize this, consultants will be in business.

VINCENT R. CERIELLO
President
VRC Consulting Group Inc.
Princeton, New Jersey

CORRECTION

DATAMATION erred in its December 1978 issue (p. 59) in reporting on a comment that I made at the DPMA annual confer-

ence in New Orleans regarding IBM's internal data communications network. Rather than saying that the network is composed of "400 million eight baud lines," I said that it is composed of approximately "400 4800 baud lines crisscrossing the United States."

LILA B. PERRY
Manager, Data Network Control
IBM Corp.
White Plains, New York

SECURITY A RESPONSIBILITY

Your News In Perspective story on security software (December, p. 62) presented the views of Shawn McLaren on the adequacy of present control packages. McLaren stated that a "semblance of security" would be good enough in many companies because it would satisfy auditors who required a security product to be in place. He further stated that "most auditors aren't capable of distinguishing between a really good security product and one that just says it is a security product."

I submit that it does not matter what the auditor believes—it is still management's responsibility to provide adequate system security. In these days of increasing corporate liability, any manager who improves control only at the request of an auditor is destined to find himself in court defending his shortsightedness.

WAYNE SOCHA
EDP Auditor
Valley National Bank of Arizona
Phoenix, Arizona

ANOTHER VIEW OF PARADISE

Project Paradise is not, as stated in the September Focus on Citibank ("Project Paradise Comes Down to Earth," p. 104), a "program to decentralize . . . data processing operations," although that happens to be the systems approach we took to support the structural changes we made. Rather, it is a customer-oriented program to decentralize our organization and management structure, yielding a completely new approach to planning, developing, marketing, and delivering banking services to corporate clients.

When I first read the story, I was prepared to overlook the fact that this fundamental misunderstanding distorted what was basically a positive view of our achievements. However, a number of people we deal with—vendors, customers and others in the bank—have expressed concern about the story's implications, so I felt I should set the record straight.

Under Project Paradise, the decentralized banking service units mirror the market-oriented organizational structure of the corporate lending groups. Thus, the services relationship can be planned and managed jointly with the credit/account management relationship. We have dedi-

cated small units to servicing specific customer segments, differentiated according to size, industry or geographical characteristics. Moreover, we are structured to manage complete transaction flows (thus clearly defining the locus of accountability for customer service) rather than separately managing the functions that constitute those flows. Data processing is one of the many functions that are broken down into dedicated units and integrated with the line managers' overall service responsibilities. As a result, we improve our capacity both to tailor services to different customer needs and to control the delivery of those services.

We should point out, then, not only that Project Paradise has *not* been "relegated to the back burner," as Mr. McCartney suggests, but that it has paid off handsomely in terms of customer service and continues to evolve to yet lower levels of decentralization.

In a way, Mr. McCartney's approach illustrates one of the chief problems data processing people encounter in the business world—the tendency to look exclusively at functional issues while failing to perceive the underlying business issues. As a result, a superbly optimized processing function may be offered as a solution to a problem that really calls for an integrated approach to basic structural and management changes.

DATAMATION would serve its readers well by knowledgeably addressing, in articles of general management scope, the core business issues that provide the context for data processing decisions. Perhaps more dp managers would learn how to come in from the periphery of corporate management if they could read about the many situations in which computer efficiency is *not* the answer.

ROBERT B. WHITE
Executive Vice President
Citibank
New York, New York

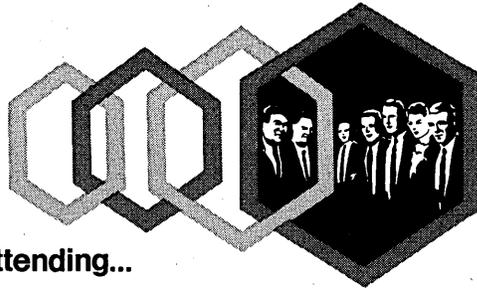
A STANDARD BY ANY OTHER NAME

Much discussion has arisen over an area called standards. Is this really an area that needs to be clearly separated from normal procedure and behavior? Is standards just another word for memos? Or perhaps it only applies to big books full of decisions made by the boss or his committees.

What is the real difference between standards and guidelines? What's the difference between standards and procedures? Maybe it's just a subtle distinction like the difference between an overview and an introduction.

Did you ever notice that while your English teacher told you that a good composition has an introduction, a body, and a conclusion, most books begin with a

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Course Objectives: To examine the different management problems found as an information system modernization project progresses from the requirement study, to the system development cycle, to the installation into the ongoing operational system.

Principal Topics: Strategic Planning Management; Systems Development Management; Distributed Operations Management.

Benefits Derived: In this course you will study a formal, structured methodology for reviewing computer applications in your company and then organizing, planning, and controlling their development and installation.

Who Should Attend: Managers, EDP systems users, business analysts, and systems analysts involved in the creation or operation of a management information system who want to expand their awareness of new, but tried-and-tested information management techniques.

DAY II: TECHNICAL MANAGEMENT...

examines **structured development methodology** based on the famous "Michael Jackson" program design technique.

Course Objectives: To examine proven and reliable ways of obtaining a well-structured system design that exactly meets user specifications and installing the resultant programs with minimal breakdowns and maintenance problems.

Principal Topics: Specification and Design Methods; Structured Program Design Techniques; Structured Testing and Quality Control.

Benefits Derived: This course will provide you with necessary knowledge of structured systems design, testing, and the installation of a computer system. The bottom line will be increased productivity in your operation—and decreased costs.

Who Should Attend: Technical managers, business analysts, systems analysts, and programmers who are considering the use of structured methods in designing a system that exactly meets user specifications.

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CIRCLE 121 ON READER CARD

LETTERS

chapter entitled Introduction, but seldom have a chapter entitled Body? Isn't it possible that "standards" is really a misused title that really should be supplanted when the book is written?

If a user comes across a standard in a paragraph entitled "How to test the IPL software," most likely he'll simply follow the standard without giving it any further thought. The important thing is that the standard be followed, not that it be identified.

To the person who wants to follow the standards, the best present is a means of putting the standard to work. To the person who is indifferent to standards, the best present is a book that takes a different approach. To a person who doesn't want to follow any standards, the best book possible is the worst book possible.

I would like to share a quote from Faulkner that only makes sense after several hours of careful pondering: "It's okay to be scared, but don't be afraid."

Now there's a standard all of us would follow, if only we understood it. Right?

TOM BERGERON
Normandy, Missouri

SEEKING TO PURCHASE IBM SOFTWARE

We were surprised to read in the November Look Ahead (p. 17) item "Should IBM Sell Its Software" that "IBM's response so far is that there's no demand from users that it do so."

For many years we at Voest-Alpine, one of the biggest dp users in Austria, with 80,000 employees, have been informing IBM that we want to "purchase" their program products (more precisely, to get a paid up, never-ending license), but IBM has only answered that this is not their policy and therefore not possible.

We asked the same question at a German GUIDE meeting in 1976 and got the same negative answer from IBM Germany.

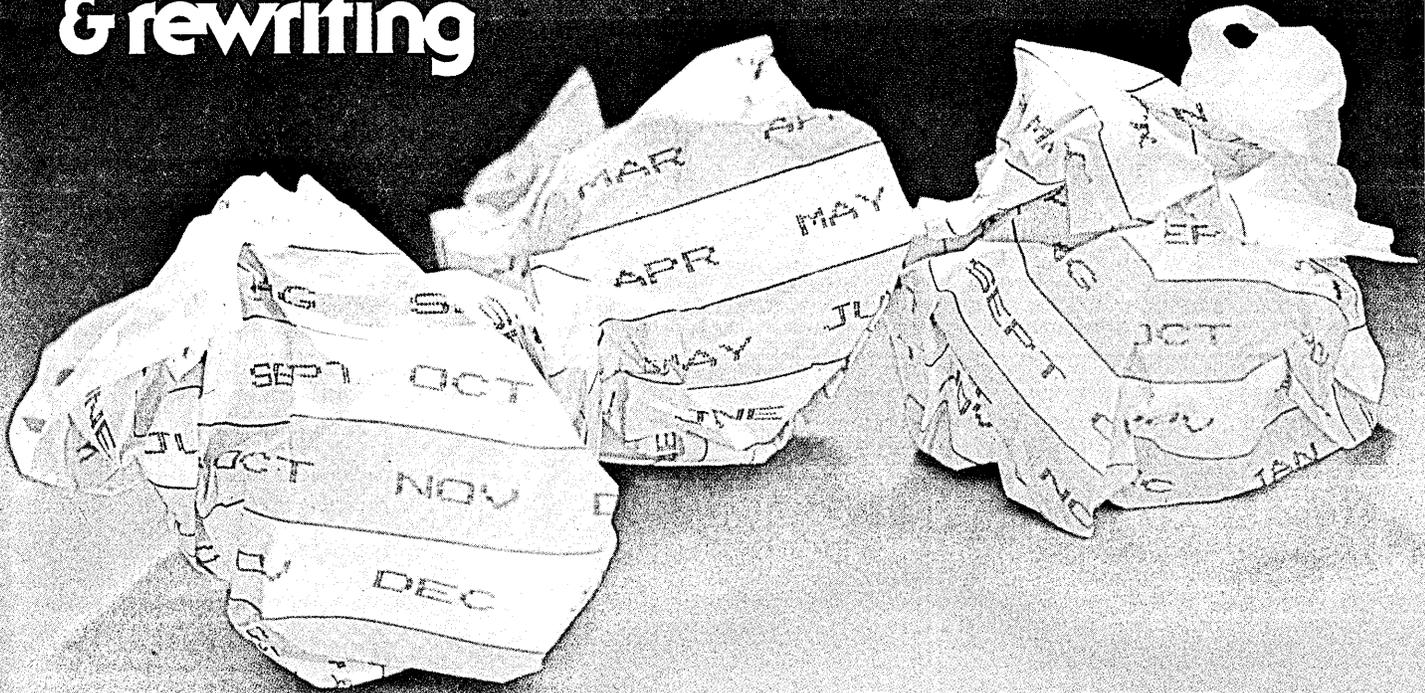
Recently we have obtained a survey from GUIDE stating that among more than 80 IBM customers in Switzerland the option to buy software from IBM was one of their higher priority demands.

As software is becoming a more and more important part of the dp budget, users should not stop asking IBM to sell its software. Not only would the purchase of software be less expensive than renting (the usual break-even point is 2-4 years), but users' long-term planning would be encouraged, chances would be improved for competitors with less financial power than the market leader, and as a consequence, software quality and price/performance ratio would also improve.

MSSRS. ZICH AND HILLBRAND
Voest-Alpine AG
Linz, Austria

*

70% of programming time is spent modifying & rewriting



RAMIS II[®] allows more time to create new systems

Recent studies indicate that, in order to keep programs current with environmental change, up to 70% of the efforts of a typical programming department are spent modifying or entirely rewriting programs that were done at least once before.

Even though the average program has a life expectancy of only 14 months.

How can you get the time to develop productive new systems?

RAMIS II.

The data independence built into RAMIS II dramatically reduces time spent on maintenance. This allows more time to create new systems.

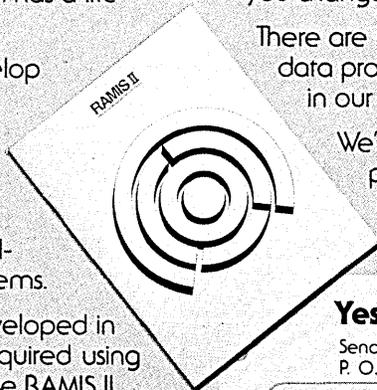
With RAMIS II, new systems are developed in no more than one-fifth the time required using conventional means. That's because RAMIS II is both a data base management system and a complete English-like nonprocedural language.

With RAMIS II, you just say what you want. You don't have to tell the computer how to produce it.

A simple request gets you information from anywhere in the data base. And, you don't have to make time-consuming application changes every time you change the data base.

There are 175 ways RAMIS II can improve your data processing. We'd like to tell you about them in our free RAMIS II factbook.

We're Mathematica, a technical consulting, policy research, and computer software firm involved in the improvement of decision-making techniques.



Yes! I'd like the free RAMIS II Factbook.

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The brains behind RAMIS II

CIRCLE 7 ON READER CARD

HIP presents visual aids

Now, with a few simple keystrokes, you can transform those formless computer printouts into clear, helpful charts and graphs.

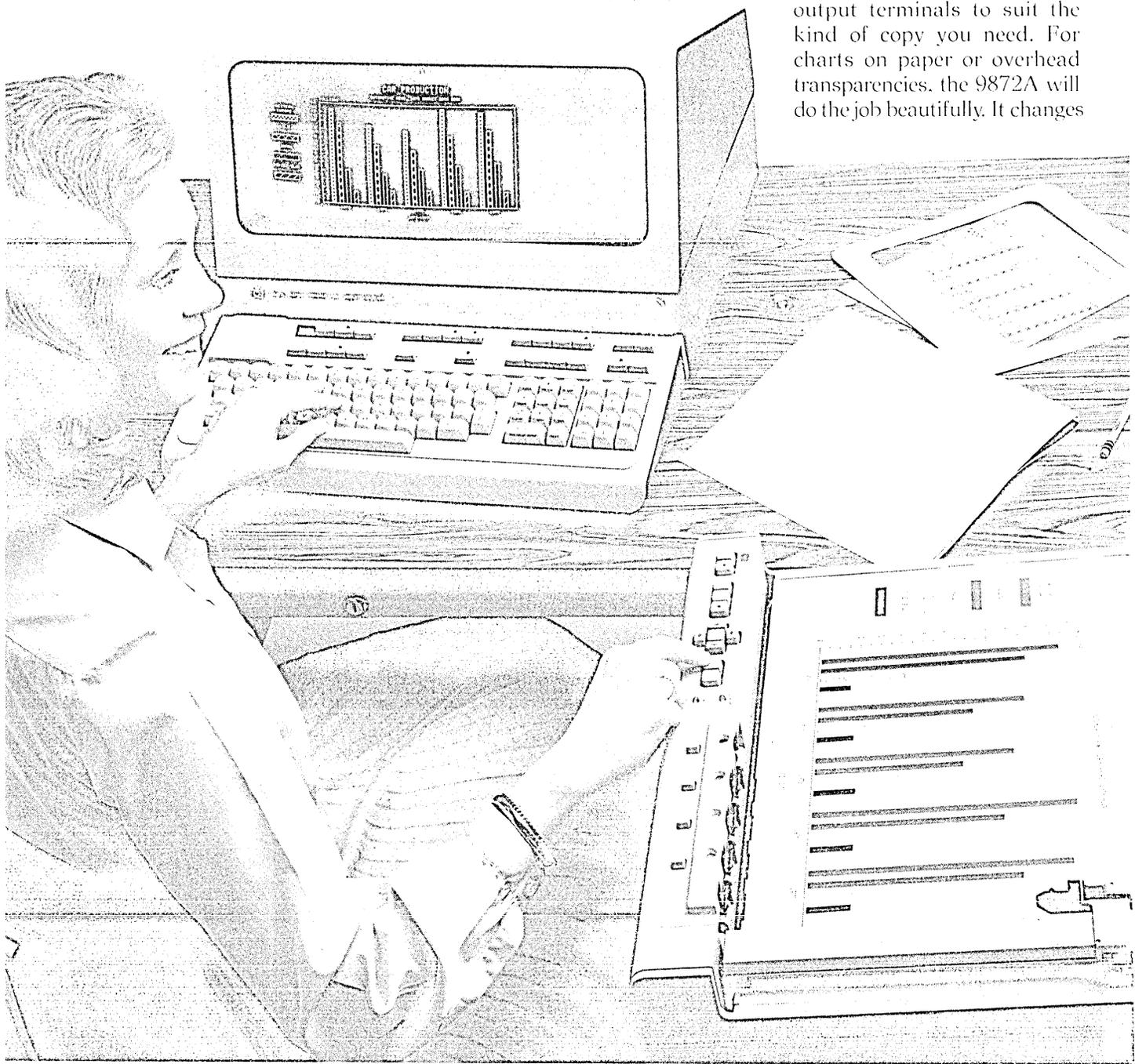
All you need is a Hewlett-Packard Graphics Workstation. It's built around our 2647A, a highly intelligent but moderately priced Graphics Terminal that lets you plot tabular data as a bar graph, pie chart, linear or logarithmic line graph. All without writing any software.

Then, if you want specially formatted data

from your CPU, you can program the 2647A in BASIC or AGL, our high-level graphics extension of BASIC language. (If you don't need all its features you may opt for our lower cost 2648A.)

Four easy ways to get hard copy.

Now you pick your output terminals to suit the kind of copy you need. For charts on paper or overhead transparencies, the 9872A will do the job beautifully. It changes



for our visual age.

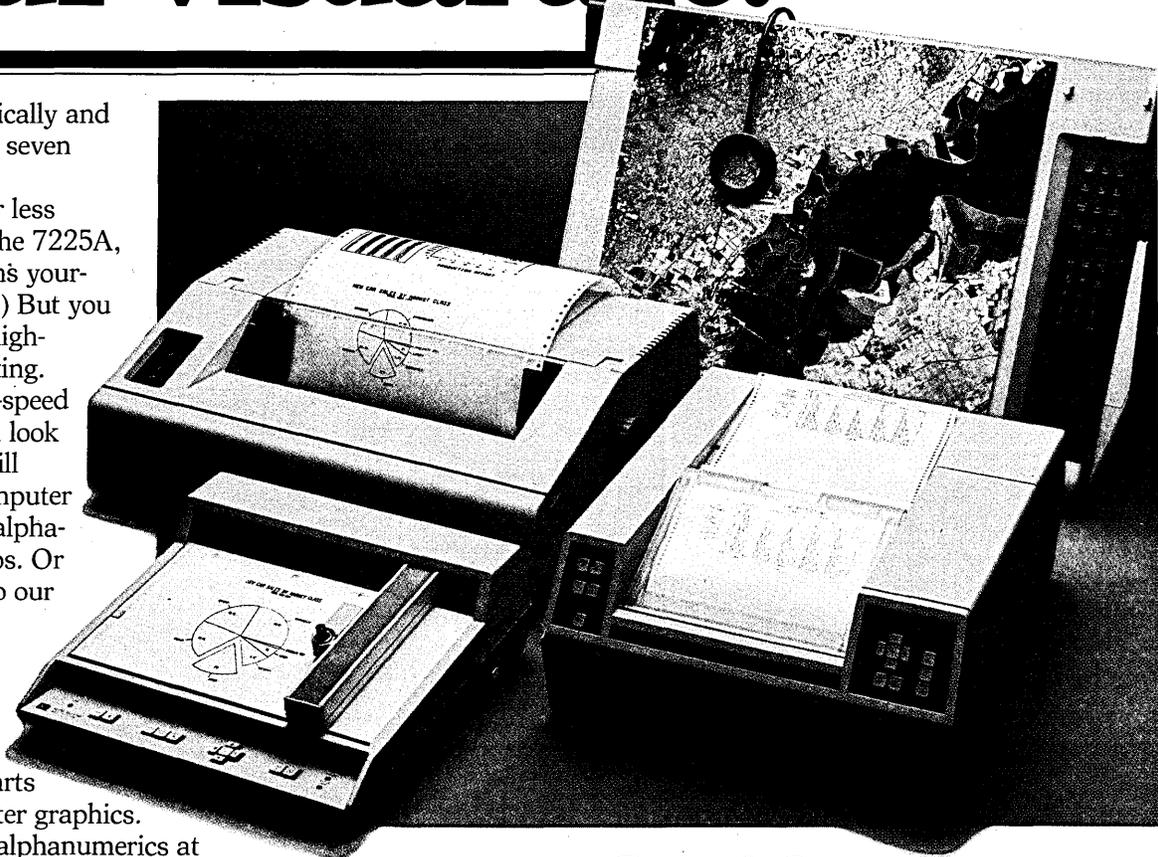
four pens automatically and will give you up to seven different colors.

With our less expensive model, the 7225A, you change the pens yourself. (A simple job.) But you still get the same high-quality vector plotting.

For high-speed graphics printouts, look at the 2631G. It will double as your computer printer, delivering alphanumerics at 180 cps. Or you can hook up to our extremely versatile 7245A thermal plotter/printer, which provides vector-drawn graphs and charts

as well as raster graphics.

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We've found a way to put all kinds of documents into a computer that were hard to store before. Things like photographs, X-rays, maps, strip charts and engineering drawings.

The 9874A Digitizer converts all this easily into X-Y coordinates for your computer or for local storage in the 2647A Graphics Terminal.

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EDITOR'S READOUT

ANOTHER CONVENTION ... WHO NEEDS IT?

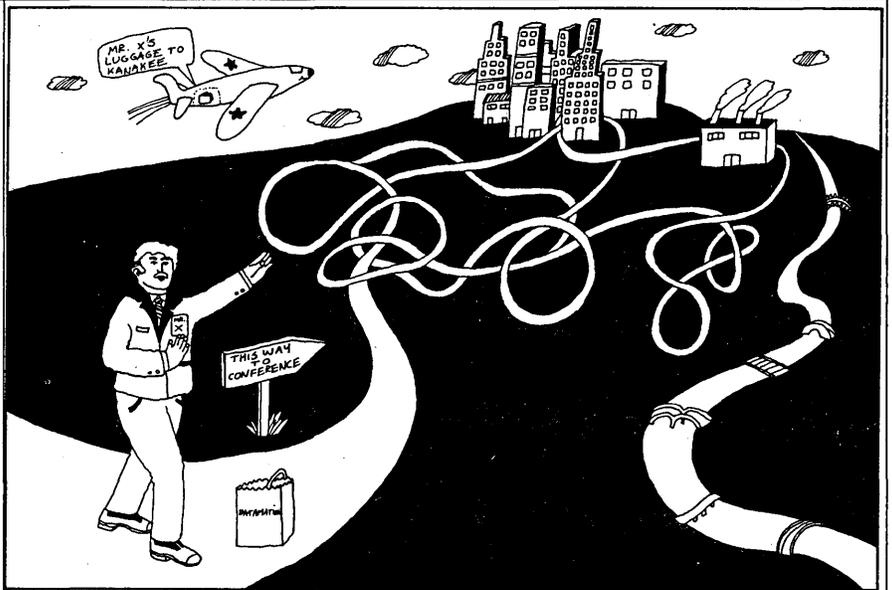
If you're feeling overly manic and would like a stabilizing touch of depression, we have a solution.

Find a copy of the 1979 Kaiser Engineers Planner. It's a marvelous 11x17-inch piece of paper upon which is printed, in jolly orange and purple, the entire year at a glance. Next fill in all the conferences that you really should attend to keep up with the industry and the demands of your job. Now contemplate your handiwork. That should do it.

If you've done your homework faithfully, you'll notice that every month has a conference, with the possible exception of August and December, when no one does anything anyway.

The thought of attending just one of these gatherings can numb the mind. Most require an airline trip to one of our ravaged cities. Traveling to the airport, checking in, being frisked electronically or manually, and sitting in a waiting room whose dinginess, distressingly duplicated in terminal after terminal, is enough to dampen the most effervescent spirit. And then the plane ride: the tv dinner tasting like tinfoil; the inevitable fat person next to you hogging the armrest; the crying kid behind you who smells funny; and the dread certainty that anything as large as a 747 has no right to be airborne. After surviving all of this you arrive at an NCC, an Info, an Expo, an Interface... the list seems endless. Your baggage has been lost, your stomach soured, and your nerves shredded. You're ready for the conference.

You endure an interminable wait to register; your reward is a badge which immediately begins unravelling the breast pocket of your 60% polyester, 40% wool



sports coat. DATAMATION shopping bag in hand, it is time to sally forth. And, on the whole, you'd rather be in Philadelphia.

Is it really worth it? Setting aside the creative justifications provided to your supervisor and accounting, what are the realities of conference going?

A goodly part of the time is chewed up in logistics: getting to and from the hotel; finding taxis; locating sessions and bathrooms; and, it seems, more and more frequently, tracing your lost suitcase that was sent to Kanakee for some reason known only to God and an anonymous airlines baggage handler.

More time is devoted to eating and drinking and recovering from eating and drinking. Rich foods and fine wines combine with jet lag to take their toll. Only a few of the most stalwart sip their Perrier and rise at dawn to run six miles before breakfast; their revoltingly bright eyes and brisk gait only add to the general malaise.

There is much aimless wandering from booth to booth with an occasional glimpse of new offerings over a sea of 60% polyester, 40% wool-clad shoulders, walking out of sessions that bear no resemblance to what was touted in the program, or sleeping in sessions that you're too tired to leave.

And so it goes.

By all quantitative measures, conferences are scarcely worth the pain. But that is not the true measure of a conference. For they provide insights, information, interaction and fellowship that cannot be gained any other way. They are our equivalent of the bazaar, the open market, and the social function is as important as the tutorial and commercial ones.

It would be nice if some of the same old faces giving the same old papers could be replaced by new faces with new ideas. And we might wish that all booth personnel were knowledgeable about the products they display. And that registration lines were shorter, the procedure streamlined, and that some part of the conference site could be set aside for multiple havens of rest and quiet where bedraggled conference-goers could sit and compare notes.

But these are all minor complaints; the human mind mercifully remembers pleasure and forgets pain. Because the few good moments outweigh the rest, we'll recover for a few weeks and then, once more, jump back on the treadmill. (However, help is in sight. On page 124 you'll find the advance program of the definitive computer conference, "The international Data Processing Bridges to the World Conference and Show." Having attended this, you need attend no other.) *



Dear Ma:

Vadic's new modems direct-connect to any telephone line: residence, business, WATS, leased... can yours?



The day of the truly portable terminal has arrived, thanks to Vadic. You see, Ma, Vadic has a brand new line of highly styled, low profile modems specifically designed for remote terminal users.

These modems direct connect to any dial-up phone, be it residence, business, WATS, behind a PBX...you name it. This means users will no longer have to rent your DAAs, saving them money and space.

Can your modems do this, Ma, or do they require the more expensive data lines?

Whatever the terminal, Vadic has the modem — 1200bps, 300bps, full duplex, half duplex, dial-up leased line. They're simple to install. Just unplug the phone, plug the modem into the voice or data jack, connect the terminal and start communicating. Putting it simply, Ma, Vadic's new modems combine the portability of acoustic coupling with

the performance and reliability of direct connect.

A good example is the VA3455 shown above. It provides 1200bps full duplex operation over the switched network or two-wire leased line. It's the coolest running modem ever built. Requires less space, too, because the phone can sit on top of the modem, or modems can be stacked without creating a heat problem.

With these great new direct connect modems at the remote end, and Vadic's remarkable triple modem, which automatically becomes a VA3400, a 212A or a 103, at the computer site, Vadic has opened new vistas in data communications. The whole story is in Vadic's new 8-page brochure. Better phone, or write for yours today, Ma.

Your independent thinking son,

Alexander Graham Jr.

Racal-Vadic the new name for



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CIRCLE 82 ON READER CARD

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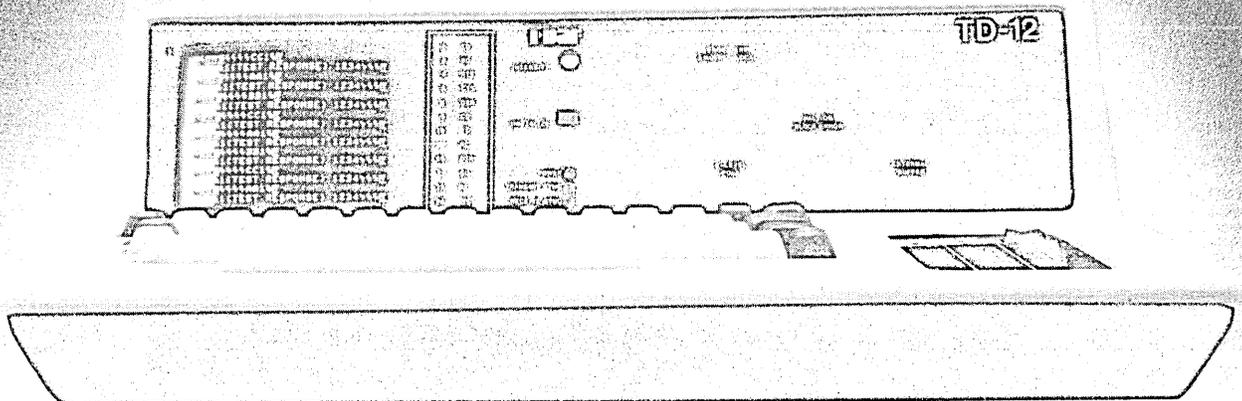
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NEWS

IN PERSPECTIVE

LEASING

CHAOS IN LEASING

Impact of IBM's 4300 announcement recalls the bloodbath that occurred when the 370 came out.

IBM's 4300 announcement and a succession of additional developments have left much of the computer leasing industry in apparent chaos.

"The leasing companies forgot the bloodbath that occurred 10 years ago when IBM brought out the 370, and now with the 4300 they're going through the same thing all over again," asserts Kenneth G. Bosomworth, president of International Resource Development, Inc., the New Canaan, Conn.-based market research firm.

Bosomworth contends that the 4300 series has seemingly torpedoed the leasing industry—or at least its more vulnerable segments—as severely as the introduction of the 370 a decade ago damaged leasing concerns which were carrying hundreds of 360s in their portfolios. Today, of course, it is the 370s which are taking a beating. Since the 4300 announcement their residual values have plummeted.

"There is so much squirming and selling off of equipment that it is difficult to assess the damage," adds Arthur D. Little's Frederick G. Withington, "but the writeoffs on the 370s could run anywhere from \$200 million to \$600 million for the entire industry."

And while some leasing concerns—particularly those offering short term walk away operating leases rather than long term full payout leases—may be staggering from the impact of the 4300, IBM has initiated several aggressive marketing strategies that could further impact the industry.

Specifically, the computer giant is offering a two-year lease on 4300s that one industry source terms "a dynamite deal." He asserts that, "there is no way leasing companies will be able to compete" with the 4300 lease offerings, so attractively are the packages priced.

Additionally, IBM is offering a guaranteed trade-in to 158 rental customers who decide to purchase their machines. These agreements enable customers to apply 20% of the value of the purchased machine to any IBM equipment acquired after Jan. 1, 1981.

On paper the significance of this offer, which could ultimately put IBM in the used computer market if the company decides to resell the machines, is nominal since probably no more than about 150 of the approximate 1,500 158s on the market would be candidates for this kind



KENNETH G. BOSOMWORTH—
Someone let the water out of the ocean.

of transaction. However, should this guaranteed trade-in policy be enacted across the board, as some industry observers suggest, it could undercut lessors who probably would be unable to offer similar incentives. Perhaps significantly in light of the firm's apparent return to the highly aggressive tactics that made it initially so successful, a guaranteed trade-in stipulation was company policy during IBM's early years, old company hands say.

Finally several sources report that IBM has offered a form of price protection in competitive situations where a 3033 is pitted against an Amdahl machine. Here the assertion—one that a source in IBM

Sources report that IBM has offered a form of price protection in competitive situations where a 3033 is pitted against an Amdahl machine.

denies—is that IBM will adjust lease prices for the 3033 to reflect fluctuations in the machine's market value. Leasing companies which would have to purchase these machines at the outset of a transaction would obviously be hard pressed to make similar concessions.

To further add to the confusion in the industry, Lloyds of London, the giant British insurance concern, has insured a number of leasing companies against losses they may incur with their computers. Now with the sharp drop in 370 values, Lloyds stands to assume losses that might well run to several hundred million

dollars. ITEL alone is rumored to have \$150 million in outstanding claims. In addition to ITEL, Lloyds insured Comdisco, DPF, Tiger Computer, the leasing divisions of Citicorp, Chase and Chemical banks, Lease Financing Corp., State Street Bank & Trust, and Decimus among others.

Which computer leasing concerns are most vulnerable to IBM's aggressive marketing strategy and the 4300 introduction? That depends largely on how these companies have structured their leases and how much business they've written. The firms with long term, full payout leases are probably home free—at least for now—while some of the wheeler dealers in the industry, those companies offering short term walk away leases, may be on less sure ground.

ITEL ranks as having placed the largest 370 portfolio and receives residuals from \$1.1 billion worth of 370s. Other concerns with hefty 370 portfolios include Decimus with \$600 million, CSA with \$380 million, OPM, \$300 million, Comdisco, \$270 million, and DPF which has \$340 million of 360s and 370s.

All these firms, except OPM and CSA, are insured by Lloyds. In its early policies, Lloyds insured lessors for what amounted to the full book value of the machines in their portfolios. Subsequent policies were more conservative, but the damage from Lloyds' viewpoint was already done, sources familiar with the situation assert. Simply put, the problem was that with the so-called "walk away" leases that lessors were offering, the lessee could unload his machine at will and be assured that even though residual prices had fallen well below book value, he could still realize book value through the policy.

Lloyds obviously didn't intend its coverage to be applied this way or utilized this way, and belatedly tried to close the barn door when it realized that new IBM products would severely impact the value of the equipment it had insured.

Shortly after IBM's 303X announcement, as an example, Lloyds' brokers in the U.S. sent out letters to companies holding policies in an attempt to clarify the situation. One New York broker, Alexander and Alexander, told its customers that the London underwriters were conducting an extensive review of the computer lease indemnity program, "particularly the extent of their total commitment with respect to the IBM 370 series."

Specifically, Alexander and Alexander said that the underwriters would not handle any policies on the 303X lines because of their apparent comparatively short-term interim nature. The firm also stated that the underwriters have been informed that in certain cases lessors have offered to sublet or remarket their

customers' equipment against a financial guarantee as to its value.

Put another way, leasing companies were saying, "Hey, guys, because of the new IBM gear, the value of your computer is dropping like crazy, but if you let us unload it for you now, we'll make sure you get such and such a price."

Only Lloyds, not the leasing companies, was the one really assuring the lessee a certain price. And with the 4300 announcement, the walk aways began to look like a stampede.

"Usually insurance works on the principle that if you insure one thousand ships and a few of them go down, you charge the other ship owners enough to cover yourself," notes IRD's Bosomworth. "But in insuring the residual value of all these machines you have a situation where someone, namely IBM, let the water out of the ocean and all one thousand ships went down." Nobody's willing to supply exact figures, but the word around the leasing industry is that Lloyds has already paid out several whopping claims and stands to pay out dozens more unless it can show illegal or improper actions on the part of policy holders, a matter into which Lloyds' American law firm, Bigham, Englar, Jones and Houston, is now looking.

The upshot of all this industry turmoil may not be fully realized for some time. However, the consensus among financial analysts and other industry sources is that ultimately someone is going to get stuck with the check for all this. The only question right now is who—Lloyds, the leasing companies, equity sources and individual investors who've put up the capital for leasing deals or the lessees themselves.

—Laton McCartney

MAINFRAMERS

WHAT'S NEW AT IBM?

Besides its low priced 4300 offerings, the giant shifts executives, announces discounts and trade-in allowances, and reports \$21 billion in revenues.

While the industry gazed on IBM's big splashy new product announcements, such as the 4300 series, the giant slipped out a passel of other announcements that also indicate its direction.

It unveiled its financial performance for 1978, a whopping \$21 billion. It shifted top executives on the organization chart. It announced the first volume discount ever in its history, with the Se-

ries/1 from General Systems Div. And it further demonstrated how it is controlling the migration of its computer users by announcing a trade-in package for the 370/158.

Treating these events one at a time, first a look at the highlights of the 1978 financial performance. In a nutshell, they were that: IBM crossed the \$21 billion mark in revenues; office products growth rate was higher than data processing products; non-U.S. operations (more than half the revenues) had a significantly greater growth rate than U.S. operations; within data processing, equipment sales continued to outstrip rentals in growth and have reached a 40:60 ratio with rentals; dp rental income from soft-

IBM recorded an impressive growth in hardware sales of nearly 27% over 1977, reaching \$5.8 billion.

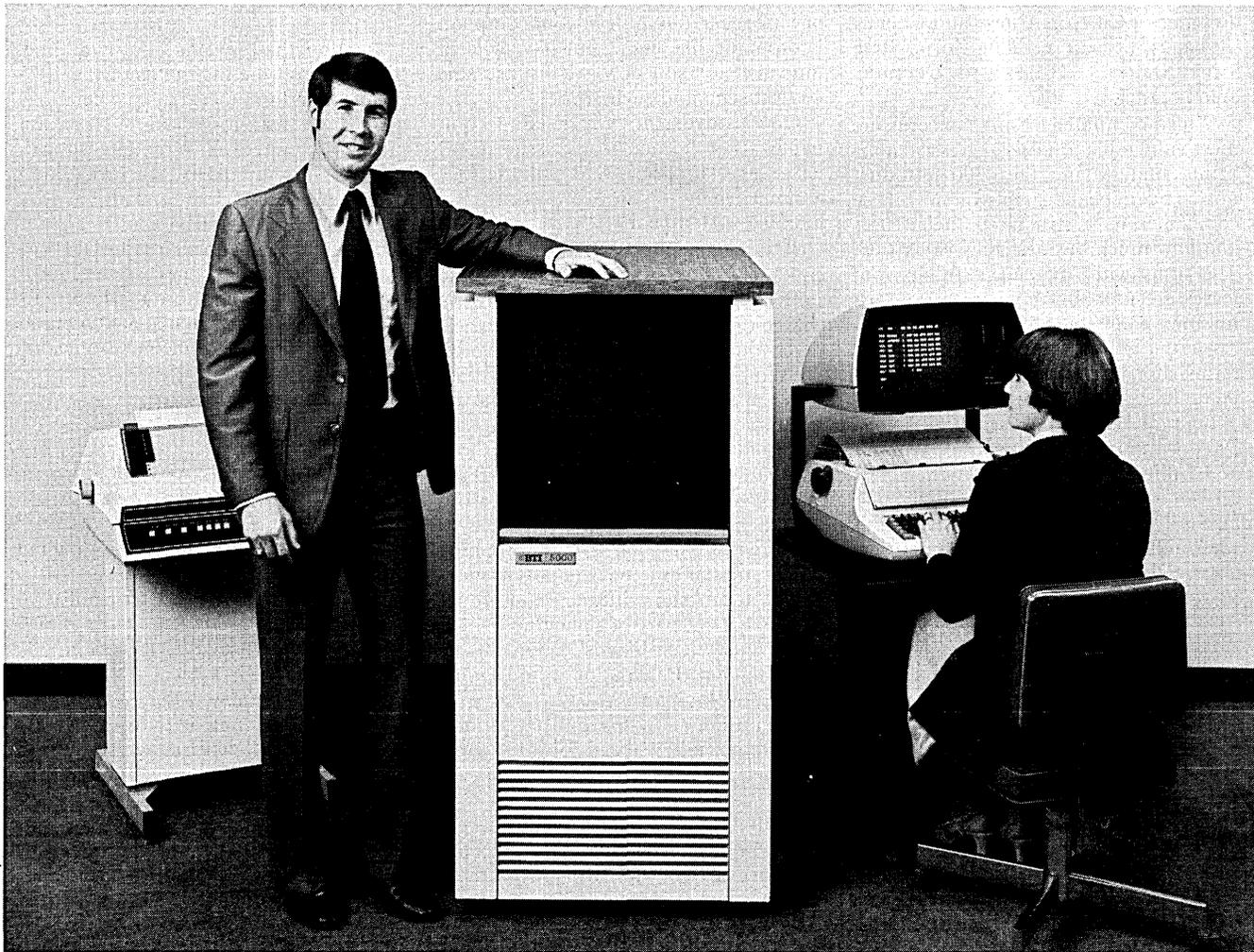
ware and from maintenance on purchased equipment is the fastest growing business in the company.

The \$21,076,089,000 in revenues for IBM represented a 16.2% increase over 1977. Profits reached \$3.011 billion, a 20.1% increase. By all accounts, the fluctuations of currency on the world market had a great deal to do with IBM's revenue growth in 1978. While total U.S. revenues grew 11.4% in 1978, the two foreign subsidiaries, Europe/Middle East/Africa and Americas/Far East, grew 21.7% and 16.2%, respectively. And these non-U.S. operations represent more than 52% of IBM's income (up from just over half in 1977). Keeping this in mind, when IBM says in its report that the currency fluctuation caused a "large part of the difference in growth rates," the realities of its revenues become confused at best.

Comparing industry segments tells another story. The data processing income, represented by the small systems of General Systems Div. and the 370 and 303X lines of the data processing groups, showed a 15.6% growth to \$17 billion. Their share of the IBM total has been dropping in small increments over the last five years because of the growth of the smaller office products business. Office products have moved from 14% of total revenues in 1974 to 16.1% in 1978. Actual growth over 1977 was 20%, reaching \$13.39 billion.

Data processing revenues have been broken out more finely in the last two annual reports, showing some significant trends. (See table.) As expected, IBM equipment sales have grown by leaps and bounds in the last few years. Last year, with System/370 price cuts and big 303X deliveries, was no exception. (In fact, the last quarter of 1978, IBM said, was the biggest ever for purchases.) IBM recorded an impressive growth of nearly 27% in

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NEWS IN PERSPECTIVE

hardware sales over 1977, reaching \$5.8 billion. Equipment rentals moved up by just 6% to \$8.6 billion; this was better than the meager 2% increase in the 1977 report, however.

While it is clear that the majority of dollars still come from rentals, the ratios have been changing. In 1974, 27% of equipment revenues were from sales; in 1978, 40%.

Another breakdown in IBM's report shows how IBM's high purchase content, along with the dwindling price of hardware, is causing a shift in its revenue sources. IBM has a category called Services, Program Products, and Supplies. The "services/rental" portion in this mostly represents maintenance income on purchased equipment and monthly fees from priced software. This has grown enormously in the last few years. In 1978, IBM garnered more than \$2 billion from this category, a growth of more than 35% over 1977.

In fact, in real dollars, this business again surpassed the growth of the equipment rentals, \$545 million vs. \$514 million. The industry is hard put to determine just how much maintenance and software each contributes to this. While the purchase content of hardware has increased, maintenance prices have also increased. On the software side, IBM's list of priced products grows longer and longer, and IBM user budgets show significant growth in packaged software expenditures each year. Clearly, maintenance and software are each becoming multi-billion dollar businesses in their own right at IBM.

Another notable development in the IBM finances is the dwindling cash and marketable securities IBM lists under assets. While "dwindling" hardly describes IBM's mammoth resources, they have dipped from \$5.4 billion to just over \$4 billion. Analysts do note that IBM has



PAUL J. RIZZO—Largely responsible for aggressive new IBM marketing strategy.

spent more than \$400 million buying back its own securities to diminish the number of shares outstanding. However, it also has spent a great deal on new plant investments, such as for its new semiconductor operations. Two new plants, in Charlotte, N.C., and Tucson, Ariz., were started in 1978, while IBM also began increasing capacity at other 26 plants worldwide. Also, 14,000 new jobs were added in 1977 and 1978.

IBM made several executive changes that are giving analysts a great deal to think about. The most significant in some minds is the ascendency of Paul Rizzo from group executive of the Data Processing Product Group into the Corpo-



DR. ARTHUR G. ANDERSON—New head of Data Processing Product Group has come up through IBM's technical ranks.

rate Office and the Corporate Management Committee. This highly respected 51-year-old executive, who has served in many corporate and World Trade financial posts at IBM since 1958, will share the Corporate Office with just two men, chairman Frank Cary and president John Opel.

Does this mean that he will automatically move into the presidency when Cary retires (presumably in two years, when Cary turns 60)? Some say yes, assuming that occupancy of the Corporate Office makes it a *fait accompli*. They point out that Rizzo, a senior vice president and group executive since 1974, has been largely responsible for the aggres-

IBM DATA PROCESSING REVENUES 1974-1978 (in \$100,000s)

	1978	1977	1976	1975	1974
Total Revs.	\$21,076	\$18,133	\$16,304	\$14,436	\$12,675
Equipment Sales	\$5,838	\$4,605	\$3,782	\$2,555	\$2,484
%total rev.	27.7	25.4	23.2	17.7	19.6
%increase	27	22	48	3	—
Services/Rentals	\$8,616	\$8,105	\$7,940	\$7,824	\$6,730
%total rev.	40.9	44.7	48.7	54.2	53.1
%increase	6	2	1	16	—
Services, Program Products, Supplies Sales	\$526	\$507	\$456	\$433	\$418
%revenues	2.5	2.8	2.8	3.0	3.3
%increase	4	11	5	4	—
Services/Rentals	\$2,086	\$1,541	\$1,222	\$1,039	\$874
%revenues	9.9	8.5	7.5	7.2	6.9
%increase	35	26	18	19	—

%increase over previous year, rounded to nearest percent.

Source: IBM Annual Report & Datamation estimates.

NEWS IN PERSPECTIVE

sive new IBM marketing strategy exemplified by the startling price/performance announcements of the new 4300 line. They also point to the excellence of Rizzo as a businessman, as well as financial expert.

Others note that the last time three men occupied the Corporate Office was when Gil Jones shared it with Vincent Learson and Frank Cary. Jones did not make the move up; he was, however, near retirement at the time. Analysts like Aharon Orlansky of Wall Street's Oppenheimer & Co., with all due respect for Rizzo, are looking over his shoulder at other "comers." Orlansky picks out P. M. Foley, administrateur-directeur generale

IBM's P. M. Foley is described as a "comer" for the top job at IBM when Frank Cary retires.

of IBM Europe and a long-time "chum" of Cary's, as a good candidate.

In the meantime, in the Corporate Office (responsible for day-to-day operations) and the Corporate Management Committee (long-term planning), Rizzo will be the corporate contact for both the Data Processing Product Group and the Data Processing Marketing Group. He will continue to be a powerful influence in the development of IBM data processing strategy.

Rizzo's new contact in the Data Processing Product Group represents a rare promotion within IBM. Dr. Arthur Anderson, who has been made president of this group, has come up through IBM's technical ranks—not finance or marketing. Sources within IBM are extremely pleased, characterizing Anderson as a fine technical man, businessman, and humanist.

His background, starting at IBM in 1951, includes posts as assistant director of research at the T.J. Watson Research Center, corporate technical coordinator, director of research at San Jose laboratories, and director of technical assessment of the DP Group. (Expanding his horizons, Anderson took a year off in 1970 to attend the Center for the Study of Democratic Institutions as a visiting fellow.)

Anderson's last position was as president of the all-important General Products Div. This division is not only responsible for all file storage developments, but also for such critical software as data base management systems. Under his direction, IBM's future in data base for the next several years has already been set.

Now Anderson has the responsibility for the integration of all hardware and software elements in current and future systems beyond the H series (supposedly to be unfolded over the next four years). He'll have a major part in shaping the

IBM of the 1980s.

Keeping in mind General Products Div.'s importance, the man who fills Anderson's slot there is William W. Eggleston. He has a varied background, having been in general, product, and marketing management within General Systems Div. and the old System Development and Data Processing Div. Most recently he was president of the Americas/Far East subsidiary and then assistant group executive of the DP Marketing Group. He now has his own business unit to run at a critical time in IBM disk file and data base product development.

This winter IBM's maverick small systems company, the General Systems Div., announced the first hardware discount in IBM history. And, strictly speaking, it included the first volume discount on IBM software as well. While analysts worried about the long-term implications for the minicomputer industry, the IBM competitors and systems houses dismissed IBM's first try at a new game as amateurish.

In fact, compared to what has been offered in the market, IBM's discounts were not impressive, particularly since they started at the 50-unit buy. It obviously moved cautiously on the first go-round: 5% off for 50 to 99 units; 10% for 100 to 149 and 15% for quantities over 150. This is versus 30%, 40%, and sometimes 50% discounts available from well established powers in this market. But it was a start, and as the cliché goes, it was significant because IBM did it.

The Series/1 minicomputer, from the day of its appearance in 1976, was hardly a high-priced entry. Aimed at large volume buys, its base price was meant for 20-system orders. In dollar terms, it indeed fell below many competitive products at list price and often below the quantity prices they offered. But it lacked the quantity discount that would attract oem buyers, and it lacked software and peripherals that large end users needed.

The result has been that Series/1 has not been a star in the IBM revenue picture. While an Oppenheimer & Co. report shows a backlog of 7,000 systems (estimated if-sold value of \$280 million), all accounts say that it has fallen below targets. European sources say less than 50% of target has been met in that important market.

GSD, however, has been improving all facets of this minicomputer line. Prices

are declining with each succeeding enhancement and model. For example, the 4952 processor, announced in January, came with a memory price of \$.02/byte memory; that represents the gradual downslope that has occurred since the first Series/1 processors were announced with \$.12/byte prices. The software portfolio is also improving, as are the peripherals.

And GSD has kept up the pressure to get the discount it wanted to announce in the beginning. Apparently, corporate headquarters in Armonk finally decided it was legally feasible to offer one now and allowed what is considered an "evolutionary" move into discounting, per-

GSD's first discount on hardware in IBM history also included the first volume discount on IBM software as well.

haps for all of GSD. (Certainly, GSD's sister division, Data Processing Div., has already shown that IBM is ready for new financing methods in general. The software for multiple 8100s is essentially discounted—i.e., support is not offered—after a user pays full price for the first site; program products for the 4300 are essentially discounted if the users use only telephone maintenance via IBM support centers.)

The Series/1 discount policy comes with a great many provisos. IBM pegs the price break to categories, and the buyer cannot mix products from different categories to come up with a buy of 50 or more units. (These categories are noted in the table below.)

In other words, a buyer ordering 50 processors and 10 terminals will receive a 5% discount only on the processors. No mixing and matching among the categories listed. And the quantity must be bought within 18 months.

From the standpoint of the oem buyer, his problem is not IBM's basic prices on the Series/1. This minicomputer is, as said, very competitively priced. The problem is the difference between what IBM charges the end user and what the oem can afford to charge. His profit is partly based on the difference between list prices and his volume discount. Right now, IBM's offering still doesn't do the job. The oem or systems house is also hampered by another IBM policy. When it

Category A. Processors and memory:	models 4952, 4953, and 4955.
B. Printers:	4973, 4974.
C. Disk and diskette files:	4962, 4963, 4964, 4966.
D. Terminals:	4978, 4979.
E. Tape systems:	4969.
F. Licensed software:	All but structured program facilities 5719 CR-1, 5719 CR-2, 5719 ED-1.

(Note: only products with a 49XX designation, specific Series/1 components, are eligible.)

orders, say, 50 units, each must be paid for at list. After the 50 units have been bought—within that 18 month period—the oem receives a rebate or credit.

Jules Street of the market research firm of Strategic Business Services, says that the oem, struggling to maintain cash flow, gets hurt by this payout and the lag between the time he sells his value-added system and gets paid for it. "The end user always wants to hold payment to the systems house until he knows the system is working."

Right now, the oem's will probably stay with the other minicomputer vendors. The likes of DEC, Data General, Hewlett Packard, Texas Instruments, and others offer discounts that run all the way up to (and probably past) 50% in large quantities. Typical is 30% and 40%. Their breakdowns of these discounts also vary.

For example, DEC's discount is pegged to the processor. A user who buys 10 disks and 50 processors gets the full discount, over 30%, on all items. (Purchasers of 150 disks, however, still get that discount.) Furthermore, DEC, DG, and others give the discount immediately with each purchase. If the buyer does not take the full complement of systems contracted for (again in a limited time), he pays back the difference.

The handling of software fees also

differs. While IBM offers the volume discounts for its licensed products, others have a different scheme. DEC and Data General charge the full price for the first complement of software; subsequent copies are sold at a significant discount and presume no support. The oem passes on the updates, fixes, etc. to his customers. This is, in a way, similar to the new offering from IBM for its 8100 customers, who can designate one central site for programming support and pass it on to other locations.

There are other significant differences among the vendors. Technically and in price, the calculations are a nightmare. Each time the chart looks complete, the

The problem is the difference between what IBM charges the end user and what the oem can afford to charge.

manufacturers pour out enhancements and new products. DEC just came out with its PDP-11/23, which provides almost all the "functionality" of the PDP-11/34's at half the price. These are the models competing with the Series/1. Data General popped the more competitive Nova 4 models out in February, which replaces the Nova 3/4 to become DG's new answer

to the Series/1.

Jim Kinlan, a DEC marketing executive, put his perspective on the choice the user faces. "The advantages of price have been wiped out. The buyer has to consider other factors, such as ease of use, software availability, compatibility of a system with other products in the vendor's line, the training offered, the cost to the user of upgrades to hardware and software."

Apparently, cycle time no longer suffices in the minicomputer industry.

IBM has demonstrated yet another means of controlled migration to new systems. On February 8, it told users of leased or rented 370/158s that if they converted to purchase by April 30 and kept the systems until 1981, they would have a trade-in allowance of 14.5% to 20% toward a new system.

Users, of course, won't be paying IBM full list price for the 158. Under current IBM policy, the user receives a credit toward purchase based on a monthly accrual. About 45% to 50% of monthly rent is applied, although this can total no more than 50% of the list price. Thus, the very long-term 158 users can buy their systems for half price and then receive a sizable trade-in credit. If the trade-in occurs January 1, 1981, it amounts to 20%; on December 31, 1981, the last day

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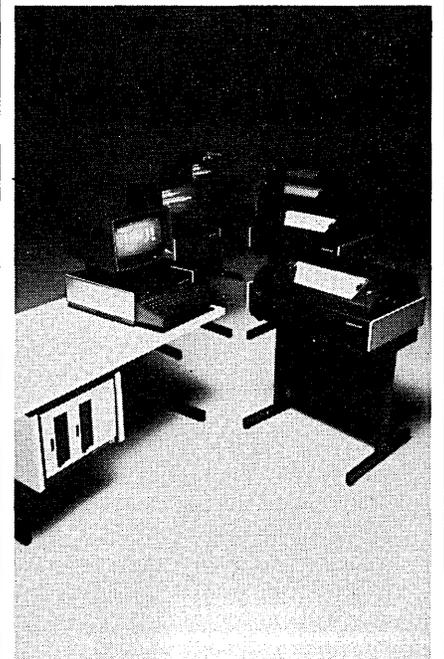
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NEWS IN PERSPECTIVE

for trade-ins, it will have dropped to 14.5%.

Frederick G. Withington, industry expert at A.D. Little, summarized the effect of this rare IBM move. First, he said, it postpones the delivery of new systems for at least some of the IBM 370 customer base; the giant already has a monstrous backlog for the 303X and 4300 models that will take it through 1980. The offering also sells off the remaining 158s and keeps these users from dabbling with multiple 4341s—an attractive deal for the customer, but no great net profit for IBM. And the trade-in would eliminate the vulnerability of this rental base to plug-compatible mainframes.

Holding off the migration of this group until 1981 obviously implies more new products. Sources say that 1981 is a good fit with rumors of processors in the H, or Adirondack, series. First model, at the low end of the large-scale H series, is due out in August. The code name is supposedly Iroquois 1. The next four, due out in the 1981 time frame, are dubbed Catlin, Lookout, Iroquois 2, and Mossy 2. Five more, at the high end, are due in 1982 and 1983.

Some analysts say the trade-in is actually no great event, since most 158s were purchased or converted to purchase. They put the remaining rental base at 10% to 15% of the 158 installations. That, however, amounts to the size of the total installed base of a few mainframers and a market the plug-compatible firms would love to have.

—Angeline Pantages

OFFICE AUTOMATION

THE 6670 INKBLOT FROM IBM

It's an abstract shape that reminds some of remote publishing, others of electronic document filing.

Attention is being focussed today on a new product category, the so-called intelligent copier, all because of IBM's announcement in February of its 6670 Information Distributor (p. 190). More than a copier with some smarts, the IBM 6670 is like an inkblot, an abstract shape that reminds some people of remote publishing and others of electronic document filing. Its maker does nothing to discourage such fantasizing, saying "this product represents a significant evolutionary step toward the much discussed office of the future." It is not the first intelligent copier, and it won't be the last.



IBM 6670: The information distributor uses a laser printer to provide original quality printing for each page either through communications lines or magnetic cards. It can be used in conjunction with the IBM Mag Card II typewriter (at right). Laser technology enables it to print up to four separate type styles on a single page in any sequence.



The 6670, being marketed initially only in New York City, Chicago, and Los Angeles, combines features of a convenience copier with a laser printer, and provides the ability to receive and transmit documents over phone lines. Most significantly, however, it bridges both word processing and data processing as no previous product has. To shrug it off as merely an intelligent copier would be akin to labeling the first automobile as just a horseless carriage.

Viewed from the dp world, the 6670 can be described as a high-capability, office-oriented peripheral. It can be used by office personnel for administrative, office, and word processing applications, as well as for dp, communications, and for its printing capability. "It's basically an RJE system that can be cost justified not only for data printing but also for local and remote word processing printing and office copying and duplicating," says Robert Conrad, an associate of Strategic Business Services, San Jose, Calif.

Conrad, who just completed a study for SBS called "Intelligent Copiers and the Future Office," explains that an intelligent copier must be copier-based, must be multifunctional, and have internal or external intelligence. He foresees sophis-

ticated versions of such devices being used in high-speed document and file input-output systems and linked to communications networks. They will transmit an entire document at speeds of one or two pages a second.

But he also sees lower cost devices of this genre being used by very small businesses as a convenience copier, for forms generation, and as a printer for data output from their small business computer systems. Between now and 1986, Conrad can see a couple of hundred-thousand intelligent copiers being sold, priced at the low end from \$5,000 to \$15,000 and at the upper end above \$100,000.

He views the \$75,000 6670 from IBM's Office Products Div. as being of a conservative design, having a lesser capability than IBM might be able to provide. He cites the slow page replication speed of 36 per minute, the lack of a forms slide or electronic forms storage, the top modem speed of 4800 baud, and the fact that IBM's mag cards are the only magnetic input medium.

"We desperately need that kind of device for the office of the future," says Einar Stefferud of the IBM 6670, "but at the same time it's still a paper-medium

device." Stefferud, president of Network Management Associates Inc. in Huntington Beach, Calif., notes that "the paper world isn't going to go away right away." Thus there remains a need for a device such as this that enables people to move their files "into electronics and still live with the paper world."

Conrad, too, observes that the idea is not to eliminate paper from offices, but rather to make it possible to manage all the documents within an office or corporation—viewing the entity as a total system—and to be able to get a document into or out of the system and be able to transmit it. He calls that "just a basic part of the future office."

He sees the intelligent copier starting out in the office environment, where it will perform nonimpact printing of data and of executive correspondence. It will also have a communications capability, perform forms generation, and have much higher quality printing than the current line of computer printers.

"The real whiz, though, is data input capability," he enthuses, "to digitize documents and graphics, like a whole page." And within that page, ocr techniques would be applied to reduce the data

"An RJE system that can be cost justified for data printing and local and remote word processing printing and office copying and duplicating."

required to digitize the entire page.

One could then input a letter, getting the device to digitize only the letterhead and the signature at the bottom; ocr would digitize the textual body of the letter. Conrad explains that to digitize the entire page might require up to 200,000 bits, a figure that could be cut to 50,000 to 60,000 using ocr techniques.

While the 6670 lacks many sophisticated features that can be found in one or another of a number of devices on the market but has yet to be pulled together into one smart copier, it nevertheless has wide applicability today. At remote construction sites, for example, there can be a need for a copier, for the communications capability, and the need to generate worksheets, drawings, and time cards.

Adds Conrad, "It'll be real easy for a company with 10 branches—much easier than going through a cpu—to put a word processor in every branch and a couple of laser printers in central warehousing locations—and do their billing. Really, you could handle typical warehousing/invoicing applications with word processing. And then you could transmit daily to a computer to update your inventory. But you could handle the paperwork and the communications and the input and output—all on the word processing system."

And there can be no doubt that many

BUSINESS DOCUMENTS BY SATELLITE



AM INTERNATIONAL CHAIRMAN Roy L. Ash, left, with Philip N. Whittaker, president of Satellite Business Systems, viewing a scale model of a communications satellite.

AM International agreed to deliver two prototypes early in 1980 of a high-speed computerized facsimile system that it will build for Satellite Business Systems.

The contract, announced last month, followed a request for information on such a system that SBS issued in July 1978 to more than 60 companies. SBS said the system could operate as an electronic intracompany mail-delivery system for business and government. It would be able to send up to 3,600 high-quality copies an hour by satellite to distant cities at a rate that is 120 times faster than most current machines.

AM International said the great increase in speed and image quality will be achieved through computer control and advanced laser scanning techniques.

Philip N. Whittaker, president of SBS, said the improved intercompany document distribution will be capable of moving correspondence "as fast as the mail that moves from office to office within a building today."

For example, he said, customers could transmit multipage priority documents immediately or transmit large batches of documents overnight and also retain complete control of the deliveries. Correspondence destined for a particular city would be processed into electronic storage by the machine when it is received at the local mailroom. At the end of the day, all mail for that city would be transmitted over the satellite. At the receiving end, the information would be collected into electronic storage devices and then reproduced. A device at the receiving end then would

reprint the desired number of copies, each with uniform quality, AM International said.

The computer-controlled features of the system would enable transmitted correspondence to have varied addressed and multiple-copy distribution. An entire report, for instance, could be scanned into the system only once, and directed to a number of recipients at different locations.

SBS said development of such terminals, which would lead to fast long-distance mailroom-to-mailroom service, ultimately might replace conventional internal mail systems and messaging equipment. Facsimile systems currently in use operate over telephone lines that often require three to six minutes to transmit each page. The new system, operating by satellite, will have a data capacity 156 times greater than telephone lines.

SBS did not disclose the value of the development contract. It said the order won't be affected by a U.S. appeals court ruling last August that overturned the Federal Communications Commission's authorization of SBS's domestic satellite service.

The court said the FCC hadn't adequately examined the anticompetitive impact of approving the services to be offered by SBS, which is a joint venture of IBM Corp., Communications Satellite Corp., and Aetna Casualty & Surety Co. FCC, which was ordered to take another look at the matter and to approve the service only if an alternative wouldn't adequately serve the public interest, has asked the court to rehear the case. *

NEWS IN PERSPECTIVE

new applications will emerge with the introduction of the 6670. Perhaps more significantly, however, the announcement will stimulate the introduction of similar products now being developed by Burroughs, Xerox, Japanese manufacturers, and others.

Matsushita Graphic Communications Systems Inc. of Tokyo recently announced a facsimile system that is said to permit on-line data entry. IBM is said to be working on scanners, displays, and other parts of an intelligent copier that would serve as both input and output to the IBM 3850 mass storage system. The application: electronic document filing.

"Burroughs, anywhere from this year through some time in 1980, is going to announce electronic document filing," predicts Conrad. They'll be followed by IBM. As the lyrics go, "We've only just begun."

—Edward K. Yasaki



JAMES A. KUTSCH, JR.—and his talking terminal, MOUTH.

APPLICATIONS

THE MOUTH THAT TALKS

Voice response terminal helps blind computer users.

MOUTH was his answer.

His question: how to provide a communications medium for blind computer users.

He is Dr. James A. Kutsch, Jr., a member of the graduate faculty of the Dept. of Statistics and Computer Science at West Virginia Univ.

His "MOUTH" is a computer terminal with synthetic speech output. It is the result of years of work begun while he was a graduate student at the Univ. of Illinois. Its name was the result of a naming contest conducted among sophomore programming students at West Virginia Univ. "We only had one entry," said Kutsch. "MOUTH, for Modular Output Unit for Talking to Humans."

Kutsch, himself blind, said "finding a reading aid or method for the blind has been a long-standing research problem. The earliest significant contribution to the problem was the work of Louis Braille in the mid-1800s. More recently, computers and other sophisticated electronic equipment have been used in an attempt to find a better solution."

While braille is the most common and perhaps the easiest form of output for the blind, Kutsch believes it has its limitations when it comes to use of computers. "The braille character consists of a matrix of dots, two wide and three high. Counting horizontal and vertical spacing between characters, 40 braille characters

would be 120 characters wide and four lines high on a printer. Thus what would appear on one line of 120 characters of print requires a maximum of 12 lines of dots and spaces in braille."

While a student experimenting with various mediums through which the blind could work with computers, Kutsch said he discovered a "cheap approach to braille, using an elastic band, bent paper clips, a screwdriver and hooks on a print mechanism." But still, the braille output had its drawbacks.

Next, he started using Morse code via Teletype terminals and later with a DEC-writer, counting on certain keys being louder than others. "Asterisks are loud and back spaces quiet." Then he worked Morse code on an IBM 1130 utilizing its system alarm bell. He recalls working late at the university one night, listening to the bell version of Morse code. "A custodian passed by and asked me what I was doing. 'I'm listening to a core dump,' was my answer."

Kutsch determined that "almost all of the research (into output for the blind) has been done by sighted individuals, with little or no input from blind persons who would be the eventual users of any discovery. A sighted person's opinion of what he would want or need if he were blind is not always a true reflection of the needs of the blind."

Kutsch decided on a list of requirements for the communications medium he was seeking. "First, it should not require its user to learn new skills, such as Morse code. Next, it should be computer independent. It should be able to be used in many aspects of computer communications. If the computer system can be used in a batch mode from a terminal, the communications method should be applicable to both. The converted data presented to the user should be as thor-

ough and complete as that presented to a sighted user. It should be equivalent in cost to devices required by a sighted person to communicate with a computer."

Braille printout was discarded early on. "Even with the use of compression techniques for blanks and short lines, braille is still very bulky. A 30-volume encyclopedia would consist of 145 volumes of five-inch thick books in braille. Further, computer-generated braille requires some sort of change to the line printer, which means a time delay in most computer installations."

Kutsch considered OPTICON, a device which presents data in tactile form to the user's fingertips. "On the surface, the OPTICON seems to present a very satisfac-

"What am I doing? I'm listening to a core dump."

tory solution. It is computer independent, readily available, reads all forms of output and presents no restrictions on what computer services are used. It is, in fact, quite adequate for reading listings in a batch environment."

But, said Kutsch, it is inconvenient to use at a time-sharing terminal, since the user must continually move his hand from the OPTICON to the keyboard and back again. Also, "the reading speed with the OPTICON is a consideration against its use."

With both braille and the OPTICON, Kutsch said, "a sensor fatigue problem enters after prolonged use without rest. This fatigue could be compared to eye-strain. The braille or OPTICON reading finger becomes tired and the ability to detect and distinguish characters lessens, causing errors and slowdown in reading. Although experienced readers may be

NEWS IN PERSPECTIVE

able to work for several hours before becoming fatigued, others cannot continue for more than a half hour without giving the reading finger a rest. Since most computer programmers spend several hours at a time at a terminal, this drawback would present serious problems."

Synthetic speech was the alternative to which Kutsch turned. Synthetic speech, he said, "seems to be the optimal medium for the computer to communicate with blind users."

Master Specialties Co., he said, has developed a technique for digitizing and storing whole words in MOS read only memory chips. "By a complex plotting of waveforms, engineers have converted analog audio signals into digital signals requiring a minimum of storage."

In the earliest voice response systems, Kutsch said, "words, phrases, and occasionally syllables were recorded on photographic film or magnetic drums. These methods are very useful in systems that require a small fixed vocabulary . . . However, their adaptation to more sophisticated systems is limited."

The most versatile synthesizers, he said, "deal with phonemes, the smallest unit of the spoken language." These, he

A 30-volume encyclopedia would consist of 145 volumes of five-inch thick books in braille.

explained, are sounds, of which there are 63 in the English language.

A problem, he said, is that using phonemes for speech synthesis means graphemes (the 26 letters of the alphabet) have to be converted for each word into phonemes. "This is not a trivial process since the English language does not follow any simple set of rules for letter-to-sound correspondence. For example, the sound corresponding to the grapheme 'o' in women and Bob is clearly quite different. Since phoneme translation is context dependent, these algorithms usually require large tables and a moderate amount of computation. However, computer-generated speech systems using synthesis by rule have been designed to produce quite satisfactory and understandable output."

Kutsch found the voice response unit he wanted from the Votrax Interface Diy. of Federal Screw Works, Troy, Mich. This was the beginning of MOUTH. Next step was the cpu, a MITS Altair, "a large box of parts and a parts list. My wife, a music major, became an electronic technician."

He said he chose the Votrax voice unit for several reasons. "First, the majority of speech synthesis applications found in the literature make use of the Votrax, and therefore, many of the algorithms for translation from text to phoneme codes

are designed specifically for use with the Votrax. Further, after hearing the device demonstrated on several occasions, it was deemed adequate for the purposes of the talking terminal based on clarity of speech and speed." One minor problem, he noted, "it talks with a Swedish accent."

The Altair 8800, he said, was selected "based on availability, low cost, modular design, and a bus structure that allows the system to be configured with any amount of memory and any number of input/output ports."

Input/output drivers and 16K bytes of static random access read/write memory, he said, were obtained from Processor Technology to complete the Altair computer system. "Read/write memory was selected for the prototype terminal so that program changes could be easily effected. A final version of the terminal would require only 2K bytes of read/write memory for buffers and program variables. The remaining 14K bytes could be replaced with read only memory, permitting nonvolatile storage of system software and tables."

Kutsch said software for his terminal consists primarily of routines to perform the translation from English text to the digital commands necessary to drive the speech synthesis device. Routines to handle the communications between the terminal and the host computer system, as well as those to manage character storage buffers, complete the list of the terminal's software.

Kutsch sees other applications for MOUTH, in addition to being of help to blind computer users. He mentioned talks to large audiences, classroom demonstrations, voice response telephone systems, use by the Navy for shipboard communications, connected to a public address system, and use by Air Traffic Control so that controllers wouldn't have to "smear a crt with error messages." He feels there are many more he hasn't thought of.

He's had nibbles from individuals who would like to buy a version of MOUTH but so far, none from a company wanting to go into production with it.

His is not the only talking terminal for the blind computer user. Kurzweil Computer Products, Cambridge, Mass., has one but Kutsch notes it is based on DP-11 and therefore, not portable, as is MOUTH.

Kutsch will be leaving West Virginia Univ. in mid-May to join Bell Labs in New Jersey as a member of the technical staff in exploratory design. Depending on Bell Labs' policies, of which he was unsure at this writing, he feels he could produce two or three MOUTH's a month in his garage should the demand be there.

Whatever, his MOUTH will go with him to New Jersey.

—Edith Myers

SEMICONDUCTORS

WHITHER THE U.K.'S INMOS?

Future of Britain's semiconductor venture might now rest in the hands of Britain's man in the street.

The future of at least a dozen U.S. semiconductor specialists has passed into the unlikely hands of the British man in the street several thousand miles away. And the number is escalating all the time.

The Americans are new employees of the fledgling U.K. semiconductor venture INMOS. As such they are at the end of a long chain of associations that lead back to the voting whims of the British public as the country nears its general election of a new government.

The present Labor government, if voted back for another four-year term, could hand over a staggering \$6 billion to its National Enterprise Board (NEB)—backer of INMOS—to pursue its strategies

Intel's Robert Noyce calls INMOS a "bandage rather than a cure for the wound."

over the next three to four years, including expansion in the U.S.

In contrast, the election of the opposing Conservative (Tory) party to government is widely expected to hobble the NEB, and kill INMOS. During the few months of INMOS' short life the Tories have sniped at the ambitious multibillion dollar venture as an "unacceptable risking" of taxpayers' money. And throughout this period, as now, the Tories have been overwhelming favorites to win the election—rumored to be as near as June but certain by November.

Now (perhaps inadvertently) one of the U.S. founding fathers of the semiconductor industry has added his voice to the Tory lobby and to the chorus of INMOS detractors from competing American companies.

During his trip to London last month to receive a top scientific award for his contribution to semiconductor technology, Intel's Dr. Robert Noyce told the British that INMOS has little chance of success.

He described the venture as the wrong solution to U.K. semiconductor needs—a "bandage rather than a cure for the wound." He warned that INMOS lacked a unique product proposition and possibly the funds to invest at the rate of his own and other successful U.S. manufacturers.

WS&A

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March 9, 1979

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NEWS IN PERSPECTIVE

Noyce said that Intel spent \$104 million last year, mainly on the constant replacement of up-to-the-minute production equipment. He said this figure would rise to \$120 million this year. He contrasted this with the \$100 million so far budgeted for INMOS over the next five years.

Other critics in the U.K. have added that rather than \$100 million, INMOS needs \$1 billion to get into contention with the Americans who hold at least 70% of the world market. This is the figure that Dutch conglomerate Philips has spent developing its semiconductor business to get just a small percent of the European market.

While allocating only \$100 million directly to INMOS, the Labor government has earmarked an extra \$370 million for microelectronic applications and support that the company could benefit from. Some \$120 million of this is for education and training programs for British industry that the government is hurriedly trying to push through.

If the Labor government is reelected, the funding of INMOS on a scale comparable with the U.S., whatever the risks, looks assured. INMOS is a pet scheme and the apple of the eye of NEB chairman Sir Leslie Murphy. "What we've done has

made an enormous difference to this country on the whole question of microelectronics," he said referring to the media's growing fascination with the computer on a chip.

He said that INMOS' new technical center at Bristol in southwest England had been flooded with 700 to 800 applications for just 50 jobs.

He added that in the U.S., staff had begun to leave Intel, Texas Instruments and Motorola to join the U.S. subsidiary, INMOS Corp., which is handling R&D and building prototypes. The NEB says that it has had a large number of applicants to a two-month old advertising campaign in the U.S. and is now actively recruiting.

"Over a dozen American technologists across a range of semiconductor activities have already joined us," said an NEB spokesman.

INMOS, it should be remembered, has already been accused of poaching staff from Mostek, from which came two of its three founding directors (the other is English). In the best high risk venture capital traditions of the U.S., the three founders will be allocated shares in the company by Murphy, and motivated by the incentive of possibly becoming millionaires.

Proposals currently with the British

Parliament will guarantee Sir Leslie Murphy and the NEB some \$6 billion in spending money, rising to \$9 billion in three to four years. There's little doubt that if Labor wins, Noyce and the other leading Americans will take the INMOS investment clout seriously. Perhaps realizing this, Noyce made what he considers his most damning indictment of INMOS — namely that it is entering the field with a product (the 64K RAM) which is known to everyone. He added that when Intel appeared, its products had been heard of by very few people.

In response, INMOS' director of strategy, Englishman Iann Barron, says that a 64K ceiling is adequate for the development of a computer on a chip and that he sees this as a key technological development of today. Many observers in Britain don't see how this can protect INMOS from savage price cutting by the Americans and the Japanese, and by "generation jumping."

INMOS told a Texas judge last autumn that the very earliest it could start to push out its prototypes was in 18 months—in other words, by the end of 1979. But volume production of the 64K chip is not expected until 1981 to 1982 at the earliest. And by then 256K RAMS probably will be the state of the art.

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VT100 CRT DECscope	1,695	162	88	59
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T1765 Bubble Memory Term. . .	2,795	267	145	98
T1810 RO Printer	1,895	181	99	66
T1820 KSR Printer	2,395	229	125	84
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QUME Letter Quality KSR	3,195	306	166	112
QUME Letter Quality RO	2,795	268	145	98
HAZELTINE 1410 CRT	895	86	47	32
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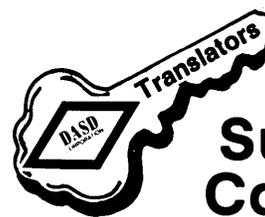
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Texas Instruments has already started to mass produce the 64K chip and IBM has offered its own with its new system 38. There is already talk of IBM putting out 256K by late 1980, and of 1 million bit RAMS by the end of 1982.

It remains to be seen whether the prototypes currently being developed by INMOS at its Colorado Springs facility and at Bristol in the U.K. can be Noyce's "unique product proposition" in other ways. There has been a persistent whisper since INMOS was created last summer that the company, as announced is just a front for more veiled creations which are the "last word" in technology. But this, as yet, is not taken seriously by the experts and by sources. What is taken seriously is that when it comes to building total systems—whether based on a 64K chip or not—Britain is even more reliant on imports of foreign peripherals than it is for integrated circuits. And this factor will force up the total system retail price, even with the development and inclusion of the innovative software that the U.K. is becoming noted for.

If this is so, the Tories are stressing that INMOS could become nothing more than a sink to pour public money down. And this in turn could result in a resounding "no" vote against the growing band of American specialists from the British man in the street.

Noyce's charge that the company lacks novelty and freshness may hold up as INMOS is seen to be charting its semiconductor course from a map of the world as it used to be.

—Ralph Emmett

COMPUTER CRIME

THE R&R SYNDROME

A Senator and an alleged thief have made computer crime a popular topic.

Jay J. Becker talks regularly about computer crime to such diverse groups as the Kiwanis Club, legal secretaries, escrow associations, bar associations, aerospace groups, law school classes and savings & loan organizations.

Becker, director of the National Center for Computer Crime Data, attributes the growing interest in his favorite topic to what he calls, "the R & R syndrome" for Ribicoff and Rifkin (U.S. Sen. Abraham A. Ribicoff, author of the proposed Federal Computer Systems Protection Act which would make certain computer offenses federal crimes, and Stanley Mark Rifkin, alleged perpetrator of a

\$10.2 million swindle of Security Pacific National Bank).

A deputy district attorney with the Los Angeles County District Attorney's office, Becker started an organization

"I want to create an entity of some sort, possibly a corporation."

named the National Computer Crime Data Center in February 1978. At the time he was chairman of the California District Attorneys Assn.'s Committee on Law and Technology. "I perceived com-

puter crime as a topic of importance to prosecutors and one on which they weren't well informed. I thought first of a *Law Review* article to alert deputies (deputy district attorneys), but that didn't work too well. Then I thought of a library resource bank."

Becker approached Los Angeles County District Attorney John Van de Kamp with his idea and the National Computer Crime Data Center was launched in February 1978 under the auspices of the Los Angeles County District Attorney's office and the California District Attorneys Assn.'s Committee on

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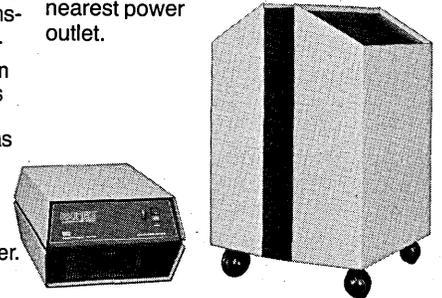
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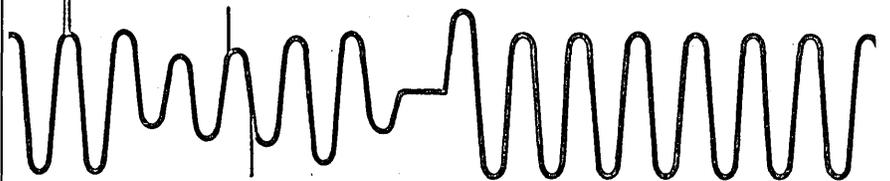
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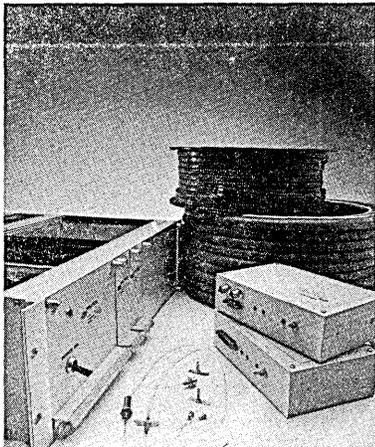
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The center also keeps track of existing and pending computer crime legislation. "We recently had a query from a Wisconsin prosecutor concerning a time-theft case. It turned out that Wisconsin had no laws under which the case could be prosecuted. We were able to provide him with copies of pending legislation in other states which could help him stimulate similar legislation in his state."

Becker said that while he gets many queries from prosecutors and investigators, he gets far more from graduate students. "Research into computer crime is very popular these days." From these queries, he's developing an index of current research.

His data bases are constantly expanding but he wants more, particularly case histories. He has a supply of "Computer Crime Report Forms" which he distributes during his speaking engage-

"After all, we've been talking openly about embezzlement for years."

ments and which can be obtained from him through his office, 320 W. Temple St., Room 540, Los Angeles, CA 90012.

He also is soliciting previously unpublished works or outlines of proposed publications on computer crime for a special *Computer Law Journal* issue on computer crime which he is editing. Originally scheduled to appear in May, it has been pushed back to late summer.

One topic he would like to see covered is "Computer Crime and International Data Flow." Becker has given talks in England and to the Dutch National Police and is extremely interested in the international aspects of computer crime. "In Italy, they're cataloguing computer crimes. We need to develop a global concept, a global language."

Becker hopes to see the work of his center become "applicable to the broader field of white collar crime. Sentencing is bad, not only for technology criminals but among all white collar rule breakers."

"Perhaps the last and worst irony," he said in a recent article in the *Washington Post*, "is the fact that all the other ironies are compounded when sentencing occurs. The defendant, usually a polite white male of the same orientation as the judge, finds himself getting a 40-day sentence after stealing a million dollars' worth of telephone parts or 15 months after stealing \$1.5 million over a period of six years."

Becker expanded on his ideas early this month at Honeywell's annual Security and Privacy Symposium. With him among the speakers was one of his "Rs," Senator Ribicoff. But it wasn't complete R & R . . . Rifkin didn't make it.

—Edith Myers

SMALL COMPUTERS

THE SMALL COMPUTER MYTH

Benchmarks show they perform a lot differently despite similar price tags and configurations.

Hillel Segal is in the business of challenging myths.

"One of these myths," says Segal, who runs organizations in Boulder, Colo., for time-sharing users and for users of small computers, "is that if two small computers are similarly configured and carry the same price tag, then they run the same way."

That turned out in recent benchmark studies not to be so, says Segal, president of the Association of Time-Sharing Users (ATSU) and the Association of Small Computer Users (ASCU). The benchmarks, conducted by Real Decisions Corp., Stamford, Conn., compared the capabilities of small computers in the \$20,000 price range and revealed a substantial difference in problem solving time.

For example, Segal said, the Wang 2200 vp was found to be faster by a factor of up to 20 in solving a standard scientific and engineering problem in which the number of variables was 50 and the precision was 12 digits.

Running time for that program required more than 38 minutes on the

Wang's 2200 VP is faster by a factor of up to 20 in solving standard scientific and engineering problems.

Datapoint 1170 and nearly 30 minutes for the IBM 5110 computing machine. It required only 4½ minutes on Hewlett-Packard's HP 45 and only a little more than two minutes on the Wang machine.

Real Decisions does the tests under commission by ASCU. They compared running times for five standard programs and did ease of use tests.

Real Decisions president, John Lewis, said the other programs included accounts receivables, new product planning and programs involving cpu intensive runs and i/o intensive runs. The programs were run in BASIC, but the vendors were permitted to substitute any other languages of their choice; none did.

The Wang system held an edge in accounts receivables and in cpu intensive runs, while the Datapoint machine was faster in the new product planning ap-

plication and in i/o tests, as was the HP machine. Wang "wasn't too fast" doing i/o intensive functions, Lewis said. He said there is no way that all five tests can be added up to provide an assessment according to each computer. "That's like trying to compare apples and oranges."

In a benchmark of time-sharing service vendors, Real Decisions did some 25 different runs and came up with different conclusions as to the price a time-sharing user would have to pay on each of 16 vendor remote computing service offerings. The one conclusive factor, Segal noted, was that users of time-sharing services should perform benchmarks if they're to get their money's worth.

In a recent study, reported in the January/February issue of ATSU's newsletter, *Interactive Computing*, the cost to run a new product planning problem including three minutes of connect time and 1,500

". . . the incredible differences between remote computing systems and services prices."

bytes of disk storage, showed a wide variation. Automatic Data Processing charged the highest price, at \$3.13, and it went all the way down to McDonnell Douglas Automation Co.'s charge of \$1.13. Next highest was On-Line Systems with a charge of \$2.81 and Rapidata, Inc., at \$2.48. Also on the low end were Boeing Computer Services at \$1.18, Computer Sciences Corp. at \$1.61 and United Computing Systems, Inc., at \$1.64.

Segal noted, however, that while ADP and On-Line had very high prices in one study, other benchmarks showed them with very low prices for other types of programs. "It again demonstrates the incredible differences between remote computing systems and services prices," which are important for users to understand and appreciate.

ATSU, the time-sharing group, was formed in 1974 and the ASCU was established about a year ago. Both have a total of some 3,000 members and early this month the two groups were to be renamed the Association of Computer Users (ACU), with the time-sharing and small computers group becoming sections of the parent body. Later, a section on word processing would be added. Members are provided with newsletters that list the facilities of vendors and frequently members receive the results of benchmark tests on time-sharing and small computers.

The current small business benchmark tests are the first of a series of 12 studies to be made on small computer offerings in the higher end price range. Later, Real Decisions will begin similar studies of microprocessor-based systems in the \$10,000 price range, also under contract

NEWS IN PERSPECTIVE

to the organization.

Segal says he isn't interested in using the studies to recommend the products of any computer manufacturer, but to provide an "important source of information to association members and other computer users" that at present isn't obtainable anywhere else. He said he's "pleased" at the results of the initial small business computer test, "because they confirmed ASCU's position that a 'seat of the pants' approach to computer selection can often result in a mismatch between company needs and computer capabilities."

Reports on the tests are being made available to members and nonmembers of ASCU in the form of 12 monthly newsletters at a price of \$150 to members and \$190 to nonmembers. Orders and further information is available from the association at P.O. Box 9003, Boulder, CO 80301.

Says Segal: "Our eventual goal is to provide reports on all computers actively marketed, and if subsequent tests continue to reveal such dramatic differences between comparable models, our reports could have a substantial impact on computer selection decisions."

—Tom McCusker

ELECTRONIC FUNDS TRANSFER

EFT — PERCEIVED

Consumers do not seem to be concerned about statutory safeguards . . . yet.

"At this stage in the development of EFT (Electronic Funds Transfer), most consumers, even financial institution customers, do not appear to perceive statutory safeguards as a necessary precondition to persuade them to use EFT."

This is one conclusion of a report to the subcommittee on EFT by the Committee on Law Relating to Computers, American Bar Assn. Section on Science and Technology. The report was prepared by Fred M. Greguras, Kutak Rock & Huie, Omaha, subcommittee chairman, and Ann L. Wright, senior law student, Creighton Univ. School of Law.

It says factors other than statutory safeguards, particularly convenience, "are more important in increasing usage at this time."

But the report's authors don't feel this will continue to be true. "This perception seems likely to disappear as awareness and knowledge increase through educational programs. Although the enactment of federal legislation cannot be justified on the basis of any systematic

abuses by financial institutions in contractual relationships with consumers, this situation will likely shelter EFT growth only so far."

The authors predict "removal of the limitations on transaction amounts and an increasing number of transactions involving third parties will make it much more difficult for financial institutions to manage the risks. Inconsistent and incomplete consumer rights established by private contract and state law would stifle the widespread expansion of EFT which is interstate in nature."

The report notes that the Electronic Fund Transfer Act, passed in the final hours of the 95th Congress, contains civil remedies for consumers for all types of violations of the law. "Its criminal liabilities apply to both system providers and to outside intruders. Most state laws create only criminal sanctions or civil liability for violations, but not both."

Some state laws, says the report, "only authorize regulatory agencies to withhold or rescind the approval of EFT facilities or to impose fines upon non-complying institutions, but the consumer is not provided a direct remedy as in the EFT Act."

The authors say federal law appears to be generally more favorable to consumers. "Most state laws do not contain a

deterrent to harassing or bad faith lawsuits by a consumer, a circumstance which can be considered more beneficial to a consumer if the total system cost is not considered as a comparative factor."

The federal legislation, the report points out, "is intended to preempt state law only to the extent the protection provided to consumers under the federal law is greater than that afforded by state law." The Federal Reserve Board is delegated the responsibility of evaluating whether federal or state law applies.

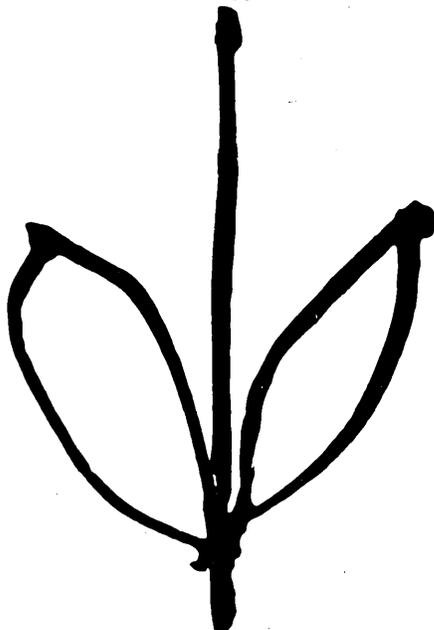
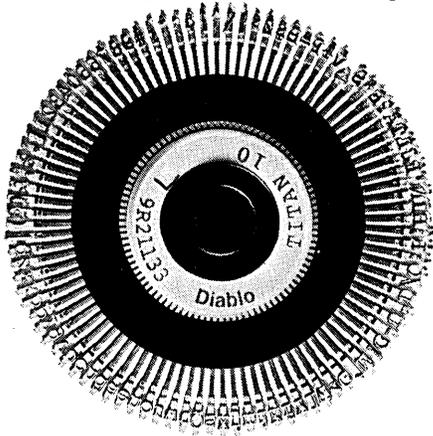
The real test for consumer acceptance of EFT, say the authors, remains "as actual POS (point-of-sale) transfers grow in volume as a substitute for some transactions of the traditional payments process. Currently the transactional relationship is still primarily consumer-financial institution. As terminal deployment statutes become more liberal and POS transfers and amounts involved increase, so too do the risks of loss. The federal legislation provides a structure for this growth but the operational realities will pose serious problems."

The authors believe the federal law "should allow EFT to develop in an aura of consumer confidence, a pro-EFT mood rather than a negative, anti-environment, a situation which financial institutions



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NEWS IN PERSPECTIVE

might never be able to overcome. The failure by Congress to totally preempt state laws will, at least initially, cause problems and must be dealt with."

State legislative bodies which are considering EFT consumer protection laws should, says the report, "defer to the federal law. Legislative bodies in those states in which laws already have been enacted should amend their laws to coincide with the federal mandate. Once the issue of uniformity is resolved, the federal law should not stifle expansion or innovation in systems development because of its relatively balanced approach."

The authors note that studies have been conducted which indicate there "is still general satisfaction with the existing payments mechanism and there is presently an extremely large group of customers in general as well as financial institution customers who either lack knowledge about the risks and benefits of using EFT or who are not even aware of EFT. The younger and the better educated financial institution customers appear to be the best potential market.

"To persuade consumers to use EFT, the services must offer greater convenience, be easy to understand and use, be perceived as no riskier in terms of potential monetary loss than the present mechanism and be of the same or less cost to utilize than the existing system. In addition, the service must offer the individual a sense or impression of (if not actual) control over financial transactions."

Recent studies, the report says, "indicate that the risk of loss is becoming of greater concern. Thus, as awareness and knowledge grows, it is likely that consumers will resist using EFT unless their concerns are quelled."

It suggests that the "general mistrust of computers and the perceived increased chance of error might be overcome by speedy and easy resolutions of disputes (over liability for loss).

"Consumers appear to identify benefits in both EFT (particularly automated teller machines and point-of-sale guarantee transactions) and the traditional payment system, and generally view EFT as complementary rather than as a replacement. Thus, the strengths of both mechanisms should be developed as the overall payments system unfolds. Point-of-sale guarantee transactions are attractive because they increase consumer convenience yet do not really alter the payments system as the customer perceives it. Use for such purposes can be viewed as a conditioning step, particularly to quell the somewhat prevalent mistrust of computers."

A mistrust that probably cannot be quelled is that of a small organization in Olympia, Wash., called Cosmic Aware-

ness Communications. It offers, via classified ads, to provide a packet of information on what it perceives as the dangers of EFT.

Readers of the packet are treated, along with Biblical references and references to the Antichrist and "forces of darkness," to the information that EFT is a "tentacle" of a "Beast" that is attempting to take over the world, that it is a mechanism "whereby cash will be taken from the economy and all entities (people) will be forced to receive a number" (imprinted on arms or foreheads by laser beam).

And, it says, the International Red Cross is a spy system "collecting data for the Beast."

The packet includes supporting documents including a reprint from DATAMATION (October 1978, p. 53). DATAMATION's title was, "EFT: Momentum Gathers." Cosmic Awareness Communications added its own: "The Beast in Motion."

-Edith Myers

EDP AUDITORS

**CERTIFIED
AUDITING**

Edp Auditors Assn. is well into first phase of a certification program.

There now exist 710 certified edp auditors.

Concern for improved edp auditing skills, which began accelerating some six years ago in the wake of the Equity Funding scandal in which some \$2 billion in bogus insurance was issued, undetected by auditors, fostered efforts on many sides to improve education for edp auditors and encourage certification.

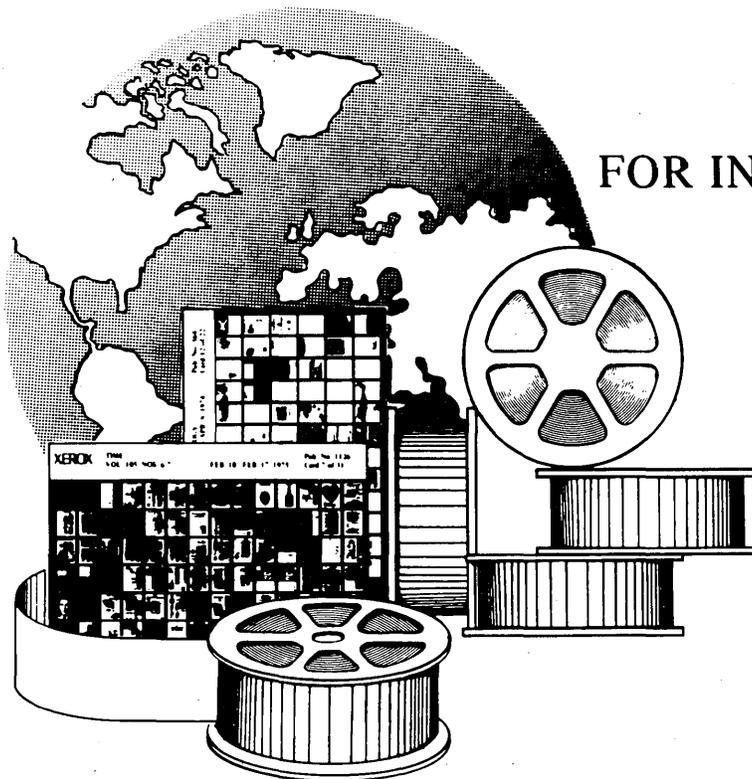
The same concern contributed to the growth of the EDP Auditors Assn., founded ten years ago with some 100 members. Today it has more than 3,000 members—and a certification program.

The association was approached in 1977 by the Institute for Certification of Computer Professionals which wanted EDPA to join ICCP and work with the certifying organization on a certification examination for edp auditors.

The proposal initially was favorably received by the auditors' group, but EDPA decided it knew best about what auditors needed to know and it turned the certification problem over to a subgroup, the EDP Auditors Foundation for Education and Research.

The foundation spent more than a year evaluating a certification program with three primary objectives: to evaluate individual competency for conducting edp audits; to provide a mechanism for moti-

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vating and monitoring edp auditor maintenance of competency; and to aid senior management in developing a sound edp audit function by providing criteria for personnel selection and development.

In June 1978, the foundation announced its Certified Data Processing Auditor (CDPA) program which would occur in two phases. Phase 1, from July 1978 to June 30, 1979, would involve issuance of CDPA certificates to "individuals who satisfy a professional experience provision (e.g., five years of attested edp audit experience or five years of attested combined edp audit, audit and

edp experience) and adopt the CDPA code of professional conduct.

Decision on awarding certificates was to be up to a Certification Review Board. This board reviewed the first phase 1 batch of applications on Dec. 2, 1978 and granted 315 applications. Certificates were mailed in January. A second meeting, on Feb. 15, resulted in 395 successful applications. Certificates are being mailed this month. A third review will take place in early April and a fourth (and last under phase 1) in early July.

Stanley H. Barnes, Gulf Oil Corp., Houston, Tex., director of certification

for the foundation, said that of the 3,000 members in EDPA "it is unlikely that many individuals will satisfy the five-year experience requirement."

Phase 2, which will begin July 1, is for those who don't. This phase, Barnes said, will include a formal examination which is being developed by the CDPA certification board. He said the board is working with both Educational Testing Service, Princeton, N.J., and The Psychological Corp., New York City, on a possible test and will submit a request for proposal to them this fall for testing to be conducted in 1980.

He said the examination areas tentatively will include computer controls, edp auditing techniques, edp audit management and evaluation, computer law and ethics, and a functional specialty (e.g., internal, external, government or financial industry edp auditing).

The foundation trustees, he said, considered various alternatives for motivating continued competency in edp auditing. "Reexamination and examination only on technological changes subsequent to the first examination were not judged feasible at this time. Thus, a mandatory continuing education program was adopted. The CDPA certification board will implement a careful quality control mechanism for the initial and subsequent approval of continuing education courses."

He said applicants for certificates under phase 1 pay a \$100 fee for filing and are refunded \$70 if their applications are rejected. The money goes to continuing education programs.

—E.M.

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**Massachusetts State Lottery
automation contract contest could be
a gambling matter in itself.**

Some gamblers believe the third time's the charm.

Maybe it will work out that way for Datatrol, Inc. of Hudson, Mass., in the competition for a \$25 million contract to automate the Massachusetts State Lottery.

The state's Lottery Commission has twice asked for bids for the contract and now, it appears, there could be a third time. And if there is, Datatrol, a subsidiary of Applied Devices Corp., will be partially responsible.

An award resulting from the second round of bids, to American Totalisator, Inc. (AmTote) was negated Feb. 28 by a Massachusetts Superior Court as a result

of a suit filed by Datatrol.

The commission requested a stay of the judgment on March 7 and Datatrol asked for an injunction prohibiting the commission from working further with AmTote on the project. Following a hearing March 9, Judge Robert J. Donelan, who issued the order setting aside the award to AmTote, ruled again in favor of Datatrol. He denied the commission's request for a stay and granted Datatrol's request of an injunction.

"The commission now has four alternatives," said a Datatrol spokesman shortly after the March 9 hearing. "They can appeal to the Supreme Court." He said he didn't think this was likely because it would be time consuming and he estimates the state is missing out on \$1 million a year in revenues by not automating its lottery.

A second alternative, he said, would be to do nothing, to drop all plans to automate. He didn't see this as likely for the same reason. A third would be to simply award the contract to Datatrol and the fourth, to go out for bids a third time, the alternative he felt was most likely.

It all started on May 19, 1978 when the Lottery Commission issued its first Invitation to Bid and Request for Proposal with a submission deadline of 2 p.m. Friday, June 30, 1978. Five companies, Datatrol, IBM, AM International (formerly Addressograph-Multigraph), Cimarron Systems of Ann Arbor, Mich., and System House Ltd., Ottawa, Ontario, Canada. AmTote asked for and received a two-hour extension.

Datatrol, in its suit, charged that such action (the granting of the extension), was in direct violation of the express terms of the proposal request.

Judge Donelan, who issued the order setting aside the award to AmTote, emphasized the extension grant as "particularly significant in view of the fact that the State of Maryland opened bids on a lottery processing contract at 11 a.m. the same day (June 30)." Datatrol and AmTote both submitted bids on the Maryland contract and the extension of two hours would have afforded AmTote extra time to examine Datatrol's bid which could have shown them what Datatrol was intending to bid in Massachusetts.

The result of the Maryland bidding

The two-hour time extension was considered significant because of a Maryland deadline the same day.

was an award to Control Data Corp. CDC ousted AmTote as automator of that state's lottery. Maryland is AmTote's home state. The company's headquarters are in Towson, Md.

Datatrol protested the original exten-

sion to AmTote and, after consultation with the state's Attorney General's office, the state purchasing office disqualified AmTote and rejected all bids, resulting in the second request for bids, issued Aug. 23.

The three finalists the second time around were Datatrol, AmTote and Control Data. A written analysis by the Lottery Commission, comparing the finalists, was submitted to the state purchasing office. Datatrol contended this analysis stated a preference for and a recommendation of AmTote. It was on the basis of this recommendation, Datatrol said in its suit, that an announcement of the award to AmTote was made on Sept. 29.

Judge Donelan, in his decision to negate the AmTote award, cited among other things, a statutory requirement for preference to a Massachusetts corporation. He said that Datatrol would fulfill the contract with supplies and materials manufactured and sold within Massachusetts while AmTote would not.

The March 9 hearing hinged on more than the judge's decision to negate the award to AmTote. The Datatrol spokesman said that subsequent to the judge's decision, Datatrol learned that an actual contract had been signed by the Lottery Commission and AmTote on Feb. 16. The Feb. 28 decision, he said, was based

on an award, not a written contract. He said the judge decided after the March 9 hearing that the written contract was illegal, and null and void.

Whatever happens next, Edward Walter, president of Datatrol said, "Datatrol intends to be a strong competitor for this

The judge cited a statutory requirement for preference to a Massachusetts company.

business. Maintaining this business within Massachusetts is in keeping with the governor's aim to provide more jobs and foster a strong alliance between the government and Massachusetts-based technology."

He said the state has projected that computerization of the state lottery will result in a \$600 million increase in lottery revenues over a six-year period.

Datatrol works on lotteries in Michigan, Rhode Island and in the provinces of Ontario and Quebec in Canada. The company said the Michigan-based lottery is bringing in \$3 million a week in bets, of which 50% goes back to bettors, 10% goes to running the operation and 40% goes to the state.

What happens next in Massachusetts, at this writing, was anybody's bet.

-E.M.

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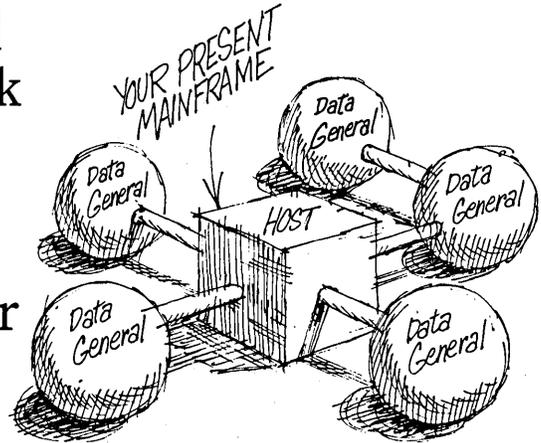
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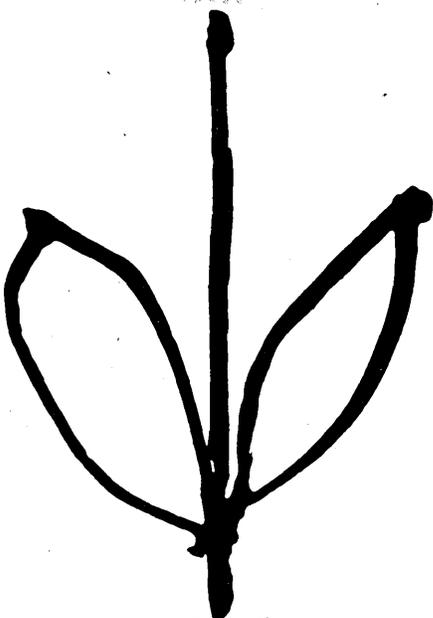
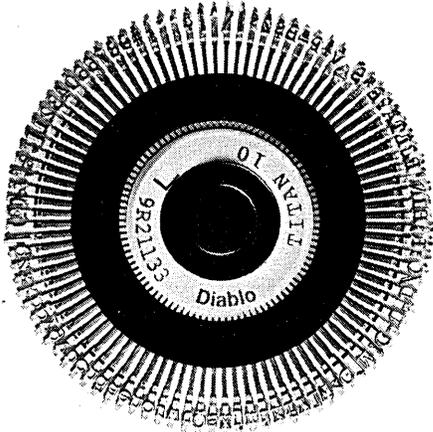
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76 DATAMATION

NEWS IN PERSPECTIVE

PERIPHERALS

**MANAGING
MASS
STORAGE**

Control Data's SMS system will cut disk usage by one quarter.

Who ever thought in late 1974 when IBM announced its model 5800 mass storage system that customers would be running out of space five years later on a system that ultimately would offer them 472 billion bytes of storage!

That is the predicament of some users, including Atlantic Richfield Co., which now hopes that IBM soon will announce double-density packing with their tape mass storage system (January, p. 52). While they wait, the name of the game is efficient storage management.

Control Data Corp. this month is announcing a software enhancement, called Storage Management System (SMS), that will be sold for \$20,000 as a subset of the Virtual Data Set Access Method (VDAM) for its mass storage system, called the model 58000. With some modifications, it's essentially similar to IBM's storage management system, called Hierarchical System Management (HSM), that was announced last year and was followed by a second release early this year. The IBM product is designated 5740-XRB and is licensed by IBM at \$350 a month.

Both products essentially are aimed at making it easier for the mass storage user to make maximum use of disk, mass storage and tape reels as the storage mediums.

Control Data's international sales manager for peripheral products, Mike Gluck, says that by using SMS, a 38500 customer is able to have data housed on a disk migrate to the mass storage system and eventually onto a tape reel for archival storage in a vault, if necessary. Such migration, of course, is predetermined by a user but the actual migration is done automatically. For instance, Gluck says, if a data set resident on a disk hasn't been accessed say for 30 days, it automatically is migrated to the MSS and then, if it still hasn't been accessed in say four to six weeks, it automatically can be migrated to a tape reel.

Data sets that are housed on a disk can be updated in the MSS and recovered on a different disk through a recovery command. This method obviates the need to remove all of the data from a disk and on to the tape, a task that might take from 20 minutes to a half hour to do.

CDC's SMS supports most of what IBM's

HSM does, but also supports ISAM and VSAM, which IBM's system doesn't. It supports IBM's time-sharing option, TSO, but doesn't support RACF, the security system; however, the CDC system supports independently provided security systems, SECURE (Boole & Babbage) and ACF 2, a package offered by Cambridge Systems Group. Gluck says future releases of SMS probably will support RACF when the package comes into wider use.

Gluck says SMS users will be able to have immediate access to restored data on the staging disk. In the IBM HSM, such data first has to go to a real disk through the CPU. When data sets are being migrated to tape reels on the CDC 38500, users can batch the data sets together for efficient storage. Gluck explains that sometimes a user with a tape reel with 100 megabytes of storage might have only 2MB of data on it. The CDC system, by batching data, could allow 50 or 60 sets to go onto the one reel.

Such storage management systems are valuable because they save operator labor, CPU processing power and, of course, free up disk space. Gluck noted that while a mass storage system typically reduces the number of tape drives needed by half, the addition of his company's SMS will reduce disk space usage by about one-quarter.

CDC said it will have a beta test on a user's equipment in June and begin shipments in August. Since it introduced the 38500 shortly after IBM did, Control Data has installed 34 systems at 21 user sites. Eighteen of them are in installations that use IBM computers, of which six are in European countries.

-T.M.

PROGRAMMING

**A CHANCE
TO FINISH
PROJECTS**

By following a list of "ifs," the programmer might just have a "snowball's chance" of completing large projects on schedule.

Large software development projects are notoriously mismanaged and never finished on time. Can such projects ever be completed on schedule?

Yes, says Dr. Robert M. McClure—if you establish a realistic schedule, if you don't change your mind in the middle of the project, if you staff it properly, provide adequate facilities, keep distractions away and everyone motivated, and manage sympathetically but firmly. Un-

der those strict conditions, says the consultant, "you might just have a snowball's chance."

McClure was one of two keynote speakers at the IEEE Comcon conference in San Francisco this winter. Professor John Linvill of Stanford Univ. spoke on hardware, McClure on software, both addressing a theme of exploding technology and responsible growth.

Linvill, chairman of the electrical engineering department at Stanford, spoke of problems and opportunities in the world of integrated circuits. "As integrated circuits go, so will go computers,"

The communications path among elements has become the most expensive thing on the silicon chip.

he said. "And where computers need to go, so must go integrated circuits."

He spoke of progress in the semiconductor technology that is now leading to very large scale integration (VLSI) and of the advances required to make that a reality.

"The architectural character of computers has been relatively stable for a long period of time," he observed. Unlike the early days of computer design, the switching element in the mainframe is no longer the most expensive part; using transistors, the switching element has become the least expensive. And now the communications path among elements has become the most expensive thing on the silicon chip.

In the past, too, memory and processing units were separate; in the present technology these can be combined. This means memory/processor units can be located in many points in a computing structure, and it's possible to design various kinds of parallelism.

"The whole computer need not, and probably should not, be lock-stepped with a single synchronizing clock," Linvill said. It means designers can get away from the synchronous machine designs of the past and look at other and different architectural approaches. "The ideal form of computer architecture for VLSI systems hasn't emerged," he observed.

McClure called software a "leading growth industry—if you count the number of people employed. Upwards of a half-million people do at least some programming on a regular basis," he said, noting that the activity is becoming "fairly pervasive." He said the software field has achieved some degree of technical maturity. "Unfortunately I don't believe it has achieved a great deal of emotional maturity."

When a large software project is late, for example, "rarely is the problem anything technical." Rather, he said, it stems from poor management, from injecting changes in the middle of the job.

"Why do programmers mistreat themselves?" he asked rhetorically. "One of the most amazing aspects of this business is the insistence of management to deprive the software staff of management tools—and the continuing willingness of the software fraternity to put up with it." McClure talked of programmers who work the midnight shift just so they can get access to machines. He said the advantages of on-line development systems are clearly understood and "beyond question today," and yet many shops still provide their programmers with the same batch methods and only one turn a day. It was a practice acceptable in 1965, but not today, the speaker asserted.

But McClure said adequate tools mean more than adequate computer power. It also includes the right kinds of software—good editors, compilers, debugging facilities, and the like, all within the state of the art. And he said programmers also need the right kind of clerical support. In the world of hardware development projects, he observed, it's long been understood that engineers and technicians working together complement each other. But in the analogous world of software, "you never get around to providing technicians for programmers."

He spoke of good design, whether in hardware or software, as being largely an artistic creation. "And the talent for design may well be different from the talent needed to program well. We have not, in the software industry, drawn that distinction. We have not developed the tradition that some people are designers and others are implementors." That tradition of craftsmanship, he said, must be developed.

Drawing from another industry, McClure noted that a machinist must spend the first seven years or so learning his trade. But you won't find a programmer willing to spend seven to ten years learning his craft.

"The solution to this problem has got to be the development of a cadre of skilled programmers whose egos are satisfied with producing the best possible implementation of someone else's design."

The keynote speaker also addressed briefly the issue of program portability, saying this is possible "but just barely." There's more to it than putting handles on packages. "I think we have learned how to write portable *programs*," McClure said, adding: "I have seen very few portable *systems*." The lack of any progress in this lies with the computer manufacturers, who have no interest in promoting portability. "It destroys their hold over their current clientele," he explained. Only the user community has a vested interest in portability.

—Edward K. Yasaki

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CIRCLE 143 ON READER CARD

APRIL 1979 77

I/O INTERFACE: The federal government has approved the final computer I/O interface standards by issuing the federal information processing standards (FIPS). It will require all federal computer system procurements after Dec. 13, 1979, to use essentially the IBM 360/370 channel interface. It ends a five-year battle for the IBM version which most computer mainframe firms had opposed because it restricted competition and thwarted future technical improvements. FIPS 60 is an I/O channel level interface to define mechanical, electrical and basic functional specifications covering the interconnection of tape drives and controllers and disk drives and controllers. FIPS 61 covers the channel level power control interface for power sequencing of peripherals and FIPS 62 applies to operational specifications of magnetic tape subsystems. The Commerce Dept. is inviting comments on a fourth proposed interface standard covering operational specifications for disk drive subsystems. The National Bureau of Standards Institute for Computer Science and Technology is drawing up a list of small computers and microcomputers that will be exempt from the new standards.

MORE YEN FOR 4300s: As expected, IBM is pricing its bargain-basement 4300 line higher in Japan than in the U.S. The system, announced in Japan about a month after its U.S. announcement, is priced at from 15% to 17% higher in Japan. The 4331 processor will be produced at IBM Japan and the 4341 will be imported from Brazil but will not be available until the second quarter of next year. The 4331 will be delivered in June. IBM said the higher prices resulted from a number of production factors, including the importing of components from the U.S. Reports that Japan's Ministry of International Trade and Industry had pressured IBM to keep prices high to protect the Japanese computer industry were denied by IBM.

RESERVE FOR IRAN LOSSES: Computer Sciences Corp., which performed computer operations support services for the Iranian government, said it had created a \$1.9 million reserve for losses from its Iranian operations. The company, which made the charge in its fiscal fourth quarter ended last March 30, said it had reduced its work in Iran in recent years to

a "relatively low level." Earlier, a csc spokesman (March, p. 87) indicated that csc still had personnel working in Iran, but wouldn't disclose the number. Last month, William R. Hoover, chairman and president, said the company's withdrawal from Iran was complete.

THOMSON MOVES: Thomson CSF, the French electronics conglomerate which plans to buy into the U.S. dp market (March, p. 85), last month settled for a semiconductor manufacturing operation. It announced an agreement in principle to acquire the RF power transistor business of Solid State Scientific for about \$6 million. The move would give Thomson its first U.S. semiconductor manufacturing operation. It has been doing some assembly, testing and marketing on a limited number of discrete semiconductors at its Nucleonic Products Co. plant in Canoga Park, Calif.

IT'S COMPLETE: Xerox Corp. has completed acquisition of the high-capacity disk memory segment of the memory products division of California Computer Products and has given it back its original name (February, p. 18). The operation is now the Century Data Systems, Inc., a wholly owned subsidiary of Xerox. The subsidiary's president is James Y. Payton, who managed the operation for CalComp and who had been a vice president of the original Century Data Systems, acquired by CalComp in 1973. Two other firms acquired other portions of what was CalComp's Memory Products Div. Billings Computer Corp. acquired the small disk memory operation and Advance Machine Corp. bought a segment which makes metal computer cabinetry.

INTEL BUYS MRI: Intel Corp. completed the acquisition of MRI Systems Corp., the large Austin, Tex., software firm whose principal product is System 2000, the data base management system. MRI will be operated in Austin as a wholly owned subsidiary of Intel's Commercial Systems Div. William S. McCalmont, the Intel division's general manager, said "the next step in improving data base management products is to optimize the use of both hardware and software for storage management func-

tions and to develop easier-to-use, higher level languages for the user."

FLOPPY DISK BUY: West Germany's Siemens has agreed to acquire the floppy disk product line of Perkin-Elmer, acquired in 1976 by Perkin-Elmer's Wangco division. The operation originated as Orbis Systems, Inc. No purchase price was disclosed. The operation will remain in its 25,000 sq. ft. facility in Tustin, Calif., after the sale is completed.

STC IN SEMICONDUCTORS: Storage Technology Corp., of Louisville, Colo., agreed in principle to acquire Microtechnology Corp. to assist its venture into the semiconductor field. Microtechnology, a spinout from Amdahl Corp., specializes in E-beam technology for high-speed logic circuits. It would design memory and logic circuits that STC would build in-house. STC is setting up a 10,000 sq. ft. semiconductor plant in Louisville. STC would pay about \$2 million in stock, if the merger is approved.

ON THE MOVE: John V. Titsworth, 53, resigned as executive vice president for systems at Control Data Corp. to become group vice president for information products at Xerox Corp. He'll head Xerox Business Systems, El Segundo; Diablo Systems, Hayward; Versatec, Santa Clara; and Shugart Associates, Sunnyvale, all in California. Titsworth, who had been at Control Data since 1968, succeeds David J. Culbertson, who was named a senior vice president and senior staff officer. Robert W. Duncan will succeed Mr. Titsworth at CDC.

TEN YEARS AWAY: Market research specialists Frost & Sullivan, Inc. don't foresee a profitable boom in fiber optics for at least 10 years. "We dispute the widely heralded forecasts of explosive growth for fiber optics markets during the coming decade," says the firm in a 211 page study, "Fiber Optics Technology and Markets." The study doesn't indicate that the market will stagnate. It says fiber optic shipments over the next 10 years will increase more than fivefold, from \$11 million in 1978 to \$60 million by 1987. But, it says, "the total is paltry when compared to either market projections touted by others or the market values on alternative technologies that proponents of fiber optics hope to displace." *

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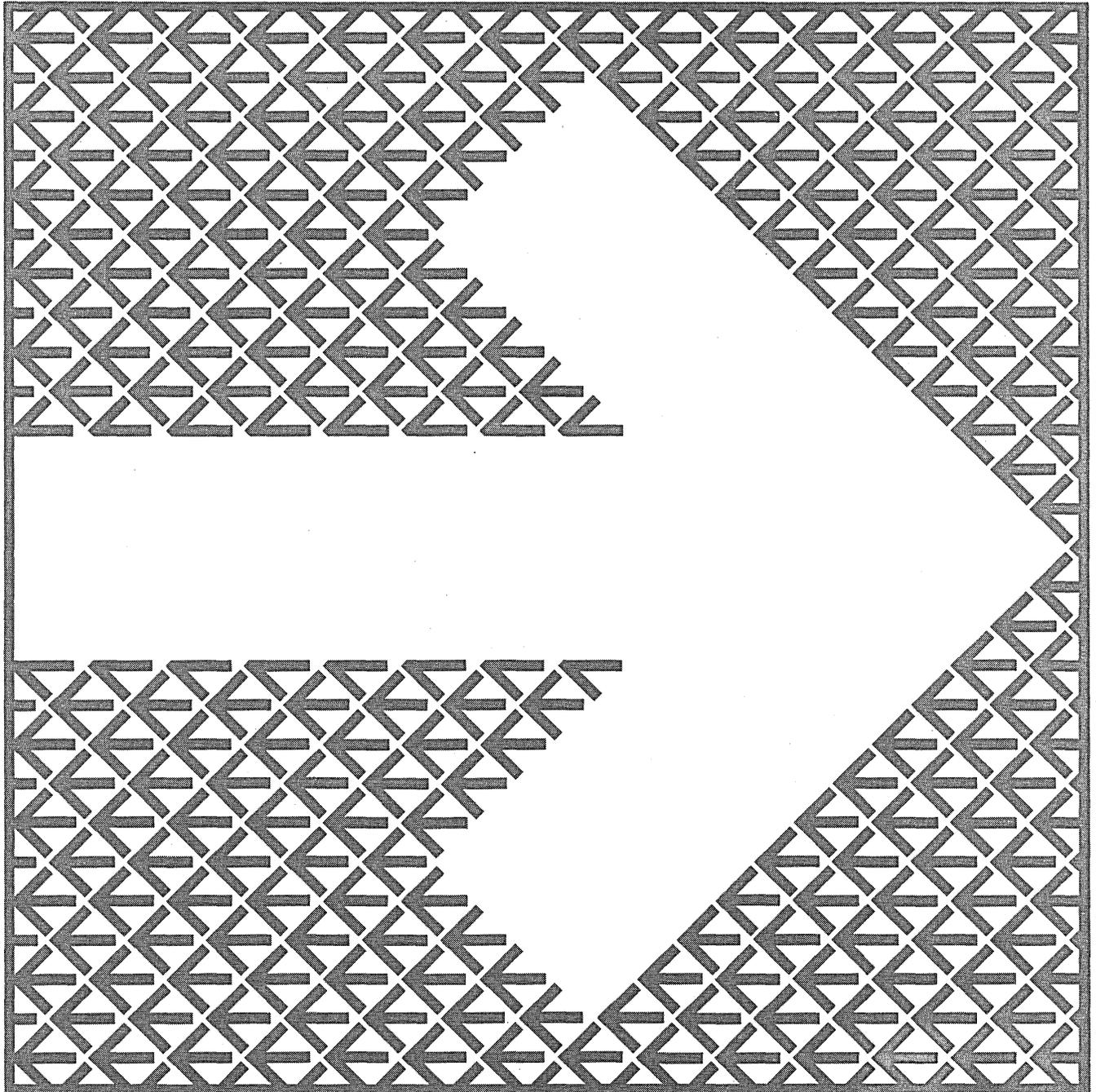
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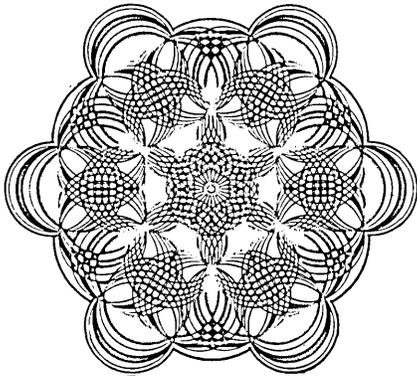
HOBBY AND GAME MARKETS FADE . . . IS THERE LIFE AFTER KITS FOR RETAILERS?

"The big change is that now the bulk of our customers . . . want a turnkey system, thoroughly reliable, with training, and a blanket maintenance contract."

by Stephan H. Seidman

In 1978, there were about 750 retail computer stores; by 1983, there will be about 2,000 such stores dedicated to the sales of computers and computer products, despite the probable failure of many financially marginal businesses.

Overall, computer retail stores generated total revenues of \$165 million



in 1978. Growing at an estimated rate of 40% a year, they are expected to produce \$945 million in revenues by 1983. Additional revenues in the retail market will be generated by distribution channels other than the stores: office equipment suppliers, electronics distributors, mail order houses, advanced consumer electronics stores, and systems houses.

The significance of these alternate distribution channels was demonstrated by Tandy Corp. which, in 1978, its first year of personal computer sales, sold between 100,000 and 150,000 TRS-80's, a computer of its own manufacture, through its chain of Radio Shack consumer electronics stores. This figure represents more sales than all other microcomputer manufacturers combined, and elevates Tandy to only the third company ever to reach that level of manufacture and shipment. (Digital Equipment Corp. achieved that same level in 1978, after 21 years in business, albeit with much more expensive equipment.)

The retail computer store grew out of the mail order business for computers

in kit form, catering to the hobbyist. As a result, most of the early stores had a very casual environment, and were staffed by technical people. Conversations about bits and bytes, often among employees, were more common than sales presentations to clients. As a sideline, the stores sold consumer video games; the application of these products were well known and very little customer instruction was required.

Now, it appears that both the hobby market and the video-game market are on the wane. Additionally, virtually none of the microcomputer manufacturers supply kits anymore, although kits are still

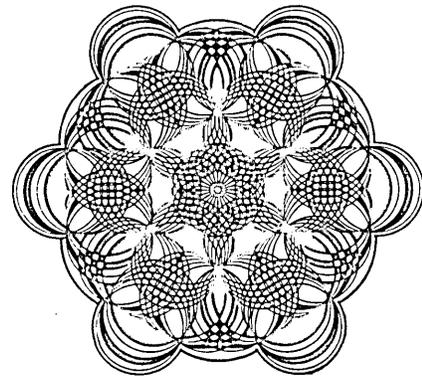
Computer stores, now faced with a shift in the buying population, are gearing up for the change.

available from Heath Co. and from some electronics distributors. The game manufacturers, such as Mattel and Atari, have upgraded to programmable products with keyboards, thus further blurring the distinction between games and home computers. Computer stores, now faced with a shift in the buying population, are gearing up for the change.

Gene Murrow, president of Compal, a group of small business computer retail stores in California, said, "At the beginning we had the *avante garde* businessman. He was technically oriented, willing to do some of the software himself; a cross between a businessman and a hobbyist. The big change is that now the bulk of our customers have little interest in how a computer works. They want a turnkey system, thoroughly reliable, with training, and a blanket maintenance contract. They want to wave their arms over the machine one morning and say: 'Payroll!' and have the paychecks immediately appear."

As can be seen in Fig. 1, by 1978, the small business computer segment of

the market had already grown to represent 56% of the sales of the computer stores, or \$92.5 million. By 1980, this segment will account for 76% of those sales, or \$251 million. Individual stores have begun to rearrange, redecorate, restaff, and change their names in order to better address the small business market. Not all



stores, however, are completely convinced of their ability to service the small business market exclusively, and are attempting to address business and consumer markets simultaneously.

Dick Heiser, president of The Computer Store, Santa Monica, Calif., remarked, "Our company is still selling a lot of personal computers to individuals and industrial customers. We have been reluctant to jump into business systems—we're still looking for good software."

The business store will have to have software capability, on-site maintenance capability, and experienced businessmen and professional accountants assisting in the preparation of the software. Murrow said, "We have professional handholders at the store—staff people who do nothing but training and answering questions. And all of our handholders have M.B.A.s; they're the key guys in the whole operation."

The successful business store will sell solutions to business problems. These packaged solutions will include problem evaluation, hardware, software, installa-

tion, training, maintenance, and the ability to upgrade the system as the client's business grows. The store name, the physical facility, the staff, and other clients attracted to the store will have to have the look of business and professionalism. Essentially, the business-oriented computer store will be a systems house with a glass front on Main Street or in a shopping mall.

The hardware product line of micro systems is functionally identical to that of its larger predecessors. A typical small business system will include an 8-bit cpu (eventually 16-bit machines may become popular), a video monitor, a keyboard, dual floppy disks, and a printer. The main difference is the price. It is this low price that enables computer retail stores to exist, allowing a basic inventory to be established with relatively modest amounts of capital—about \$40,000. (An additional \$100,000 might be required to get a retail computer store started.)

In 1978, hardware and peripherals accounted for 66% (\$109 million) of computer store revenues. By 1983, hardware

The successful business store will sell solutions to business problems.

will have a 55% share, amounting to \$520 million. Upgrading and the aftermarket in peripherals will keep the sales share for hardware fairly high, even though unit prices will fall dramatically. Because the systems approach will be taken, the price of systems sold to small businesses will not decrease very much because the cost of software and other services will increase.

With respect to software, the absence of a universal, integrated financial software package for micros appears to be the major block to the potential penetration into the small business market. Manufacturers and store owners expect that somehow it will be possible to provide an integrated package which will be acceptable as-is by their clients, in spite of the fact that larger machine vendors have been unable to do so. For a store to succeed in the business market, it will be essential to provide custom software services, both for the satisfaction of the client, and for the store to be able to achieve an overall 45% gross margin on the system sale.

In 1978, software products and services contributed \$35 million in sales to computer stores, an overall 21% of total sales. By 1983, that amount will increase to \$331 million, representing a 35% share of sales. Most of the custom work will involve the modification of modular, easily customized software packages.

In the shift to the business market, the ability to provide efficient maintenance,

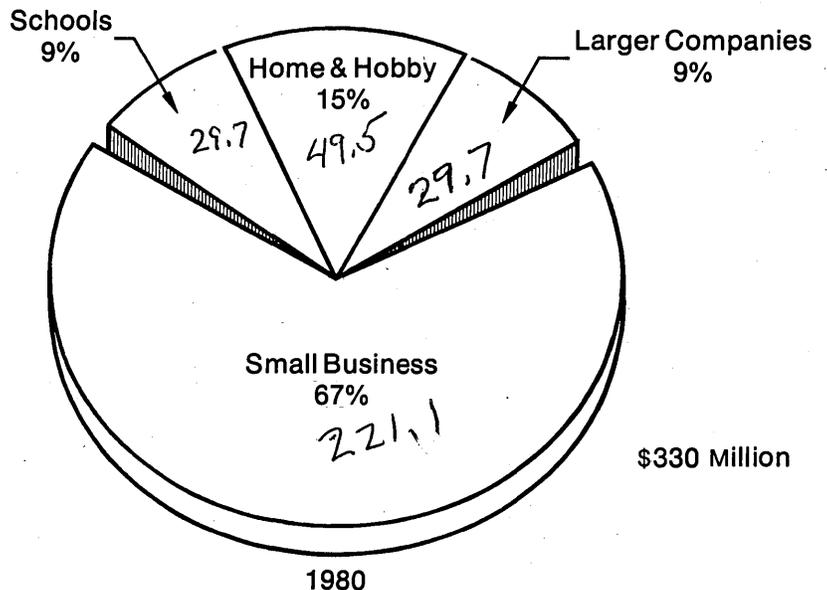
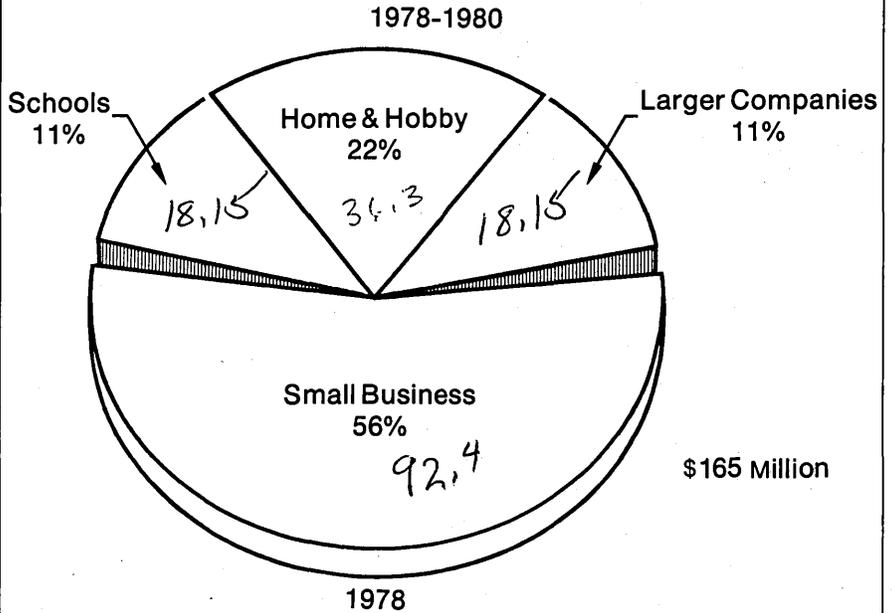
preferably at the customer's site, and preferably by means of a maintenance contract, will be essential. Maintenance revenues will increase from a rather insignificant level of \$5 million in 1978 to \$45 million in 1983.

A significant development in the industry today is the emergence of the middleman between manufacturer and the individual store; for example, the manufacturer's rep, the electronics distributor, and the computer wholesale distributor.

The middleman is of value to the manufacturer because he relieves the manufacturer of the trouble and expense of dealing with end users or stores which may wish to buy one computer at a time. He is of value to the store because he will

sell single units, frequently off-the-shelf, providing immediate delivery, and the possibility of "net-30" payment terms instead of COD or advance deposits. Theoretically, because of his much larger buying power, he should not have to add to the existing competition for the already-too-small gross margins on hardware. It is on this premise that Byte Industries, Inc. is dropping its franchise program in favor of a network of independent dealers who will want to buy from Byte in order to achieve higher gross margins than if they did their own purchasing. Byte management believes it can make money by selling to the independent Byte Shops at prices which will allow the stores to make a profit also. The stores are only required to buy from Byte as long as its pricing

DISTRIBUTION OF COMPUTER STORE SALES BY APPLICATION



FOCUS

remains competitive.

Traditional electronics distributors, such as Hamilton-Avnet, Cramer, and Schweber, have also entered the market, as intermediaries between manufac-

Traditional electronics distributors have entered the market, as intermediaries between manufacturers and end users.

turers and end users. The major effect of these distributors has been to divert industrial purchasers from the retail computer stores to the purchasing departments of their respective companies. This is particularly true in those companies which are encouraging distributed processing and which want some control over the hardware and software used throughout the company. Specs are written by the dp department, and the systems are purchased through the routine channels. On the other hand, these distributors also provide individual stores with discounted equipment, shipments from inventory, and payment terms.

The growing impact of these distributors is reflected in Fig. 1, where, in the next two years, the share of revenue that computer stores derive from larger companies will drop from 11% to 9%.

"We don't know how much business we lose to electronics distributors," Heiser commented, "but we do have several instances where someone comes in and buys a personal computer, and then takes it to work and becomes the computer expert at work. In one case, a chief engineer at an incense manufacturing company purchased a micro, wrote software for production planning, payroll, and job costing, and then leased the system to his employer."

The expected entry of a mass manufacturer, such as Texas Instruments, with extensive resources and retail experience will be of some help to the larger, well established retail stores, but will force many small manufacturers out of business. A manufacturer such as TI would be able to provide greater discounts, quicker service, and a significantly higher level of advertising and point-of-sale merchandising support than most existing companies in the market. TI is expected to move into the market in late 1979 with a consumer product, followed shortly thereafter with a business product. While the actual price of the hardware is not crucial when selling a packaged solution to a small business, the reputation and support available from a company such as TI will be an asset to the

store in making the sale.

The systems dealers are hoping TI products will have modular, easily expandable software to enable them to create custom solutions for clients. Retailers who prefer to sell hardware are hoping TI will provide them with a single-application machine. Thus, TI's product line is likely to be determined by its plan for retail distribution.

"The key is whether the TI system will have modular software," said Heiser. "If it does, it will be a natural monopoly machine. Everyone will try to write software for it—and TI will document the machine well, and have a good repair system. Also, since most stores are selling systems in the \$1,000 to \$8,000 range, the expected pricing of the TI equipment—between \$500 and \$1,000—will force a major readjustment in pricing and service policies in the retail computer stores."

In spite of the problems and the potential for new problems as the character of the market changes, computer retail stores are here to stay and will be a significant force in business data processing. It remains for the stores to upgrade their own business skills, to learn the requirements of their business clients, and to survive the next few years of tight financial operations and intense competition.

The data presented in this article represents the results of a survey by

Mr. Seidman and published by Strategic Business Services, San Jose, California. The survey results are based on interviews with microcomputer manufacturers, computer store operators, franchisers, and users. *

STEPHAN H. SEIDMAN



Mr. Seidman has been a consultant for the last eight years. In addition to independent consulting, he has worked for several consulting firms and is the author of a number of research reports. His experience in dp dates back to 1954 and includes managerial positions at Scientific Data Systems, Philco-Ford, and Rockwell International. Mr. Seidman holds two patents on computer design techniques, and is a member of Tau Beta Pi and Eta Kappa Nu. He holds a master's degree in psychology and is the author of *Using Transactional Analysis to Improve Communication*.



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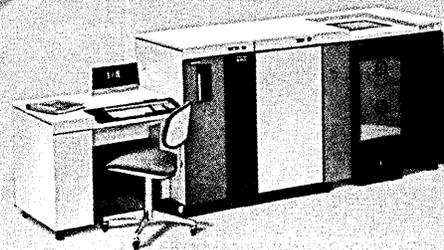
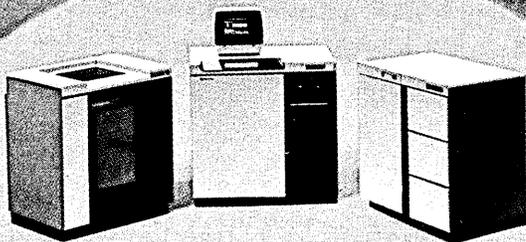
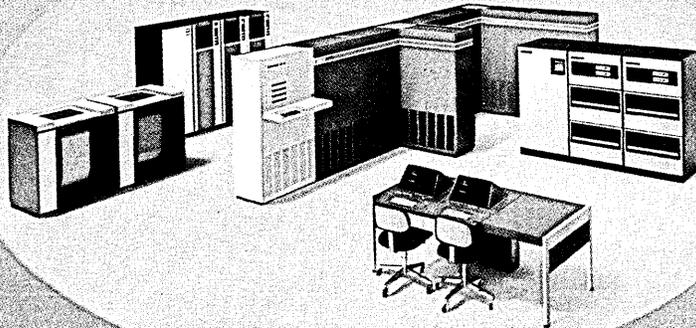
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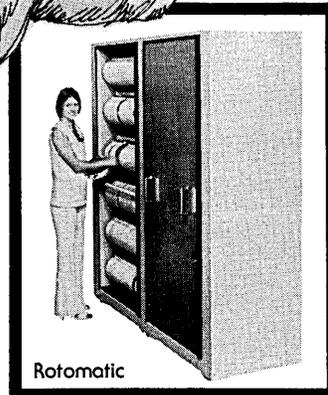
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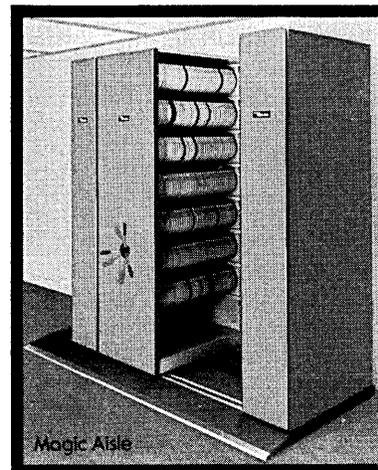
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More than a decade ago, Honeywell pioneered the separation of network processing from information processing. That experience, plus our capabilities, gives you confidence as you approach distributed processing. Chances are, we can show you how to distribute your processing with greater ease, in less time, and at a lower cost.

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Honeywell

Design the information system to match the organization it supports.

CENTRALIZE? DECENTRALIZE? DISTRIBUTE?

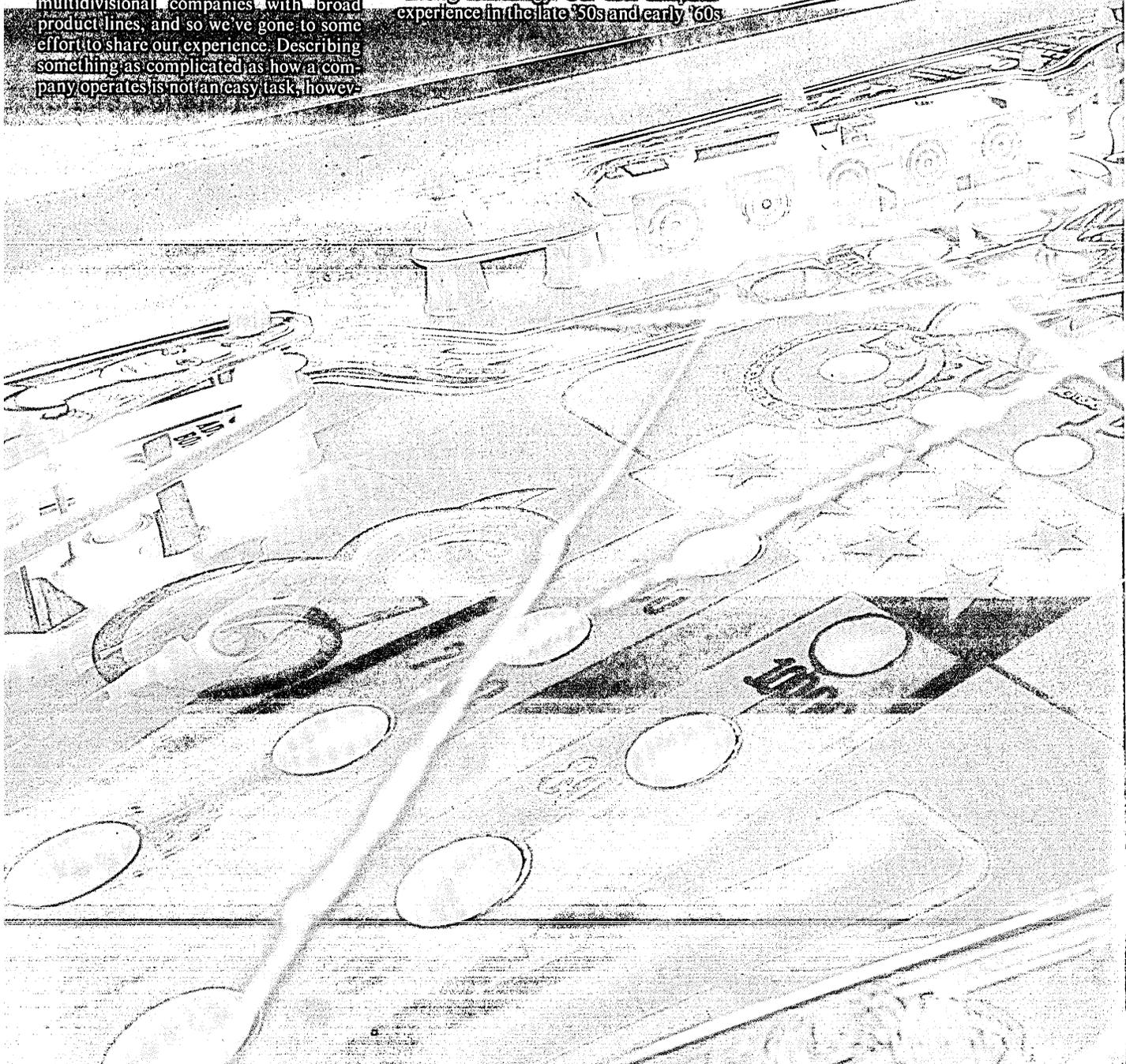
by **Gort Van Rensselaer**

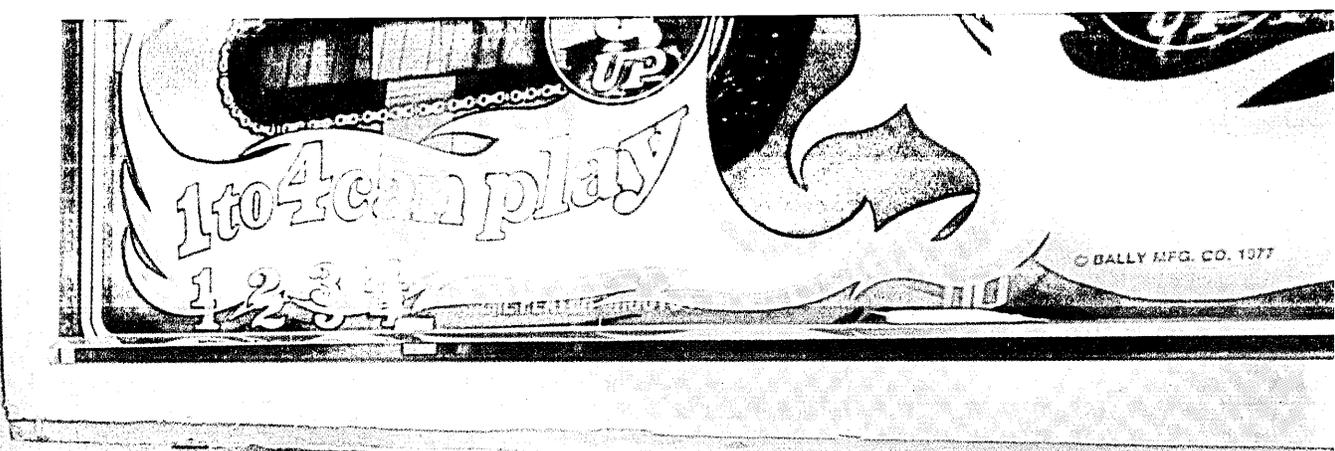
Hewlett-Packard Co. has been extremely successful in using large and small computers to handle its administrative data processing in whatever environment was necessary: centralized, decentralized, or distributed. We think that what we've learned can be useful to other worldwide multidivisional companies with broad product lines, and so we've gone to some effort to share our experience. Describing something as complicated as how a company operates is not an easy task, howev-

er, especially given the added confusion that comes from an unsettled data processing vocabulary, so it seems best to trace what we have done with specific examples.

Basically, we have evolved from a purely centralized operation to our present mix by riding on the coattails of advancing technology. Our first computer experience in the late '50s and early '60s

was with large stand-alone processors (and we still have some of those). As the company grew, we developed a central data processing facility at our corporate headquarters in Palo Alto, Calif. This facility served a number of San Francisco Bay area users in a batch environment, in





Universal numbering conventions were established for non-dp reasons, but proved key to dispersing the processing.

which input and output was transferred by messenger or taxi.

In the early '70s, this center became too cumbersome to manage. It became increasingly difficult to respond adequately to the diverse needs of a large number of users. The short term answer was to go to an RJE environment—while still retaining a centralized computing facility—where control of the operation of application systems would be transferred to the users.

During the same period, we began to use time-sharing for interactive systems requiring geographically dispersed terminals, and to install a worldwide data communication network with local data entry to support our sales and service activities. The time-sharing and remote data entry applications gave us confidence in the effectiveness of minicomputers, and the development of the communications net was to be the groundwork for what has followed.

About five years ago we realized that our standalone installations outside the Bay area were more responsive to local management needs than our common RJE systems were. As a result, we began to decentralize a large portion of our previously centralized data processing.

Finally, our data communications network and decentralized computers together made it possible to experiment with distributed systems, where data storage and processing functions are shared across a mix of computers and lines, and where nontrivial operations are performed at more than one place. This activity has grown very rapidly, and several of our major data processing applications systems now operate in a distributed mode.

Thus far our experience with distributed processing has been positive. Distributed processing has made it possible for us to adapt to a constantly expanding

geographic operation, and a constantly changing organizational structure, while maintaining consistent administrative support. It has permitted us to meet the reporting requirements of our own management and those of the governments of the various countries where we operate, in a timely and cost-effective manner. And it has improved the accuracy of administrative data by moving a significant portion of the processing to the source of information.

The most significant lesson we have learned from our experience, however, is that there is no one best way to process data. Information systems must be designed to match the organization they support. Thus our decentralized organization with its strong central management requires both decentralized and centrally managed systems. (See Table 1.) Understanding why this is true requires a short explanation of our business.

THE BASICS OF THE BUSINESS

Hewlett-Packard manufactures more than 4,000 products for wide-ranging markets which are primarily in manufacturing-related industries. We have 38 manufacturing facilities and 172 sales and service offices around the world, and together these employ about 45,000 people. We have experienced a very rapid growth of about 20% per year, culminating in sales of \$1.7 billion in 1978.

To support this business, we currently have some 1,400 computers (not including desktop units or handheld calculators). Of these, 85% are used to support engineering and production applications, are usually dedicated to specific tasks, and often are arranged in networks. A number of them are also used in computer-aided design applications as front-end processors for large mainframes.

The remaining 200 computers are

used to support business applications. The largest is an Amdahl 470/V6 located in Palo Alto, and there are nine medium-sized IBM systems in other large facilities. Seventy HP 3000s are used in our factories and larger sales offices, and 125 HP 1000s are scattered about for data entry, data retrieval, and data communications work.

Generally speaking, the HP computers are oriented toward on-line applications, and the large mainframes toward batch processing (although three also support on-line applications). In addition, HP uses about 2,500 crt terminals in business applications alone.

The network tying all this together (Fig. 1) consists of 110 data communications facilities located at sales and service offices, at manufacturing plants, and at corporate offices in northern California and Switzerland.

Some long-standing management traditions have contributed to the successful application of all this hardware. For example, for the past 20 years HP has been oriented toward decentralized management responsibility at the operating level with strong central management coordination. Local managers have been accustomed both to making their own decisions and to reporting to management on a frequent and detailed basis.

Another important tradition has been the adoption of companywide coding standards. Universal conventions for product number, account number, part number, entity code, employee number, and others were established to meet business requirements long before computer systems were extensively employed.

But perhaps the most important systems-related management tradition has been the existence of functional advisory councils. These groups were established to resolve common local problems in such areas as order processing, materials management, cost accounting, and quality assurance. Today, these councils provide a forum in which to arrive at a consensus for dp related problems and to achieve user support.

We have found the decentralized management, the companywide standards, and the existence of the councils all to be invaluable in building and managing our complex, dispersed systems.

TEN BIG PROBLEMS

Yet, for all our built-in advantages, progress hasn't always come easily.

As our use of computers has evolved, we have faced a number of continuing challenges, some of the most important of which are:

1. Establishing a central planning and management program for company-

Centralized	Decentralized	Distributed
Materials services	General accounting	Production information
Vendor contracting	Cost accounting	Customer information
Consolidated statements	Customer service	Orders & changes
Legal reporting	Production	Accounts receivable
Employee benefits	Shipments	Payroll & personnel
	Purchasing	(85%)
	Inventorying	
	Product assurance	
	Payroll & personnel	
	(15%)	

Table 1. After nearly 20 years of evolution, HP has come to the conclusion that there is no one best way to process data, and the company does some processing in each kind of environment.

Distributed Computing Network

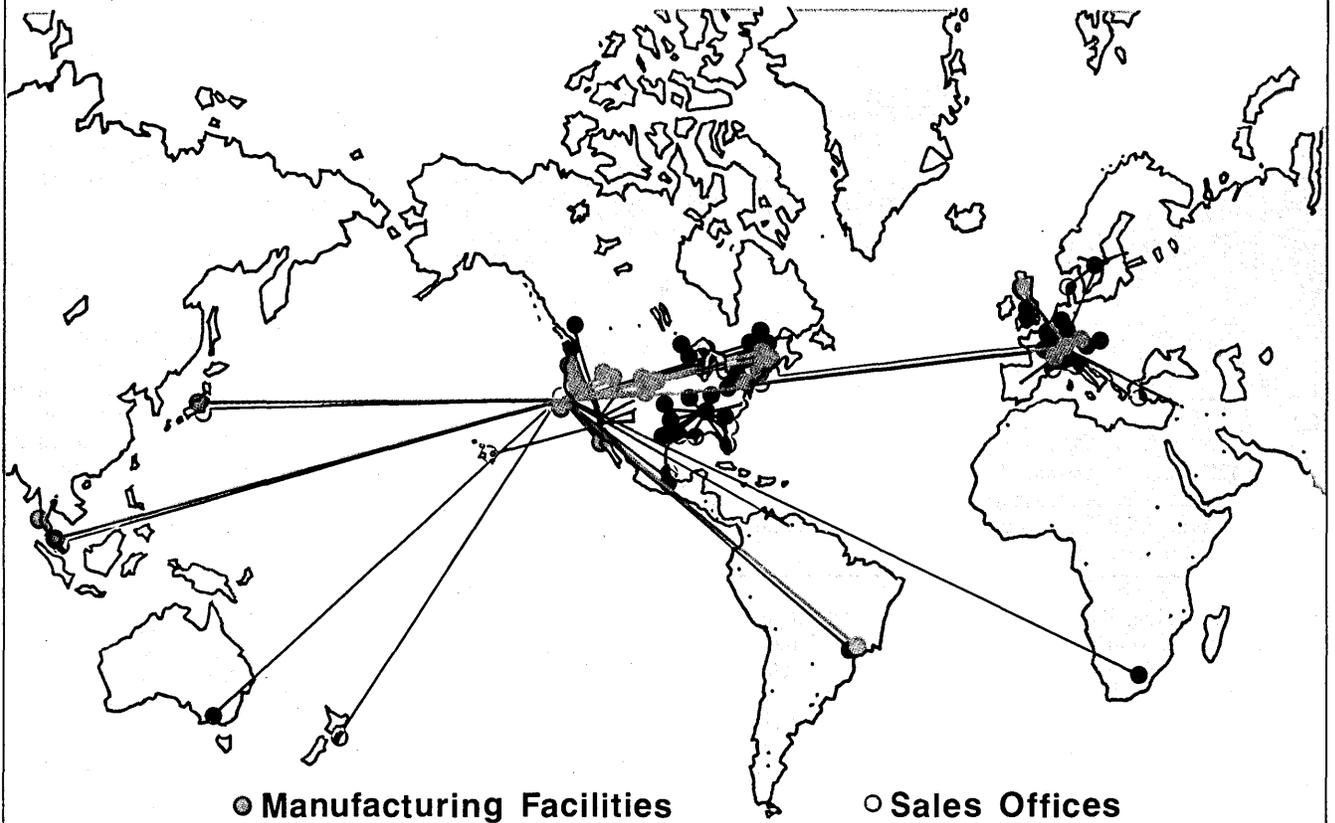


Fig. 1. HP's internal communications network has 110 nodes linking manufacturing plants and sales offices to corporate centers in Palo Alto and Geneva. Most lines are dial-up facilities, and so communications line costs are held under \$50,000 per month even though message volume averages 140 million characters per day.

wide information systems activities so that decentralized development work could be coordinated.

2. Designing systems which could respond easily to constant geographic expansion, organizational change, and the addition of new operating units.

3. Coping with ever-increasing needs for detailed and accurate information to meet management and government reporting requirements while controlling administrative costs.

4. Designing systems which could be adapted to respond to specific local needs while maintaining companywide compatibility.

5. Getting user-managers to accept responsibility for the specification and operation of their systems.

6. Convincing users in different functional areas that data is an organizational resource to be shared by all, and that individual transactions should simultaneously update the records of all functions.

7. Avoiding unnecessary duplication of effort in designing and supporting systems.

8. Developing the skills of data processing staff members to meet the needs of a growing organization, and as-

signing priorities to their activities.

9. Establishing, maintaining, and promoting the use of standards for hardware, software, documentation, project management, data, and auditability and control as a foundation for well-coordinated worldwide applications systems.

10. Controlling security and privacy in an on-line, decentralized, and distributed multinational environment.

Although we have made a great deal of progress in solving many of these problems, candidly, a number of them are still unresolved.

We began to seriously address the first and most important challenge—establishing management control over companywide systems developments—about two years ago. We saw then that a large amount of data processing hardware had been installed in decentralized locations and that many potentially incompatible systems were being designed. Furthermore, we realized that the plans for hardware installation were not well-coordinated with the needs of systems being developed centrally. In an attempt to deal with these matters we established an Information Systems Planning Office. This in turn led to the creation of an Information Systems Planning Task Force (simi-

lar to the advisory councils discussed earlier), which was assigned responsibility for defining how HP's information systems activities should be managed.

The task force first identified three organizational areas which required different approaches to system design and operation: sales and service, manufacturing, and corporate administration.

HP's fundamental organizational unit is the manufacturing division profit center. There are 38 of these. Each occupies a single plant location, and performs a full range of business functions (including research and development, manufacturing, and marketing) as well as support functions (financial control, personnel administration, and product assurance). In many respects, each division resembles an independent company.

We practice management by objectives and attempt to have decisions made by the people who are closest to the problems. From an organizational viewpoint, this means that manufacturing support systems must be *decentralized*. The exceptions are centrally managed distributed systems such as those for payroll and personnel.

With such decentralization, there is an unfortunate tendency for redundan-



HP has 172 sales and service offices around the world, about 70 of which are directly connected to the firm's communications network. Most offices maintain their own customer, order status, and product data files on-line, and are involved in some form of distributed processing for each.

cy in system design. To minimize this, HP has established a sharing policy for common programs, which has been quite successful.

HP's worldwide sales and service organization employs a different type of system. Customers are served by a single organization which just happens to be geographically dispersed. Sales and service activities related to specific product lines are performed by specialists; and these specialists are supported by a *distributed* marketing administration system which ties the sales and services offices to the company headquarters and to the factories.

The third entity, corporate, provides those services such as product assurance, payroll, and employee benefits, fi-

nancial and legal reporting, which are best handled in a *centralized* manner.

The planning team studied how existing information systems supported these various company operations. During this analysis, it became clear that our most successful systems were those which matched the company's organization and management philosophy. This led to the conclusion that systems should be centralized, decentralized, or distributed depending on management needs.

The following four examples describe specific HP information systems or facilitates and show how they match our organization. The first deals with the communication system, which is the heart of our minicomputer network. The second and third examples are of two systems



Most of the processing done at the 38 manufacturing sites is performed in a purely decentralized manner. Exceptions are for payroll and personnel data processing, and for functions performed in coordination with the sales offices.

having distributed data bases, one with central master files (at two locations) and the other with both central and dispersed masters. The final example deals with decentralized systems which interface some distributed systems.

110-NODE NETWORK

The communications system which supports our computing network employs minicomputers at 110 worldwide locations. These minis take care of a number of data communication functions. They handle data entry, format data for transmission, automatically detect and correct errors, and adapt transmission protocols to meet the requirements of various countries. In addition, the minis support on-line access to local data bases.

We started to build this network in the late '60s when we were using paper tape, which was slow, very expensive and—even more important—extremely error-prone. In 1968, HP introduced a minicomputer oriented primarily toward scientific applications. To see if we could use this machine in business applications, we started using it to support a communications network with intelligent terminals. The network was successful right from the start, and we've been continuously adding to the locations served. Five years ago we began to install display terminals on the network. More recently we've been adding distributed data bases and an inquiry capability.

The network operates in a store and forward mode. In Europe, for instance, we transmit everything to Geneva (Fig. 2) and concentrate the data there for more efficient use of the overseas lines to Palo Alto. The communications system uses the standard dial-up worldwide telephone network over most routes. This greatly reduces the cost, since we pay only for the actual time used. For example, it takes about one minute a day to transmit all the information back and forth to New Zealand. A single dial-up call to New Zealand is clearly a lot less costly than having a dedicated line.

The average worldwide data volume is about 140 million characters per day. This translates into about 100,000 messages. Still the line cost runs under \$50,000 per month, which is very economical compared with the communication costs of other companies using on-line systems at similar data volumes.

The largest communication system applications are for marketing (60% of the traffic), accounting (15%), employee information (10%), and administrative messages (15%). We transmit about a million orders per year over the network,

almost 50% of which originate outside the U.S., and about three million invoices. The network is also used extensively for file transmission.

The system has provided an excellent means for transmitting administrative messages (electronic mail) and has been particularly effective for overseas communication, where the telephone is costly and inconvenient because of time zone differences. Using the system, the cost of transmitting a letter-size message overseas is typically 30¢. This low cost, coupled with the system's speed and convenience, has resulted in a large increase in day to day communication between people at the operations level in our U.S. and overseas offices.

As the largest user of the communications system, the marketing administration group is responsible for planning and implementing systems enhancements, which are developed by a small central team of programmer analysts. New releases are transmitted as data to the remote locations and put into operation at a prearranged time. The installation of these periodic system enhancements normally goes smoothly, but a fair amount of expertise is required at the remote locations to cope with unexpected bugs which occur due to slight hardware differences, special local modems, and other incompatibilities.

MARKETING ADMINISTRATION SYSTEM

The second application system example is the distributed marketing administration system, which supports the sales and service organization. The primary objective of the marketing system is to provide accurate and consistent information to support our customers on a worldwide basis. To do this requires a centrally managed distributed system.

The marketing administration system (Fig. 3) suggests how centralized, decentralized, and distributed processing all go on simultaneously.

'Decentralized processing is used for production planning, product configuring, and shipment scheduling at the manufacturing sites, and for order entry and service scheduling at the sales and service offices.

Centralized processing comes in for such functions as financial and legal reporting and administration of the employee benefits program at corporate.

Some forms of distributed processing are employed for maintaining and accessing distributed data bases. The data for customer records all originates at the sales offices, for example, and slices of the customer data base are kept in each sales

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Distributed Computing Network - Europe

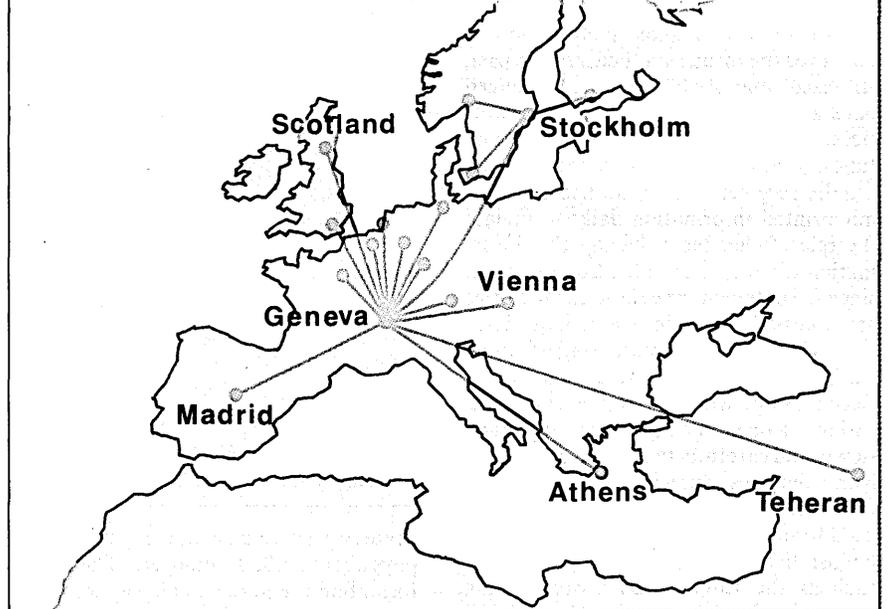


Fig. 2. The network operates in a store and forward mode. In Europe, for example, local sites may perform data base inquiry and update their own files, but must batch all data for files maintained in Geneva. Similarly, Geneva batches data bound for Palo Alto files.

The Geneva office handles both sales and manufacturing orders for products produced in Europe, sending only summary information to Palo Alto. For products manufactured outside of Europe, Geneva ships orders directly to Palo Alto; order status files for those sales are maintained simultaneously in Palo Alto and Geneva.

office, but a complete customer data base is simultaneously maintained at corporate and slices of the data base also exist at the manufacturing plants.

The data for product records all originates at the sales offices, for another example, and slices of the product data base are kept at each plant, but complete product data bases are simultaneously maintained at corporate and at each sales office.

Orders and changes are entered at the sales and service offices, transmitted to headquarters where they are entered on central files, and then sent on to the factories for acceptance and delivery acknowledgement. Company order, shipment, and backlog status is maintained centrally to provide information to top management. Delivery information is transmitted from the manufacturing divisions back to the sales offices where orders are acknowledged.

Invoices are centrally processed in Palo Alto and Geneva. The credit and collection functions are decentralized to the sales offices, with central reporting of receivables status to provide financial control.

Files of European open orders are maintained in both Geneva and Palo Alto. An order from a European sales office containing items to be supplied from a European factory and a U.S. factory is

processed in Geneva. Complete detail pertaining to the U.S.-supplied items is transmitted to Palo Alto; however, only order statistics are sent to Palo Alto for the European-supplied items. Order status information is transmitted back and forth daily to keep the two files in sync, and a monthly audit procedure insures that nothing has been overlooked in the daily updates.

Up to date order status change information is transmitted daily from the Palo Alto headquarters to the larger U.S. sales offices to provide on-line access for response to customer inquiries. The remote files are kept in sync with the master files by computer control. That is, the update program requires each batch update to be performed in the right order. (The Jan. 17 update cannot be performed before the Jan. 16 update.) Local files can be recreated from the central files should recovery be necessary.

Although data communication is handled in a batch mode, the system operates in the same manner as an on-line distributed system in which a significant portion of the data processing is done at more than one location. Data is batch communicated because this is the most economical method to employ with currently available communication facilities.

The use of display terminals in the sales offices to access order status infor-

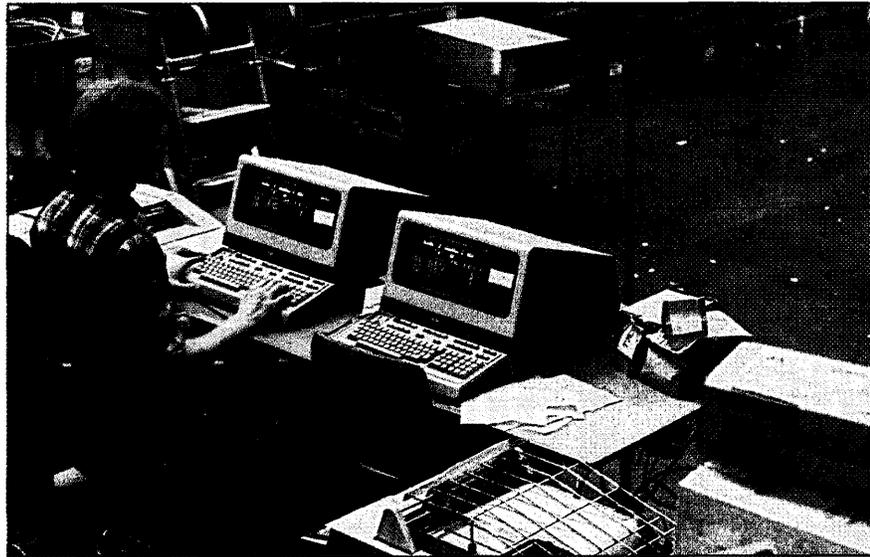
mation produces a labor saving of close to 20% over the former methods. In the past, HP used microfiche reports, produced once a week and mailed to the sales offices. Data retrieval was awkward and time consuming. In addition, reports were usually received late, so we had to transmit printed information daily to update the microfiche. Now, having this information directly available also cuts costs, since fewer telephone calls to the factories are necessary for order status inquiries.

Managing the marketing administration system is a continual challenge. Because of its wide geographic and applications scope, changes must be made slowly and carefully to avoid upsetting existing features. Individual HP organizations and functions have a continuing need for enhancements and want these to be installed quickly. Functional councils, such as the Information Systems Task Force, the Order Processing Council and the Customer Service Council, have played important roles in prioritizing these needs and obtaining support for overall system development plans. Needless to say, differences of opinion are strongly expressed in meetings of these councils.

Another management challenge is the coordination of international dp system activities. Europe, in particular, has important and unique system needs which are best developed and supported locally. These needs, however, must be closely coordinated with the main system because of the close interrelationship of transactions and files. A great deal of overseas travel, along with rotation of knowledgeable personnel, is needed to keep these efforts properly coordinated. To accomplish this coordination, three U.S. systems people are currently assigned in Europe, and two Europeans in the United States.

PERSONNEL/ PAYROLL SYSTEM

In order to comply with local laws and customs, an independent personnel/payroll system is maintained by HP in each country in which we have operations. In the United



Approximately 2,500 crt's (and 200 computers) are used for business dp alone, including these at the Sunnyvale installation's receiving dock.

States we have a distributed system which pays about 25,000 employees. The pay information is entered on display terminals at about 30 remote locations, each with its own daily updated disk file. The data is transmitted to Palo Alto monthly, where the payroll is processed. The pay checks are either transmitted back to the originating locations for printing or they may be directly deposited in the employee's bank account.

Why do we process our payroll in Palo Alto, rather than at the remote locations? We do this for two main reasons. First, to help administer overall HP benefits. For example, we have a nationwide insurance plan, a retirement program, cash profit sharing, and a stock purchase plan; all of these must be administered out of a central file.

Second, many government reports must be made on a centralized basis: retirement legislation reports, equal opportunity reports, withholding taxes, etc. By producing the information needed for benefit administration and government reporting a by-product of the payroll system, the information need only be entered into the computer system once.

The distributed data base which supports the payroll/personnel system operates in a different mode from that which is used for the sales and service system.

Each division is responsible for the accuracy of the data relating to its employees. The data is kept on local HP 3000 disk files updated daily. Changes made to these files are transmitted to Palo Alto several times a month, where they are used to update the central file prior to payroll processing.

The audit and control procedure which ensures that the central and remote files are in sync works in the following manner. After the central file is updated, the modified records are transmitted back to the local entity for comparison. Any discrepancies are then reported.

Discrepancies can arise from two causes. First, somewhat more stringent edit routines can be applied centrally, so an unedited error is occasionally detected. Second, certain changes to employees' records can be made centrally and these are sometimes not recorded in the local files. A small, but significant number of errors are detected by this audit and control procedure.

The payroll/personnel system serves a number of departments: finance, accounting, personnel, and tax. An advisory board consisting of members of each of those departments reviews and approves changes to the system's programs, which number several hundred per year.

Eighty-five percent of HP's U.S.

CHARACTERISTICS OF APPLICATION SYSTEMS

Activity	Factory Management System	Marketing Administration System	Payroll/Personnel System
Development	Joint effort between divisions and corporate on modular basis	Various operational units working under centrally coordinated plan	Corporate
Operation	Decentralized (use is optional)	Distributed	Distributed
Data Base	Locally maintained, serves all manufacturing facility departments	Centrally and locally maintained, local sales office data bases updated daily	Locally and centrally maintained, central data base updated before each payroll run
Support	Sharable systems centrally supported	Central support of basic systems, local support of alterations	Central support

Periodic enhancements to the communications system demand a fair amount of expertise at remote sites.

employees are paid by this system. The other 15% are located in manufacturing divisions which have elected to run their payrolls locally. Personnel data for this 15% must still be maintained in the central file to take care of the centrally administered benefit programs. Keeping this independently prepared data accurate and consistent with that prepared centrally is a significant challenge. This experience has dramatized the advantage of sharing common data used by different functions. The discipline of the payroll system has proven to be invaluable in keeping central personnel records up to date and accurate.

The remote personnel files of both kinds permit local entities to produce reports on their employees. In addition, they provide a timely interface to local systems such as cost accounting. The remotely used software is centrally supported, and changes are released periodically.

FACTORY MANAGEMENT SYSTEM

The last application system to be described is the factory management system, which is implemented on HP 3000 hardware. This decentralized system supports the functions of order processing, materials management and purchasing, production planning, product assurance, service support and accounting.

The factory management system consists of a group of functional modules which access a central data base which serves as an information resource for the division. As mentioned earlier, most systems used by our manufacturing divisions are decentralized and locally managed. Although each HP division has unique re-

quirements which must be satisfied by its local support systems, there is a remarkable similarity between the needs of the different divisions. Most HP divisions are oriented largely toward assembly operations, so manufacturing support systems are designed around a bill of materials processor. As a general rule, 80% of a division's needs can be satisfied with the basic system. We developed the factory management system to multiply the return on development and support costs by sharing systems between these decentralized locations.

The factory management system has been developed over the last five years, one module at a time. (An example of a system module would be materials management, production planning, or cost accounting.) The development has been done by joint development teams consisting of division personnel responsible for providing the specifications and ensuring that the system meets their functional needs, and of central data processing specialists who make sure that the modules operate efficiently and properly interface other system modules. On completion each module can be shared by other divisions on a voluntary basis.

We have not attempted to solve all system problems in each module. We have followed the 80-20 rule, taking care of major requirements that are common to a number of divisions. In fact, we have encouraged sharing divisions to add unique features required to meet their local needs. Quite often these unique features are of value to other divisions and later get incorporated into the "standard" modules.

This approach to sharable system

design has been very successful. We find that the shared modules save up to 75% over the cost of local development and that they can be implemented in a fraction of the time. So far, over half of HP's 38 divisions have elected to participate in this program, and nearly all have plans eventually to use some parts of the system.

The factory management system has been especially useful to new divisions (which are being added at a rate of about three per year). It has permitted managers in these divisions to have a high level of systems support capability early in their growth cycle. On the other hand, the system has been much less useful to older, established divisions with mature systems. These entities have found it difficult to justify the cost of change (especially retraining people), even though on-line operation and other enhancements would be desirable.

The factory management system architecture permits divisions to utilize either the complete system or individual modules to support specific functions. Many divisions have installed modules to automate activities which previously were handled manually. Often these modules are interfaced with existing systems implemented on IBM (or IBM-compatible) hardware.

With the large number of divisions using the factory management system, we have found it profitable to establish a central support facility. This group installs enhancements to the system on an on-going basis, makes modifications as required to match changes in interfacing systems (such as companywide distributed systems), and helps the divisions install modules. Several functional advisory boards have been established to facilitate priority setting and to keep the central group tuned in to user needs. One of the important problems considered by the advisory boards is whether to enhance existing systems to achieve short-term benefits, or to put the effort on additional systems capability to satisfy future needs.

The factory management system provides an interesting management challenge. Since it uses within one facility a data base supporting all using functions, managers must rely on the accuracy of one another's data. This can be difficult to implement in an organization accustomed to individual departmental control of systems resources, but it pays off by providing consistent information and eliminating the classic argument over whose numbers are right.

For access to those numbers, HP is making wide use of display terminals in factory applications, as well as in sales and service work. The primary advantage



The largest mainframe in use is an Amdahl 470/V6. Others include nine medium-size IBM cpu's and 70 HP 3000s.

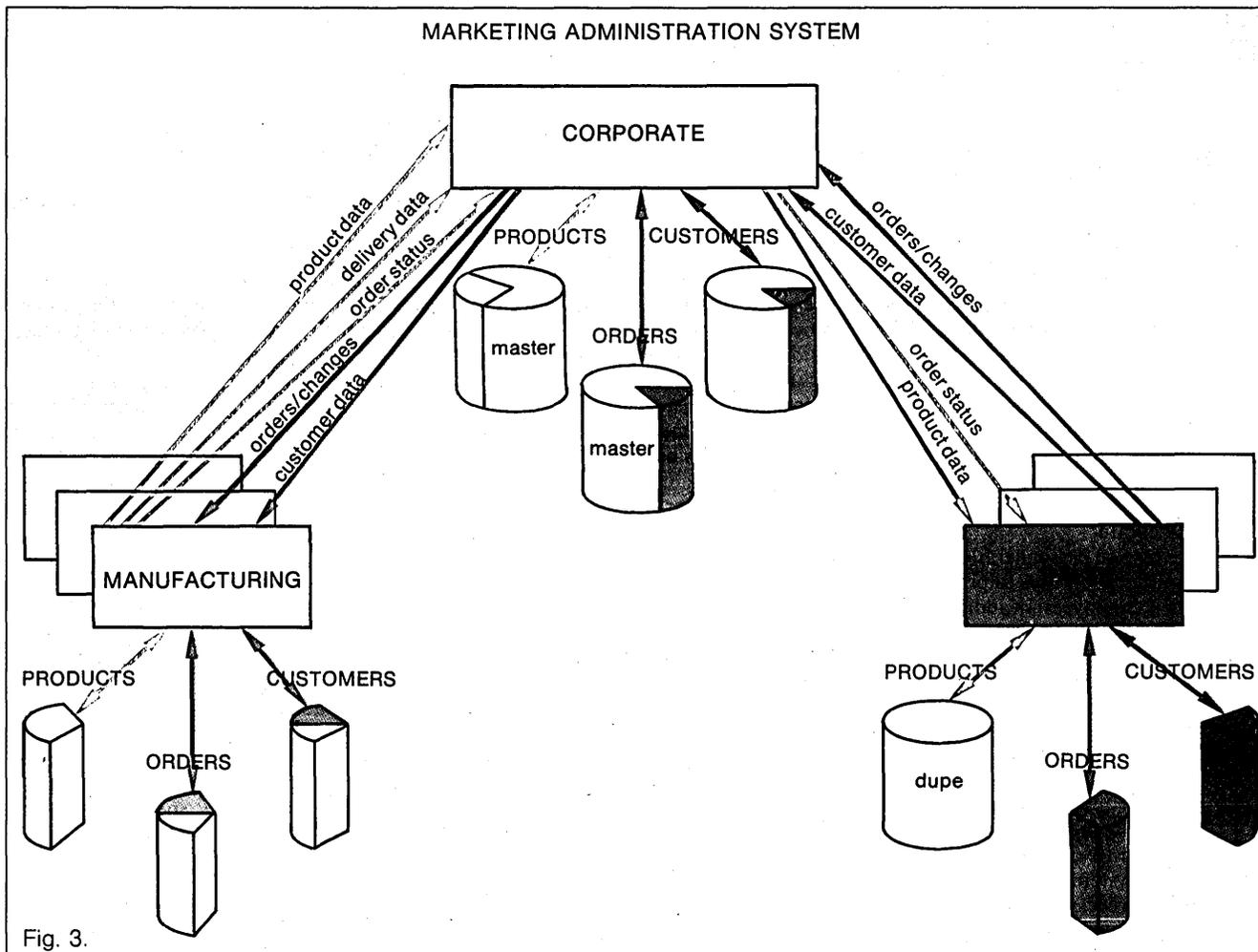


Fig. 3.

of these on-line terminals is usually thought to be that access to data, but there is an important secondary justification: paper saving. Terminal availability greatly reduces the number of printed reports required. In one study (involving another manufacturer's hardware), we found that half the cost of installing on-line displays was justified by a direct reduction in printed reports which the users agreed to give up in return for on-line access to data.

FOUR STRINGS TO TIE IT TOGETHER

An important activity of managing systems in a large worldwide company is the central systems support which ties the whole process together. Four main functions or aspects are involved at HP: (1) long-range planning, (2) "visibility and leverage," (3) personnel, and (4) standards and guidelines.

The preparation and maintenance of an overall plan for systems evolution and development is essential. This involves the combined efforts of manufacturing, sales and service, and company-wide personnel. To accomplish this, we've established three planning teams. The manufacturing planning team is headed by the vice president of corporate services and his staff. The marketing team con-

sists of members of the staff of the vice president of marketing. Companywide planning is handled by the office of the controller. The central management job is to consolidate the results of the planning efforts by these three teams and then communicate these plans throughout the company and to upper level management for approval or for suggested modification.

The aspect we call "visibility and leverage" has played an important role in the success of our systems. We believe that good managers will make good decisions if they have the right information. A great deal of needless duplication of effort has been avoided by communicating information about information system activities taking place throughout the company. For one thing, this has highlighted existing sharing opportunities.

Information systems personnel are very important in this scheme, and growth of the number of people in this function parallels that of the company's dollar growth: 20% per year. Most of the hiring and development of these people is decentralized, but the central activity provides an overall framework to improve consistency.

Another important function of Central Information Systems Services is user management education. Training programs are conducted regularly cover-

ing the role of users in system design and operation.

The final area, *standards and guidelines*, is essential to the success of all our systems. As mentioned earlier, we have some well-established, company-wide coding standards which arose out of non-dp activities. In addition, the dp systems themselves have helped create and maintain standards. For example, our worldwide order processing system imposes a strong data standards discipline. Factories and sales offices must follow the rules in order to communicate with one another and to ensure that orders are processed.

We have put a lot of effort into standardizing our documentation procedures as well. Documentation is of great importance as a project management tool during system design. It is also a key ingredient of our systems sharing program, as it helps a prospective user evaluate the utility of systems under consideration.

In contrast, hardware and software standards have probably been of less importance to HP. Nearly all of our computers are manufactured by HP or IBM, and have compatible communication protocols at the hardware interface level. Magnetic tapes can be readily interchanged, for one thing. Then too, HP minis emulate HASP workstations for IBM mainframes. Data is transmitted using

Order status information is transmitted back and forth to Europe daily, to keep files in sync.

standard protocols. We have adopted COBOL as the standard language for application programs, and we use the HP Image data base management system extensively in our HP 3000 applications. There aren't too many pieces to coordinate.

In summary, our minicomputer systems have helped us find workable solutions to the 10 challenges listed earlier. These systems have helped us provide consistent support for our administrative activities under conditions of rapid growth and change. They have kept our sales organization supplied with the up to date information necessary to provide full service to our customers in all of our worldwide sales and service offices. They have helped our management keep score by providing key information when needed. And they have helped us cope with ever-increasing government reporting requirements.

HP's internal business systems are continually being improved to meet changing requirements. As this goes on, and as we evaluate the results, it seems

that several characteristics emerge over and over again as the most significant:

Successful systems put the control of the data close to the source of the information and the control of processing close to the manager responsible for the function being performed. In an organization like Hewlett-Packard, this will frequently imply distributing the processing, but not always. When distributed processing is called for, there are additional criteria for success. Among these are an existing set of standards and coding conventions, some mechanism whereby disagreements among users and developers can be resolved, and some facility for sharing programs and procedures among the participants.

When all of these things can be combined, as they have at Hewlett-Packard, user managers are satisfied, corporate managers have the data they need when they need it, and administrative productivity is increased—and those have been the goals all along, haven't they? *

CORT VAN RENSSELAER



Mr. Van Rensselaer has been Hewlett-Packard's manager of corporate information systems since 1966. He has

worked for HP since 1942, beginning with a position as development engineer, then production control manager, assistant sales manager, and U.S. sales manager. He has been the general manager of three divisions: the Colorado Springs Div., the Oscilloscope Div., and the Dymec Div. (now part of the Computer Products Group), and has also been manager of HP corporate planning.



With 48 plants in 18 countries, the real choice was not *whether* to implement a distributed processing network, but *how*.

HOW TI DISTRIBUTES ITS PROCESSING

by Ron Person

Installation of the minicomputer nodes of Texas Instruments' distributed processing network was begun in 1971. It made sense to locate the specific processing power needed at each site because we are a varied organization with large geographic dispersal—our 48 plants are located in 18 countries. The efficiency of distributed processing is also demanded by our growing sales—we expect a fivefold increase in net sales billed in the next decade.

TI's distributed processing system presently links 5,100 terminals and 190 RJE stations, and we expect this to grow to 25,000 terminals with 10,000 minicomputers by the mid 1980s. The Information Systems & Services Group has the responsibility of managing this system.

The Corporate Information Center (CIC) is host to many of the distributed minicomputers. It handles the corporate data base and information common to many of the distributed systems. Its capabilities include RJE batch processing, inquiry (IMS, MSG, and CICS), TSO, microfiche and copy service, data preparation, Xerox 1200 printing, and plotting.

CIC uses two IBM 370/168AP's and two IBM 3033s. Each has 8 to 12 megabytes of addressable storage with more than 472 billion bytes of auxiliary storage. Eighty dual-density tape drives are used to access the 70,000 tapes of corpo-

rate information.

CIC is presently handling 6,000 batch jobs, 320,000 IMS transactions and 1,250 TSO log-ons per day. Although the use of CIC is large, the use of distributed computers at TI has grown twice as fast as host usage in the last 10 years.

TI's Communication Grid (TICOG) is the worldwide communication network supporting Information System and Services. Fig. 1 shows the land line and satellite communication channels used by Europe, Asia, and Latin America.

Begun in 1972, TICOG uses packet-switching technology. (Packet-switching divides messages into multiple, fixed-size packets. Packet size is chosen to be optimal for reducing system bit error rate.) A TI 980B minicomputer selects the most effective routing for each individual packet and transmits it. A receiving 980B minicomputer then reassembles the packets into the original message. The system is also packet-buffered to compensate for error introduction when using satellite channels. In addition to the TI 980B minicomputer, some special-purpose hardware is used along with ASC data-concentrators with software tailored for satellite communication. The entire communica-

tion process is transparent to user data.

TICOG also periodically polls quiet communication paths. Potential future path failure is detected and repaired before that path is needed. A history of these failures is maintained to aid the

identification of faulty equipment.

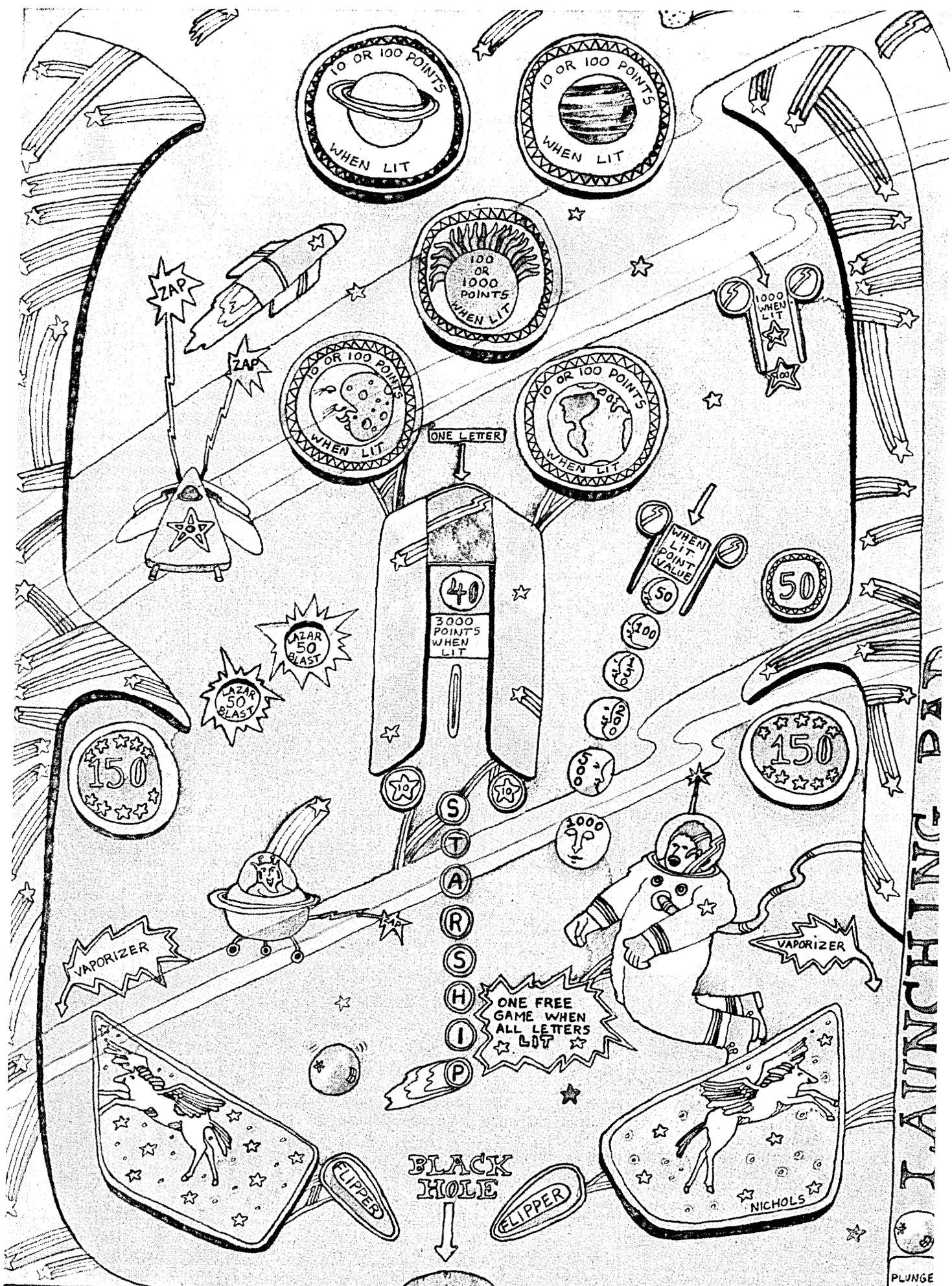
Most of TI's distributed processing systems use a minicomputer system designed for on-line transaction processing called the DXS (Data Exchange System). Its functions include concurrent batch, interactive communications and transaction processing; local data base; local and remote data collection; interface to a host (DXS or CIC); multitasking operating system; storing and running the application programs; and hybrid inquiry, a procedure transparent to the operator in which data not available on the local DXS data base is automatically retrieved from the host data base and is either displayed or used in the application program (see Fig. 2).

A DXS can be configured with one or more cpu's. This ability to use multiple cpu's is an important function—one cpu can be designated to handle applications, one to handle terminal polling and another to control host communications. The use of multiple cpu's increases throughput and creates communication redundancy in the system. If a local DXS processor goes down, this communication redundancy allows work to continue on another networked DXS or a mainframe host in CIC.

Three models of DXS are used in our applications. Their disk storage size ranges from 9.2 megabytes to 400 megabytes. One DXS can support up to 30,000 transactions per day. For example, one corporate group's system handles 24,000 transactions (requiring file updates) per day. Average transaction levels for DXS are approximately 6,000 per day. With the large growth in distributed use at TI, the number of transactions is growing at 20% to 100% per year.

TI uses distributed processing in a wide variety of applications, including automated design of printed circuit boards





LAUNCHING BALL

PLUNGE

SPACE PINBALL
 ★ ★ ★ ★ ★ ★ ★ ★ ★ ★
 150,000



5 BALLS
 FOR A DIME

using interactive graphics. This graphics capability is also used to do design editing on integrated circuits. The data base contains the standard parts library. Another application is a work-in-progress schedule and control system used in production planning that generates statistical engineering data for analysis. Mechanical controls for processing are also controlled by this front end process system. We also have a real-time system allowing visibility of job status, dynamic work queue sequencing and shop load analysis; a purchasing system; and an on-line, real-time schedule and control system that provides visibility of worldwide inventories, from which data is automatically fed into production planning models, to the Product-Customer Center.

Two of our more interesting applications are a real-time system for customer service management in the field, and an in-factory use of distributed processing.

THE FIELD INFORMATION SYSTEM

Historically, a large problem for all customer service organizations has been the availability of current customer problem status. In previous batch systems, when a customer or management made an inquiry into problem status it took research into files and batch printout to answer his questions. The resulting time lag caused management inefficiency and customer frustration.

Texas Instrument's Computer Assisted Repair Effort (TI-CARE) includes: toll-free centralized service dispatch, real-time status on each service request, service history on all equipment, inventory control of service parts and equipment to the customer engineer level, and preventive maintenance planning. Also, the field can change work-order scheduling.

The Field Information System (FIS) is used to implement TI-CARE. FIS is a distributed transaction processing network that allows data collection, scheduling, and resource management of any particular service call in the United States. The FIS network covers the contiguous United States and includes the CIC host as shown in Fig. 3.

In the past, different methods have been used to make work status and man-

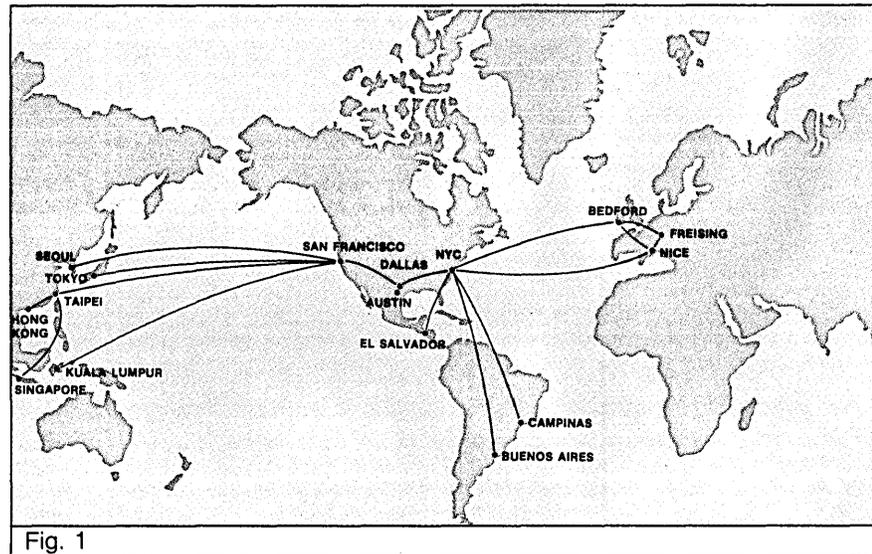


Fig. 1

agement information more visible. One of the first attempts was to have each customer engineer fill out an Incident Report for each call completed. These reports were collected locally and mailed to a national collection center. At the national center they were keypunched for entry into the CIC data base. With this arrangement, reports were two to three months old by the time they were available to the managers who used them. They could hardly be used to properly manage a constantly growing field support network.

Next we tried having data sent to district offices. There information was keyed into intelligent terminals that recorded the data on cassettes. The cassettes were then mailed to the National Service Headquarters for integration into the CIC data base. Management reports could now be generated at the district level from information keyed into the intelligent terminals. Although this was better than the previous system, management information could still take as long as 30 days before reaching the appropriate managers.

Without on-line interactive knowledge of job request status and locations of all the customer engineers, it was ex-

tremely difficult to maintain an adequate support response time. Previous customer response times were on the order of 9 to 12 hours. Some customers were satisfied with responses of even a few days, but others began, rightly, to demand response times within a few hours. The need for each dispatcher and manager to know the location of each of his CE's and the current status of all customer requests led to the development of TI-CARE, for which speci-

fications began in 1975. It took 22 months and a great deal of experience learned from the National Centralized Dispatching System before the final specifications were developed.

For ease of use we decided to design the system so that the customer with a problem could call any dispatch center in the United States and receive a response to his needs. System response had to be quick to reduce both frustration and cost since either a client or the customer engineer were probably waiting on the phone.

Either very high reliability or automatic redundancy was necessary; a dispatch center disabled for an extended period would leave our customers without adequate service response.

Data is collected on all the activity as it occurs and is used to derive indices which field service managers can use to manage their business. These management reports are generated on a current basis so that operational managers can fine tune their local businesses and see trends as they develop. This day-to-day information is vital to the proper management of assets and people.

The Field Information System

(FIS) was built around the Service Ticket used to generate a customer request. When an equipment serial number is entered, all recent information on that piece of equipment becomes available. To ease the generation of this equipment data base, much of the information is entered when a piece of equipment leaves the loading dock. The Factory Order Control System, which controls factory packaging and shipping, automatically enters equip-

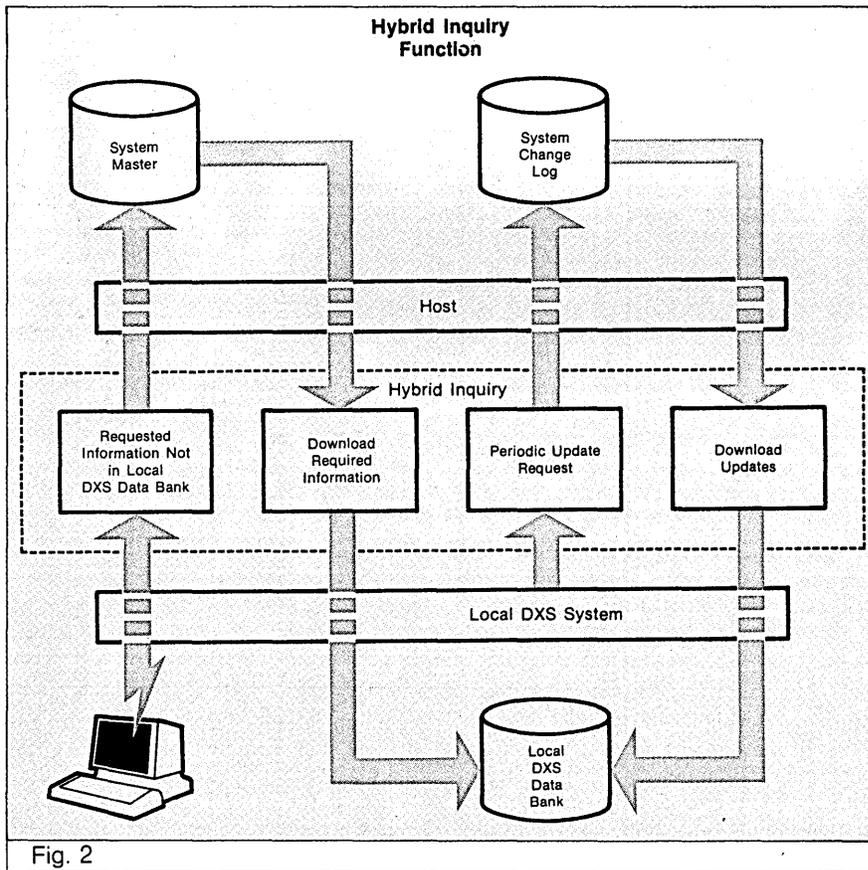


Fig. 2

ment data into the FIS when equipment is shipped. This information contains factory ship dates, warranty dates, warranty status, contract status, coverage hours, and the like.

The dispatcher needs to make only a limited input—the serial number for example—to receive a large amount of necessary information. While the customer is still on the phone, pertinent information such as phone number and equipment location is verified.

The FIS then assigns a ticket to the job request and computes the closest service office by using telephone prefixes laid over a geographic grid of the entire United States. This means that a customer can call any of the 11 dispatch centers and the



appropriate service office will receive the service request. After selection of the nearest service office, FIS transfers the service ticket into the nearest office's work queue.

When the customer engineer becomes available he calls into the service office. There the work queue displayed on the crt shows work tickets in order of receipt, the equipment model number, status of the work ticket, and the location of

the equipment. From this information the dispatcher can decide which job to assign. The dispatcher then pushes a function key on the 914A terminal and the entire work ticket is displayed. Information is read off the terminal to the customer engineer for entry onto his call report. Errors are reduced by making the screen display and the call report exactly the same format. The dispatcher then keys into the terminal the information that the CE is on his way to the customer.

After responding to the request, the CE calls the dispatcher and reads the completed information from his call report. Entering that information into the terminal updates the data bank and work queue. The CE then receives his next assignment.

During all of this, FIS has kept track of service inventories down to the customer engineer level. Part of the inventory control system in FIS is an automatic reordering system known as Flowline. When an inventory falls below a predetermined level, it is automatically reordered in a standard quantity from the factory warehouse and shipped to the location where it is needed.

The system has also been storing all the transaction data for use in computing indices used to manage the service organization. Some of the performance indices calculated by TI-CARE are: the number of incident reports, tickets, trips, and recalls; the number of calls requiring parts, of calls where parts aren't available, and the number of parts red-rushed from each stocking location; the mean

time to travel, repair, dispatch, diagnose, and complete; the mean miles traveled and the actual miles traveled; the percentage of recalls and the calls per day; the cost in dollars per hour and in dollars per call; and the number of tickets in each billings status.

The host DXS system contains a centralized data base which is downloaded daily to the eleven dispatch centers that use smaller DXS's. The localized data bases and communication redundancy make a highly reliable combination. For example, the dispatch DXS's in use includes two cpu's; one acts as the application processor and the other handles terminal polling and communication routing. Should malfunctions occur, this feature allows terminals to continue functioning by immediately rerouting communication around the malfunctioning cpu to another cpu in the network. Thus, even when a network node goes down the system remains vital and functioning and terminals can still enter tickets and dispatch CE's. The local daily data base means each dispatch center can operate autonomously for extended periods even if it loses all communication with the host or other dispatch centers.

As each transaction takes place at the dispatch DXS, the transaction is spooled and transmitted to the host DXS in Houston. The host in turn replies with any new information that will update the district data base. All of this takes place in a few seconds so the DXS's are effectively communicating real time. This provides the advantage that a customer can call any service center and find out the status of his request.

The intelligent terminals in conjunction with DXS do IBM 3270 emulation and are also used to communicate with the Corporate Information Center's data base. This means the FIS network both collects field data and gives the field inquiry status to the corporate data base. Information needed by corporate level managers is available to them on a real-time basis while the access of corporate data is restricted to selected FIS terminals.

The main data base is maintained in 300 megabytes at the host DXS located in Houston. The 11 dispatch sites use DXS's, each with two 9.2 megabyte disks. Remote crt's and printers are connected to the dispatcher's DXS's and the entire network is tied together by two 4800 baud data lines.

The Field Information System is continually growing and being enhanced. Some future projects to increase FIS's power are: operating indices to the CE level, automatic customer billing, automatic service call selection, and CE field com-

munication via portable terminals. Future enhancements to FIS will include failure analysis reports by model number, customer, etc. to aid in determining and forecasting service problems; distribution of field service charges to other cost centers within TI; cost analysis reports, and daily equipment down reports.

IN-FACTORY DISTRIBUTED PROCESSING

We use an in-factory application of distributed processing known as the Distributed Application Processing System (DAPS). DAPS is based on the belief that proper management of an input rate to an operation is the prime factor in minimizing material build-up in an area and smoothing the work load.

DAPS provides the capability of tracking a part number and quantity through a series of work stations relative to a designated cycle time. The system is linked to the Corporate Information Center. Input to the DAPS DXS computer is through TI 914A intelligent terminals, TI Numeric Entry Terminals (TINET's), and

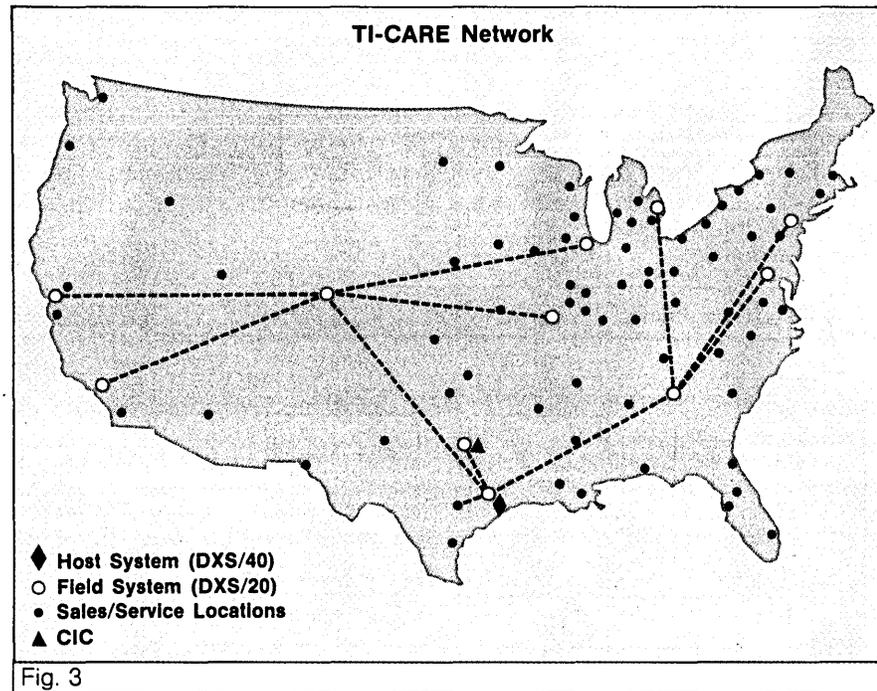


Fig. 3

continued for only a short time.

It was important that all definitions and transactions be standardized, with accepted terms and usage. An information inquiry was designed which displays all inquiry types, their definitions and formats. Any inquiry results in either

communication to dispatchers. It also addresses such common production questions as: What is the latest schedule? Where is the part? What do I do next? What are the problems? What is hot? Can we meet the schedule work load?

In addition to on-line information

Series 700 terminals.

DAPS manages work in progress by controlling workstation queues and flow rates. It also increases the information available to management concerning individual work-station queues.

Hard-copy scheduling, work status, and problem job reports can be delivered on a daily basis. The increased visibility and real-time status allow flexible rescheduling and priority expediting for hot jobs. Scheduling and managing are also easier because shop load versus shop capacity is now visible. Summary data in the form of schedules, starts, and completions are sent automatically to the Material Control System at CIC.

A team of approximately 20 manufacturing managers and supervisors at all levels developed and reviewed the DAPS specifications. Information for the specifications was gathered to the lowest possible user level. All proposed system functions were approved before the development team started work.

It took six months to install the first DAPS system at Austin, which was put into immediate use. Formal parallel information keeping under the old system

the presentation of the requested information or an error message precisely describing the problem.

The system replaces manual logging of assemblies as they move through the manufacturing stations, and eliminates the need for slow verbal and written

available, customized data listings are distributed to support project and shop management. The Active Record Status report is printed every weekday evening and contains ETA's, commit dates, job statistics, etc. A Run History shows the history of work completion and targets for

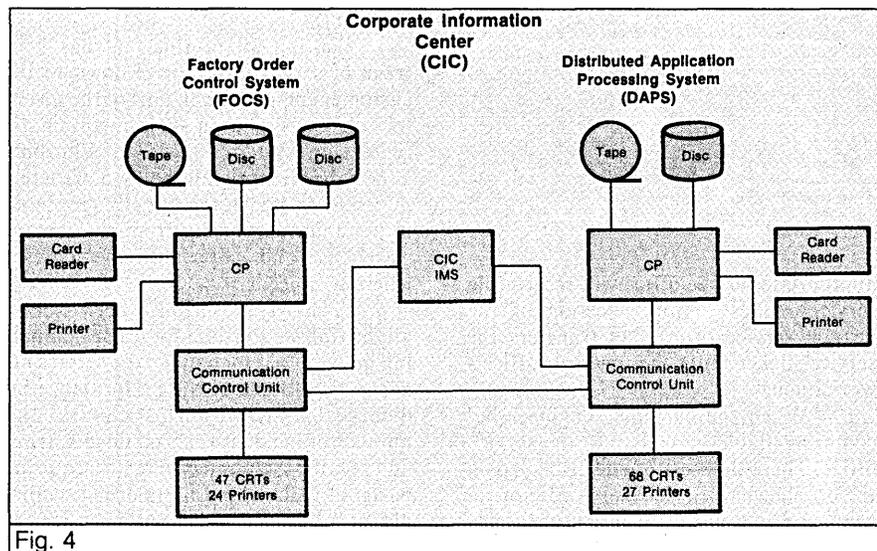


Fig. 4

DAPS is based on the belief that proper management of an input rate to an operation is the prime factor in minimizing material build-up and smoothing the work load.

specific work lots. A Shop Load report contains past and future projections of work hours for each work station.

DAPS is made up of distinct units. The largest unit, the shop, is a separate facility or easily identified subset of a fabrication facility of supply organization. A group of stations compose a shop. Stations perform a single operation or series of related operations inside one shop. The station's capacity is expressed in parts/day and hours/day. There are three unique station types:

In-basket or queue station is usually the first station from which orders are released to control the flow.

Problem stations are for jobs that cannot continue in the normal flow until certain corrective actions are taken. The problem job is removed from the queue of workable jobs.

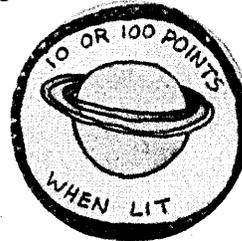
Close-out stations follow the last process in a fabrication process and mark job completion.

The specific sequence of stations that a category or family of parts must proceed through is called a flow type. The

four years ago, the system operated with only eight terminals.)

The DAPS and FOCs systems operate 24 hours a day, 7 days a week with time off only for preventive maintenance and backup procedures. Each transaction entered during the day is saved on tape so that complete recovery of data is possible.

While computer-queued scheduling may be the best scheduling plan for overall factory optimization, it may be disrupted occasionally by managers attempting to achieve goals that optimize their individual areas. In such a case, the results may not be best for the factory's goals. This does not mean that blind service to the system is always necessary. For example, a station may not accomplish a job in the same manner as other stations or as the model assumes. In some cases, it may not be worth the political and psychological disruption to reorganize that station. But, there does come a time when the level of inaccuracies in the model must limit customization—either, the differing station must change or the system model must change.



time necessary for completing a certain operation is called cycle time. The cycle time for a specific flow type is the sum of the station cycle times for that flow type. This cycle time includes wait, setup, run and move times for each station.

Flags are used on the station crt screens to identify problems. Not all problems are shunted to a problem station since some are temporary and can be easily solved en route to the next designated station. Each shop can define its own set of flags to best fit the operation.

The DAPS system is on-line real-time on DXS; however, changes are only made to the Corporate Information Center's IMS when the Material Control System is updated nightly. The shipping and packaging system, FOCs (Factory Order and Control System), works in conjunction with DAPS. Together they link 170 terminals located at 10 sites spread over four cities. Both DAPS and FOCs have access to CIC as shown in Fig. 4.

The DAPS system runs on a DXS with a 100 megabyte disk. This keeps track of 18,000 to 20,000 lots distributed throughout the 550 stations within 20 shops. (When DAPS was first implemented

One of the problems we had assumed might occur was the failure of dispatchers and supervisors to input data quickly. This fear proved unfounded and the system has been maintained on a continuously up-dated basis. Part of the reason for successful implementation at that level was the personal commitment of each user.

A problem we didn't suspect was the continuation of previous lines of communication. Even though training programs were carried on at all levels of system use, many of the second and third level managers still used an informal system for gathering information. Although they now had the ability to immediately call up operational information on a crt, they still relied on the managers under them to gather information and bring it to them. Dispatchers were still expected to keep information on paper or in their heads when it was immediately available to them on DAPS. It took time for previous communication channels to atrophy.

Some general considerations we have learned must be taken into account when implementing a distributed processing system include:

Initial success in data processing will encourage new users to bring more and more applications into the system. As a result, new and more sophisticated functions are continually being added until the machines are overextended and previous system specification cannot be met. At this point cost-effective expansion must be available.

Software and applications must be cost effective before the time new generation equipment is necessary.

The total recurring costs need to be determined. In a constantly changing and growing organization, reconfiguration and moving could cause costs to greatly exceed initial estimates.

It is important to determine what level of programming/diagnostic expertise is needed in the field. When bugs appear at a remote site, it's often difficult to diagnose the problem, much less solve it. The development of diagnostic software for remote use may be necessary.

Many minicomputers have their own sets of languages, different instruction sets, smaller cores, etc. Thus, individuals must be trained to work on a specific type of minicomputer or product family. Further, a new class of systems engineers is needed—engineers who understand the architecture, network, and design limitations of these machines.

Every effort should be made to ensure an accurate system before it is released to the users. It may take much longer to get over the distrust of a new system if the initial attempts at using it produce error laden information.

With all of the effort and the many problems involved in implementing a network of this size, Texas Instruments has found the benefits to far outweigh the difficulties. For us, distributed processing is the answer to our widely dispersed, multisite, multifaceted data processing needs. *

RON PERSON



Mr. Person is a product marketing engineer with Texas Instruments' Digital Systems Division. He joined the company in 1978, and presently works with π 's distributed transaction computer, dxs. He has an M.S. in physics from Ohio State Univ. and an M.B.A. from Hardin-Simmons Univ.

Stringent emission standards and soaring fuel costs make increased engine efficiency essential. Here's how one of Detroit's Big Three automakers is using a three-level, hierarchical ddp system to meet this goal.

ENGINE CONTROL SOFTWARE DEVELOPMENT AT FORD

by Richard Ceci
and Charles Durrett

Tightening vehicle exhaust emission standards and sharply rising fuel costs have presented automobile manufacturers with an engineering challenge unequalled in the history of the industry. The challenge is to make cars with low exhaust emissions and high fuel economy while maintaining acceptable drive characteristics. The long-term task will be a major redesign of present-day automobiles, with emphasis on reduced size, weight and alternative powertrain systems. The short-term task is to improve the calibration and control of existing spark-ignited internal combustion engines.

To reach the nearer goal, computer and microcomputer technologies have been applied to engine control to attain flexibility and precision beyond the capacity of nonelectronic control systems used in the automobile industry for years.

The flexibility offered by electronics is required to handle variations that must be built into engine control systems on several levels. First, there are differences in exhaust emission standards between California and the other 49 states, for high altitudes, and for various horsepower ranges, engine models and designs. In addition, a given engine must meet emission, economy, and driveability requirements in a number of operating modes: starting (cold, normal, hot), warmup, altitude, hot environment, urban driving, highway driving, and maximum power.

Ford's Engine Engineering Office therefore asked the Computer Applica-

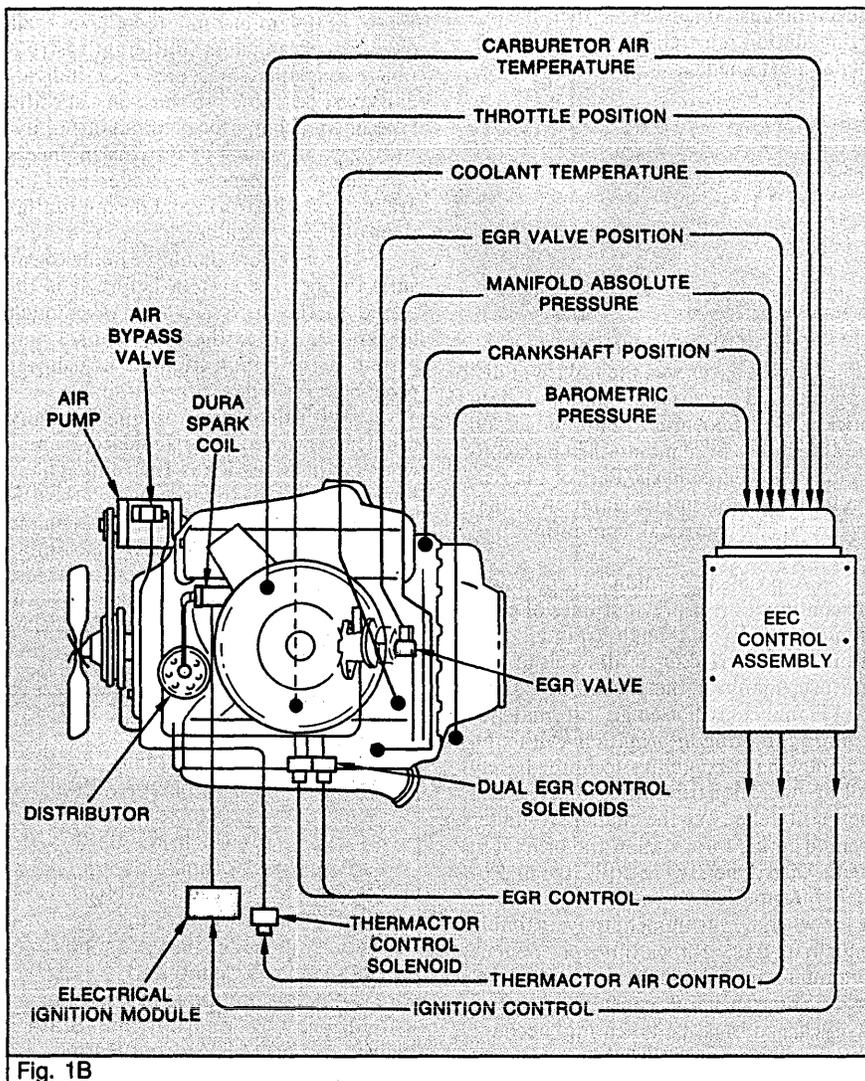


Fig. 1B

tions Dept. to develop a special-purpose, computer-based system that would more effectively support electronic engine control (EEC) microcomputer software development. This system, to include hardware and software already being used in development activity, would support software design from definition of strategy and calibration to dynamic verification of the prototype electronic control assembly (ECA). The resulting three-level, hierarchical distributed data processing system went on-line in May 1977.

The 1978 Lincoln Versailles was Ford's first production car to include a microcomputer-based electronic engine control system. Fig. 1A shows the EEC system for the Lincoln Versailles' 302-V8 engine for 50 states and Canada, which includes the ECA, sensors, electronic ignition module and coil, distributor without advance mechanisms, and an air-pressure-operated exhaust gas recirculation

(EGR) system. The seven sensors (shown at the top) continuously monitor their assigned functions and send signals to the ECA, which computes the correct ignition timing, EGR flowrate, and thermactor timing, then sends commands to the ignition module (to adjust timing), the EGR control solenoids (to adjust flow rate), and the thermactor air control solenoid (to direct secondary air flow). Fig. 1B shows the EEC wiring harness installed in the car.

The ECA is mounted in the passenger compartment behind the instrument panel near the brake pedal support, and consists of a processor assembly and a calibration assembly. The processor assembly, which is identical for all ECA strategies and calibrations, contains a microprocessor and a power supply that provides a continuous reference voltage to the sensors. The smaller plug-in calibra-

tion assembly contains the masked read only memory (MROM) chip set for the specific strategy and calibration.

The workings of the ECA can be visualized in the operation of the EGR system (see Fig. 2). The EGR valve, which controls the flow of exhaust gases, is operated by air pressure from the thermactor bypass valve. The pressure and vent valves work together to apply air pressure to the EGR valve (to increase EGR), lock in existing line pressure (to maintain EGR), or vent line pressure (to decrease EGR). The microcomputer uses the data from the seven sensors to calculate the correct amount of EGR flow for existing conditions, checks current pintle position, and operates pressure and vent valves to increase, maintain, or decrease EGR. Valve positions are sampled about 20 times every second, actual and desired positions are compared, and necessary adjustments are made.

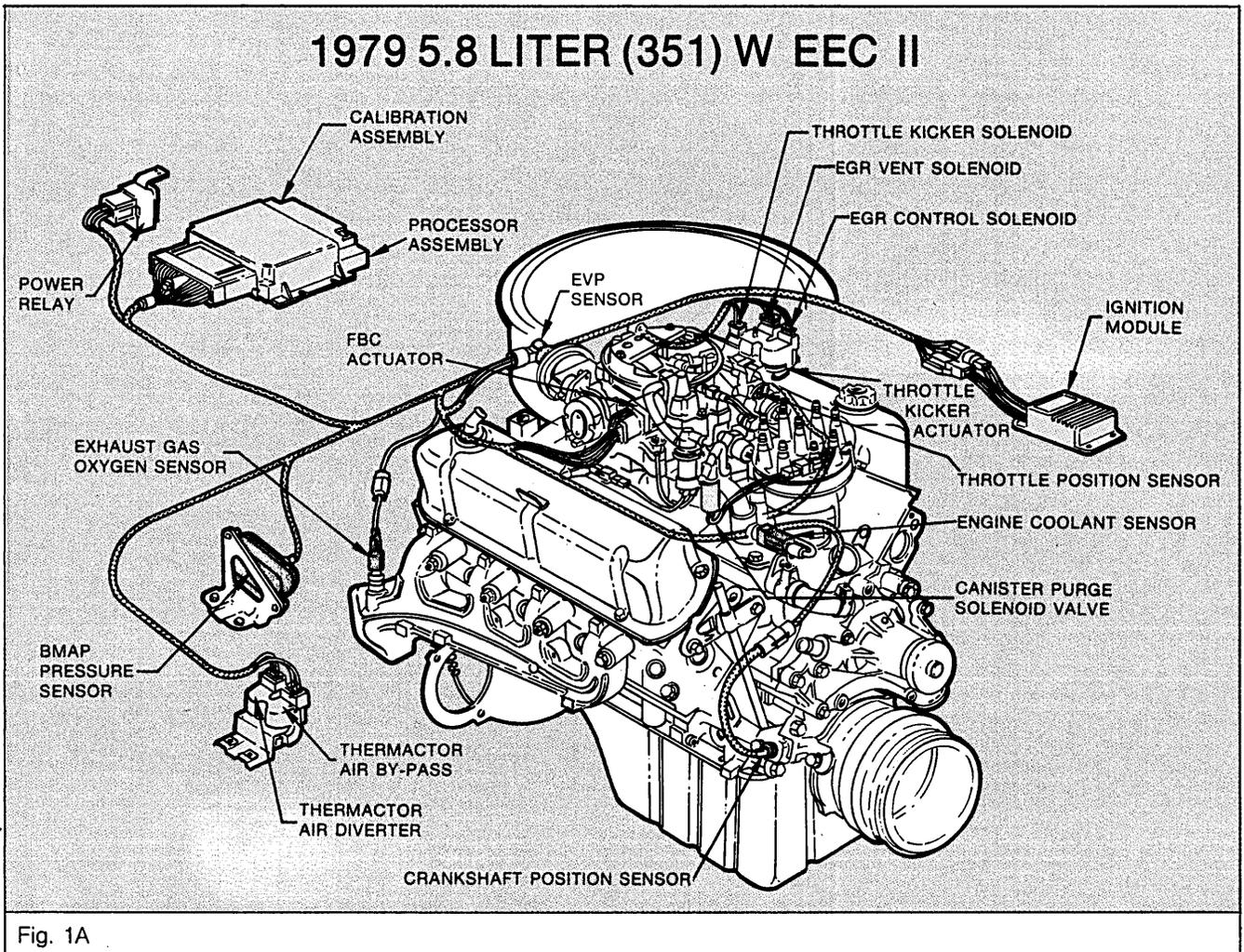


Fig. 1A

THE DDP HIERARCHY

The process of producing acceptable EEC software for large-volume production of MROM's depends on ready access to microcomputer program files stored in the development computer. Some steps in the process are carried out entirely on the development computer, while others require a subsystems/systems component engineer's review and judgment before the next step is undertaken. The EEC software develop-

ment system must be able to handle a large number of programs for projects at various stages of development.

The hierarchial distributed dp system that the Computer Applications Dept. developed to accomplish this is shown in Fig. 3. Forty-four of 48 lines into the DECsystem-20 are used by subsystems engineers in EEC software development, operating 30cps printer terminals. A PDP-11/40 (bottom left in Fig. 3) runs dynamic verification tests of microcomputer soft-

ware and hardware, and the PDP-11/10 and PDP-11/04 each control a modified Intel Universal PROM Programmer. The primary functions of the second-level (Fig. 3 center) PDP-11/40 in EEC software development are temporary storage and transfer of EEC software files between the DECsystem-20 and the minicomputers on the third level. Another function, not related to EEC software development, is to act as remote job entry station communicating by a HASP software link with an IBM 370/

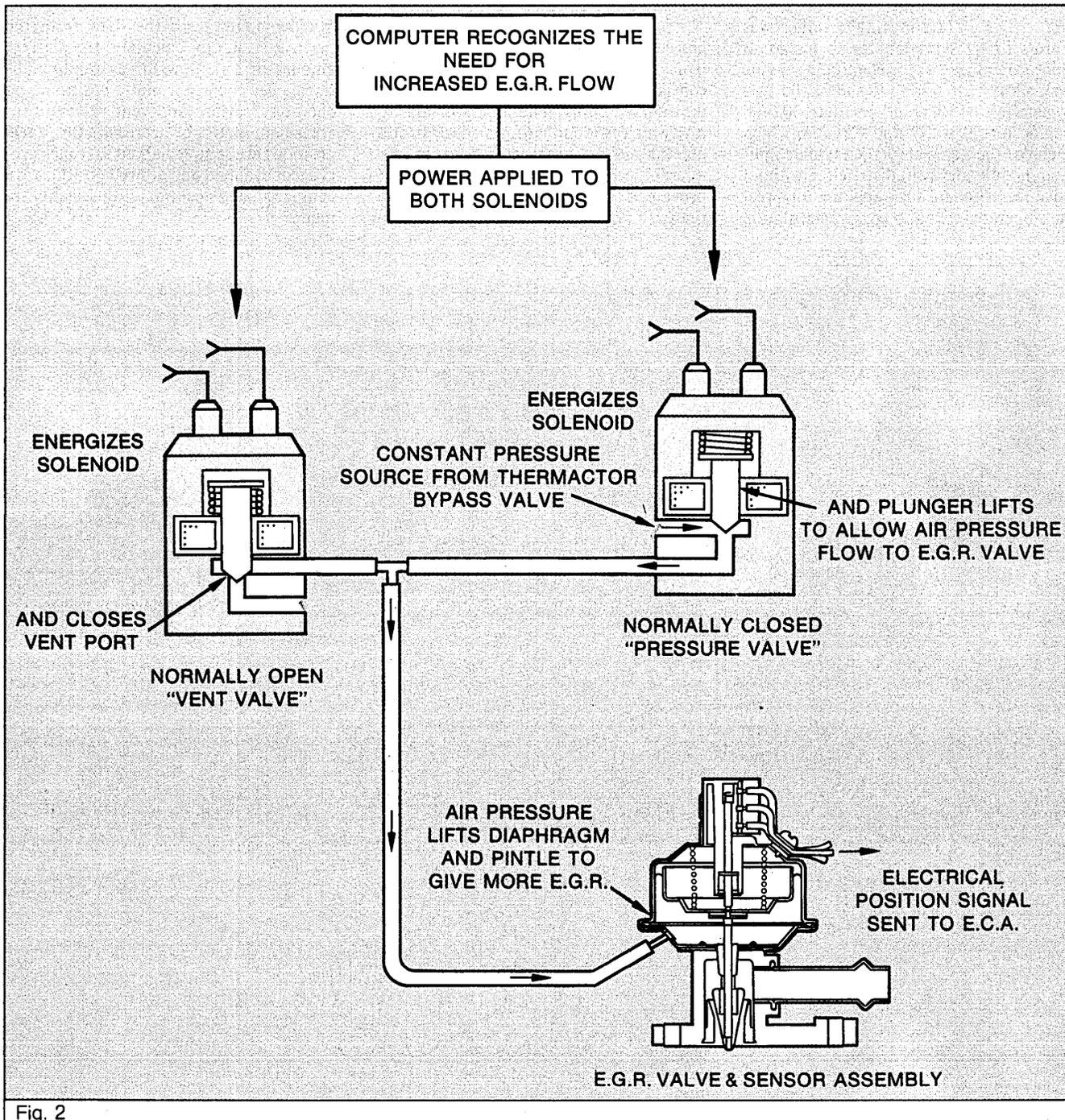


Fig. 2

168 for engineering analysis. The PDP-11/40 is also used for developing PDP-11 application programs (largely utility and mapping programs for third-level computers) and for handling communication with a remote DEC system-10 research computer that doubles as backup to the DECsystem-20. Computer applications analysts at crt or printer terminals use dial-in ports to the PDP-11/40 for program development and system diagnosis.

Communication between the PDP-11/40 real-time system and the two DEC-system time-sharing configurations uses a communications protocol written by Computer Applications Dept. personnel, using subroutines obtained from DECUS (Digital Equipment Computer Users Society). Data and program transfer between second- and third-level minicomputers is via DECnet. The PDP-11/40's run under disk-based RSX-11D and RSX-11M real-time executives, while the PDP-11/04 and PDP-11/10 use core-only RSX-11's.

The communication links use 1800bps asynchronous interfaces connected by leased Bell phone lines. Our future plans for the ddp network involve increasing the communication link speed to 4800bps, and increasing the number of nodes available for EEC tasks to meet our expanding work load.

The basic steps in EEC software development are:

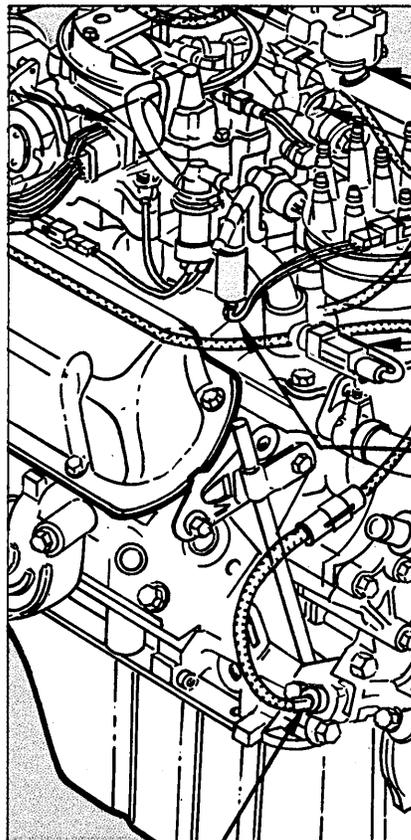
- Define strategy and calibration for engine control.
- Create a computer program to represent that strategy and calibration.
- Translate the program into binary code suitable for the EEC microcomputer.
- Emulate binary code for design verification.
- Program erasable programmable read only memory (EPROM) chips from the binary file.
- Release EEC microcomputer for vehicle development.
- Perform extensive software design verification.

The detailed operations involved at each step of the procedure are:

Step 1. A systems engineer defines the strategy (engine parameters to be measured and controlled), transformation equations representing the mathematical relationships between input and output values, and the calibrations (control ranges for the input and output signals). He may use several sets of strategies and calibrations to pinpoint specific combinations that meet the Environmental Protection Agency's fuel economy and emissions requirements, and produce the best possible performance, response and handling characteristics. Several strate-

gies may be needed because alternative strategy/calibration combinations may be equal in exhaust emissions and fuel economy but vary widely in driveability.

Step 2. A software subsystems engineer designs a practical computer program based on the systems engineer's strategy/calibration objectives, heeding constraints posed by the microcomputer memory size and speed, and the accuracy of sensors. The program must be sufficiently flexible that modifications can be made as necessary at various steps in de-



velopment.

Step 3. A components engineer codes the program in assembly language (there is no commercially available higher level language for the special-purpose, Ford-designed microcomputers). The coding process usually involves three or four lines of code for each memory location; 4K words of memory typically requires 10,000 to 12,000 lines of code, including assembly directives and comments.

Steps 4 and 5. The assembly language program is entered in the disk files of the DECsystem-20 and is translated from assembly language into machine language by a Ford-developed cross-assembler. In this process, 10,000 lines of assembly code are transformed into per-

haps 4,000 lines of object code. The cross-assembler takes into account specific characteristics of the microcomputer to provide syntax checking and listing of assembly errors such as improper statements and undefined locations.

Step 6. In the first of several quality assurance operations, the EEC binary program is checked on the DECsystem-20 through redundant programming. In this process, a different engineer writes a program for the same strategy/calibration in FORTRAN.

To detect accuracy and logic errors in the EEC program, both the EEC and FORTRAN programs are run on test cases that the engineers have prepared. These cases simulate an assortment of inputs representing the full signal range of all sensors to determine the corresponding output signals that each program would generate. Using an application program called STRATA, the 36-bit DECsystem-20 simulates the processing capability of a 12-bit microprocessor, including such limitations as no floating point and fewer significant digits. The computer printout tabulates output data for both the EEC and FORTRAN programs with the percentage of error in the EEC program. (The FORTRAN program is assumed correct, although both are checked if there are massive discrepancies in the results.) Discrepancies are corrected by recoding the EEC program in assembly language and repeating the procedure through Step 6 until agreement is reached in the simulation.

Step 7. The verified EEC program is transferred from the DECsystem-20 to the PDP-11/40, moving from a multiuser, time-sharing environment to a task environment. The PDP-11/40 maintains roughly 300 different EEC binary files for convenience in programming EPROM chip sets. The program is in turn down-line loaded over DECnet links to one of the core-only, third-level minicomputers controlling a PROM programmer. The primary function of the two core-only minis is to map the 12-bit code provided by the host processor onto an 8-bit chip set mounted in the PROM programmers.

An EPROM chip set for the Lincoln Versailles contains 4K 12-bit words and consists of six 2708-standard chips of 1K 8-bit words each (three 2716 chips at 2K 8-bit words would be equivalent.) The PROM programmers have been modified so that three chips, instead of two, can be programmed at one time; programs may either be identical or represent different parts of the software package for the same microcomputer. (Coding these three 2716 EPROM chips, three at a time, presently takes five minutes. Previously, punched paper tape produced on the DECsystem-10

There are two cargo there today. The country's brings you both of

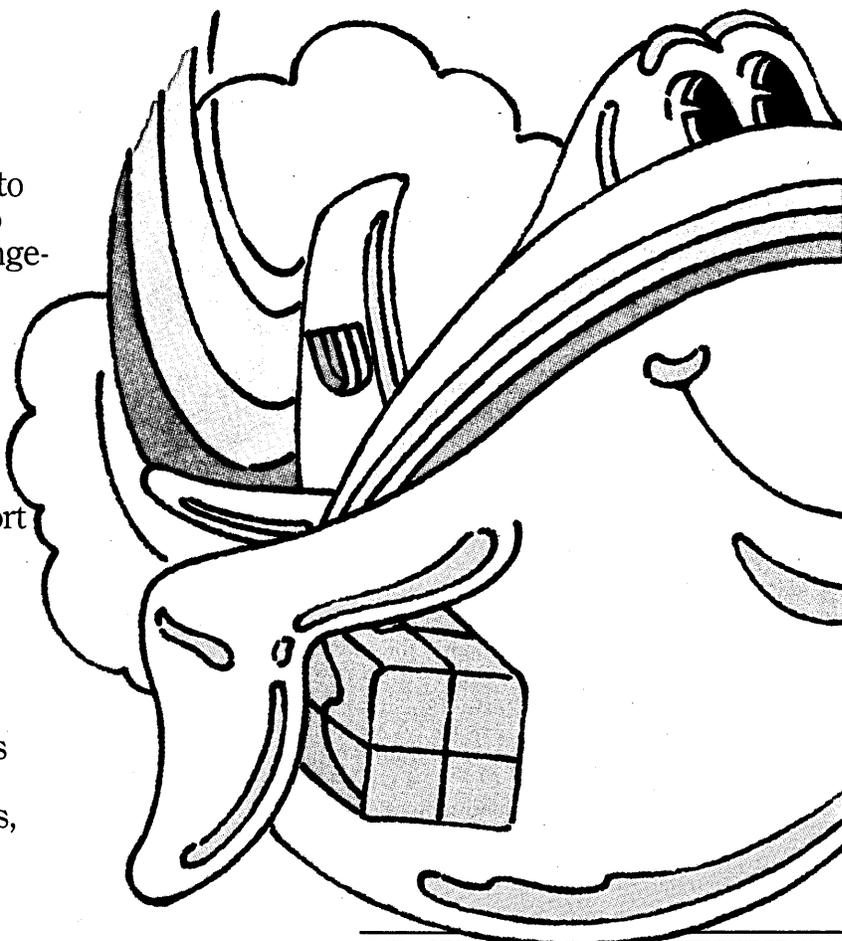
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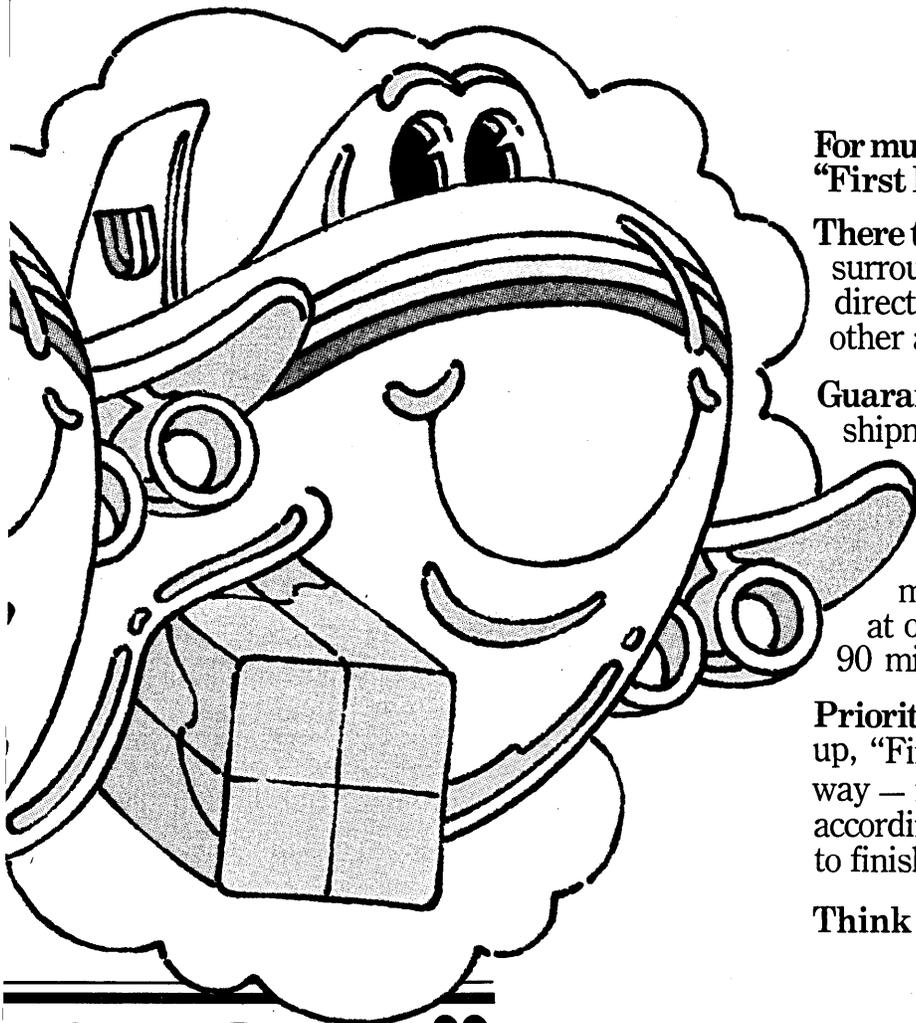


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CIRCLE 10 ON READER CARD

APRIL 1979 109

was used to control the chip programmers; programming time was from 20 to 25 minutes for six 2708 chips, two at a time.)

Step 8. The chip hardware and software are bench-checked to minimize costly fault detection in later on-vehicle testing. As in the test cases for quality assurance in Step 6, subsystems engineers on the EEC development team specify the analog voltages used in simulating signals received from various sensors. If problems are observed, the subsystems engineer returns to Step 3 to correct the program at the assembly level. In general, a correction (Steps 3 through 7) requires as little as 15 minutes and no more than an hour. (An alternative approach would be to make a chip patch, but that is often unsatisfactory with regard to documentation and, in any case, is not much faster than correcting the program.)

Step 9. The prototype ECA is installed in a test car which is driven under various conditions while systems engineers check for problems in initial specifications and implementation (mathematical relationships, etc.). This step is the

longest in the entire development process. It may take several months, including returns to Step 1 for redefinition of strategy and calibration.

In what could be called Step 10, an internal Ford Motor Co. process takes EEC software development from road testing to production status. This process includes optimizing the control program to reduce memory requirement (in the case of the Lincoln Versailles, going from 4K words to 1.5K words). Because flexibility for development is no longer needed, engineers can reduce required memory by replacing subroutines with in-line code and variables with constants.

After the software is optimized and revalidated, the prototype ECA undergoes dynamic verification at a special test stand under control of the third-level PDP-11/40. A test recipe developed and stored by software subsystems engineers on the DECSYSTEM-20 is transmitted through the host minicomputer to the real-time test computer. Various combinations of simulated sensor readings are fed to the microcomputer every 25msec and output data are recorded, analyzed, and printed.

THE NEXT STEP

The commitment to microprocessor technology at Ford is substantial. Plans for future system enhancements are presently being made. Notable among these plans is the implementation of a higher level engineering oriented specification language to be used to describe engine control strategies in a concise and precise format. This language, referred to as the Ford Automotive Control Terminology (FACT), is aimed at streamlining the engine control development process. The specification language will potentially be used as a programming language, but this must not compromise the engineers' need for engine control description.

Phase two of the implementation calls for simulation of the FACT engine control strategy on the DECSYSTEM-20. A DEC-20 FACT compiler will be used to generate executable DEC-20 code. Phase three will be the development of a microprocessor code generating compiler. This will allow the EEC microprocessor to be programmed in a higher level language, eliminating assembly language programming. *

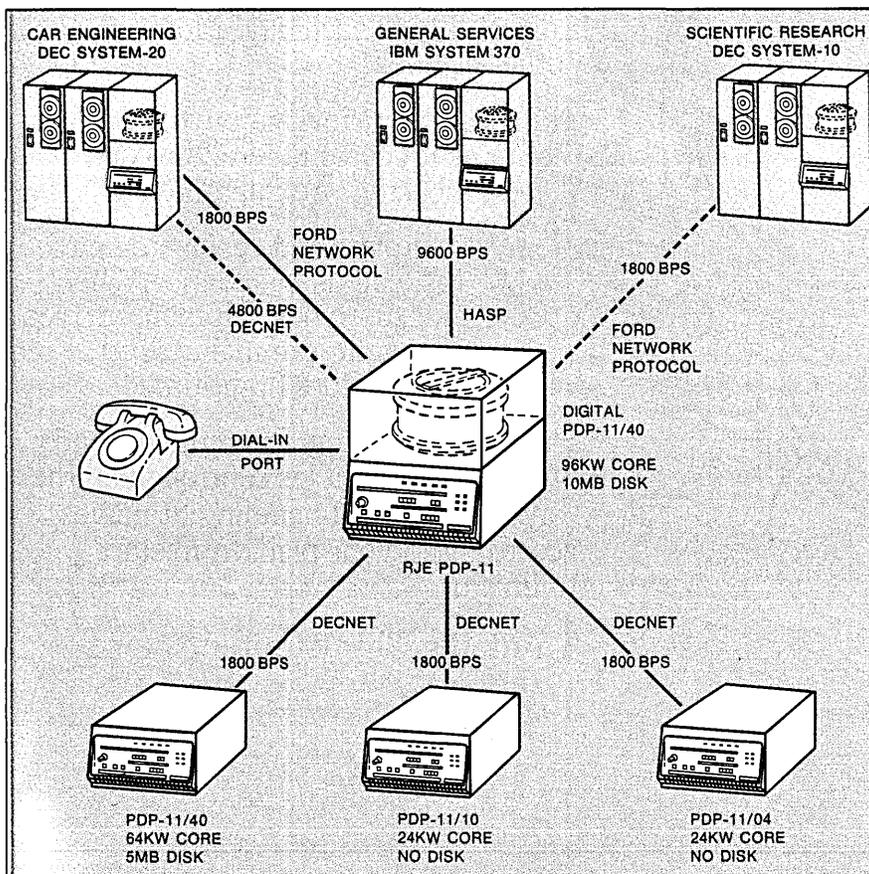


Fig. 3

RICHARD J. CECI



Mr. Ceci is a computer applications engineer, Engineering Computer Services, Car Engineering, at Ford Motor Company in Dearborn, Michigan. His B.S. is in chemical engineering from Wayne State Univ. He will be receiving his M.B.A. from the Univ. of Michigan.

CHARLES D. DURRETT, JR.

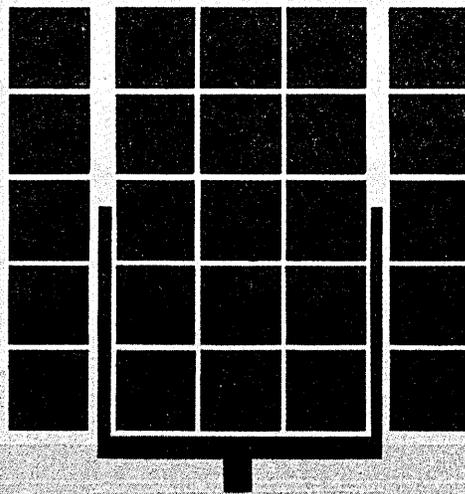


Mr. Durrett is product design engineer, Electronic Engine Control Dept., Engine Engineering, Powertrain and Chassis Engineering, at Ford in Dearborn. His B.S.E.E. and his M.S. in systems engineering are from Oakland Univ. in Rochester, Michigan.

Hewlett-Packard

Computer Advances

Volume 4 Number 2



An HP1000 network
controls the world's
largest solar field.

Learning to live with the world we live in

Solving the mystery of earthquakes

Every year thousands of lives and millions of dollars are lost as a result of earthquakes. Yet, no one completely understands them. Lawrence Livermore Laboratories in Livermore, California, and the United States Department of Energy are taking steps to find out more about the workings of seismic energy.

Utilizing an HP1000 distributed systems network, Livermore Labs maintains four seismic stations to monitor earthquake activity: two in Nevada and one each in Utah and Southern California.

An unattended HP1000 operates

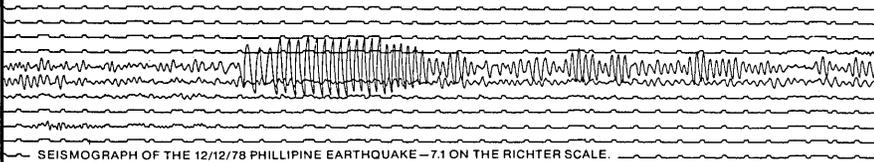
at each of the seismic stations, continually transmitting seismometer signals on a real-time basis via telephone line to Livermore's central HP1000 computer. All pertinent data including time, date, magnitude, and location of the event are recorded and stored.

Should scientists wish to study particular events or the way seismic energy is propagated through the earth's crust, Hewlett-Packard's IMAGE/QUERY data base management software lets them examine the seismic data base and list all events that meet their specified values and parameters. The University of California at Berkeley, the University of Nevada at Reno, and the U.S. Geological Survey constantly access

Livermore Lab's data to further their earthquake studies.

"This monitoring system is capable of covering a broad dynamic range," says Marv Denny, project manager. "Through our studies and the meaningful, accurate data we can provide, more and more is being understood about what really does go on beneath the earth's surface."

Livermore Labs' HP1000 network collects seismic data from stations deep in inactive gold mines.



Down with energy costs!

The cost of energy is continually rising. With a computerized energy management system, International Energy Conservation Systems, Inc. is helping managers of some 60 widely scattered buildings in the Atlanta and Washington, D.C. areas to save 15 to 50 percent of their energy costs.

At the heart of the system is an HP1000 computer—shared by all users and connected via telephone lines to each building's utility systems. The computer monitors energy use on a second-by-second basis. The system

can select from 16 different tailor-made, energy-sensitive strategies and put the appropriate one into effect automatically and instantaneously for each building. Heating, ventilating, and air conditioning systems are regulated depending on ambient temperature, solar effects, relative humidity, and other changing parameters.

"Most customers have averaged about \$2,000 a month savings on their bills, while some have saved more than \$10,000 during some months," notes Richard Jackson, IECS secretary-treasurer. "System in-

stallations usually pay for themselves in three to 18 months." One IECS-controlled facility, Northside Hospital, claims savings of 19 percent in energy and over \$100,000 in the first year. This installation paid for itself in less than four months.

Other successes: the Prado Office Park West Building has had an annual energy savings of 50 percent, while the all-electric Rutherford B. Hayes Building in Washington, D.C. has reduced its electrical consumption 25 percent per year with improved comfort levels.

Asarco works for its employees

Excessive exposure to heavy metals can be harmful to an employee's health. ASARCO Incorporated, a world leader in non-ferrous metal production, is using a Hewlett-Packard 1000 computer system to help maintain a quality working environment for its employees through an up-to-date biological and environmental monitoring program.

When employees begin working at Asarco, they have blood or urine samples taken. These samples are then analyzed by the lab with results entered into the HP1000's IMAGE data base. Periodic sampling will show any blood or urine changes due to occupational exposure to certain airborne substances. Based upon the analysis and evaluation of those samples, corrective measures can be suggested and/or implemented quickly.

Diffusion modeling of smoke-stack emissions is another important HP1000 application at Asarco. Determining the impact of stack emissions on the environment under varying temperatures, pressures, winds, and factory conditions is essential to maintaining clean air, yet can be extremely expensive. "Before purchasing our HP1000," says Rodwell B. Watson, senior statistician, "we had the diffusion models run on a contract basis. Today, we may be saving as much as \$45,000 a year by doing it ourselves."

Harnessing the sun's power

With oil supplies rapidly diminishing, a practical alternative to fossil fuels must be found. Sandia Laboratories of Albuquerque, New Mexico, is studying the potential of solar energy and uses an HP1000 distributed processing network to operate the world's largest solar test facility.

During a four-hour test period, Sandia's facility is capable of receiving five million watts of solar energy. If converted to electrical power, this would be enough to support a community of 1,000 homes. The facility also provides experimental engineering data for the design, construction, and operation of proposed solar thermal electric plants.

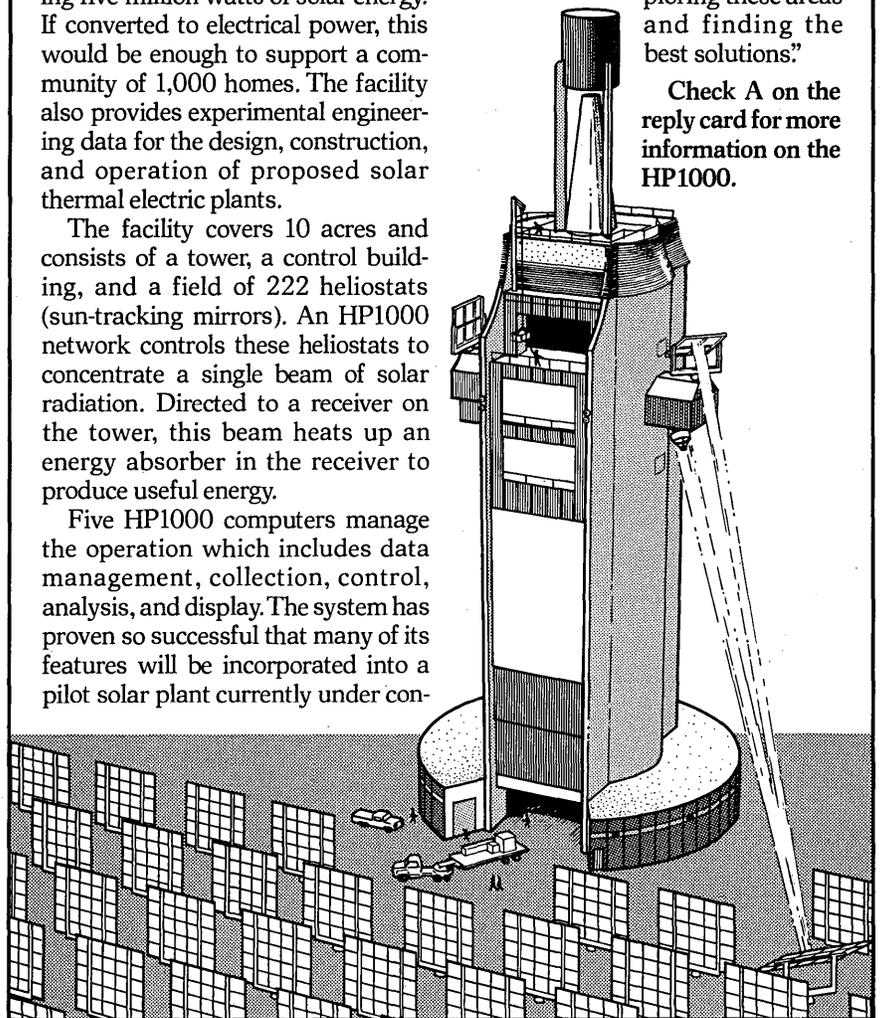
The facility covers 10 acres and consists of a tower, a control building, and a field of 222 heliostats (sun-tracking mirrors). An HP1000 network controls these heliostats to concentrate a single beam of solar radiation. Directed to a receiver on the tower, this beam heats up an energy absorber in the receiver to produce useful energy.

Five HP1000 computers manage the operation which includes data management, collection, control, analysis, and display. The system has proven so successful that many of its features will be incorporated into a pilot solar plant currently under con-

struction near Barstow, California.

Dave Darsey, automated control system project leader, states, "Though the use of solar energy has many advantages, there are still problems and techniques to be worked out. The HP1000's excellent networking capabilities, sophisticated control, and data communications make it an excellent tool to assist us in exploring these areas and finding the best solutions."

Check A on the reply card for more information on the HP1000.



Draw your own conclusions

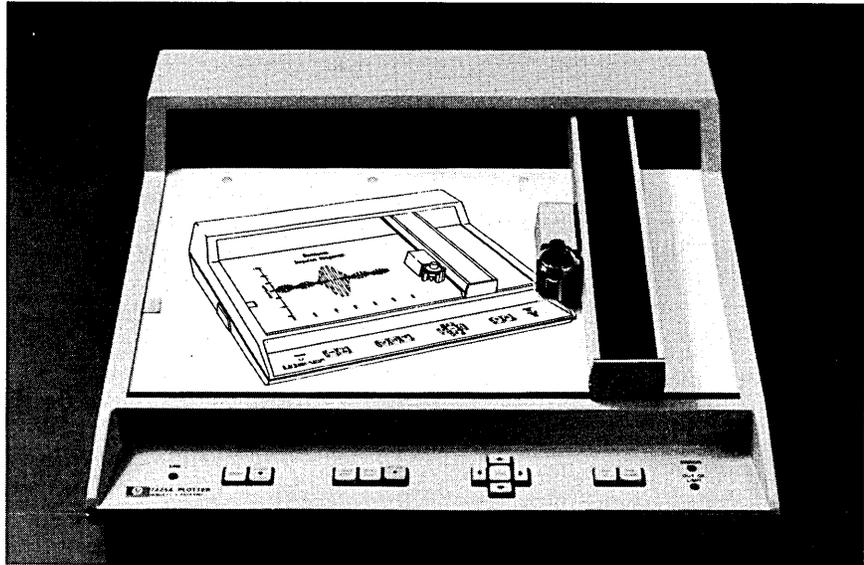
Scientific and business computation often generates volumes of tabular data. One problem is that in this form much of its value is hidden or lost. Charts and graphs bring meaning to this data. The new, compact, single-pen HP7225 plotter offers a high quality and reliable graphics solution—at a low price.

An important parameter in judging a plotter's performance is the quality of its output. Utilizing state-of-the-art linear stepper motors and microstepping techniques, the HP7225 draws virtually stepless lines at a resolution of 0.032mm on either A4 or 8½ x 11 inch paper. And the simplicity of the drawing mechanism—no pulleys, gears, or cables—helps the HP7225 achieve an extremely high level of reliability.

The plotter's modular construction is another advantage. The major portion of its electronic circuitry, including a microprocessor, resides on a single printed circuit board. Results: fewer parts, reduced power requirements, inherent reliability.

A plotter with personality

Requirements for a plotter vary considerably depending on a user's changing needs. To accommodate this in a flexible, yet economical way, the HP7225 uses removable "personality modules." This innovative system provides the appropriate interface, language, and graphics capability for a variety of computer systems, desktop computers, intelligent graphics terminals, and instrument systems. You



The HP7225 graphics plotter: a self portrait

can buy the plotting performance you need today. And, by simply purchasing and plugging in a different low-cost module, you can meet many additional interfacing and plotting requirements in the future.

Three personality modules—microprocessor-based plug-in cards—are currently available, with more planned for the future. Each offers relative and absolute vector plotting, internal scaling, and pen up/down capabilities.

One module is a \$150* binary language interface used for Hewlett-Packard desktop computers. For the OEM, a more flexible binary module was designed to offer varied interfaces and a remote front panel capability. It is available for \$200*. The third module costs \$750* and supports the HP-IB** interface, speaks HP-GL (Hewlett-Packard Graphics Language), has

internal character sets and dashed lines, and is compatible with GRAPHICS/1000 software.

Sophistication at a low price

Because we have incorporated flexibility with state-of-the-art technology, the HP7225 is extremely easy to use. Full capability front panel, automatic reset, electrostatic paper hold-down, and easy-to-change high quality pens (in four colors) are just a few of the advanced features rarely found on a low-cost plotter.

For more information on the compact HP7225 graphics plotter, check B on the reply card. Prices start at \$1850* (personality modules extra)—low enough to dedicate several plotters to your task needs. For special OEM product and discount information, check C.

*U.S. domestic prices.
**IEEE 488-1975 standard.

Capture day-to-day data

Effective management decisions must be based upon reliable, up-to-date information. Hewlett-Packard's new family of interactive data capture terminals is helping make data accuracy a reality.

Designed primarily for manufacturing companies, these low-cost, compact terminals can be tailored, through 60 combinations of modular options, to accommodate a wide range of tasks—from machine shop management to time data reporting. Furthermore, interactive computer control helps assure that data is accurately collected at its source. Seventeen user-definable prompting lights, 10 special function keys, and a 15-character LED display lead the operator through transactions one step at a time. Employees can input and retrieve data without prior computer experience or training.

An optional alphanumeric keyboard and/or display is also available. Each of the 26 alpha keys can serve special functions such as retrieval of the last order, invoice number, or quantity of parts in stock.

Read with mirrors

Source data comes in various forms: marked sense cards, punched cards, or industry Type III identity badges. Hewlett-Packard has developed a multi-function reader that combines a fiber optic read-head with mirrors. Not only can it read all three media, but dirty and crumpled punched cards can be read without error—an important

advantage in a manufacturing environment. This innovation is available as an option on the HP3075 desktop terminal—well-suited for office applications—and the HP3076 wall-mounted version. A Type V identity badge reader is also available as an option.

Wall-mounted or desktop, our data capture terminals have an optional printer to document transactions.



More than a time clock

Accurate time reporting is essential to cost accounting functions. The wall-mounted HP3077 time-reporting terminal provides this—and more.

Serving as a time clock, with a large digital time display, the HP3077's innovative Type V badge reader can read badges both right side up and upside down. Prompting lights instruct employees when to enter their badge. Buzzers indicate correct/incorrect entry. And, a memory buffer enables

badges to be read as fast as they are inserted.

The HP3077, as well as the HP3076 can improve security by controlling access to restricted areas. Electrical door locks are operated by a relay in the terminal's wall-mounted cradle. When a badge is entered, employee data and time of entry are sent to the computer. If acceptable, the door opens.

A choice of connections

These terminals also make it easy for the system programmer to select an appropriate data communications mode. A choice of point-to-point, multipoint, and multidrop is available by just setting a switch on the back of the terminal.

To find out more about HP's durable, low-cost data capture terminals, check D on the reply card. The HP3075 starts at \$2090* the HP3076 at \$2475* and the HP3077 at \$2530* OEM and quantity discounts are available.

*U.S. prices only

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HEWLETT  PACKARD

EDP professionals have a word for the new Wang VS computer.

"Incredible."



Richard Berger, Vice President and Data Processing Manager, Bughaus, Inc., a Volkswagen service center network headquartered in Hartford, Conn.

"Because we had been using a computer—the Burroughs B1700—with card input sequential files and no video displays, we suffered long delays and storage constraints.

"Now, with our Wang VS system, storage is virtually unlimited, and we simply

recall a screen load of information on the CRT to make a change in seconds—all of this without interrupting our normal flow of work.

"We've put everything in our business onto our VS system, including payroll, accounting, sales and wholesale and retail inventory control. And we did it in 90 days without changing languages and with only minor modifications in almost 90 COBOL programs."

EDP professionals in more than 100 companies are singing the praises of the Wang VS. And for good reason.

The VS is a remarkably sophisticated, fully expandable virtual storage computer designed to provide maximum interaction in a mainframe environment.

The VS provides for distributed data processing, thus avoiding costly consumption of mainframe resources. It's fast, responsive, ease to use and can support up to 2.3 billion bytes of on-line storage. What's more the VS speaks EDP people's language: COBOL, BASIC, RPG II and ASSEMBLER.

We also think you'll appreciate how simple the VS is to operate. In fact, because of its level of sophistication, it can be operated by people with little or no computer-related training or experience.

One more thing: the entry level price of the VS is under \$50,000. Which is perhaps the most remarkable thing of all about this computer.

For more information on the VS, return this coupon to Wang Laboratories, Lowell, MA 01851.

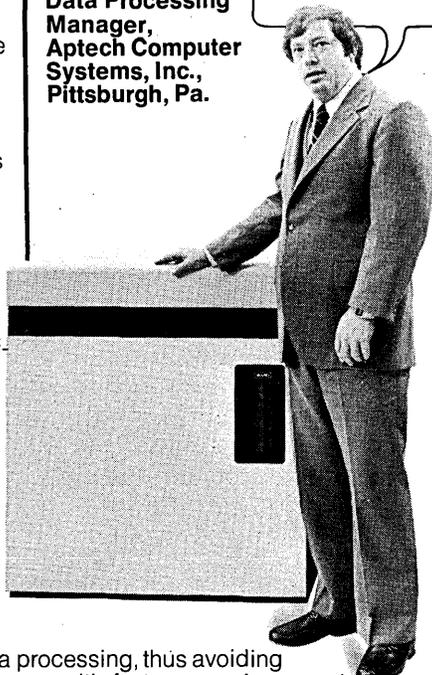
"We are absolutely amazed at the throughput rate we've achieved with our Wang VS. On our very first job for one of the country's largest student insurance agencies, the VS arrived in Pittsburgh on December 23 and was completely installed and operational on-site on February 15, with 61 programs written, debugged and tested—all by only two people—and not a single line of code had been written until the machine came in the door.

"The VS really fulfills all of our requirements, particularly in areas where other systems are weak: cost/performance, language-availability, user-utility software.

"I think the real key for the DP manager is the utilities available with the VS, its speed and its interactive COBOL compiler. These three things combined make for a very powerful tool."

J.P. Scott, Data Processing Manager, Aptech Computer Systems, Inc., Pittsburgh, Pa.

"Unbelievable."



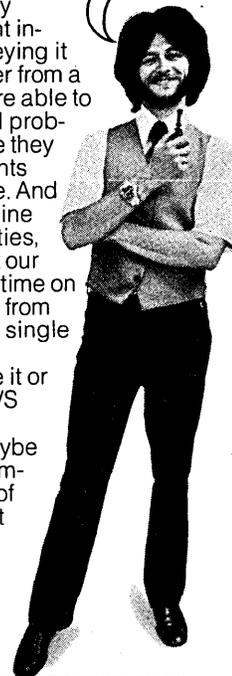
Kenneth W. Cakebread, Manager of Data Processing, Trans-Air Forwarding and Brokerage, Inc., Inglewood, Calif.

"I had 30 days to convert about 220 programs from our old batch-oriented Honeywell 62 system to our new Wang VS system. Not only did I do it: Thanks to the programming power of the VS, I actually came up with more.

"Before we converted to the VS, the biggest problem we had in the accounts receivable area was misapplying cash. No more. Now, by capturing current information and keying it into the computer from a workstation, we're able to sort out potential problems long before they get to the accounts receivable stage. And with Wang's on-line editing capabilities, I'd say we've cut our average editing time on a per-item basis from 30 seconds to a single second.

"And believe it or not, while the VS gives us faster access and maybe triple the programming efficiency of our old system, it was only half the cost."

"Amazing."



I'd like to know more about the Wang VS. Please send me a copy of your Executive Brochure.

Name _____

Title _____ Phone _____

Company _____

Address _____

City _____ State _____ Zip _____

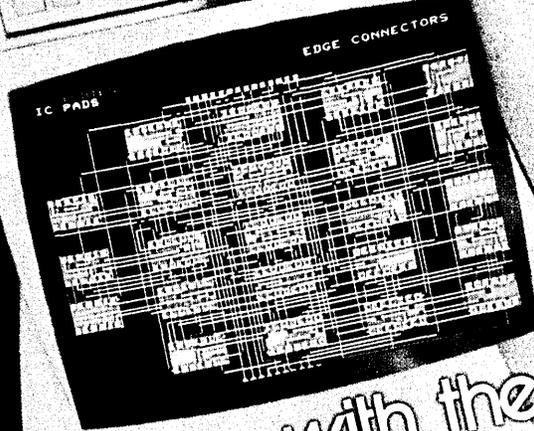
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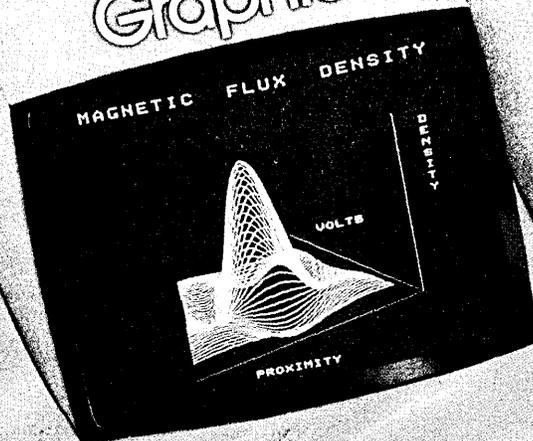
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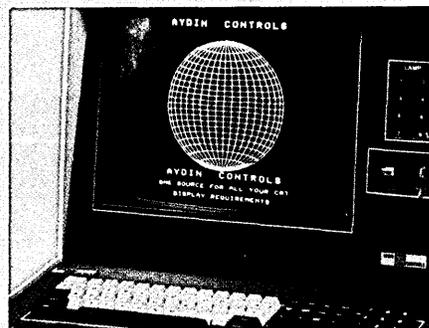
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Voice Data Entry.

How an intelligent voice terminal can cut hidden data entry costs up to 60%.

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With the system's instant playback—display or audio response—errors are caught immediately and corrections made at the source. So data integrity is greatly enhanced. And the intelligent controller can give you immediate analysis of trends.

In addition, the terminal ties in with your existing computer system—no reprogramming required. And, as an intelligent terminal, it is a complete source input. So there's no need to access the main computer while you're entering data.

The Interstate Voice Data Entry System is the ultimate method of data entry. It can cut your hidden data entry costs by up to 60%. In fact, system cost payouts of 12 months or less are common.

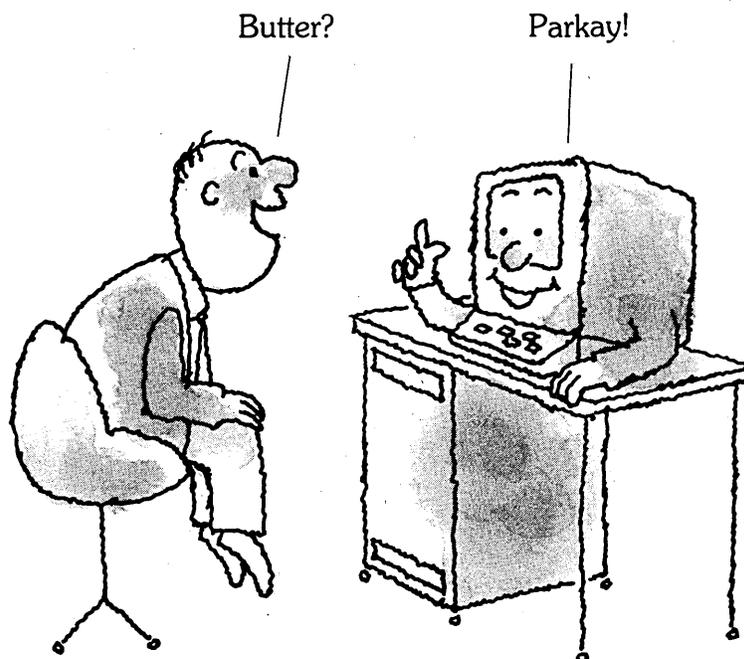
Plus, it's available now. If you're ready for Voice Data Entry, contact Daniel F. Fink, Director Voice Products Marketing, Interstate Electronics Corp., 1001 East Ball Road, P.O. Box 3117, Anaheim, CA 92803, (714) 635-7210.

INTERSTATE ELECTRONICS CORPORATION

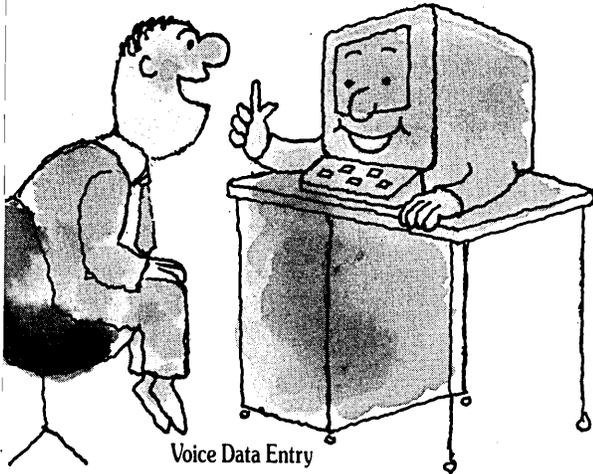
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It means Interstate Electronics. We were founded in 1956 by a group of aerospace scientists. We fast became a major defense

technology and systems. Available now.

Interstate Electronics Corporation is a major subsidiary of A-T-O Inc., a diversified international operating company with annual sales of \$625 million.

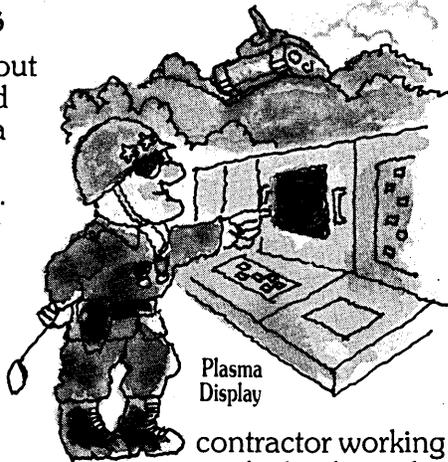
For more information on the Interstate revolution and career opportunities at the high technology end of information processing, write or call Interstate Electronics Corporation, 1001 East Ball Road, P.O. Box 3117, Anaheim, CA 92803, (714) 635-7210.

You're hearing a lot about Information Processing. And you're going to be hearing a lot more about a company called Interstate Electronics.

Information Processing is the new frontier of high technology.

It means computer terminals that listen and respond to human speech.

It means a new generation of sensors, new techniques of analysis... a whole new technology of data acquisition, processing and display.



Plasma Display

contractor working on the leading edge of high technology.

And now the fallout of that technology—exciting new information systems, products and displays—is making an impact on your marketplace.

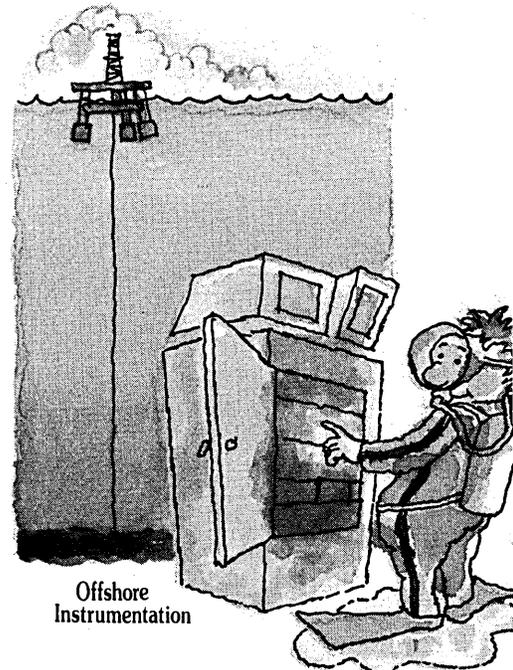
Like Interstate's intelligent voice terminals. Available now.

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And the most advanced (and reliable) offshore instrumentation



Advanced Military Systems



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INTERSTATE ELECTRONICS CORPORATION

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Information Processing and Display. Systems. Products. Services.

IT'S THE FLEXURE THAT GIVES THE MUSCLE TO THE UNMATCHED RELIABILITY OF TALLY LINE PRINTERS.

Flexure technology—special steel couplings that support and move the print carriage. The print hammer fingers of the patented Tally print comb are also flexures.

Designed for unlimited life, a flexure has no wear points nor lubrication requirements. Adjustments are never necessary.

TALLY® PRINTERS WORLDWIDE

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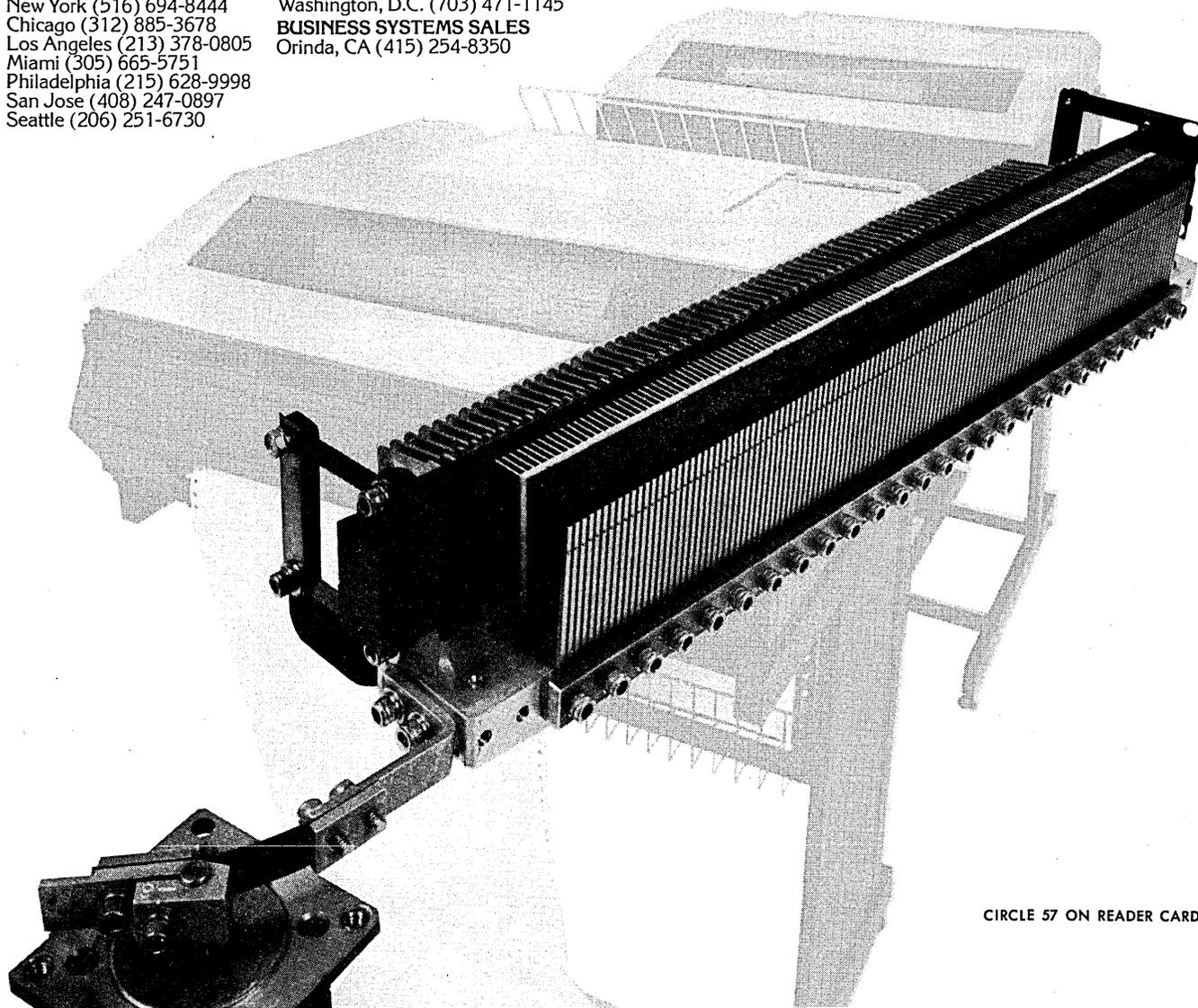
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Thus the stage is set for a highly reliable printing technique based on low stress parts moving at low speed over short distances. For example, print hammer movement—there's a hammer for each character position—is limited to the distance of a single character. Tally has eliminated clutches, belts, timing variables, cam shafts, pivots and sliding wear surfaces. There are no preventive maintenance requirements. No duty cycle limitations.

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CIRCLE 57 ON READER CARD

New intelligent terminal concepts for advanced distributed data processing:



INCOTERM[®]

The new Model 1001 Visual Display Unit marks a new milestone in intelligent terminal development. A uniquely capable work station . . . a powerful partner in large-cluster, interactive distributed data processing configurations.

The first of a new generation of intelligent terminal system hardware and software from INCOTERM, Model 1001 features advanced human factors design to promote higher speed operation, reduce fatigue and improve performance.

The 12" alphanumeric display provides capacities of 2,000, 1920, or 960 characters; and has a tilt screen which allows operators to "tune out" glare. Seven glare-control techniques improve visual interface. The CRT can also be posi-

tioned to three vertical heights. High- and low-intensity characters and character-blink are provided.

The microprocessor-driven, detachable keyboard features n-key rollover, homing keys, and a keyboard tilt device to accommodate varying desk and table heights. A lock provides security at the input level; an optional "privileged mode" lock can be specified for supervisory access. The Model 1001 automatically turns itself off when not in use.

The entire unit — keyboard and screen — operates under software control of any of the INCOTERM Terminal Processing Units, which can be specified in the SPD 20 Family (core or MOS memory) or SPD 15 Family (microprocessor based). Either Family offers a series of intelligent terminal processing alternatives to meet

small stand-alone needs or large-cluster interactive distributed data processing applications with powerful software to handle data entry and local transaction processing. In practically any telecommunications protocol. Why not learn more about INCOTERM . . . and the new Model 1001 Intelligent Terminal? Write or call today.

More power to your terminal.



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Wellesley Hills, Massachusetts 02181
Telephone: (617) 237-2100

1979 'A'

City of Bridges and Howard Johnson's brace to handle expected record crowd from 137 nations; exhibitor space at premium.

DP BRIDGES TO THE WORLD COMES TO PITTSBURGH

International monetary standards, reductions in natural resources in the free world, the technology gap in developing nations, and the rapid turnover of data entry personnel will be the key issues to be discussed at the first annual International Data Processing Bridges to the World Conference and Show to be held in Pittsburgh (the City of Bridges) April 1-5, and sponsored by IMPS (International Micro-Programmers Society), SIGPOOH, and the conference management group of Muhammed & Ishii, Ltd.

Program chairman Charles "Chuck" Johnson reports that over 17 technical and management sessions are planned, and will follow, in interleaving, hierarchical schedules, immediately after the four-day registration period.

Under the general chairmanship of Dr. J.R.A. Auk, the IDPBWCS has attracted more than 500 exhibitors; most of these vendors have found locations on the exhibit floor. The exhibit area will be the Gold Room of the Howard Johnson Motorlodge-Oakland; that inn also serves as the conference headquarters.

Special press arrangements allow DATAMATION to publish in advance the text of the keynote speech by industry guru Dr. Oscar P. Babel, as well as three of the outstanding technical papers.

Concurrent with the show will be the usual gatherings of industry pioneers, hospitality suites and cocktail parties, although at IDPBWCS many of these fetes will have intriguing flavors of ethnicity.

If the predicted crowd of 132,000 materializes, it will inflate IDPBWCS to the largest computer conference in history. Conference organizers, in spite of the gargantuan task, have been heard to enthuse, "It's really been a big job, but we've made

lots of new friends."

REGISTRATION SUNDAY APRIL 1

Registration for Bridges to the World will be held in the Inner Foyer on Sunday April 1, from 7:30 a.m. to 11:20 a.m. and from 1:25 p.m. to 6:15 p.m.; in the Outer Foyer from 11:00 a.m. to 3:45 p.m., and Thursday April 2 and 3 in the Inner and Outer Foyer, as well as around the block, from 9:10 a.m. to 11:45 a.m. and from 1:30 p.m. on into Wednesday morning. All foreign names should be translated into English. South American visitors are asked to use their mother's last name only. Arabic attendees are reminded that the line forms to the right. Members of the press and friends of the press who would rather not wait in line are asked to proceed to the champagne reception area in the Far and Away Room.

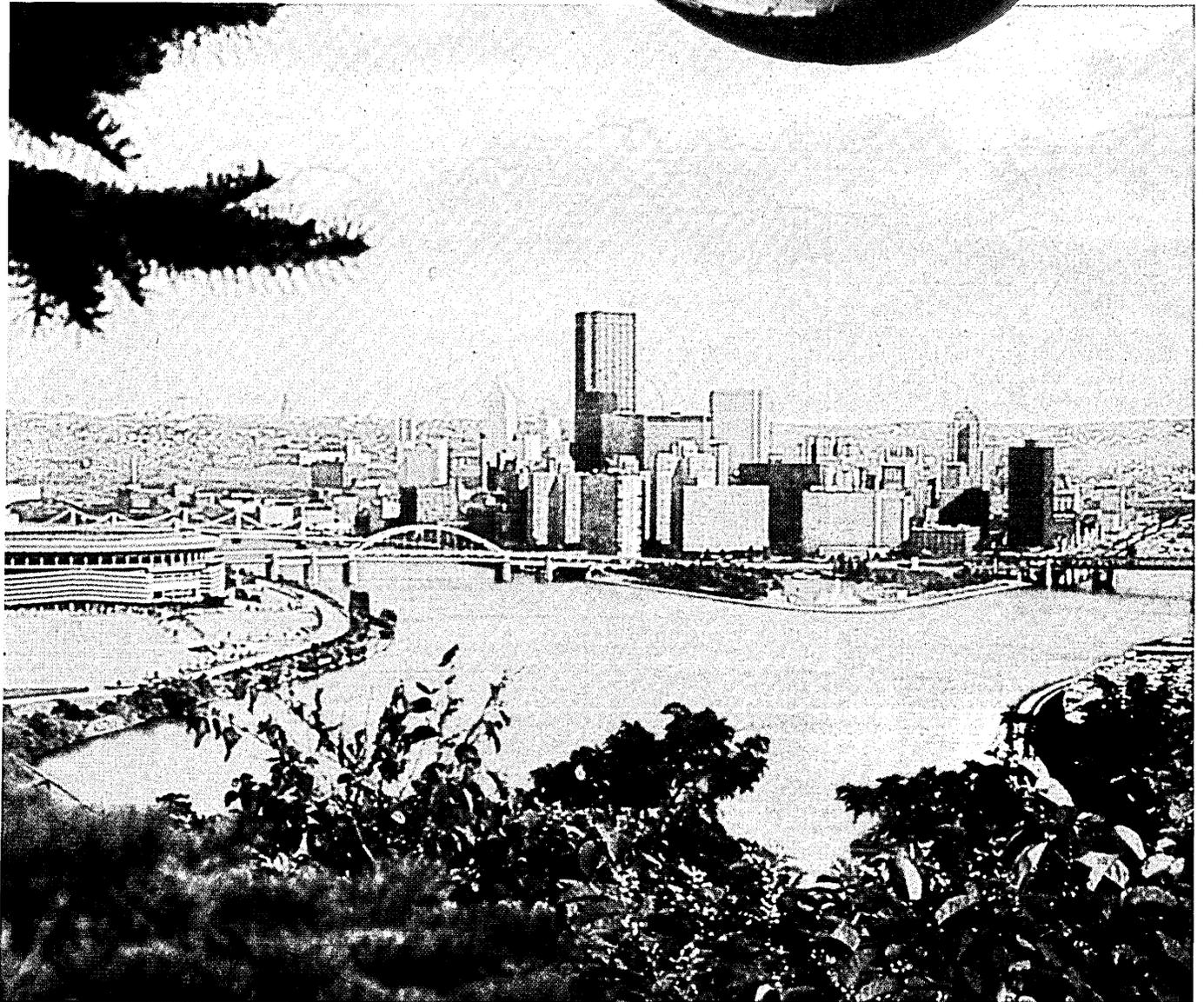
WEDNESDAY, APRIL 4 MANAGEMENT SESSIONS

Organizing the Imaginary Office of the Future, 2:30-5:30
Analysis and selection of rumored products.

TECHNICAL SESSIONS

Case Study Presentation "How One Topeka Light Bulb Firm Used Automation to Solve Its Accounts Receivable Problem in Just Two Years," 2:00-7:00.







THURSDAY, APRIL 5 MANAGEMENT SESSIONS

Setting Up Your Own In-House Couth School, 8:30-10:30.

Covers wine tips and stain removal, suggestions for the use of behavior modification for the chronic sneaker wearer, and an update on OCR (Off-the-wall Character Recognition).

Basic Communication Basics, 10:45-11:00.

A hands-on session to which attendees are asked to bring their own lengths of string and two tin cans or similar objects of approximately equal proportions.

Early Retirement Through Research Report Writing, 1:30-3:00.

Featuring prominent speakers on the subjects of: Pricing for Impressiveness, Disguising the Press Release for Re-use, and Recycling Consulting Experience for Fun and Profit.

Migration Path Engineering, 3:00-4:15.

Attendees will receive a free 27-page cross-indexed guide to the complex movement of workers within the dp industry (your choice between the New England and Orange County versions).

Adventure Capital, 4:30-5:10.

The subtleties of corporate finance, investment theory, and advanced psychology will be covered. A separate, tax-deductible fee for this workshop includes the price of your personal copy of Chapter XI of the Bankruptcy Act.

TECHNICAL SESSIONS

Telepathic Microprocessing: A Hands-Off Workshop, 10:30-11:45.

IBM Shares Technology: A Special Seminar, 12:45-4:15.

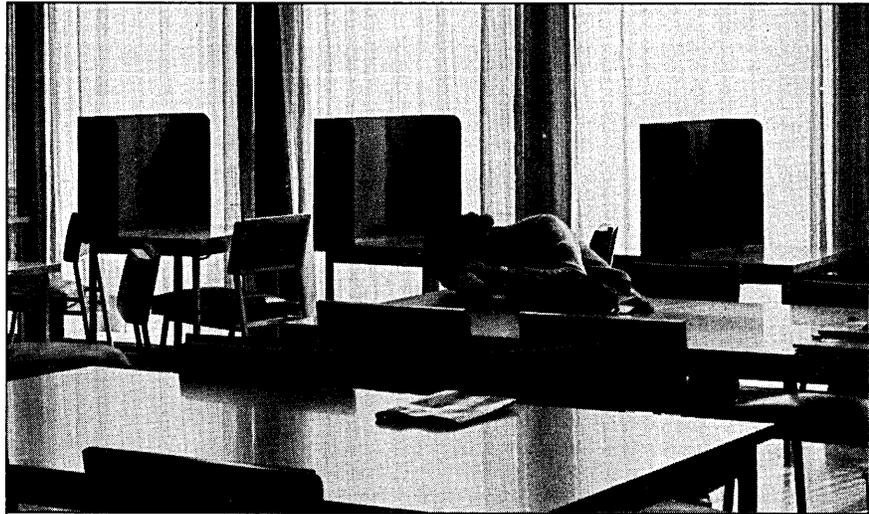
Former engineering managers will present a series of prolonged, amusing anecdotes on Developing Power Supplies for the System/7.

Marketing Tutorial, 4:30-4:45.

The topic is "Truth in Packaging: Modems, Oem's and M&M's." What do they do anyway? Are they really "systems houses"? Will they melt in your hand?

Understanding Obsolescence, 4:45-5:30.

A tutorial given by the late Dr. Rudy Morgansterne, proving once again that no one has ever heard of the age-old wisdom set down by the philosopher Santa Yana:



EARLY ARRIVER, Clinton P. Scuggs, awaits registration. Scuggs, of Altoona, Pa., vowing to be winner of initial First to Register (FTR) award offered by one of the IDPBWCS sponsoring groups (SIGPOOH), arrived in Pittsburgh on March 2.



AD HOC PLANNING SESSION takes place in Market Square, currently undergoing restoration.

"Those who do not remember history are destined to forget what has happened."

For those whose travel budgets require an extra day's expenditure, a special preconference job enrichment seminar program is planned, featuring a brief, repetitive smattering of the usual dp topics.

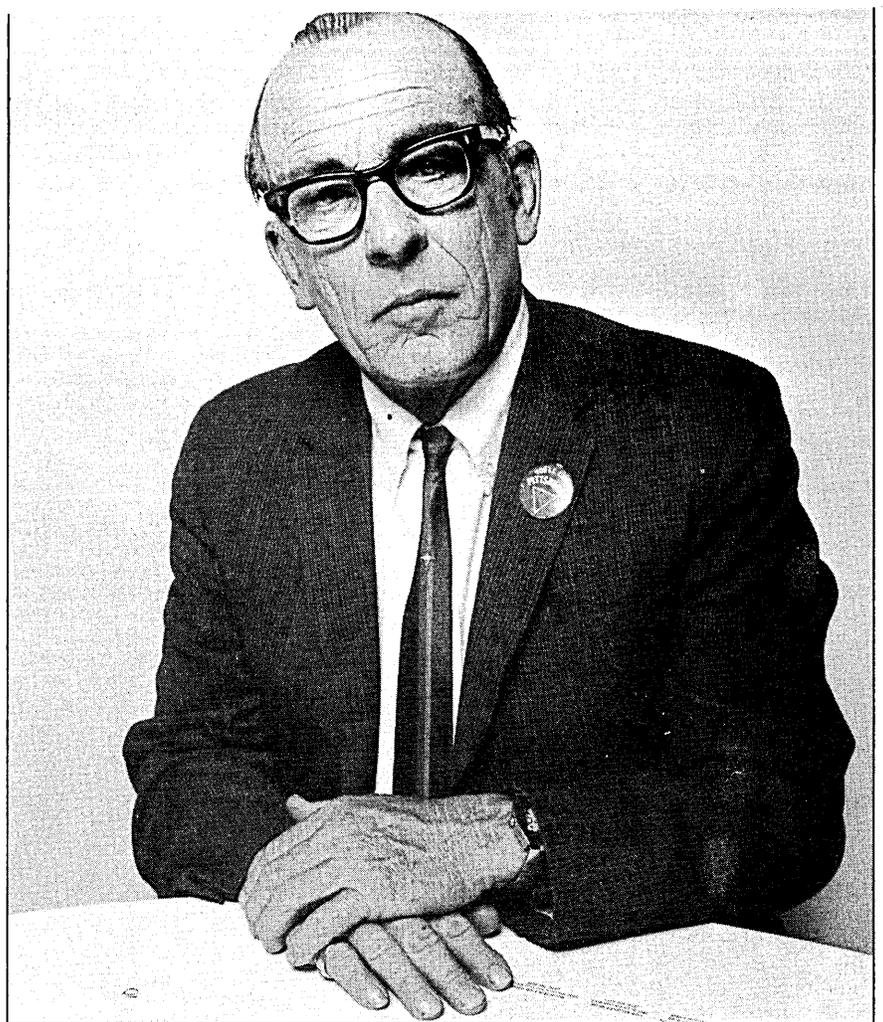
Special feature Thursday April 5 at 7:30 p.m. in the Up and Coming Room, a Q&A press panel, providing an opportunity to discuss the dp industry with art history majors. Featured will be industry editors John Veritable of Electronic Gnus, our own L.F. Grunion, and someone from Canada. *

SPECIAL AWARDS

The I.M. Touring Award is presented each year to the outstanding individual in the computer industry who has done the most needless, albeit management-justified, traveling. This year, DPWCS is pleased to announce the winner is, for the first time in 27 years, not a director of marketing, but a simple programmer, Wilma Loop, who traveled to Rochester, Minnesota for a copy of SUBR15 and never returned. Accepting the award for Ms. Loop will be her analyst and ski instructor, Spider Freidenburg. *



WILMA LOOP—a simple programmer.



A MESSAGE FROM THE GENERAL CHAIRMAN

Dr. J.R.A. Auk

As you know, the theme for our conference is "Bridges to the World"—a theme, I feel, that is highly appropriate in these deeply troubled times. It represents a consensus of the conference steering committee—with one, and *only* one, exception—and it was reached after a great deal of introspection, good-natured give and take, and, I'm not ashamed to say, prayer. It signifies to me what I feel will be a deeply meaningful learning experience for one and all, regardless of race, creed, national origin, or actual hands-on programming experience. After all, education is the only hope for understanding, peace in the world, and computer language standards.

I am not in a position at this point in time to give you actual details of the program because of some minor procedural difficulties—which will soon be smoothed out, I hasten to add—raised by one particular individual. But I would like

to take this opportunity for a look back and a look ahead at what might be called the past and future of this great industry of ours.

As many of you know—perhaps not those fresh-faced youngsters amongst my old friends—I have been in the industry many, many years, since the days of vacuum tubes, or, as our British cousins called them, in their charming vernacular, "valves." (I wonder if they so call them still?)

Now we have passed through three—or is it four?—generations of computer development. Many of the problems in circuitry that once plagued us have been solved. So I have some advice for you young people. I foresee a new admiration in the future for you who specialize in automatic programming—or what is now sometimes called "systems software." *There* is the future, my young friends. We who have pioneered in the development of this great industry gladly pass on the torch and the flowchart templates to you. *

Dr. J.R.A. Auk designed and built one of the early computers, Zodiak I, and formed a company to market it in 1954. Since the acquisition of his company for stock by Amalgamated Computer and a subsequent 100 to 1 reverse split of Amalgamated, he has been a consultant. He now lives at the California State Home for Obsolescent Circuit Designers.



A MESSAGE FROM THE PROGRAM CHAIRMAN

Charles "Chuck" Johnson

Maybe you're wondering why the top dog of the hottest computer outfit the world has ever seen is the program chairman instead of the usual ivory tower type.

I'll give you a clue. "Bridges to the World" may be the theme the PR guys came up with but "Bridges to Reality" is more like it.

Do you realize we're unloading these things on people to take home?

Do you know they're putting these little suckers in cars? I mean that's 10, 12 million units every year. And I'm just talking domestic volume.

So you'll see a few little changes at the show this year, folks.

The luncheon speaker—the guy from the phone company that gives you the history of tariff filings since 1908—is out. The Dallas Cowboys cheerleaders are in.

The technical sessions end at 8:00 a.m. when the exhibits open. Since there was only one room left over after we got all the exhibits in, all the sessions will be parallel. We laid a little high technology on this problem. Everybody gets a headset—everybody who's got \$2.50—that plugs into the arm of your chair. There are 71 channels for papers and you just switch from one to another to sample them. Channel 72 has Muzak for the press.

My outfit has a hospitality hotel, just down the street. You want to visit us after the exhibits close at 10:00 p.m., all you got to do is go to our booth, buy something, and get a pass. No letters of intent. I mean we need those purchase order numbers.

Now let me give you new guys a word of advice. At Amalgamated, we are buying up all the software on the market and burying it in the hardware. We just about got all we need, like forever. So pretty soon you software types can all jog off into the sunset.

The last thing is, you'll really like this show. We finally got some decent-looking broads instead of those stragglers from a rained-out NOW parade. I mean we flew one 747 load of them down here from



Amalgamated. And before you lady professors start rushing for the phone to call the IRS, each and every one of these little beauties is a documented word processing supervisor and is entitled to be here at company expense.

So I—and the girls—will see you at the Amalgamated hospitality hotel tonight.

Get to the exhibits early. You can't miss the Amalgamated exhibit. We've got the main ballroom. *

Charles "Chuck" Johnson is chairman, chief executive officer, president, chief operating officer, and acting marketing director of Amalgamated Computer Corp. Previously an aluminum siding salesman, he founded Amalgamated in 1955 and began a series of acquisitions, starting with the Auk Co. He now has the only vertically integrated computer company, from gold mines to computer discount stores.



YOUNGEST REGISTRANT, Ivan Ngstoronovich, 4-year-old software whiz from Azerbaidzhan, takes time from busy schedule to feed pigeons.

PITTSBURGH IN YOUR POCKET

When the young George Washington, then a major in the Colonial Army, selected the area known today as the "Golden Triangle"—the junction of the Monongahela, Allegheny and Ohio rivers—as the site for a fort to defend the English position in the West against the inroads of the Canadian French, then pushing their claim to hegemony over the Ohio Valley with the establishment of an outpost on the Allegheny River, little did he realize that one day more than two hundred and twenty years later that fort (which was named Ft. Pitt after the pro-Colonial British statesman of the time, William Pitt the Elder), now grown into the great industrial center we know as Pittsburgh, would be chosen to host the first annual International Data Processing Bridges to the World Conference and Show.

And yet that is precisely what has happened and during the week of April 1 through 5 the "City of Bridges" will throw open the doors of the Gold Room of the Howard Johnson Motorlodge-Oakland to the first annual IDPBWCS.

With more than 500 exhibitors from 137 nations displaying their wares to the estimated 132,000 conference attendees, one can only imagine the look of wonderment in the young soldier's eyes were he able to stroll the aisles with a DATAMATION shopping bag on his arm picking up the various brochures and literature describing the latest advances in the realm of international data processing.

Major Washington would no doubt bring his new bride, Martha, with him to the IDPBWCS and she, too, would feel a sense of wonderment as she occupied herself seeing the manifold sights of what was once known by the sobriquet "Smoky City," referring, of course, to the smoke which in the early decades of the 20th century billowed from the multitude of industrial stacks that crowded this busy and bustling city and its environs, the stigma of which has today been erased thanks to smoke control laws and to the dramatic renaissance of the city following World War II.

What would Martha find were she to stroll around the "Golden Triangle" today? What sights would she savor? Of what pleasures would she partake? Come with us as, in imagination, DATAMATION follows Martha in her successful and surprising saunter through Pittsburgh.

No other city alive can more pleasingly and comfortably accommodate the visitor's hoary and time-honored custom

of "just looking around" than can the city of Pittsburgh, as Martha will find out. Within the walkable width of the "Golden Triangle" she will find artful architecture, winsome window shopping, pleasurable parks, delicious dining, enlivening entertainment, nostalgic nooks, continental crannies, and vivid vignettes of city life . . . all amidst a powerful, pulsating artery of the industrial world.

Come with us as we stroll to every Pittsburghian diversion, from big league sports to river cruises. Just tear along the dotted line, put Pittsburgh in your pocket, and join DATAMATION and Martha in a titillating time.

We begin early in the morning at the Point State Park, the tip of the "Golden Triangle" where the Allegheny and Monongahela rivers meet to form the Ohio River, which, in turn, of course, meets the Muskingum, the Big Sandy, the Scioto, the Licking, the Miami, the Kentucky, and the Wabash rivers before mingling its waters with the Mighty Mississippi at Cairo, Illinois. The Park commemorates the planting of Anglo-Saxon (A-S) civilization on the American frontier in 1754. The A-S hegemony, however, was temporarily violated when, in the same year, the French seized the area and built Fort Duquesne. In 1758, fortunately, A-S civilization returned once more when the British, under General John Forbes, laid waste to Fort Duquesne, regained supremacy and built Fort Pitt (see paragraph one).

A computer-controlled fountain in the Park, fed by a fourth "unknown" river, is a focal point of the "Golden Triangle," shooting its water, pure as a mountain spring and accented charmingly by 24 white and gold lights, to heights of 150 feet and more, depending upon the prevailing winds. (Spray from the fountain drenching the unwary spectator is often the source of innocent merriment for those "in the know.")

The Point Park offers an unparalleled view of Three Rivers Stadium with its promise of contemporary excitement. Just looking at the imposing concrete rotunda across the Allegheny River brings to mind the sound of cheering crowds or the sight of renowned athletic teams in vigorous competitive action. The stadium, which also embraces such popular entertainment as symphony concerts, rock operas, auto derbies, and other mammoth outdoor happenings, is within an easy jog, walk, or amble of the "Golden Triangle." It may also be reached by car, bus, or ferry.

Refreshed by the sight of Three Rivers Stadium, bracketed by the numerous bridges that span the Allegheny at

this juncture, we wend our way up Liberty Avenue into the heart of Downtown Pittsburgh. Along this well-named thoroughfare we discover a wide variety of specialty shops and assorted businesses ready to cater to our every whim and fancy. Having indulged ourselves, we move on past the Chamber of Commerce, take a turn around the New Federal Building onto Grant Street and pause, momentarily enraptured by the breath-taking view of the Alcoa and U.S. Steel Buildings. Though tempted to tarry, we have decided on luncheon in Chinatown and we find that the sun has already passed its zenith. We hurry on, with scarcely a sideways glance at the "architectural monarch" of Pittsburgh, the Romanesque Allegheny County Court House and Jail.

An exotic contrast to Grant Street's imposing business structures, Chinatown occupies the upper end of Third Avenue off Grant Street. Larger at one time, Chinatown now consists of a restaurant serving Cantonese food, an Oriental gift shop, and a Chinese grocery store. (It is also somewhat obscured by the bridge leading onto the Boulevard of the Allies.)

Following our delightful repast, we proceed past the nearby County Morgue to Forbes Avenue. We follow this broad roadway, sturdy and straight-arrow as the General for whom it is named, to Panthers Hollow, gateway to Oakland. Here we find an expansive milieu of beauty, learning, and culture within the limits of the city, where we will spend a rewarding afternoon discovering the pleasures of the Western Pennsylvania Historical Society, the Soldiers and Sailors Memorial, and the Bureau of Mines. Here, too, we find the Univ. of Pittsburgh's 42-story "Cathedral of Learning," which presides over Pittsburgh's cultural center. Of neo-Gothic architecture, it is said to be the only skyscraper college building in the Free World. On display on the first floor of this imposing edifice are 18 nationality classrooms, each carefully modeled after a style of the country it represents. Special arrangements have been made with the University so that IDPBWCS convention attendees with appropriate badges from the countries represented can enter his or her country's replicated schoolroom and sit at a student's desk for up to five minutes. (An Exhibitor's badge will provide for an additional five-minute stay.)

Only the setting of the sun will cause us to return to our respective hostels, footsore and weary but pleased with our self-guided tour and ready for a "night on the town" in the eternally fascinating metropolis of Pittsburgh.

INTRODUCING THE PERKIN-ELMER 3220

The Highest Performance Mini.

Full 32-bit architecture. DMA bandwidth of 8 MBytes. MOS memory in 256KB modules with error correction as standard. Memory error logging down to the chip level, if you want. Memory expansion to 4 MBytes. Cache memory, 128 16-bit registers, number-crunching features no 16-bit mini can match. And, all for less than a PDP-11/60.



The Lowest Cost Supermini.

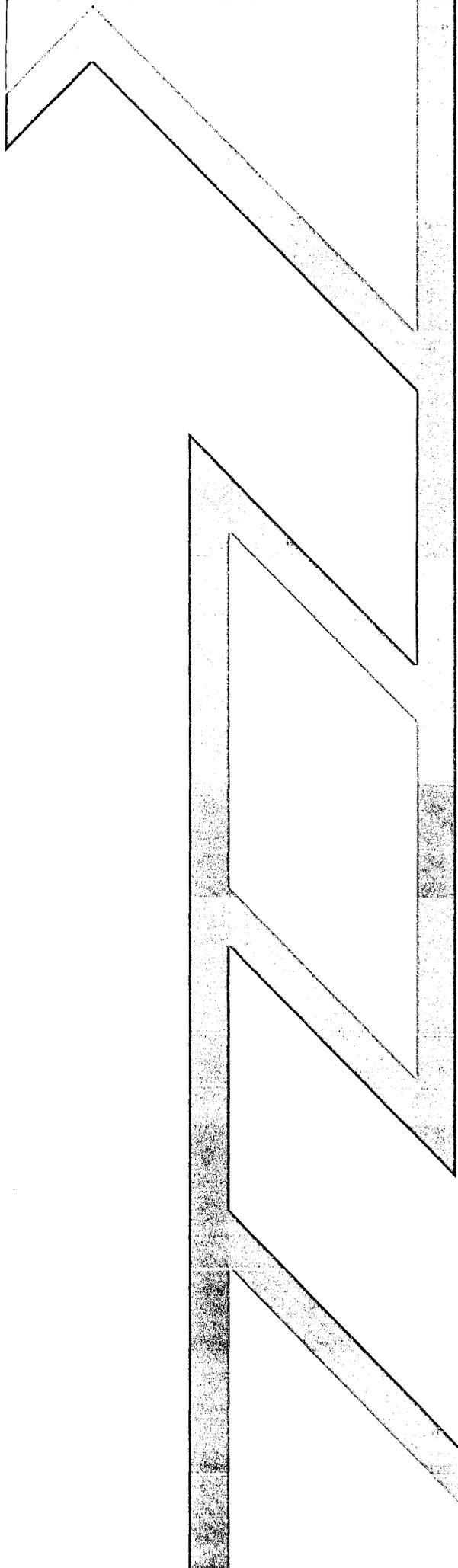
Outstanding run-time speed and accuracy. Fast, responsive program development. Easy, cost-effective program conversion. Check the comparison chart.

Either Way, We've Got Them Beat.

	DEC 11/34	DEC 11/60	P-E 3220	SEL 32/57	PRIME 550
Architecture	16-bit	16-bit	32-bit	32-bit	32-bit
DMA Bandwidth	2MB	6MB	8MB	26MB	2.5MB
Maximum Memory	256KB	256KB	4MB	1.87MB	2MB
Number of Registers	8	16	128	8	128
Direct Addressing	56KB	56KB	4MB	.5MB	32MB (virtual)
Writable Control Store	No	Yes (opt.)	Yes (opt.)	Yes (opt.)	No
Shared Memory Support	No	No	Yes (opt.)	Yes (opt.)	No
Pricing – Processor 256KB, PF/AR, Systems Console, Chassis and Cabinet	\$29,700	\$41,900	\$33,500	\$41,600	\$70,000
256KB Expansion Memory	N/A	N/A	\$10,000	\$12,500	\$15,000

	Optimizer Technology	Average Compile Time	Whetstone Benchmark	Matrix Inversion Program	Binary Search	Price *
3220 FORTRAN VII	Global	2000 LPM	2.25 Sec.†	3300 Sec.†	39 Sec.†	\$ 88,600
VAX FORTRAN IV Plus	Block	1300 LPM	.85 Sec.	3700 Sec.	109 Sec.	\$167,200

Both 3220 and VAX configured with: 512KB, Floating Point, 10MB Disk, Dual Density Tape, OS, FORTRAN. Without cache memory option.



Dynamic 32-Bit Software, Perkin-Elmer Quality.

The software available for the Model 3220 is exactly what you'd expect from Perkin-Elmer, a company whose reputation was built on quality products. It's true 32-bit software, tuned and proven where it counts in the field. And not just for months. For years.

Powerful software like our FORTRAN VII it's targeted to ANSI FORTRAN-77 and IBM FORTRAN H compatibility to reduce conversion costs.

A flexible operating system for event-driven, real-time applications. Program development with up to 32 on-line, interactive terminals. The industry's most advanced transaction processing monitor, supporting commercial applications with up to 64 terminals, using COBOL and SORT/MERGE

Shareable software that allows our OS/32 MTM to make multi-terminal, multi-task program development a snap. And, increases memory efficiency as well.

From the Inventors of the 32-bit Supermini.

Five years ago we introduced the first 32-bit supermini, when we were known as Interdata. Now we are the Computer Systems Division of Perkin-Elmer, a Fortune 500 company respected for 40 years for the reliability and performance of its high-technology products. Today we have more than 2000 successful 32-bit installations worldwide.

The Model 3220 is our first product to be introduced and marketed entirely under the name Perkin-Elmer. The 3220 leads off our new Series 3200, with more to come. A compatible family based on advanced systems and software, the Perkin-Elmer Series 3200 is the next generation of 32-bit

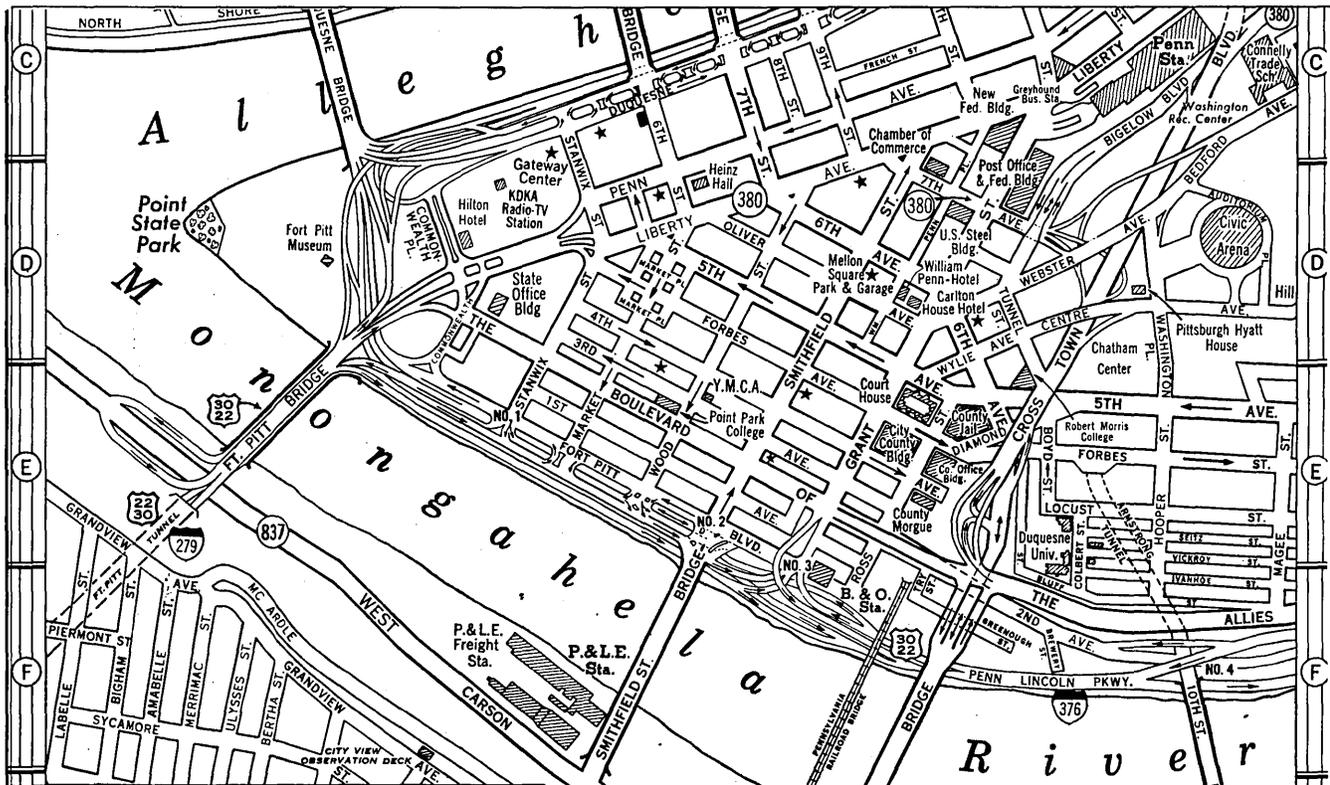
superminis. Perkin-Elmer remains the undisputed leader in 32-bit performance and price.

Find out how we've got them beat any way you look at it.

Call or write for a demonstration today
Perkin-Elmer, 2 Crescent Place,
Oceanport, NJ 07757. (800) 631-2154.
Or, in New Jersey (201) 229-6800.

PERKIN-ELMER

CIRCLE 144 ON READER CARD



ON GETTING TO THE AIRPORT FROM HOWARD JOHNSON'S MOTORLODGE

Motorists in Pittsburgh are fortunate to be served by a most interesting network of roads, bridges, underpasses and overpasses, parkways and tunnels. As an aid to convention-goers who may be facing the challenge of this network for the first time, DATAMATION offers the following hints for successful motoring in Pittsburgh and, more particularly, in getting through to the Greater Pittsburgh International Airport.

First, note that highways often have multiple names in Pittsburgh and environs. This sometimes leads to confusion when the unwary motorist, untutored in the local idiom, seeks directions from a native Pittsburgher. For example, on the Pittsburgh side of the Monongahela he will refer to the Penn Lincoln Parkway as Parkway East, while on the west bank of the river he will, quite logically, refer to the same highway as Parkway West. A trifle, but still a potential for confusion. Now then, on the east bank this same highway is also known as Interstate Highway 376 and/or Federal Highways 22 and 30. The Interstate Highway designation, however, changes to 279 after crossing the Ft. Pitt Bridge. This 279 designation disappears in turn at a junction near Settler's Cabin Park where Penn Lincoln Parkway (Parkway West, Interstate 279, etc.) becomes the Airport Parkway and/or State Highway 60.

Also note that all tunnels are referred to by Pittsburghers as tubes.

Now, for getting to the airport. Clearly, the proper way to get from Howard Johnson's Motorlodge-Oakland to the Greater Pittsburgh International Airport is to get on the Penn Lincoln Parkway (Parkway West, Interstate Highway 376, etc.) and stay on it, ignoring name changes, across the Ft. Pitt Bridge, through the Ft. Pitt Tunnel (tube) and so on and so forth until you reach the Airport Parkway (State Highway 60, see above).

This plan presents two major challenges:

1. getting on, and
2. staying on.

Howard Johnson's Motorlodge-Oakland is situated on the Boulevard of the Allies. The Penn Lincoln Parkway runs between the Boulevard of the Allies and the Monongahela River. Proceed toward Downtown Pittsburgh on the Boulevard of the Allies. You will immediately notice a street running parallel above you—this is Fifth Avenue. You will also notice a street running parallel below you—this is Forbes Avenue. You will also notice another street running parallel and even farther below you with a railroad track down its center—this is your goal, the Penn Lincoln Parkway. You will also notice a bridge cutting over and through and under these various streets—this is the Brady Street Bridge. Now this is the exact point where you should look for a left-turn on ramp to the Penn Lincoln

Parkway. (If you are unfortunate enough to miss this turnoff, be sure to stay on the Boulevard of the Allies until you reach Chinatown, i.e., the corner of Grant Avenue—any other turn you might make would take you away from your goal.)

Let us assume you make the proper turn and are now on the Penn Lincoln Parkway (Parkway West) headed in the right direction. The alert motorist can stay on this highway all the way through the downtown section. It is, however, difficult to describe in words the proper technique for doing so. This is why DATAMATION has provided you with the accompanying map. An hour or two of reasonably intensive study should provide the average motorist with sufficient information to make a successful run. Take special note of directional arrows, especially those between the Liberty Bridge and the Smithfield Street Bridge. Hesitation in this section of the parkway can be dangerous. Note also the archipelago of islands at the juncture of the Smithfield Bridge. Finally, entrance onto the Ft. Pitt Bridge is best achieved by "going with the flow," unless, of course, it happens to be a day the Pirates are playing, in which case you might well find yourself at the Three Rivers Stadium. (Even if you're not a baseball fan, you might enjoy this new perspective on the Golden Triangle.)

Bon voyage, then, and happy motoring! *



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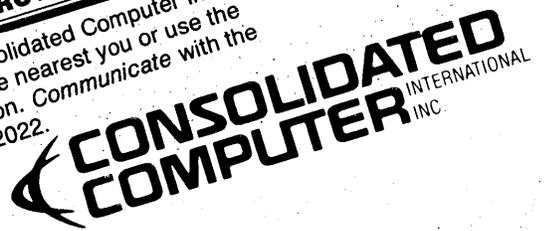
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CIRCLE 75 ON READER CARD

KEYNOTE ADDRESS: A JEROBOAM OF JARGON

by Dr. Oscar P. Babel

Ladies and gentlemen, members of the press: All these years I'll bet you've been scratching your heads and asking yourself who is the person who comes up with all those terrific buzzwords you computer people like to throw around so much.

Well, you can stop scratching, because Dr. Oscar P. Babel has decided to step out of the closet and finally set the record straight.

With no false modesty I can tell you that I, Oscar P. Babel, have single-handedly invented 99 and 44/100s of all the jargon we use in this great big wonderful industry of ours. And now, on the occasion of the First Annual Dp Bridges to the World Conference, I'd like to draw attention to some of my accomplishments and what they mean to the industry and the world at large.

Undoubtedly, you've all heard the phrase "distributed processing." Where did you think that phrase came from? A little bird told it to you maybe? You saw it written on the wall in the men's room perhaps? No. Oscar P. Babel made it up, ladies and gentlemen, created distributed processing out of his very own imagination.

And what about "price performance" or "bang for the buck"? Also Babel originals. And "data base management," "off-line," and "on-line," and "down time"—Babel inspirations every one of them.

Yes, ladies and gentlemen, it was Oscar Babel who took you from OIS to MIS to DSS. And it was Oscar Babel who coined the immortal phrase "Information Resources Management." It was Babel who put the "virtual" in memory, the "structured" in programming, and the "top down" in software.

I'm telling you all this because I want you to appreciate how much you owe me. Boy, oh boy, do you owe me. Who do you think it is that's been keeping you in your job all along, helping you convince those suckers outside the industry that you really know what you're doing down there in the computer room?



What better way is there to underscore the debt the data processing industry owes Oscar P. Babel than by my addressing this august group and receiving its accolades. And I'll tell you the truth, it's about time you people started giving me my just deserts because not only have I been *numero uno* in saving your jobs—I've been protecting this industry from our friends abroad who would like nothing better than to get a big piece of the pie, if you know what I mean. And I've been doing this without so much as a "how-de-do" from good old Uncle Sam.

What is this man talking about speechwise, you may be asking yourselves? Well, let me enlighten you. The people who put together this conference are telling us that data processing is the bridge that links the world together. Now I am the last person to argue that. Go to Sweden and what do you see. The Swedes finally got their minds off of sex and aquavit and are all worried about trans-border data flow and the like. Well, whoopee I say to that.

Same thing with Japan. All you hear about is computers, computers, computers. Drives you nuts. Even down in Brazil they've got better things to do now than samba all night long.

Yes, everybody's computer crazy today, and that's good news for us because it means we all keep working, right? But it could be not such hot news too, because pretty soon those people on the other side of the bridge may figure out what we're doing and say to themselves, "Hey, you know, we can do that too, maybe better and cheaper than those Americans."

That's why all our buzzwords and jargon are so important, ladies and gentlemen. They're the secret weapon we've got in our back pocket. Let me explain to you what I mean. Just the other day I had to talk to a room full of smarty-pants Japanese gentlemen. We talk and we talk, and by the end of the day the Japanese gentlemen are shaking hands and giving each other smarty-pants looks because they figure they know as much about computers as Oscar P. Babel does.

Then just as we are about to go home I drop the bomb. I say, "Unfortunately, gentlemen, all this information we've discussed today may well prove obsolete with the advent of multihierarchical cross-lateral firmware."

Well, you should see the look on the faces of those Japanese gentlemen. Whoa boy. Of course, they don't admit they never heard of this multihierarchical firmware which I have just invented in my brain and which, of course, as you know and I know, doesn't exist. They just look at each other real funny and hop on the next plane home where they will spend months or even years trying to learn all about this wonderful new firmware the American's got.

And that, ladies and gentlemen, is the value of the buzzword. You can have all the dp bridges you want, but as long as old Uncle Oscar can keep on pumping out the jargon, you don't have to worry. Those bridges will only lead one way—right smack back into the American pocket-book.

So not to keep tooting my own horn too loudly, ladies and gentlemen, but I think it's a fair statement—even an understatement—to say the buzzword is the single most important invention America has produced in the 20th century. So you can call me Oscar, or you can call me Dr. Babel, but remember me always as the Father of the American Buzzword. That's all I ask as thanks, and believe me, that's little enough. *

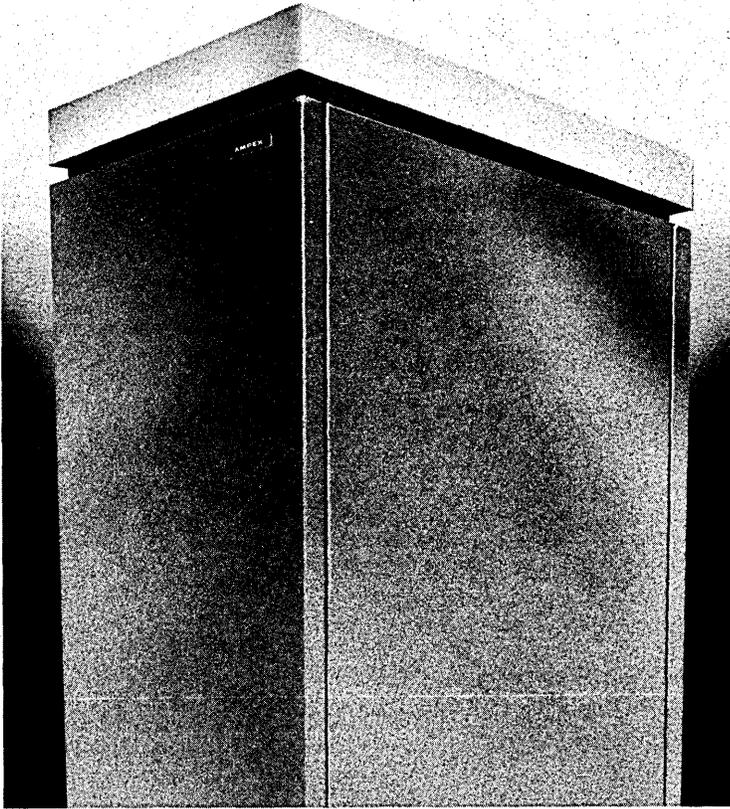
A graduate of Amarillo State College where he received a Ph.D. in Semantics, Dr. Babel most recently served as a consultant to the IBM marketing and public relations staff. He is the author of *How to Double Talk Your Way Through Almost Any Crisis, or Management Can't Can You If They Can't Understand You*, as well as the popular children's book, *Pig Latin Made Hard, or How to Make Your Big Brother Look Dumb*. He is a member of the IEEE, the BPOE and the American Automobile Assn.

SUPER MEMORY FOR A SUPER MAINFRAME

Money is the main reason you'll look into this Ampex add-on memory for the IBM 3031/32/33 mainframe. And performance is the reason you'll buy it. The ARM-303X from Ampex costs a lot less than IBM's own memory expansion, and it'll take any of the big three computers all the way to 16 million bytes of memory.

The whole works are in a single cabinet that hinges right to the IBM frame housing processor storage. Get rid of a door and get as much memory as you need, in one-meg increments for the 3031 and 3032, and in two-meg increments for the 3033.

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there's no extra plumbing to worry about.

Ampex diagnostics are another plus with the ARM-303X. The CE display panel (plus Ampex diagnostics) pins down errors to the single memory chip at fault. And you'll have the secure feeling that comes from knowing that Ampex Customer Support

will assume total responsibility for installation and maintenance support.

Dommie Johnson has the details, along with all the numbers you need to prove that Ampex add-on memory is the best way to get more work from your IBM-3031/2/3, and still save about a third the money you'd spend otherwise. Call him at 213/640-0150, or write to Dommie at Ampex Memory Products Division, 200 N. Nash Street, El Segundo, CA 90245.

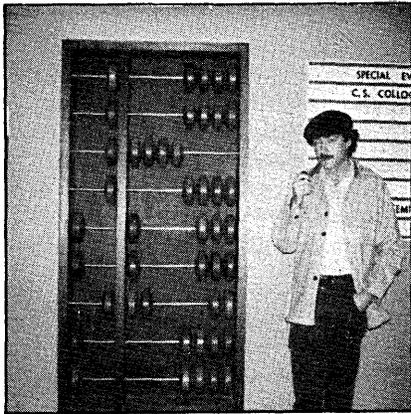
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PRODUCT PREVIEW

PANACEA

The model 13 Panacea represents a revolutionary breakthrough in state of the art technology. The versatile model 13 will do everything for anybody. It has superior price/performance and provides an unequalled degree of reliability. Exact specifications have yet to be released, and the vendor refuses to comment on specific



applications, saying, "The Panacea does it all. What can I say? This is the most remarkable thing to come down the pike since Christopher Columbus discovered Ohio!" Performance and pricing information were not disclosed. GENERAL OMNISCIENCE, Hollywood, Calif.

Booth #42, West Hall
Near Maintenance Parking

COMPUTER

This large-scale, solid state, biquinary, digital computing system is intended for users with large problems. The Analytic Biquinary Arithmetic Calculating Utility System (or ABACUS, as it is informally known), should have great appeal to users in the New York area; ABACUS is said to be immune to power fluctuations, brown-outs, and total blackouts (when equipped with optional candle light source). While not exactly a new processor, large-volume importation of the ABACUS is only now possible, after the formalization of relations between the U.S. and the People's Republic of China. NEW CHINA TRADING

CO., Plains, Ga.

No Booth #

Exhibitor on Waiting List at Press Time

SYSTEM DEVELOPMENT TOOL

If the team responsible for writing a system can have debuggers, why can't the analysts responsible for torture-testing the system have a corresponding tool? That was the question in the back of this software house's collective mind when it started work on the Basic Utility to Guarantee Generation of Erroneous Results (B*****). Designed to run concurrently with the program under test, B***** is guaranteed to knock the stuffings out of any applications program, even the best designed, most fault-tolerant system. Initially, the package generates bad input for the system under test. If an alphanumeric value input to a numeric field doesn't stop the system, B***** will try other data type mismatches, such as real into an integer field, and complex into a logical field. Of course, some applications systems are sufficiently well designed that bad input data gets rejected out of hand. In this case, B***** uses a more sophisticated technique: it literally writes bad code into the application program. The vendor claims that in 85% of its test cases the application will fail at or before this stage. Still, some programs are fault-tolerant, and have recovery procedures that can handle failed modules. So, B***** goes a step further, and actually writes NOP's over segments of the application. Again, if the application can recover, B***** takes another shot: it issues a series of invalid supervisor requests guaranteed to pull the operating system down on top of the application. The vendor says this feature is the basis of B*****'s guarantee. On the off chance that future operating system releases are impervious to this approach, the vendor will send a consultant, armed with a 12-gauge shotgun, to fulfill the warranty. B***** licenses for \$1,999.95 plus the cost of shotgun shells. DICHLORO, DIPHENYL, TRICHLOROETHANE & MOSQUITO CONSULTANTS, Everglades Station, Fla.

Booth #2314A/2314B

PROGRAMMERS' AID

We all know how little things, such as messy, mud-slinging divorce cases, drunk driving arrests, and income tax audits, can affect our on-the-job performance. Until now, the soon-to-be-single-again, drunk programmer might well wind up with a case of severe schedule slippage, especially when he notices the IRS agent talking with his boss and the accounting department. Of course, Murphy's Law inevitably holds true, and the same poor programmer has to demo his big (non-functioning) system to a client or top management within a few days. In days gone by, this set of circumstances could very well put our friend, the programmer, in the unemployment line.

But not to worry. Now there's Save-Job, a programmer's aid to get through that demo. Using several breakthroughs in artificial intelligence, Save-Job needs only be given a copy of the non-functional program, and samples of desired output. From this, Save-Job works backwards to find the input data that will guarantee the desired outputs. In fact, the vendor says its demo was preprocessed by Save-Job, just to make certain it would be ready for the show.

Save-Job is written in Autocoder for 1401s; an SPS version for the 1620 is said to be in the works. Pricing is based on ability to pay; the formula is \$500 plus 50% of the programmer's annual pay above \$6,000. PSYCHEMOUT SYSTEMS, Angels Island, Calif.

Center Island
Main Hall
Booth #1

MONSTER COMPUTER

For truly massive number crunching and very large scale modeling, the Phobos Pyramid Processor (PPP) provides processing power to spare. Both architecturally and physically organized as a pyramid, the PPP comprises 100 levels of microprocessors, each with its own memory. The base "stratum" of the PPP consists of a 100 by 100 array of interconnected micros; the next is 99 by 99, and so on up through the remaining 98 strata. Interconnections between micros allow them to communicate with the eight micros orthogonally and diagonally adjacent on their stratum, four micros on the next tower stratum, and one micro above. Input data for simulations and number crunching enter at the bottom, and after specified processing at each level, propagate through the higher strata, until the results arrive at the lone micro on top.

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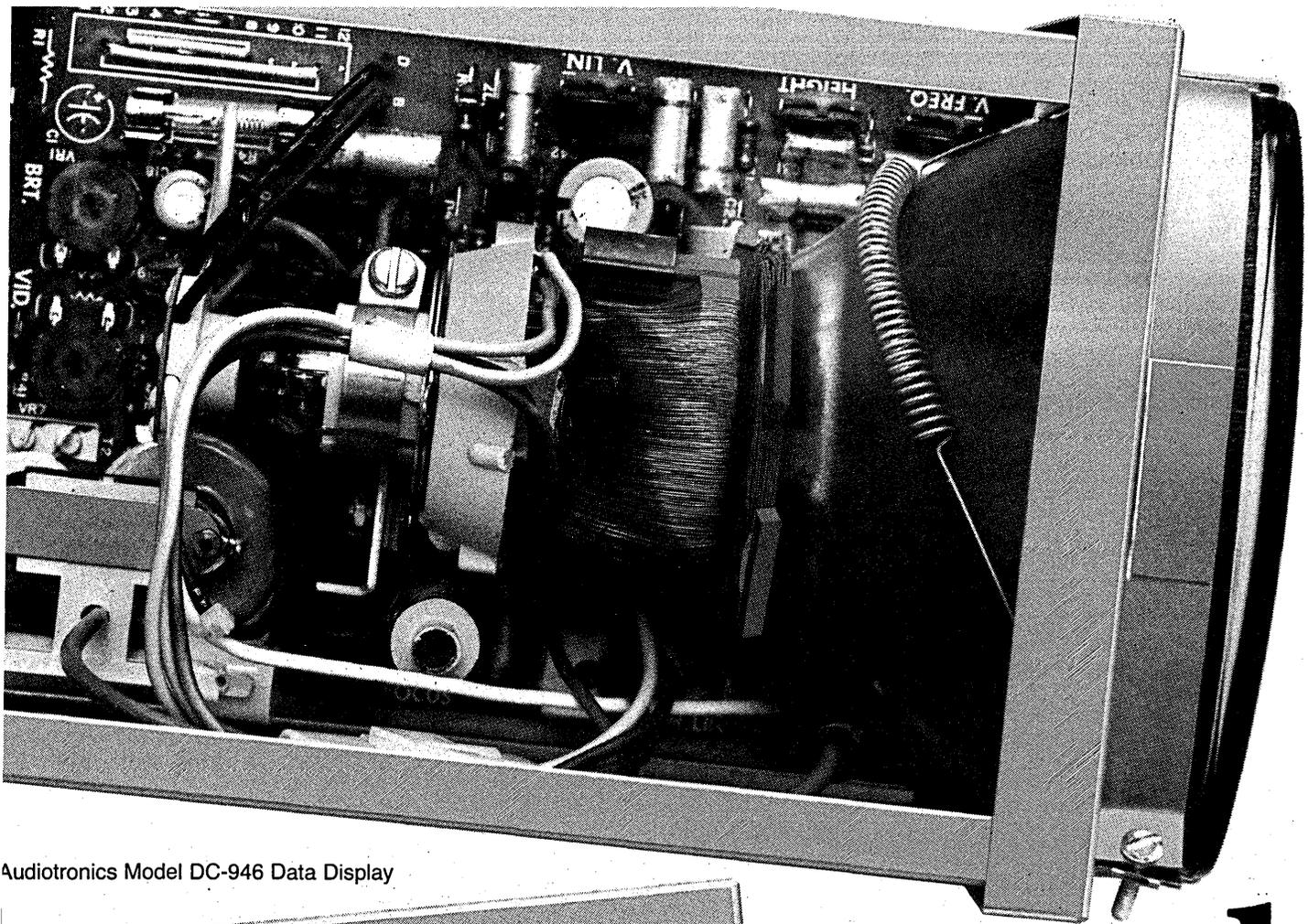
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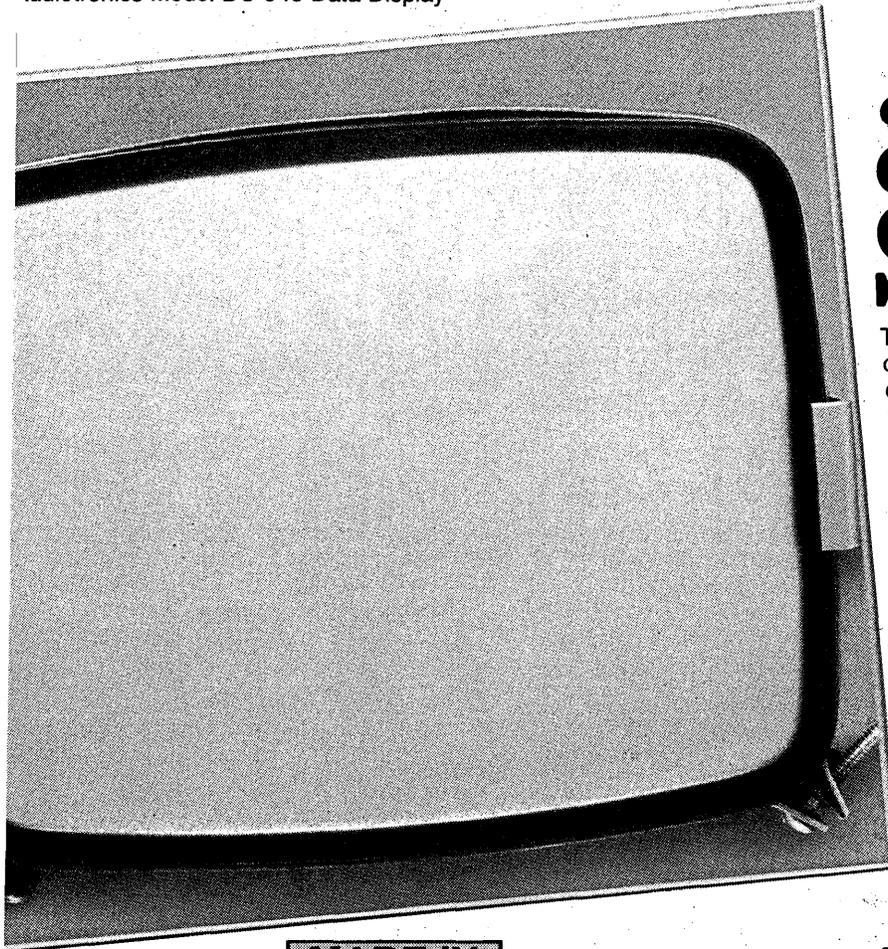


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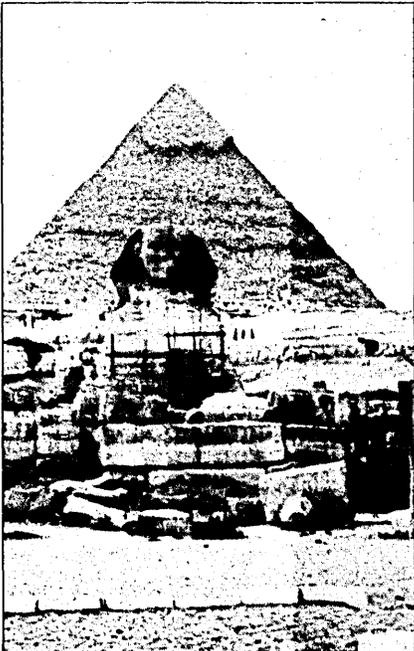
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CIRCLE 27 ON READER CARD



System control and interprocessor communication are controlled by ROM associated with each processing node. Programs are written in Q, this vendor's proprietary C-like systems implementation language. A friend of ours who has evaluated the system at length, observes that the pyramidal structure closely resembles the



management organization of many large companies. He's already submitted a budget request for the \$14-million PPP, and his may well be the first *Fortune* 500 firm to take delivery. PHOBOS COMPUTER PRODUCTS, Winnemucca, Nevada.

First-Time Exhibitor
Seventh Floor Alcove

WORD PROCESSING

We've heard complaints to the effect that machine-generated letters are impersonal, nonresponsive, and just plain demeaning. Apparently this word processing vendor has heard the same complaints. Its latest system, dubbed Dear John (will the cute names never end?), has the usual features for turning out letter-perfect documents, as well as several "personality" modes for producing truly customized correspondence. While many word processing systems have dictionary features, Dear John also has a thesaurus. With the thesaurus, Dear John can take a form letter, and randomly replace words with synonyms; this virtually guarantees that each letter produced will be different. To further individualize each letter, Dear John can be told to make typographical errors (transposition, dropped letters,

etc.) and strikeouts. The systems standard forms feeder also is controllable, and can insert letterhead upside down or cocked to one side. An optional personalization kit, consisting of a brown-ink pad and rubber stamps to simulate coffee rings and cigarette burns, can lend a human touch to machine-prepared letters. BROKENTYPE AUTOMATION, Chicago, Ill. Booth #31 *

Contributing to this section: Sarah Rolph, conference program; Bill Rolph, conference chairman and program chairman; John Waterhouse, tour guide; Laton McCartney, keynote speech; Bill Musgrave, product preview; Jim Griglak, research and graphics; Wendy Crisp, editor; theme button, Martha Bolté.

THE SOLUTION TO THE SOFTWARE PROBLEM

by M.R. Paige

1. Introduction
2. Notation and Methodology
3. The Principal Software Theorem
4. Some Results and Conclusions
5. Discussion
6. Summary*
7. Bibliography

*Parts 1-6 of this paper are not reproduced here. The Technical Committee for the Seventh Annual Conference on Software Development advised that the section "Notation and Methodology" was unnecessary, in view of the peculiar nature of the paper. On the suggestion of the program chairman of the First Annual Conference to Address the Programmer's

Plight, I have omitted the third section, which was said to have "unjustifiable assumptions," and the "Results" section, which was considered inconclusive. The Committee for the International Conference on Software Engineering recommended deletion of the "Introduction," for being "circuitous and gratuitous beyond reasonable limits," and the "Discussion," which in their words was "incorrigible." Finally, the Fault Tolerant Computing Symposium Committee regretted that the footnotes were unprintable and suggested that the "Summary" be reduced to 3% of the total length of the text. These suggestions have been adopted.

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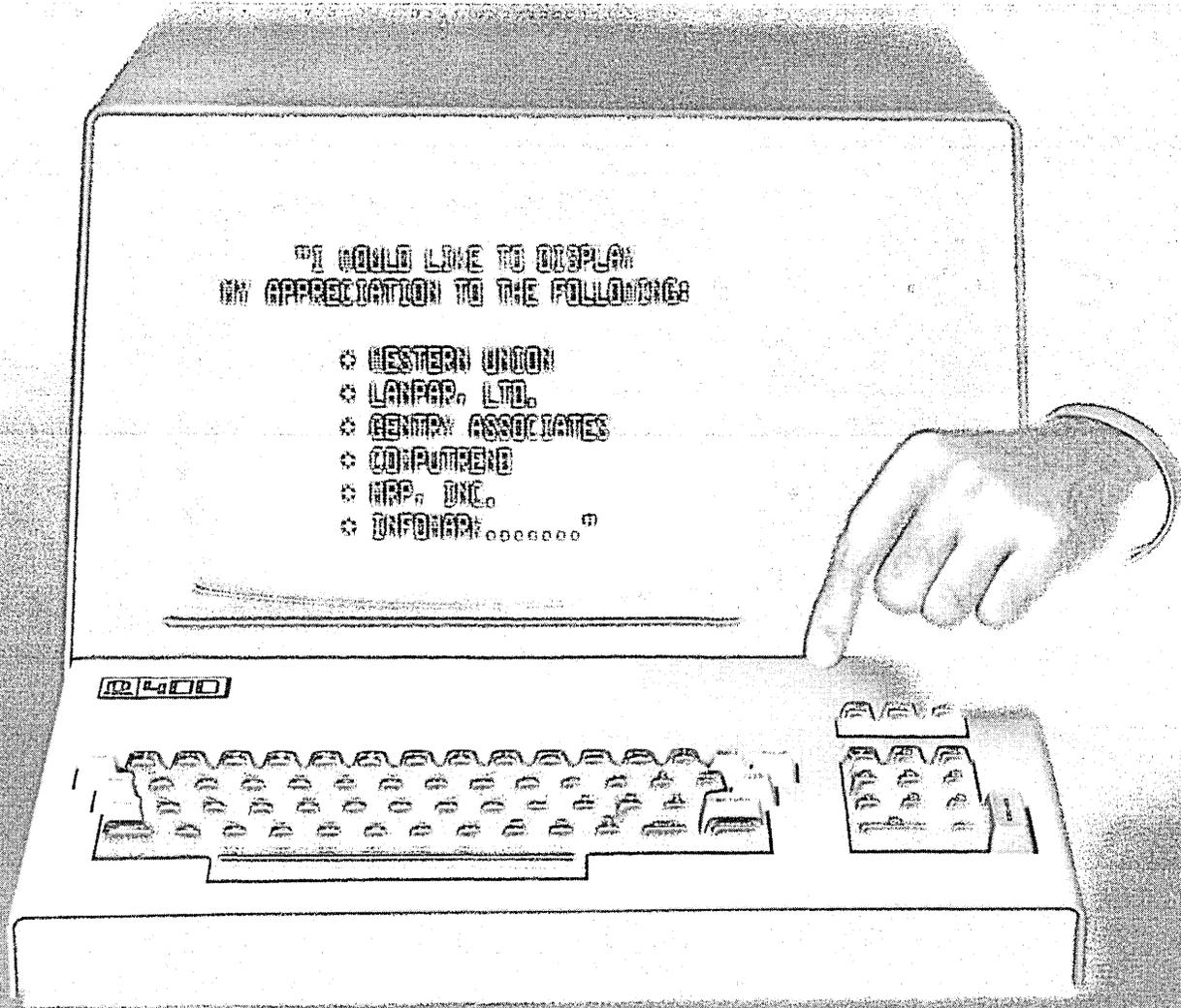
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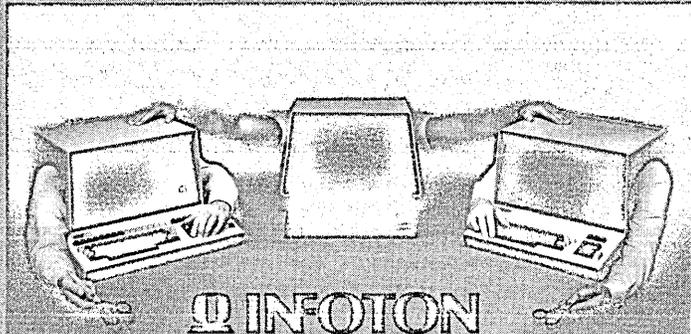
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CIRCLE 52 ON READER CARD





First annual Bridges to the Good Life Award paper.

COMPUTER-AIDED HOUSEHUSBANDRY

by Marilyn J. Richardson

We are living in an era of computer-aided instruction, computer-aided design and drafting, computer-aided medicine, computer-aided sports, and computer-aided games. Why haven't we initiated computer-aided house-husbandry?

The increasing number of househusbands, resulting from the increasing number of nonhousewives systematically broadening their horizons, need all the help they can get. The world is ready for a personal computing system that is chock-full of human factors engineering.

A personal computer installed in a home under the tutelage of a fledgling househusband could easily be programmed with housekeeping, fatherhood, and husbandly duty loops that would automatically call up new chores or functions when designated ones were finished. The nature of such programming loops would be completely at the discretion of the user. Once the operator gains a modicum of experience in both housekeeping and computer programming, he will be able to structure his system more specifically to meet his individual needs.

If computer-aided househusbandry is to be effective, it must be flexible enough to accommodate requirements for a variety of household routines. Cost, however, is also a crucial factor. Any househusband with potential is cost conscious, but it is important to note, where personal computers are concerned, the least expensive may not be the most economical way out. It would be sheer folly to try to run a 28-room home with the aid of a system designed for a one-bedroom apartment.

Naturally, the complexity of the computer selected should be directly proportional to the amount of help needed. The cpu required will depend on the number and type of peripherals, how many bytes of memory will be needed, and whether the unit will operate from disk drive or magnetic tape. In other words, how much work is the machine going to have to do for this guy, and how often?

Another factor in the choice of a personal computer is the I/O station. Probably the least expensive is the old-fashioned keypunch. Considering the

bulk of materials necessary to run one of these, another choice might be better, lest the househusband find his cupboards overflowing with stacks of punch cards. Keypunching can also be a repetitive and laborious process, especially if work must be redone to compensate for accidental folding, spindling, or mutilation. The preparation and filing of these cards alone could be a full-time job.

Another relatively inexpensive I/O device is the teletypewriter combined with a line printer, which would allow the househusband to type in commands and to receive responses on that green and white computer paper that has become so popular as stationery for the college crowd. However, this, too, has its drawbacks. The househusband could, in no time at all, find himself knee deep in reams of unbound printout.

The easiest to use and least time consuming I/O terminal is the crt. Crt's could be stationed strategically throughout the house to provide the trainee access to the computer from wherever his chores might take him.

Whatever combination of cpu and I/O station is chosen to aid a man in his housework, care should be taken to coordinate the system with the home's decor. If a person has to spend a great deal of time working with and looking at a piece of equipment, it should be as aesthetically pleasing as possible. If the househusband is not really well-versed on the principles of decorating, it might be safest to go with basic beige.

AID TO THE FALTERING There is no end to the help a properly programmed computer could give a faltering househusband.

Packages of several programs could be purchased and altered to meet the needs of individual households. A program could be written to direct the househusband in preparing the morning meal. Prompting messages could be included to remind him to cook items in the proper sequence. For instance, a prompter could alert him to the wisdom of preparing the bacon before the eggs.

When breakfast is finished, the housekeeping loop could call up the laundry, or whatever chore is next. The computer could be interfaced with various household appliances to reduce the amount of operator interaction. When the

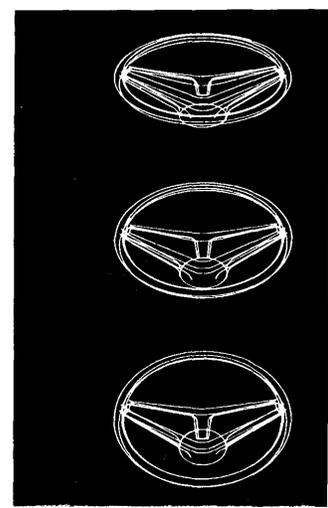
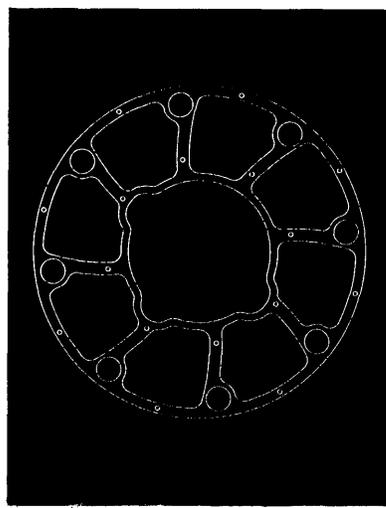
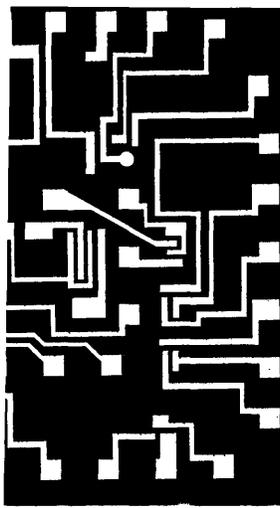
computer is slaved to the washing machine, it can help ensure that white clothes are never bleached in the presence of blue jeans or red blouses. ("Slaved" is not a pun on the househusband's status. It is bona fide computer jargon originally coined, I believe, by our keynote speaker, Dr. Oscar P. Babel.)

Computer-assisted househusbandry could make certain all chores are completed in a minimum amount of time with a minimum amount of effort. With today's technology, it is possible to have several menus accompanying a single station. A computer menu can contain any number of programmed functions which the novice could implement with the push of a button. A sewing menu, for example, might contain detailed instructions and layouts for creating cheerleader uniforms and giant killer bee costumes.

Should the househusband somehow muck up a program and proceed in a fashion that could result in a real mess, the program could include a set of error messages to make him aware of his boobo before he goes too far. These error messages could be structured to ask him questions such as, "Are you certain you removed all tissues, bubble gum, and living entities from the pockets of the children's clothing before you put it in the washing machine?" Or, "Do you really want to bake that cake at 600 degrees for two hours?"

Of course, any self-respecting househusband does not want a computer to run his life completely. The program suggested here is meant only as a guide, a help to get him through some of the rough times and assist him in formulating some workable structure for his chores that will leave him more time for himself. Occasionally we all need to be reminded that all is not in vain, that we are people, too, and that someone cares. When the househusband feels he is being taken for granted and gets no familial understanding in his dedication to forge ahead with mundane drudgery for the sake of his loved ones, he will find a sympathetic ear in the computer's option cycle.

We suggest a "Don't clean the oven when you're exhausted; catch up on the soaps instead" option, or a "You've worked yourself to a frazzle for this family. So, to hell with the budget, go out and buy something nice for yourself" option, or even "Not tonight, dear." *



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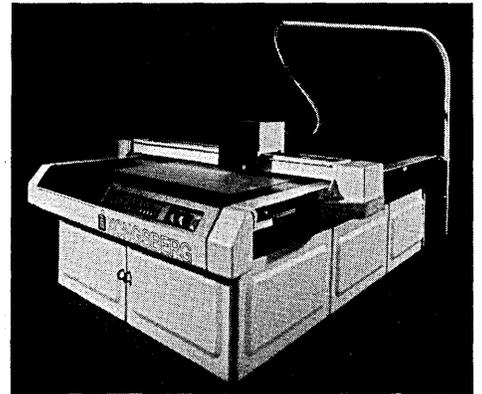
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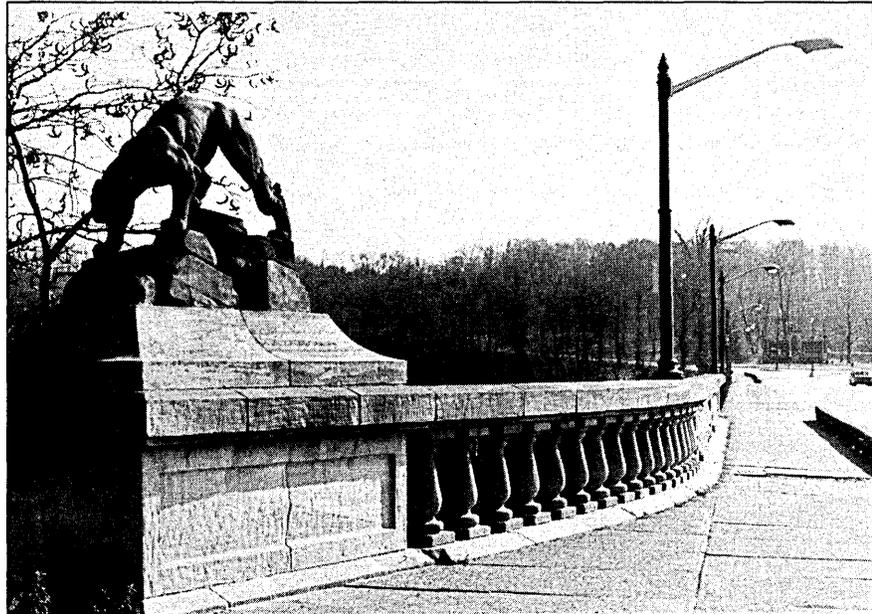
CREATIVE CONSULTANCY

by Marvin Grosswirth

It is a privilege to participate in this conference because its theme, "Bridges to the World," is one that has been close to my heart for many years. I know of no firmer foundation on which to build such bridges than the sharing of one's knowledge, experience, and skills with the ignorant and less fortunate, and I know of no one more capable of accomplishing that noble ambition than the management consultant. It is my hope that by acquainting you with some of the subtleties of consulting I will encourage you to enter this truly rewarding profession. Being a consultant is not easy, but as other consultants, management leaders, and the IRS will readily confirm, the benefits are well worth the effort.

Your credibility as a consultant will depend largely upon your background. If absolutely necessary, you can rely upon your education and professional experience. Ideally, however, you should be on the faculty of a university school of business or at least some institution that offers management courses. Academicians have the distinct advantage of freedom from contamination by the unsavory activities of the day-to-day business world and retain a certain objectivity that can never be achieved by individuals in what consultants like to refer to as "the field." If you do not have a doctorate, it will be well worth your while to acquire one, even if you are not affiliated with a faculty. Securing a Ph.D. is not nearly as difficult as one might assume. Those of you who are serious about obtaining a doctorate may see me later; I am sure a suitable arrangement can be worked out. (Personal checks are accepted, but diplomas will not be issued until checks clear.)

While you are working on—or waiting for—your degree, begin practicing the language of the consultant. I shall not dwell here on the importance of jargon in the business world, as you have all received copies of my earlier paper on this subject. There are, however, certain words and phrases that are essential for establishing credibility as a consultant. *Management team, management-by-objectives, corporate goals and objectives, implementation, cost-effectiveness, leading edge, and pipeline* are just a few examples of how consultants talk and write. These days, many consultants are called upon to resolve the difficulties that



BRONZE PANTHER appropriately guards the bridge crossing Panthers Hollow.

arise between management and employees. Such expressions as *dynamics, interpersonal, dialogue, communication, viable, and leadership* are part of the consultant's stock-in-trade when dealing with such matters. Above all, remember that you are dealing not with people, employees, secretaries, programmers, technicians, or even personnel—you are dealing with *human resources*. A few hours perusing the reports, prospectuses, and proposals of other consultants will soon acquaint you with the language, as will any catalog or brochure describing management courses.

Proper vocabulary is not mere window dressing; it serves an extremely useful purpose. Most consultants learn very early in their careers that the right words can render a proposal, a report, or a set of recommendations sufficiently vague so that they are (a) readily adaptable to virtually any circumstance, and (b) protected from being negated or contradicted at some future date. As the eminent consultant P.H. Dorn once said: "If you really nail it down, sooner or later, they'll nail you down!"

No prospective client will respect you if your fee is too low. Determining a proper fee requires some practice, but here is a practical formula to help you get

started. First, decide how much you are worth per day. Estimate how many days the project will require, then add another week as a hedge. Multiply the number of days by the daily rate. Estimate—generously—out-of-pocket expenses such as secretarial services, telephone calls, stationery, duplicating costs, postage, Valium, lunches with, and Christmas presents for, the client, etc. Add that estimate to the time-cost estimate. Double that total and round it off to the next highest five hundred dollars. That is your fee. State it firmly, confidently, and without the tell-tale tremor in your voice sometimes caused by a naive conscience. You will be amazed at the readiness with which the prospect agrees to the fee and you will probably go home berating yourself for not asking for more.

SATISFY YOUR CLIENT

You must, of course, earn that fee, which means, obviously, you must satisfy your client, especially if you expect repeat business. It is essential, therefore, you begin your research by determining whose budget will be tapped to pay for the project, and what conclusions that individual expects you to reach. By doing so, you produce two major accomplishments: first, you add an inestimable level of effi-

ciency to your own work by eliminating any data that is irrelevant to, or deviant from, the predetermined conclusions. Second, you support, sustain, or vindicate—sometimes all three—the person who must authorize payment of your invoice.

As an important corollary to that basic axiom, you must remember that in the course of your research, there are some people—or, rather, human resources—who should be treated with consideration and courtesy, always taking care never to offend or demean them, while there are others who may be ignored, disdained, and patronized with impunity. A little experience will soon enable you to ascertain which of the human resources share the client's management philosophies and which do not. As to other, more specific aspects of conducting research, I refer you to J.L. Kirkley's excellent paper, "Dynamics of Interpersonal Leadership Communications for Maximizing Corporate Goals and Objectives," copies of which have been distributed to you.

I cannot stress too strongly that your final report is the most important phase of your work. You must realize that it is the only tangible object the client can lay his hands on, and for which he has paid a considerable (albeit underestimated) sum. You have been given a copy of W.R. Crisp's "Write It Right, Write It Good," which goes into the details of report format. Let me dwell, therefore, on several of the finer points.

First, you have no future at all as a consultant if you cannot summarize your entire report in no more than three pages at the very beginning of the document. The summary should begin with your conclusions, so as to allay any fears the client may have that he has been shafted. The remaining portion of the summary should support those conclusions. Here, as nowhere else, you must learn to be both vague and obvious. If the company is losing money, recommend the development of profit centers. If some of the company's items are not selling, suggest a reevaluation of the product line. If there is an overabundance of deadbeats (below the executive level, of course), advise a study of the firm's human resources to effectuate economies through staff reduction.

The summary is also an excellent vehicle for perpetuating the client's dependence on your services. In some instances, you may actually be able to recommend outright that the client continue to use a consultant. It is far more elegant, and considerably safer, however, to recommend projects that necessitate that approach. For example, if you can effectively convince the client to install data

processing equipment no one in the company understands or knows how to use, you will have established a lucrative and long-lasting relationship. I commend to your attention a short but pithy essay entitled "You Can Get Blood from a Turnip!" by I. B. Emdahl. Unfortunately, I do not have copies to distribute. The article is hard to come by, but if you are on intimate terms with a computer marketing executive, he may let you look at his copy, especially if he knows that you are planning to become a consultant.

Once the summary is written, some less successful consultants tend to be lax about the balance of the report on the assumption—entirely correct—that no one of any consequence will read it. Such laxity is a mistake. Executives will not read the report but they will flip through it. They expect to see charts, graphs, tables, and percentages; do not disappoint them. If you cannot generate enough data to develop your own charts and graphs, adapt some from other reports or from professional journals. You need only change the headings and wording to conform to your report and no one will be able to tell the difference; indeed, after a short time, even you won't. Also be sure—on the odd chance your client will want to harrass an underling by assigning the report to him to read—that its contents are a reflection of all your resources of mediocrity, colorless language, and inconclusive findings. If someone at the nonmanagement level can read your report and draw firm conclusions, either he does not belong with the company or you do not belong in the consulting business.

ENSURING REPEAT BUSINESS

Speaking of adopting material from other sources, let me mention another device for ensuring repeat business. You are no doubt aware of the current proliferation of a management tool called the "profile chart." This is, in effect, a checklist permitting values to be assigned to certain items, ostensibly providing the manager with a profile of a team, a project, or an individual. Try, whenever possible, to include such profile charts in your report and strongly recommend they be used, especially if they pertain to human resources. Whatever the client does with them will work to your advantage. If he does not use the profile charts, as is likely, he will feel guilty and apologetic, creating the desire to make it up to you somehow—usually by giving you another project. If, on the other hand, he is foolish and courageous enough to try using those charts, he will quickly incur the animosity and recalcitrance of other managers who will suspect him of at-

tempting to evaluate their worth for his own insidious purposes. This will open the door wide for a consultant (guess who) to step in and recommend ways of resolving the resulting interpersonal conflicts within the management team.

I have tried to cover a few of the finer, more subtle aspects of consulting and I hope I have given you all some food for thought. Let me now discuss, therefore, the one question uppermost in every novice consultant's mind: "How do I get clients?" It is easier than you think.

For one thing, remember that charity begins at home. If you were to drop a few subtle hints around the office that you are considering leaving your present position to become a consultant, you would probably be pleasantly surprised at the warmth with which that notion is received. If you intimate to your supervisor that all you need is one client to make the big move, you may make the happy discovery that the very company now employing you would be delighted to get you off its payroll and pay you a consultant's fee. They may have such a high regard for your abilities that they will pay you a retainer just to be on call when and if they need you. Experience has shown in such cases that it rarely happens they do need you, but forward-looking companies regard such fees as a form of insurance.

A particular advantage to having your former employer as your first client is that you can use that as a reference when prospecting for additional clients, particularly if those prospects are in the same business or industry. They will be only too happy to engage a consultant who is knowledgeable about what some other company in the field is doing.

It is also possible to have clients come to you. By participating in conferences such as this one, you gain a reputation as an expert; soon, desperate executives will come knocking at your door. As a perfect example, I can see that right now, some of you are fidgeting in your seats and edging toward the door, apparently unable to contain your urgent desire to consult with me privately.

Another useful technique for gaining a reputation—and, therefore, a clientele—is to have your papers published in professional journals and industry periodicals. It is amazing how much credence people are willing to give to an idea, a concept, or a statement once it has been set in type.

In conclusion, let me repeat that I am delighted to participate in this valiant effort to build "Bridges to the World," happy in the knowledge that as we do just that, everyone—government, industry, and the consumer—will pay the toll. #

When efficient data management is the problem, capacity planning is likely to be an essential part of the solution.

CAPACITY PLANNING AT LONE STAR

by Robert E. Castaldi

Lone Star Industries, a *Fortune* 500 company, is the number one producer of Portland cement, ready-mixed concrete, and sand and gravel, and is also a leader in the distribution and retailing of building materials. We have experienced accelerated growth over the last few years, culminating in gross sales in 1978 of over \$1 billion.

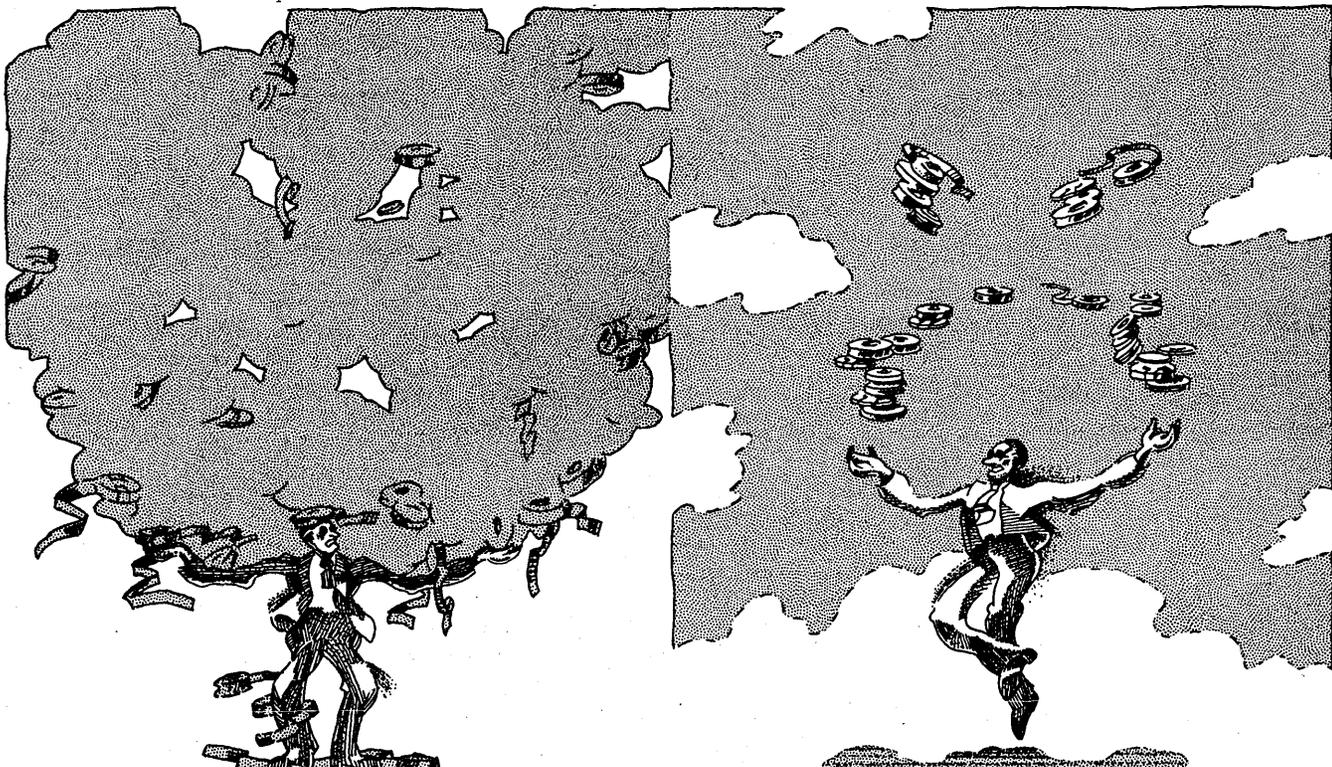
This rapid growth has had an impact on Lone Star's dp operations; in order to keep pace, capacity planning studies of our computer environment have become critically important. One result of capacity planning has been a comprehensive data management plan that can be adopted for all systems applications, and

which has proved to be an alternative to more expensive solutions, such as expansion of direct access storage device (DASD) resources and/or the implementation of the mass storage subsystem (MSS).

Lone Star's dp network evolved from a centralization project begun in 1973. The current environment includes 10 RJE sites with satellite data entry and report distribution down to a district level, as well as TONE (a TSO environment for OS/VS1). The heart of the network is an IBM 370/158-3 running OS/VS1.

Due to the time constraints imposed during the centralization project (a result of the acquisition posture of the corporation during the same time period), most systems were converted with little or no concern for data management or pro-

duction efficiency. For example, old, heavily tape-oriented systems remained the same after conversion. The timing problems were compounded by the inability of hardware vendors to meet short-notice delivery dates. As a result, more than 25% of the tape reels in our library used less than 10% of their available footage. Increasing the problem, new systems introduced after the RJE conversion used the same basic criterion for determining the storage medium for data sets as was used during the conversion era—that is, if data sets were sequential and required a history or retention of each cycle's data, then they were a candidate for tape usage. Because of the continued unavailability of DASD space, these data sets were put on tape as Generation Data Group (GDG) da-



ta sets with no regard to size or frequency of use. Since the tape environment was well managed and automated with the aid of University Computing Company's UCC-1 (TMS), the data management problems were given low priority; there were more pressing concerns.

Although somewhat aware of problems caused by our overdependency and underuse of tape resources, the challenge of defining and implementing a good solution was not considered until March 1978. At this time it became apparent, through capacity planning studies, that Operations would physically run out of library space for our growing tape needs before the end of 1979 (see Table 1). The data center manager, Robert Napier, and I discovered other needs as well, which could be resolved by an overall data management plan; we began considering possible solutions to the problems.

Software tools were developed to help identify and document the problems and bottlenecks. A tape mount report revealed that during our peak period (11:00 a.m. to 3:00 p.m.) we were experiencing 8 to 15 tape mounts in a four-minute period. A tape usage report (block count and block size) revealed that a large percentage of our tapes used less than 10%. After this research, we defined the problem as follows:

1. Increased elapsed time for all data center users.
2. Uncontrolled growth of tape library.
3. Inefficient use of operations staff.
4. Underuse of computer resources.
5. Channel overloads and underloads.
6. Storage space problem.

The objectives of our data management plan were to solve these problems by managing our data more efficiently in a manner compatible with controlled growth, while remaining cost effective and maintaining our existing software environment.

ALTERNATIVE SOLUTIONS There were a number of available options, but most were quickly discounted. The alternatives (and their drawbacks) were:

- Manual controls (labor intensive).
- Heavy restrictions with tight space controls (lost productivity).
- Encourage users to restrain usage (ineffective and uncontrolled).
- More DASD space to convert to DASD GDG data sets (too expensive).

Mass storage system (too expensive).

The only apparent realistic solution was to develop software to manage DASD space.

Once the environment was defined, a decision could be made on whether to develop the software in-house or procure an available system from the marketplace (assuming one existed that met our needs and was cost justifiable). The first step in defining our data environment was to determine the optimum medium for specific data sets and how our proposed system would handle different classes of data sets. Our primary concern was to have available on DASD all frequently used data sets without incurring large expenditures for additional DASD devices.

Table 2 shows the five general categories of data sets and the storage media proposed through their life cycle. The criteria determine to which class a data set belongs.

The criteria are flexible and may vary depending on DASD space availability. The data management software facilitates the migration of data sets through their life cycle. While studying the alternatives in order to choose a software solution, the decision was made to procure a software package designed to manage direct access space and data migration. We decided it was impractical to develop this software in-house because of the size of the Systems Programming staff and their current and projected work load.

To select a data management package we had to develop a detailed data management plan around each package to see how well it fit into Lone Star's environment. If a product was able to help control and manage the migration of data sets through their life cycle while maintaining our current software environment, it was considered a candidate. Necessary features outside the realm of our data management project were: volume reconfiguration, partition data set (PDS) compression, TSO interface, and DASD and ar-

chival reporting. Over half a dozen products were initially considered; most fell short of our primary objectives. Finally, two products were considered: Cambridge Software's ASM2 and Software Module Marketing's DMS/OS. ASM2 was initially chosen, mainly because of the vendor's experience. Also, ASM2 appeared to be a proven performer based on conversations with existing users. Its major disadvantage, as we saw it, was its having evolved from a data management system for a TSO environment to its present form by the use of add-on features. The DMS/OS package, on the other hand, is of superior design, it is top down, extremely modular, and table driven. However, the package had had limited testing in the marketplace. We evaluated both products over 45-day periods to test their operation with our data management plan.

We found DMS/OS to be better documented, less cumbersome to install, and more compatible with our current software environment. Both packages create an archive of data sets which have been migrated from disk to tape. Our biggest bottleneck was getting the tape volumes in these archives back into the tape management system's (UCC-1) scratch pool. This obstacle was surmounted under DMS/OS with a single utility program and by coding one of the many user exits available in the package. Since the DMS/OS package was table driven, most of our requirements were implemented through table updates and any future changes could be made by changing table entries through TSO facilities.

It should first be noted that all our production tape data sets are GDG data sets. At the time we build the high-level indices for the data set in the systems catalog, the OS/VS GDG facility allows us to define the number of generations of a data set to be kept in the catalog. Each generation is given a unique low-level qualifier and the oldest existent data set name is deleted from the catalog when a generation is created that exceeds the number of entries allowed for a particular data set.

TAPE FORECAST (ASSUMING NO GROWTH IN USER COMMUNITY)

Total tapes in library	8,314
Tape management software forecasts	2,439
Regional dp management '78 & '79 estimates	1,000
Projected total tapes in use year-end '79	11,753
Available storage space	600
Storage space available (move 3705 communications equipment)	1,200
Projected available library size	1,800
Space deficit	10,114
	1,639

Table 1.

Tape data sets are then flagged as scratches by our tape management system (UCC-1) when their catalog entries no longer exist. It is essential to us that the systems catalog also control the DMS/OS catalog or its equivalent.

Also, part of the overall plan is to eliminate RJE-user volumes. Prior to implementation of the plan, each RJE user had his own volume(s) to use and manage. Since the DMS/OS system was planned to manage the disk volumes, control had to be centralized. Our home-grown security system provides data security and integrity at the data set level, so there was no need for a user to know where a particular data set resided.

The operating system was generated with UNITNAMES (defines generic names for classes of unit addresses) of POOL for those units that contained user data sets and user packs were mounted on these units. The JCL coded to create a data set included UNIT-POOL with no volume serial number, thus directing the allocation to one of the POOL devices. The catalog pointer reflected the particular volume where the data set resided so that all future references would be resolved. The existing security system doesn't allow specific references to user volumes through JCL without a continually changing security key. The implementation of the data management philosophy should easily be understood with this background.

SYSTEMS AUDIT IS BY-PRODUCT

Since the conversion to the new data management philosophy required the review of all existing systems by a highly skilled sys-

tems technician, a by-product of the conversion was a systems audit. This audit verified for optimum block sizes, data flow, number of generations kept, efficient JCL coding (use of RETAIN and PASS), optimum data set format, etc. Much of the savings in I/O counts and cpu time reflected in the benchmark figures are a result of the audit.

The actual implementation can be broken down into three parts: how DMS/OS will handle the classes of data sets during normal production processing (described in Table 2); how the data sets are handled in a rerun situation; and DMS/OS processing and interaction with the current system environment.

Small, frequently used data sets are created as disk GDG data sets residing on POOL volumes. At the end of each day (third shift), DMS/OS RETAIN processing archives to tape all generations of these data sets except the two most current. The two generations remaining on disk facilitate the running of the next cycle or a rerun condition. The generations on the archive tape are never accessed in normal processing. The archive tape is written as one physical file with a block size of 20,000 bytes, and DMS/OS files keep track of the physical location of the data sets on the archive volume. One day's processing of these data sets can take up only one tape volume.

Small, infrequently used or medium-sized data sets have all generations archived to tape. This is done by creating the data set as a disk GDG data set on a POOL volume and issuing a Deferred Archive request after the data set is referenced for the last time in the systems cy-

cle. These deferred requests are queued up in a DMS/OS file and are processed in the day's end DMS/OS run, along with the RETAIN process. The first step of the next cycle of the system then restores all data sets that were previously archived in this manner. Due to the operating characteristics of the restore software, little time or system resources are expended in the restore operation. This technique insures that excessive DASD space is not tied up over long periods of time without access. DMS/OS may also be used to immediately migrate disk data sets to tape. This differs from archival in that the data sets may be processed directly from tape once they have migrated. Since the disk space is freed immediately, this is preferable over deferred archival for medium-sized data sets.

The major considerations in choosing between the two are: are the data sets sharing the same tape volume accessed in the same step? and, will the migrated data use a sufficient amount of the tape volume? Data sets on a multifile tape cannot be processed simultaneously. The migration is a DMS/OS function that may be run in the system's job stream to move data sets from disk to tape. Once they are on tape, they are accessed and stored on tape for their entire life cycle. Data sets that do not migrate (for reasons of size, format, or use) were not put under the control of DMS/OS.

For normal production runs, there are no special considerations for the Operations and Production Control staff. In a rerun situation, there are some cases when a restore operation may have to be performed before the rerun can be execut-

DATA SET DESCRIPTION	DATA SET LIFE CYCLES			CRITERIA*
	CREATED ON	ACCESSED FROM	STORED ON	
Small frequently used GDG data sets.	disk	disk	Two most current generations on disk; all other on tape	Six cylinders or less and accessed more than two days per week. (Data sets used several times per day may be handled in same manner if larger.)
Small infrequently used GDG data sets. Medium-sized data sets.	disk	disk	tape	Six cylinders or less and accessed less than three times per week. Greater than six cylinders, but less than 20 cylinders
Medium-sized data sets	disk	disk and/or tape	tape	Greater than six cylinders, but less than 100 cylinders.
Data set organization and use dictate disk data set. No history needed.	disk	disk	disk	VSAM, ISAM, direct access, etc.
Large GDG data sets.	tape	tape	tape	Multifile were possible.

*Criteria may change based on DASD devices and installation objectives.

Table 2.



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V.P. North American Sales
Data General Corporation

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CIRCLE 15 ON READER CARD

Since conversion to the new data management philosophy required review of all existing systems, a by-product was a systems audit.

ed. This is necessary if a data set to be accessed by the rerun has already been archived, but this is rarely the case as data sets are not archived until the third shift DMS/OS RETAIN processing. In most cases, the normal rerun procedures for GDG data sets may be used since all generations referenced by the original run would still be on disk. In our case, because we use UCC-15 for reruns, it only involves changing a parameter card. Data sets that are archived are given a pseudo volume serial number of ARCHIVE in the systems catalog, so it is easy to determine which generations have been archived. The occasional need to restore a data set, which involves creating a control card, is a small price to pay for the benefit of a significant reduction in tape mount requests.

Two DMS/OS features facilitate the implementation of our data management philosophy and its integration into our data processing environment: a daily archive run and a monthly merge run.

The DMS/OS daily processing will run on third shift and achieve the following functions: archive all generations of GDG data sets on the POOL volumes except the two most current generations; archive all deferred requests, both batch and TSO; search all TSO volumes and archive all data sets that have not been used in 30 days; and scratch temporary data sets on all volumes that are two or more days old.

During archival in this daily run,

all data sets except TSO sets and those that have explicit expiration dates are given a retention date of 99000. This conforms to our UCC-1 standards. TSO data sets are given an expiration date of 60 days past the date archived. If they are not restored within that period, they will be deleted from the archives in the next monthly forward merge run. Among the data sets that will have explicit expiration dates are those that were restored from the archives. Batch data sets are given an expiration date two days past the date restored and TSO data sets are restored with expiration dates of zero. When a data set is restored, it maintains its status in the archives. The batch data set that was restored will meet the criteria for archival on the next daily run, which means there will then be two versions of that data set in the archive. Since the restored version will expire in two days, it will not be forward merged on the next run. The TSO data set that is restored will again be selected for archival 30 days after its last use. TSO data sets are restored with a DMS/OS TSO command when needed by the user.

The other scheduled DMS/OS run is a monthly job stream which forward merges all current archive data sets with archive volume being used less than 70% to new archive volume. The old volumes are not cataloged by DMS/OS during this process, thereby appearing as scratches to the tape management system (UCC-1).

(There are no special considerations for interfacing with UCC-1.) Since UCC-1 at Lone Star is driven by the systems catalog, UCC-1 handles DMS/OS archive volumes the same as any other tape volume. Our only problem with the forward merge process was flagging data sets within DMS/OS archive control as scratches when they no longer appeared in the system catalog. Only DMS/OS is aware of the individual data sets on the archive volumes. The information on these data sets is kept in an OS/DMS file called the DSNINDEX.

A utility program was written by Lone Star's Technical Services staff to change the expiration dates of all archived data sets that were no longer in the system catalog to the current date. This program is run just before the forward merge run and during the run expired data sets are not forward merged and their entries are deleted from the DSNINDEX.

Thus, by installing the DMS/OS package with a set of table entries to fit our needs and adding an exit and a utility program (DMS/OS has committed itself to providing a merge exit to replace the utility), we were able to satisfy all our stated objectives, plus realize the benefits of a systems audit and DMS/OS additions functions as a by-product. The following benchmark results illustrate the benefits and cost ratio of the proposed plan.

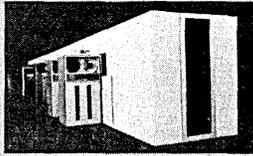
For the benchmark, our data man-

DATA MANAGEMENT BENCHMARK RESULTS

DATE		ELAPSED TIME (MIN)	CPU TIME (SEC)	I/O COUNTS (EXCPS)	TAPES	CYLINDERS
11/27	Current EIM	213	1,206.5	218,065	35	
	Test EIM	159	1,121.5	111,625	8	59
	Differences	54	85	106,440	27	
	% Reduction	25%	7%	49%	78%	
11/28	Current EIM	223	998	195,039	35	
	Test EIM	166	928	101,286	8	57
	Differences	57	70	93,753	27	
	% Reduction	25%	7%	48%	78%	
11/29	Current EIM	247	1,169	211,125	35	
	Test EIM	174	972	111,089	8	53
	Differences	73	197	100,036	27	
	% Reduction	30%	16.5%	47%	78%	
12/01	Current EIM	232	1,196	196,871	35	
	Test EIM	181	1,059	109,558	8	54
	Differences	51	137	87,313	27	
	% Reduction	22%	11.5%	44%	78%	
Overall Average	Current EIM	229	1,142	205,275	35	
	Test EIM	170	170	108,389	8	56
	Differences	59	59	96,886	27	
	% Reduction	26%	10.5%	47%	78%	

Table 3.

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CIRCLE 17 ON READER CARD



agement philosophy ran with the daily cycle of our Eastern Inventory Management (EIM) system and parallel with the production system for four days during the week of November 27, 1978. The EIM system was chosen because it was representative of our heavily tape-oriented systems and because all the data categories in Table 2 are represented. DMS/OS RE-TAIN processing was done daily and a merge was done on Thursday, November 30. A rerun was also done which required a restore. All were performed flawlessly. The EIM cycle consists of ten jobs representing just under four hours of elapsed time per day.

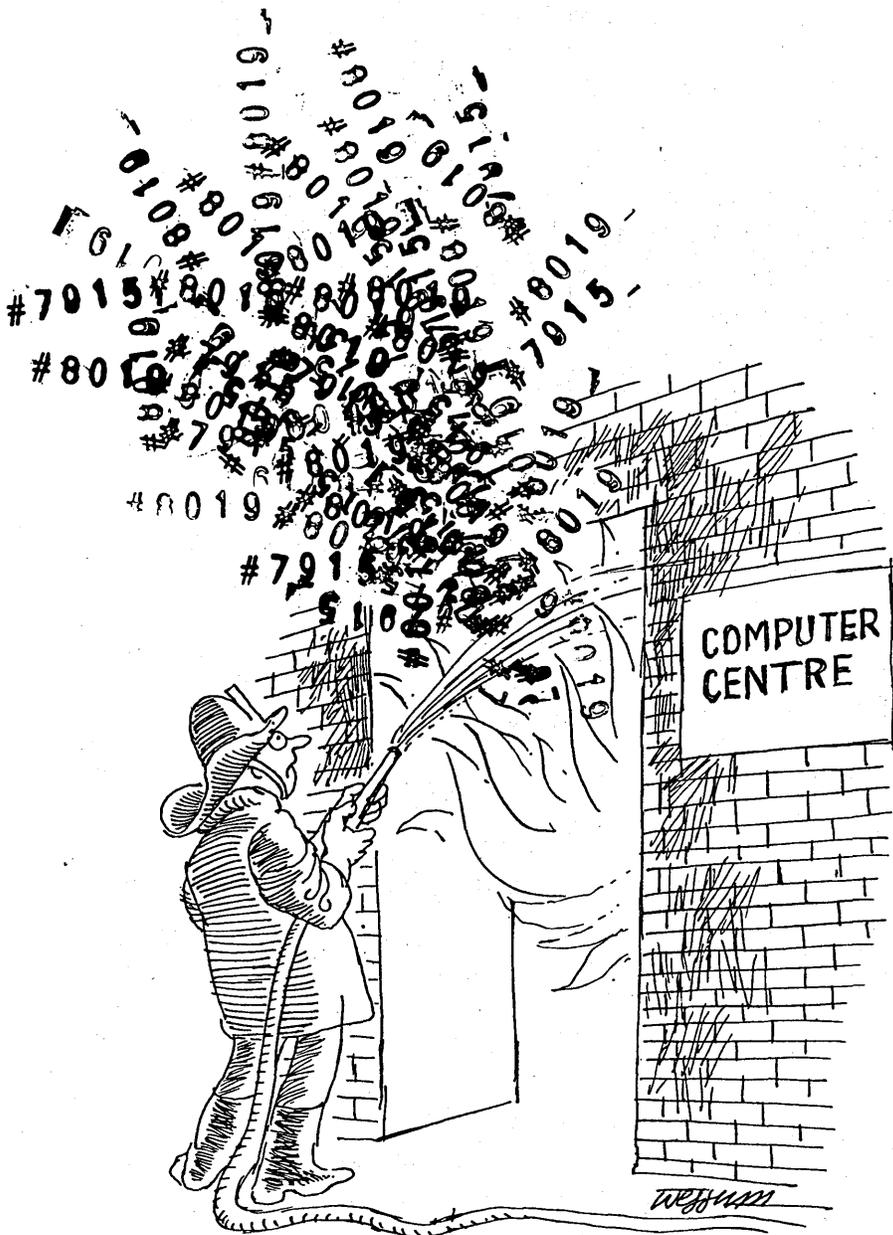
The results of the benchmark (Table 3) summarize daily savings as well as an overall summary of the four days' runs. Where there were 35 tapes used in the cycle; there are now eight tapes used. In the overall EIM system, with the current number of generations retained, there are 1,062 tape volumes maintained at any one time.

With the implementation of our data management philosophy, there will be only 254 tapes maintained at any one time. This includes DMS/OS archive volumes that were used for all generations retained. This is a savings of 808 tape volumes of \$8,080 (at \$10 per tape). The

maximum number of cylinders taken up by the generations remaining on disk is 71. This represents \$153 worth of disk space (based on the replacement cost of a 3340 data module). The net savings of converting this one system is \$7,927. With the cost of DMS/OS, including TSO and VSAM options, at \$14,000 we recovered 60% of the cost from converting one system.

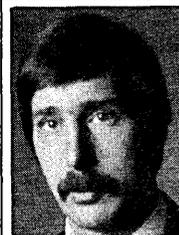
The ability to automatically archive and restore data files from one DASD storage device to another will facilitate, when needed, our planned migration to 3350 storage media. With this in mind we can view these data management savings in an even better light. Using IBM's Extended Term Plan (ETP) as a common base for comparison, our current DASD configuration would cost \$7,992 per month. The new 3350 configurations, while adding an additional 935 megabytes of data, would cost \$5,985 per month. With a savings of \$2,000 per month, the DMS/OS package could be paid for in seven months — not to mention the tape savings and hardware resource savings. Dramatic savings in cpu time and elapsed time were also realized, as illustrated in Table 3; I/O counts were cut almost in half.

Overall, the benchmark and the consequent implementation of the data management plan brought great benefits to Lone Star: increased throughput with reduced cpu use, reduced overall channel loads and I/O wait time, elimination of the overdependency and underuse of tape resources, boosted operator efficiency, and reduced operating expenses. *



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ROBERT E. CASTALDI



Mr. Castaldi is supervisor of systems programming at Lone Star Industries, where his duties include the development, installation, and maintenance of subsystems to enhance user productivity, computer efficiency, and data set security and integrity. He also provides technical support to all data processing functions and has developed several software packages that are now marketed. Prior to joining Lone Star he was a systems programmer with Con Edison of New York.



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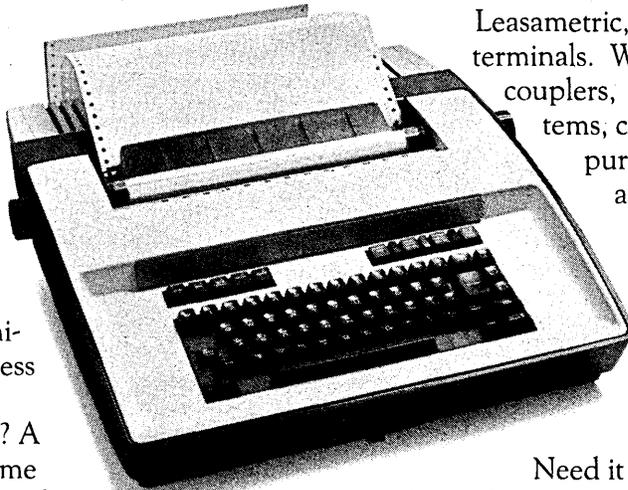
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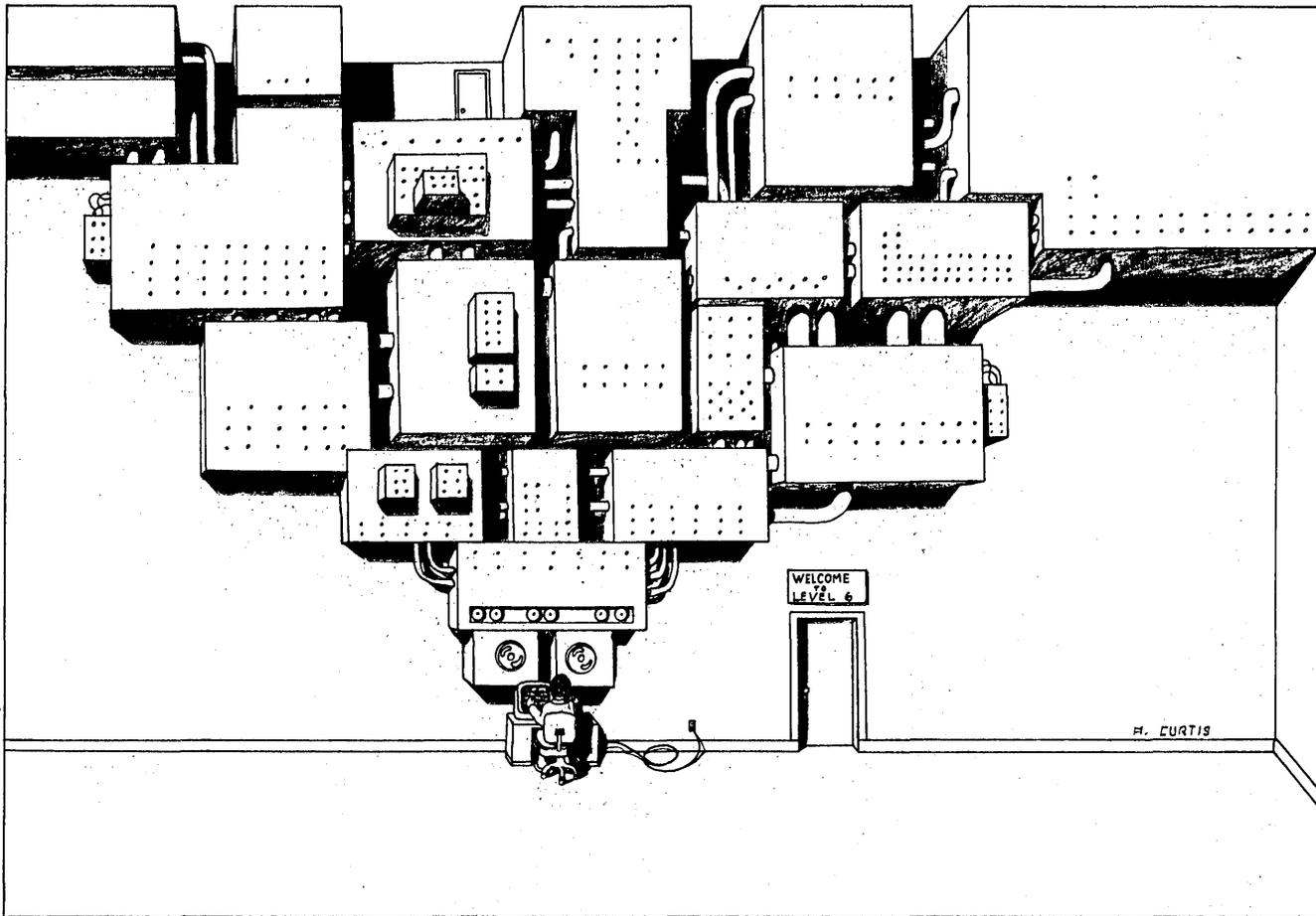
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Unlike any previous mini system Honeywell had developed, Level 6 architecture required new definitions and a rethinking of priorities.

THE EVOLUTION OF AN ARCHITECTURE

by Efrem G. Mallach

Honeywell's Level 6 minicomputer series is a complete departure from our earlier mini systems. Announced in January 1976, the series included six processor models and a broad range of peripheral and communication options by the summer of 1978. Software in the GCOS6 family includes three upward-compatible executives and compilers for various high-level languages. Applications include standalone systems, network nodes, data base and transaction processing, process control, and more.

Our earlier mini systems were direct descendants of Computer Control Corp.'s DDP-116 of the early '60s. The DDP-116 was the first commercial 16-bit system, and its family served its users well. (Lest anyone accuse me of claiming perfect predictive power for 3C's planners, I'll note that they also offered the first—

and only?—commercial 19-bit system.) By 1973, though, the DDP-116's architecture—expanded beyond the original designer's wildest expectations—had reached the end of its competitive lifetime. Exercises in extending it for the '80s resulted in too many compromises. Major extensions would have required all new software—and why hobble that software by tying it to an old architecture? Rather than going to the well one last time before it ran dry, we decided to develop a new architecture. Thus, there is no similarity between Level 6 and earlier Honeywell minis.

When we started to define Level 6, in late 1973 and early 1974, we saw a number of market needs that the hardware architecture had to satisfy; perhaps the foremost was flexibility. While business-oriented dp systems tend to differ in size and speed with their nature remaining constant, minicomputers don't. A

mini embedded in a process control system, for example, is different from a mini used as a programmable data entry system or a network concentrator. To the extent that Level 6 has a unifying theme, it is this flexibility.

Flexibility requires a range of compatible products with different performance levels. Related needs are flexible communications capability (we designed Level 6 to be used in a variety of networking applications) and simplified maintenance.

With these and similar considerations in mind, we settled on some approaches to the architecture. Probably the most important was the top-down design philosophy. This was an attempt to prevent later problems in extending a low-end architecture upward. Specifically, we tried to develop an umbrella architecture that would cover all then-foreseen needs. We are still implementing the complete

architecture as it was then defined, and we see Level 6 being the vehicle for a long line of future enhancements.

As an example of this top-down approach, we defined Level 6 addressing up to 16 million bytes of memory. We haven't built a processor with this capacity yet, and with today's technology we couldn't put 16MB into our largest chassis. However, every Megabus™ (Trademark of Honeywell Information Systems Inc.) we've shipped has the 24 address lines this size memory would require, in addition to 16 data lines. Every controller can transfer data to or from any address in this range and every memory unit can be configured to any address in this range (with the intentional exception of Model 23 components). So, today's components have the flexibility to be part of tomorrow's larger systems. Processor and memory evolution will not obsolete them, nor will it force us to use awkward schemes (such as I/O memory mapping) to retain them.

Along with the top-level definition, we also laid out subsets from the start. An example of this is the different address lengths, which will be discussed below.

The flexibility of Level 6 begins with physical modularity. In fact, the hardware goes together very much like a child's set of bricks: you fit the big red bricks onto the green base, the little white bricks onto the big red ones, and so on. Every part fits with every other one, and you can build up exactly the house—or minicomputer—that you need.

Level 6 modularity starts with the Megabus, a single central bus connecting all system elements. It comes in 5/4in. (13.3cm) modules, each holding five boards. Modules can be strung together as needed.

The next level of packaging is the 15in. x 16in. (38 x 40.5cm) board. Every functional unit is on one such board, and each board is a unit. You can have more than one board of a type (this is common with communication processors and with memory) but each one functions independently of the others.

The major functional units are, in most cases, implemented as general-purpose modules. For instance, there is one Level 6 controller for the whole spectrum of low-speed peripherals: card readers, printers, diskettes, consoles, and more. These general-purpose units are given a specific personality via adapters: 3/2in. x 12in. (9 x 30.5cm) boards that plug into the basic unit. Those "little white bricks" complete the physical modularity scheme.

MEGABUS IS THE HEART

The Megabus is the heart of Level 6. All inter-unit communication takes place over the Megabus. This includes

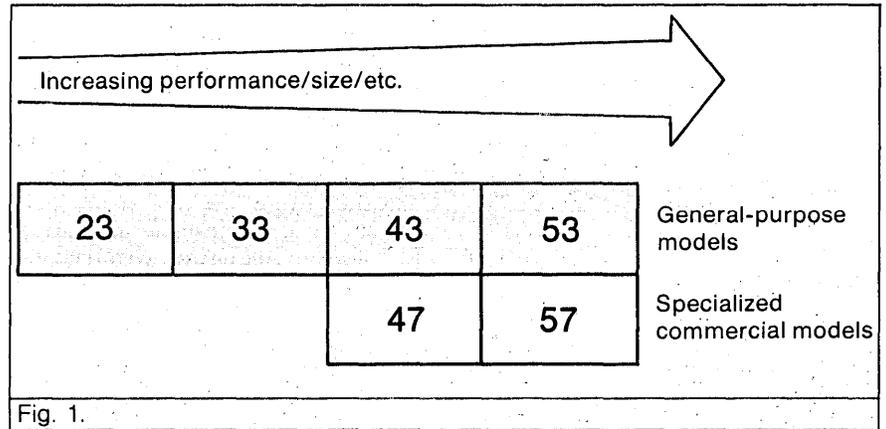


Fig. 1.

instruction and data fetch by the cpu. It also includes data transfers between memory and I/O controllers; once these are initiated, the cpu has no further involvement with them. (While the architecture does allow for "programmed I/O," where the cpu is involved with each byte transferred, no standard Level 6 controllers work that way.)

Physically, the Megabus is two vertical columns of connectors. These provide 100 signal lines, almost all of which are used. Forty lines carry the address and data bits. Twelve support a bus priority network, through which any unit can tell if another unit also wants the bus, as well as what their relative priorities are. Six carry the current cpu processing priority, so a unit can tell whether or not it's allowed to send an interrupt. (Bus access priority and cpu interrupt priority are independent of each other. A controller with a high data rate and no internal buffering might need a high bus access priority, but its function in the system might only justify a low cpu interrupt priority.) The approximately 30 remaining signals control Megabus dialogues, carry check bits, and so on.

The concept of connecting all the system elements to one bus is not new with Level 6, of course. (The DEC PDP-11 probably did the most to popularize this approach.) However, we were able to incorporate some lessons learned from earlier designs, and to overcome their shortcomings. Briefly, a few of the Level 6 innovations are:

Completely distributed control. A Megabus doesn't need a cpu, or any other central arbitrator. Coordination is handled by bus interface logic on every board. The bus itself includes no logic elements.

No dedicated slots. They're all identical. Cpu interrupt priorities are "soft," not wired-in. You can tune a system without touching the hardware.

Split cycle. The Megabus isn't tied up during a memory read cycle. Rather, it's released after the data request. The memory unit seizes it again to return the data. This brings practical Megabus throughput close to its theoretical limits, and automatically provides interleaved operation when more than one memory board is installed. (That's because a request can reach one memory unit while another one is cycling. Each request is handled, independently of the others, by the unit to which it is addressed.) The split cycle also prevents certain types of multiprocessor deadlock that plagued earlier single-bus systems.

Self-diagnosis. Every controller runs a basic self-test on system startup. The Megabus carries the results to the control panel.

Multiprocessor support. A Megabus can have up to 16 processors on it. (It could also have none.) In addition, multibus systems are in use—another approach to multiprocessor systems. The Megabus incorporates the necessary signals to make either type of multiprocessor work.

Model	23	33	43	47	53	57
Typical Register-to-Register Add time (usec)	4.5	3.1	2.0	2.0	1.4	1.4
Max. Mem. (words)	64K	64K	1M	1M	1M	1M
Floating Point			Opt	Opt	Opt	Opt
Commercial Instrs.				Std		Std
Memory Management			Opt	Opt	Std	Std
Cache Memory					Std	Std
Writeable Control Store			Opt	Opt	Opt	Opt

Table 1.

CENTRAL PROCESSORS

The most visible element of any computer system is its central processor. The relationship between the six processor models in Level 6 today can be diagrammed as in Fig. 1. Table 1 summarizes some of their characteristics.

Existing Level 6 processors have all been built using LSI "bit-slice" technology. Each "slice" includes arithmetic/logic capability and 16 registers for a 4-bit-wide processor. Models 23 and 33 use four such slices and are 16-bits wide internally. Models 43 and up use five, and can process 20-bit operands in one clock cycle. This capability is needed in address manipulation, since 20-bit addresses are necessary for direct access to one million words. In manipulating other operands, one of the slices is "masked out" to provide compatibility with the smaller systems. The 16 registers in the bit slices contain the processor's data and address registers (seven of each), with the use of the remaining two varying from one model to another.

Despite their use of similar technology, the processors do differ substantially in their internal implementation. Models 23 and 33 are 16-bit designs, each on a single board. As we move up to the Model 43, we pick up instruction prefetch (using a 32-bit buffer that's kept filled from the instruction stream), and 32-bit memory data transfers (using two successive bus cycles in response to one read request). A fully configured Model 57 could consist of five boards, as shown in Fig. 2.

The Level 6 processors are all microprogrammed, as the bit-slice approach implies. This means that complex instructions can be included at negligible additional product cost. Cpu features such as automatic priority dispatching use this capability to advantage. In addition, the Model 43 and above support user microprogramming to extend the instruction repertoire.

Incidentally, we've found user microprogramming to be wrong for most of the people who look into it. Firmware on most modern systems isn't just fast software with 64-bit instructions. Parallel control of six different parts of a cpu can get very complicated. Also, some initially attractive applications aren't helped as much as one might expect. An example of this is emulating other systems. Our internal data paths were optimized for Level 6 instruction and data formats. As a direct result, they are not particularly well suited for those of most other systems, where the bits are arranged in different ways. In short, if you give users up-to-date capabilities at the assembler level, very few have to go below it. (Most of our users stay

above it; higher-level language use of Level 6 predominates.)

The cpu software visibility is an important part of the architecture. Four aspects of it are worth discussing: the register structure, the instruction format, the approach to indexing, and the concept of "address size independence." The first two are of interest because they give some insight into the way architectural trade-offs are made, the last two because they represent valuable Level 6 innovations.

Conceptually, Level 6 has 64 register sets, one per priority level. Each level can, in fact, be treated as a "virtual machine" in the larger models, where a level change can trigger an address space change as well. (Additional virtual machines can be created by software.) Today's implementations all use one set of physical registers in the cpu, and store the inactive sets in memory. The architecture, though, treats them all independently.

The Level 6 register set includes seven 16-bit general (or data) registers, and seven base (or address) registers of unspecified length. There are some additional registers as well, but these are the fundamental ones. We chose the seven-plus-seven structure because:

- Experience has shown that seven registers aren't enough. (This presumes a certain programming approach. This approach characterizes minicomputers today and shows no signs of disappearing. For other approaches, it has been argued that one register is too many.)

- Having a single bank of fifteen (or so) registers would require 4-bit register selection fields in instructions. Since we expected 16-bit instructions to comprise the bulk of most programs, we didn't want to use that extra bit, especially since most instructions would have two such fields.

- In systems such as the IBM System/370, which has 16 registers to serve both purposes, programmers usually assign registers to one purpose or to the other at the beginning of a module. This split then remains fixed. Furthermore, the split is usually about half-and-half between base and data register usage.

- By specifying two register sets, we could limit the set of possible operations on address registers. This made some dangerous types of bit-fiddling extremely awkward (though never impossible). The closed set of address register op-

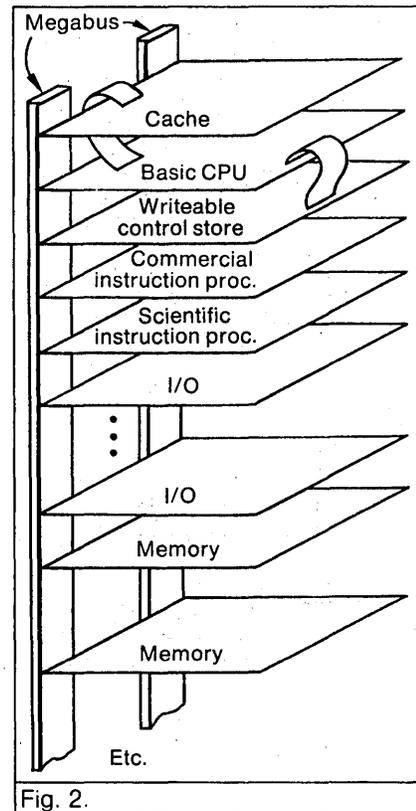


Fig. 2.

erations was also a key element of the address size independence concept.

There seems to be a trend today away from one bank of general-purpose registers, and toward an adequately large set of more specialized ones. We can see this trend at every level of system, from single-chip microprocessors to the Cray-1 supercomputer. Our experience with Level 6 bears out the correctness of this trend.

BASIC INSTRUCTION FORMAT

The basic instruction format is shown in Fig. 3. Most instructions are 16 bits long, with extensions as necessary.

The first decision was the basic length. Instruction set design is the art of compromise, of course. People clamor for more and more operation codes, more and more operands, and more and more modes of operand addressing. Yet these take space: a 32-bit instruction occupies twice the space of a 16-bit instruction, but is much less than twice as useful. We decided rather quickly to use a 16-bit basic format with extensions.

As to the layout of those 16 bits, the major competitor to our final selection was the "symmetric" format shown in Fig. 4. (Among the systems using this format are the DEC PDP-11 and Texas Instru-

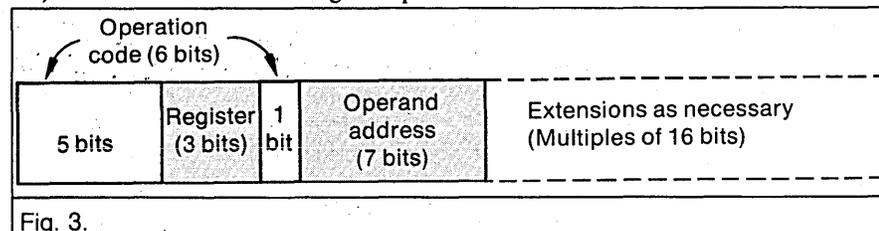


Fig. 3.

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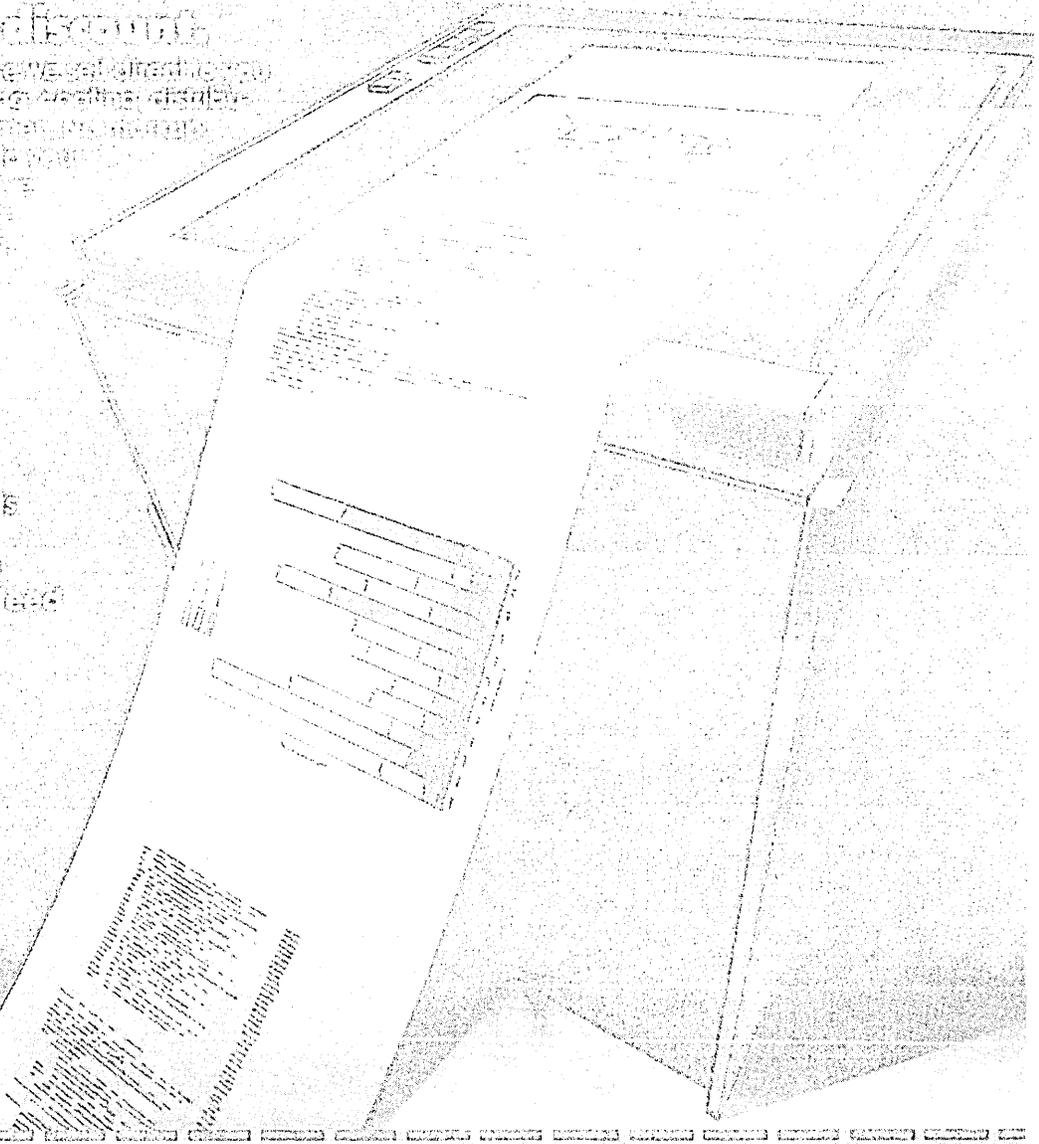
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The trend is away from one bank of general-purpose registers, and toward a large set of more specialized ones.

ments 990.)

The advantage of the symmetric approach is that both operands of an instruction can, if necessary, be in memory. Despite this, we chose the asymmetric format, where one of the two operands must be in a register. Some of our reasons were:

- We wanted more op codes than four bits would permit. (Even the PDP-11 and TI 990 use the pure symmetric format for just a few op codes because of this limitation.)

- We wanted more memory addressing flexibility than a 6-bit address syllable would permit.

- Most importantly, we saw that the memory-to-memory feature of the symmetric format is hardly ever used in practice. (Gordon Bell, DEC's vp of engineering, has confirmed this. He has written "the PDP-11 is programmed mostly like a register machine." We did design the Level 6 instruction format before Dr. Bell's paper appeared.) When it is used, it is usually for lack of enough registers—and by providing twice as many registers as there were in the symmetric systems we studied, we hoped to eliminate lack of registers as an issue.

Evaluating the "correctness" of this format is hard, perhaps impossible. Examples can be created to favor any approach. A particular group's choice will depend on what programs the group members think are typical. Still, using a set of assembly language system programs, we've found Level 6 code to be generally more compact than that of any other system we've evaluated.

When we say a machine has a certain "word length" one of the things we mean is that its index registers count "words" in memory. For instance, suppose you use an index of 5 in a true 16-bit mini. This means your operand will be located five 16-bit words past where it would have been without indexing. In a true 32-bit mini, the same index value will adjust your effective address by five 32-bit words—and that's ten 16-bit quantities. In either case, accessing array elements is awkward when your data element isn't the same size as your computer's word length. Even if a compiler hides this problem from the programmer, the run-time overhead is always there.

With the Level 6, we wanted to get

away from the constraints of a fixed word length. Accordingly, Level 6 index registers do not count by any fixed unit. Rather, the indexing unit is implied by the operation code of each instruction. We call this "indexing to the atom." For instance, if you're testing a 1-bit flag in memory, the index registers count bits—such as from the beginning of a flag area. If you're reading a byte, they count bytes—say, from the start of a byte string. If you're multiplying 64-bit floating-point numbers, they count 64-bit floating point numbers—for instance from the start of a FORTRAN array. And so on for the other data lengths that the hardware supports. Indexing to the atom simplifies stepping through arrays or strings; it means that incrementing an index register automatically gets you the next element, no matter what size the elements are.

ADDRESS SIZE INDEPENDENCE

Address size independence is one of the most important features that permit the Level 6 architecture to cover a wide range of memory sizes, without costly inefficiency at the low end or the limitations of a small address space at the top. ("Address space" refers to the amount of memory one program can use at a time. In some minis, the amount of memory attached to the system may be larger than the address space.) Address size independence is based on these concepts:

- Address operands are carefully and clearly differentiated from other types. (One of the reasons this works is that the address registers are distinct from the data registers.) The programmer is given bit-level manipulation facilities only for nonaddress operands.

- The size of an address in memory is an unspecified multiple of 16 bits. This applies to direct addresses in instructions, indirect addresses, pointers, and anywhere else address can appear. In practice, addresses occupy 16-bit or 32-bit memory fields.

- The size of an address register (including the program counter) is similarly unspecified. It will normally be no longer than an address in memory; it can be shorter.

- The hardware must be sensitive to address size. For instance, when a programmer is indexing into an array of addresses, the hardware must know if an ad-

dress occupies 16 or 32 bits. It must then adjust the indexing accordingly. (This turned out to be rather easy because Level 6 indexes to the atom.)

- The software must provide facilities to compensate for a programmer's not knowing the size of an address. For instance, you have to be able to allocate space for a data block containing 12 "words" plus five "addresses."

Address size independence was the topic of a paper by Phil Stanley at the 1978 ACM/IEEE Symposium on Computer Architecture. Suffice it to say here that the concept works: large numbers of programmers have been writing Level 6 code that is assembled for machines with different address sizes. The penalty for using 32-bit addresses is just a small percent in both time and space.

This, a somewhat subjective tour of Level 6 architectural highlights, has been intended to expose some of the processes that go into an architecture definition. It's impossible to go into all the false starts we made and the interim designs we threw out; but rest assured, there were plenty of each. *

AUTHOR'S NOTE: The Level 6 architecture is not the work of one individual, but the combination of many people's ideas. Particular credit should go to George Bekampis, John Conway, John Grandmaison, Bob Huettner, Shashi Rajpal, Mike Simon, Phil Stanley, and Bill Woods. To the extent that the system here described has merit, the credit is theirs.

EFREM G. MALLACH



Dr. Mallach managed the systems design group responsible for the original Level 6 specifications. He is now technical support manager

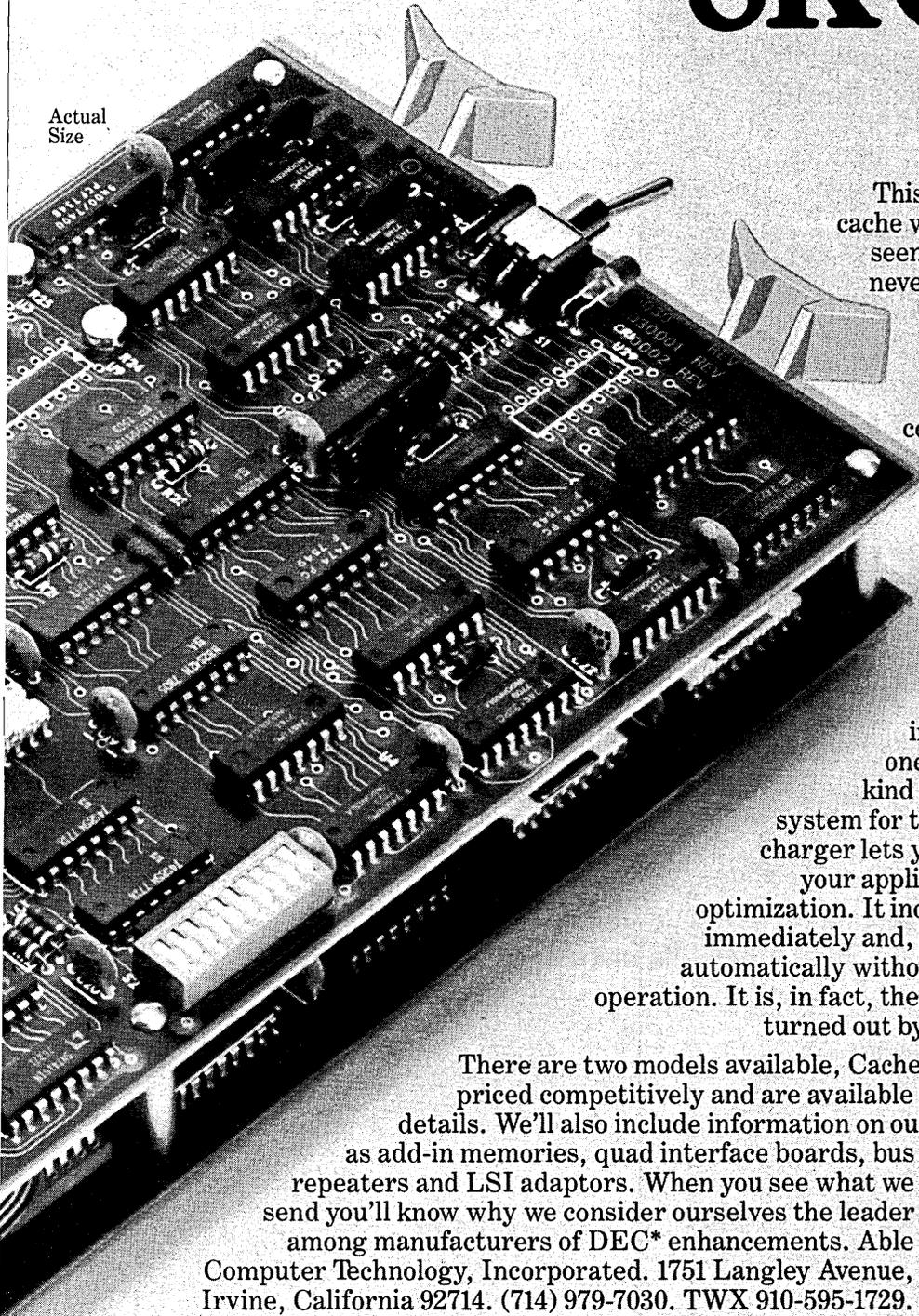
in Honeywell's Minicomputer and Terminals Market Development Group. Previous Honeywell assignments included the management of conversion software and emulator development. He has also been director of systems and applications at Incoterm Corp., and manager of systems software in Computer Usage Co.'s Boston office. Dr. Mallach is also affiliate associate professor of computer science at Worcester Polytechnic Institute.

Operation code (4 bits)	Operand 1 address (6 bits)	Operand 2 address (6 bits)	Extensions as necessary (Multiples of 16 bits)
----------------------------	-------------------------------	-------------------------------	---

Fig. 4.

The Incredible 8K Cache

Actual
Size



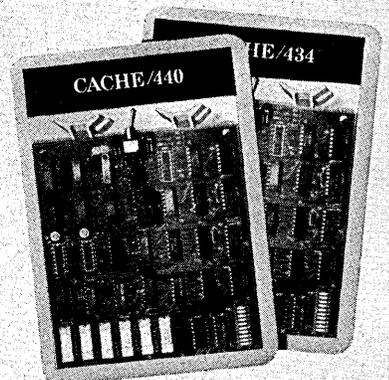
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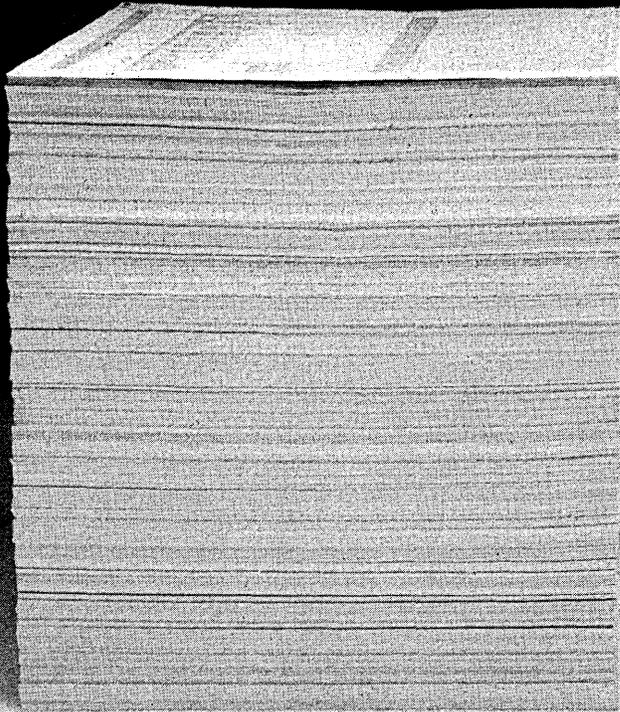
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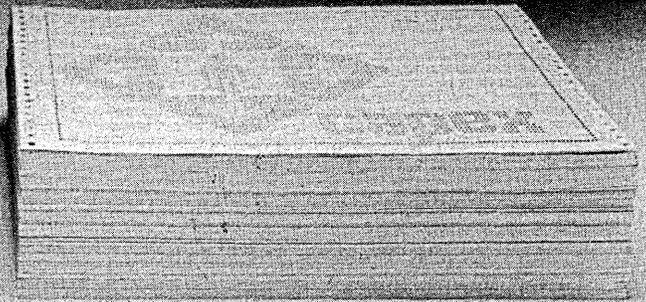


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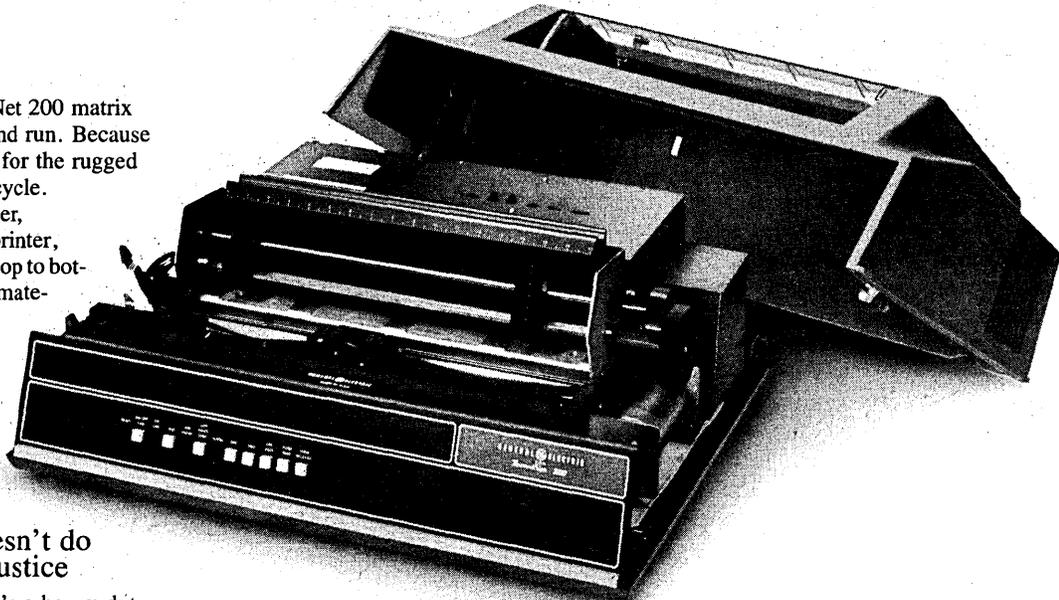
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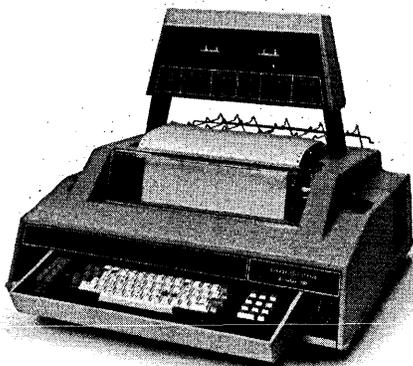
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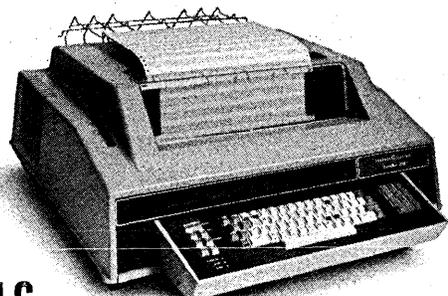
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ADF's significant improvements in programmer productivity and IMS program development must be weighed against design restrictions and higher operating costs.

A NONPROCEDURAL LANGUAGE FOR ON-LINE APPLICATIONS

by **D.H. Holtz**

If you are using IMS as your data base management system and you are developing on-line applications, it may be appropriate to evaluate IBM's Application Development Facility (ADF). ADF is to the on-line environment what languages such as GIS, MARK IV, and ASSIST are to the batch environment. ADF is a non-procedural language that uses rules to specify the screen design and processing functions to be performed. Standard code inherent in ADF takes care of the common, repetitive tasks of I/O, screen formatting, auditing, etc., and eliminates the need for repeatedly coding that type of processing logic. Significant improvement in programmer productivity can thus be achieved with ADF. The use of standard functions can dramatically reduce coding and testing, thereby reducing the total development time for a project and greatly reducing the personnel time needed for ongoing maintenance.

Throughout the industry, the most widely chosen method of solving the problems of programmer productivity, responsiveness to end-user needs, increasing information demands, and changing data requirements, is to add more people. As a result, systems development has become one of the most labor intensive processes in American business.

Since the cost of personnel is increasing while the costs of computer processing are declining, systems designers must be on the lookout for ways to efficiently manage this trend. ADF is one way to do that—it offers a potentially significant improvement for IMS program development. Design restrictions and a higher

operating cost, however, must be weighed; it presents a trade-off of people costs vs. computer costs in providing a method for rapid systems development. The decision would be easy if ADF reduced the development time of most application projects at little expense of computing resources, but ADF is not suitable for all applications and it does cost more to operate. Therefore, the decision to use ADF is contingent upon the acceptance of the present limitations of the product: the use of more computer resources, and the methods imposed by ADF.

When the ADF product was originally announced, we at Deere & Co. were primarily interested in it because of the field level data independence that it offered, rather than the promise of increased programmer productivity, although we were also optimistic that we could reduce the man days required to code on-line programs. One of the most serious problems we face is the high cost of modifying application programs whenever a change is made to a data base. We anticipated that with ADF we would be able to implement data base changes consistent with our data base direction without seriously impacting existing production systems. We did indeed find that data base changes could be accommodated very quickly with minor code changes. The ADF rules specifications do not support complete independence from the physical schema of the data, but the modifications necessary when changes are made to a data base structure are relatively easy.

We felt that ADF deserved a detailed investigation because it did appear to offer some opportunity for addressing critical problems we were facing. Howev-

er, we were quite apprehensive about the product and its effectiveness in meeting our objectives and requirements. We had no documented facts on the level of productivity to expect or the performance impact of ADF on the IMS system. We were also concerned about how well our people could use the ADF method of rules specifications. Thus it was decided that a task force study of ADF was in order.

FIRST ADF INSTALLATION AT DEERE

We first installed ADF on our test IMS system for a trial period in March 1977. We received management approval to evaluate ADF for a six-month period, during which time we selected three COBOL on-line inquiry applications to use for ADF benchmarks. The applications were rewritten in ADF, attempting to keep the screen displays and processing as close to the COBOL programs as possible. The call patterns did not end up exactly identical because of the processing methods of ADF; functionally, however, the ADF programs provided the equivalent information.

All of the test cases were written with ADF Standard Processing, which is the use of only ADF "rules statements" to define the processing functions. Special Processing is also available, which allows the developer to write routines in conventional procedural code to interface with the Standard Processing modules for performing specialized functions not available in Standard Processing.

The productivity gains realized on the test applications are summarized as Case 1, Case 2, and Case 3 in Table 1. Obviously, we had reason to be pleased about these results because the man days required to code the ADF applications

"We are confident that ADF will become a significant part of IBM's product direction."

were dramatically less than COBOL. Based on those results, we were confident that an ADF application using Standard Processing could be done in one or two man days.

Programming is an entry-level job at our installation, so the typical programmer writing IMS programs has less than one year of experience with the company. The person who wrote the ADF test applications was also an inexperienced programmer who did not know IMS, DL/1 (the data manipulation language used for processing IMS records), or MFS (Message Format Services). This gave us the opportunity to learn that a beginning programmer can be much more productive with ADF than with procedural languages. Less initial training is required, and it seems to be easier to learn. Using ADF, the programmer doesn't need to code DL/1 calls, Segment Search Arguments, PCM work areas, 01 levels, and MFS control statements. Thus, the inexperienced programmer is not overwhelmed with all of the IMS-related coding considerations and can concentrate on mastering the ADF rules specifications.

PROGRAMMER PRODUCTIVITY		
	(man days)	
	COBOL	ADF
Case 1	8	4
Case 2	64	2
Case 3	46	1

Table 1.

The Case 2 referenced in Table 1 needs some qualification; the application was done three years ago and it was one of our first on-line IMS systems. The total of 64 man days spent for the application includes time spent for maintenance and enhancements over that period, but how many days we aren't sure. The initial development time was certainly much more than two man days.

Case 3 reflects an important aspect of ADF that was not apparent until we began using it. With ADF, update and inquiry programs are essentially equivalent. Separate programs do not have to be written with ADF to provide both inquiry and update capability. That is taken care of by the ADF user profile which is used to specify the type of processing individual users are allowed. The 46 man days spent for the COBOL programming in Case 3 is actually for two functions: inquiry and update. Both functions were accomplished in one man day with one ADF program.

In all of our test cases, the ADF sys-

PERFORMANCE RATIO ADF/COBOL			
	Non-conver-sational	Conver-sational	Update conver-sational
DL/1 Calls	1.0	1.2	1.3
Cpu time	2.4	1.8	0.8
Region Time	0.7	1.1	0.5

Table 2.

tem was written after the COBOL program functions were clearly defined and coded and the test data base and other IMS definitions were in place. We expect that there will always be some time that must be allotted for dealing with the normal problems associated with a new system. Thus, the ratio of COBOL to ADF man days found in our test cases may not accurately represent a typical situation. The use of experienced programmers and/or analysts might also result in a different comparison.

We did a considerable amount of performance monitoring on the ADF test cases. Obtaining accurate performance results is next to impossible in a complex systems environment such as ours; a dedicated machine is just not available to allow complete isolation of the variables to be measured. The minimal amount of activity on a machine still includes overhead from the operating system control programs—MVS, JES, and IMS. We tried to obtain results that would be reasonably accurate and indicative of the productive IMS/ADF environment.

PERFORMANCE BENCHMARKS

The results of our performance benchmarks are shown in Table 2. The DC Monitor Utility was used to measure the three variables which we felt were the most critical. All of the figures are given as ratios of ADF to COBOL, to make them meaningful. We used low transaction volumes and assumed that the results could be used to project higher volumes. All of the ADF modules were preloaded for the test results shown in the table. We found that preloading the ADF common modules was necessary to achieve acceptable performance levels.

We expected conversational ADF to require more resources than the nonconversational COBOL to which ADF was being compared. Conversational processing, whether COBOL or ADF, is inherently more expensive than nonconversational. Also, conversational ADF provides additional functions such as security checking and menu-driven processing. We concluded from the results shown in the first column

of Table 2 that conversational ADF would cost about 50% more to process than a similar nonconversational COBOL program. We felt that this was a reasonable expectation for the type of processing being done.

The first column of Table 2 shows relative performance of nonconversational ADF compared to nonconversational COBOL.

Nonconversational ADF should have been reasonably close to COBOL since the processing modes were equivalent. The DL/1 calls and region time were close to the COBOL times, but the cpu time was rather high. The cpu time was erratic in our testing and this may have been due to higher priority interrupts. We did determine that ADF requires dynamic loading of various common processing modules. This would account for some additional cpu time compared to a single load for a COBOL program. The third column of Table 2 is the performance comparison of a conversational ADF update program and a nonconversational COBOL update program.

We benchmarked ADF update transactions for one of the test cases to ascertain any differences between inquiry and update functions in ADF. Note that the cpu time was actually less for the ADF test case than for the comparable COBOL program. To get increased programmer productivity and reduced machine costs would be fantastic, but we knew that this was atypical. After reviewing the COBOL program, we found that the data base call patterns were not done efficiently. We do monitor all of our Production programs, but this one was being used differently than expected. Based on this case and other later benchmarks, we found that update processing in ADF had about the same relative cost to COBOL as did the ADF inquiry-only program.

The case of ADF using less cpu time than the comparable COBOL program does illustrate a potential benefit of the ADF common module approach to program development. The data base accessing logic is predefined in ADF, thus providing consistent and generally efficient call patterns. The use of conventional pro-

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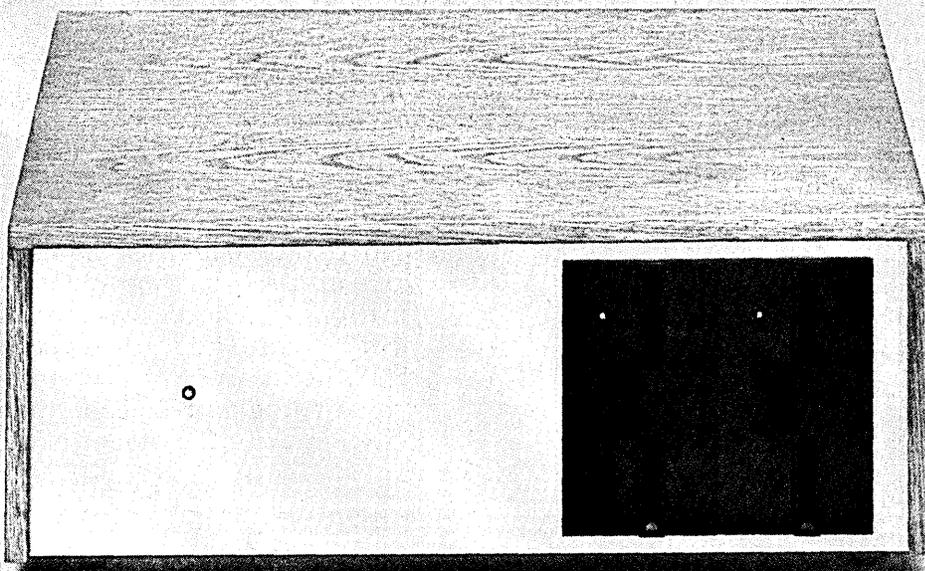
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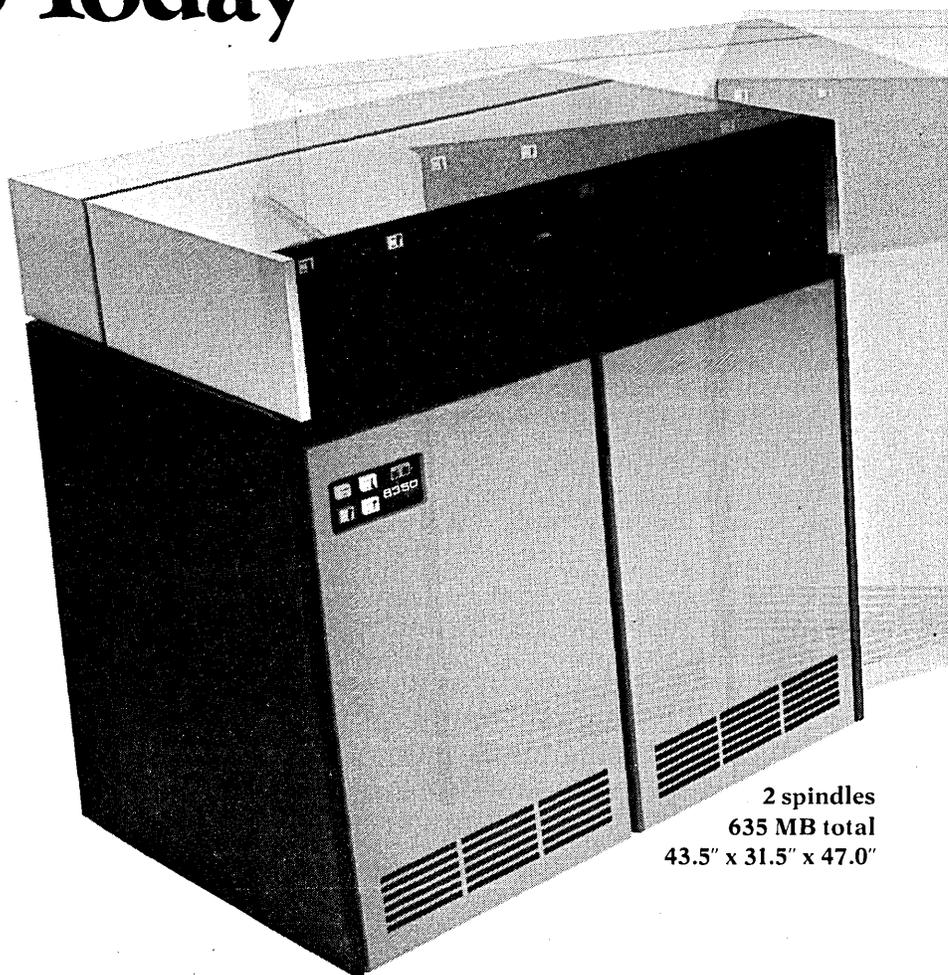
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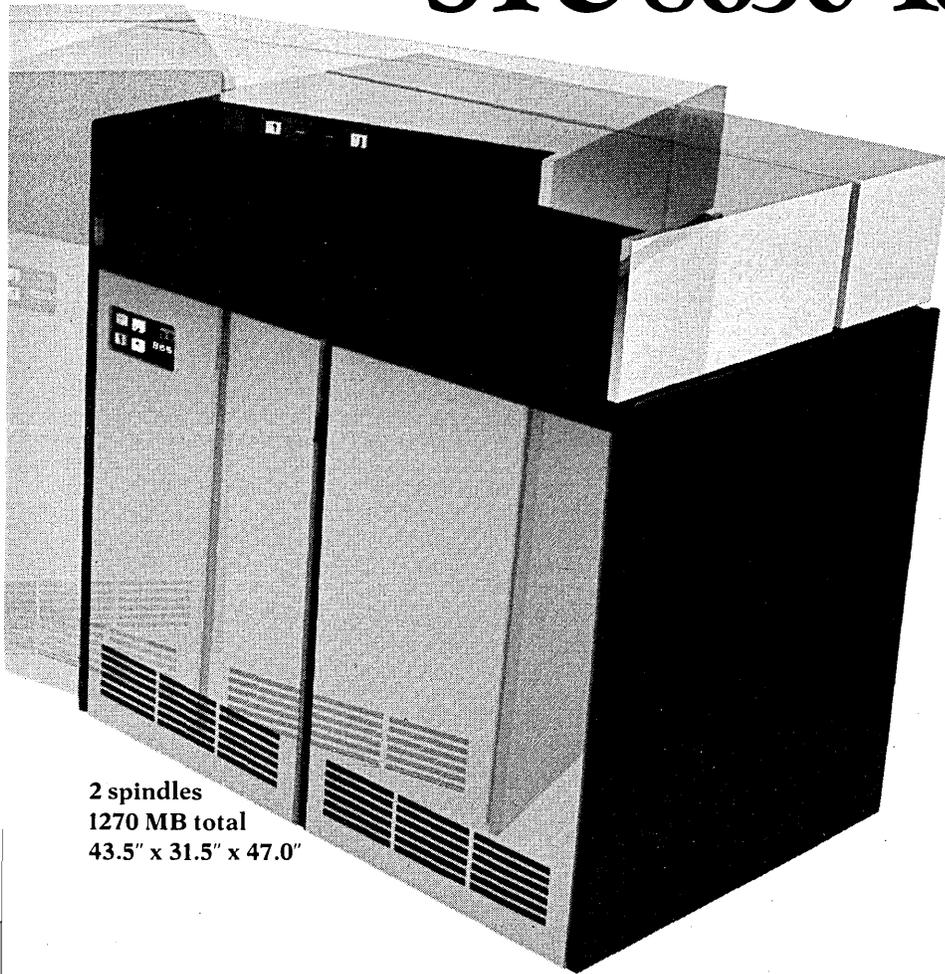
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cedural code requires coding of the data base calls in every module, thereby running the risk of coding inefficient call sequences. Thus, a review and monitor of all conventionally written programs is necessary to assure consistent and efficient data base processing.

In general, performance does not appear to be a restrictive factor in the use of ADF. One should expect to trade some computer resources for a higher level development language like ADF. The name of the game is trading computer time for people time. A simple break-even analysis can be calculated to determine the amount of computer resources one is willing to compromise to reduce manpower costs. Obviously, very high volume transactions are not feasible with ADF. Assuming that the so-called 80-20 rule is somewhat realistic, then about 80% of the transaction volume would be accounted for by 20% of the transactions. Those 20% would be the transactions to avoid with ADF for performance reasons. But that still leaves a sizable number of applications as good candidates for ADF.

We concluded from the evaluation study that ADF was a viable product and that we had applications that would potentially benefit enough to justify the implementation of ADF. ADF has now been used successfully for several production applications. The productivity improvement we have experienced for the production applications has been as significant as for our test cases. The programming man days required for several projects are shown in Table 3.

ADF PRODUCTIVITY—PRODUCTION SYSTEMS		
(man days)		
	COBOL (estimate)	ADF (actual)
System A	25	3
System B	60	6
System C	12	2
System D	23	1
System E	35	2

Table 3.

ADF USE IN PRODUCTION PROJECTS

All of the production projects on which ADF is used were selected because they were very well suited for ADF processing. We require an approval review by our data base administration staff to assure that ADF is not misused. The technical feasibility of using ADF to meet the system requirements is assessed and the increased computer operating cost is calculated. The systems we

have approved for ADF development are those that could be done with minimal special processing and had relatively low projected daily transaction rates. The systems shown in Table 3 were all done with just the ADF standard processing.

We have installed ADF on two production IMS systems and our test IMS system. The transaction volume has been low for the production systems and there has been no degradation of IMS from them. A larger region size and scratch-pad area did have to be defined for ADF, but that did not impact any existing applications. The response time for an ADF transaction has not been measurably different than for conventional transactions.

We have been expanding our use of ADF and have used special processing for some applications. When special processing is used, the productive gains are not as significant. Special processing is available to accommodate unique processing requirements, but if considerable special processing code must be written, the productivity benefit is lost and the program may be difficult to maintain in the future. As we gain more experience, we hope to be better able to judge how much special processing can be used before the benefits are lost. Other installations are using considerable special processing quite successfully.

The use of ADF has been rejected for several projects because of deficiencies in standard processing that would have required special processing to overcome. The inability to access multiple data bases and multiple hierarchical paths and the access to only one occurrence of a segment type are two key restrictions that have limited our applications. Other companies have also recognized these and other limitations that hinder more widespread application for ADF using the benefits of standard processing. The IMS ADF Project within GUIDE has been actively pursuing a number of requirements and has had very positive response from IBM. We are quite optimistic that future releases of the product will address these requirements which would really provide for much more expanded use of ADF. A new release of ADF, announced in December 1978, appears to offer some of the functions that installations have been requesting.

The use of ADF does impact conventional methods of systems development. We have had to develop special naming standards and operating policies and guidelines. The data analysis and data base design work still have to be done and the basic processing requirements for the system have to be defined, but the programmer can write the ADF system and

generate output screens without the usual detail program specifications, and if the initial screen formats are not satisfactory, they can be easily changed. Some training is needed for both systems analysts and programmers. Analysts must have a basic understanding of ADF to allow them to recognize potential ADF applications and ascertain the justification for the use of ADF. They must know the capabilities as well as the limitations in the product to be able to evaluate its effectiveness in meeting the requirements for a system. They must also be familiar with the operating mode of ADF to communicate with the end users and provide them useful operating instructions. Currently, no vendor course is offered for the systems analyst. Some companies are developing their own in-house education program for the analyst. A one-day session for analysts would probably be adequate.

The data base administration (DBA) staff should need only the same familiarity with ADF as is suggested for the systems analysts, since there are essentially no data base design dependencies. The data analysis and data base design functions are not dependent on whether ADF or conventional coding is used for the processing programs, and ADF operates as a regular IMS DL/1 application program. Data bases could be designed to fit the constraints of ADF to allow ADF to be used more readily, but that is not consistent with the data base design direction we have established.

Because ADF operates as a normal IMS DL/1 program in a message processing region, transaction code and PSB definitions are required from the DBA. The naming conventions are unique to ADF and installation standards have to be documented for them. The DBA must be aware of the ADF conventions and know what to define for execution of an ADF system. At Deere & Co., we have designed a special form for use by our DBA staff to insure that all of the necessary information is supplied for the implementation of a production system.

PROGRAMMERS NEED ADF TRAINING

The ADF programmers need comprehensive training in ADF. The Program Description Operation Manual is a useful reference document, but learning to code an ADF application from it would be very difficult. IBM does offer a four-day class that provides adequate background for the programmer. We have found that the programmers get much more out of the class if they have had some exposure to ADF and the ADF terminology prior to attending the class.

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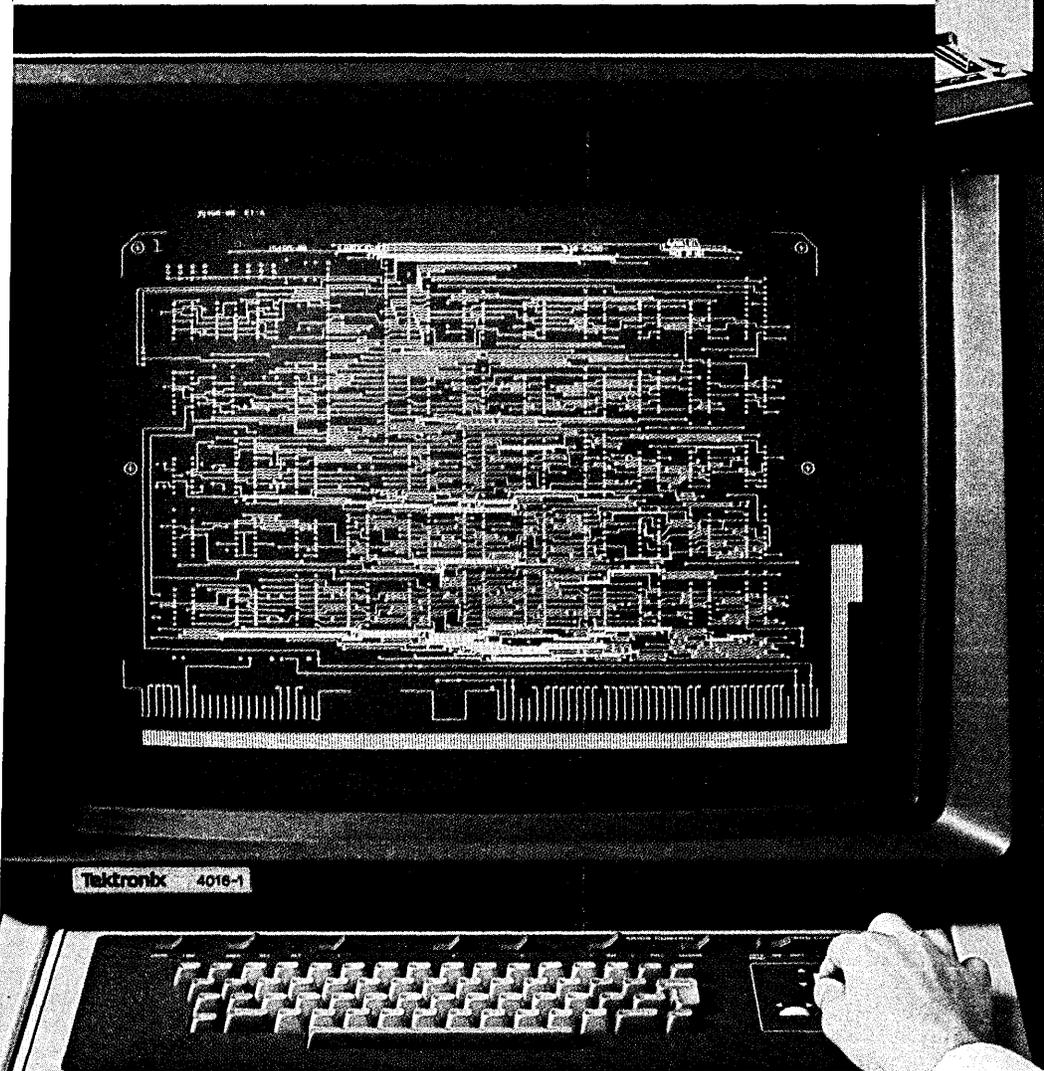
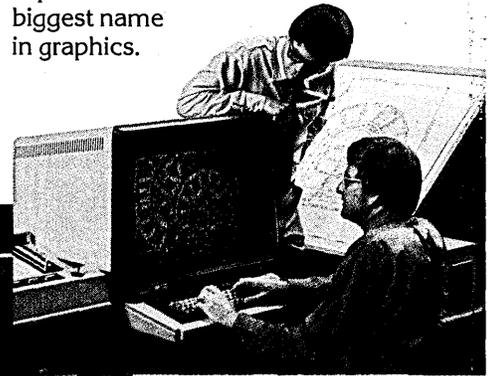
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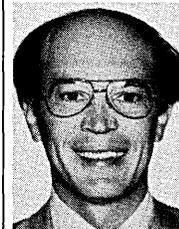
The rules specifications of ADF seem to be learned quite readily, although a new vocabulary is introduced, different naming conventions are used, and various rules must be tied together to form an executable ADF system. New programmers tend to be confused by all of that until they have written and implemented an application themselves. The programmer should be given an application to work on immediately following the class. The productivity to be expected will not be seen in the first application, but the learning curve is short.

Special processing routines written in conventional code require an interface to ADF. The first special processing routines typically take the programmer double the normal time to understand the interface and data mapping that ADF provides. As with standard processing the programmer gains considerable experience from the initial one.

Most of the experienced ADF installations have recommended that one person become the resident ADF expert. As with most software, there are techniques and methods that are only learned through experience. The ADF specialist can assist the occasional ADF programmer, provide training for analysts, and provide general support for the ADF system.

We are confident that ADF will become a significant part of IBM's product direction. It does have limitations and does change the familiar way of doing design and programming. However, our experience has shown enough potential benefit from ADF to justify the related cost and implementation considerations. We also believe the experience gained in using this product will be particularly valuable because nonprocedural languages must be the way of the future. *

D. H. HOLTZ



Dan Holtz is manager of the data systems design division of the data administration department at Deere & Co., Moline, Illinois. His

10-year career at Deere & Co. has included managerial responsibilities in software development and data base administration. Holtz is also project manager for the GUIDE ADF project.

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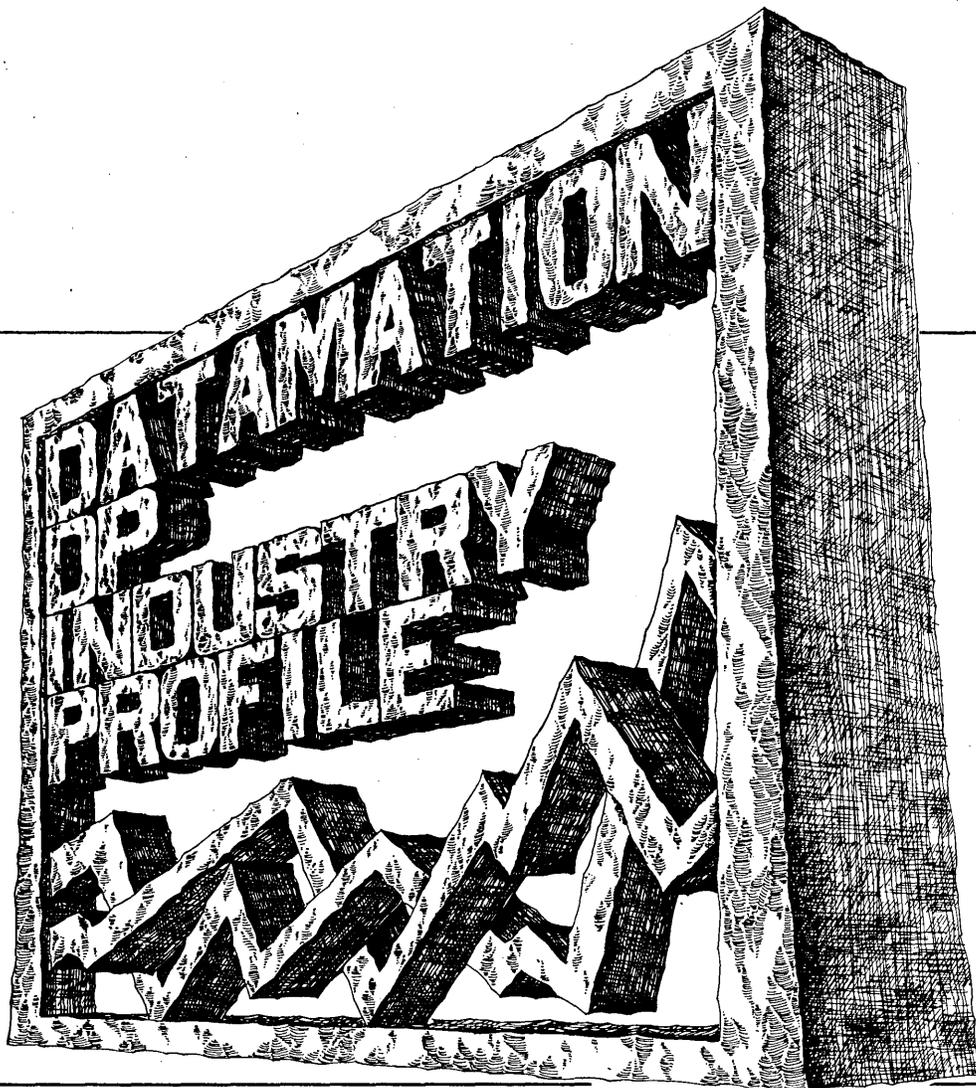
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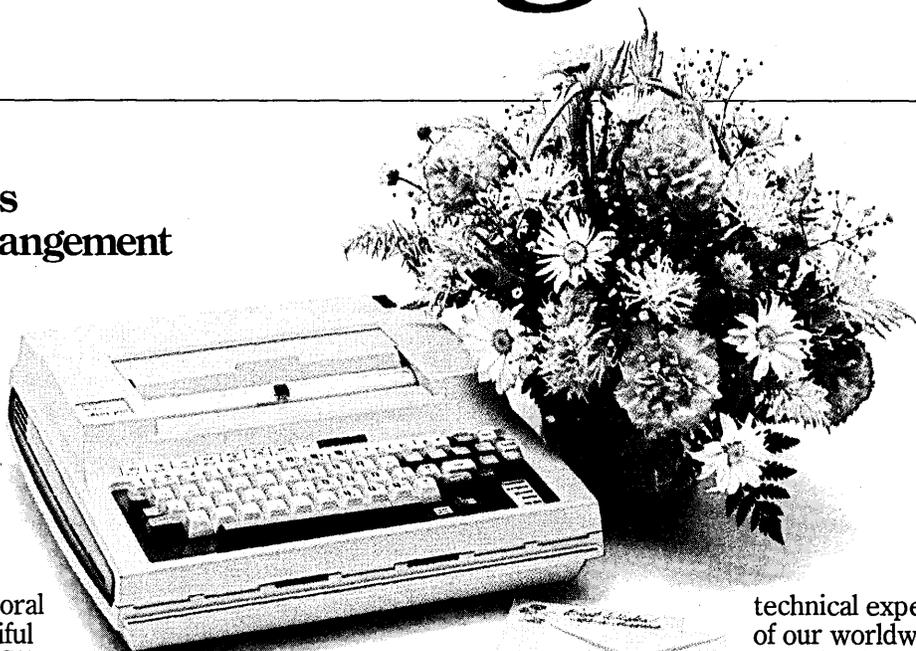
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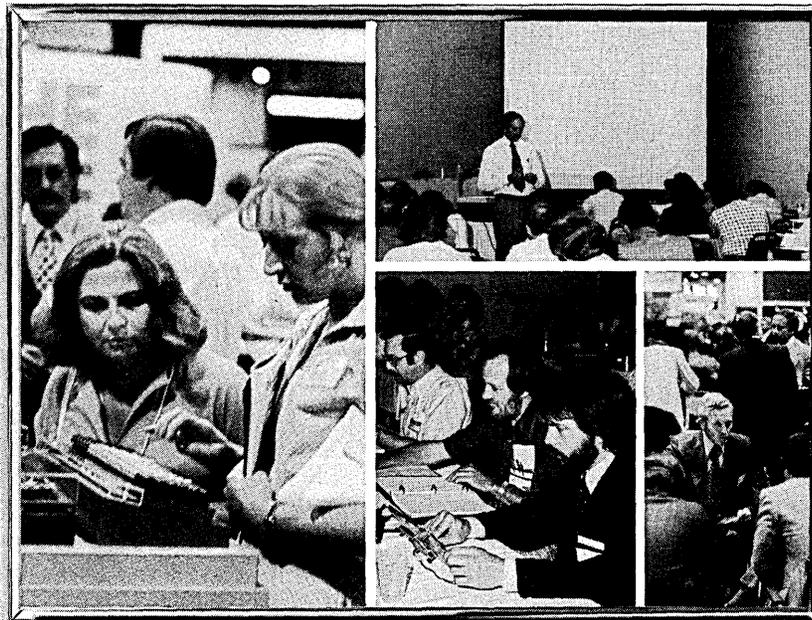
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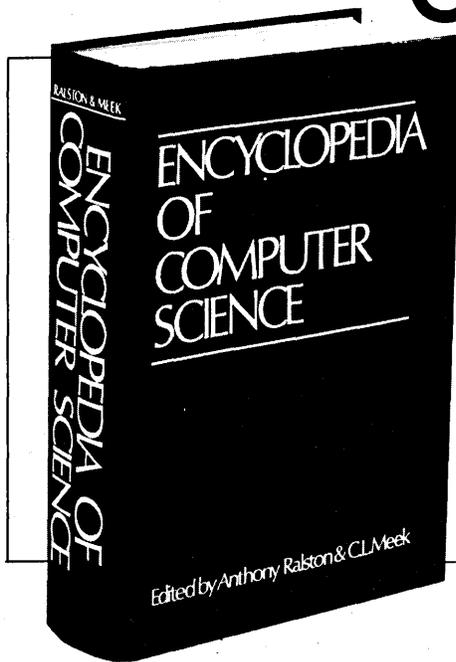
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DCC is proud to announce the CM-9100, the newest member of our family of microprocessor controlled communications processors. The CM-9100, a software programmable statistical multiplexer, concentrates up to 32 synchronous and asynchronous data streams into one high speed link. By assigning bandwidth dynamically on a statistical basis, the CM-9100 achieves more than double the throughput of conventional Time Division Multiplexers.

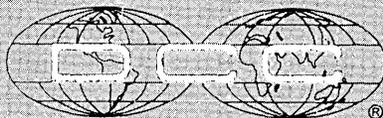
In addition, the CM-9100 features:

- ▣ Expandable from 4 up to 32 input terminal ports plus up to 2 high speed output ports.
- ▣ Error free transmission between CM-9100s using GO BACK N ARQ.
- ▣ X-25 level 2, for the high speed link.
- ▣ Per line status display.
- ▣ 50 bps to 19.2 kbps capability on all ports.

- Built-in diagnostics.
- Buffer overflow protection using CTS/XON-XOFF flow control.
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- Integral 4800 bps modem optionally available.
- Optional high speed back-up line for increased reliability and load leveling.
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The CM-9100 is an entry level unit fully compatible with DCC's high capacity (up to 480 ports) multimicro-processor, the CP-9000. The 9000 series allows disciplined network development with uniform protocol and common software.

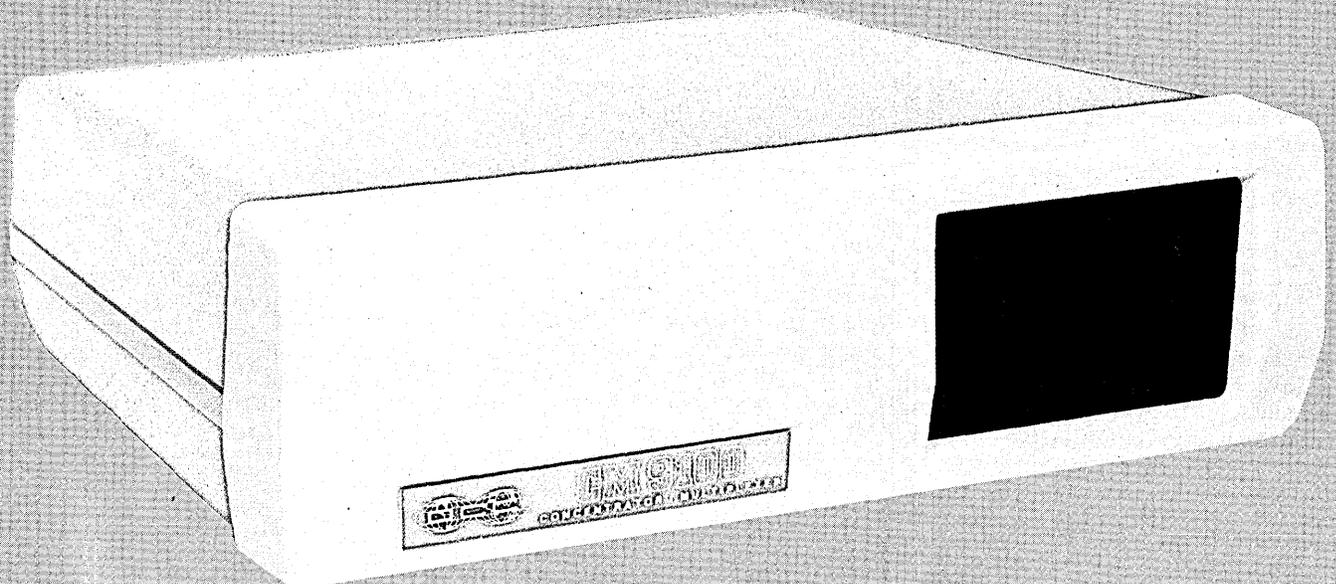
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HARDWARE

OFF-LINE

To remove the software and bus contention overhead from its 16-bit microprocessor, the 8086, Intel has come up with the 8089 I/O processor (IOP). Instead of coming up with a simple DMA controller, Intel chose to model the 8089 on a mainframe I/O processor, such as a System/370 channel controller. In addition to simple memory-to-I/O and I/O-to-memory transfers, the 8089's instruction set includes arithmetic and logic functions, bit testing and manipulation, word assembly/disassembly, and field search and/or translation. The IOP and the cpu communicate independently through messages placed in memory; their only direct means of communicating is through interrupts. The programmable 8089 can operate out of main memory or its own private memory; it can interface to any combination of 8-bit and 16-bit busses. The chip's formal announcement is expected at mid-year.

Texas Instruments has broadened its 16-bit microprocessor line with the introduction of the 4MHz TMS9900-40. The microprocessor uses separate data and address buses, which is said to enhance performance by avoiding multiplexing delays. Of memory-to-memory architecture, the TMS9900-40 supports three I/O methods: DMA, memory-mapped, and CRU which features single command page switching for systems with more than 64KB of main memory. The TMS9900-40 is augmented by a clock generator/timer (TIM9904-40), a peripheral systems interface (TMS9901-40), and an asynchronous communications controller (TMS9902-40). In lots of 100, it goes for \$41.25.

TERMINAL

Developed to meet the needs of the automotive industry and to fill needs identified by AT&T's Long Lines for private line, administrative message applications, the Teleprinter 1000 comes in receive-only, keyboard send/receive, and automatic send/receive versions. ASR versions include 11,000 characters to 33,000 characters of bubble memory. The RS232-interfaced upper and lower case ASCII terminals run at 120cps. Users can define page formats, including type font changes within or between forms. Pricing is subject to tariff approval. The RO version will be in the range of \$103 to \$125 per month, the KSR ranges from \$110 to \$133 per month, and the ASR goes from \$151 to \$229 per month. AMERICAN TELEPHONE AND TELEGRAPH, New York, N.Y.

FOR DATA CIRCLE 330 ON READER CARD

NETWORK TRAFFIC DESIGNER

Prospective customers for PABX systems or additional telephone company equipment can evaluate vendor claims regarding expected performance using the Network Traffic Designer. Conversely, telephone equipment vendors can use the handheld unit to help them prepare customer proposals. The Network Traffic Designer consists of 12 solid state program modules and a Texas Instruments model 59 pocket calculator. The programs process standard traffic engineering data and use a variety of overflow optimizing techniques for DDD and voice telephone bulk circuits. The Network Traffic Designer handles WATS, FX, tie, SCC, and OPX circuits. Any combination of circuits can be optimized with overflow techniques including Automatic Route Advance (ARA), Flexible Route Selection, or Least-Cost Routing (LCR) with queuing. Complete with software modules, pocket calculator, and users manual, the Network Traffic Designer sells for \$995. With the addition of a \$255 printer, the unit can prepare formatted reports. RICHARD L. DEAL AND ASSOCIATES, INC., Fairfax, Va.

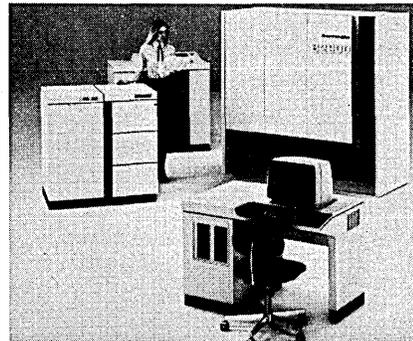
FOR DATA CIRCLE 331 ON READER CARD

COMPUTERS

Hot on the heels of IBM's E-Series announcement, Burroughs came out with

the first two systems in its new 900 series. The smaller B2930 is said to have "considerably more throughput than an IBM 4331" at a "slightly higher price," while the B3950 is said to be in the same performance class as an IBM 4341 with a slightly lower price. And Burroughs matched IBM's aggressive price for memory: \$3,750 for 256KB, or \$15,000 per megabyte.

The two systems use "micro-modular, concurrent" architecture, under which multiple, independent functional modules operate asynchronously. The program module prefetches instructions, analyzes them, calculates data addresses, and passes this information, via an ad-

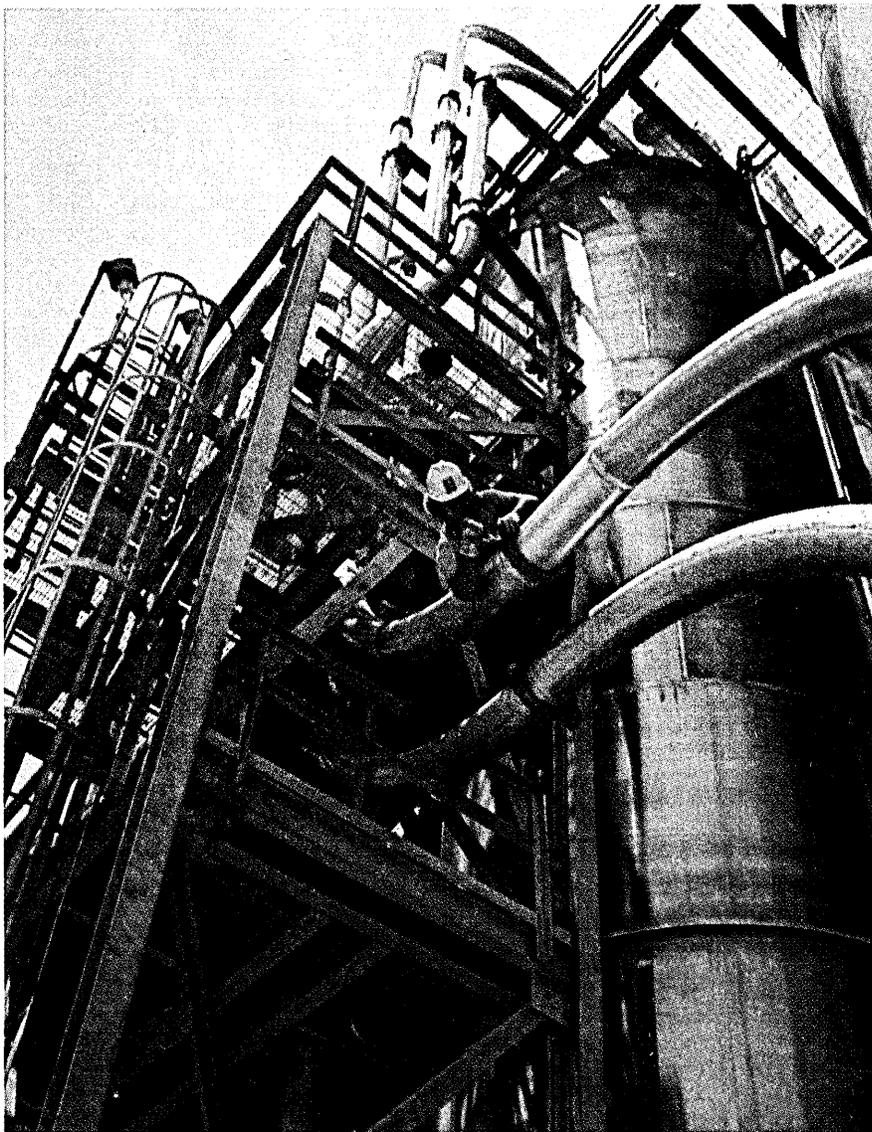


dress buffer, to the control module. The control module takes this data and passes the addresses, size and formats of the operation to the memory access module which handles memory accesses for the execution module; it also handles reading and writing of data in the data buffer. The execution module executes the preprocessed instruction. Memory requests from the memory access module and the I/O processor are coordinated by the memory control module. The I/O processor moves data between memory and peripherals without adding I/O overhead to the cpu. Data link processors are microprocessor-controlled gateways to specific peripherals; each is tailored to a given device. Memory is built of 16K-bit chips; the memory data path is four bytes wide. The system uses TTL circuits, with as many as 800 gates per chip. High-speed control store makes instruction codes available to the processor in 45nsec.

Under its Software Facilities Program, the vendor packages and licenses

DP Dialogue

Notes and observations from the IBM Data Processing Division that may prove of interest to DP professionals



Soltex Polymer Gets Tasks Online Eight Times Faster with DMS/VS

"Under DMS, we can do an online job in one-eighth the time required to program it conventionally," says Walter S. Fletcher, manager of management information systems for Soltex Polymer Corporation. "On the average, one line in DMS does as much as 50 to 80 lines of COBOL."

Display Management System/Virtual

Storage (DMS/VS), an IBM program product, is a simplified programming system for online applications that recently helped Soltex meet an urgent need. A leading producer of polyethylene and polypropylene, plastic resins for a wide variety of applications, headquartered in Houston, Texas, Soltex had to reprogram its basic set of applications when

Soltex placed this new polypropylene production unit, near Houston, in service during the fall of 1978. When the company needed application software rapidly for inventory, order processing and other basic functions to support its manufacturing and marketing operations, it turned to IBM's DMS/VS.

it became a subsidiary of Belgium-based Solvay & Cie S.A.

"We reprogrammed and installed the applications on our IBM System/370 Model 115 with three man-months of effort," Fletcher notes. "Without DMS it would have taken 24 to 27 man-months.

"DMS also helps us minimize maintenance requirements by involving users in the design process, so that the system better reflects their real needs. And we have a closer rapport with users now that they don't wait months for delivery of an application."

Changing the structure of a record or lengthening it by adding fields is easily accomplished under DMS/VS, Fletcher points out. "It does 90 percent of the work of programming this kind of online business system."

DMS/VS converts information from a fill-in-the-blanks sheet directly into executable form. It generates and displays user-defined screen formats, processes terminal transactions, and accesses an existing data base or one newly defined under DMS/VS. Screen formats can be revised and new ones added quickly and easily, without reprogramming.

"DMS generates all the steps required to process or inquire against a file," Fletcher adds. "It is self-documenting and allows very creative design techniques. We can use programmers with experience primarily in the application area rather than a technical staff."

As the cost-performance ratio of the hardware continues to improve, data processing costs are becoming people-intensive, Fletcher believes. Therefore the productivity of people is of increasing importance to management.

"DMS has helped us hedge against rising personnel costs," he says. "We began creating a responsive online Management Information program with an initial staff of two programmer/analysts and one operator. DMS enables us to maintain existing systems and tackle new development work."

Virginia National Bank Gets Set for the Future

"We're fighting a cost battle. Our projections show that by 1985 it will be very difficult to earn any money unless we make fundamental changes in our consumer services."

David O'Connor is senior vice president, consumer services, of Virginia National Bank, Norfolk, Virginia, which has moved aggressively into the world of on-line banking. Currently it uses 400 units of the IBM Finance Communication System, including the IBM 3614 Consumer Transaction Facility, installed in 47 locations throughout the state of Virginia.

If the average cost of a consumer transaction this year is arbitrarily indexed at \$1.00, O'Connor points out, it will go up to \$1.26 by 1985 if there are no changes. So his goal is to channel 36 percent of consumer transactions through the Cashflow system by that year. Cashflow is Virginia National's trade name for its on-line, customer-operated banking services, available in drug stores, shopping centers, and similar locations.

Meeting that goal will help hold that \$1.00 index down to \$1.02, O'Connor says, adding that the measure of success is progress toward that goal, not the imme-



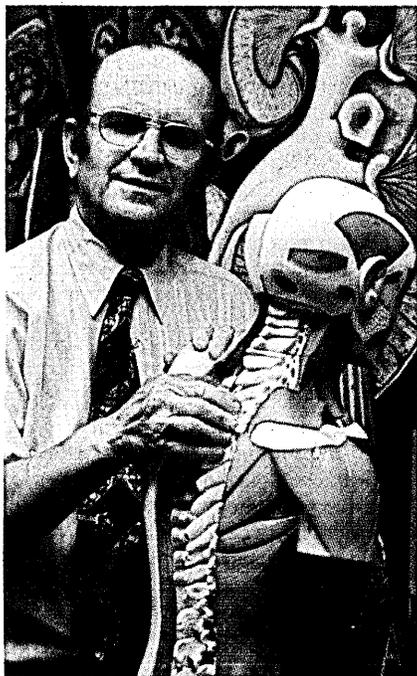
diated cost per transaction. "We use a computer model of operations to compare projected to actual costs and transaction volumes, to confirm that Cashflow is on track," he notes. "And we are delighted with our progress to date: 400,000 transactions a month now pass through the customer-operated facilities, we have stayed within our projected costs, and average balances are going up."

"Cashflow centers also offer an attractive alternative to the increasingly expensive construction of conventional branch offices. But beyond the purely economic factors, the shift to online, computer-based banking will position us to cope with rapid shifts in the banking environment and to offer wholly new services," O'Connor adds.

"We're preparing a fundamentally new delivery system for banking services. We're excited about it, and we feel sure our depositors will be too."

This Cashflow facility of Virginia National Bank, in a Norfolk supermarket, can offer 75 to 80 percent of the services available in a conventional branch office.

Helping Teachers Teach at U. of Evansville



Dr. William Snively was the moving force behind the development of computer-based learning aids for medical and health-care subjects at the University of Evansville.

There's a teaching aid at the University of Evansville, Indiana, that's available morning, noon and night, seven days a week. It's the university's computer, which is helping students of nursing, medicine and other health-care specialties in three of their courses covering the human body and how it works.

A student taking anatomy and physiology, for example, can work at a computer terminal in the Computer Assisted Instruction Lab - typically in ten review sessions per school term, of about 50 minutes each. Dr. William Snively, who directed the development of the learning system, emphasizes that computer-aided instruction is one of six carefully integrated modes of study at the university. The five others are lectures, classroom work, textbook study, laboratories and other programmed instruction including written and audio/visual programs. Each has its own advantages in helping students keep their interest up, while meeting the demands of a heavy workload.

During a study session, the IBM System/370 poses questions that the student answers by typing at the terminal keyboard. "The questions and answers are designed so the program can distinguish whether a wrong answer, in context,

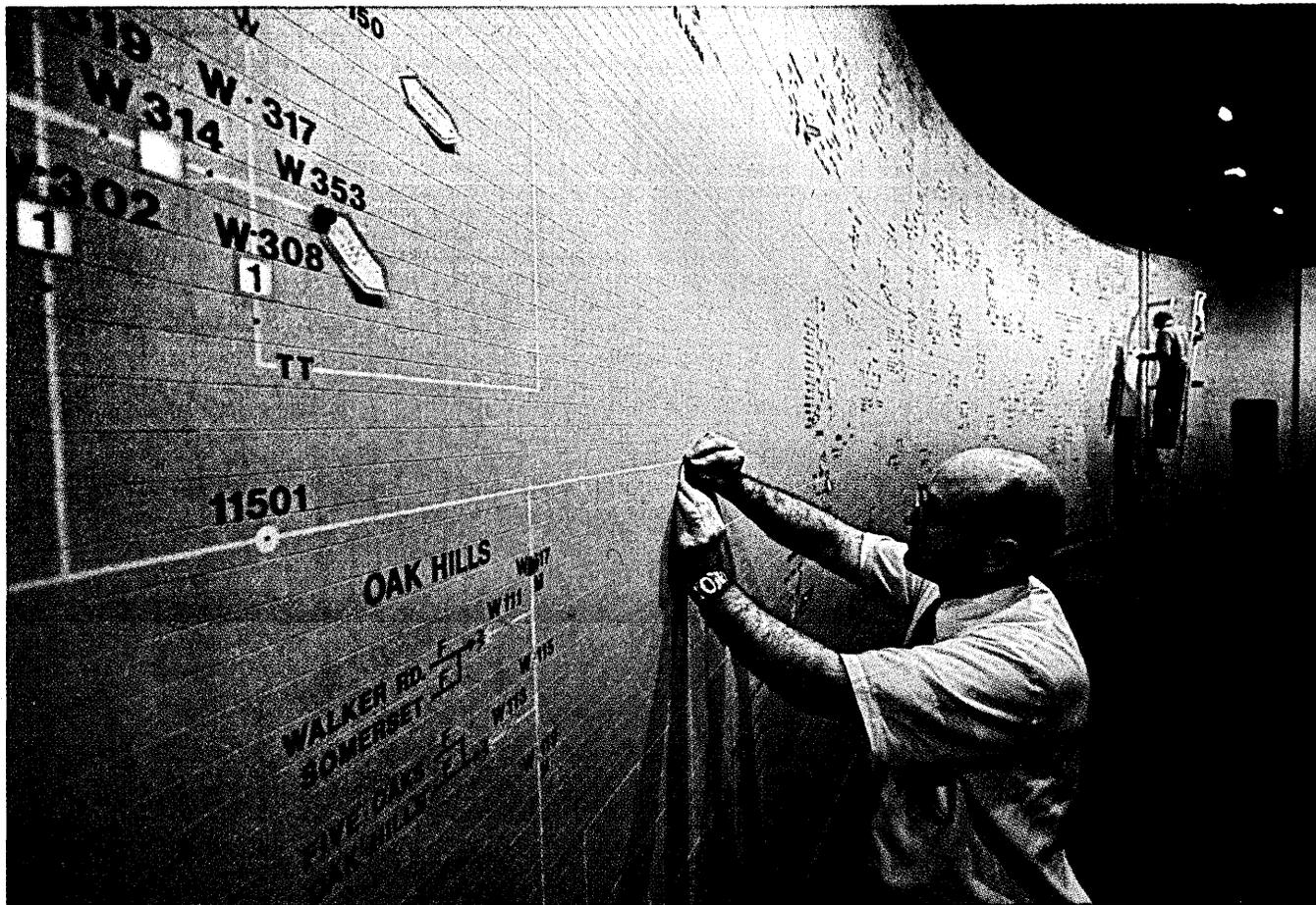
is an educated miss or a wild guess," Professor Snively notes. "And the system responds accordingly: 'You're almost right but here's a point you missed.' Or: 'Where were you last night?'"

"Because these are undergraduate students, we've used humor and informal language in the system responses, and the computer addresses each student by name. In addition to making a session more enjoyable, this also makes for more productive involvement by the student."

"We don't require anyone to use the computer," Snively says, "but 50 percent of the students do so voluntarily." One course on acid/base disturbances, which deals with changes in the chemistry of body fluids, is a systematic coverage of the subject. Those for anatomy/physiology and patho-physiology are computer-assisted reviews. All three were adapted from programmed learning texts by Scott Kincaid of the university's data processing department.

The computer keeps track of each student's performance and reports on progress to the student and to the instructor. However, the computer score never goes into the student's grade or record.

"It seems that everybody benefits from this system," notes Snively. "The constant use of the terminals, 15 in all, attests to its popularity with the students. And it lets us make better use of our time in preparing material and meeting personally with students who have a particular question or problem that they have trouble understanding."



Energy Control Center at Portland General Electric. A technician uses a tag to make a notation on the automated "mimic board," which graphically represents the sub-transmission system.

VSPC Helps Portland General Electric Make Planning Decisions

The cost of energy is rising steeply for Portland General Electric Company, which supplies electric power to the Portland area in northwest Oregon. Now that the region's potential for hydroelectric power has been fully utilized, and the company must develop higher cost sources, planning with the aid of computerized modeling is helping PGE to control costs and conserve capital.

"VSPC made the computer directly available to our professional people just when they needed it most," says Keith Parkyn, Manager of Data Services. Engineers, financial planners and programmers all use Virtual Storage Personal Computing (VSPC) to interact directly with an IBM 3032 Processor through 50 terminals in many PGE locations. With the aid of mathematical models of the utility and its power distribution system, they plan construction projects, analyze power flows, and examine operating contingencies.

"Some of these programs produce massive tabular output," David Kruse, Supervisor of Technical Systems, points out. "And we often require several runs of

a model to obtain a useful one. With VSPC, the engineer can look at the results in the terminal display — and, if he likes, vary a parameter value and repeat the run before taking any printout."

VSPC has easy access to the corporate data base: planners who need data on power usage, financial history, or the like, can run programs against the existing files, usually with no data entry services at all.

A user can get as many as 10 "turn-arounds" a day, if the situation dictates, under VSPC, compared to two a day at best under batch, Kruse notes. And he can submit work to the batch queue, selecting his priority in terms of his needs. If he can accept overnight turnaround, for example, the charge to his project is very low. "Enabling people to submit these jobs remotely, through VSPC, relieved the operators of a real burden," he adds.

"VSPC has enabled our programmers to get a huge maintenance programming backlog under control," Parkyn continues. "Today we keep this backlog at about 1,800 manhours, which is where I want it, to assure a steady workload. User com-

plaints have about disappeared."

Much of the application programming at PGE is under the Customer Information Control System/Virtual Storage (CICS/VS), for online business systems, Parkyn explains. "Using VSPC, a programmer can write or change a CICS/VS routine at a terminal and then test it immediately at the same terminal," he says. "It's not uncommon to have 25 people logged onto VSPC at once."

DP Dialogue is designed to provide you with useful information about data processing applications, concepts and techniques. For more information about IBM products or services, contact your local IBM branch office, or write Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

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Data Processing Division

HARDWARE

certain widely used software products. The basic package required to run one of the new systems licenses for \$700 per month and comprises the Master Control Program (MCP VI), Network Definition Language (NDL), a Generalized Message Control System (GEMCOS), and a compiler for RPG II, or ANSI '74 COBOL, or FORTRAN, or BASIC.

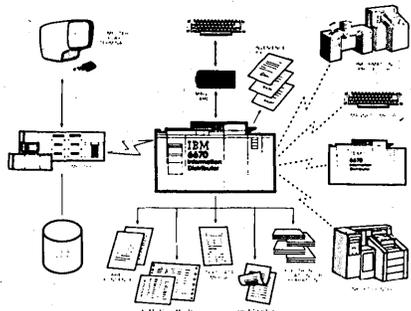
The B2930 comes in 0.5MB and 1MB versions. For \$140,000, users can get a 0.5MB processor with seven data link processors (an eighth is optional), a data communications processor, and a microprocessor-based disk controller. This system leases for \$4,250 per month. (The pricing comparisons made in the first paragraph are for configured systems.) A B3950 can have from 2MB to 5MB of memory, and seven to 32 data link processors. An entry level B3950 sells for \$230,000 and leases for \$7,200 per month. Deliveries are to begin by year's end. BURROUGHS CORP., Detroit, Mich.

FOR DATA CIRCLE 332 ON READER CARD

THE MISSING LINK?

Q: What links word processing and data processing, sends and receives documents over telephone links, prints with a laser, and, in its free-time, moonlights as a convenience copier? A: IBM's 6670 Information Distributor.

The 6670 can print data coming from remote 6670s, computers, or mag cards. It has its own formatting capabilities and can justify or adjust lines, provide line and page numbering, print headings and footings, and change type styles (up



to four different types on a page; nine styles are offered). Text formatting is controlled through an Operator Control Language entered on magnetic cards. Eight frequently used formats, consisting of 13 instructions specifying margins, tab stops, type styles, and the like, can be stored within the 6670.

Communications (at up to 4800bps) can be bisynchronous, emulating a 2770, or SNA/SDLC. (That's an exclusive "or"; you get one or the other, but at this time, not both.) Using SNA/SDLC, the 6670 can communicate with 370s having appropriate supporting software; a 3705 communications controller (or equivalent) is required. Under bisync, the

6670 can talk to other 6670s, as well as Office System/6 products, 360s and 370s, Systems/3 and 34, and Word Processor/32s. Notably absent from the list of supported cpu's is the recently announced 8100 Information System.

Communications from a 6670 originate from mag cards; an operator must initiate transmissions. Autoanswer allows the machine to receive unattended.

The 6670 uses two microprocessors: one to control text processing and communications, the other handles copier operations. A nonremovable diskette holds system code and customer data (about 100 "standard length" letters). The machine is monitored by a microprocessor that informs the operator of malfunctions.

As a convenience copier, the unit can make 36 copies a minute on bond paper. Communicating, the 6670 prints its first set of pages at 400cps, while subsequent sets come out at 36 pages per minute (1,800cps). Both sides of a page can be printed.

The 6670 sells for \$75,000. Rental and lease customers pay a per copy charge on pages after the first 5,000. On six-month rental, the 6670 goes for \$1,565 per month (plus 2.8¢ per page after the allowed 5,000). Twenty-four-month leases go for \$1,375 per month (2.5¢ per additional copy); a three-year lease is \$1,315 per month (2.4¢ per extra copy). Deliveries are to begin this calendar quarter. INTERNATIONAL BUSINESS MA-

CHINES CORP., Office Products Div., Franklin Lakes, N.J.

FOR DATA CIRCLE 333 ON READER CARD

PRINTER INTERFACE

The PRI printer interface card interfaces the vendor's microcomputers to dot-matrix and daisywheel printers. The card actually holds two interfaces: one, Centronics parallel for dot-matrix units, the other daisywheel parallel. The daisywheel interface includes ribbon lift and lower circuitry. The card, factory assembled, sells for \$195; cabling goes for \$15 in either 62cm or 110cm lengths. CROMEMCO, INC., Mountain View, Calif.

FOR DATA CIRCLE 334 ON READER CARD

DISK CONTROLLER

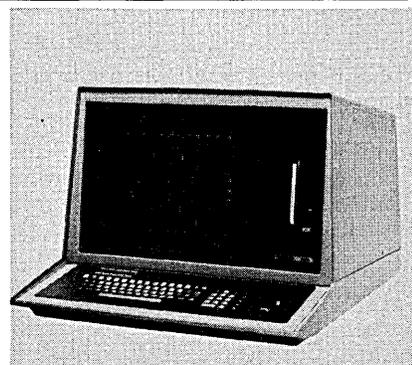
The SMC12, an intelligent single-board controller, interfaces Data General (and compatible) minicomputers to as many as four storage modules drives — in any mix — for a maximum subsystem capacity of 1,200MB. The controller has two buffers, allowing single-command contiguous sector transfers of up to 64KB. The controller's transfer rate goes up to 1.2MBps. RDOS, IRIS, and BLIS/COBOL compatible drivers can support the controller; a standalone diagnostic/formatter verifies the controller's functioning and flags bad disk sectors when a new pack is formatted. In quantity one, the SMC12 sells for \$3,580. MINICOMPUTER TECHNOLOGY, Palo Alto, Calif.

FOR DATA CIRCLE 335 ON READER CARD

HARDWARE SPOTLIGHT

DESKTOP GRAPHICS COMPUTERS

Late in 1975 this vendor announced its 4051 desktop computer (roughly the same shape as IBM's 5100 which was announced several weeks earlier) with graphics capabilities using the storage tube technology that makes the vendor's line of terminals so popular. Now, after three and a half years of loneliness, the 4051 has two new compatible relatives: the 4052, with an 11-inch screen, and the 4054, with a 19-inch screen. While all three are compatible with the same peripherals, the same dialect of graphics-enhanced BASIC, and the same data file formats, the two new family members use a microcoded 16-bit processor (four AMD 2901A bit-slices) instead of the 4051's 8-bit 6800. Depending on the program at hand, the new machines are said to be anywhere from four to 40 times faster than the 4051 (an "average program" should run seven to 10 times faster on the new units). The new units (and the 4051, for that matter) have integral tape drives (300KB per cartridge), direct view storage tube displays, and RS232 and IEEE-488 interfacing. The 4050 series crt screen have



the same resolution (points per inch); the bigger screen on the 4054 means more addressable points. The 4054's larger screen also allows it to display lines of up to 133 characters. The 4054 uses a vector character generator (the others use dot matrix characters) and provides four user selectable character sizes. The 4052 carries a price of \$9,800; the 4054 is \$16,500 (these prices are for entry level 32KB units). Lease, quantity discounts, and oem agreements are offered. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 329 ON READER CARD

MARK SCANNER

The educational field traditionally has been the major market for optical mark scanners, but this vendor says interest is growing in the commercial market. The vendor's Sentry 7003 scanner sounds appealing to both markets: it can operate on-line or off-line, reading one or both sides of a page at 900 pages per hour. And it's not only a reader: it can be programmed to tabulate results and to print on the documents as they pass through. In the on-line mode, the Sentry 7003 appears to the

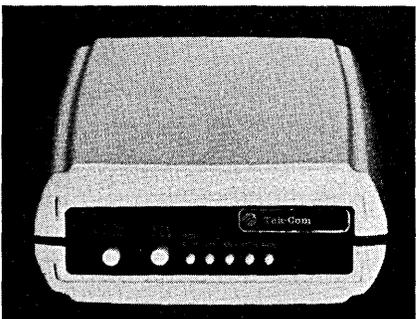


cpu as a 2780 or 3741; off-line it can prepare seven or nine track mag tapes at 800bpi or 1600bpi. The unit can handle forms ranging in size from 3½ X 7½ inches to 8½ X 12 inches. A "sheet compiler" is used to describe forms to the scanner. It defines fields to be scanned, output formats, edit checking, and if desired for grading, right answers and a grading formula. Scanner lease prices start at \$975 per month. NATIONAL COMPUTER SYSTEMS, Minneapolis, Minn.

FOR DATA CIRCLE 336 ON READER CARD

MODEM

The TC5001 modem operates asynchronously at speeds of up to 1200bps over two- or four-wire leased lines. The Bell 202C, D, and E compatible unit has RS232



interfacing and can operate in full- or half-duplex mode. Test functions and diagnostic indicators are built into the TC5001. The TC5001 sells for \$395, quantity one. TEK-COM, INC., Sunnyvale, Calif.

FOR DATA CIRCLE 337 ON READER CARD

GRAPHICS HARD COPY INTERFACE

Users of Tektronix 4000-series graphics terminals and 4050-series desktop computers can use this vendor's T-100G interface board to produce hard copies of a crt image. The interface connects the Tektronix crt or computer to either a Printronix P-300 impact printer or this vendor's modification of the P-300, the T-100. In use, an image is printed on standard 14½-inch fanfold paper, or, using a 90° rotation feature, on 8½ X 11 forms. It takes 40 seconds to copy a screen. On the T-100, the plot density is 100 dots per inch in each direction. The field instal-

lable interface sells for \$975. TRILOG, INC., Irvine, Calif.

FOR DATA CIRCLE 338 ON READER CARD

PET ADD-ONS

Tired of knocking your knuckles together entering a large program on your PET's small keyboard? Running out of memory for that large program? This vendor is trying to circumvent both of these problems with its full-size add-on keyboard, and 8KB, 16KB, and 24KB memory increments. The keyboard works in parallel with the PET's integral keyboard; its advantages are said to be its typewriter-size



It's already a big success!

The party's over for all dumb terminals and a lot of smart ones too. But, at \$698 (quantity 100), the party's just beginning for Intertec's InterTube II.

Standard features to celebrate include a full 24 line by 80 character display, 128 upper and lower case ASCII characters, reverse video, complete cursor addressing and control, an 18 key numeric keypad, special function keys, blinking, protected fields, character and line insert/delete, editing, eleven special graphics symbols, a 25th status line which displays the terminal operating mode and an RS-232 printer port.

You'll discover even more reasons to celebrate when you sit down in front of an InterTube II. Our wide bandwidth monitor produces crisp, sharp characters everywhere on the screen. InterTube's Z-80 processor enables a host of operator oriented features to boost the efficiency of both software and programmers. And, InterTube's rugged modular design combined with its built-in self-test mode insures quick and reliable servicing.

Join the thousands of InterTube celebrations going on around the country at this very moment. Call us at the number below and start your own celebration (BYOB—we'll bring the InterTube II).

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CIRCLE 134 ON READER CARD

HARDWARE

and its feel. While it generates all the characters available on the PET's keyboard, the add-on's key tops aren't labeled with the PET's graphic character set. The keyboard sells for \$125. The additional memory sells for \$250 for 8KB, \$450 for 16KB, and \$650 for 24KB. The keyboard and memory are said to be installable without tools, because they just plug into sockets. SKYLES ELECTRIC WORKS, Sunnyvale, Calif.

FOR DATA CIRCLE 339 ON READER CARD

WIDE DAISYWHEEL PRINTER

With as many as 316 characters stretched across a 26.2 inch line, this is one wide-bed printer. The 40cps metal daisywheel printer can put 264 10-pitch characters on a line, or the aforementioned 316 characters in 12-pitch. The unit, known as model 1380WB, shares many of its electronic and mechanical components with the vendor's existing line of HyType II word processing printers; the 1380WB uses the HyType II 12-bit parallel interface. The printer also can control both carriage position in 1/120-inch increments and paper movement in 1/48-inch units; horizontal and vertical positioning are bidirectional. In lots of 500, the 1380WB sells for \$2,235, including friction platen and RO cover set. DIABLO SYSTEMS, INC., Hayward, Calif.

FOR DATA CIRCLE 340 ON READER CARD

PORTABLE TERMINAL

The Execuport 4080, an 80-column portable send/receive terminal, can print the complete ASCII or APL character set at 10cps or 30cps. Microprocessor-controlled, the thermal printing terminal features an LED printhead position indicator, upper and lower case printing, a self-test routing, and horizontal tabs that can be set by the user or through a computer command. A Data Logger option allows



printing of control characters during trouble shooting or program checkout. The print mechanism is capable of limited plotting, with a resolution of 24 points per inch vertically and 10 horizontally. Subscripts, superscripts, underscores, and overscores can be printed; parity errors are identified by printing the bad characters a quarter step above the print line. The 4080 includes an integral acoustic

coupler, and is supplied with a snap-on carrying case cover. The terminal sells for \$2,395, including a one-year warranty. COMPUTER TRANSCIEVER SYSTEMS, INC., Paramus, N.J.

FOR DATA CIRCLE 342 ON READER CARD

WORD PROCESSING

Magna SL is this vendor's entree to shared-logic word processing. Systems range from a single workstation, printer and two diskettes, up to three workstations, three printers and seven diskettes. Existing Magna-series typewriters can function as workstation/printers; these typewriters can give the system compatibility with IBM-formatted magnetic cards. Magna SL's crt workstations can display an entire 8½ X 11-inch page, with the four edges of the paper, margins, tab stops, and special instructions. Unusual paper sizes, up to 16½-inches long and 16-inches wide, can be accommodated by scrolling. The standard display shows 66 lines of 102 characters; scrolling allows pages of up to 99 lines of 158 characters. Each crt workstation has its own diskette drive, and the cpu can have three archival drives in addition to its systems diskette. A workstation can process documents from any diskette, including a diskette in another terminal. The system can process text formatted into several columns per page in addition to

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CIRCLE 136 ON READER CARD



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Kraco Enterprises, Inc. is one of the country's largest manufacturers and distributors of automobile radios, CB radios, and accessories. To help service its thousands of customers worldwide, Kraco has installed a Series 21 distributed processing system from Mohawk Data Sciences. This compact, easy-to-use system not only handles order entry, billing, inventory control, and payroll at Kraco headquarters, but communicates as well with the mainframes of its distant customers.

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HARDWARE

correspondence-style documents. A two workstation Magna SL, with one daisy-wheel printer, sells for \$25,000; adding a third workstation brings the price up to \$33,000. A.B. DICK CO., Chicago, Ill.

FOR DATA CIRCLE 341 ON READER CARD

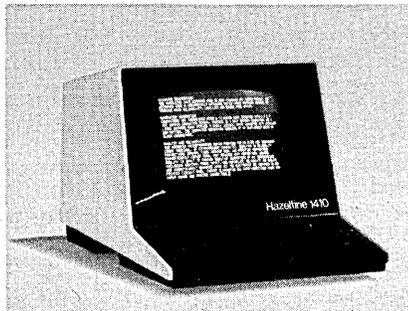
MICROCOMPUTER

This vendor's Mk-16 16-bit microcomputer is based on a proprietary processor used internally at General Electric for the last three years; GE is said to have an equity interest in this spin-off firm. The stack-oriented processor has a 16MB address space, 14 registers, 23 addressing modes, and writable control storage. It can perform operations on bytes, words, and double words; an addition is speeded at 960nsec, and a 16-bit multiply (yielding a 32-bit product) at 9.6usec. Pascal, an assembler, an editor, a monitor, and disk and cassette operating systems are available for use on the Mk-16; a cross-assembler, micro cross-assembler, and a simulator also support the Mk-16. Packaged in a Pascal development system (PDS-1), including crt terminal, 56KB processor, floppy diskette, monitor and Pascal P-code software, the system carries a \$12,500 price tag. MIKROS SYSTEMS CORP., Albany, N.Y.

FOR DATA CIRCLE 343 ON READER CARD

CRT TERMINAL

Intended for large end users and oem customers, this vendor's 1410 crt terminal adds to the existing 1400 terminal a numeric keypad and packaging patterned after the vendor's next large series. The 24 line by 80 column terminal has an



RS232 interface and eight switch-selectable operating speeds up to 9600bps. In annual quantities of 1,000, the 1410 sells for \$580; the terminals carry a two-year return-to-factory warranty. HAZELTINE CORP., Greenlawn, N.Y.

FOR DATA CIRCLE 344 ON READER CARD

ARRAY PROCESSOR

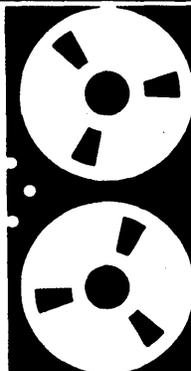
The MAP-200 and MAP-300 series are this vendor's "new generation" of floating-point array processors for use with 16-bit

and 32-bit minicomputers. The 32-bit programmable array processors have their own cpu's with supporting software, allowing host-independent I/O. The MAP systems can be field-expanded with additional memory, arithmetic units, and I/O boards. Shared memory multiple MAP systems can operate with a single host. The processors have three independent banks of memory, allowing three tasks to be processed in parallel; users can mix 500nsec, 300nsec, and 125nsec memory. A host-resident FORTRAN program can control the MAP. Typical systems sell in the \$30,000 range. CSP, INC., Burlington, Mass.

FOR DATA CIRCLE 346 ON READER CARD

WORD PROCESSING

This vendor's model 6000 is a desktop word processor designed for standalone operation or as an input station in a cluster sharing a common printer. The unit consists of a black-on-white crt display, keyboard with numeric pad, diskette drive, and text-editing software. Four 6000s (or larger 8000s) can share the vendor's Rotary V daisywheel printer. An asynchronous communications option (\$1,500) allows the word processor to communicate with other word processors and computers. Additionally, the 6000 is



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Their Applications

Munich, Germany/September 17-21, 1979

American manufacturers of computer equipment for business, industrial, and scientific applications are invited to join with the U.S. Department of Commerce in the fall of 1979 for one of Europe's major sales events in the flourishing European markets—SYSTEMS '79 seminar and exhibition. It is being held at the U.S. Pavilion, Munich Fairgrounds, Munich, West Germany.

The SYSTEMS exhibitions are internationally recognized as the key marketplace in Europe for the computer industry. Held biennially, this premier computer show regularly attracts Europe's largest audience of industry, scientific, government, and military customers. In 1977 22,000 visitors came to see SYSTEMS. These visitors represented 42 nations. EDP sales are expected to rise 18 percent from 1977 levels to \$4.3 billion by 1982.

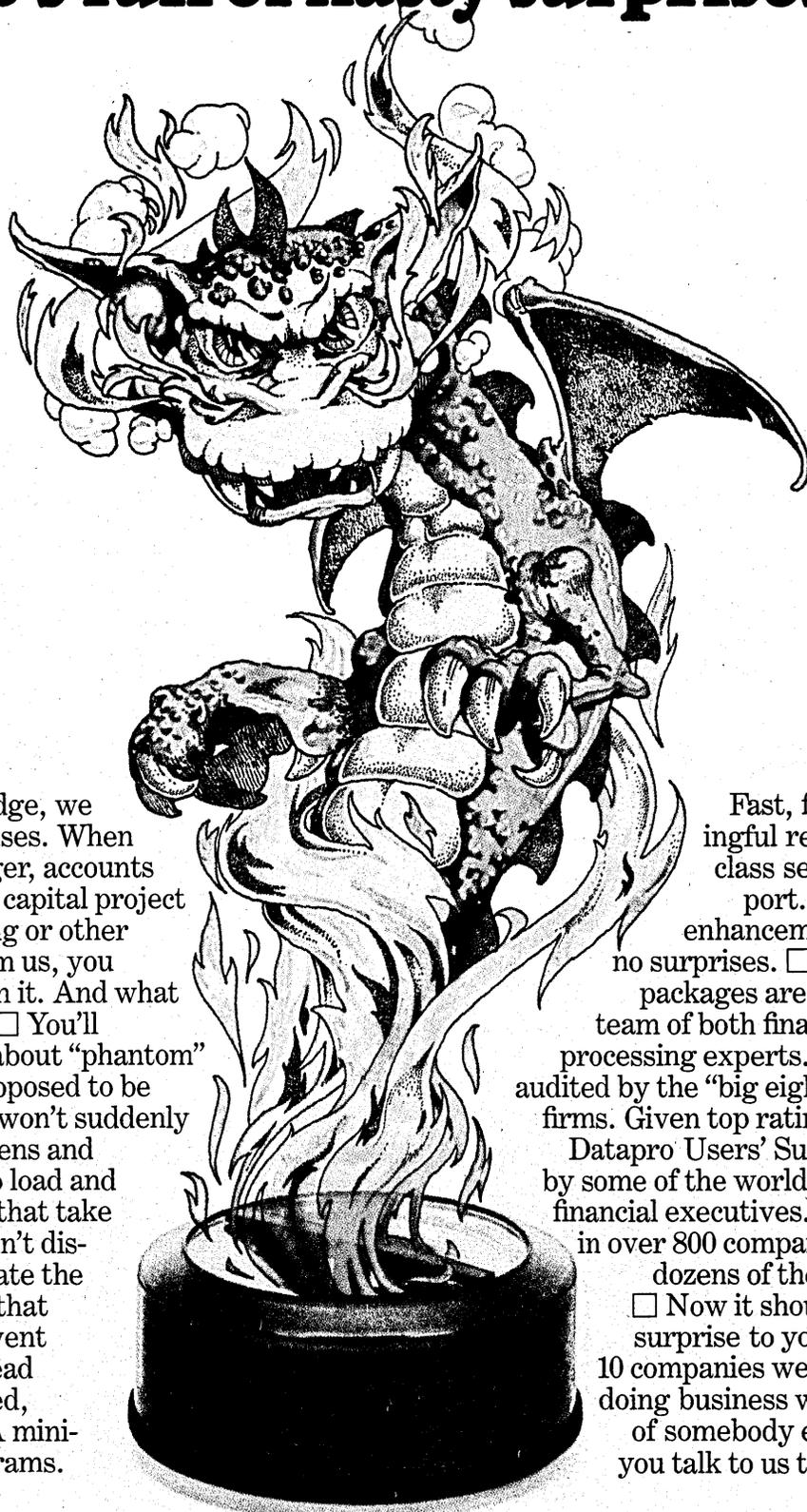
An early sellout of space is anticipated, so make plans to participate soon. This well-known export sales event will help U.S. companies maintain their position as principal suppliers of computer equipment to the German market.

For more information, call the Project Officer: Dwight I. Umstead; telephone 202/377-4414.



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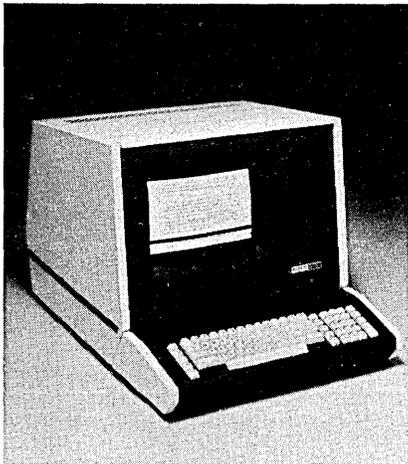
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CIRCLE 60 ON READER CARD

HARDWARE

media compatible with the vendor's existing 8000 product line. The system has basic text editing capabilities, including character, word, line, paragraph, and page insert/delete, automatic centering, justification, and automatic hyphenation. A program key simplifies repetitive tasks.



Pages may be up to 160 characters wide. The system also supports filing operations, with capabilities for sorting and selecting on multiple alphanumeric keys. The 6000 sells for \$6,990; deliveries begin this month. CPT CORP., Hopkins, Minn.

FOR DATA CIRCLE 345 ON READER CARD

WORD PROCESSING

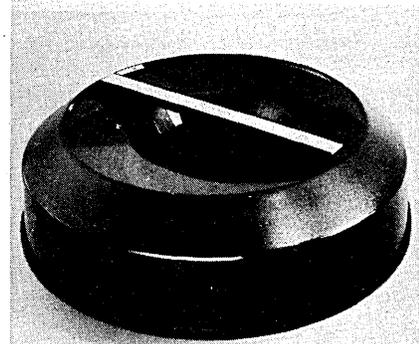
The Visual Type 3 (VT 3) shared-logic word processing system sports 66-line by 102-character displays with separate keyboards. Intended for users with medium to heavy text editing requirements, the VT 3 can support up to 10 displays and 10 printers. It can store as many as 2,400 pages of text which can be accessed from any attached work station. Characters can be displayed as either white-on-dark background, or reversed as dark characters on a white background. The display shows characters in an elite type style in either 10 or 12 pitch; the screen also can show proportional spacing and right justification. Operators can work on separate documents, or several operators can simultaneously prepare a long document. Six new software releases, for the VT 3 and most previous Visual Type systems, provide for sorting, recording system activity, automatic footnote formatting, automatic entry and verification of variable forms, and communications between other Visual Type systems and some computers. Options include direct output to photocomposition equipment, ocr input, and mag tape and disk storage for documents. A typical system with five workstations and two printers sells for \$89,500; the same system rents for \$3,320 per

month. XEROX BUSINESS SYSTEMS, Office Systems Operations, Dallas, Texas.

FOR DATA CIRCLE 349 ON READER CARD

DISK PACK

The 947/80 disk pack, available unformatted, can hold up to 81.4MB of data. Intended for use on a CalComp Trident T80 drive, the pack has 808 data tracks and seven alternates on each of its five

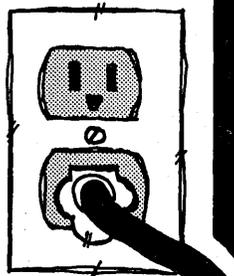


recording surfaces. The disk surfaces have a "Crashguard" protective coating, said to resist damage in the unfortunate event of a head hitting the surface. The 947/80 is priced at about \$400. 3M CO., St. Paul, Minn.

FOR DATA CIRCLE 347 ON READER CARD

*

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CIRCLE 122 ON READER CARD

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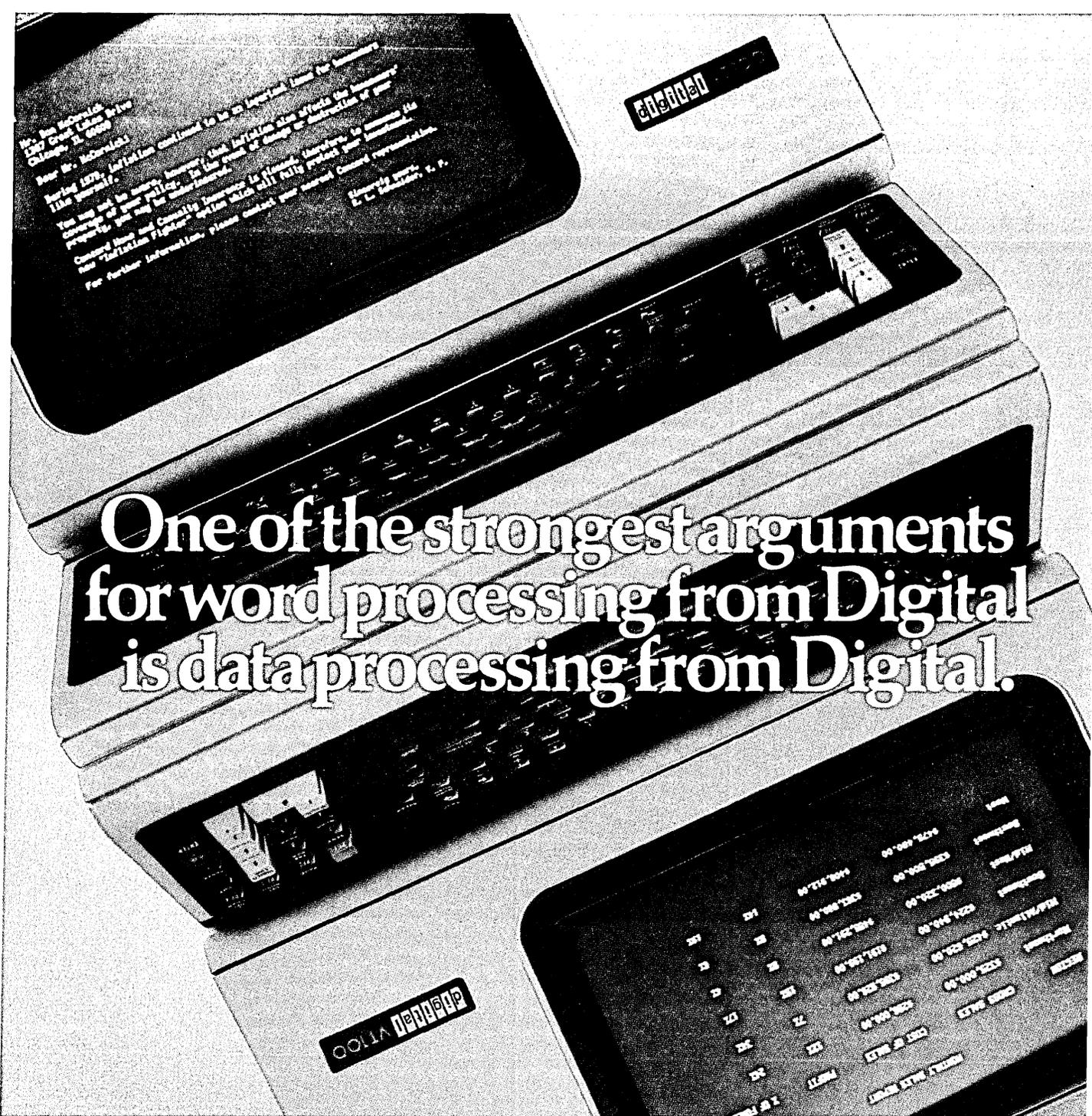
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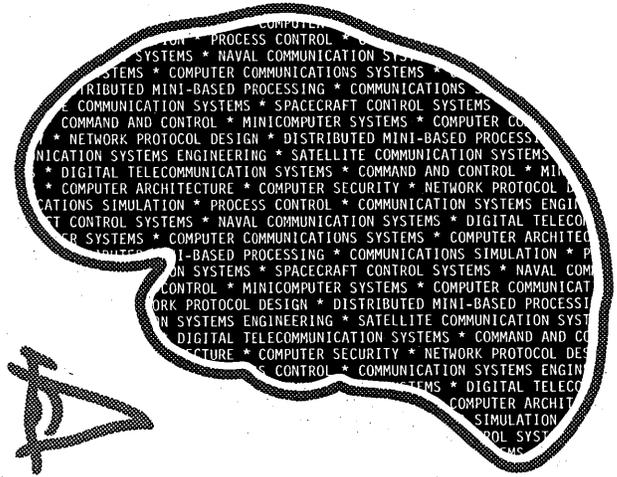
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SOFTWARE AND SERVICES

UPDATES

Whatever happened to structured programming? Not many installations picked up on the techniques and those that did report mixed results, according to Infotech International. "Beyond Structured Programming," Infotech's latest State-of-the-Art Conference, to be held in Atlanta the fourth week of this month, is said to present the latest advances in software development techniques. These advances owe a debt to structured programming, but they extend those concepts into systems analysis and design, data structuring, and software testing and maintenance. The conference, chaired by Les Belady of IBM's Yorktown Heights Research Center, has a \$785 fee; a follow-on tutorial, "Successful Software Management," is \$530; both can be had for the flat rate of \$1,200.

A Solar Energy Resource Atlas, being prepared for the Dept. of Energy by EG&G's Energy Measurements Group, will include data on solar radiation, weather, hazards to solar systems, and other pertinent statistics. The data base being used to compile the atlas consists of 23 years worth of records from roughly 250 weather stations throughout the country; most of the data reduction will be done on the central computer at DOE's Nevada Operations Office. Publication is scheduled for early next year.

Innova Systems, a New York software house, is reportedly working on a memory management system with a 32-bit addressing space. The system, rumored to be called Innova-Heap, will be for M6800 microcomputers.

MICROPROCESSOR UTILITY

What started out to be a useful dump utility for use with this vendor's Innova-Stak (see November 1978, p. 200) has grown into a much more widely appealing dump utility for 6800-based microcomputers. While developing Innova-Sdump, a product for dumping the contents of an Innova-Stak maintained stack, the vendor used a generalized snapshot dump. After the package was completed, the vendor recognized the snapshot as a helpful tool, and incorporated it within the package. When used with Innova-Stak, Sdump can provide dumps of the entire stack from the top down, or the current frame. If the utility is asked to dump the entire stack, and has the misfortune of finding the top frame destroyed, the package will try to dump from the bottom of the stack on up. Macros supplied with the package can provide a calling trace during the debugging phase; the trace can be eliminated without reassembling application code. Two new versions of the stack utility were announced concurrently with the dump utility. Innova-Stak 1.0, optimized for production programs, has all error checking removed to reduce its execution time and memory requirements. Innova-Stak 1.2 builds on the initial version announced in November by providing an automatic dump whenever an error is detected. The vendor licenses its software for a term of 49 years. Innova-Sdump goes for \$50; each version of the Innova-Stak goes for \$35 (or all three for \$95). Users outside the U.S. and Canada can expect to pay an additional \$5 on each license. INNOVA SYSTEMS INC., New York, N.Y.

FOR DATA CIRCLE 301 ON READER CARD

MANUFACTURING DBMS

Users of this vendor's Data Pathing source data management systems are now offered a pair of data base management packages said to provide capabilities (previously available at a central host) at the front-end processor level. The two packages are Relational Data Management (RDM) and Basic Data Management (BDM), a subset of RDM. The packages allow the design, implementation, and modification of data bases used by manufacturing control systems. Used with a Data Pathing System 150 processor(s) BDM and RDM can reside in a model 154 Disk

Processor. As many as four 150 processors can share a 154-resident data base. The two packages support data structures appropriate for handling basic manpower, material, and production data. BDM and RDM offer three access methods (sequential, direct, and random) and two physical organizations (random, and linear or circular sequential). Partially inverted files and multikey retrieval are supported by the relational data features of RDM. Available for installation in the second quarter of this year, BDM carries a monthly license fee of \$100 and RDM \$500. One-time license fees are \$3,000 and \$15,000, respectively. NCR CORP., Dayton, Ohio.

FOR DATA CIRCLE 302 ON READER CARD

PDP-11 SORT

Speedsort/11 for PDP-11s running IAS, RSX-11D, or RSX-11M, can be invoked through a user command, or optionally through a call from a FORTRAN program. Speedsort can accommodate as many as 15 sort keys; keys can be 16- or 32-bit integers, single- or double-precision floating point numbers, and unsigned bytes or 16-bit words. Compatible with all file types supported by DEC's File Control Services (FCS), Speedsort can handle fixed or variable records, and spanned or unspanned blocks. The user can select the disk to be used for workspace: a second disk can be selected to reduce disk arm contention, or a disk may be selected because it temporarily has sufficient free space. Command files are supported. Speedsort has a verify mode that allows the user to specify sort keys and then verifies the file is sorted. Speedsort/11 rents for \$600 per year; the FORTRAN call interface is an additional \$100 per year. Multiple cpu discounts are offered. PENNINGTON SYSTEMS INC., Pennington, N.J.

FOR DATA CIRCLE 303 ON READER CARD

INSTRUCTIONAL LANGUAGE

Pilot, a computer aided instruction language that has been generating interest among small systems users for the last five or so years, has been implemented on Commodore's PET personal computer. Dubbed Petpilot, the package includes the language processor, an editor, and optionally, a four-hour tutorial on Pilot pro-

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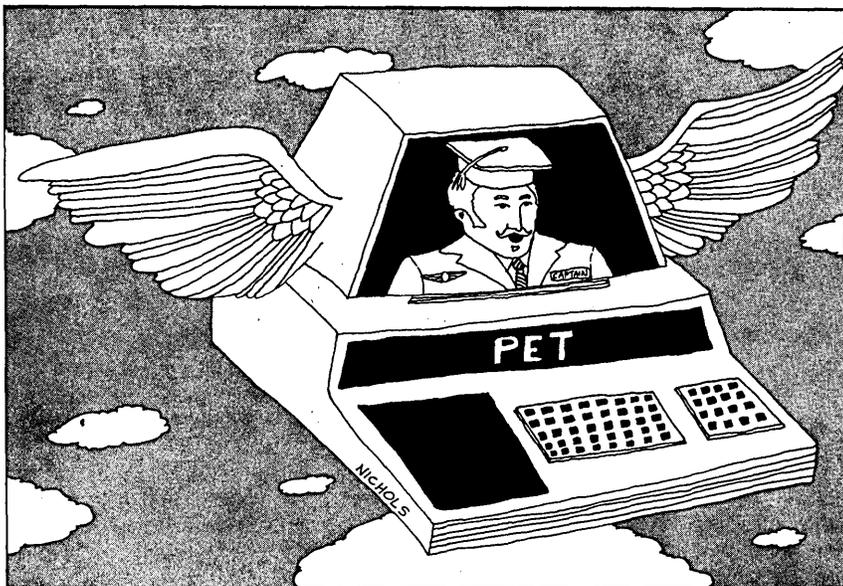
IMS users such as *American Airlines, Dow Chemical, TWA, American Can, The Hartford, Union Carbide;* and TOTAL users like *Combustion Engineering, Northwestern Mutual Life, Anheuser-Busch, Corning Glass Works, Eli Lilly and Holiday Inns* are a few who agree ASI-ST and data base belong together. In addition, ASI-ST provides an unequalled return on investment by maximizing the productivity of both man and machine. Since ASI-ST fully supports conventional data files as well as complex data bases, these benefits are not restricted to IMS and TOTAL users. To obtain more information contact:



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SOFTWARE AND SERVICES



gramming. Pilot allows presentation of instructional dialogs, questioning of the user, evaluation of the user's answers, and appropriate branching. Additionally, Petpilot allows full access to the PET's BASIC interpreter via a COMPUTE statement. Petpilot will run on a stock PET, using the personal computer's built-in tape drive. Any Petpilot program is said to run on such a system, although creation of large

programs may require a second tape unit. The vendor also notes that since the PET can only move tape forward, there are limits on how far back a program can jump. Licensed on a per-PET basis, Petpilot goes for \$12, including sample program, teacher's guide, and reference card. The tutorial is an extra \$8. DAVE GOMBERG, San Francisco, Calif.

FOR DATA CIRCLE 304 ON READER CARD

MICROCOMPUTER BASIC

For users of M6800-based microcomputers and this vendor's LFD-400 or LFD-1000 minifloppy diskette systems, Super BASIC is an upward compatible enhanced version of SWTP8K BASIC. Super BASIC needs 12KB of memory and is compatible with SWTP BASIC (versions 2.0, 2.2, and 2.3). In addition to extending the language, this vendor says its BASIC runs 35% to 40% faster than the SWTP version. Super BASIC supports direct, random access files, and, when used with the vendor's miniDOS, named disk files and batch processing capabilities. Nine-digit BCD arithmetic is included for commercial applications. Super BASIC includes a PRINT USING statement for formatted output, BASE for subscripting from 0 or 1, and STRING to control the length of strings up to 127 characters. The language implementation includes 31 functions, among which are BUFR which allows PEEKing and POKEing into file buffers; VARPTR, which returns the address of a variable (numeric or string), and PI, which yields the value of pi to eight decimal places. Supplied on minidiskette, with user manual, Super BASIC sells for \$49.95. PERCOM DATA CO., Garland, Texas.

FOR DATA CIRCLE 308 ON READER CARD

WORD PROCESSING

Written in Business BASIC for 64KB Data General Novas under DOS, RDOS, and

soon AOS, Word Power provides word processing capabilities from a model 6053 crt terminal. Document size is limited only by available disk space; Word Power can merge data from address lists with form letters for repetitive mailings. Features include scroll forward and backward, character and line insert/delete, and cut and paste operations. Visible tab stops and alignment for preprinted forms on an associated daisywheel printer are also supported. Centering, underlining, mar-

SOFTWARE SPOTLIGHT

MICRO PROGRAM DEVELOPMENT

MicroSim, a PDP-11-based microcomputer program development system, allows the user to edit, assemble, load, and simulate the execution of assembly language programs targeted at Intel 8080s, 8085s, and Zilog Z80s. Versions for other microprocessors reportedly are under development. Using MicroSim's editor, users enter programs in their target micro's assembler mnemonics. As each line is entered, MicroSim checks for syntax errors and then assembles the line into object code. After an error-free assembly, the user need only type RUN to load and simulate the execution of his program. The package recognizes the difference between instructions, data, and addresses, keeping object code separate from data

and addresses. The system detects errors, such as jumping into data, halts the program, and issues an error message to the user. An additional feature of the simulator is an internal clock which counts exactly how many microprocessor cycles the program will use when actually loaded into its target microprocessor. MicroSim runs in 28K words under all DEC PDP-11 operating systems; an LSI-11 version is said to be near completion. A perpetual lease goes for \$5,900 for the 8080 and 8085 versions, and \$6,900 for the Z80. The code common between versions of MicroSim represents \$4,000 of the price. Rental plans are offered. THE DIGITAL PRODUCTS GROUP, Menlo Park, Calif.

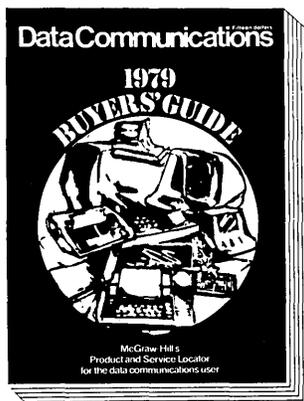
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RESOURCE MONITOR

RECAP (Resource Collection and Plot) provides this vendor's large-scale systems users with the capabilities to monitor, record, and analyze the use of system resources; the package runs under GCOS (releases 4/J and 4/JS) on Series 60, Level 66, Level 66/dps, and Series 6000 mainframes. Data collected by the system can be printed as detailed reports or bar graphs showing 16 categories of usage. RECAP can help users plan daily operations to smooth resource utilization, collect data for analysis of system operations, develop historical records, and detect heavy demand for specific resources. RECAP uses a 2KB privileged slave program (COLL) to collect operational data and post it to a statistical collection file every 30 seconds. A second program preprocesses this file, then a data analysis and reduction program analyzes the data, produces a printout, and prepares the data for processing by the plot preparation program. A plot print program completes the RECAP package; it produces a bar graph for each 15-minute slice of a day's operations. RECAP can produce a wide variety of bar graphs, including those illustrating memory usage of slave jobs, mass storage channel use, tape drive usage, jobs waiting for memory, usage of processor time allocated to time-sharing, mass storage use, and the number of active jobs held in the system scheduler queue. RE-

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DISK UTILITY

A VTOC service utility, VSERV, provides DOS and DOS/VS installations with a means to identify poorly used disk space and manipulate VTOC's. A graphic disk mapping facility shows data areas and free spaces in extent order; it also provides summaries and statistics on data set usage, free space, and alternate tracks. Manipulation commands allow users to create, delete, update, or rename files; commands also are available to truncate ISAM or sequential files. VSERV also can move VTOC's. Available with a 30-day free trial, VSERV sells for \$500. SOFTWARE ASSISTANCE, Santa Clara, Calif.

FOR DATA CIRCLE 315 ON READER CARD

JOBLIB ANALYZER

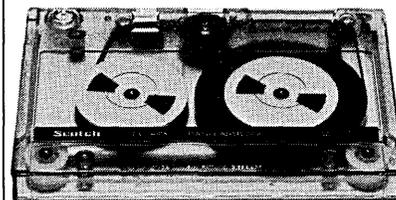
Job/Analysis runs under any version of OS and provides reports cross-referencing data between JOBLIB's and PROCLIB's. Extracting information for JOBLIB's, the package provides a cross-reference of JOB's and PROC's, details of JOB errors, statistics on the number of PROC's per JOB, and listings of JOBLIB members with all DD statement overrides. Job/Analysis uses the PROCLIB(s) so it can print a PROC listing with symbolic resolution (including DD overrides), data set cross-references, a program and STEP within program cross-reference, and a cross-referenced report of SYSOUT CLASS-FORM #s. Users can select individual JOB's or entire JOBLIB's for processing, as well as specifying individual reports and items within reports for printing. The package also can have IMS/VS features allowing cross-referencing PSD/DBD's and real program names. The package is offered on a perpetual license, priced from \$1,500 to \$5,500, depending on options selected. CHICAGO DATA SYSTEMS, INC., Oak Brook, Ill.

FOR DATA CIRCLE 306 ON READER CARD

PERFORMANCE MONITORING

To support its customers using Dynaprobe computer performance monitoring systems attached to 360s and 370s, this vendor has developed software called the Performance Data Base. The software complements the vendor's existing reporting package, Dynapar, and is said to be particularly useful in reporting over long periods of monitoring. Performance Data Base summarizes, stores, and reports on data collected by Dynaprobe systems. The package runs under OS/VS or MVS and occupies roughly 280KB; it's available

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package runs on 16KB Level II TRS-80's. That price (plus sales tax if ordered with-in California) gets the software, documentation, and a subscription to a monthly newsletter. THE PROGRAMMING SHOP, Palo Alto, Calif.

FOR DATA CIRCLE 311 ON READER CARD

PROJECT CONTROL

Combining interactive computing with PERT/CPM time, cost, and resource calculations, Readinet is a project control tool for users of Data General Novas and look-alike processors such as this vendor's own Point 4 minicomputer. Said to be "ideally suited to the construction industry and large manufacturing projects," the package is operated from a crt terminal with printed reports available on demand. Projects processed by Readinet can have any number of activities and events, limited only by available disk space. Project work weeks can be five, six, or seven days, selected at the beginning of the run, and an unlimited number of holidays can be specified. Any event in the network can have a schedule date assigned; multiple starts and finishes are allowed. Ending events can float. Each resource type can have its own cost, and as many as 16 resources can be assigned to any activity. Costs not linked to resources, such as materials and rentals, also can be assigned to

activities. Progress reports show the percentage of completion per activity or the activity's completion date (if completed). Time card data and real costs can be reported with an optional module. Readinet's report menu contains up to nine offerings; additionally, ad hoc reports, bar charts, and resource allocation/finance reports can be generated. Managers also can interrogate (via an optional module) the network data base, searching for activities or events satisfying various conditions. Written in Business BASIC under the vendor's IRIS operating system, Readinet goes for \$2,900 in its basic version; quantity discounts are offered. EDUCATIONAL DATA SYSTEMS, Irvine, Calif.

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ON-LINE PERSONNEL MANAGEMENT

This vendor's on-line Personnel Management System (PMS) handles personnel and benefits functions. The system maintains employee profiles, including skills inventory, work experience, education, compensation, organization history, and personnel status. Employee histories are added to during the update process; when querying by employee name, the system is said to accept phonetic spellings. Eligibility screening for benefits plan enrollments, and production of certificates of coverage, are a part of PMS's benefits capabilities, as

are reports for insurance carriers, on-line verification of coverage, and production of files for input to other systems, such as payroll. Prepackaged reports are available from the system, but the vendor encourages user-defined reporting through a report query language. PMS runs under CICS or the vendor's Magic on-line monitor. The system is written for 360s and 370s operating under OS MFT or MVS. PMS is offered on a perpetual license or on a transaction (monthly fee per employee) basis. License fees range from \$65,000 to \$150,000; transaction fees vary by number of employees. TESSERACT CORP., San Francisco, Calif.

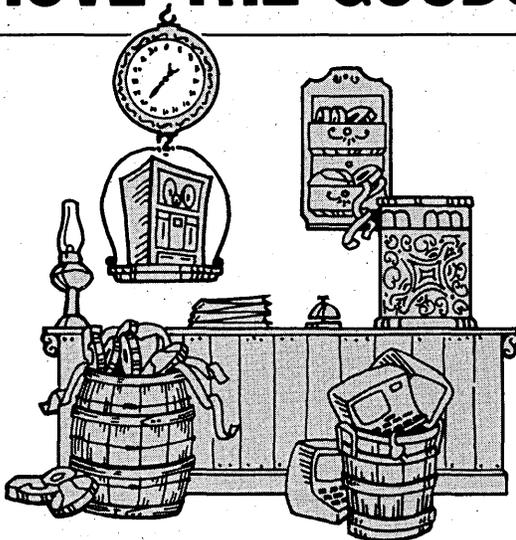
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MICRO FILE CONVERSION

A program written for Intel MDS systems running ISIS-II can translate data files from ISIS format to CP/M format, and vice versa. The \$150 program accepts both double and single density diskettes. The program simply translates binary data files from one format to the other, so an object code file conversion would come through with its native operating system dependencies, ruling out direct conversion of compiled programs. The program, packaged on single or double density ISIS-II diskette, sells for \$150. XENER CORP., Springfield, Va. *

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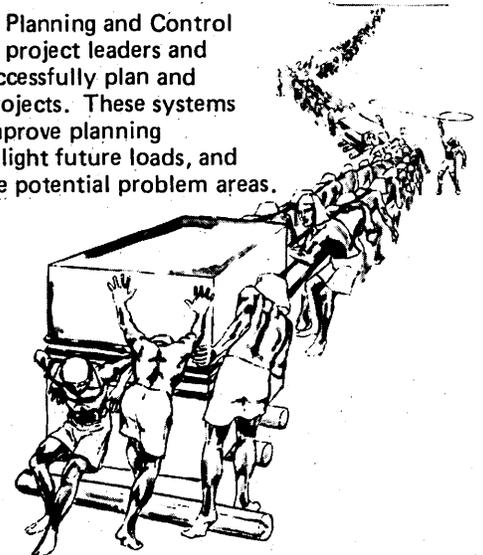
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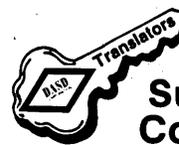
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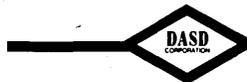


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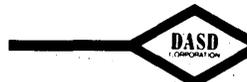


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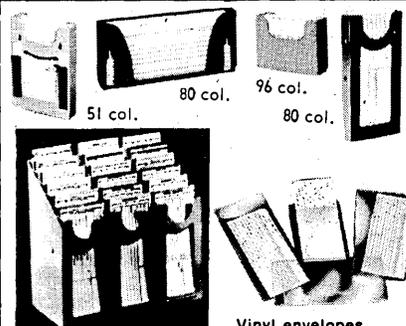
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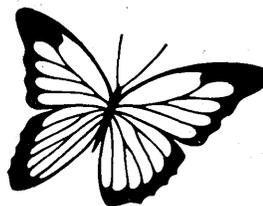
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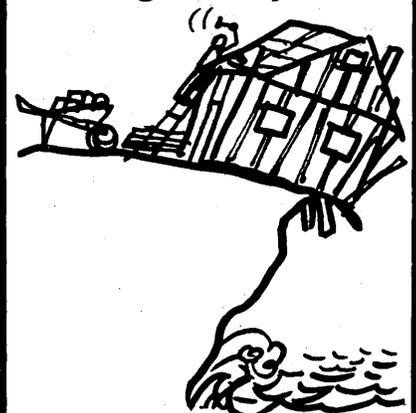


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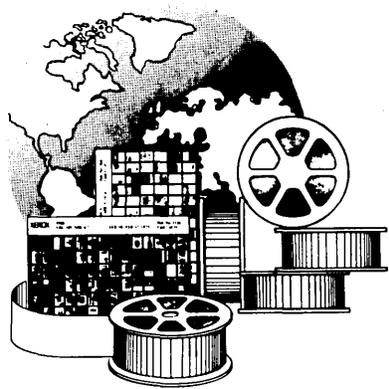
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COMPUTER PROGRAMMERS with at least two years experience in scientific applications are invited to apply for a position as Research Assistant Unclassified with the Climatic Research Institute of Oregon State University. Duties will include working with geophysical fluid dynamics models of the atmosphere and oceans with emphasis on large data bases on a variety of fourth and fifth generation computers. Requires at minimum a B.S. degree in computer science, math or physics. Starting salary \$12,000 to \$16,000 depending on previous experience. Application deadline is 1 May 1979, with duties beginning approximately 1 June 1979. Please send resumes including names, addresses and telephone numbers of two references to: Robert L. Mobley, Director of Computations, Climatic Research Institute, Oregon State University, Corvallis, Oregon 97331.

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CIRCLE 197 ON READER CARD

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ENGINEERS**

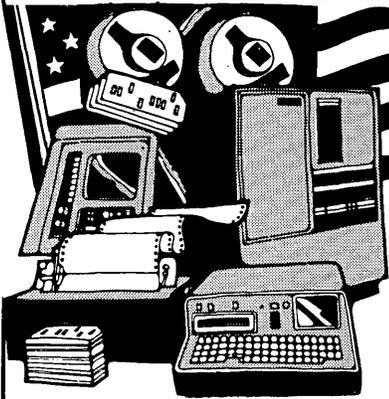
with systems programming/software dev exp IBM OS systems or minicomputer assembly language sought by quality energy, mfg, systems & consulting cos. Software, hardware & real time applications opptys. \$18-29,000 SW, SE, W & NE.

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SCIENCE/SCOPE

The Marine Corps' A4-M Skyhawk attack plane will be more accurate on bombing runs, even at long range, thanks to a system that computes exactly when weapons should be released for a bull's-eye. In making its calculations, the Hughes-developed Angle Rate Bombing System (ARBS) considers such factors as bomb ballistics, line-of-sight angle to the target, airspeed, and aircraft flight angle. Bombs and air-to-ground rockets can be released automatically or manually at the pilot's option.

ARBS has two ways to acquire and track a target. In daylight the pilot can select the TV sensor to locate a target visually and lock on the tracker. During the day or at night he can use the laser spot tracker, which automatically locks on a target that is illuminated by either a ground or airborne laser.

Neither darkness, smoke, nor haze will deter a new imaging infrared missile seeker from picking out targets on the ground. The sensor, by detecting very small differences in heat radiated by objects, produces TV-like imagery on a cockpit display so the pilot or crew member can lock on the target. After the missile has been fired, the pilot is free to engage a second target or take evasive action while the missile homes on the first target. Developed by Hughes under a joint Air Force/Navy program, the seeker has been flight-tested in the U.S. Air Force Maverick air-to-ground missile and the U.S. Navy Walleye glide weapon. It also is compatible with the Air Force GBU-15 glide bomb.

The Manufacturing Division of Hughes Missile Systems Group in Tucson has many immediate openings for engineers. These career opportunities require expertise in designing test equipment for advanced major electronic and missile system programs. Typical openings range from digital logic, analog, and IF/RF circuit design to electro-optical and IR system design. Also needed are industrial engineers and manufacturing production engineers for designing, developing, and producing complex missile and electronic systems. For immediate consideration, send resume to Roy McCalla, Hughes Aircraft Company, P.O. Box 11337, Tucson, AZ 85734. Or call (602) 294-5211, Ext. 5484.

The U.S. Navy has awarded a Hughes subsidiary a contract to build and operate a worldwide satellite communications system. The system, known as LEASAT, will consist of four satellites and ground equipment supplied by Hughes. It will augment the Navy's fleet communications network and improve the Defense Department's ability to send and receive messages from ships at sea. LEASAT also will be used by ground units of the Army, Air Force, and Marine Corps. The first satellite will be launched from the Space Shuttle in 1982. When all four satellites are on station, the Navy will lease the system for at least five years from Hughes Communication Services, Inc.

Creating a new world with electronics



SOURCE DATA

BOOKS

THE POWER OF PEONAGE by Robert L. Glass

The author offers 21 short tales—either cautionary or exemplary, depending on your point of view—of how lowly programming grunts have undermined or overthrown technical management. The stories are grouped under these headings: Power for Fun, The Power of Evil, Power for Profit, Power for Principle, and Power for Expedience (Getting the Job Done in Spite of Direction).

The dastardly deeds range from simple-minded, harmless practical jokes through mutiny to “hijacking” a time-shared computer to show up a boss who wants to replace it with a less powerful and efficient one from “Marketronics,” or You Know Who.

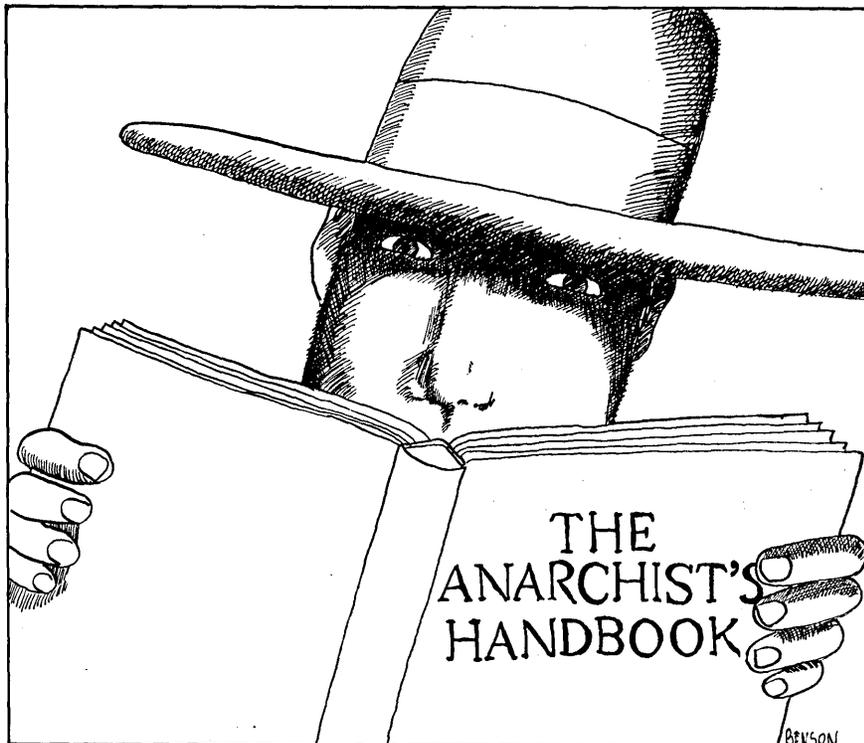
One of the mutinies leads to a mere burning of flowcharting templates. Another results in the ousting of a dp center manager who thinks a pet research project has priority over payroll.

The book will make a lot of dp managers mad. But it's an important book, because it is a true “underground” book that shows the management problem as viewed from below. And because it deals with critical ethical questions.

The book is also uneven. Some of the stories aren't terribly interesting. And the motivation of some of these trouble-makers is not made clear. We're not always told enough about what it is that management has done to deserve these tricks. But mostly the managers are technically obsolete, insensitive, crudely authoritarian . . . or All of the Above.

The main message to dp management seems to be not to become technically obsolete. They can also read the book to learn how their underlings can sabotage them. The message to programming peons is less clear, but for some of them, this will read like an anarchist's handbook.

Mr. Glass has an obvious antimanagement bias. He “loves” the idea that management disinterest “in the details of computing technology can be used in potent ways against them.” But I suspect that his bias was won honestly and bitterly. One of the standard, legitimate complaints in our industry is that we take



our brightest technical people, wave a wand, and proclaim them Managers. There is a shocking paucity of good dp management training.

I'd like to see the book made required reading in courses that examine the ethics of programming and technical management.

Now that I think about it, the only educators I know of who deal with ethical problems are Jerry Weinberg's Technical Leadership Workshop crew at Ethnotech. Maybe it's time for ethics to take its place in the curricula of our formal and infor-

mal dp schools.

Whether you're interested in ethics or not, you really ought to read this book. It helps to explain what motivates technically competent programmers, both positively and negatively. It gives us some insight into why some projects fail (the subject of another book by Mr. Glass). And it suggests that a lot of good programming talent is being wasted by atrocious management. *Computing Trends* (1979, 101 pp., \$8.95).

—Bob Forest

COMPUTER FAILURE AND ENERGY SHORTAGES by Henry H. Petersohn

This volume is a reasonably detailed look at power related computer failures and what to do about them.

There is enough elementary level electrical engineering included for the reader to feel confident in dealing with

the mysteries of electric power. The presentation discriminates clearly between transients, brownouts and blackouts, and the solutions usually suggested: voltage regulators, motor generator sets and UPS. There is an excellent model of how to analyze the problems and develop a workable solution. The cost/benefit study is given in some detail.

Petersohn also suggests how to

"sell" the solution to management as well as telling management how to look at the proposed alternatives.

It is perhaps a minor flaw, but a listing of some typical vendors might have been included. This aside, the book is highly recommended for edp and operations management if they are being plagued with inexplicable failures at seemingly random intervals. Check your power (the book tells how) and follow Petersohn's model solution. The Technology Press (1979, 192 pp., \$25).

—Phil Dorn

SOFTWARE RELIABILITY: A STUDY OF LARGE PROJECT REALITY

by Thomas A. Thayer, Myron Lipow and Eldred C. Nelson

This book is the compilation of the results of carefully kept control measurements of

several programming projects, and as such is valuable to project managers for planning and comparison purposes. However, its effectiveness is limited to use as a case study, because the data being collected was allowed to dictate the study parameters. The result is that this book is an attempt at quantitative analysis which skirts academic discipline and allows the data to spoil the investigative goals. As explained in Chapter 3, the parameters were established by analyzing a large set of "problem reports," written by untrained and uncontrolled operations staff. In Chapter 7 it is directly stated that the authors' primary goal was the collection of data. Combining the two to formulate a "reliability" classification only achieves a classification to the perceptions of the authors of the problem reports. North-Holland Publishing Co. (1978, 311 pp., \$40).

—Earl Crabb

The report is \$25. Faim Technical Products, Inc., Box 1013, Melville, NY 11746 (704) 364-7960.

PACKET SWITCHING

According to Logica's report on packet switching, private circuits are less expensive for the user with large volumes of data to be sent, while the traditional telephone network remains cheaper for light usage. It is said that packet switching does save money for those with networks with medium traffic volumes, especially where fast response times and short transaction lengths are common.

The report has three major sections. The first section is on technology, and discusses the need for and alternatives to packet switching, interfacing terminals and hosts to a packet-switching network, and performance, security and privacy. The section on costs and applica-

REPORTS AND REFERENCES

SMALL BUSINESS SYSTEM SELECTION

Computer Guides, a British firm, offers an unusually clear and detailed guide to small business systems geared to new and/or nontechnical users. While the suppliers listed are all U.K. firms, there is enough practical advice about the equipment and its business uses that the report will almost certainly be of interest to those not in the U.K. as well.

The introduction includes a brief history of the evolution of small business systems, details components, and describes a (hypothetical) typical day's small business processing. There are eight pages of specific suggestions about how to choose a small business system, followed by a seven-page example of a purchase specification. Included in the selection suggestions are many questions addressing significant variables to ask of the potential suppliers.

The first table in the system guide is called Confidence in Supplier, and includes figures on staff employed on small business systems, processor manufacturer, number of systems installed (worldwide and in the U.K.), number of systems on order (in the U.K.) and year of first delivery (in the U.K.). The other tables cover support, cost of acquisition, ease of use/cost of developing systems (addressed by a table comparing intended use of system and a table comparing languages and packages), on-line facilities, and upgrading/compatibility (addressed by charts showing processors and storage, peripherals, and terminals, and alternative sources of processors). Each of these categories is preceded by an interpretation of the data presented including sensible assessments of necessary supplemental information.

There are also short articles about how to choose and use a consultant, "simple" data communications, future developments, and two case studies in selection and installation.

This is the first report we have seen with ads in it. While this might annoy some people, it seems worthwhile, as the concise, in-depth report is available at the relatively low price of \$55, including air mail postage.

A similar guide on word processing systems is available at the same price. Computer Guides, Ltd., 2 Duncan Terrace, London, N1 England 01-278-9517.

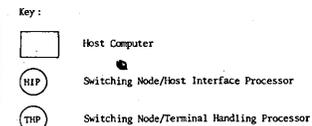
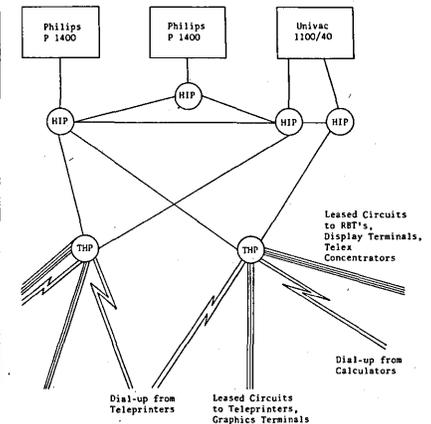
DESIGN LANGUAGE

Faim publishes a series called Current Technology Reports, each consisting of the text of a speech and of subsequent questions and answers.

Vol. V, No. 8 in the series features Mr. Marvin Rubenstein, systems specialist at The Chase Manhattan Bank, telling about the design language/methodology they use called PSL/PSA (Problem Statement Language/Problem Statement Analyzer).

Developed at the Univ. of Michigan, PSL/PSA is also in use at AT&T, where Mr. Rubenstein predicts it will become "the standard for developing systems."

"PSL/PSA runs on several different IBM machines, on Burroughs equipment, and on DEC minis such as the PDP 11/70. . . It occupies a large segment of core, and requires dedication of some in-house support to run," Mr. Rubenstein says, and likens it to installing a data base management system. The methodology is similar to IBM's Business Development Language, he says, which "will probably become their working tool within the next four or five years."



tions discusses network costs, user costs, tariffs, and a comparison of services; three pages of discussion about applications, and four case studies—Citinet, British Steel Corp., American Management Systems, and CNET (a figure from this case study is shown). There is also a brief discussion of future developments in packet switching. The final section is a survey of public packet-switching networks in the U.S., Canada, Europe, Belgium, France, the Federal Republic of Germany, the Netherlands, Scandinavia, Spain, the U.K., and Japan, \$250. Logica, Inc. 801 Second Ave., New York, NY 10017 (212) 697-2366.

MARKETING DIRECTORY

A directory of computer dealers, agents, houses, retailers, third parties and distributors is available as a cross-referenced volume—listed by geography, name, or category—or as mailing labels. The Computer Marketers Directory is \$80, addi-

REPORTS AND REFERENCES

tional copies \$40; mailing labels range from \$100 to \$150 (depending on the kind of label and whether you want them categorized). MV Publishing, Inc., 1000 Quail, Suite 120, Newport Beach, CA 92660.

VENDOR LITERATURE

MICROCOMPUTER HANDBOOK

The Series/80 Databook describes, with photographs, conceptual diagrams, and prose, six board level computers, three rack-mounted systems, and three prototyping systems, all based on the popular 8080A microprocessor. Memory boards, I/O expansion boards, analog I/O boards, peripheral controllers, chassis, and power supplies, more than 30 in all, are included in the book. Additionally, the book describes the vendor's Starplex development system, in both its hardware and software. Appendices cover the 8080A's instruction set and I/O control

parameters. NATIONAL SEMICONDUCTOR CORP., Santa Clara, Calif.

FOR DATA CIRCLE 317 ON READER CARD

POS TERMINAL

The RS-6052 point of sale terminal, designed for use in specialty retail stores, is described in a four-page, illustrated brochure. The brochure explains how the 6052 captures data on magnetic tape cartridges, how it can maintain more than 40 programmable control, department, and clerk totals, how it can read OCR-A, bar codes, and credit cards, and how it can compute extension and sales taxes. The 6052's operation and modular construction also are covered. Quality assurance, support, and service conclude the presentation. DATAROL, INC., Hudson, Mass.

FOR DATA CIRCLE 318 ON READER CARD

WORD PROCESSING SUPPLIES

A six-page, four-color foldout flier describes word processing supplies this vendor offers for use with a wide variety of

word processing systems. Ribbons and erasing tapes, as well as magnetic media are detailed in tables with specifications and packaging information. Prose descriptions and tables cross-referencing media with specific word processing systems round out the brochure. NASHUA CORP., Nashua, N.H.

FOR DATA CIRCLE 319 ON READER CARD

TERMINAL

The PT-80 modular electronic teleprinter is described in this six-page brochure illustrated with color photographs. To illustrate the terminal's modular construction, it is shown without its enclosure; the reader sees a number of printed circuit boards and mechanisms interconnected by ribbon cables. The brochure explains interfacing compatibility, print quality, and type fonts. The company and its service also are covered. The back page contains a list of regional sales offices and their phone numbers. SIEMENS CORP., Data Communications Div., Iselin, N.J.

FOR DATA CIRCLE 320 ON READER CARD

FINITE ELEMENT MODELING

Modeling lock bayonet provides a case study in the use of this vendor's interactive modeler. The modeler helps users prepare models for subsequent processing on a mainframe. The illustrated booklet covers problem definition, model construction, and a comparison between using this vendor's system and preparing the same model manually. A directory of U.S. and international sales offices is included. APPLICON INC., Burlington, Mass.

FOR DATA CIRCLE 321 ON READER CARD

CUSTOM DESIGN

When we think of this company we usually conjure up an image of minicomputers and systems. A 12-page, illustrated brochure entitled "When You Need Something More" opened our eyes to the custom design work done by the vendor's Special Systems group. The booklet begins by noting the myriad standard products the company offers, then it poses the question, "But suppose you need something more." That's what the Special Systems people are for; the booklet lists several "typical Special Systems products," such as terminal products designed for specific jobs, interfaces with specialized I/O devices or other computers, communications products, and peripheral switches. The booklet discusses how custom interfaces can provide more flexible systems, and how custom switches provide more reliable control. A postage-paid card allows readers to request more information, or to request contact from the Special Systems people regarding a specific need. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 322 ON READER CARD



"I don't mind your transferring me to another office, sir, it's just that I assumed it would be one in our organization."

®DATAMATION®

VENDOR LITERATURE

WORD PROCESSING SUPPLIES

The 1979 edition of this vendor's "Guide to Word Processing Accessories and Suppliers" comprises 84-pages and more than 1,200 items. The selection includes more than 200 printwheels and a selection of NEC Spinwriter Thimbles. Also described are ribbons, and diskette storage and retrieval systems. AMERICAN WORD PROCESSING CO., Tarzana, Calif.

FOR DATA CIRCLE 323 ON READER CARD

GRAPHICS AND IMAGING

A 28-page brochure from this vendor describes the relative advantages of various display technologies and compares them to the features of the vendor's System 3400 Video Image Processor. The brochure details interfacing, system software, and hardware options. LEXIDATA CORP., Burlington, Mass.

FOR DATA CIRCLE 324 ON READER CARD

COMMUNICATIONS

An eight-page brochure outlines this vendor's capabilities and its line of Bell-compatible communications products. "We've got the modems you need" and "we use space age technology Buck Rogers never dreamed of," the imaginatively illustrated brochure proclaims. It then goes on to discuss how modems can be mixed and matched according to user needs and how built-in diagnostics tell a user what's going on in his system. The brochure also discusses the company's FCC-certified coupler, compatibility with specific Bell units, limited distance modems, multiplexors, and interface adaptors. Additional literature on specific products is offered to those wishing it. PRENTICE CORP., Palo Alto, Calif.

FOR DATA CIRCLE 325 ON READER CARD

WORD PROCESSING

This vendor's Office Information System, OIS/140, and its Multilingual Support Package are discussed in two single-page fliers. After a brief description of OIS/140, the brochure goes on to discuss the system's cost effectiveness, flexibility, versatility, family orientation, and ease of use. The description of the multilingual support option explains how this vendor's systems can perform word processing of text in English, French, German, or Spanish. WANG LABORATORIES, INC., Office Systems Marketing, Lowell, Mass.

FOR DATA CIRCLE 326 ON READER CARD

MICROCOMPUTER PRODUCTS

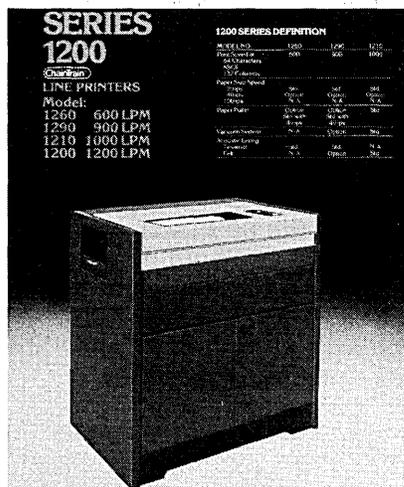
A 6800-based single board computer and 15 support and interface modules are described in this vendor's catalog. Also discussed are development systems, resident and cross-assemblers, and compilers. The vendor also uses the catalog to present its custom systems and consulting capabili-

ties. WINTEK CORP., Lafayette, Ind.

FOR DATA CIRCLE 328 ON READER CARD

LINE PRINTERS

A newly revised four-page brochure describes this vendors 600 lpm to 1,200 lpm line printer offerings. The brochure in-



cludes photographs of the equipment, specifications, standard features and options. DATA PRINTER CORP., Malden, Mass.

FOR DATA CIRCLE 327 ON READER CARD

MACHINE CONTROL

The Series 7920 Multicontroller, a microprocessor-based counter and controller for precision operations, such as coil winding, metal fabricating and tube bending, is the topic of a six-page, illustrated brochure. The brochure explains installation, batch counting, access and entry of configurations, and secondary control for high-speed machines. Detailed specifications are provided. VEEDER-ROOT CO., Hartford, Conn.

FOR COPY CIRCLE 354 ON READER CARD

ELECTRONIC CASH REGISTER

The heavy use of annotated illustrations allows this vendor to describe its ECR Model 2000 Charge Poster in four pages; the brochure is worth at least twice as many pages of prose. The electronic cash register is shown with its cover lifted and its various components are identified. A close-up of the keyboard serves to illustrate the machine's operational capabilities. Reproductions of a number of printouts show the information captured and reported by the machine: receipts, clerk reports, sales by department, and register reports. Specifications also are included. SHELDON INDUSTRIES INC., Monrovia, Calif.

FOR COPY CIRCLE 353 ON READER CARD

USED MICROCOMPUTERS

Not an offer to sell, but an offer to buy is presented in this vendor's six-page, pock-

CONVERSION SOFTWARE

Dataware Translators meet the needs of a changing Computer Industry

Dataware's conversion approach provides the major solution to management's conversion problems and facilitates the recovery of the initial capital investment in systems development.

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Converts RPG and RPG II programs to the industry standard ANS COBOL. The translator achieves an extremely high percentage of automatic conversion (approaching 100%) of the source code.

Circle 151 on Reader Card

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Automatically converts from IBM PL/1 to ANS COBOL. The Translator is capable of handling IBM OS or DOS (48 or 60 character set) source programs as input.

Circle 152 on Reader Card

RPG/RPG II to PL/1

Converts RPG and RPG II programs to an optimized PL/1. The translator achieves an extremely high percentage of automatic conversion (approaching 100%) of the source code.

Circle 153 on Reader Card

AUTOCODER/SPS to COBOL

Automatically converts a high percentage of SPS/1400 Autocoder source code to ANS COBOL.

The Translator converts from:

- IBM 1401
- IBM 1401 SPS
- IBM 1440
- IBM 1460
- IBM 1410
- IBM 7010

Circle 154 on Reader Card

- (Any) COBOL to (Any) COBOL

Circle 155 on Reader Card

- EASYCODER/TRAN to COBOL

Circle 156 on Reader Card

- AUTOCODER (7070) to COBOL

Circle 157 on Reader Card

- BAL/ALC to COBOL

Circle 158 on Reader Card

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2565 Elmwood Avenue
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VENDOR LITERATURE

et-size price list. The folder lists the prices offered for Radio Shack computers and peripherals, and for Commodore's PET; those wishing to sell other systems are invited to call for a quote. The flier also serves to announce the upcoming publication of the vendor's Blue Book of Used Microcomputers. NCE/COMPUMART, INC., Ann Arbor, Mich.

FOR COPY CIRCLE 355 ON READER CARD

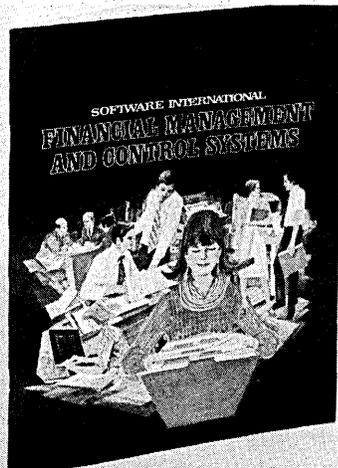
OFFICE FURNISHINGS

An oversized, 28-page, four-color brochure provides a case study of office design with this vendor's modular systems furniture. The problem at hand: subdivide a 6,700 square foot rectangular room into work areas for an entire small company. Within these constraints, the vendor shows how its equipment can outfit the offices of executives, clerks, secretaries, accounting personnel, engineers, purchasing agents, and the sales department. Conference rooms and reception areas also are proposed. Discussions cover the furnishings' electrical and communications wiring capabilities, construction, fabrics, finishes, acoustics and designs. STEELCASE, INC., Grand Rapids, Mich.

FOR COPY CIRCLE 356 ON READER CARD

SOFTWARE

The five modules that make up this vendor's financial management and control system for small business computers are described in a 42-page booklet. After an introduction to the five systems—general ledger and financial control, accounts payable and expense analysis, accounts receivable and cash management, fixed



asset accounting and property control, and payroll plus—each module is examined in greater detail. Block diagrams; line drawings, and sample outputs illustrate the various facets of each module.

SOFTWARE INTERNATIONAL CORP., Andover, Mass.

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SEMINARS

OFFICE TECHNOLOGY

Martin Simpson Research Associates and *The Office Products Analyst*, a monthly newsletter, are sponsoring a seminar called "Copier and Word Processing Trends in the 1980s." Speakers will include P. Kenneth Ohlson, director of marketing, office systems, Nashua Corp., on The Outlook for Liquid Toner Plain Paper Copiers and Suppliers; John L. Sehon, manager, product marketing, Xerox Corp., on The Market for High Speed Non-Impact Computer Line Printers; Joseph Sapienza, product manager, Wang Laboratories, Inc., on Word Processing and the Intelligent Copier; Dean F. Scheff, president, CPT Corp., on Word Processing and the Dealer Market; and Jack Gilmore, product line manager, Digital Equipment Corp., on the relationship between dp and text editing in the automated office. \$485 for the two days, \$290 for one day. Martin Simpson Research Associates, Inc., 63 Wall St., Dept. S-4, New York, NY 10005 (212) 344-3480.

DATA BASE

Infotech is having a conference May 7-9 in San Francisco entitled "Data Base—The Next 5 Years." Data base programming productivity, data modeling, relational languages, data base machines, CODASYL and ANSI proposals and data base vendors' viewpoints will be discussed by a panel of experts, including William Kent of IBM, Dr. G. M. Nijssen of Control Data, Grayce Booth of Honeywell, Dr. P. B. Berra of Syracuse Univ., Dr. E. D. Falkenberg of Siemens, and L. Merz of Control Data.

Following the conference will be a two-day tutorial, "Information Analysis," presented by Dr. Nijssen. Fee for the conference is \$785. The tutorial is \$530; for both, the fee is \$1,200. Infotech International Inc., 234 East Colorado Blvd., Pasadena, CA 91101 (213) 793-0687 or 681-1845.

PROJECT MANAGEMENT

A three-day seminar on project management aims to illustrate techniques for planning, implementing, installing, and controlling projects. The intended audience includes computer project managers, dp managers, vice presidents of administration and financial managers. The course takes a case study approach, and includes discussion of the effect of dp organization on project management and of contact with the user. Presented May 23-25 in New York, June 27-29 in Toronto,

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THE NETWORK.

CIRCLE 207 ON READER CARD

SEMINARS

July 25-27 in Denver, August 15-17 in Los Angeles, and September 26-28 in Chicago. \$545. Univ. of Chicago Center for Continuing Education, 1307 E. 60th St., Chicago, IL 60637.

SOFTWARE TECHNOLOGY

In May and June Software Research Associates will present five software seminars in San Francisco, each consisting of a talk by an expert. Dr. Domenico Ferrari will discuss Performance Enhancement Technology. Dr. Edward Miller will address Modern Software Engineering Tool Technology. Mr. Tom Gilb will speak on Software Metrics Technology. Dr. Herbert Hect will cover Software Reliability Technology, and Dr. Bictor Schneider will talk about Software Costing Methods. \$425 each. Contact Software Research Associates, P.O. Box 2432, San Francisco, CA 94126 (415) 957-1441.

TELECONFERENCING

A management consulting firm call Organization Media Systems, specializing in video and other forms of corporate communications, is offering a seminar on teleconferencing in Dallas on May 14-16. They claim that teleconferencing is "rapidly becoming a viable management alternative." The conference will include economics of teleconferencing, satellites, land lines and microwave; current and future services; how to design facilities; preparing for a teleconference, and a step-by-step planning procedure. Speakers will include managers who are using teleconferencing in their organizations. \$390. OMS, 8700 Davis Blvd., Ft. Worth, TX (817) 281-4126.

COURSES

COMPUTER CONCEPTS FOR SMALL BUSINESS

Computer Concepts for Small Business is a training program designed for business people who are unfamiliar with computers and who are investigating the possibility of using a computer for the first time. The material consists of 2½ hours of cassette tapes and an illustrated instruction manual that is coordinated with the narration on the tapes.

There are eight lessons. Each one begins with a statement of objectives and ends with a review quiz (with answers). The titles of the lessons are an outline of the course:

1. Computer Fundamentals
2. Hardware and Software
3. Systems and Documentation
4. Computers and People
5. Alternative Data Processing Services
6. The System Development Process
7. Computer Security
8. How to Acquire Computer Services

There should be a great demand for this kind of course. Each of the thousands of organizations selling small business systems should have an instruction course to present to prospective customers.

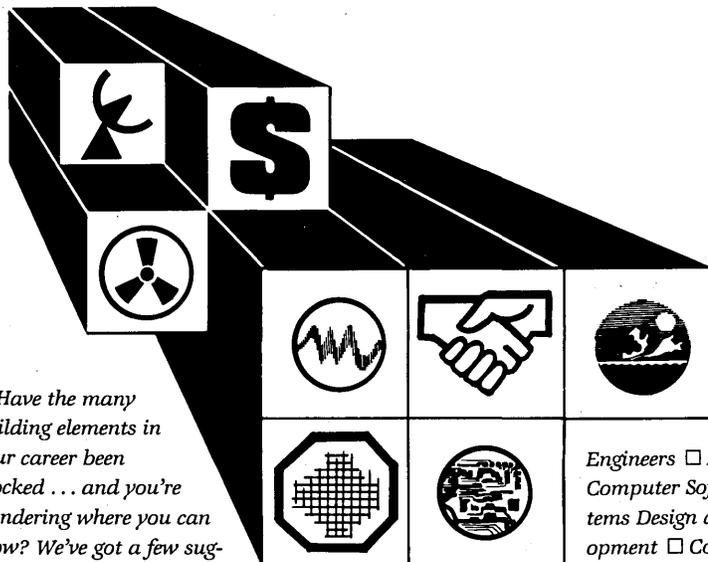
The concept is excellent, and two-thirds of the material is very well done. Unfortunately two serious problems severely limit the utility of the course.

The first problem is the assumption that there will be one or more persons involved with data processing on a full-time basis—as data processing manager, computer operator, data-entry clerk. The

course inflates the mysteries of data processing and emphasizes the specialized skills that used to be required to create and manage a conventional small-scale computer installation (e.g., a System/3 with punched-card input). But now perhaps the majority of first-time users of minicomputers have no one in the office who spends full-time on data processing.

The second fault of the course is that direct data entry via crt is passed off with merely a mention. By implication, the material suggests that data should be batched onto magnetic media before being read into the computer. Perhaps Bur-

ARE YOU BLOCKED IN YOUR CAREER?



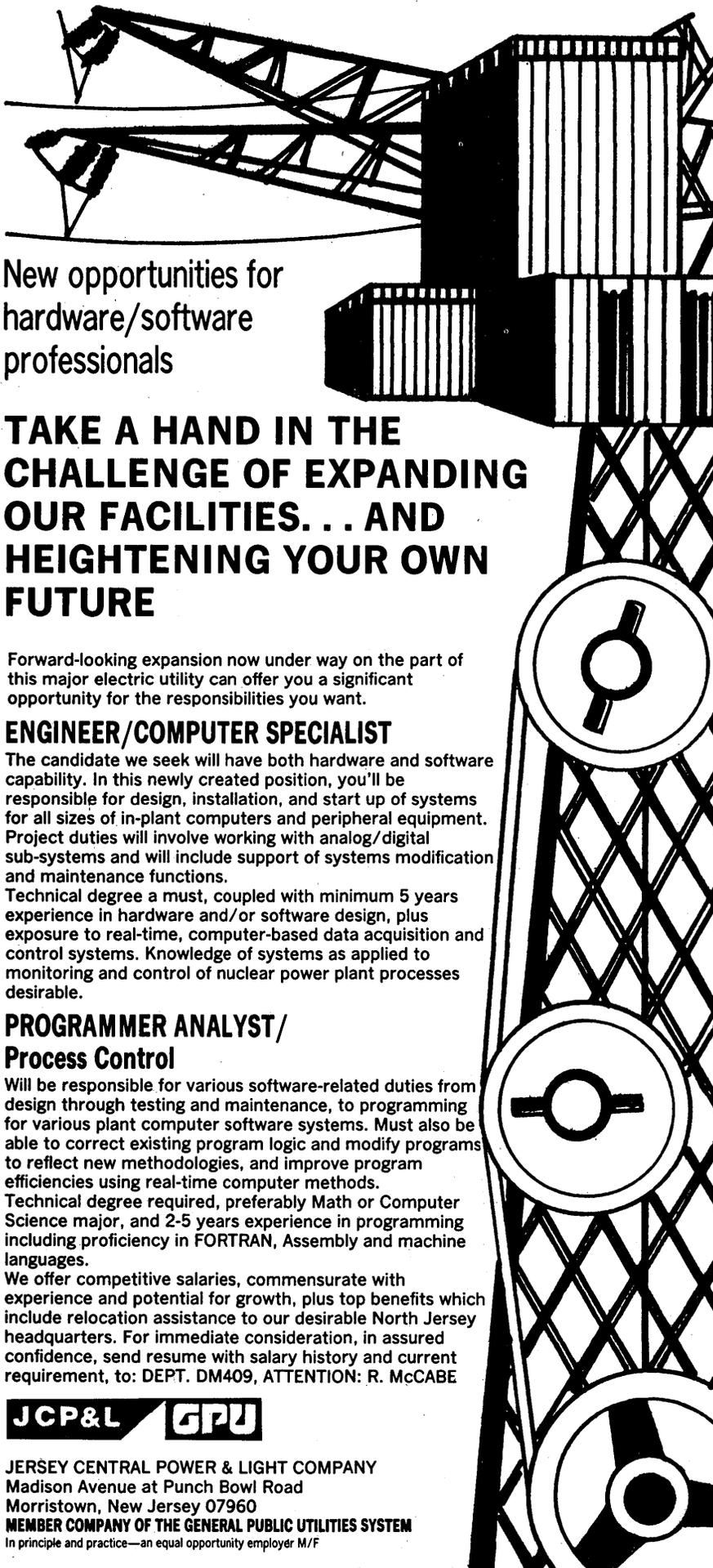
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CIRCLE 204 ON READER CARD

COURSES

roughs and NCR are still selling this plan for minicomputer data entry, but most modern minis are operated with dispersed data entry wherein transactions are recorded directly on computer files without an intermediate step.

The course is consistent in that batched data entry with specialized personnel does require data processing management, if not a specific data processing manager. This whole style is passé.

Modern minicomputers are effective in the small-business environment precisely because non-dp types can access data directly via terminals and because the system can function without dp professionals on the payroll. Because it contradicts these advantages, the course is not one that a minicomputer sales organization should present to potential customers. (\$145). INFO 3, Woodland Hills, Calif.

-Louis B. Marienthal

NOVA INTERFACE DESIGN

The Univ. of Michigan College of Engineering presents a series of engineering summer conferences. Course 7905 is Minicomputer Interface Design: Examples from the Nova Computer. The interrelationship between program instruction and hardware is to be stressed. Case studies of the Nova interface will cover complete hardware design, and integration of design into FORTRAN, ALGOL, and BASIC will be addressed. \$225. June 18-19. Continuing Engineering Education, 300 Chrysler Center, North Campus, Univ. of Michigan, Ann Arbor, MI 48109 (313) 764-8490.

CAPACITY MANAGEMENT

A five-day course on software physics and capacity management will be held in Palm Springs May 21-25. Topics to be included are performance measures, capacity calculations, work-load characterization and forecasting, and configuration design. \$625 (\$375 for Institute members). Institute for Software Engineering, P.O. Box 637, Palo Alto, CA 94302 (415) 493-0300.

AMA CATALOG

American Management Associations has a pretty new course catalog. It's a good thing, too, because they offer so many courses we wouldn't want to try to list them, ranging from general management to sales and marketing to manufacturing, to, of course, information systems and technology. The catalog is free. Contact Carol Henderson, 135 West 50th St., New York, NY 10020.

APL

Scientific Time Sharing Corp., a supplier of APL time-sharing services, offers a free one-day introductory course providing an

overview of the language, using financial planning as an example. For more information on this or their regular APL course offerings, contact Joan Gurgold, Seminar Coordinator, Scientific Time Sharing Corp., 7 Holland Ave., White Plains, NY 10603 (914) 428-6910.

CRYPTOGRAPHY

Massachusetts Institute of Technology is offering a course June 4 and 5 covering the basic principles of computer cryptographic systems, to be held at MIT. Instruction in the Data Encryption Standard and the new public-key cryptographic systems will be included. Economic issues will also be discussed. \$220. MIT Center for Advanced Engineering Study, Cambridge, MA 02139 (617) 253-7406. *

Aphorisms to Live By

1. Be optimistic about next week.
2. Said loud enough, things will have to get better.
3. Having enough faith will insure anything will work.
4. Never stop to plan if you can keep busy making progress.
5. People and IBM can be blamed for anything.
6. Always remember some people are more human.
7. Just a few more people will solve any problem.
8. Training is good if you haven't got anything better to do.
9. If you generalize well enough, you can always blame the other fellow.
10. Bigger and faster is better.
11. When you make a change, surprise the other fellow with it. This leaves him speechless and silence indicates agreement.
12. The world of theoretical progress always spins faster than the real world.
13. All changes are good.
14. If things are bad now, assume any change will be an improvement.
15. Never let lack of preparation hinder the implementation of a change.
16. A high level staff meeting will always make the big boss feel better.
17. Plead ignorance and the problem will go away or be excused.
18. Given enough hardware, you can hide inefficiency.

—Eugene T. Harrison III

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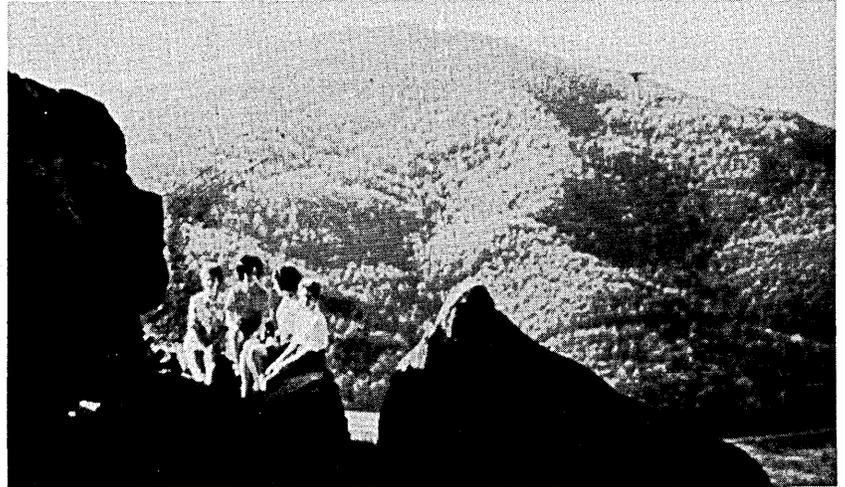
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SOFTWARE: PRODUCTIVITY OR QUALITY?

For the last few years, deep concern has been expressed about the increasing cost of software (especially when compared to the rapidly declining cost of hardware), the critical importance of software to the continued growth of the industry, our increasing dependence upon software, and the displeasure of software users.

This concern has fostered activity aimed at improving the software development process, making it more disciplined, improving the productivity of software developers, and, in some cases, improving the quality of the end result. We have been inundated with new approaches, techniques, and methods, each claiming to cure past ailments. Every aspect of software and its development has been discussed, from proper selection of personnel to management of the process, from design and coding techniques to formal verification and proof of correctness, from error prevention to abstract models of the number of errors remaining in a delivered software system. Some new knowledge and new insights have been found, but opinions still prevail and unsubstantiated claims abound. We still operate in a state of relative ignorance. We measure the obvious and the easy whether it is meaningful or not, and then attempt to justify it.

Relevant industry data is nonexistent for the crucial aspects of software development and for software developers. We have but scant data on the number of software developers (programmers, analysts and related specialists) there have been over time. We have absolutely no knowledge about how much software has been produced or of what kind of software has been produced for which computers; we don't even have estimates of how much software exists.

Yet, we persist in attempting to make software developers more productive. There is the implication in this that we know what is *meant* by productivity. That inference is unwarranted. The classic conception of programmer productivity surrounds the ratio of units of output produced per unit of a worker's time; but a line of code is not a proper measure of software development, it just happens to be an easy one to obtain.

Since we really don't know how productive software developers have been in the past, how can we speak of *improving* their productivity—and at *what* are we trying to make software developers more productive?

There are indications that the productivity of software developers has been continuously rising at a more than adequate rate. The productivity of software developers can be indirectly estimated based on the processing capacity supported by the total software produced. This is based on the assumption that there has been a continuous, significant improvement in the price/performance ratio of computer systems since 1950, and the estimates of the U.S. population of software developers and the value of computer systems in use (both general purpose and minicomputers). The value of computers in use and the number of software developers have grown in parallel between 1955 and 1975. Table 1 shows these two sets of data.

The average rate of growth for the 20-year period shown

Year	Value in Use \$M	No. of Software Developers	\$K/SD
1955	\$ 180	\$ 2,100	85.7
1960	1,950	22,000	88.6
1965	8,230	94,000	87.6
1970	25,000	260,000	96.2
1975	37,900	390,000	97.2

Table 1. Value of computers in use and software developer population by year.

has been 31% per year for value in use and 30% for software developers. (The rate of growth for both, however, has been declining in recent years, averaging less than 9% per year from 1970 to 1975.) Column 3 of Table 1 shows the ratio of the value of computers in use per software developer. Note that the ratio was relatively constant until 1965; the rise after 1965 is attributable to the increasing use of minicomputers.

If we assume price/performance has improved by a factor of 10 every 10 years (a relatively conservative estimate) and say \$1 million would buy one unit of processing capacity (UPC) in 1955, we can estimate the growth of processing capacity from the value in use data combined with the value shipped data for those same years. Performing the necessary arithmetic gives the results shown in column 3 of Table 2. Column 4 shows the UPC per software developer.

Year	Value Shipped \$M	Value in Use \$M	Units of Processing Capacity	UPC/SD
1955	65	180	1.4×10^2	0.07
1960	590	1,950	4.0×10^3	0.18
1965	2,050	8,230	4.0×10^4	0.43
1970	4,360	25,000	3.0×10^5	1.15
1975	8,000	37,900	1.3×10^6	3.33

Table 2. Units of processing capacity (UPC) and UPC/software developer by year.

The calculation shows that installed UPC has increased by a factor of nearly 10,000 in those 20 years or at an average rate of 58% per year. The installed UPC per software developer has gone up by a factor of slightly less than 50 over the same time period; that is, at an annual rate of slightly more than 20%. In other words, every year for those 20 years, year in, year out, each software developer produces enough software to support 20% more processing capacity than he or she did the year before. Looking at these data in more detail, it appears that there may even have been a slight improvement in productivity from 1960 to 1975, rising from 19% per year in 1960-1965 to 24% in 1970-1975.

If the productivity of software developers were as poor as one might be led to believe, the population of software developers should have been growing at a rate that more closely matches the growth in capacity than the growth in value of computers in use. Although this analysis is relatively simple and is based on data that may not be completely accurate, the magnitude of the errors in the data is not large enough to negate the conclusion: the productivity of software developers has been consistently improving over time.

WHY DO WE EMPHASIZE PRODUCTIVITY?

This conclusion raises a question as to whether our concerns about productivity and the efforts to remedy them are properly directed. Are we like the drunk on his hands and knees at the base of the lamppost looking for his keys because that's where the light is, rather than looking where he dropped his keys?

Are we putting our emphasis on productivity because the problems and issues of software *quality* are murkier? Or are we saying that quantity is a proper substitute for quality?

It is not true that higher quality follows from higher pro-

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ductivity. If we succeed in improving software developer productivity without improving the quality of software, the result may well be lower cost, poor quality software. Unless the productivity improvement incorporates the concept of quality (present definitions and measures certainly do not), the result could well be a sacrifice in quality in exchange for the gain in productivity. Perhaps it is time to reassess the state of software development and rearrange our priorities, making the improvement and measurement of the quality of software the primary focus.

Of course, increased productivity is mandatory if we expect to implement software systems of the size, complexity and reliability that are being predicted for the future. However, we must not attain improvement in one—quality or productivity—at the sacrifice of the other, although we may initially experience a decline in productivity to gain significant improvements in quality.

Software quality significantly differs from the traditional concept of physical objects. For one thing, tolerances are almost totally foreign to software. Given the same initial conditions and input data, a program must produce exactly the same result every time. If it doesn't, we assume the hardware is malfunctioning or out of tolerance. Being intangible, software doesn't break or fail in the traditional sense. We know little of its failure modes and their underlying causes except that flaws or errors causing the failure don't occur spontaneously, but are embedded from the beginning.

What then do we mean by software quality? Software quality is a multidimensional concept. It is considerably more than the number of errors or flaws or bugs per thousand lines of code. Most of the present quality control efforts appear to be concerned with this one dimension, and a considerable amount of theoretical work has gone into models for predicting the number of errors remaining in a program after a given amount of testing. Theorizing that a delivered software system contains 0.5 errors of an unknown nature per thousand lines of code with a probability of 0.95 is not helpful to its users. What is needed is the ability to assure users that no action on their part can create an undesirable result.

It is commendable to want to deliver a software system containing no errors in the code, but it would be much more commendable to deliver a software system containing no *defects*. Software quality is not solely defined by lack of logical, syntactic, and coding errors; software that is error free is not necessarily without defects. A defect is anything that prevents the user from doing what he is permitted to do; or that allows him to do things he isn't permitted to do; or that produces erroneous, misleading or unpredictable results, or otherwise limits the user's understanding and use of the software.

There is no single point at which the final quality of a software development effort is determined. Decisions and choices made throughout the development process, beginning with the preliminary design (where it would appear most quality considerations are determined), and ending with integration testing, influence the final quality of the system. Yet we rarely evaluate software quality against the decisions, tradeoffs, and compromises made during the process; we frequently fail to record these factors, and many such decisions are made subconsciously.

ALL SOFTWARE STANDARDS ARE RELATIVE

There is no absolute standard for software quality. Quality must be judged relative to the conditions under which the software was developed. A one-shot program should not be judged against the same criteria that would be used to judge the quality of a large application system expected to be used for ten years. Nor should the criteria for a program to run in batch mode that is unlikely to be enhanced be the same as the criteria for an interactive system serving hundreds of users whose needs are expected to change with experience and time—a perception we often fail to consider in defining requirements.

We must determine at the outset the characteristics and properties the software is expected to embody and judge the quality of the end result against them. It is unreasonable to penalize the software developers for poor computational efficiency if the development decisions didn't take computational efficiency into consideration. It is equally unrealistic to blame the software and its developers for sins of the operating system or hardware.

On the other hand, the developers must understand the limitations the hardware and operating systems place on the software. We must also be able to detect those defects, limitations, and failures that are the result of poor understanding or knowledge on the part of the developers.

Determining the quality of software is a complex process; it requires considerably more knowledge about the software development process than we have today. For example, though we understand that it becomes significantly more difficult and costly to remove errors the further along we are in the development process, we don't know how to prevent or detect those errors at the very beginning. And though we can prove some specifications correct, we can't prove the code that implements the proven specification is itself correct. We know that coding tricks can be disastrous, but we don't know how to preclude their use. We appreciate the concept that programs should be understandable, but we don't know exactly what that means.

Achieving higher quality software will thus require considerably more knowledge of and discipline in the development process than is applied in most organizations today. We must develop a much larger theoretical understanding than is currently available. For instance, we are all aware of the space/time tradeoff for computational processes and data organization that can be made in most software implementation efforts, but we have no rational basis for determining how close we have come to some theoretical level of efficiency. Each case is taken on its own merits and determined *ad hoc*, with the final decision usually left to the coder. We must develop a much firmer foundation for determining the properties and characteristics embodied by software if we are to begin to improve its quality.

Among the factors related to software quality are system organization, data organization, processing methodology and algorithms, space/time tradeoffs, hardware and operating system support and constraints, existing software such as utilities and libraries, constraints imposed by interfaces to other systems such as data base management systems and existing applications, workmanship standards, and documentation. These are related in various ways to the larger issues of performance (how efficiently the software functions and how helpful is it to the users), costs (of use, failures, corrections, enhancement, migration, etc.), and the less tangible concepts of reliability, availability, usability and a host of other -ilities.

QUALITATIVE MEASUREMENT IS NECESSARY

It is unlikely that all of the characteristics and properties of software that constitute its quality will yield to quantitative measurement. It is also unlikely that we will ever be able to discover all the necessary theoretical underpinnings. That does not mean that we should ignore these aspects. At a minimum, we should construct models of the aspects of quality against which to evaluate a given software product. Even for the software characteristics that can be measured quantitatively, the best we can do at present is evaluate them qualitatively. For instance, we can easily count the number of bytes of storage a program requires on a given computer. If minimum storage is a desirable characteristic, a storage use goal can be set for the implementors, but we have no way to rigorously determine the theoretical minimum they should be able to attain. The established goal is someone's best estimate of what is attainable. Thus, the space efficiency of the program can only be evaluated qualitatively in the sense that the implementors did as expected, or better or worse than expected. The numeric percentage is not very meaningful

as a measure and may be misleading without all of the relevant facts.

The lack of theoretical foundations coupled with the vast difference between software and physical objects does mean we cannot directly use the traditional methods of industrial quality assurance and control. Traditional methods can serve as models for what we need to do, but we will need to make significant modifications to apply them to the software development environment.

A proper software quality assurance methodology will supply insight into the source of errors and provide feedback to the developers to facilitate the elimination of errors and defects at the source. Software development is a craft and, as such, depends on highly skilled, creative, innovative craftsmen. Success in raising the quality of software is not likely to diminish the need for such craftsmen; rather, the need is more likely to increase.

If our emphasis on solving the software problem has been off target, it is understandable given the extreme pressure produced by the industry's explosive growth. But now is the time to reexamine our priorities and reassess our goals. Productivity of software developers may not need to be as deep a concern as we have made it, whereas quality, which has been ignored for the most part, is central to providing the results the industry needs and users demand, as well providing the only rational basis for understanding and improving productivity.

—M. I. Bernstein

PROGRAMMERS: OUR CLOSET COMEDIANS

The world is full of comedians. A few become great humorists, such as Mark Twain, among whose famous lines we find, "Training is everything. The peach was once a bitter almond; cauliflower is nothing but cabbage with a college education." Other comedians become adequate, if not superior, entertainers. And some become computer programmers.

The suspicion that dp shops harbor many a closet comedian is aroused by the proliferation of computer-related humor, from fanciful portrayals of machines-with-their-own-ideas to bits of doggerel in appropriate jargon bewailing the lot of the programmer. The image of computer types as eccentric individuals with untamed hair, bizarre costumes, psychedelic imaginations, and weird senses of humor reinforces the suspicion.

This notion may not be too far-fetched. It has been noted that computer programmers, having a logical, mathematical bent, often enjoy applying these same talents to music. Similarly, some characteristics of humor may spring from the art of the programmer.

Anyone who has spent time trying to make a computer dance to a certain tune has had to draw upon his sense of humor just to withstand the ordeal. Programming is a notch below weather forecasting when it comes to trial and error, and error, and error, and error, in humiliating quantity. We've all lived through that best-forgotten scene when the boss came in to show off his pride and joy to an important customer and, precisely at that moment, the machine stopped purring, hiccupped, and spewed paper all over the room. There are also all the times you loaded your carefully constructed program and the computer, damned literal-minded beast that it is, smugly ignored what you meant and had the audacity to do exactly what you told it, mocking you at 1,100 lines a minute. After you have pounded



your head on the disk drive and kicked the cpu panel, what else can you do but laugh at the perverse relentlessness of its logic?

And there is, after all, a certain humor to be found—maybe not by the harried inventory clerk, but by you (privately, after hours, when everyone else has gone home and left the problem to you)—in the fact that the machine suddenly decided to post each sale not to the proper item but to the *next* item in sequence, erasing the previous one as it went. Dropping a lighted cigarette into the card reader when you opened it to see what happened to the other half of the card is not nearly as funny as having to hand the boss a 400-page report (only two days late) because when you added in that last percentage calculation you also told the system to skip to a new page for every line of print, and when you came in this morning just before the meeting, there it was in all its massive glory. Yes, it helps to have a sense of humor, even if it is not always appreciated by the spoilsports in the user departments.

But being able to laugh when the only alternative is throwing a tantrum or defenestrating the computer is not all there is to it. There is a certain logic to humor, and that logic may have a parallel in finding solutions to problems that occur in everyday programming.

Dictionaries are not very helpful in trying to isolate the elusive essence of humor. In fact, writers and critics since Aristotle have wrestled with attempts to define what triggers the response of laughter. Thomas Hobbes described it as self-delight or "sudden glory," and Friedrich von Schlegel got carried away in talking about Socratic irony which "arises from the union of the art of life with the spirit of knowledge, from the encounter of a perfected philosophy of nature with a perfected philosophy of art." That probably doesn't sound like anything that goes on in your shop. But what about this: incongruity.

It's incongruity that makes a line like this work: "A man cannot be too careful in the choice of his enemies." Oscar Wilde said that, and he was the champion of one-liners before he made a mistake in the choice of his enemies.

INCONGRUITY AS THE SOURCE OF HUMOR

Important thinkers like Kant and Schopenhauer accepted the theory of incongruity as the source of humor: the notion that sudden reversal of expectations is the thing that brings a laugh. We all know about reversal of expectations when we initiate the execute command, right? But maybe the connection goes deeper than that.

The American Heritage Dictionary defines incongruity as: (1) Not corresponding; inharmonious; disagreeing; incompatible. (2) Made up of disparate, inconsistent, or discordant

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parts or qualities. (3) Not consistent with what is correct, proper, or logical; unsuitable; inappropriate.

It's easy to see that incongruity is the source of humor in all kinds of comedy, from pie-in-the-face slapstick to the intellectual wit of Oscar Wilde. "The only way to get rid of a temptation," said he, "is to yield to it." On the same subject, Mark Twain wrote, "There are several good protections against temptations, but the surest is cowardice."

Programmers know a lot about temptation. Which of us hasn't thought of introducing impolite words into a printout, or fantasized about the looks on their faces when they discover we've erased all the files and gone home?

Temptation by definition means something we really shouldn't do (however much fun it might be). So we anticipate some sort of moral advice. Instead, Wilde reverses our expectations by inviting us to plunge right in—what else, after all, are temptations for? And Twain offers us cowardice—the opposite of virtue—as a better remedy than moral fortitude, while telling us at the same time that he wouldn't hesitate to sample forbidden joys himself if only he had the nerve. Both of these writers are able to surprise and amuse us by perceiving an incongruity and producing a result contrary to our expectations.

Perception of congruity must necessarily be the logical counterpart of perception of incongruity. Such awareness is basic to sound programming. To find one's way through the complexities of multiple simultaneous processes and to arrive at the logical solution, managing all the variables along the way, furnishing each bit of data at the proper time, and resolving the end products into usable, retainable form requires a mastery of congruities. To identify the irrelevant and unnecessary, and to avoid placing any function in an improper relation to the others, are tasks of shearing away incongruities.

Besides reversing our expectations and causing us to laugh in surprise and pleasure, incongruity in humor has a deep-

er effect. In a line like Mark Twain's "Nothing so needs reforming as other people's habits," another incongruity is revealed, and that is the incongruity of our pretenses. Humor penetrates those pretenses and unmasks our humanity.

LAUGH OR GO MAD

The human element, too, is the other chief ingredient in the computer person's special capacity for humor. What is more human than Charlie Chaplin boldly taking on impossible tasks, or W.C. Fields in a battle of wits with an infant? And what is more dehumanizing, after all, than the sterile and humorless machinations of a batch of wires and electronic circuitry? The individual who must perforce devote a significant portion of his mind and his attention to the manipulation of logical sequences and rigid relationships must, no matter how great his aptitude and taste for such diversions, find relief somewhere. Perhaps the image of "computer types" and the nature of computer-style buffoonery are such for good reason: *sanity requires it*.

Satirist Samuel Butler anticipated by a century some of our contemporary concerns: "It is for neglecting them (machines) that he (man) incurs their wrath, or for using inferior machines, or for not making sufficient exertions to invent new ones, or for destroying them without replacing them. . . . The machines, being of themselves unable to struggle, have got man to do their struggling for them: as long as he fulfills this function duly, all goes well with him—at least he thinks so; but the moment he fails to do his best for the advancement of machinery by encouraging the good and destroying the bad, he is left behind in the race of competition; and this means that he will be made uncomfortable in a variety of ways and perhaps die."

The care and feeding of computers is a serious business; and it is perhaps a credit to our senses of humor not only that we do it well, but that we do it at all.

—Meredy Amyx

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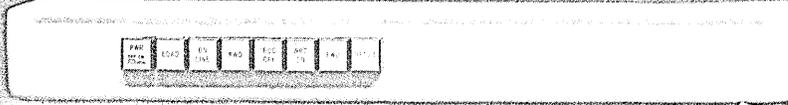
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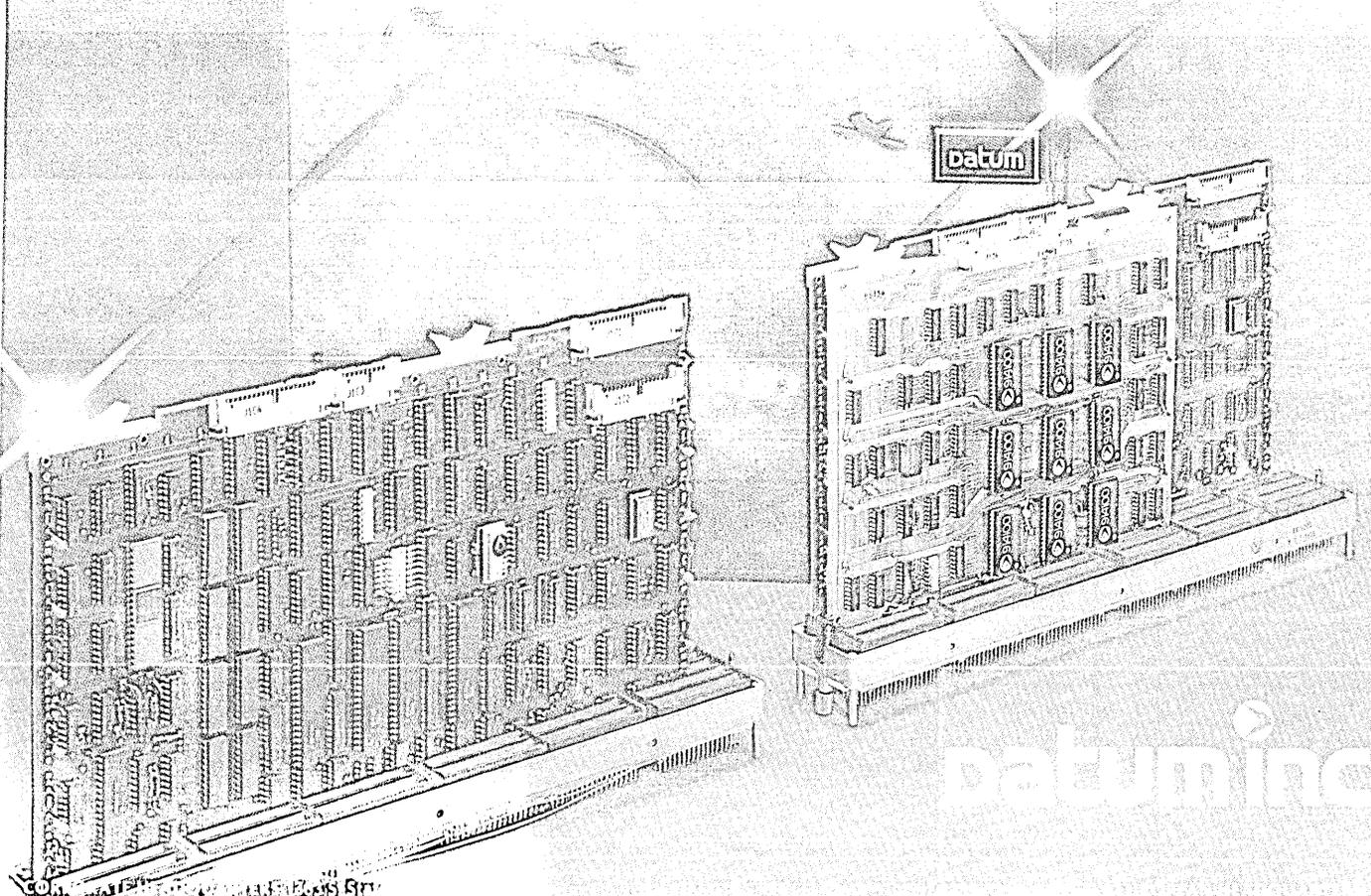
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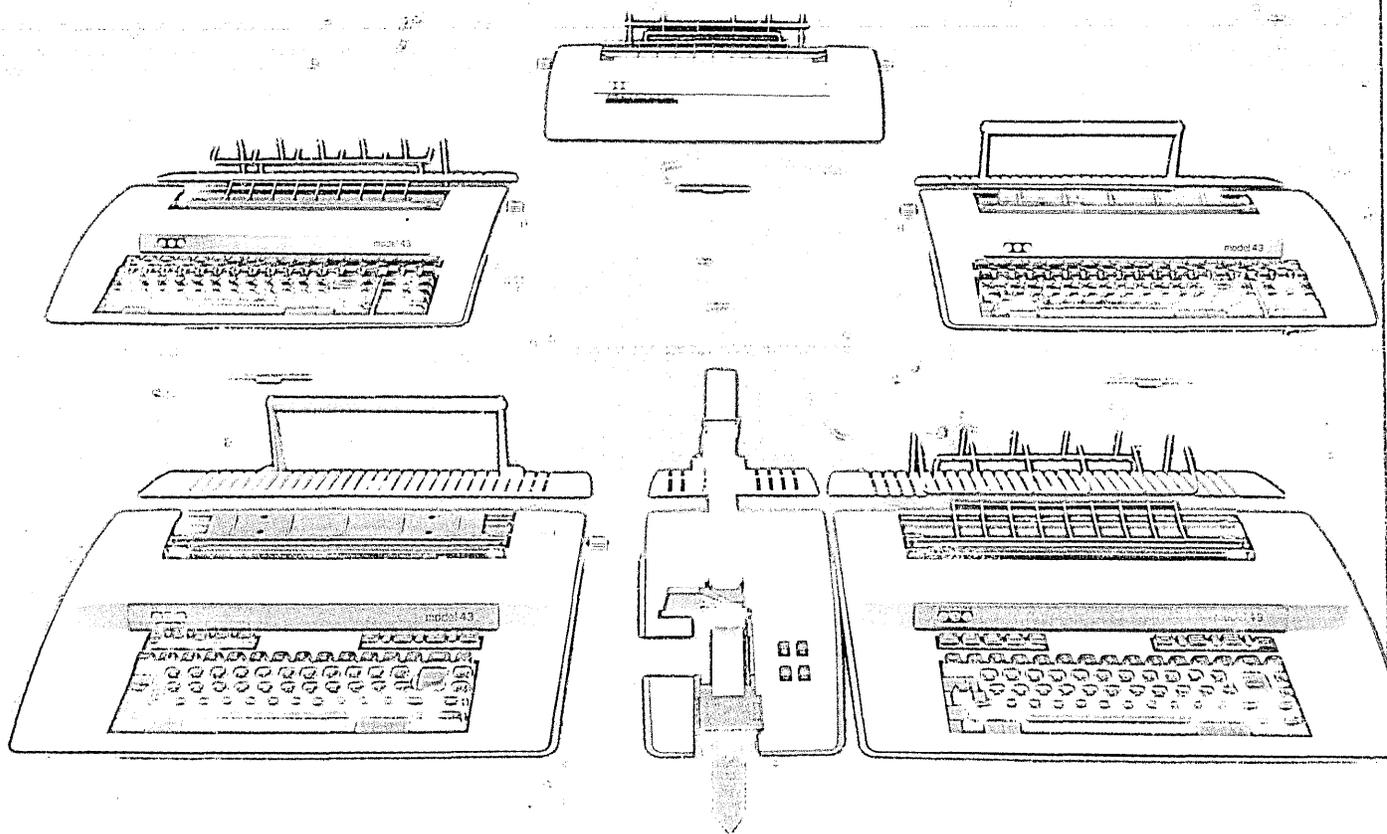


PDP-11
SOFTWARE
COMPATIBLE



Datum Corporation
11520 Embedded NRZI Tape Controller
Model 11520
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DATUM INC



OUR MODEL 43 TELEPRINTER FAMILY IS THE BEGINNING OF A NEW LEGEND.

When we introduced it just a year ago, the basic idea behind the Teletype® model 43 proved so sound and flexible that today it's grown into a comprehensive terminal family with extensive capabilities for message communications.

Model 43's come in a variety of configurations with either 80 column friction-feed or 132 column pin-feed printers. Some units are designed for use on the switched network, others for point-to-point private-line systems. (There's also a new generation of 5-level buffered teleprinters for Telex applications.)

The basic model 43 series operates on-line at 10 or 30 eps in either the half- or full-duplex mode and prints multiple copies using the 96 character ASCII code set. A wide choice of interfaces, including EIA RS232C and DC 20-60ma, are available for easy system integration.

With the automatic send-receive configuration, messages can be prepared off-line via the paper tape punch, edited, combined with

a master tape, then sent at maximum terminal speed—automatically and unattended—when line rates are lowest.

Buffered 43's operate on-line at speeds ranging from 10 to 180 eps and provide up to 20,000 characters of storage for sending, receiving and editing. These terminals send and receive automatically via the buffer while messages are simultaneously being prepared for future transmission. They also include full forms control, the automatic answer capability and answer back.

Just like its predecessor, the legendary model 33, our model 43 family is designed for extreme reliability. The reason is simple: simplicity. Our model 43's use only five major pluggable components (six, counting the paper tape module on the ASR), along with extensive use of LSI circuitry.

So when you think of our model 43 family, think of it as the beginning of a new legend.

THE TELETYPE MODEL 43 FAMILY

Teletype Corporation, 5555 Truhy Avenue, Dept. 3185, Skokie, IL 60076, Tel. (612) 932-2000.

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