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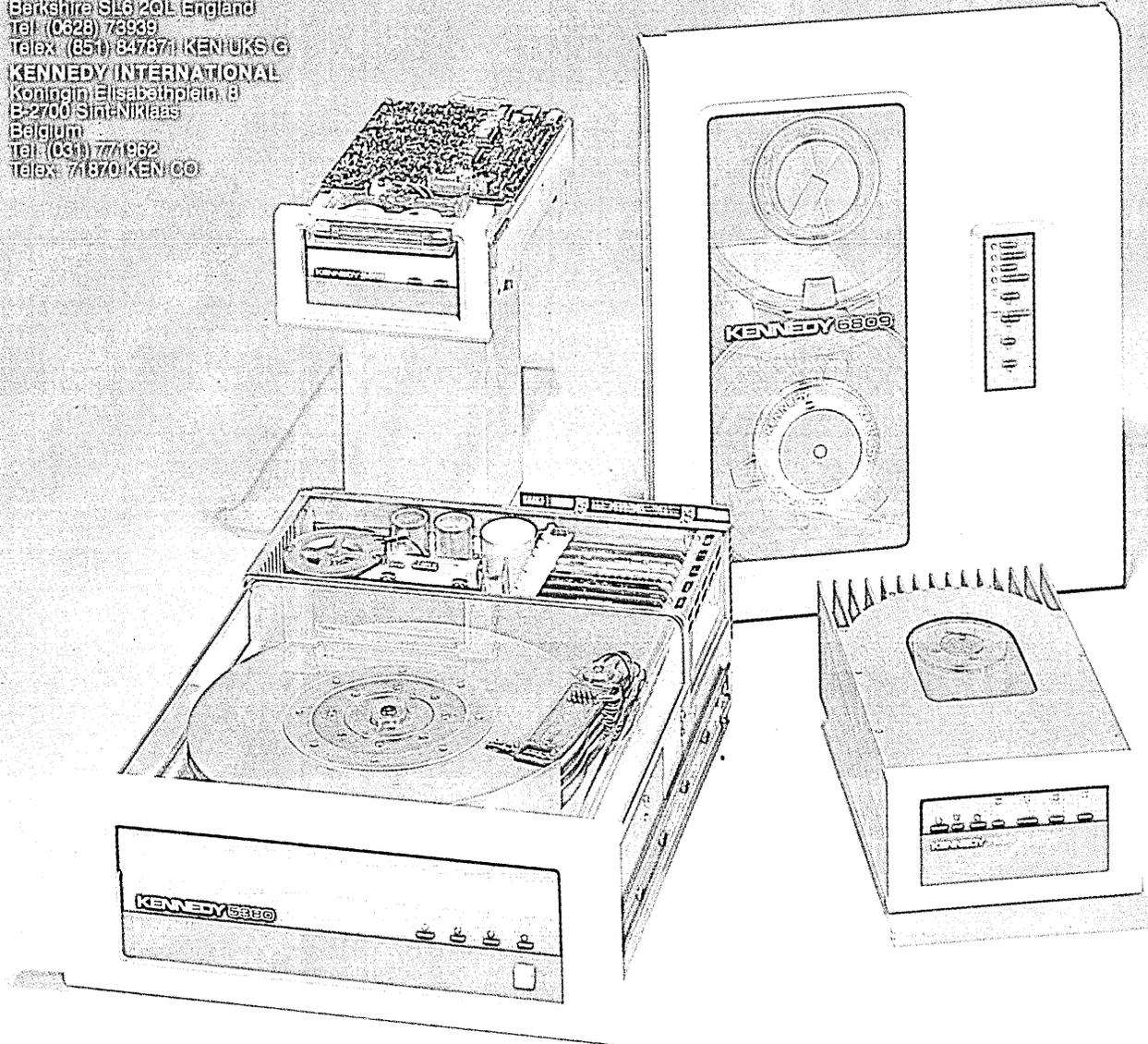
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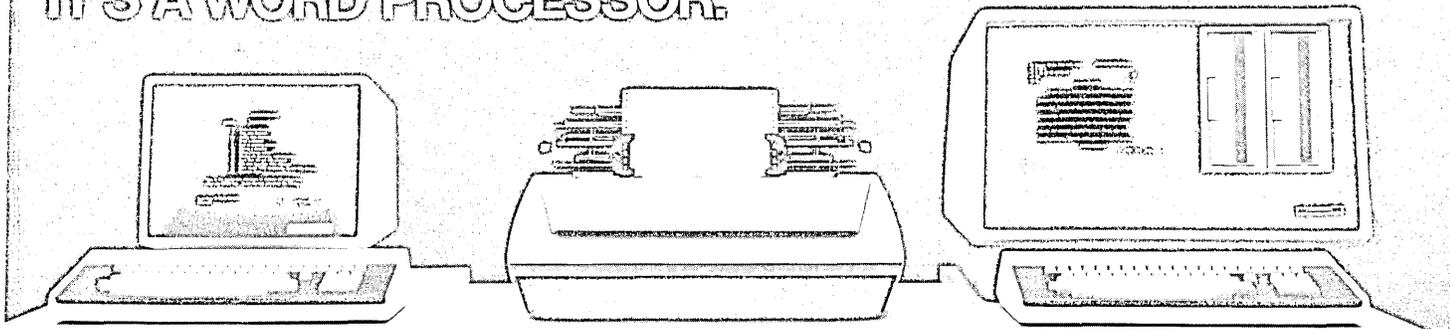
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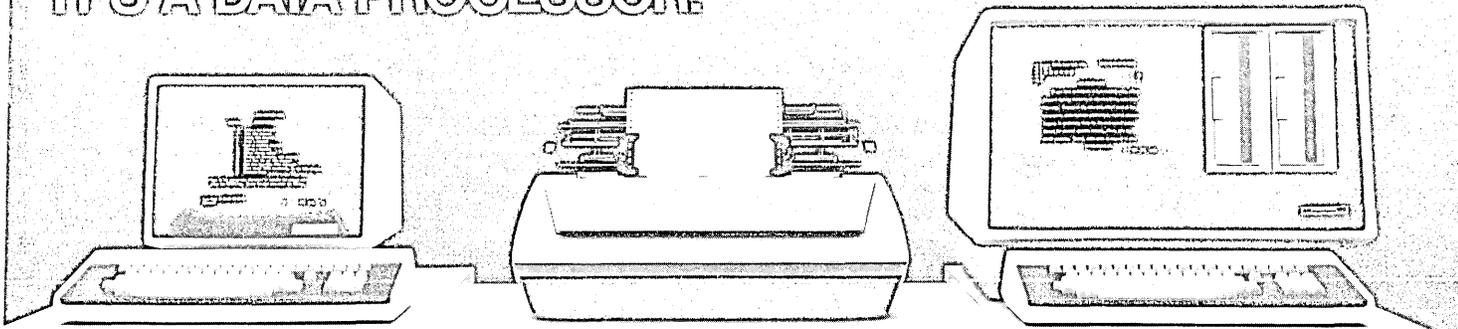
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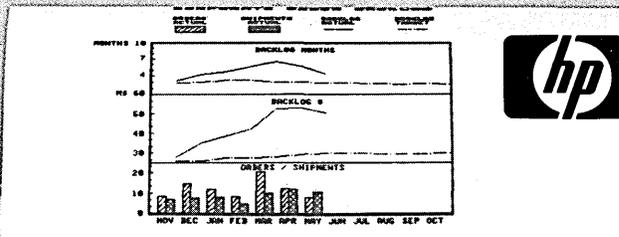
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*The HP 2623 is available without hard copy for \$3750.



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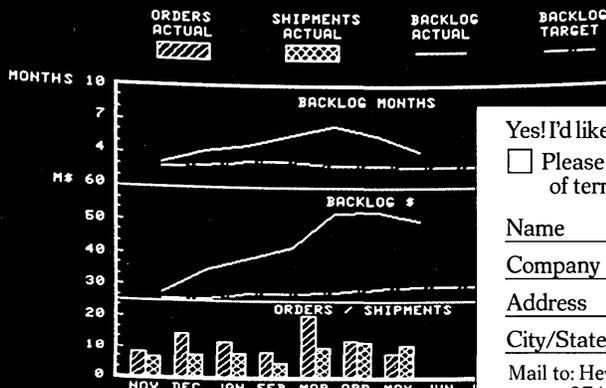


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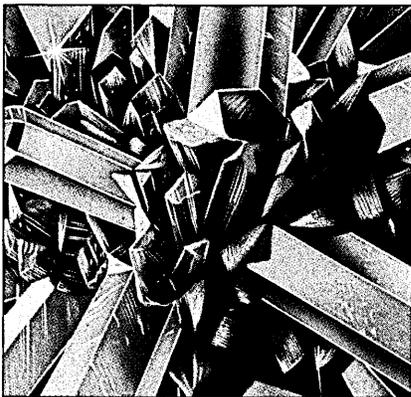
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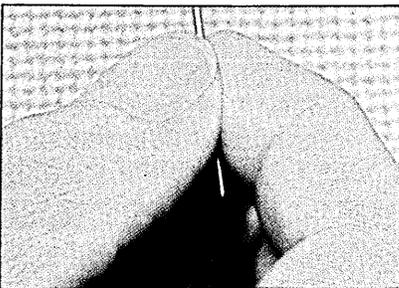
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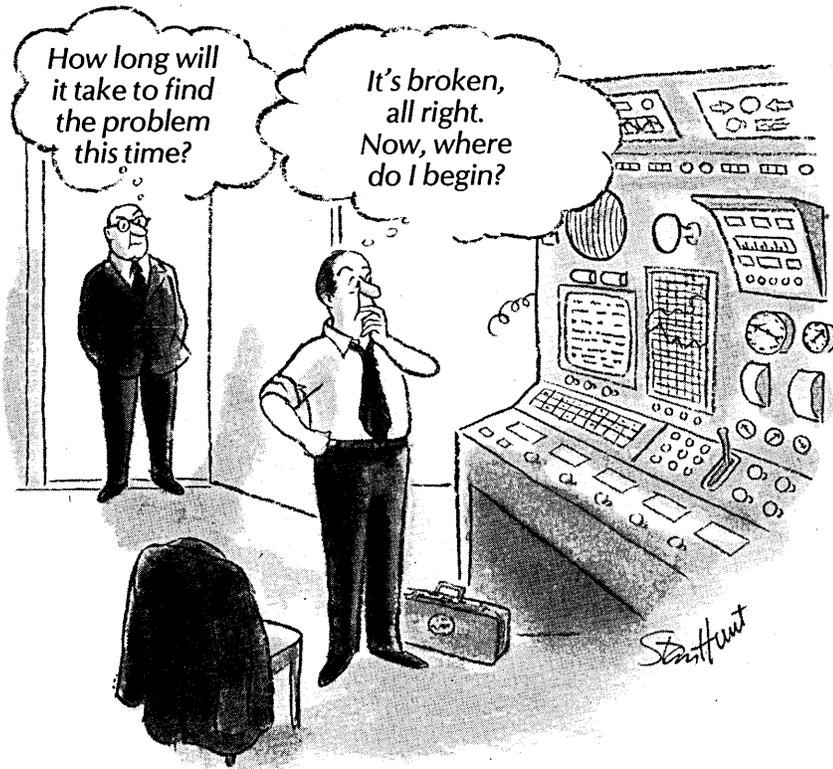
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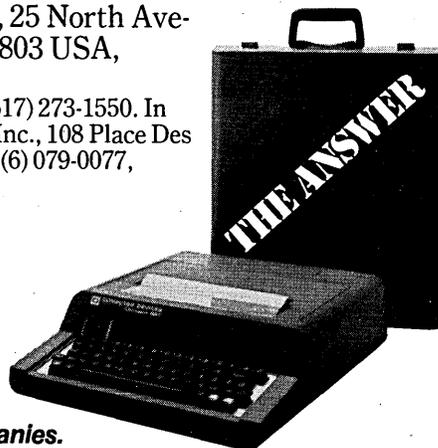
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Intel would like to give you free 3350s. Now.

With light-speed paging and swapping, Intel's new FAST-3815 intelligent memory system frees your 3350s (and 3380s) for the task they were meant to perform: data storage.

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- Improving paging and swapping up to 300 percent,
- Enhancing systems perfor-

mance by reducing page service time up to 67 percent (vs. a 3350),

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Intelligent memory priced at \$6K a megabyte

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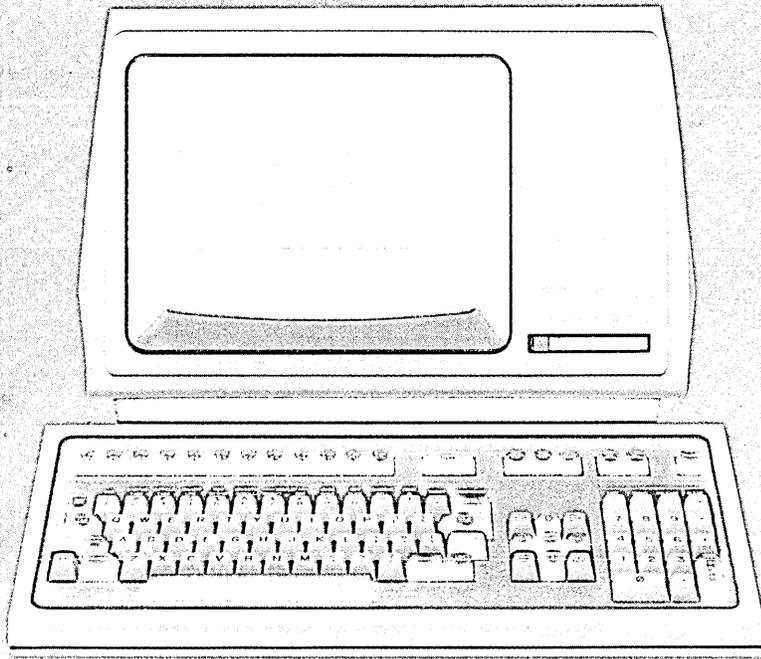
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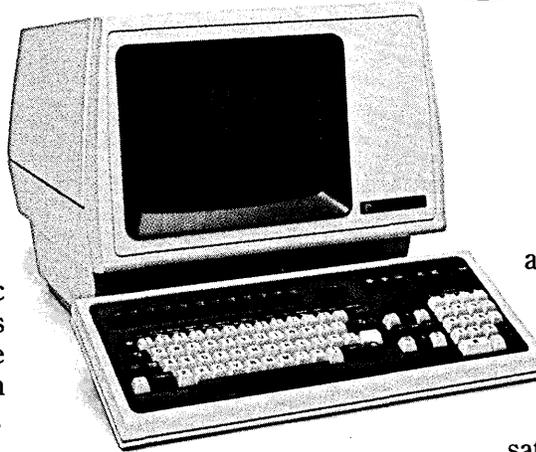
intel delivers solutions

CIRCLE 7 ON READER CARD



A powerful display of innovative thinking.

Introducing TI's new OPTI 900 Model 940 Electronic Video Terminal.



The OPTI 900* Model 940 is the first in a family of electronic video terminals from Texas Instruments. Combining the power of an editing terminal with the convenience of video display, the Model 940 brings new perspectives to applications including data entry, electronic mail, commercial timesharing and data base management.

The 940 offers state-of-the-art human-factor design features to help reduce operator fatigue, and a variety of versatile characteristics to enhance any business application requiring high performance editing.

Standard display features on the Model 940 include a 12-inch diagonal screen with an operator-selectable format of either 80 or 132 columns by 24 lines. A 25th status line displays information in three selectable modes for functions like tabs, margins, errors or host computer messages.

The 940's display can be split both vertically and horizontally into separate data regions allowing a user the flexibility to operate within one region without disturbing another. And for applications like process control, the Model 940 features scrolling regions for quick, effective data comparison.

There is also a transparent print feature that permits a host computer to bypass the screen and transmit data to an optional local printer, allowing the operator continued use of the screen during the printing cycle. And the Model 940's memory can store up to 1,920 characters of data.

Featuring 128 displayable ASCII characters, the versatile Model 940 includes a unique combination of double high, double wide and double high/wide characters for display emphasis and reduced visual strain. Additional video features include 7x9 dot matrix characters with true underlining and true descenders.

The Model 940's detached keyboard, designed to increase operator comfort and productivity, is connected to the display monitor with a 6-foot coiled cord and features operator-oriented functionally clustered keys. For added user convenience the Model 940 also offers detachable nonglare screen filters and a tiltable display monitor

as options. Other available application-oriented options include international or graphic character sets and additional memory of up to 5,760 characters to give the 940 added versatility for data entry applications.

TI is dedicated to producing quality, innovative products like the new OPTI 900 Model 940 Electronic Video Terminal. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that come from 50 years of experience.

Supporting TI's data terminals is the technical expertise of our factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

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LOOKING BACK

DREAM BIG DREAMS

September 1961: Louis Fein asked readers to travel with him to the year 1975 and consider from that vantage the development of an academic discipline called synnoetics.

Fein's article took the form of a university president's address to a group of puzzled alumni. What the president wanted to explain was how the department of computer-related sciences had recently been transformed into the department of synnoetics; he had perforce to start with a definition, which was roughly this: synnoetics is the discipline treating of composite systems—consisting of people, machines, plants, animals or automata—the combined mental power of which is greater than the mental power of the sum of their parts. The president described this synergy of ratiocination as a supradiscipline, on the order of mathematics, and said that its techniques were as applicable in political science as they were in chemistry, linguistics, or any other endeavor. Synnoetics course titles included "Heuristics" and "Foundations of the Science of Models."

Computers played a role, but were by no means the driving force, in this prospering department. Early on this university had, like other institutions, acquired a computer at what seemed like bargain rates. An enthusiast from the engineering department was appointed director of the computing center and soon set about getting faculty members to use his facility. He came to believe that he was the practitioner of a new discipline, appropriately called computer sciences, and to maintain that the computing center should be the prime mover in identifying and recommending computer-oriented research topics and courses of study. Not surprisingly, he developed a habit of framing problems in such a way as to make them seem solvable by computer.

The director had his way for awhile, and the university even went so far as to grant a few advanced degrees in computer science. Eventually, though, the faculty recognized the folly of allowing so much of its research to be shaped by the existence of computing equipment, and the department of synnoetics was created to give the machinery a proper context.

MATURE CONSIDERATION

September 1, 1971: The question of whether the proposed antiballistic missile system could work, and if so whether it should be built, was receiving wide attention. In Forum, Boris Beizer had his say.

Beizer felt it was first of all necessary to stipulate exactly what it meant to say that such a system could "work." He produced the following utilitarian definition: An ABM may be said to work if the effect of a [nuclear] attack is such that the gross national product is reduced less than it would have been without the ABM, taking into account the portion of GNP it took to build the system and the probability and cost of an inadvertent firing or misfire.

That said, Beizer proceeded to argue that the ABM could indeed be made to work. The system would have to face an attack designed to overwhelm its detection capabilities by means of decoys, electronic countermeasures, and independently targeted multiple warheads, and those detection capabilities would depend on a computer system so large that critics were claiming it couldn't be built. Beizer said it could, and pointed to the success of the earlier SAGE system. An industry in its infancy, he said, had surmounted totally new problems, including programming tasks measured in thousands of man-hours.

ABM opponents were also misguided in comparing the proposed defense system to commercial efforts, Beizer said, reasoning that because the money and effort spent on military systems was roughly 10 times greater than that given the commercial kind, the military systems were significantly less likely to fail.

In closing, Beizer pointed out that every voice raised to deny the viability of the ABM served to undermine its credibility and thus to ruin its effectiveness; proponents didn't want the system built so that it could be used, but for the sake of convincing the enemy that it *could* be used. It was therefore impossible to debate the matter on purely technical grounds, and readers were implored not to offer their assessments without "serious, mature consideration of the political aspects of the ABM."

—Ken Klee

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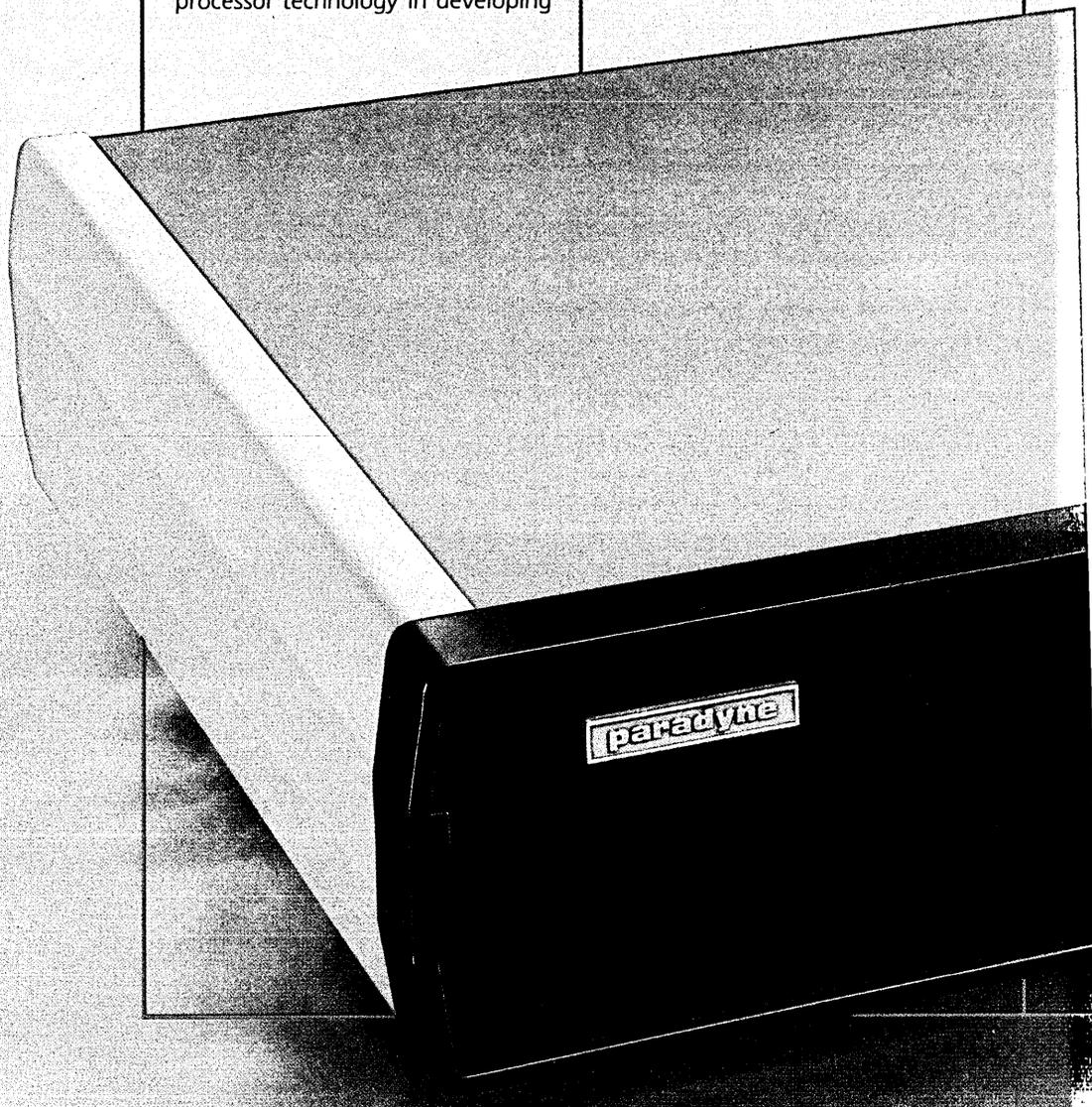
As the leader in using LSI and microprocessor technology in developing

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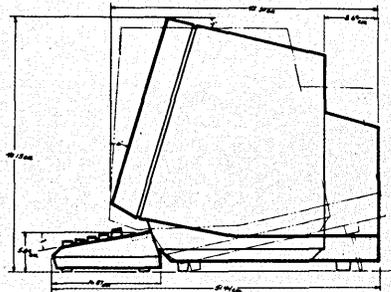
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The result? More efficient, cost effective communication!

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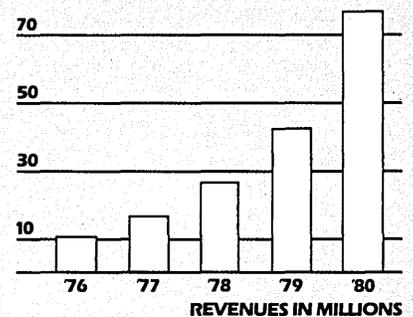


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PIXNET by providing the capability for on-line, interactive processing applications.

RESPONSE gives IBM users a distributed data processing capability by putting processing power in remote locations and utilizing PIXNET for its communications functions.

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CIRCLE 11 ON READER CARD

μP 14400

What's the score on the BTI 8000?

	BTI 8000	DEC 11/780	PRIME 750	DG MV/8000
MAX. NO. TERMINALS	200	96	63	128
MAX. NO. CPUs	8	1	1	1
MAX. MEMORY—MBYTES	16	8	8	4
MAX. MASS STORAGE—GBYTES	8	9.6	4.3	6.7
AGGREGATE BUS TRANSFER RATE—MB/SEC	60	19.3	8.0	36.4

In this game, it's clearly no contest. The BTI 8000 32-bit multiprocessor system gives you the lead in the first inning, and keeps you there all the way. And, you can sign it up for 30 percent less than competitive systems.

Furthermore, the BTI 8000's hardware and software architecture will continue to make it a top performer, long after other systems have been traded away.

For example, starting with a basic system, BTI's exclusive Variable Resource Architecture lets you increase processing power by ten times, just by plugging in resource modules. You don't have to rewrite systems or applications software either.

Despite its "superstar" status, the BTI 8000 is friendly to users and a real team player. A virtual machine environment, hierarchical ac-

count structure and fail-soft architecture eliminate any worries about security, control or downtime.

As for reliability, BTI bats near 1000, thanks to service via remote diagnostics. BTI has been using this method for over 10 years, and currently supports over 3000 systems.

These are just a few reasons why you should put the BTI 8000 in your starting line-up. For a complete scouting report, contact your nearest BTI office.

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CIRCLE 12 ON READER CARD

LOOK AHEAD

DPD DIPS INTO
GSD'S DOMAIN

IBM insiders say there will be a slew of announcements from Big Blue by year-end -- a "big machine," a service bureau network, Hydra/VM software (August, p. 38), and some new 4300 machines. But the big news is that not only is IBM readying a bigger 4300 engine, but it's also looking at a low-end system in the series. One problem remains -- GSD is said to be balking at the small machine.

DISCOUNTING
3033S?

Ever hear of quantity discounts on 3033s? Neither had IBM, until Bell Labs recently told the supplier it wanted such a deal before it would ink the pact for a large 3033 order. Last we heard IBM hadn't said yes, but it hadn't said no, for that matter.

CAD/CAM IN
NEW JERSEY

Perkin-Elmer, the Oceanport, N.J. 32-bit minicomputer maker is close to signing a deal that would put it into the CAD/CAM market in a big way. A joint venture with Lockheed to market that firm's Cadam software is being discussed. It would give P-E a good chance of grabbing a large chunk of growing distributed CAD/CAM market. Cadam is currently licensed to IBM for use on large mainframes. P-E's system would sell in the \$100,000 range, according to those in the know.

XTEN NOT DEAD

The Xerox networking scheme, which was withdrawn from public view last year after many dollars were invested, is on the block. Nobody's saying who the interested parties are, but Xerox is said to have lined up some prospective buyers. XTEN was to have competed with AT&T's own withdrawn network, ACS.

THE SEVEN-
YEAR ITCH

The first retail computer store, opened back in 1977 by Dick Heiser, is up for sale. Located in Santa Monica, Calif., The Computer Store -- not to be confused with the East Coast chain of the same name -- has grown to a \$1,500,000 business. Its most popular items are systems for word processing, business planning (VisiCalc still sells machines), file processing and communications. The current staff plans to stay on and may even hire four additional computer-savvy staffers so that the store can stay open for six days a week. Heiser says he's selling so he can pursue other interests including teaching and "roaming around on information networks." His asking price: \$500,000 plus inventory.

LOOK AHEAD

INFORMATICS MAKES ITS MARK

Look for an introduction from Informatics of a new software product designed to help IMS/DC users develop application programs on-line. The new Mark V product is expected late this month with a selling price of about \$100,000. Menu-driven, the software carries forward the philosophy of Informatics' highly-successful Mark IV. The new product is said to be in field test currently and is to be introduced early next year to overseas customers.

NEW CHANNELS FOR TERMINALS

While the 3270-type terminal market has been Lee Data Corp.'s bread-and-butter, the firm is moving into new arenas. With annual revenues up to \$6,700,000 last year, the firm has set its sights on asynchronous terminal markets so it can get non-IBM business. Also in the works at the two-year-old Minneapolis company are color and graphics capabilities for its All-in-One line of display units. The secret behind Lee Data's high-quality, high-capacity (up to 66 lines of 132 characters each) is the switch from Motorola screens to those made by another Minneapolis firm, Moniterm Corp., headed by Ward Johnson, former oem sales and field support manager at CPT Corp.

STAY WHERE YOU ARE

The high costs of relocating personnel to California from other parts of the country don't bother Interactive Systems Corp., the Santa Monica software firm. It has hired people in Boston, Gaithersburg, Md., San Francisco and Austin and let them stay where they are. Each programmer is given a block of code to work on and develop on his or her own.

RUMORS AND RAW RANDOM DATA

Dylakor should be coming out this month with a DOS version of its Dyl-280 report writer. Pricing is understood to be similar to that of the OS version: \$127 a month....Burroughs is back in court because of its ill-fated B 3950, but this time the suit was filed by rival Sperry Univac. That firm charged Burroughs with violating the City of Minneapolis' bidding rules in opting for a different system than a 3950....Our prize for most extravagant advertising goes to Tandem Computers whose sleek grey Mercedes 450 SL was seen cruising Manhattan's Upper East Side recently. It had company logo license plates....Now that Xerox has signed up Hamilton/Avnet to distribute its 820 personal computer, observers are wondering if IBM will cut a similar deal for its new machine. IBM already moves its 3101 ASCII terminal through industrial distributors so a personal computer deal would be a natural.



Think what your programmers could do if your users did their own reports.

Answer/DB, the latest Implementation System from Informatics, is the new on-line software tool for report generation. It lets non-DP people develop their own report requests at a terminal — in an English like language — with as few as four simple statements.

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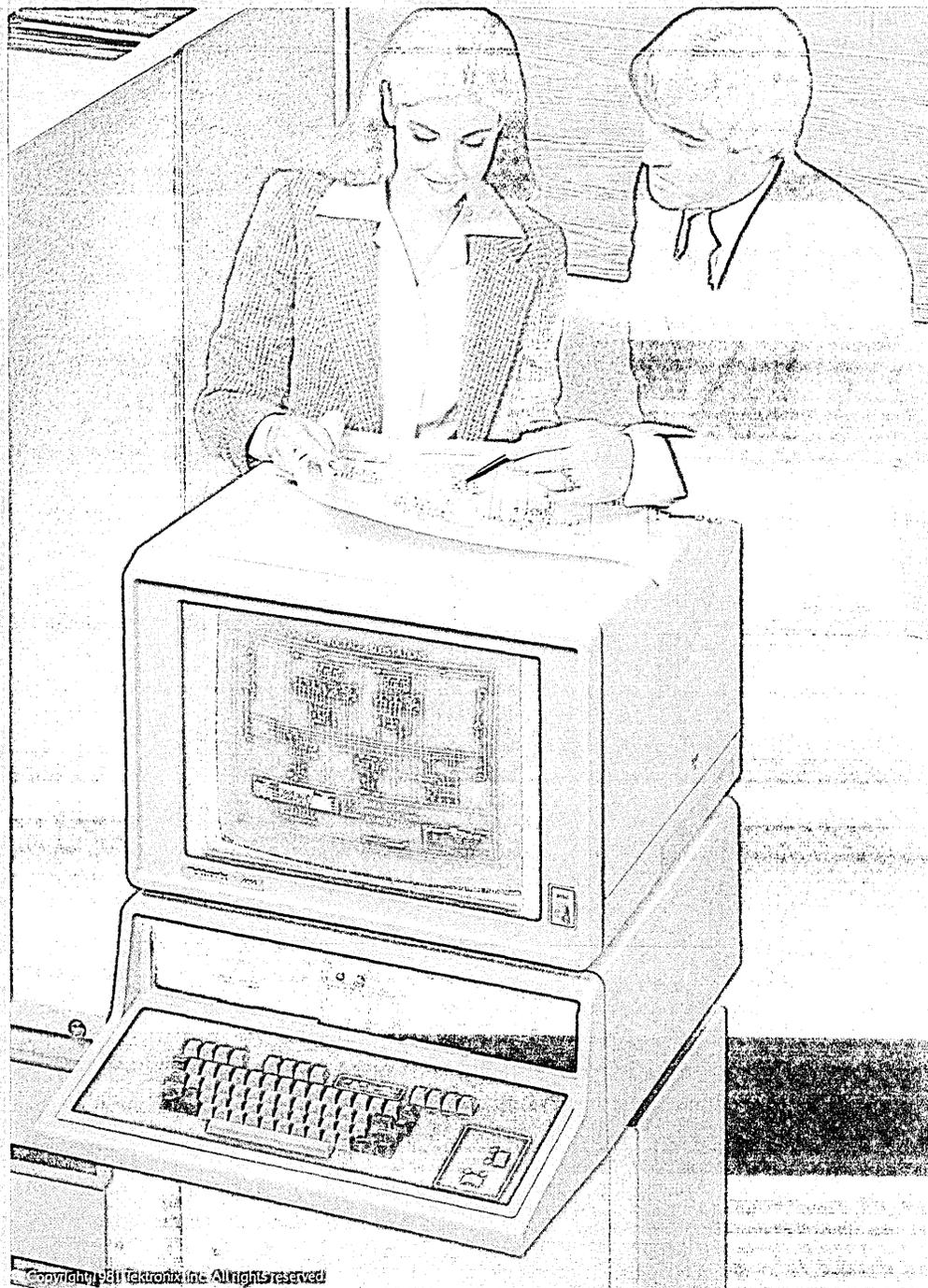
Name _____ Title _____
 Company _____
 Address _____
 City _____ State _____ Zip _____
 Telephone (____) _____
 Computer _____ Operating System: DOS/VS OS/VS
 TP Monitor: IMS/DC CICS/VS TSO **DM9/1**

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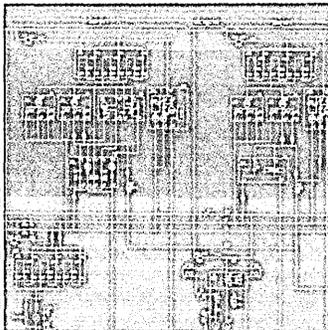
CIRCLE 13 ON READER CARD

The Information Management Company.

The Tektronix 4114 Computer Display Terminal



High resolution 4114 displays can be scaled up, as below, using local 2-D transforms. You can recall locally recalled picture elements and position them within the display under thumbwheel cursor control. RAM/ROM is expandable to 1 megabyte.



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Local segments. Fast redraw. Refresh dynamics. 19.2K baud communications.

When you can't work any harder, we'll help you work faster.

The power you've always wanted is right before your eyes.

The new Tektronix 4114 combines host computer power with unprecedented local intelligence and transmission speed. It combines the unequalled resolution of the 19-inch Tektronix storage tube with the capacity to construct, store, redisplay and manipulate graphic elements locally, without transmission from the host. It includes 3000 short vectors of local refresh and new fast redraw capability.

It adds up to a reduction in the delays, interruptions and high line costs that inhibit creative thinking and productive results—and a boost to the graphics interactivity that inspires them.

You can stay linked to the host without being locked into it. Command local graphic primitives. Create character sets. Store and retrieve picture segments

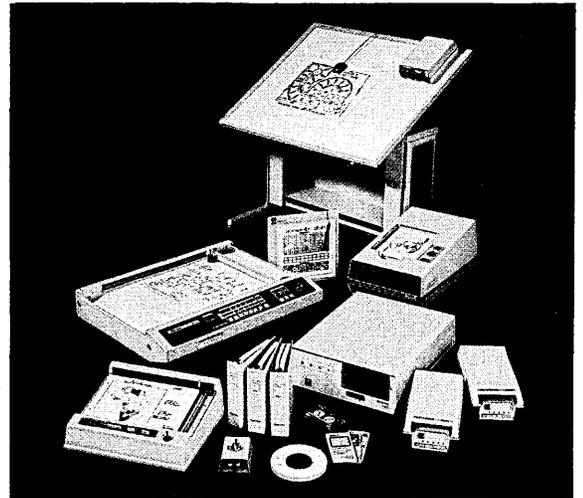
locally. Perform local translation, rotation and scaling. Try alternatives in refresh mode. Then communicate with the host at speeds up to 19.2K baud.

You can even define the size and location of a scrollable, refresh dialog area—the functional equivalent of a second alphanumeric display.

Optional enhanced version keeps refreshed information in high-contrast color. A particularly convenient, easy-viewing feature in high-density graphics environments.

You can expand user RAM memory to 800K bytes, and add optional integrated single or dual flexible disk mass storage. You can consolidate and reorganize files, display directly from disk, or send data from disk to plotter while you turn the terminal to other tasks.

Why waste time waiting for what you can see right now? A Tektronix sales engineer can show you the 4114 in action.



Or call toll-free, 1-800-547-6711 (in Oregon, 1-800-452-6773 for complete product details or OEM quotations.

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CIRCLE 14 ON READER CARD

CALENDAR

SEPTEMBER

Comcon Fall, September 14-17, Washington, D.C.

The IEEE's Computer Society has selected "Productivity—An Urgent Priority" as this year's theme. Contact Comcon Fall '81, P.O. Box 639, Silver Spring, MD 20901, (301) 589-3386.

OCTOBER

ECOMA-9, October 6-9, Copenhagen.

"Evaluation, Implementation, and Improvement of Contemporary Information Processing Systems" is the theme for this year's Ninth European Conference on Computer Measurement. Contact Scott Yasler, CDP, ECOMA-9 Conference, Scheuchzerstrasse 5, CH-8006 Zurich, 01-362-1268.

BIAS 1981, October 6-10, Milan, Italy.

The International Meeting Exhibition of Automation, Instrumentation, and Microelectronics is the only one of its kind to take place in Europe this year. Contact FAST (Union of the Scientific & Technical Associations), p. 1 e. MORANDI 2, 20121, Milan, Italy.

INFO '81, October 12-15, New York City.

"Increasing the Responsiveness of Information Systems" will be the theme of the Information Management Exposition and Conference. A special section will be devoted to prepackaged and customized software. Contact Clapp and Poliak, Inc., 245 Park Ave., New York, NY 10167, (212) 661-8410.

WPOE '81, October 13-15, San Jose.

This is the fourth annual Word Processing and Office/Business Equipment Trade Show and Conference featuring equipment, products, and sessions. Contact Cartlidge and Associates, Inc., 491 Macara Ave., Suite 1014, Sunnyvale, CA 94086, (408) 245-6870.

Systems '81, October 19-23, Munich.

Both the conference and exhibition at Systems '81 will strongly emphasize telecommunications. "Thinking in Systems" is the theme. Contact Kallman Associates, 30 Journal Sq., Jersey City, NJ 07306, (201) 653-3304.

GAD/CAM Graphics Users Expo, October 27-30, Fort Worth, Texas.

The expo is held in conjunction with Computer Aided Manufacturing-International, Inc.'s 10th annual meeting. The conference will focus on various graphics systems' capabilities relative to manufacturing users' needs. Contact CAM-I, Suite 1107, 611 Ryan Plaza Dr., Arlington, TX 76011, (817) 265-5329.

NOVEMBER

Federal Office Automation Conference, November 3-5, Washington.

The conference program provides coverage of issues including management, applications, technology, equipment, and systems and services. Contact Federal Office Institute, P.O. Box E, Wayland, MA 01778, (617) 358-5119.

ACM '81, November 8-11, Los Angeles.

Exhibits, tutorials, workshops, panels, plus a number of special events will be part of this year's ACM. Contact ACM '81, P.O. Box 24059, Village Station, Los Angeles, CA 90024, (213) 536-9735.

Autofact III, November 9-12, Detroit.

New technological refinements and management approaches to the automatic factory are the major subjects of this year's conference and exposition, sponsored by the Computer and Automated Systems Association of the Society of Manufacturing Engineers. Contact SME Public Relations, One SME Dr., P.O. Box 930, Dearborn, MI 48128, (313) 271-1500.

Western Educational Computer Conference, November 19-20, San Francisco.

Sponsored by the California Educational Computing Consortium, this is the CECC's fifth year. Contact Ron Langley, Director, Data Processing Services, California State University—Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840, (213) 498-4111.

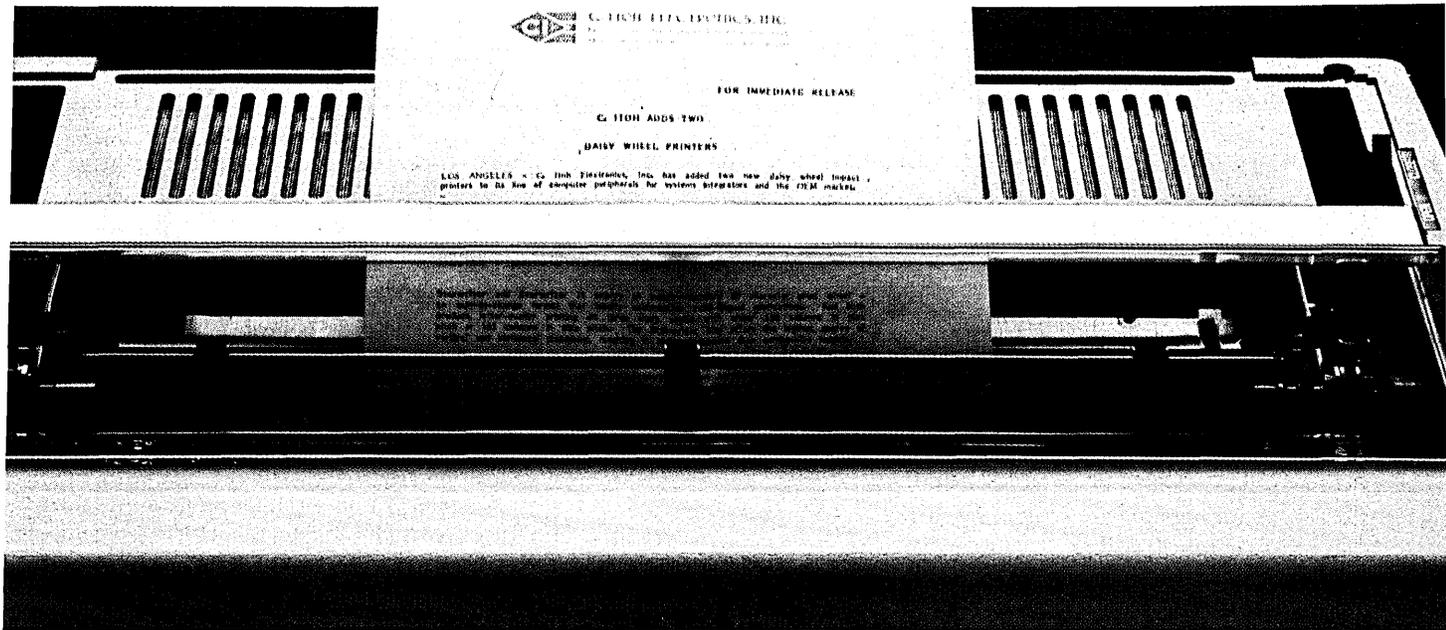
1981 National Telecommunications Conference, November 29-December 3, New Orleans.

"Innovative Telecommunications—Key to the Future" is the conference title. Topics include using communications technology to develop energy resources, and other innovative uses of telecommunications products and services. Contact Kenneth Black, New Orleans Public Service, 365 Canal St., Rm. 950, New Orleans, LA 70140, (504) 586-2173.

DECEMBER

Twelfth International Conference on Computer Performance Evaluation, December 1-4, New Orleans.

The conference is sponsored by the Computer Measurement Group, and will feature CPE sessions from three viewpoints—technical, managerial, and tutorial. Contact Donald Deese, FEDSIM, 6118 Franconia Rd., Alexandria, VA 22310, (202) 274-8461.



LETTER PERFECT.

You can actually see the superior print quality when you use C. Itoh's new daisy wheel impact printers. Besides clear and crisp print characters, you also get the throughput performance you're looking for, at prices never before available to quantity buyers of Daisy Wheel printers.

C. Itoh's Starwriter offers you a print speed of 25 cps while the Starwriter II operates at 45 cps. Both machines incorporate the latest LSI technology and utilize an easy-to-change industry standard 96-character wheel. Starwriter printers are the perfect choice for multilingual and multi-discipline applications.

The two Starwriter models also feature self-test capabilities and a programmable VFU. You'll be able to print up to 163 columns on

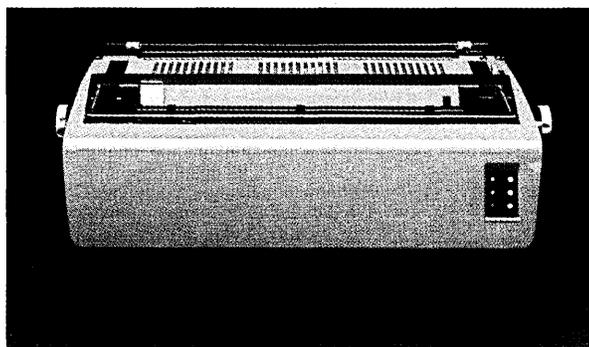
multiple copies and you can process paper widths to 381 mm (15"). Both models are equipped with front panel indicator lamps and switches.

You can put our printers to work the minute they're delivered. They're plug-compatible and meet either the industry standard parallel interface specifications or serial RS 232 C with voltage or current mode capacity.

So if you're looking for perfection

in printing, let our Starwriters do the job. All printers are backed by C. Itoh's warranty and nationwide service organization. For more information, contact C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066; Tel. (213) 306-6700. Chicago Office: 240 E. Lake Street, Suite 301-A, Addison, IL 60101; Tel. (312) 941-1310. New York Office: 666 Third Ave., New York, NY 10017; Tel. (212) 682-0420.

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Just a few years ago, advanced technology and system compatibility were mutually exclusive. But when Prime began making computers, technology and compatibility became one.

Big. Better. Best. The Prime 50 Series includes the Prime 250-II, 550-II, 750, and the new Prime 850. The Series is so flexible, it can handle virtually any application you have. And so powerful, it can meet your most demanding needs.

If you're in a start-up mode, the perfect way to begin building your system is with the Prime 250-II. If you need more power, you'll find the solution in the Prime 550-II or the Prime 750. And if you're looking for maximum performance, the Prime 850 is the most powerful mini available today.

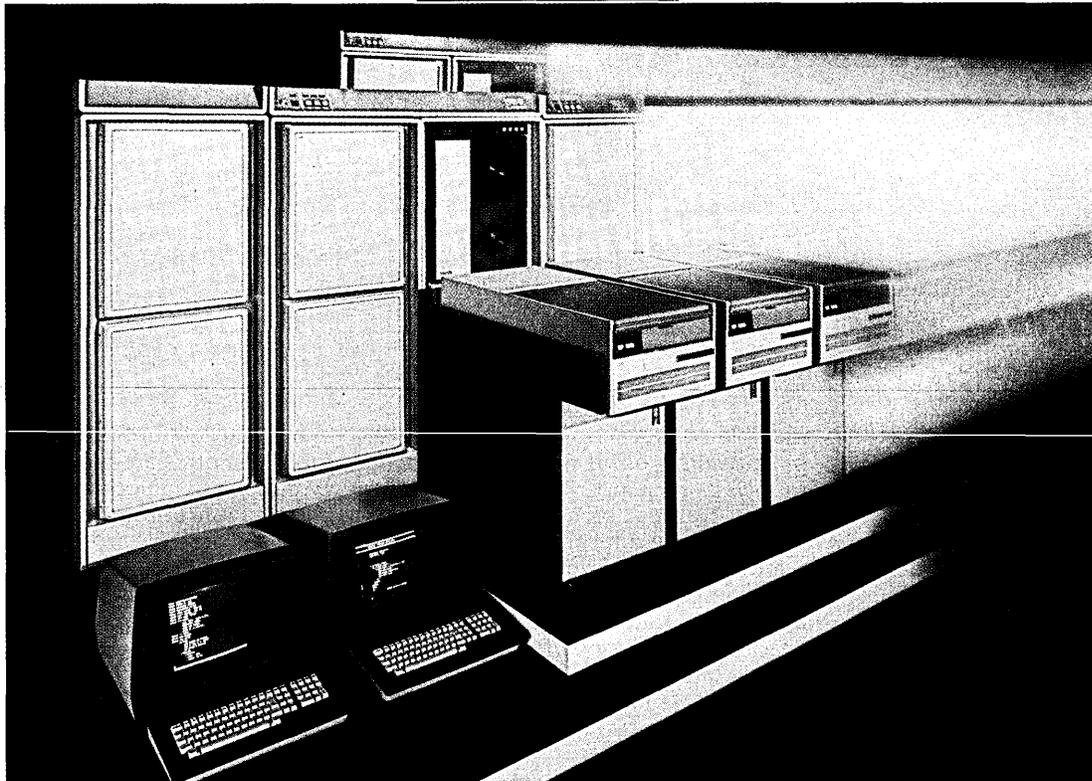
You should know too that any 50 Series system can be networked with any other. They can also communicate directly with mainframes. And all Prime systems support a broad band of industry-standard languages.

The economy of compatibility. The Prime 50 Series is designed around a single operating system, which makes all systems compatible with each other. So you can easily and economically move up to a larger system, or expand to any number of small, remote systems. And you'll have nothing new to learn because the same software goes with you.

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LETTERS

WHO NEEDS HISTORY?

Re: "Growing Up Computing" (June, p. 211), the title of the article is very apt. In reading some of the statements attributed to some of the students, it is very obvious that they are still growing up. I would be the last to want to dampen their enthusiasm for the computer, and certainly many boys and girls are enthralled by the power of such a device. The acknowledgement they get and the sophistication they feel is analogous to the feeling a teenager gets behind the wheel of a Trans Am.

I think those of us who are in the computer industry, as well as other adults and parents, should take a serious look at what is being said here. It reaffirms all the more need to make sure that the educational programs of the nation are organized to give a balance to the curriculum to which young people are required to subscribe.

As one who is technically trained from a technical school, I have been privileged to be in the computer industry for almost 20 years. With home computers now available and affordable, I can understand a student's disdain for history. Much of it is because of poor and uninspired teaching methods. But, the older I get the more I see the need to study and understand history.

Particularly ill thought out is John Pencsak's statement that "they need to take history out of the schools and put computers in instead, because history has no meaning." How sad that a young person with his apparent intellect could arrive at such a poor conclusion. One would think with the logical thought process brought on by computers and the depth of thinking required that certainly no one could ever arrive at a conclusion so erroneous. While certainly there are not the rigors in the liberal arts curriculum that there are in engineering and technical curriculums, no thinking person could ever make such a statement.

We should remind the young man that people have fought, lives have been taken and sacrificed, and blood spilled over the events of history—events such as the Holocaust, the Inquisition, the misguided Crusades, World War II, and the Vietnam

War. We should engrave on his or her mind that "those who fail to learn from history are doomed to repeat it."

How scary that we could be bringing up a generation of computer geniuses who will intentionally try to avoid studying and remembering the things which have caused so much human suffering. They will never study the excitement and the meaning of the great positive events such as the discovery of electricity, the development of the steam engine, the founding of a nation such as ours, man's first flight, the placing of a man on the moon, the first flight of the space shuttle, and even the invention of the computer itself.

Certainly no thinking person could really learn or contribute to this life without a working knowledge of what it has cost us to get here and the mistakes which have been made.

"History has no meaning." Indeed!

TERENCE D. HUGHEY
Chairman
Chromatics, Inc.
Tucker, Georgia

I want to comment on the opinions your young panelists expressed concerning the importance of the study of computers vis-a-vis that of English and history. English, they said, "grows increasingly redundant" and "is boring"; history is so unimportant that everyone agreed it should be dropped from our school curriculums.

I want to go on record as saying I don't agree. In fact, why do I even have to write this letter? If your staffers were interviewing some top-notch data processing guru who made such an outlandish statement, I'm sure they would call him on the carpet. Why do these kids get a break? Just because they're kids?

The study of English and history are so important to us as civilized beings that to try to make a comparison of value between these subjects and the study of computers just makes no sense. I don't want to give the impression that these kids are "bad" because they feel as they do; they are no different than most members of their generation.

But when we as adults encounter in our own children this same attitude, it is our job to do what our parents and teachers did for us when we were that age—point out the importance of such subjects as English and history.

A lack of language skills can be costly in the long run—even if your line of work is dp. Every year thousands of dollars and many man-years are spent on a dp project, only to have largely everything go down the drain. Why? Because the "wizards" who wrote the software did not have enough grasp of the English language to write a comprehensible set of instructions explaining how their wonderful creation could ever be used by those poor souls it was supposed to benefit.

And as for history, the subject deals with questions much more important than those encountered in our mundane 9-to-5 jobs. Without an understanding of history, there is no understanding of the tremendous sacrifices and accomplishments made to get us where we are in 1981.

The saddest part of the entire interview came in the closing paragraphs. One of the youngsters foresaw future schooling when students will remain at home devoid of any human interaction and will sit in front of their crts. Of this image, one youngster replied, "That's great. I love that."

I don't love that image of the future; I don't think it's great at all. In fact, I think it's one of the most awful visions of the future I can conjure up.

Hey kids, machines aren't important—*people* are. How can some glorified tv set be so interesting that it makes you lose interest in interacting with real-life people? Come on parents, teachers, DATAMATION; of course we all like computers, but let's get things back in their proper perspective.

JERRY SCHULZ
Milwaukee, Wisconsin

It may be true that "boys still tend to take more science courses than girls," but I find that a poor excuse for the fact that DATAMATION could not manage to discover a single female student interested in computers. Per-

LETTERS

haps the article should have been entitled "Growing Up Male—And Computing."

Perhaps the real problem is that your staff has begun to believe all of the advertisements in your magazine which depict the female in data processing as a typist or an operator of tape drives.

ALICE J. SZIEDE
Computer Specialist
U.S. Geological Survey
Reston, Virginia

UNJUSTIFIED SLUR

Re: "Evaluating Database Languages" (May, p. 116), although Stamen and Costello did a fine job of introducing some general ideas in their article, they didn't go into enough depth to help the average reader. Also they cast an unjustified slur on the hierarchical data model: "Systems based on single file or hierarchical data models . . . are not powerful enough to represent the interrelationships of data required by many business applications."

This must come as a shock to the thousands of IMS and System 2000 users, who are representing every imaginable interrelationship of data with hierarchical systems. Furthermore, Stamen and Costello have glossed over an important point: a procedural language operates on a data model which is little more than a restricted view of the actual physical data as organized on mass storage, while a nonprocedural language deals with a logical, external view of the data which is not closely dependent on the "underlying data model of the database management system."

To bring all this down to earth, IBM

provides a relational language (SQL) for its hierarchical DBMS, and Intel has both a natural language (SCF) and a nonprocedural language (QUEX) for System 2000. What is a hierarchical data model to a procedural language in both of these cases has been submerged beneath an external personality. The hierarchical data model is still there, but only if the user wants to worry about it; he can just as well devote himself to the nonprocedural interfaces.

Thus the tried-and-true hierarchical data model, which tends to be cheaper to update than complex networks, can be used by the DBMS to manage its internal data, while the user's view is maintained separately and tends to change dynamically according to his external activities. IBM, Intel, and others are working on truly relational systems, but performance and other problems have limited the success of the relational modeling approaches praised by Stamen and Costello.

JIM CRAIG
Manager, OS DBMS Development
Intel Corp.
Austin, Texas

NOWHERE REVISITED

Re: Readout (June, p. 31), surely you jest. If not, when you packed your long teeth and black tie for the Pioneer Day dinner, you packed your reasoning ability as well.

Neither inductive nor deductive, the very best that can be said for your June editorial is that it is "seductive"—an easy association of ideas put together just to meet a deadline. If the NCC and this year's Top 100 both indicate the healthy growth of the

data processing industry, an equally valid alternative to your conclusion is that the health is a *result* of the IBM antitrust trial. This being the case, one could properly call for a continuation of this very meaningful and useful stimulus to the dp industry. It is far from "obvious" that IBM's competitive efforts have not throttled the U.S. computer industry. Some rational persons go so far as to insist that's what the trial is about.

"Square-eyed" is one thing, but "square-toothed"?

JACK LEWIS HIGH, JR.
McLean, Virginia

The fundamental purpose of the IBM antitrust trial is to continue to sober the drunk from Armonk. Like an unreformed alcoholic, IBM, if allowed to continue as currently structured, will surely revert to its old ways to the damage of every citizen. The control of information is too precious, too far reaching to leave in the hands of one who has abused its position.

LAURANCE J. OCHS, Atty.
Washington, D.C.

In your editorial, you asked: "Who would have dreamed in 1969 that something called a 'personal computer' would invade the exhibit floor [of the NCC] a dozen years later?" Maybe the California Continuing Education of the Bar is who. Several of us put on a program for California lawyers in March 1970 entitled "How to Try a Plaintiff's Antitrust Case." The material we used was dreamed up in 1969. The program was a panel discussion among a group of lawyers evaluating a prospective treble damage case in a then-fictitious industry for which we could, of course, create an appropriate market structure of manufacturers, product lines, market shares, and business practices to illustrate our point.

That "fictitious" industry manufactured small computers for home, office, and kitchen use. One of the companies in that industry offered its kitchen model computer in a choice of "decorator colors," a touch we haven't yet seen in real life, as far as I know. But otherwise, the structure of the market as we hypothesized it in 1969 isn't far from the reality that we see around us today.

MATTHEW P. MITCHELL
Feldman, Waldman & Kline, Attys.
San Francisco, California

THE MONKEY'S BACK

Re: "The Monkey On Management's Back" (Readers' Forum, June, p. 253), Mr. Sitner's item makes an excellent point. I've been in dp better than 12 years and have spent too much time trying to get programmers to use such things as numbered paragraph names and plain English data names. Getting them to include well written, accurate, and concise sentences to document their code—I've long given up on.



"Actually, I'd settle for a man who's never been indicted."

© DATAMATION

CARTOON BY TOM STRATTON

P. Sharp Associates, the international APL specialists, present "A Working Introduction to APL," the comprehensive introductory APL course. Designed by the inventor of APL language, Kenneth E. Iverson of the SHARP PL Development Group.

As more and more organizations depend on APL time-sharing services and software, I.P. Sharp now introduces an innovative training package to keep pace with growing need for qualified APL programmers, users and managers. "A Working Introduction to APL" provides rapid on-site training on any APL system. And includes exactly the same course of instruction and training materials offered at I.P. Sharp training centers.

No prior computer experience is necessary.

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Students who want to become APL programmers will receive the

Speak the Language

necessary foundation for further growth. Emphasis is placed on learning how to learn.

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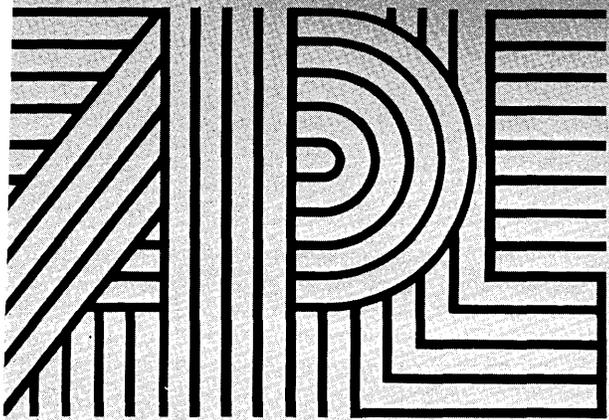
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CIRCLE 17 ON READER CARD

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LETTERS

The problem is not restricted to dp. It's a common problem throughout the business community. People who can't read, can't write.

As someone who has tried ideas very similar to Mr. Sitner's for many years, I would agree with his views on libraries and disagree with those on making "... all programmers (no matter their capabilities) write source coding which is clearly understandable, self-documented, and standardized." For, part of those "capabilities" Mr. Sitner feels are "no matter" include a good command of the English language. Without

this, no one can write (or read) good documentation—in programs or outside them.

NEIL LETTSOME
Data Processing Manager
Rainfare Inc.
Racine, Wisconsin

THE SATURATED MARKET

Re: People (May, p. 175), Dr. Atchison talks about the influx of students to undergraduate computer science programs and suggests the possibility of a future saturation of the job market.

This situation reminds me in some

respects of the situation in physics 20 years ago. When I finished high school, physics was a glamour course and attracted many students, as did related areas of the sciences and engineering. Few people at that time foresaw any end to the demand for physicists. In fact, if the exponential growth models then being used to form projections actually had been followed literally, today at least half the population of this country would be solid state physicists.

Obviously, the job market became saturated. When I received my PhD (after nine years of study), instead of the expected choice of job openings, I had to write hundreds of letters to turn up even a few interviews. No one had prepared me for this turn of events. No one had suggested I might be more employable if I added computer programming to my repertoire of skills. Nevertheless, I was lucky. I never had to drive a taxi for a living. I was able, after much discouragement, to work into an academic position in a related field.

I think there are two lessons here that may be applied to tomorrow's computer science programs. First, saturation of job market *is* inevitable. Second, this need not be devastating to the individual job seeker.

The highly commercial nature of the computer does give it an advantage over the physics of twenty years ago. There are already many ongoing surveys of jobs, salaries, etc. These should make it easier to spot trends. However, it is all too easy to expect tomorrow to be like today. In order to alert aspiring computer students of impending changes in the field, wise men and women will have to be sensitive to these possibilities.

Anticipation of difficulty should help soften the blow for the graduate entering a saturated job market. At best, it will allow him or her to alter academic choices in time to improve chances of obtaining a job. Computer science education, like physics, does provide skills that are useful in many different endeavors. Taking advantage of this by including a broadly based, liberal component in the computer science curriculum should help the student who must look for work beyond the traditional boundary of "computer science."

KENNETH H. DOUGLASS, PhD
Assistant Professor

Division of Nuclear Medicine
The Johns Hopkins Medical Institutions
Baltimore, Maryland

While the problems cited by Atchison are quite real, the robust state of the computer science field certainly gives academic institutions the power to deal effectively with these problems. I would like to offer the following suggestions:

1. Academic salaries can be increased by increasing faculty productivity. If computer sciences can develop computer-aided construction techniques for all levels

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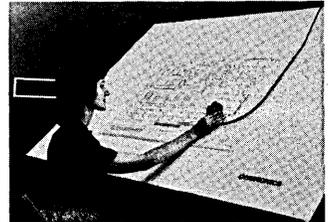
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CIRCLE 19 ON READER CARD

LETTERS

of education, they can certainly adapt it to their own teaching requirements.

2. Computer science should have a much greater reliance on laboratory instruction. Now that fairly complete microcomputer systems can be purchased for less than \$2,000, many schools are requiring that all computer science students get one. This allows the instructor a medium far beyond the limitations of a lecture room or textbook and also solves the problem of inadequate or overcrowded laboratories.

3. The curriculum must emphasize courses that encourage the student to be innovative.

4. There is nothing wrong with students forsaking or postponing graduate study in favor of well-paying jobs. The violent swings in job opportunities for technical specialties which we have seen during the past 20 years certainly should encourage them to "make hay while the sun shines." The appropriate response from the academic institutions should be varying degrees of combined work-study programs. The incredible proliferation of hardware and software courses for practicing professionals strongly attests to a need that the academic community is not filling. The concept of "lifetime" education has been

talked about for years. It is time that computer science put it into practice.

PETER GOTTLIEB

Dames & Moore, Los Angeles, California

RESEARCH HOUSE WRONGED

Data Decisions was not credited for the charts entitled "Business Applications Software Outline" which preceded the company's survey of financial applications vendors and packages in our August issue. We regret the error. Both the charts and the survey were based on reports in Data Decisions' *Computer Systems*, a looseleaf reference service available on a trial review basis from Data Decisions, 20 Brace Rd., Cherry Hill, NJ 08034, (609) 429-7100.—Ed.

REVIEWER REBUKED

Re: Source Data (May, p. 197), I was disturbed to read the review of my book by Sally Williams-Haik. Her attack includes a condemnation of the "mediocre quality of the layout" for "Carol Wald's delightful collages" which illustrate my book. It's hard to understand this complaint since each piece is given a full unobscured page facing the title page of each chapter.

Ms. Williams-Haik incorrectly has me teaching at Stony Brook. Consulting the title page would have made it clear that I am at the University of Maryland.

Her insulting comments about the dp professionals who might read this book are uncalled for. She doubts that programmers would have passion for their work, an understanding of the term "psycholinguistics," and a background in statistics.

She also fails to notice that the unifying force and the purpose of my book is to emphasize the human factors issues in programming, database usage, and interactive systems design. Her inability to understand how software metrics relates to evaluating human performance in programming is so shocking I must wonder if she is a competent critic of this book.

Software Psychology was the featured selection by both computer science book clubs and is in its third printing in less than a year. It seems that the professional dp community has more capabilities and intelligence than this reviewer perceives.

BEN SCHNEIDERMAN

Associate Professor

University of Maryland, College Park, Md.

GLARE DE LUME

Re: "Europe's Human Approach" (May, p. 38), I was amazed that no mention was made of a basic and pervasive design flaw that I have seen in all VDT: the arrangement of the keyboard characters. The QWERTY arrangement commonly seen was, as is well known, designed (by trial and error) to slow the key-operator down—a hangover from Christopher Scholes's typewriter. A markedly improved arrangement was established in the '30s by the ergonomic scientist Dvo-

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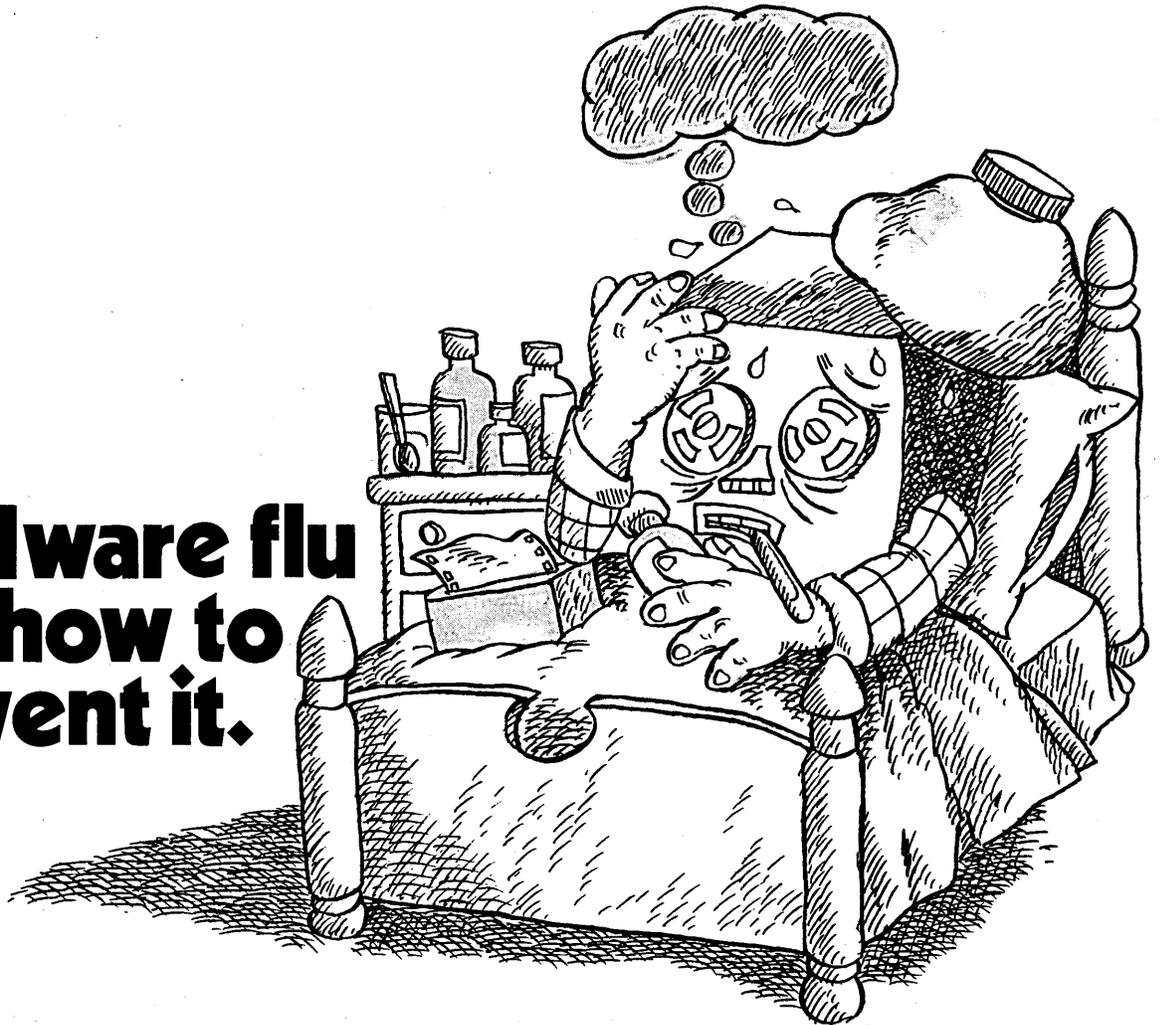
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CIRCLE 20 ON READER CARD

LETTERS

rak, but has been almost totally ignored.

Changing the keyboard arrangement can readily be accomplished at low cost. It is not at all difficult (as has been shown by experiments in Oregon and other places) to retrain operators to use the easier, faster, and less error-prone design. Any article on ergonomic features of terminals should not overlook the basic and central design element of the keyboard arrangement.

MICHAEL W. HAM

Director, The National Registry
The American College Testing Program
Iowa City, Iowa

What's wrong with the right picture:

1. No writing/work surface to speak of,
2. Operator faces wall (the wrong picture was a better orientation),
3. Overkill on ambient light (four overhead source luminaires, four indirect lights, desk light—come on!),
4. Workstation is totally isolated (I'm sure this operator has working interfaces) . . . in this category the absence of a phone totally isolates the operator!

Finally, it's not possible to lay out a workstation without knowledge of precisely

what goes on there; i.e., there are no good, bad, ugly layouts per se—this "right" picture is an ideal layout for a Mafia road processing operation (if the operator has a bulletproof vest on backwards).

JOHN DINAN
Topsfield, Massachusetts

My company is just now introducing a glare-attenuating fabric shield developed about 13 months ago in Sweden and used extremely successfully on many VDTs throughout Scandinavia and the rest of Europe. The effect is to increase contrast and clarity of characters coming through the shield from the tube while blocking reflections from incident light passing in the reverse direction. The technique works, and users report perceived reduction in many of the detrimental effects of VDT usage pointed out in the article.

EVELYN T. SHAW
Vice President
Screen Data Corporation
Kinnelon, New Jersey

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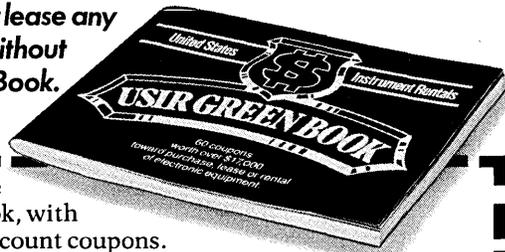
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MONEY TALKS . . .

Re: Editor's Readout (May, p. 33), I certainly agree with the basic theme—that people skills are crucial to management advancement. The thought could be expanded, however, as described by this aphorism:

“Men who manage men
Manage men who manage things,
But men who manage money,
Manage all.”

That is consistent, of course, with the famous “Golden Rule”:

“He who has the gold makes the rule.”

After some 30 years as an information systems manager in user organizations and with hardware and software vendors, I have now spent a year as finance manager; it has been an interesting and worthwhile education.

JOSEPH L. PODOLSKY
Division Controller
Hewlett-Packard Co.
Microwave Semiconductor Div.
San Jose, California

I wish to add three salient questions to your observations a technical person should consider in selecting a career direction.

1. Am I the type of person who can find fulfillment vicariously through the success of others?

2. Having once given up the technical ranks, will I be satisfied with the lack of personal mobility in the job market? The higher one climbs the management ladder, the fewer opportunities that exist outside the existing company.

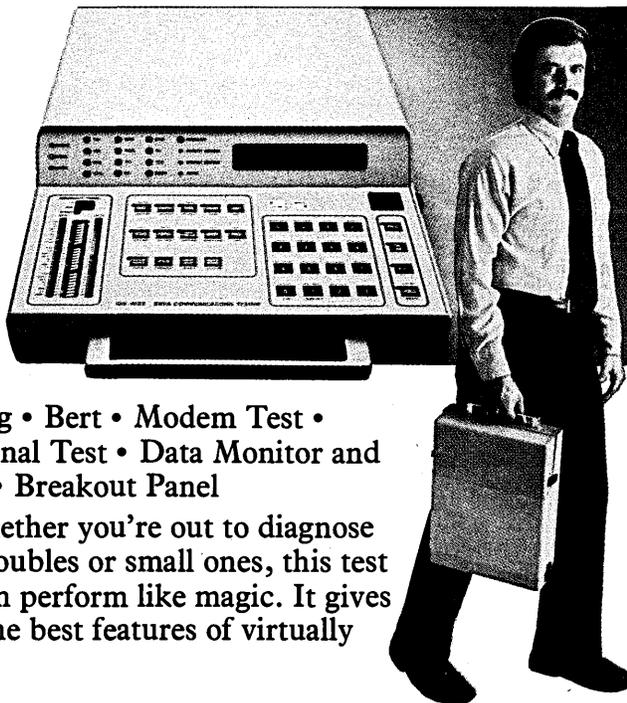
3. Can I accept the reality that, to succeed in management, I will no longer be the acknowledged senior technician I once was?

CIRCLE 21 ON READER CARD

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CIRCLE 22 ON READER CARD



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NV-A850 Remote Controller

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Variable speed, still frame.

Schools, chain stores, medical schools, hospitals and other professionals are using the variable-speed feature for a variety of instructional demonstrations,

from intricate assembly procedures to complex lab techniques. With speeds ranging from one-fifth to twice normal, action can be screened as fast as it takes to comprehend it. For extra-close analysis, you can proceed one frame at a time, and you still get a sharp, clear picture with Panasonic still-frame compensation.

2-track audio.

When it comes to bilingual communications, Panasonic speaks your language, whatever language it is. With 2-track audio, companies can make train-

ing tapes and sales presentations in two different languages on one cassette. For educational purposes, you can put questions on one track and the answers on the other.

2-hour memory.

With this Omnivision II system, you can stack up to 2 hours of "how to" material, interviews or research on a single cassette. With unattended auto-repeat, you can play the same cassette over and over with better pic-

ture and sound quality than with film-loop systems.

Programmable search.

With the Panasonic NV-A850 Programmable Auto-Search Controller, virtually any segment on a cassette can be retrieved at the touch of a button. Its memory can store up to 64 separate tape locations on a single cassette. You can





NV-8200
Video Cassette
Player/Recorder

NV-A800
Auto Search Controller

even pre-program it to automatically play back up to 15 segments in any order. The NV-A850 features LED readouts in hours, minutes, and seconds, as well as fast forward, rewind, pause, stop, and frame advance.

Fast 1/2" editing flexibility.

To help you edit material exactly the way you want to present it, the Panasonic NV-A960 Editing Controller (optional) interfaces directly with the NV-8200 or NV-8170 so you can perform 1/2" to 1/2" assemblies. Or perform 1/2" to 3/4" edits. Accurately. And fast.

Performance and reliability.

The NV-8200 and NV-8170 are designed to stand up to rigorous use with critical components mounted on a rugged annealed aluminum die-cast chassis. And for low jitter and excellent picture stability, both decks feature a direct-drive video head cylinder and capstan servo. Both decks also have tough crystal-oriented HPF™ video heads. The results: A signal-to-noise ratio of 45 dB, horizontal resolution of 300 lines black and white and 240 lines color,

and high-quality pictures even under continual use.

Both decks are solenoid operated. And, with the NV-A810 Remote Controller (optional), all machine functions can be operated from the palm of your hand.

Worldwide applications.

For multi-national companies, the NV-8170E (not shown) is a natural because it can play tapes recorded in either PAL or NTSC formats. How does it do it? With its PAL or modified NTSC video output, DC motors and multi-voltage capability.

Perhaps the best part of

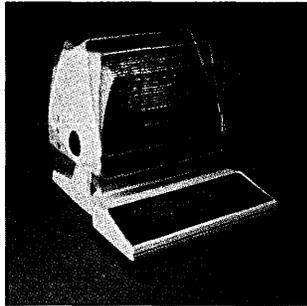
these Omnivision II decks is what they are part of: A total video communications system. Including portable and studio cameras, monitors, recorders and a wide choice of accessories. It takes a lot to deliver versatility. And any way you look at it, Panasonic has what it takes.

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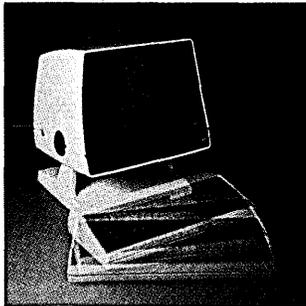
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CIRCLE 23 ON READER CARD

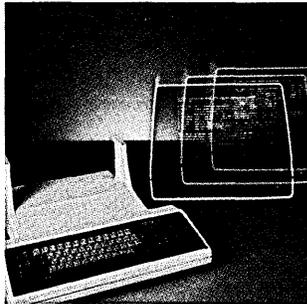
EASIER.



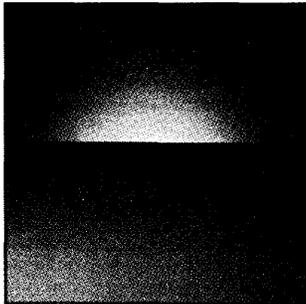
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Easier To Work With



Easier To Accommodate



Easier To Move Elsewhere

It's a word that best summarizes the benefits of the Memorex 2078 Display Station. Important benefits for users of some of today's most popular CPUs, including the IBM 43XX. And of today's most advanced

communications protocols, like SNA/SDLC.

The 2078 Is Easier To Work With.

People who are more comfortable are more productive. That's why there are more "people" features designed into the 2078. A non-glare screen and keytops. Non-reflective moldings. Recessed display. And a monitor that tilts 30° up and 15° down. There are also more operational features. Like a line and column indicator. An alternate cursor. An operator information line. And keyboard click and non-click mode.

The 2078 Is Easier To Move Around.

Space is always at a premium, be it on a desktop or an entire office work area. Which is why Memorex made the 2078 both compact and versatile. The whole package measures just 17" wide by 19" high by 24" deep. And it weighs a mere 55 pounds. A detachable keyboard and a removable monitor

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CIRCLE 24 ON READER CARD

LETTERS

Two additional points of view to consider:

1. One of the most significant realities is that machines are but a tool to be applied in the delivery of the true MIS product—service. Regardless of how extraordinarily technical a person is, that skill is of limited value to a company if the individual is lacking in the ability to exercise good communication skills and deal comfortably with people.

2. The MIS industry has only itself to blame for lack of success in being elevated within the corporate structure.

For a product or service to become of perceived value, it must be sold to the ultimate user based on its inherent productive worth.

Much of the time, the MIS professionals are so enthralled with the bits and bytes that the real purpose and proof of value are lost. MIS people must become sufficiently prepared to deal at all levels of a company structure and not shrink from the responsibility of providing measurable results. Virtually all other professional disciplines within an organization can be measured by units produced, contracts signed, accounts receivable collected, new markets opened, new generations of future products created, and so forth. All directly contribute to the company's bottom line.

Each of us within the MIS arena is obligated to identify and produce means which permit objective measurement and clearly demonstrate MIS' contributions in real terms to the company's welfare. It is incumbent upon the MIS professional, technical and administrative, to become integrated into a company's business processes as a business manager, not as a leader of technicians.

In today's world, MIS is no longer the extension of the accountant's realm. With the advent of CAD/CAM, office automation, telecommunications, and sophisticated integrated business applications, the MIS professional's responsibilities expand to affect nearly every aspect of the modern business environment.

D.D. DARWIN
Director, Information Systems
Rockwell International
Defense Electronics Operations
Anaheim, California

AT LAST

Re: "Salary Survey" (April, p. 98), Last year I wrote to express my disappointment and concern over the survey not having included enough trainers. I see that this year the position has been included and I hope that this will at least get installations thinking about having their own training coordinators.

HARVEY KARLIN
Training Coordinator
Computer Systems Division
First Pennsylvania Bank
Philadelphia, Pennsylvania

CONTINUING DOCUMENTATION

Re: "Death, Taxes, and Dp Documentation" (February, p. 73), let us hope that Lindsay Wilson's intelligent and ironic article has penetrated the minds and hearts of at least a few of us who work in the dp field with some creative intents.

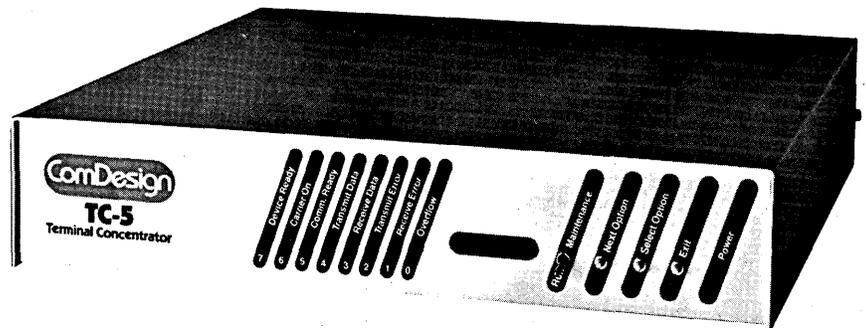
I hope DATAMATION will soon be devoting a whole issue to the documentation tragicomedy, a genre much loved wherever in the world dp somehow happens. The possibility that dp itself may be one of the objects investigated and processed within the computerized information system it

brought into being is something still far away from the average *weltanschauung* of the international dp community.

Too many dp managers keep on thinking that a healthy documentation is a threat to their own health and consequently prefer to do without for as long as they can. This sounds very popular and sort of "playing to the gallery," because most people at dp departments simply hate documentation and are prone to make friends with whoever thinks this way.

The typical dp worker, from senior analyst to junior programmer, superstitious-

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The readers of *Datamation* and *Data Communications* magazines must appreciate that kind of attention, for in every brand preference survey conducted since 1974, they've selected MAI's Sorbus Service Division as the number one service company – the third party service company they'd most prefer to do business with.

That same good feeling carries over to the OEM market, where Sorbus is the service arm for over 50 manufacturers. Why?

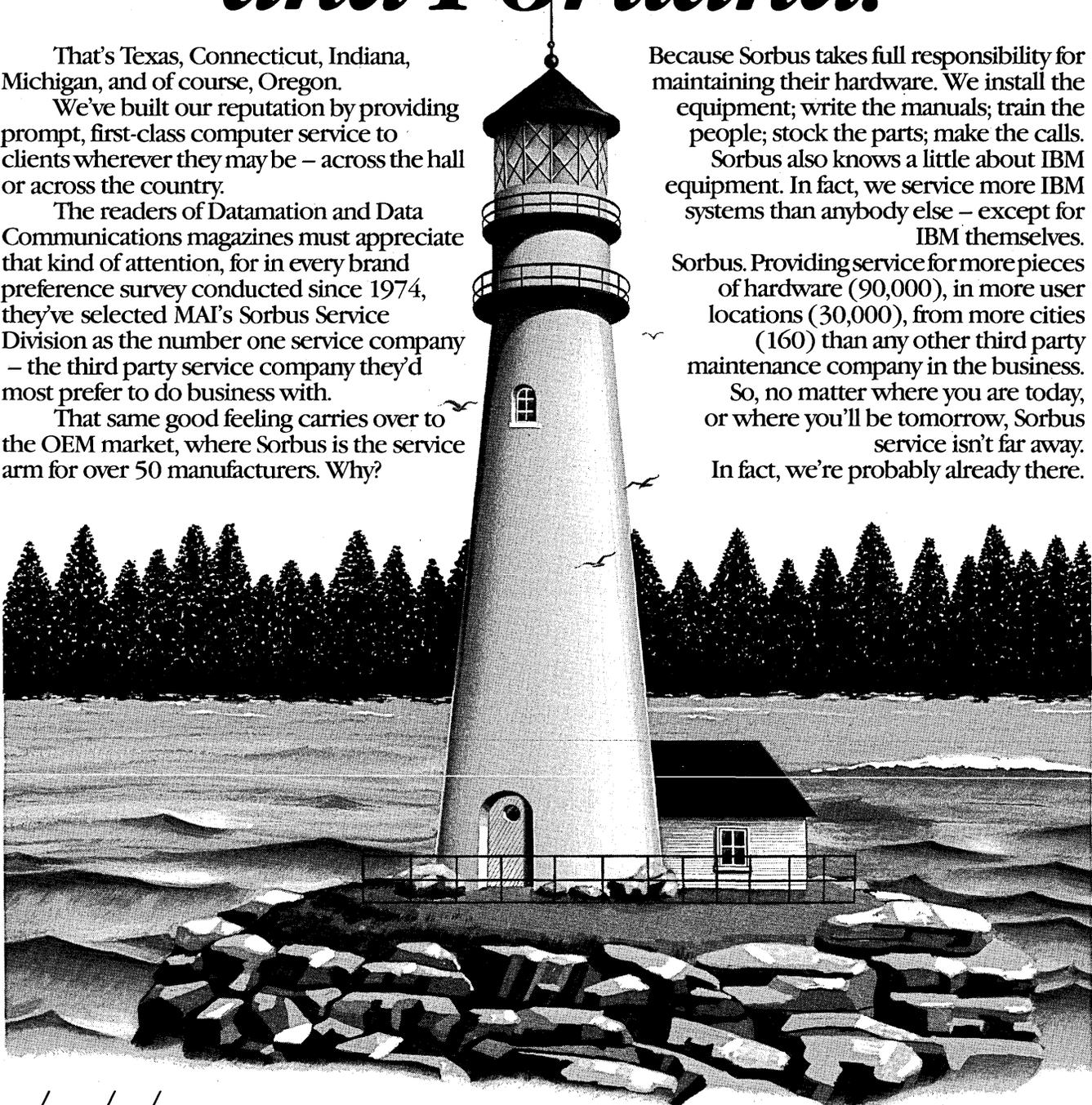
Because Sorbus takes full responsibility for maintaining their hardware. We install the equipment; write the manuals; train the people; stock the parts; make the calls.

Sorbus also knows a little about IBM equipment. In fact, we service more IBM systems than anybody else – except for IBM themselves.

Sorbus. Providing service for more pieces of hardware (90,000), in more user locations (30,000), from more cities (160) than any other third party maintenance company in the business.

So, no matter where you are today, or where you'll be tomorrow, Sorbus service isn't far away.

In fact, we're probably already there.



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CIRCLE 26 ON READER CARD

LETTERS

ly believes that documentation is second-rate activity polluting his career honor roll. These individuals were perfectly sketched in the fast case history of Ms. Wilson's article ("and he took with him the ins and outs of about 700 interlocking programs"), are indeed the most surreptitious enemies of a well-structured and efficiently managed documentation system.

Outside the dp department, top management's silent approval of antidocumentation instincts is easily gained, satisfied as they usually are with the cherished notion that documentation is a time-consuming extra likely to weigh some weeks or months on a project's time schedule. Fiscal documentation can't be eluded but it covers a very little part of what should be meant by "dp documentation."

At my dp department we are trying to set up a documentation database parallel to the applications database, distinct but not "discriminated." This database is designed to contain all the relevant news about the main dp objects: files, procedures, programs, records, reports, screen maps and pages, utility modules, users and other key-entities we consider indispensable for completeness of vision and control over the entire information system. Since we have allotted generous disk space to this end, our database will gradually replace all paper-based documentation, be it made up of codes, numbers or narrative. We believe that dp documentation may be a promising testing-ground for a first experience in word processing even if, at the moment, we have no definite idea about this side of the problem. What we keep clear in our minds are a few basic principles which support the whole system:

1. The documentation system is supervised, maintained, protected and "promoted" by a specific technical function led by the new figure of the documentation administrator.

2. Documentation starts when the project starts and is produced at every stage of the project's development cycle. Documentation precedes, not follows, coding of any kind (programs, modules, job-streams and so on). Whenever possible by ad hoc software documentation replaces coding and supplies the input for automatic code generation according to definite standards. A set of input-oriented forms are available to receive project's information to be recorded onto the database files via on-line interactive procedures.

3. Documentation that can be obtained directly from source code is to be automatically extracted by ad hoc software at compile or catalog time (processing SYSLST after a COBOL compilation, for example, hopefully waiting for a CBL DOCU to be introduced as a result of creating more user-friendly compilers!).

4. Incomplete or outdated documentation is to be periodically looked for by

control software, and requests for amendments and/or updates are produced in form of bulletins addressed to the persons who are responsible for the entities found faulty. These requests are to be obeyed as soon as possible under the supervision of the above mentioned technical group in charge of the system.

LUIGI BENELLI
Senior Analyst/Programmer
Florence, Italy

CORRECTION

Re: "Don't Call Us, We're Testing."

(April, p. 276), I object to the title used on my Forum article. It is misleading in that it implies the opposite of the article's thesis. The reason for the assurance tests is to discover and correct failures in our computer network before a customer finds them, thus reducing, and ultimately eliminating, the need for telephone calls reporting unexplainable difficulties. The fact that we're testing in no way implies that customer calls for assistance or information are no longer welcome.

DAVID A. FEINBERG
Seattle, Washington

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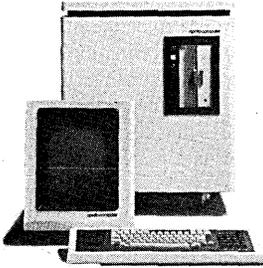
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CIRCLE 27 ON READER CARD

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Apollo Computer has finally put an end to the computer compromise.

With the introduction of Apollo's DOMAIN, you can now get both the resource and data sharing capabilities of today's best timesharing systems with all the performance and responsiveness of a dedicated mini—all in one cost-effective system.

DOMAIN (Distributed Operating Multi-Access Interactive Network) processing is a new and dramatically different approach to computing. It's a high performance

local network of dedicated computers in a distributed environment. Its unique architecture is designed to allow each user maximum autonomy within the network, while retaining the vital communications and resource sharing capability among every user.

The principal advantages of DOMAIN are greater system productivity and total system cost-effectiveness. The key to these advantages are:

A high level of predictable performance, including a VLSI CPU (with 32-bit architecture) dedicated to each user on the network, executing in a 16 megabyte demand paged virtual memory.

A new mode of user machine interactivity, including a high-resolution bit map display permitting each user to run multiple programs simultaneously.

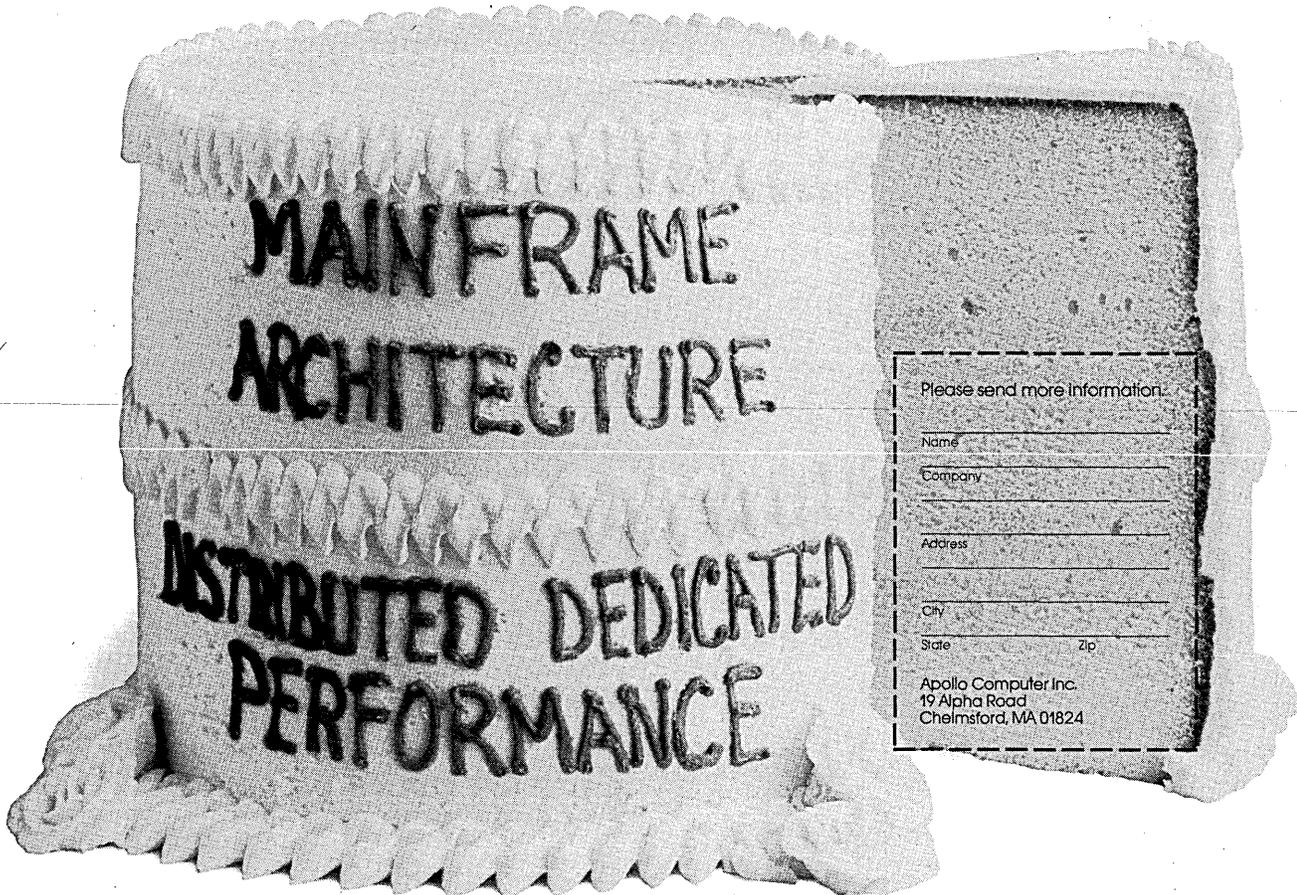
A network level modularity, providing a system with a very high performance level, a wide range of growth capability, and a vast improvement in system reliability and availability.

DOMAIN is designed to accommodate a wide range of application environments, including scientific, engineering, research, finance, CAD/CAM, text processing and transaction processing. The system is capable of running very large, single program applications, as well as multiple program applications.

By configuring dedicated CPU's in a network architecture, Apollo's DOMAIN really does let you have your cake and eat it too.

For more information on DOMAIN processing and Apollo Computer, simply fill out and return the coupon below.

Now you can have your cake and eat it too.



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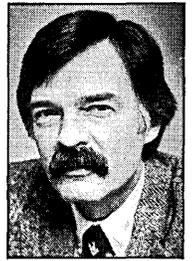
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apollo computer

Apollo Computer Inc., Headquarters: Chelmsford, MA: (617) 256-6600; District Offices: Mountain View, CA: (415) 967-3231; Edina, MN: (612) 835-4541; Wayne, PA: (215) 964-8510; Dallas, TX: (214) 239-8528.

CIRCLE 28 ON READER CARD

EDITOR'S READOUT



THE DOOMSDAY PULSE

A single high-altitude nuclear blast could cripple computers and communications across the entire U.S.

Tumbling slowly through the blackness of space, the satellite moves to a point exactly 330 miles above Omaha, Neb. Suddenly it vaporizes in a silent nuclear fireball. In less than a second the entire United States is bathed with a high voltage wave called EMP (for electromagnetic pulse). The country's power grid fails, most communications from coast to coast are knocked out, almost every computer system in the U.S. is damaged or destroyed. Military command and control networks are severely crippled; the President and his advisors have no alternative—they order all-out retaliation. And all over the world, from railroad cars, silos, and submarines, missiles rise into the sky like flaming spears.

This doomsday scenario is not fantasy, but a frightening possibility. As a chilling two-part article in the May and June issues of *Science* magazine points out, we are at this moment involved in a race with the Soviets to "close the EMP gap."

EMP has been known to physicists since the atmospheric tests back in the '60s, but its threat to our computer and communications systems took a long time to filter through to the awareness of Pentagon planners. One of the reasons cited is that the vacuum tube technology used 20 years ago is highly resistant to the pulse, which can reach a peak of 50,000 volts per meter with a rise time in the 10 nanosecond range.

EMP awareness among the military is now at an all-time high. But the experts agree that even with the hundreds of millions of dollars that have been spent to harden command and control systems and Ma Bell's military network, these systems are



still highly vulnerable. And it is the ubiquitous use of semiconductor technology that is to blame. The fragile chips are particularly susceptible to damage by EMP.

Coincidentally, in the May issue of *DATAMATION*, Charles "Tony" Hoard, Oxford professor, authority on programming language design, and a winner of the ACM 1980 Turing Award, was quoted as ripping apart Ada, a computer language being adopted by the Defense Department, which will, among other things, control U.S. and NATO missiles. "Do not allow this language in its present state to be used in applications where reliability is critical, e.g., nuclear power stations, cruise missiles, early warning systems, antiballistic missile defense systems. The next rocket to go astray as a result of a programming error may not be an exploratory space rocket on a harmless trip to Venus; it may be a nuclear warhead exploding over one of our own cities."

So here we have two examples of potential technological breakdown that threaten our very existence. Without too much trouble, we could fill several volumes with additional examples. But, contemplating just these two, several messages come through loud and clear:

1. The more complex the technology, the more prone to failure. And, ironi-

cally, the failure is likely to be one of its smallest and simplest components.

2. Efforts to correct the complex system usually breed additional errors. Using more technology to overcome the deleterious effects of technology is like using gasoline to douse a fire.

3. We all seem to be slightly insane. The idea of pointing nuclear-tipped missiles at each other is mad enough, but to rely on complex technological systems that may not work, or that may even cause the disaster we seek to protect ourselves from, is even more lunatic.

4. Technology is not the villain. As Joseph Chilton Pearce says in his new book, *The Bond of Power*, "Technology is sweeping the earth and our social-mental breakdown seems an outgrowth of that sweep. As usual in imbalance, our attempts to redress lead only to extremes equally unbalanced. Technology seems here to stay and the issue isn't how to get rid of it (which we wouldn't want to do even though we sometimes hate it) but how to achieve balance with it."

How to achieve that balance is the question. It is a task that calls for an expenditure of time, resources, and energy far greater than that devoted to making our complex technology even more complex. The stakes are very high. *

For letters and reports that really matter, you can't beat our D-50. With its superfast hammer and a resolution twice as fine as other daisy wheel printers (over 11,000 points per square inch), the D-50 prints the sharpest characters and clearest graphics in the business.

It's available in KSR (Keyboard/Send/Receive) terminal and RO (Receive Only) printer and terminal models.

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The D-50 features long lasting reel to reel ribbon. You can complete lengthy jobs without an operator having to change it.

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The D-50 uses standard 96 character plastic daisy wheels. They're available in a wide range of type styles, including international sets.

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Dataproducts' Daisy Wheel Printer.
When you have to make the best impression.



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...S IN PRINTING

CIRCLE 29 ON READER CARD

INFOCUS

CANADA— SHEDDING AN IMAGE

**Success abroad is helping
Canada's dp industry over-
come its inferiority complex.**

"Canada is beginning to shed its Third World nation image of itself. Our companies have begun to operate successfully abroad, and we've proven to ourselves that we can do something good which others will accept."

This comment from Ian Sharp, president of the Toronto-based timesharing and consulting company I.P. Sharp Associates Ltd., reflects the newfound nationalistic leanings of a country that has historically been short on self-confidence. Still searching for separate status, Canada wants to gain recognition in the domestic as well as international marketplace.

Canada's quest for an independent identity has been going on for over a century. For most of its 114 years, the country has lived in the shadow of larger, more powerful nations such as Great Britain and the United States. As a result, Canada developed a deep-seated inferiority complex that pervaded every aspect of life.

Manufacturing, for example, has operated in Canada under a "branch plant economy," with multinational giants running most major industries. While national companies have made attempts at local production, these efforts have generally been thwarted by the skeptical Canadian consumer. Homegrown wares often meet with such typical buyer reactions as, "If it's Canadian, it can't be as good as what's produced elsewhere." "What is it a copy of?" "Can we get it from another country?"

The Canadians in fact seem to be their own worst enemies. Both the government and the public are equally to blame for snubbing local enterprise. And the result has been obvious—Canada's demoralized manufacturers have felt that their products were indeed second-rate. This inferiority complex has also left its mark on the country's computer industry.

Since the dawn of the computer era in North America, Canada has relied on hardware and software imports from the U.S. To facilitate marketing, the major firms set up subsidiaries or offices on Canadian soil. Most of these multinationals (particularly the U.S. contingent) tended to consider the country as just another state or region in the vast American arena. Many of them still think that way today.

The Canadian branches themselves

are also prone to view their operations as merely American adjuncts. One top Canadian dp executive cites Xerox as a good example of this provincial mentality. Established in Canada as a separate firm with a separate president, Xerox's Canadian company is nevertheless seen as simply another regional sales operation. It was not surprising therefore when the Canadian Xerox president was "promoted" to be a manager for one of the company's U.S. sales territories. While many other people would have considered that move a demotion, the Canadian chief realistically thought of it as a step up the corporate ladder.

Such opinions admittedly do little to bolster the collective ego of the Canadian computer community. Self-effacing to a fault, the Canadians have worried too much about their lack of mainframe might. Patrick J. Suddick, director and vice president of corporate field marketing for Honeywell Ltd. in Canada, speaks as both a Canadian and a multinational employee when he says: "We tend to be apologetic about the fact that we are strictly a marketing operation and don't do any computer manufacturing in Canada. We should recognize and admit that the real strength of the Canadian computer industry lies in its ability to apply a number of uses to existing computers. Telecommunications, software, packet switching, satellites and process control applications for mining and petroleum are just some of the areas we excel in. Computer-aided learning applications and languages are others.

"I believe the whole industry felt inferior when we found we couldn't com-

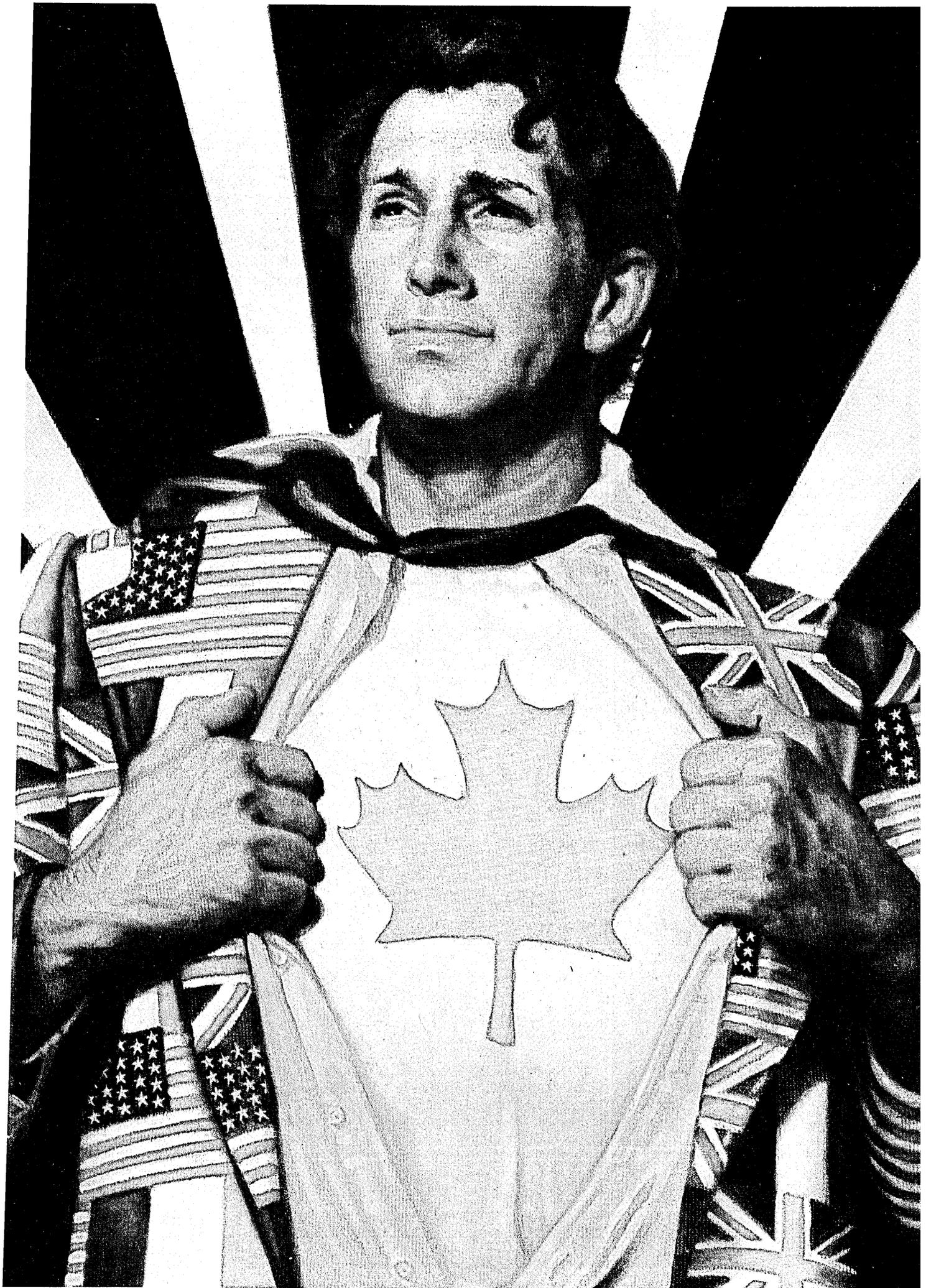
**"We tend to be apologetic
about the fact that we are
strictly a marketing
operation."**

pete in mainframe and large-scale hardware technology," he declares. "But now that we've found other areas we're good at, we're beginning to feel better about ourselves as Canadians."

The Canadians did indeed find the hardware road rough going. The marketing obstacles, however, were obviously not apparent during the '60s and '70s when various Canadian-owned hardware manufacturing ventures were launched. Many of these companies imported parts—disk drives, cpus, printers, and terminals—reconfiguring the boards or adding Canadian-made circuits, screens, or communications capabilities. They then turned around and peddled the final system as a Canadian product.

The formula was far from foolproof, as some of the would-be hardware makers found out. While these Canadian companies were certainly capable of churning out computers, they lacked marketplace credibility. This deficiency hurt them in their head-on

ILLUSTRATION BY RICHARD WILLIAMS



IN FOCUS

competition with larger U.S. firms and subsidiaries whose wares were already well established.

One small Canadian manufacturer, Consolidated Computer Inc., got around this credibility problem by first advertising its system in American publications (namely DATAMATION and the Canadian version of *Time*). The ads, according to former Consolidated president William G. Hutchi-

"Other countries realized the value of our products before users in Canada did."

son, gave the impression that the system had been well received in both the U.S. and Europe. In actual fact, however, only one machine had been sold in England. Nonetheless, the clever strategy worked, and the company was well on its way on both sides of the border.

The acceptability factor, Hutchinson points out, works both ways. If a local product is not considered acceptable outside the country, he explains, then the Canadians will not believe it's as good as imported equipment. Foreign buyers react similarly. If Canadian users or the government are

hesitant to purchase a particular product, then prospective foreign buyers, he says, also become reluctant.

Government support is often the key component in successful product promotion. In the past, Canadian enterprises had a hard time drumming up such support both at home and abroad. And while things are slowly improving, national companies still stand a better chance of getting financial backing from public and private sources if they can market their wares outside Canada.

The Canadian videotex venture (Telidon) is a good case in point. After sales of the technology in the U.S. and Venezuela, the Telidon team pulled in \$27.5 million from the federal government and an additional \$100 million from industry.

Other manufacturing firms, including Gandalf Data Communications Ltd. (modems and PACX units), Develcon Electronics Ltd. (modems and communications switches), Mitel Corp. (PBXs and VLSI semiconductors), Epitek Ltd. (thick film ICs), Norpak (Telidon decoders and graphics gear), Micom Co. (word processing equipment), AES Data Ltd. (wp systems), all acknowledge that foreign sales of their products have boosted their domestic business.

"Canada is unique among the countries of the world in this phenomenon," according to Desmond Cunningham, chairman of Gandalf's operating companies in Canada, the U.S., and the U.K. "We are a nation that doesn't like to take risks of any kind. And if we can find a similar product made abroad, we'll generally take it in preference to our own. That's changing gradually as we're beginning to realize that products manufactured here, particularly high technology goods, are of a world class standard. We've had to make them so in order to compete worldwide. Other countries realized the value of our products before users in Canada did. Now our own people are catching on—and up."

Cracking the domestic market has been a perennial problem for the Canadians. "It's always been easier to market abroad, particularly in Europe, than it has been to sell on the home front," confirms Gandalf president Colin Patterson. "Of course, Canada was generally regarded as a politically neutral country abroad. This factor," he admits, "was very helpful to Canadian companies making presentations in foreign countries."

While the remote computing services and software segment of Canada's dp industry didn't suffer as many inferiority pangs as the hardware sector, it did have its share of marketing headaches. Gerry Meinzer, president of Real Time Datapro Ltd. in Toronto, and president of the Canadian Assn. of Data Processing Service Or-

Approximately \$15 billion worth of computers will be sold in Canada between 1980 and 1987.

ganizations (CADAPSO), explains why: "In the beginning the major problem concerned the use of remote or timesharing services, as opposed to in-house computers. Even though the Canadian geography and economy dictate services more often than in-house, companies had been sold on the idea of having their own computer."

Selling homegrown software wasn't initially easy either. "Being Canadian made a difference on the software side at first," says Meinzer, "because users recognized the U.S. package names, particularly in specialty areas. The question always came up as to whether the Canadian package was as good as the broad-based American one."

As in other countries, the size and structure of the local market was a major consideration for firms contemplating a dp plunge. In the early days of the technology, the Canadian market was geographically dispersed and extremely limited—only very large users, such as banks, universities, and major corporations, could afford the big machines and the people to support them. There were in fact very few users of this class in Canada at the time. The corpora-

LITTLE KNOWN FACTS ABOUT OUR NEIGHBOR TO THE NORTH

Since its birth as an independent nation 114 years ago, Canada has pioneered innumerable innovations in a range of diverse fields. The following is a compilation of some of the more significant contributions made by Canada in computing and other realms.

- Dr. Kenneth E. Iverson, born in Camrose, Alberta, invented APL. Although most of his research on APL was conducted at Harvard University and IBM, Dr. Iverson has now returned to Canada, where he is employed by I.P. Sharp Associates Ltd.

- The Remote Manipulator Arm, slated to be tested on the Columbia space shuttle flight this month, was developed and manufactured for NASA in Toronto by Spar Aerospace Ltd. in conjunction with scientists from the Canadian National Research Council.

- The first airborne navigational computer was invented by Wing Commander J.G. Wright of Liverpool, Nova Scotia, while he was a lieutenant in the RCAF during World War II. The R Theta computer was the first practical navigating instrument that was completely automatic.

- The first commercial electron microscope in North America was developed in the late '30s by members of the University of Toronto's physics department. The team included Professor E.F. Burton, C.E. Howe, Ely Berton, and James Hillier.

- Alexander Graham Bell was actually a Canadian citizen when he invented the telephone at his parents' home in Brantford, Ontario. A great deal of controversy has raged over whether the telephone was invented in Canada or the U.S., despite the

fact that Bell himself indicated that it was done in Canada in 1874.

- The first transatlantic wireless message was received by Guglielmo Marconi on a hilltop in St. John's, Newfoundland, on Dec. 12, 1901.

- The first wireless voice broadcast was accomplished by Canadian Reginald A. Fessenden on Dec. 23, 1900. Fessenden also made the first radio broadcast to ships at sea from a transmitting station in Brant Rock, Mass.

- The "batteryless" radio was invented in Toronto in 1924 by Ted Rogers, who developed the AC tube, which allowed radios to operate off ordinary household electricity.

- Insulin, which has saved the lives of millions of diabetics, was discovered in 1921 by Edward Banting and Charles Best at the University of Toronto. Doctors and scientists at Toronto General Hospital and the Hospital for Sick Children in Toronto have now developed a portable pancreas which contains a microcomputer.

- Pablum, the world's first precooked nutritional cereal for children, was developed in 1930 by three doctors at the Hospital for Sick Children in Toronto.

- The first producing drilled oil well and refinery in the world have been credited to Canadian James Miller Williams. In operation in 1857 in Petrolia, Ontario, the well produced an astonishing 60 barrels a day.

- Former DATAMATION news editor Tom McCusker is Canadian. Whether this fact is a claim to fame for Tom or Canada hasn't yet been determined.

—B.B.

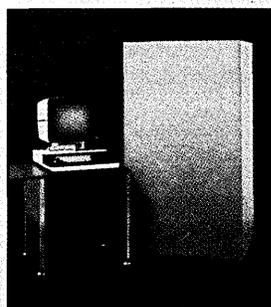
Stop apologizing for inadequate computing capacity and get a system that will grow with your needs.

Before you trade your overloaded 370 for a 4331, consider how soon it will be before you're forced to move up to a 4331-2. And then migrate to a 4341. And on and on. Every time you change systems, you lose time and money. Not to mention productivity.

Magnuson puts an end to this costly process with a 4300-compatible mainframe that is field-upgradable.

Magnuson's M80/31 gives you more throughput for less cost.

The Magnuson M80/31 provides up to 20% more throughput than the 4331-2, for as much as 20% less cost. And the M80/32 offers up to 50% more

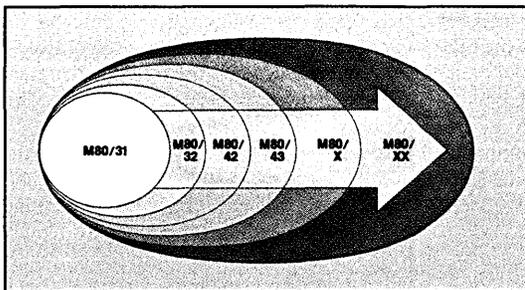


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CIRCLE 30 ON READER CARD

Magnuson means never having to say you're sorry.



IN FOCUS

tions on Canadian turf were also mostly subsidiaries of multinationals that had their main cpus installed at their headquarters.

The home market was therefore serviced by the Big Guns—the larger computer companies that had the necessary sales and service staffs. It clearly would have been suicide for a small Canadian firm to compete in this widespread but restricted marketplace. For one thing, a Canadian company could not have produced enough to make a purely domestic operation cost effective. And without a local market base, the company obviously could not have ex-

panded internationally.

The availability of smaller and cheaper hardware and user-friendly architectures has drastically changed the marketplace in Canada as well as all over the world. Former Consolidated chief Hutchison, who now heads up his own consulting firm, cites statistics that indicate that approximately \$15 billion worth of computers will be sold in Canada between 1980 and 1987. Sales of remote computing services in Canada totaled about \$1 billion last year, according to CADAPSO president Meinzer.

Canada's high technology industry

is indeed growing, as attested to by the membership roster of the Canadian Advanced Technology Assn. (CATA). Launched in 1978 with six companies, CATA currently includes 98 member firms. Last year, these companies (excluding Northern Telecom) had sales of around \$300 million, compared to 1977 totals of about \$20 million.

The Canadian dp market is currently broad enough to support small as well as large companies. Some of the smaller firms can now even survive solely in the domestic domain. Most companies, however, still feel the need to do more than just survive, so they go international.

In the past few years, such companies as Northern Telecom, Gandalf, Data-crown, and I.P. Sharp have joined the multinational ranks. More recently Infomart, the largest marketing firm for Telidon, made its multinational move. Hoping for a share of the dp action beyond the border, the new Canadian multinationals have set up subsidiaries and branch offices in the U.S. and Europe.

This market migration may be a harbinger of things to come in a country that's becoming more confident of its computing capabilities. Whether moved by a new sense of pride or patriotism, the Canadian industry is not only beginning to emerge from its collective complex, it is beginning to brag about its accomplishments.

"The industry has become world class, and we don't feel inferior anymore," declares Infomart president David Carlisle. "I believe it's partly because national barriers and national feelings are generally passé in the world of technology."

—Beverley J. Bleackley

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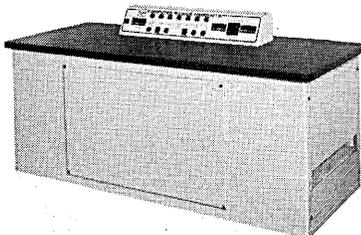
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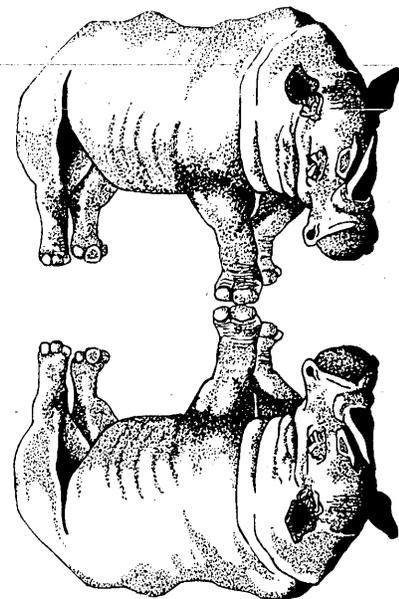


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NEWS IN PERSPECTIVE

COMPUTER SERVICES

IBM: AT YOUR SERVICE

All indications are that IBM is preparing to reenter the computer services business—and in a big way.

After five years of planning and preparation, IBM is now on the verge of reentering the U.S. computer services business.

Sources reveal that IBM is readying a service bureau facility in Tampa, Fla., to put an end to its "forced retirement" from the business because of a 1973 antitrust settlement with Control Data Corp.

The mainframe giant has been free to return to the U.S. services business since those terms of the settlement lapsed in 1979. Only recently IBM president John Opel was reported as saying it was just a question of "when."

Now, according to well-placed sources, the company is shooting for a December startup date for its Florida facility. IBM is believed to have already test-marketed timesharing services to at least three IBM customer beta sites from the Florida facility.

According to one insider, IBM toyed with the idea of a number of locations for the bureau operation—notably Kansas and Dallas—before deciding on Tampa. He said that marketing for the whole operation is being handled from Greenwich, Conn., but that IBM decided against locating its bureau in the New England area because of the high cost of living.

One source said that IBM has been moving programmers and engineers into the Florida facility for at least a year. "There could be as many as 200 people down there, including a technical staff of over 30 people," the source said.

A good number of programmers have been moved from IBM's Kingston, N.Y., software center, where the company's 8100 operating system was developed, said one insider.

The exact configuration of the Florida complex is not yet known, though one source says it will eventually be centered on an H Series complex running under a hybrid of the company's MVS and VM/370 operating systems.

The Tampa complex will "piggyback" on IBM's official internal network, CCDN, which connects all its branches to a number of large data centers throughout the IBM organization.

"Under this arrangement," said one

expert, "CCDN would become a public network—and IBM would become a super value-added carrier [VAC] like Tymshare."

The advantage, he explained, is that users who could not afford leased lines would be able to use IBM's high speed data links, wideband, and the company's SNA network products. "IBM can also buy or lease space from its Satellite Business Systems affiliate so that customers can have network services beamed from the sky."

IBM's intention is for a client to dial up his local IBM branch and be routed by the high speed network into IBM's bureau complex. Said one source, "If his needs are slight, he can use his terminal and IBM's VM timesharing facility to write his own programs or access IBM's educational material."

He added, "If his computers are too small, he can have IBM handle his monthly batch load. Or he can lease space on the service bureau's sophisticated high speed peripherals for color printing and eventually color graphics."

Said the source, "As his needs increase he'll start fitting more pieces of his dp operation into his IBM bureau. From a

The Tampa complex will "piggyback" on IBM's official internal network, CCDN, which connects all its branches to a number of large data centers.

quiet road, the network link to his bureau will become a busy highway with his programs being uploaded and downloaded constantly."

IBM would then seal the bond by offering the client remote diagnostics and maintenance. "And pretty soon the highway to the bureau would start to resemble a lifeline or umbilical cord. His very lifeblood," the source concluded.

In this way, say experts, a bureau client could start with a simple timesharing terminal at \$50 a month and soar to a full facilities management (FM) treatment at more like \$15,000 a month for the whole package.

According to one research group, IBM is also taking some other steps to push this trend along. New York-based Advanced Computer Techniques Corp. (ACT) says that IBM normally pushes out two or three field engineers per customer site. Next year it will be two or three per two sites along with a 10% increase in support costs, ACT claims.

According to a recent ACT study, IBM's field engineers have been told to avoid handling technical questions directly and instead get the customer in the habit of dialing up an IBM machine. The research group's conclusion is that the days of free customer handholding are over.

"Despite the persuasiveness of its



bureau approach, IBM knows that its customers would much rather do their own processing," explains one source. "But they don't have an effective remote processor and they can't really afford the on-site personnel."

"IBM's dilemma," said the source, "is to keep its users happy by giving them the remote processor they need and yet at the same time make them want to use the service bureau."

"IBM's solution," he continued, "is a triumph of logic. Simply sell the client a remote computer that can run virtually unattended at his sites, but which is programmed and maintained by IBM's service bureau or data center."

This innovation, known within IBM as Hydra (News In Perspective, August, p. 38), is expected in its early raw state to be a new release of IBM's VM operating system—and that's expected before the year is out. IBM insiders say Hydra will play a crucial role in the new service bureau venture.

"So far Boulder, Colo., currently

with some 125 support personnel, has been earmarked as IBM's remote maintenance center of the future," said one source. "But from now on, that technical support mantle will be shared with the new Tampa center," he predicted.

Interestingly, the planning that led to the Tampa center didn't originate at a

One expert feels that IBM is a bigger immediate threat to the mini vendors than to the services companies.

high level within IBM, claims one insider. Five years ago a young manager in IBM's DPD marketing group caught the ear of its executive vice president, Buck Rogers, with an "entrepreneurial" plan to get the company back into the service bureau business. At that time (and throughout most of the '70s), says the source, IBM was very concerned about its poor record of diversifying into new businesses.

In 1970, the source explained, IBM

was so concerned about not meeting its growth targets that it was frantically searching for new markets to enter.

Once the young manager's plan was received, IBM set about checking out its validity by getting a number of leading consultancies to research the texture of the services business and pinpoint market opportunities, the source explained.

In 1977, IBM's Corporate Management Committee, the company's top tier policymaking body (then headed by Frank Cary) reportedly approved a plan for reentry into the services business. The plan called for a business that would be doing an absolute minimum \$300 million a year in seven years, and which would generate a 20% (gross) profit, the source claimed.

Though the junior manager had virtually invented the assignment, leadership of the project was given to an older and more experienced marketing executive, Jim Hewett.

A computer services department was quietly set up within DPD, sources say,

ILLUSTRATION BY JAN SAWKA

NEWS IN PERSPECTIVE

and Hewett was asked to assemble his group.

Hewett's main appointments were a technical head for the project, Kurt Ziegler, and a marketing executive, Bob Dryden. When asked to reveal the current titles of Hewett and Ziegler within DPD, IBM said it was not its practice to do so except for vice presidents and above.

Dryden left the project 14 months ago to become executive vice president of another service bureau concern, Boeing Computer Services. Dryden was unavailable for comment at press time.

Marketing for the new operation was set up in Greenwich, Conn. (because it was close to Hewett's home, say some), and after thorough investigation of the real estate market, IBM finally chose Tampa for its

An ACT study says that IBM's field engineers have been told to avoid handling technical questions directly and instead get the customer in the habit of dialing up an IBM machine.

service bureau and technical support center.

Right from the start IBM's technical thinking on the bureau could be characterized by one word—"big."

"Ziegler likes big things," said an associate, "big computers, big networks, big ideas. He'd like to produce the Grand Creation."

This seems to suit IBM, whose aim is to bundle together the fruits of its centralized thinking over the years into one vast FM package, said the associate.

As a start in this direction, Ziegler is believed to have asked IBM's Federal Systems Division to build him a new micro-computer (at the \$5,000 to \$25,000 level) that could function across any IBM computer and operating system.

"This separate processor would be leased to the user along with IBM's bundled FM service, that is, VAC network, large system, micro, Hydra 4300 and add-on bureau service," said the associate.

One source explained that all the elements work together. "Once the user starts spending \$10,000 a month for bureau services, the thought of 50, 100 or 200 unattended Hydra 4300s running at his remote sites becomes appealing.

Added one consultant: "IBM could then take up the slack on 4331 sales. A booming bureau provides potential for a big follow-up hardware business."

This is the logic behind the formation of Massachusetts-based Spartacus Computers by one former IBMer. Spartacus is hoping to ship low cost Hydra-like computers to customer sites by the end of next year.

In addition to Spartacus, a number of PCM black box builders are known to be readying their own similar products for

what could be a huge new market.

The hunt for a good Hydra-like remote processor has also occupied the thinking at existing service bureaus which will now be challenged by IBM.

"We've seen which way the wind will blow for some time," said Comshare president Richard Crandall, "and we already supply such remote programming and maintenance services to our clients."

Other service bureaus seemingly have been less fortunate, point out observers, and have had unpleasant experiences in their search for the "right processor."

One expert feels that IBM is a bigger immediate threat to the mini vendors. Says Yankee Group's Dale Kutnick, "IBM's Hydra 4300 is the 'satellite' processor the company has been searching for. It will allow the company to close ranks on its big users and shut out the mini makers."

One consultant added that IBM's new bundled bureau approach would allow the company to offer both the best and the worst of its products in one big leasing package. "It'll ensure revenue both now and for the future. We could be heading into a whole new era in leasing," he said.

"Another advantage, perhaps an unfair one, of bundling," says ADAPSO spokesman David Sturtevant, "is that IBM can do clever things with its pricing."

Sturtevant said that the services organization and its members were adopting a wait-and-see posture. "It's too early to see just what IBM's exact focus on the market will be, but we have to assume at this stage that it will be an honorable one."

It's already clear that several ADAPSO members privately fear the competitive advantage that IBM could reap from such bundling.

Comshare's Crandall said, "We would prefer that there be a maximum separation between the IBM parent and any new bureau concern as there was with its former venture, SBC [Service Bureau Corp.]."

But IBM insiders point out that the company is not looking to produce a "warmed-over SBC."

"IBM's new service bureau is bundled into DPD," said one source, "and every indication is that IBM wants it to stay that way—at least until it has healthy revenues." Added the source, "It's possible that IBM will eventually spin off the bureau concern—after all, the company is still searching for an effective diversified business."

Another consultant pointed out that even spun off, the new bureau would be a big threat to the service companies. "There's nothing to stop IBM lending—virtually giving—its offspring all the money it needs at very favorable rates."

The consultant pointed out that everyone had so far missed one very important point: "IBM didn't just get out of the bureau business in 1973 because of an antitrust case

settlement," he said. "They got out because, apart from successes by a few aggressive New York salesmen, SBC wasn't doing very well."

"IBM is determined to get it right this time," he concluded.

Though ADAPSO is putting on a brave face at this early stage, there is a feeling among its members that IBM will meet their business with greater resolve this time.

ADAPSO is already fighting to keep Citibank out of its patch and is preparing for the entry of AT&T.

If two is company, then IBM as a third could really make for a crowd.

When put to the company, IBM had little to say about this whole future scenario. Says a spokesman, in characteristically mild fashion, "We have acknowledged we will offer network and related computer services at some point in the future. It is not our practice, however, to comment on possible future product offerings."

—Ralph Emmett

MERGERS

GAMBLING ON MEMOREX

Burroughs is hedging its bets on a different type of marketing threat to IBM.

When word first surfaced that an alliance between Burroughs and Memorex was a distinct possibility, the "niche players" or better still the "niche analysts" immediately went into action. One product line would fit well here while another type of device would fit well there. All these assumptions were based on a merged corporate entity going forth united to do battle against Big Blue from Armonk.

But the strategy on which two months of negotiations between the two companies was based seems to indicate a quite different approach. In fact, a divide and conquer marketing approach as outlined by a Burroughs spokesman could both benefit users with new options and at the same time provide a different type of marketing threat to IBM.

"We want to keep the whole company as a separate subsidiary for the near future," explained William Conlon, senior vice president for corporate product management at Burroughs. Memorex has a unique identity in the IBM plug-compatible market, "and we will want to maintain that Memorex disk product line, which includes

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NEWS IN PERSPECTIVE

TRAILING-EDGE TECHNOLOGY?

Mock employee badges have shown up at Memorex Corp. They bear a corporate logo combining the BUR from Burroughs and the REX from Memorex, thus reading BURREX. A local newspaper, in trying to account for the low price offered by Burroughs for the ailing peripherals and media maker, says the latter "has little to offer in leading-edge technology." So when a Memorex employee was asked why the newly contrived name didn't place Memorex before Burroughs, he replied, "It indicates our trailing-edge technology."

a plug-compatible 3350-type system and research being done on a future 3380-type disk.

It is quite likely that two versions of the Memorex disk subsystems would evolve, Conlon explained. One version would be the traditional plug-compatible device that is designed to be attractive to existing IBM disk users, and the second version would be Burroughs-compatible for use with Burroughs cpus.

Would this by definition mean that Burroughs systems eventually become IBM-

Of major interest to Burroughs is the Memorex disk product line.

compatible? Decidedly not, according to Conlon. "We have a systems architecture which is not compatible at the machine language level with IBM and we don't intend to compromise that."

Still, the concept of Memorex enhancing the versatility of IBM systems seems to fly in the face of Burroughs, which is ultimately trying to replace the IBM equipment. But there are many ways to dislodge an IBM system, Conlon indicated, and one is to first aim at peripherals and subsystems before taking aim at the mainframe.

And so the future Burroughs/Memorex strategy looks like this: start by installing plug-compatible disks at IBM shops. Maybe add a Burroughs office automation system or a Memorex front-end as a follow-on. Then, when the user has an IBM cpu surrounded by Burroughs/Memorex devices on all sides, come in for the final blow by pointing out that only Burroughs mainframes can get top performance out of Burroughs/Memorex equipment. At that point the user presumably would be told that Memorex plug-compatible devices can easily be modified in the field to operate with Burroughs mainframes.

Whether or not the strategy would work remains to be seen. If Memorex really were allowed to keep its own identity, the merger would not be typical of similar corporate unions which ultimately see one company swallowed up by the other.

In the final analysis, the "niche analysts" could prevail. Perhaps merged prod-

ucts united under the Burroughs logo would make more sense than leaving Memorex out there to ply its plug-compatible devices.

Conlon seemed to hedge his bets on what will happen in the future. On the one hand, he said the two companies and their products seem to complement each other. "Our main emphasis is on computer systems mainframes and theirs is on peripherals. We consider disk files to be a critically important peripheral in the future development of our total systems. So it made a nice fit," he said, referring to the alliance.

But the Burroughs executive also talked about the Memorex ability to operate in the plug-compatible market, which he said was of interest because it represented a new area for Burroughs. "We're interested in the plug-compatible market, which we're not in currently and which is a good business for them," he explained.

In the long run, some industry observers saw Memorex being unable to solve its manufacturing and other problems. That would force Burroughs to overshadow the Memorex identity as a strictly defensive move to assure that the valued Memorex disk products survive to appear under the Burroughs name.

Nevertheless, Burroughs has been having its own corporate problems of late. It may not have the resources available to remake Memorex in its own image for some time. So the Burroughs/Memorex strategy might prevail after all.

—Ronald A. Frank

ANTITRUST

IS THERE NO JUSTICE?

Judge Greene tells AT&T and Justice he won't recess the trial to wait for Congress to pass legislation restructuring the telecommunications industry.

During its seven-year tête-à-tête with AT&T, the Justice Department has at least proven that it is neither deaf nor dumb. But many now wonder if it is perhaps blind.

"I don't think they ever intended to litigate," contends Edwin Spievack, attorney for the North American Telephone Association. "While the Administration was getting a handle on the situation, Justice kept quiet. Now they've indicated they have no interest in going after divestiture."

"The case is settled as far as Justice

and AT&T are concerned. Any continued prosecution is a sham."

Still, when AT&T began its case on Aug. 3, Justice attorneys in Judge Harold Greene's courtroom were cross-examining as crisply as ever. But events of the previous week caused observers to question whether their hearts and souls were in their work.

On July 29, Assistant Attorney General for Antitrust William Baxter and AT&T attorneys George Saunders and Howard Trienens held a private conference in Greene's chambers. Speaking for the plaintiff, Baxter asked Greene to recess the trial until June 1, 1982 to allow Congress time to pass legislation that would restructure the telecommunications industry. The Admin-

An Administration task force revealed that Bell has made three offers during the last four years to divest itself of certain assets.

istration had determined that S. 898, the Senate's vision of the future of telecommunications, did not quite match its own. It would like, as Baxter told Greene, the gentlemen and women from Capitol Hill to pass an amendment making the allowed volume of Western Electric equipment sales to Bell units dependent on the amount of hardware sold by WE to non-Bell companies.

"We have checked it out with the Bell Company," Baxter informed Greene, "and the Administration is wholly in support of it." The amendment had been in the works for several weeks, and the Administration made it clear it regarded the measure as an adequate substitute for the divestiture relief requested by Justice.

"It's a complete sellout to AT&T," a spokesperson for an industry group says. "It's the most appalling thing I've ever seen. Travesty is too mild a word. The President is getting some rotten advice."

Greene, who has been handling the trial with the aplomb of a skilled politician and the determination of a drill sergeant, apparently agreed.

"This does not strike me as a very reasoned approach," he told the three lawyers. "It strikes me as rather peculiar."

"It is not my business if Congress wants to pass legislation restructuring the communications industry, or whether they can or can't do it. There are a lot of other things I would rather do than try this day after day. I am not eager to take this masochistic punishment of being here every day and absorbing a great deal of technical, economic, and legal information, even as much as I like the lawyers in this case."

"But I will not interrupt this case merely because it might have political impact or ramifications in some other forum."

Motion to recess denied. Next procedure: a motion to dismiss.

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er reached Greene, rumors abounded that Justice would seek such a resolution following the denial of the recess motion. The speculation followed disclosure of an Administration task force analysis which revealed that Bell has made three offers during the last four years to divest itself of assets worth \$20 billion, including Western Electric, as a quid pro quo for dismissal of the suit. The offers occurred in 1977, 1979, and earlier this year. All were rejected by the Justice Department. AT&T chairman Charles Brown denied his company had ever offered to divest Western Electric.

"If they tried to dismiss that case, they'd have every business in the country on their backs," warns Herb Jasper, executive vice president of the Ad Hoc Committee for Competitive Telecommunications (ACCT). "They ran into a real buzz saw on this. Baxter's behavior obviously indicates that he wants to keep his job and didn't want to resign over this.

"But what they've done is stupidly complicate the legislation. Our position for five years has been don't compromise the suit. But now the Administration will obviously do it, so we'll have to ask for more protection in Congress because we know we won't get it in court."

Greene is at least as unpredictable as Congress, and he may grant the precise relief Justice originally sought but no longer seems to want. The judge might, of course, also send Justice packing.

On the morning following the dismissal rumors, at least six groups were ready to appear in Greene's courtroom to contest it. Pursuant to the Tunney amendments to the antitrust laws, the government

The Administration's actions have angered a number of Senators.

cannot unilaterally approve any agreement to settle an antitrust suit. The court must give notice of filing and offer interested parties a chance to intervene. Those doing so can then seek an appeal in a higher court or, if the judge so determines, be granted a new trial.

The way around that, of course, is to go to Capitol Hill and amend the law," Spievack explains. "That's exactly what they're doing."

They're not doing it too well. Although S. 898 easily passed the Commerce Committee, it has yet to reach the floor. Under Senate rules, the Administration's proposed amendment, along with another which would give specialized carriers equal access with Long Lines to Bell's local-exchange networks, must be inserted into the legislation when it is taken up by the full Senate later this month.

The Administration's actions have angered a number of Senators. Foremost among them is Strom Thurmond (R-S.C.),

chairman of the Judiciary Committee. He has twice tried and failed to get S. 898 referred to his committee, which wants to investigate its antitrust implications. Sen. Robert Packwood (R-Ore.), whom Jasper describes as "if not in AT&T's pocket, then certainly acting like he is," so far has had the votes to stall Thurmond. But just prior to last month's recess there were indications that the gentleman from Oregon might face considerable difficulties convincing the remainder of his colleagues of the virtue of his position.

"The Reagan Administration, in my view, has demonstrated a singular lack of interest in the enforcement of antitrust laws," Sen. John Danforth (R-Mo.) complained during confirmation hearings of James Miller as chairman of the Federal Trade Commission. "This, in my opinion, is a mistake.

"Free and open competition is at the heart of Republican philosophy, and diligent enforcement of the antitrust laws is important to the maintenance of a competitive marketplace."

Sen. Slade Gorton (R-Wash.), the lone dissenter in the 16-1 vote to confirm Miller, said actions such as the attempted dropping of the AT&T suit indicate "indifference about the enforcement of the antitrust laws." Gorton asked that Miller's nomination be held "until I have had an opportunity to discuss these matters" with Administration officials.

"People have come out of the woodwork that the Administration never realized were there," says an attorney whose client recently won a large antitrust judgment against AT&T. "In a sense the Administration is having its cake and eating it too. It has paid lip service to the Bell side by saying that if there is a legislative solution, they won't pursue the case further. And they've appeased the other side by continuing the trial. So they've fulfilled their political obligations.

"Thurmond is stirring up all sorts of discontent. He must have lost a dime in a phone somewhere."

The Senator from South Carolina was not stirring up nearly as much distress as the President. The political firestorm after the attempted dismissal forced the Administration to withdraw, tail between legs, and lick its wounds. Nevertheless, it promised to "make whatever efforts are appropriate" to win passage of its controversial amendments.

"We're naturally disappointed that the delay wasn't granted and the Justice Department was unable to dismiss the suit," a Bell spokesman said. "We have said repeatedly that Congress is the appropriate forum for resolution of the structural issues confronting our industry.

"But we are pleased that the government has essentially abandoned the extreme relief it sought from the court and instead

prefers a legislative solution."

Others were not so pleased.

"It's going to be very difficult to trust Justice now," a source says. "I'm not even sure why they're continuing. The Administration doesn't mean it and Baxter doesn't mean it. I guess the trial staff will try its best, though."

"It's going to be very hard for Justice to go forward with any spirit and determination," says independent consultant John Guttenberg. "There's confusion and morale problems all over the department. Baxter either has a gun at his back or has been totally duplicitous. The Administration has taken charge of the case and the legislation. Congress is the more likely milieu of [Defense Secretary Caspar] Wein-

There is almost no chance that Rep. Wirth's crew will look favorably upon the Administration's amendment.

berger and [Commerce Secretary Malcolm] Baldrige," both of whom have vigorously opposed any divestiture."

Those two aren't the only ones who will try to win the battle on the playing fields of Capitol Hill. The object of interested parties' affections when Congress returns this month will be Rep. Tim Wirth (D-Colo.), chairman of the House telecommunications subcommittee. His group has been holding fact-finding hearings all summer on the state of competition—or lack thereof—in the industry.

The subcommittee has taken considerable time and energy to establish a factual foundation prior to drafting its bill, which it is expected to do late this month or early next. That measure will undoubtedly be far different from Sen. Packwood's.

There is almost no chance that Wirth's crew will look favorably upon the Administration's amendment, which an AT&T spokesman characterized as "making sure Western sells inside and outside. Nobody's ever proven that their prices are higher than they have to be." Wirth is generally perceived to be much less sympathetic to AT&T's entreaties than Sen. Packwood.

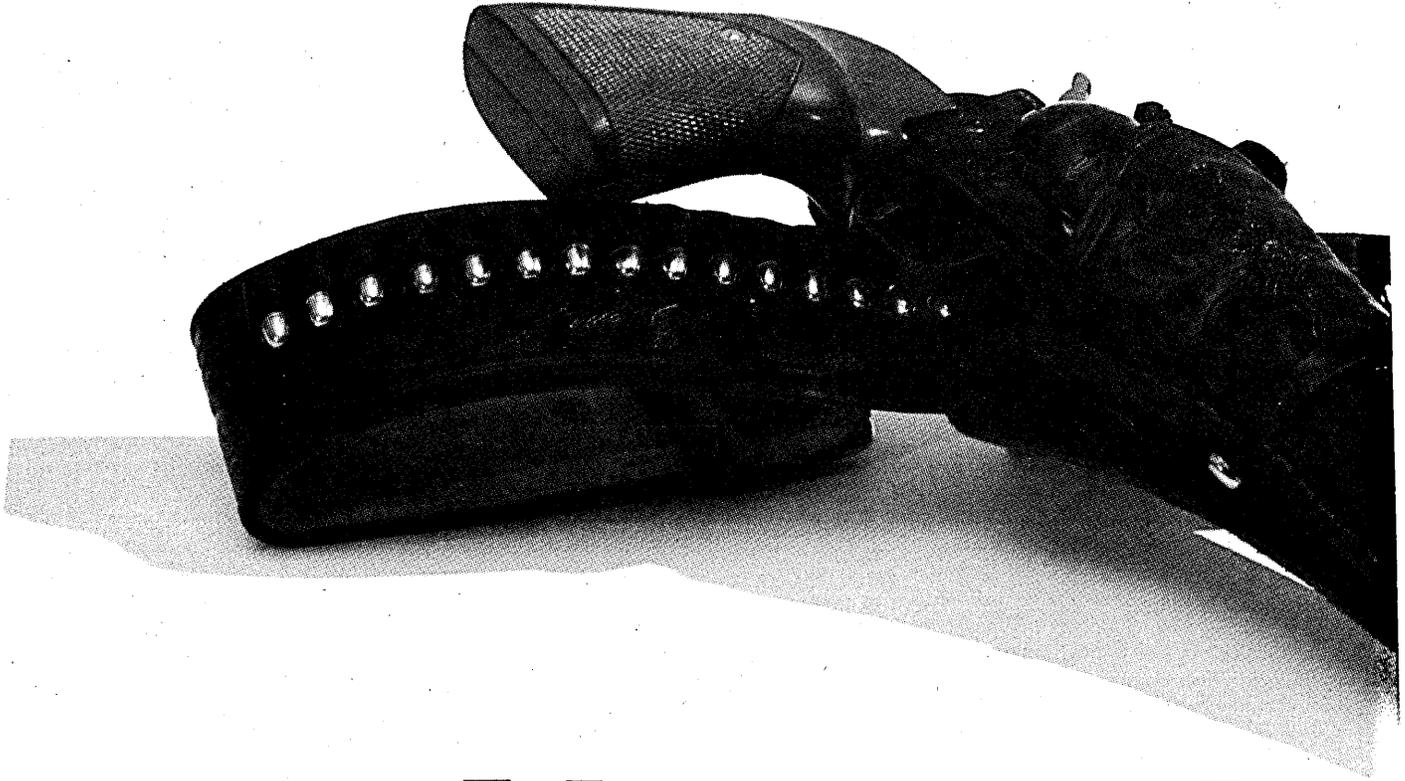
"The pressure on [Wirth] is phenomenal," the attorney notes. "He's going to come out of this a diamond."

"Packwood has already indicated how he feels," Jasper says. "It's 'don't bother me with the facts, I've already made up my mind. Don't tell me there's no competition, because I know there is.' What kind of a statement is that?"

"A lot depends on Wirth, but I wouldn't want to put all my eggs in there. He's a political animal like the rest of them. What he will decide may be miles apart from what we consider good legislation."

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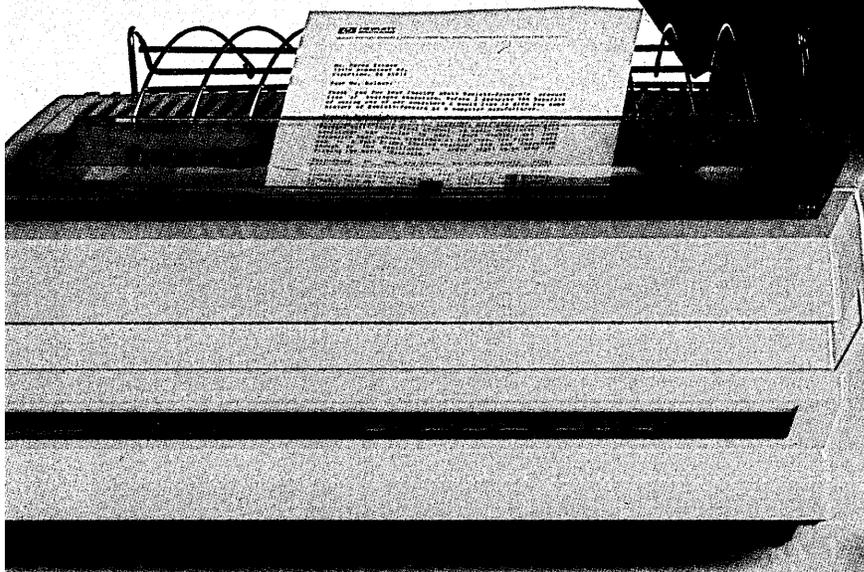
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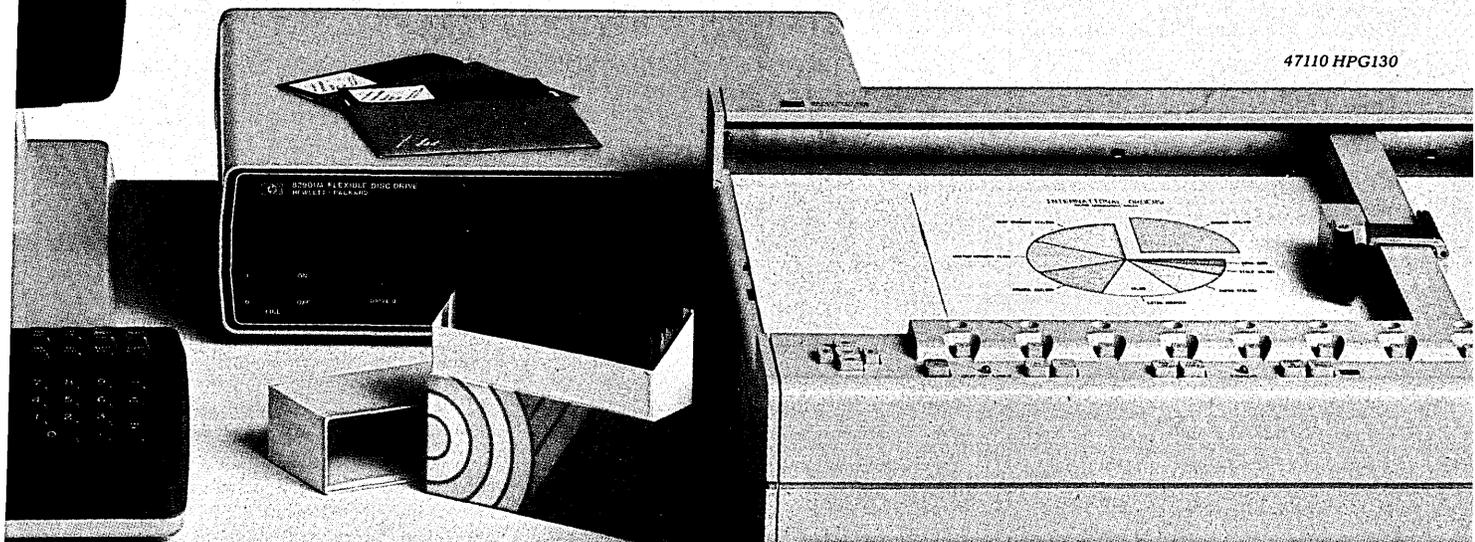
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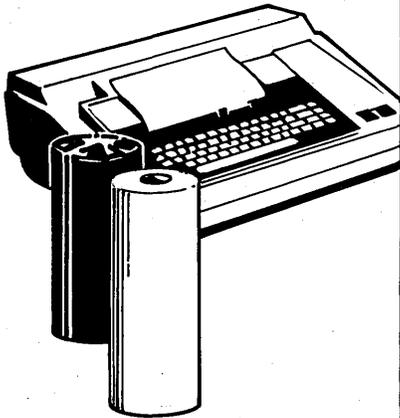
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NEWS IN PERSPECTIVE

The force has not been with them lately.

S. 898 is an anathema because it allegedly fails to adequately separate both the manufacturing and research and development of regulated and deregulated products and local exchange service from long-distance service. They have no friends at the Justice, Commerce, and Defense Departments, all of which apparently would be perfectly satisfied with preservation of the status quo. So what's the opposition to do?

"There seems to be a growing awareness among users," Tymshare president Tom O'Rourke says. "The recent price increases will impact on companies like never before. It may make them realize that they don't want this monster which can get prices through whenever it wants and for however much it wants unleashed in the marketplace. The whole affair makes you feel like you're in the middle of the road with a steamroller coming at you."

"The whole thing is bizarre," the attorney says. "There are so many heads to this hydra nobody comprehends who's doing what to whom. Mr. Baxter has had to eat a lot of crow, and I'm surprised he's still there if he's committed to what he said publicly [that Justice would 'litigate the case to the eyeballs']. It's extremely difficult for Jasper and [Jack] Biddle [executive vice president of the Computer and Communications Industry Association] to reach Baldrige. I don't think either of them has been to a rodeo in 25 years."

"At the ninth hour we're certainly not going to fold up our tents and walk away," Spievack promises. "Their private little dismissal game got blown apart, and they've had to back off several steps."

"We haven't given up hope in the Senate. They're far away from a resolution of the issue. And the battle is a long way from over. We're into next year for sure."

And the next year, and the next, and the next. . . .

—Willie Schatz

IBM IN THE EEC'S CLUTCHES

Speculation is that the
antitrust case in the European
Court against IBM will go fast
and furiously.

Movie buffs will remember in *Butch Cassidy and the Sundance Kid* how a member of Butch's gang agrees to knife fight with him as long as there are rules. Hey, wait a minute, says Cassidy, there are no rules in knife fights—whereupon Cassidy strikes his op-

ponent a deadly blow beneath the belt.

The movie is playing again in Europe with IBM in the Cassidy role and the competition directorate of the EEC Commission as the follow-the-rules challenger. Bubbling with confidence, close-to-commission sources believe the commission is freewheeling to an antitrust case victory against the U.S. giant by early next year. The outcome will have a big impact on IBM, its competition, and their users.

If the commission wins, total unbundling of main memory and basic operating system software together with early disclosure of interface data may spread to the U.S. If IBM wins, it will set the seal on a remarkable antitrust defense record for a company which, its lead counsel in Europe,

The charges alleged a dominant position of IBM and abuse of this position to protect itself from competition by PCMs.

Jeremy Lever, suggested, was "more sinned against than any other corporation in legal history."

Cassidy and his gang notwithstanding, knives have already been bared and the first blood has been drawn by the commission. In July, the Court of Justice of the European Communities (the European Court) took just four hours to hear and dismiss an IBM request for interim measures. These would have gained the giant time and maybe freed it from the obligation to defend itself against the commission's charges. Unfortunately for IBM, there is no appeal against the European Court's verdict.

How the rest of the case will go is far from clear. The only probability is that it will be over fast, in contrast to some other notoriously long drawn out antitrust cases. The commission's competition directorate, familiarly known as DG4, started work on its IBM investigation way back in 1974. Last December, it filed a "statement of objections" on IBM in Armonk in the name of the 10-member nation commission and supported by Amdahl, Memorex, and Intel (now National Semiconductor). The commission acts as administration for the EEC members. These include West Germany, France, the United Kingdom, and Italy. Together, they theoretically carry slightly larger economic clout than the U.S.

The charges alleged a dominant position of IBM and abuse of this position to protect itself from competition by plug-compatible manufacturers. Specifically objected to were bundling minimum main memory and basic software with cpus, withholding installation productivity options (systems generation aids) from non-IBM cpu users, and failing to disclose interface information on new products till after first customer shipment "if at all."

The commission gave IBM until the



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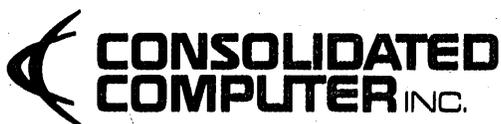
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end of April this year to defend itself against the charges. IBM then surprised everybody by attacking the DG4 head-on at the level of Europe's supreme court. IBM's complaints were that the statement of objections was not comprehensible, that the period allowed for a reply was inadequate, that DG4 had no right to speak for the commission, and that the procedure was a breach of international law because it interfered with the internal affairs of the U.S.

What IBM has gotten out of this protest so far is a rap on the knuckles from the European Court, an extra four months to prepare its answers, and an almost unanimous verdict from U.S. and European sources that it screwed up on its initial tactics.

Sources are more than usually reticent about commenting openly on the case for a number of reasons. Those closest to the action represent one side or the other and do not want to reveal information which could be used in subsequent stages of the case. And the parties involved are precious contacts or clients for others in an otherwise good position to comment.

That said, the universal comment is that the rules in Europe are different from

IBM has complained that the whole procedure is a breach of international law because it interferes with the internal affairs of the U.S.

those in the U.S., that IBM's complaints will be difficult to uphold, and that IBM was tactless in the extreme to challenge Europeans on the grounds that similar charges had already been ruled on in the U.S.

IBM is "seeking immunity from European jurisdiction in antitrust proceedings," according to the commission's counsel John Temple Lang. "Lawyers are quite surprised at [IBM's tactics] . . . and how they're conducting themselves," said one U.S. government source keeping tabs on the action. His explanation was that IBM must feel that by trying to delay the procedure, the company will get some sort of judgment on a back issue and that it will already have changed its practices by the time it takes effect. But the legal setup is very different. "In U.S. courts, trial judges are always looking over their shoulder for fear of being overruled on appeal. There is no appeal here," he said.

Pro-commission sources claim that it was the U.S. law firm Cravath, Swaine and Moore that instructed IBM's European counsel to adopt the delaying tactics which have worked so well in the U.S. case. But they argue that the Europeans' hearts are not in it. "Not one of the nine counsel from Europe believes in what they're doing," said one source.

Ironically, IBM is rumored to have outbid the commission in retaining the ser-

vices of its lead counsel, Jeremy Lever. In the July hearing, Lever said that the DG4 administrative procedure was unlawful, asserting that "one simply cannot have individuals going round the community (EEC) and in the name of the commission but unlawfully threatening undertakings with massive fines." He said that the commission could try again, and come up with a new statement of objections if it were so advised.

Lever also brought up a diplomatic note, sent by the U.S. government to the commission, referring to the case. Approved by the U.S. Department of Justice, the note points out to the commission that a similar investigation is on in the U.S. and expresses the hope that the European proceedings would not prejudice the results of the U.S. case. It asks for consultations under the auspices of the Paris-based Organization for Economic Cooperation and Development (OECD). The commission, say both EEC and U.S. government sources, has replied favorably.

In the meantime, the IBM attack on DG4's authority may have appeared "plain, bloody, chauvinistically stupid" to Europeans close to the case. But in view of the scheduled course of the case and DG4's line of attack, the company may have been faced with few alternatives.

By Aug. 31, IBM was required to have delivered its reply to the statement of objections. On Sept. 16, IBM will renew its attack on DG4 (the July attempt to quash the case was to obtain temporary relief from compliance). If this fails, as most observers bet, the commission will discuss IBM's reply with the company probably in December, check whether it got its facts right, and decide whether to proceed with a formal decision. If so, it will then draft the decision, put the decision to a consultative committee of EEC national administration representatives in the antitrust field, adapt the decision to their liking, submit to the full EEC Commission for approval (which has normally been almost a formality in competition cases), and then publish the decision. At this point, it's put into effect, without further reference to the courts wherever they may be.

The commission could order IBM to change its marketing practices. And it could even impose a fine on IBM equivalent to 10% of its EEC revenues, a sum that could therefore be almost \$1 billion. IBM would have one chance to contest the verdict at the European Court, but its verdict would be final. The only higher authority is the International Court at The Hague. And it would have to be the U.S. government, not IBM, that would take on the EEC.

Apart from believing IBM has gotten off to a bad start by attacking commission practices and the independence of the European Court, pro-commission sources think they have a watertight case against the U.S.

firm. To justify what must seem extravagant claims, considering all the other unsuccessful cases against IBM, they argue that dominance should not be difficult to prove.

Though IBM could query overall European dp market share figures, it will have difficulty saying it does not have an 85% to 90% share of the IBM and IBM-compatible market. "The only way IBM can prove this is not a distinct market is to show there is a large number of users who frequently shift from non-IBM to IBM and IBM-compatible systems, or vice versa," says one who has followed DG4 reasoning.

If dominance is proved, then the commission has to show that main memory and basic software are physically able to be sold separately from cpus.

In the minimal amount of information it allows to seep through the iron curtain of the industrial world, IBM says it believes

Sources claim the U.S. law firm of Cravath, Swaine and Moore instructed IBM's European counsel to adopt the delaying tactics which have worked so well in the U.S. case.

its defense will show there has been no violation of the EEC's Article 86 dealing with competition law. But it will not comment—nor indeed will commission officials—on whether top IBM board members have offered a compromise deal to DG4. Rumored to be on offer from IBM are concessions on operating systems software unbundling as long as IBM can hang on to bundled main memory and interface information. IBM has already agreed to release IPO and SIPO to non-IBM cpu users.

But despite the arguments in favor of the DG4 case, there are still a number of doubts. One is on the professionalism of the DG4 case.

One analyst not renowned for pro-IBM postures dismisses the DG4 complaints as "truly ridiculous. They're trying to keep themselves in a job," he says. "They've only had a couple of people working on the case, they're not terribly knowledgeable about the industry, and they have very poor files and minimal evidence."

In July, there were no DG4 staffers working full time on the case. For IBM, by contrast, in Brussels, Paris (IBM's European headquarters), and London, the staff is estimated at upwards of 200. At the European Court hearing in July, the commission sent two representatives while IBM sent 15.

"If they throw enough money at a problem, they think it will go away," observed a pro-commission source disgustedly, all the more disgusted because the commission may have to pay IBM's costs if it is overruled.

IBM's chances to get out of the com-

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NEWS IN PERSPECTIVE

mission's clutches will come in two stages—first, the Sept. 16 challenge to the admissibility of the DG4 case, and second, on appeal over the commission decision, if the case goes that far.

IBM's best hopes for success come from eliciting support from users and lobbying the various committees that will be involved in the different stages of the DG4's scheduled procedure. Telling points are that ever-faithful users often support IBM's policies, and that a DG4 ruling against IBM on bundling and interface disclosure may hurt European mainframers more than it would hurt the U.S. giant.

—Andrew Lloyd

TECHNOLOGY

AI: MORE THAN A SCIENCE

Teknowledge Inc. has taken upon itself the missionary role of spreading the good word on knowledge engineering, expert systems, and artificial intelligence.

It could take an engineer one year to learn to make effective use of a structural analysis software package called MARC. So now there's a package called SACON (structural analysis consultant), which applies the techniques of artificial intelligence to advise the structural engineer on the use of MARC. By getting a computer to serve as an interactive instructor, one avoids taking up the time of an expert, someone whose time is both expensive and hard to come by.

"There are literally hundreds of those applications where the people who have the experience and the real expertise are in short supply and high demand," says Bruce G. Buchanan. "So Teknowledge is formed around the idea of providing that knowledge engineering help."

Teknowledge Inc. (pronounced *tech-knowledge*) has taken upon itself the missionary role of spreading the good word on knowledge engineering, expert systems, and the benefits available from the years of artificial intelligence research that have been performed on some campuses. As phrased by Stanford University's Edward A. Feigenbaum, AI is a science becoming a technology.

In this thing called an expert system, the computer is made to serve as a consultant in a narrow discipline or on a set of specific problems. SACON is an example of

this. Recognition of this new capability and its value to industry has caused several companies to approach people at Stanford for assistance on specific problems. But the university bars involvement in things of a proprietary nature, and so to get around this Teknowledge was recently formed in Palo Alto, Calif.

Several companies have already signed up to send employees to lengthy training programs that will be conducted by Teknowledge. In addition to six-month and one-year courses, the company is also planning one-day executive briefings around the country.

Expert systems typically consist of a knowledge base, the fount of knowledge that makes someone an expert in his field, plus the software that makes it possible for a computer to draw inferences from statements of fact. This latter software, which Feigenbaum calls an inference engine, has been made into a sort of utility package and becomes one of the important tools of knowledge engineering. The prototypical example is Emycin, the inference engine originally developed as part of an expert system called Mycin. Emycin can also be viewed as a high-level programming language, but, says Buchanan, "more accurately it's a tool for building expert systems."

Emycin and a similar package called Age are two of the knowledge engineering tools that Teknowledge will help harness to solve the problems of industry. People from client companies, Buchanan explains, will build the knowledge base to drive Emycin, having first learned of Emycin's limitations and what it can do. Its strength, he says, is in diagnosis tasks, its ability to provide advice on what to do once it has been told what the problem looks like. While many types of problems don't fit this mold, he adds, there still are "literally hundreds that do."

Buchanan, who is acting president of Teknowledge, says he wants a student who has taken a six-month course to return

In an expert system, the computer is made to serve as a consultant in a narrow discipline or on a set of specific problems.

to his company qualified to work with experts there in the construction of expert systems driven by Emycin. After a year of instruction, a student should also be able to modify Emycin and Age to adapt them to more different types of expert systems. The student ideally will be very familiar with corporate problems that can harness the tools of knowledge engineering. He need not be a computer scientist or full-time programmer but should be a good programmer and very familiar with computing.

Building the knowledge base, he adds, is not always an effort requiring sever-

NEWS IN PERSPECTIVE

al man-years. "There's a lot of art in scaling the problem to make it a manageable problem," he says. "We've had small-scale experiments where an initial knowledge base was built in the course of several days, enough to begin understanding the strengths and limitations of that small knowledge base and see where it needs to be extended." And then it can be fine-tuned over several months.

There appears, however, to be no effective guide to selecting good applications. "Part of the art of building expert systems is matching the application to the tools that are available," explains Buchanan. "Just as we were never very good about saying this problem should or should not be put on a computer, we're not very good at saying precisely that this problem is a good one [for an expert system] because. . . ."

He leans back in his chair and adds, "It's still an art. But so is most of computer programming."

—Edward K. Yasaki

DATABASE SYSTEMS

DBMS: OUT OF THE CLOSET

Demand is reflected in the dollar size of the market, estimated by some software vendors to be near \$1 billion annually.

For the past decade database management systems have received a rather cool reception from data processing managers. Few knew how to use them. When they were permitted in to dp shops, it often was as a solution to a very specific application problem. Like almost everything else in the computer room, database systems evolved as disjointed, isolated tools that only programmers could use.

Times have changed. Backed up against the wall by the rapid proliferation of data and irate users waving their lists of unfilled requests, dp managers have warmed up to the idea of database systems, "user-friendly languages," and the promise of productivity.

But so have the users out in the functional areas, who are controlling bigger and bigger chunks of the corporate dp budget, according to observers.

Demand is reflected in the dollar size of the database market, estimated by some software vendors to be near \$1 billion annually. One database systems executive, John Maguire, president of Software AG,

Reston, Va., a company which grew 75% last year, presented an interesting sequence of figures that indicate the market could hit the \$4 billion mark by 1985. On the conservative side are industry analysts who estimate the \$4 billion point won't be reached by 1990.

No matter who is right the message is clear—database systems are in demand

One of the most interesting and least understood examples is the intelligent database machine (IDM) made by Britton Lee Inc.

and the companies providing them are headed for healthy growth curves.

The vendors appear to be addressing two main issues: first, improving each use of the dp system, usually through friendly languages and more powerful data dictionaries, and second, improving performance, particularly focusing on DBMS machines.

Although few companies or consultants agree on which approaches will prevail, they all seem to express feelings similar to those of John Schmitt, a senior database consultant for Intel: "I think we are on the brink of something here."

Schmitt's comment was directed in particular at the emergence of hardware dedicated specifically to database functions. One of the most interesting and least understood examples of that trend is the intelligent data machine (IDM) made by Britton Lee Inc., Los Gatos, Calif. Britton Lee's approach to improved performance is a dedicated database management "engine" designed specifically to support DBMS functions. It is aimed at the oem market and sells for about \$50,000.

The company likes to point out that its machine is "10 times faster than a software-only approach" and it offers "all the benefits of IBM's SQL with none of the disadvantages." There is one major catch—the intelligent data machine only comes with an operating level language; someone has to write all the necessary interfaces to a host machine.

For instance, to make an IDM fit into an IBM shop, a user language interface has to be written, as well as a host computer language interface, neither of which is a small task.

However, according to Judy Miller, director of sales for Britton Lee, an oem customer is already at work writing an SQL translator.

"This machine may make millions of consultants and programmers who write the interfaces," quipped one Britton Lee employee during a demonstration of the product at this year's NCC.

Another shortcoming of the system is that it cannot support tape drives that are often used as backup. Instead, backup can

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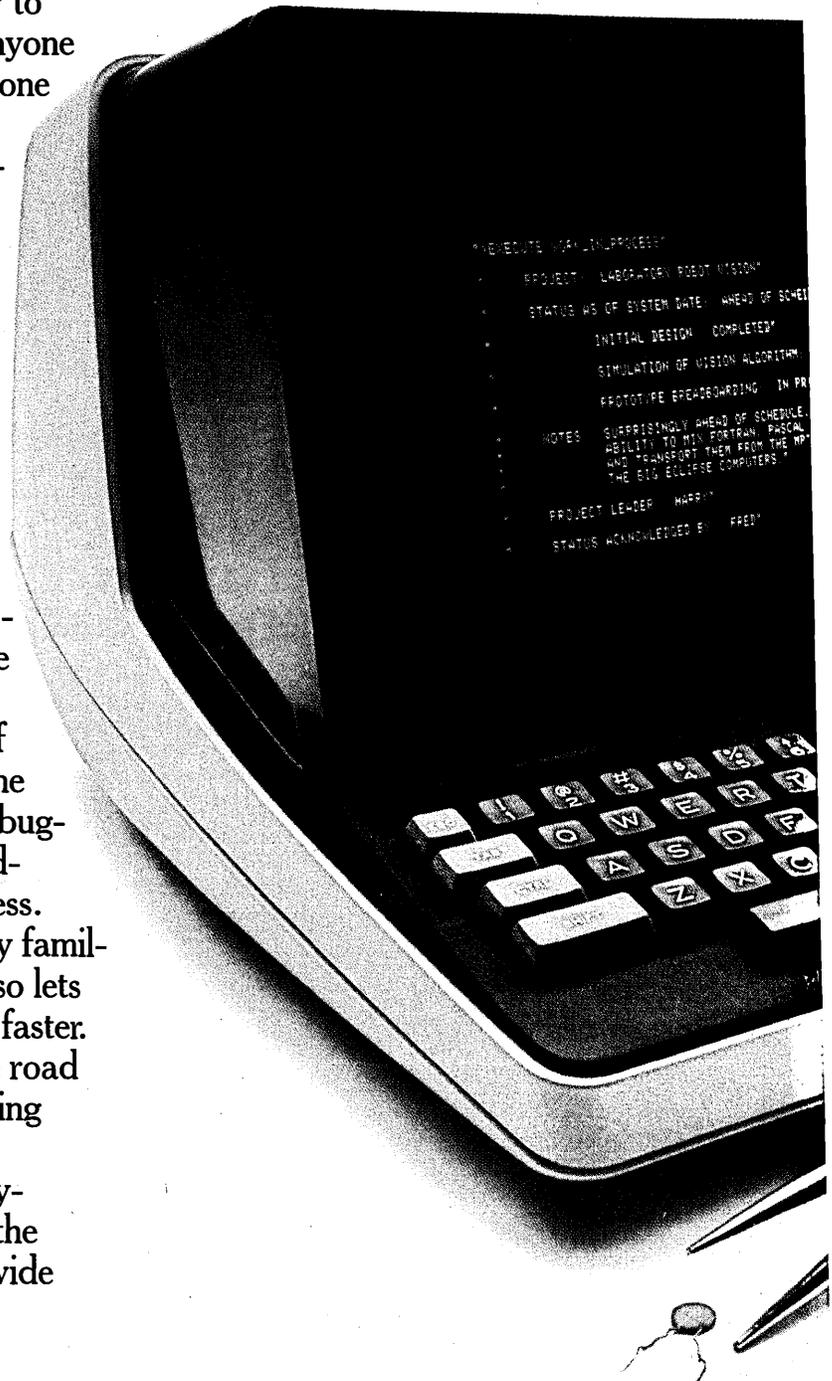
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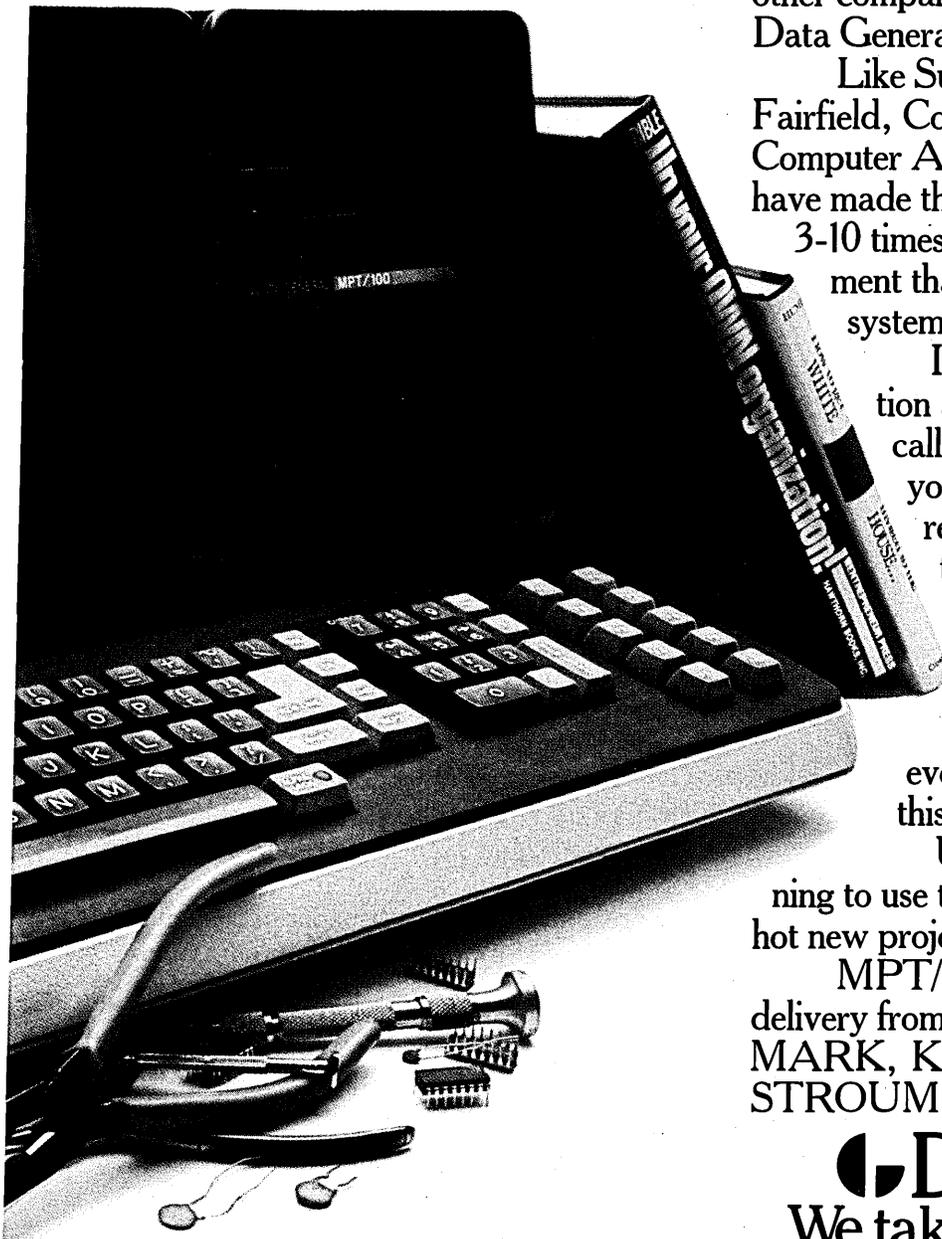
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DatagraphiX recently spoke with Mr. John E. Dye, Senior Director of Information Services, Blue Cross and Blue Shield of North Carolina, about his company's decision to install an on-line COM system.

DatagraphiX: What prompted you to consider an on-line microfilm recorder?

Dye: There were basically two major reasons. Faster turnaround and operational convenience. With on-line COM we could eliminate all of the tape handling. It doesn't require extra people and there is no throughput delay. We can get microfiche duplicates to the users much more quickly than paper reports.

DatagraphiX: Previously, you used a service bureau. Why did you decide to purchase your own unit?

Dye: We did a cost justification study and found that the money we were spending on a service bureau was just about what we would have to spend for our own COM recorder. Initially, our present needs would utilize only 20% of the machine's capabilities, so we could grow without additional equipment costs. Economically, it made sense.

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Dye: I've used DatagraphiX equipment for about 15 years. I have found DatagraphiX to be a good, solid company that supports their equipment and provides reliable service.

DatagraphiX: Did you encounter any difficulties in the transition to on-line?

Dye: We were impressed with how easy it was. Our technical librarian was able to perform most of the conversions. And DatagraphiX supplied very thorough training in hardware operation and the use of its on-line software.

DatagraphiX: So you are satisfied with the reliability of the AutoCOM II®?

Dye: Very much so. Uptime is better than 95%.

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be run on one of the disk drives under the machine's control. It is rumored that Britton Lee plans to remedy that shortcoming with a future product announcement. Also, the IDM does not provide data integrity or constraint checking. That, too, is expected to be addressed by future product releases.

The machine uses a relational approach to its data structure, making data "content dependent" not "position dependent," observed sales director Miller. "Get next record" is not a valid command to the IDM," she added.

Inside the mysterious black box, which is about the size of a small house safe, is a database accelerator board, an I/O processor board, a general resource manager, a disk controller board, and a memory board. The chassis was designed to hold 16 boards, so there is plenty of room to add more I/O or memory, said Miller.

All this souped-up software and specially designed hardware make for a very fast database processor. According to the company, the machine will run at 10 MIPS, compared to an IBM 3033, which runs at about 7 MIPS.

The key to achieving faster throughput is off-loading functions from the host. Among the functions the IDM will handle are storage and update to the database. It will traffic-cop multi-user situations, taking care of all security and recovery measures as well as monitor uses to make sure no one monopolizes the system. The IDM will also select the path through the data and optimize the I/O accesses by grouping data requests together when the information is stored on the same disk drive. The economy feature reduces the number of I/O trips out to disk.

There is an ironic twist to the way the IDM operates. Britton Lee comes along and creates a powerful engine for the express purpose of off-loading the database functions out of the mainframe. But when you take a closer look, the host has been loaded down with a new set of tasks in order to operate the IDM; all translation has to be handled by the host computer.

Users will also find the IDM falls into the heart of an old controversy in the database field—whether a vendor should create the product using new architecture or build with the old.

According to Software AG president Maguire, new architecture can be a "draw-back."

"There have been two approaches to operating database machines," he said. "In general, it's been the new architecture people versus those who tried to use existing architecture." Software AG, joined more recently by the Storage Technology/Magnuson announcement of their database machine, offers an example of database machines that incorporate conventional software.

Cullinane tried its hand at making DBMS machines that used a new architec-

ture, but then got out of that business. "The trouble with the promise of new architecture is that all the software has to be written from scratch. That's one reason Britton Lee's machine is not being marketed to end users," said Maguire.

No competitors, says Britton Lee—at least not yet. It concedes that Intel's soon-to-be-announced database chip may change that monopoly position. Britton Lee's Miller does not feel Intel will be a head-to-head competitor. Theirs is a "truly low-end product compared to ours."

Reluctant to name specific customers, Miller did say the company's customer list numbers about 20, most of which are

Cullinane tried its hand at making DBMS machines that used a new architecture, but then got out of the business.

computer hardware makers. Among those customers, some industry sources close to the company say, are Data General and a Minneapolis computer maker, both of which are considering an IDM under their computer cabinet.

Britton Lee expects to be in full production with its IDM by the end of this month—that would mean about 300 units per year.

Meanwhile, Cullinane, the been-

there-and-gone maker of database machines, agrees that building a good database processor is "very do-able, but selling it is quite another matter."

Cullinane couldn't find a market for its product, recalled Bob Goldman, senior vice president. "The number of people who would spend the money [on database machines] was limited."

Cullinane's marketing approach was considerably different than Britton Lee's. Cullinane's machine sold for about \$300,000 into the end-user market. It included features like a report writer, a query language, and peripherals, such as a console terminal, a printer, and a backup tape drive. Britton Lee sells to oems, and it offers nothing more than an operating code and super-fast processing speeds.

"Even the cpu's not that expensive," said Goldman. "Other peripherals haven't gone down in price."

"The savings from off-loading the mainframe compared to the cost of the processor and peripherals doesn't wash," he added. "And think about what you are asking someone to do. You walk into a 3033 site, a software company OEMing someone else's hardware. You are asking them to put in a foreign piece of hardware, not IBM, and off-load their most critical applications, the database system."

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NEWS IN PERSPECTIVE

nane thinking about chips? "No," said Goldman, his company is not looking to chips. The company says it intends to "stick with what will work in the IBM shop."

"We are not bucking the trend," said Goldman. I like to think we're setting trends." Three years ago Cullinane introduced the first database processor; now everyone has one.

Instead, Cullinane is dumping its resources into applications programs. "There is nothing you can do to improve productivity more than offer applications."

Software AG, on the other hand, is thinking about applying chip technology to its database business, but not on a big scale. "It is far too early to be locking in database technology on a chip," said Maguire. The company is considering offering only 4% of its database instructions on the chip. Out of about 200,000 instructions, Software AG is looking only at the 8,000 instructions that represent the compression-decompression algorithms.

One company that is expected to put a lot of database technology on a chip is Intel. Since the company's February 1979 acquisition of MRI, the Austin, Texas, database software house that developed the System 2000, there has been little doubt that Intel would move in this direction. But how much of Intel's database system will actually go on the chip is pure speculation. Al Sisto, Intel's marketing manager for commercial systems software, sidestepped any questions that touched on the subject.

He did say that the company's overall direction includes continued work to make its end-user language easier to use, removing the need for a user to worry about the data structure. "All they would have to do is ask their question. Such problems as how to ask the question, how to store the data, all those efficiency kinds of things would be handled by the black box," said Sisto. "It's because hardware is becoming the disposable item."

A growing problem for dp managers is acquiring too many end-user languages, each most efficient for a specific application. "If you take that scenario to the extreme, in order for a user to maximize efficiency one task might require the user to access data from four different terminals, using four different languages," said Sisto.

Intel's answer is to develop a generalized user interface for all those languages out there. The umbrella language "would handle the problem of sending out the proper message to other units," he explained.

While most of those companies in the database market have spent their resources addressing the mainframe and mini markets, there is a company in Lafayette, Ind., that is pioneering the development of a high performance database system for micros such as Apples and TRS-80s.

Micro Data Base Systems, Inc. uses conventional data structure—it has not

struck off on a new architecture—but an unconventional code writing technique. The company refers to its code writing method as miniaturized code. "We reduce our instructions to the smallest number of lines of code as possible," explained Andrew Whinston, a Purdue University professor and database management expert,

Software AG is thinking about applying chip technology to its database business, but not on a big scale.

who also serves as chairman of the board for fast-growing MDDBS.

Formed in January 1980, the company has over 800 installations of its system, Whinston estimates. Though serving separate markets, that number is about neck-and-neck with Cullinane and Software AG. The product price, of course, is significantly lower, selling in the \$2,000 range, compared with the big boys who average about \$150,000 per database system sale.

"We tackled the micro market because that was the greatest challenge. If we could create a high performance database to run on a micro then we could move it up," said Whinston. The company's long-range strategic plan is to develop the product to the point where it would be portable all the way from the micros to a Cray supercomputer.

With that kind of strategy on its books, this could be a company to watch.

Whinston is also adamant about providing a variety of end-user languages to meet the needs of both programmers and nonprogrammers. Down the road, he expects to see the use of artificial intelligence in database systems. He sees the day when databases will be integrated with applications in one system. "You define the data, the applications, how they should be used, and their limitations. A simple query language would be used to express the problem," he predicts.

For instance, a user might ask for a forecast of profits in 1983. The system would realize how to solve the problem. It knows it is not enough to just look at information on profits. The database becomes an intelligent system that knows what data it needs to gather and the calculations it needs to perform on that data, said Whinston.

"Then when the system gives you its answer, it also gives you the method it used to solve the problem." When DBMS matures to this level, said Whinston, the industry will have brought artificial intelligence operations and management sciences into the decision-making environment.

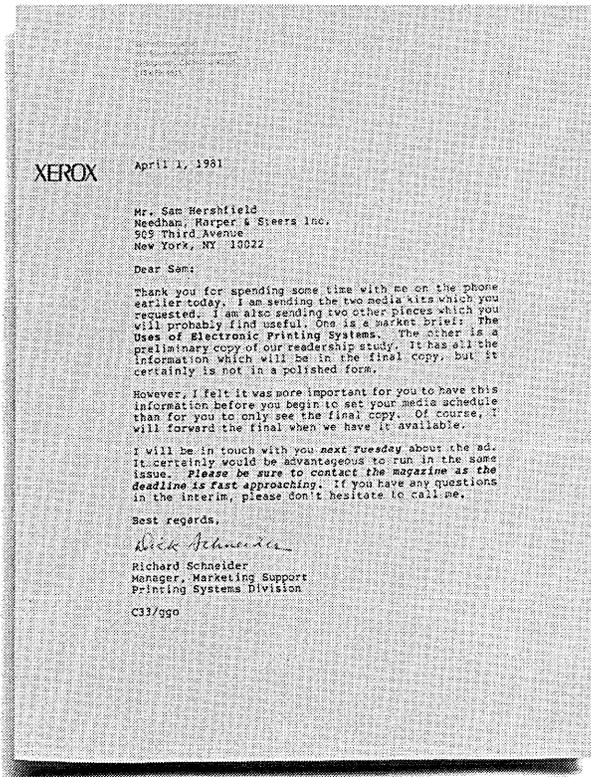
Of course when that happens the industry faces a huge data management problem—the problem of accessing data stored in a big network of disks or other types of

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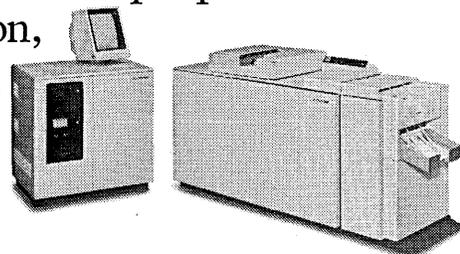
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storage units. "The weakest link in computer technology is the link between the host and secondary storage," said D.L. Childs, vice president of Set-Theoretic Information Systems Corp., Ann Arbor, Mich. "As the ratio of the size of the secondary storage to the size of the buffer storage grows larger, more and more computer resources are spent scratching around trying to find the data."

One solution is to support any and all data structures simultaneously, or "heterogeneous data structure capability," as Childs calls it. His company takes a novel approach to achieving this capability, leaving behind conventional thought about architecture, data structure, and programming, while current design philosophy relies on location oriented retrieval; Set-Theoretic's approach is a mathematical one, bearing no relation to methods used today.

The outcome of this approach is that a Set-Theoretic system could search for data using most any method, such as addresses, associative, or parallel accesses to relevant data. System throughput would be significantly enhanced and the space required to store data reduced, according to Childs.

However, Set-Theoretic is only one of many approaches that aim to break away from today's rules and by doing so achieve great leaps in performance. Many consultants speculate it will take great leaps forward in performance to deal with the huge network of computers we are building today.

—Jan Johnson

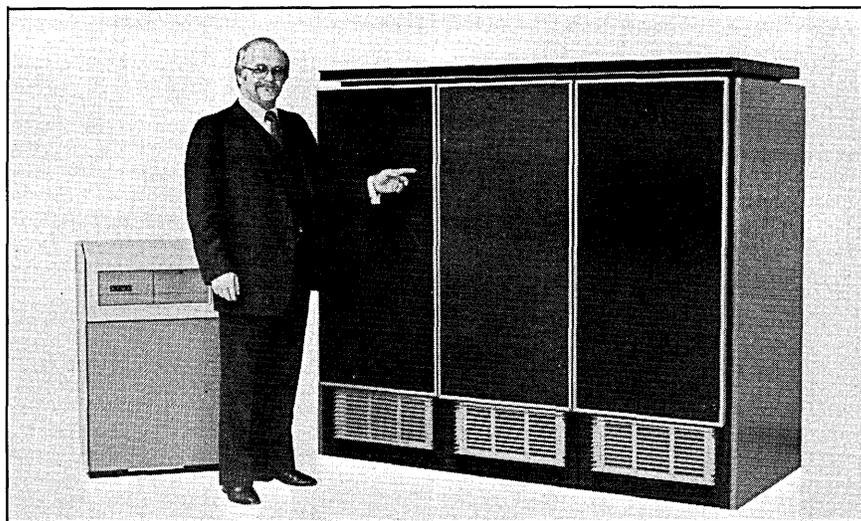
PERIPHERALS

UNIVAC TO IBM WITH MEMORIES

California company made it in memories with Univac and now looks to the big marketplace.

A tiny Chatsworth, Calif., firm, which in the 10 years of its existence has become the world's largest supplier of memory products for Univac computers, is getting ready to take on IBM.

Amperif Corp. makes extended memory, fixed head drums, flying head disks, controllers, and magnetic tape drives marketed primarily to the installed and expanding base of Univac Series 1100 computers, with secondary penetration aimed at Univac Series 90 computers (the old RCA line). At the end of this year it plans to announce products aimed at the IBM 370, 303X and 4300 machines.



WITH PRIDE: Keith Tattersall is proud of the firm's newest product—a cache disk memory system for the Univac Series 1100 computers.

The firm has been called the Storage Technology of the Univac market, but, emphasizes president Keith Tattersall, "We're not like Storage Technology. We don't make look-alike products. Storage Technology's 3370 [disk drive] parts are interchangeable with IBM's. We try to give the user added value, to offer products the mainframe manufacturer doesn't provide."

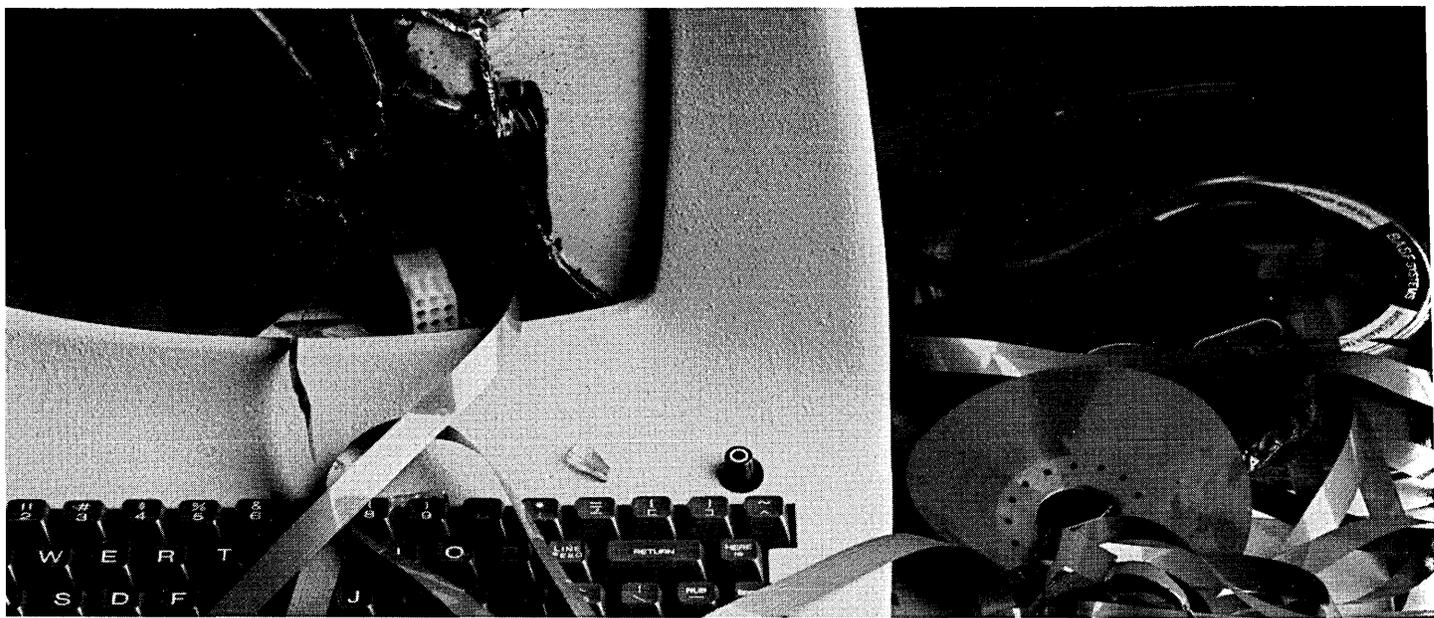
For the Univac market these include

two product lines Univac has announced but not yet delivered. One is Amperif's solid state drum models SSD432 and SSD1782, which are plug-compatible replacements for Univac's fixed head drums FH432 and FH1782. Amperif's drums use 64K memory chips and provide data access times averaging three microseconds compared to 4,300 and 17,800 microseconds respectively for the two Univac fixed head drums. Tattersall

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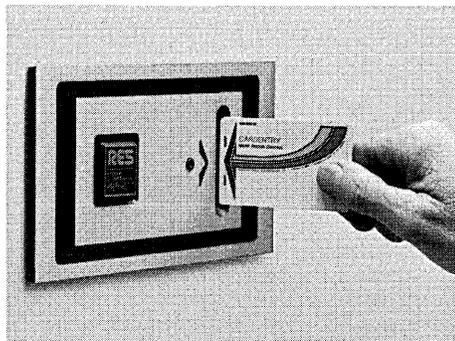
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NEWS IN PERSPECTIVE

said Amperif's design affords equivalent data storage capacity in less space, uses less power with greater reliability, and provides for off-loading of data to nonvolatile memory in case of power loss. Univac has announced a solid state drum but hasn't delivered. "They're four years behind us on that."

He said Univac is "two and a half years behind Amperif with a cache disk memory." Amperif's cache disk, he said, enables central processors to access data stored on disk at speeds four times faster than conventional media. It offers a nine-millisecond average cpu access time to data and an average hit rate of 80% to 90% in finding data in cache memory, although the rate is application dependent.

Tattersall doesn't expect to see Univac's equivalent to this "for another nine months." Univac announced the product at a user's meeting in the spring of 1976. "I've

"Univac is two and a half years behind us with a cache disk memory."

never seen them pre-announce that far ahead. They're reacting to us."

The Amperif president sees his company's position vis-a-vis Univac as a "them following us" situation. Whether or not this will be true with the IBM-compatible products he declined to say. "We will offer the same basic products with the same equivalence [to the IBM market as to Univac's]."

Amperif was founded in 1971 to provide design consulting services to electronic manufacturers. Tattersall had been with a company called Datametrics, where he headed up a special group making peripherals for Univac systems. One of the earliest and biggest customers for these peripherals was an ambitious timesharing Univac-using company called Intranet. When Datametrics dropped the line, Intranet picked it up, and Tattersall went with it. He was there through a stormy period which saw the firm into and out of Chapter XI.

Intranet survived and still produces some Univac peripherals. "We see them out there once in a while, but not very often," said Tattersall. "They're more into electronic games now."

He said Amperif's biggest and only real competition is Univac itself. "Oh, we see the specialty houses some times, people like Telefile [Telefile Computer in Orange County]. Ampex put its toe in the Univac marketplace once but didn't stay long enough to get credibility. We haven't seen anybody come in to stay."

Amperif, Tattersall claimed, was the first company to produce mass memory based on charge coupled devices (CCDs). In 1975 the company began development of a CCD-based rotating drum memory. By August 1976, the firm had designed, manufactured, and installed the world's first semiconductor memory system incorporating

16K CCD memory. This system is still in use at the University of Wisconsin.

The company is proud of what it likes to call its "large, showcase" installations. The Bureau of the Census has 36 billion bytes of memory, all Amperif, said Tattersall. The firm also has installed a large solid state drum replacement for the Social Security Administration.

He said Univac's announcement of the 1160 computer "is getting us into market areas we had not penetrated before, particularly manufacturing."

It's also beginning to get them into smaller shops. He noted that the 1160 competes with IBM's medium range 4300s, which might afford a clue to what Amperif plans for that series.

Whatever else it plans, Amperif isn't going to be as quiet in its second decade as it was in its first. For one thing, it's armed with \$2 million in new financing, half from Continental Illinois Venture Capital Corp. and the other from an unnamed private source. And, Tattersall plans to take his company public, "eventually, probably next year."

Why is the company called Amperif? "It's a good name, ahead of the alphabet. Our attorney didn't know how to spell peripherals. We wanted to be American Peripherals. It's worked out well."

—Edith Myers

COMMUNICATIONS

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By combining Westar satellite capacity with its own earth stations, Cylix can offer users an alternative to conventional private line nets.

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Known as the Cylix network, the offering began in the early 1970s as an on-line service to the broadcast industry. At first it was known as Data Communications Corp. and it offered specialized services to radio stations using conventional land-based phone lines.

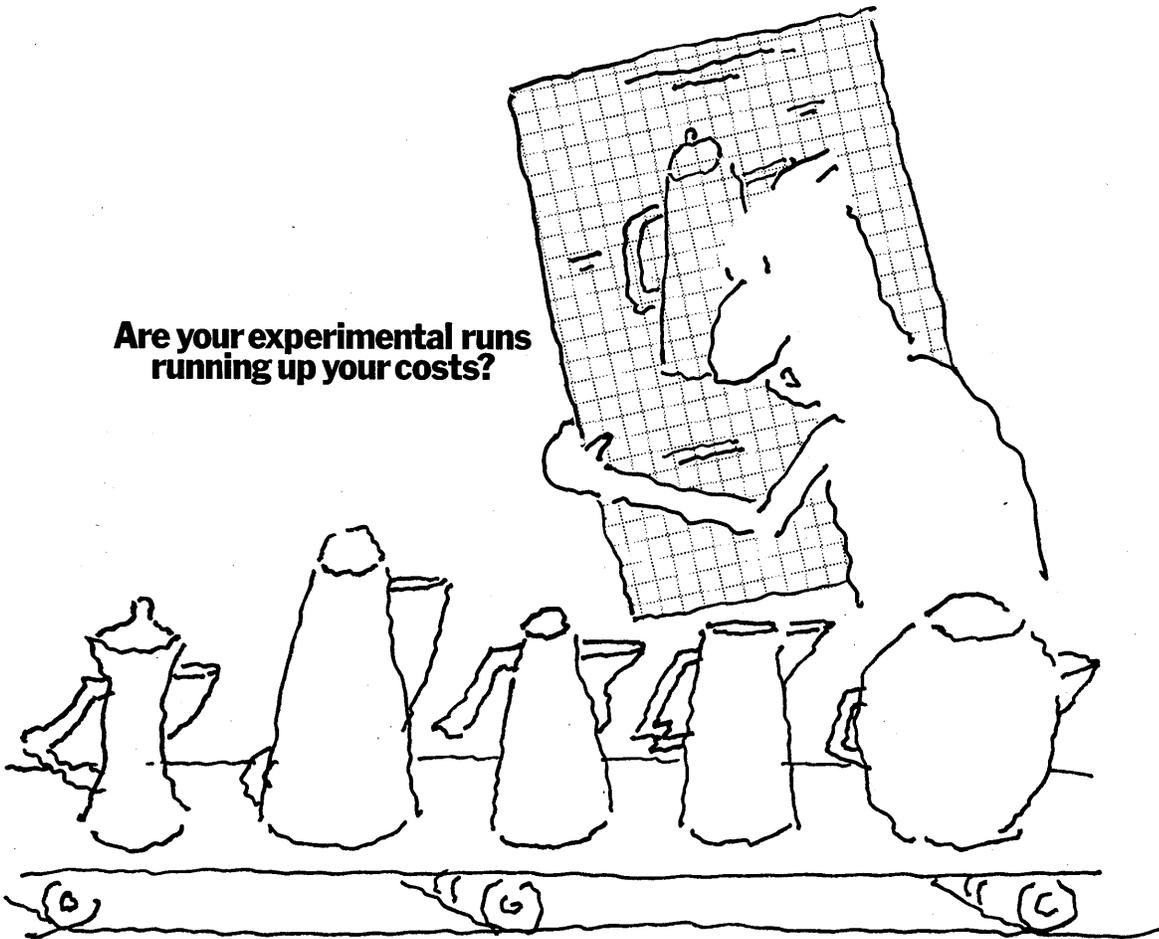
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CIRCLE 55 ON READER CARD

NEWS IN PERSPECTIVE

nal service to broadcasters was expanded to become a shared use network. In 1977, the first nonbroadcast user was brought on-line, and since then the network has been reshaped into a value-added service called the Cylix Communications Network.

A key element in the Cylix network today, according to president James Ziegler, is its switch to satellite facilities. By combining Westar satellite capacity from Western Union with its own earth stations, Cylix can offer users a viable alternative to conventional private line nets, Ziegler says.

Although the Cylix net provides only transmission capability for specific types of terminal protocols, the service can include equipment supplied by Digital Communications Corp., a subsidiary of M/A-Com Inc. The exact relationship with Digital Communications and M/A-Com is "terribly confusing," Ziegler admits, saying only that the main investors in Cylix are Storer Broadcasting, Scripps-Howard Broadcasting, and Digital Communications Corp.

The Cylix service is aimed primarily at users of transaction-oriented terminals like the IBM 3270 and Burroughs TD-830, Ziegler says. Initially the net supported only the Burroughs protocol, but 3270 support is being added this summer and X.25 support is slated for November.

There are six corporations currently using the network, with 13 waiting for service. There is typically a 45-day wait after agreements have been signed to hook up a new customer, Ziegler says. While costs are difficult to document because of the many variables involved, he claims the typical

Cylix service is aimed primarily at users of transaction-oriented terminals like the IBM 3270 and Burroughs TD-830.

user configuration is priced at about \$350 per drop.

One of the critical factors in network cost is the terminal response time. Admitting that he gets a little paranoid when discussing that matter, Ziegler says, "The response time on our network can run anywhere from two and a half seconds to seven or eight seconds. We tailor it based on the users' requirements and what they are willing to pay."

Explaining that the \$350 per drop estimate is based on a typical response time of about four to five seconds, Ziegler notes that would encompass the time from the beginning of the inquiry to the end of the response. One of the confusing factors in dealing with response time is that some terminals wait until a screen is filled before the display is illuminated, while other crts fill a screen one character at a time, he says.

One of the reasons that a terminal

inquiry may take five seconds to get a response on the Cylix net is that a typical transaction includes two satellite hops. Each satellite hop adds about a quarter of a second to the response time, according to Ziegler. But most users are not affected by the delay incurred by the satellite, particularly if they are sending long messages. Since many switch from lower transmission speeds to 9,600 bps on Cylix, "the speedup due to faster line speed more than compensates for the additional delay, and customers actually see faster response time on our network," Ziegler contends.

Basically the Cylix network is a permanent virtual circuit service as opposed to a virtual call or dial-up type of facility. From the user's standpoint, Cylix is designed for customers who want their terminals to "always be live" so that they can send a message with only the push of a button. There are no complicated log-on procedures because many people using the network are not computer-oriented, comments Ziegler. Because of those characteristics, Cylix is mainly an alternative to leased multipoint or in-house private line networks.

Although it supports terminal-oriented protocols, Cylix has a large number of minicomputers on the network including Data General Novas, Texas Instruments 990s, and some micros based on the Intel

8080. These are customer machines, and Cylix typically interconnects to terminal cluster controllers rather than individual crts or printers.

One user that will soon switch to the Cylix satellite net is Real Time Management Inc., a service bureau serving the manufacturing and distribution industries from Bridgeport, Conn. The company had been

One of the critical factors in network cost is the terminal response time.

using Western Union supplied private lines for about 10 years but recent tariff hikes made it necessary to look for alternatives that would cost less, according to Warren Sisson, vice president.

The company was already using the Burroughs TD-830 poll select protocol, so Cylix support fit right in. The equipment used by Real Time Management's customers includes System 70 intelligent crts from ADDS and TI 990 minicomputers. When evaluating the Cylix costs, the net looked best at longer distances, Sisson said. Agreeing with the average cost of about \$345 per drop, he said one location in Georgia now costs his firm \$1,800 per month because it is far from the main WU net locations.

Sisson said he visited the Cylix facilities in Memphis and felt that the network

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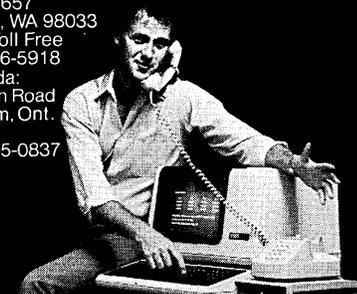
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NEWS IN PERSPECTIVE

had included redundant capabilities in as many places as possible. He added that Real Time Management was not yet operating over Cylix, so specific comments on the service would have to wait.

While Cylix is attractive to certain users, it does not offer broadcast message capabilities. In addition, it is mainly a point-to-point service with each virtual circuit serving as a point-to-point connection. Ziegler qualifies that by explaining that the X.25 support will allow connections to multiple channels. So in that sense, Cylix will provide point-to-multipoint service when X.25 is available.

Since Cylix is primarily aimed at transaction type traffic the network does not encourage high volume bulk data transfers. A small amount of this high volume data is now running, but it is channeled to the late night off-peak hours when long holding times will not affect access to users.

Essentially, Cylix users are sharing common facilities. They contract for a slice of the total capacity, and when they exceed their allocated capacity, the net has built-in safeguards to make sure they don't encroach on other users' time, Ziegler says.

—Ronald A. Frank

INTERNATIONAL

IN FRANCE IT'S TELETEL

By whatever name, the key to videotex success is customer acceptance and use.

The latest of those videotex tests that are popping up all over the world went operational in France in early July.

But just what is videotex? Omri Serlin, Strategic Business Services, San Jose, Calif., doesn't think "there'll ever be a definition that will satisfy everybody." He likes the broad definition that it has something to do with television sets; it has something to do with communications lines or other communications media; and it has something to do with computer-driven databases.

Videotex also has been described as the generic name for an interactive mass medium that delivers text and visual information directly to consumers in which the user interacts with the system via a handheld keypad, pushbutton console, or full alphanumeric keyboard.

Some call it the "information service of the future." It goes by many names in its many offerings. In France it's Télétel.

The French test is called the Télétel 3V test (the Vs for the three involved communities: Vélizy, Versailles, and the Vale of the Bièvre). In the test 2,500 volunteer homes are linked to a nationwide network of information services.

In a hastily arranged inauguration of the test, Louis Mexandeau, then newly named Secretary of State in charge of the French PTT, explained the selection of the three communities.

"For technical reasons, we needed a test site in the Paris region." French Tele-

"For technical reasons, we needed a test site in the Paris region."

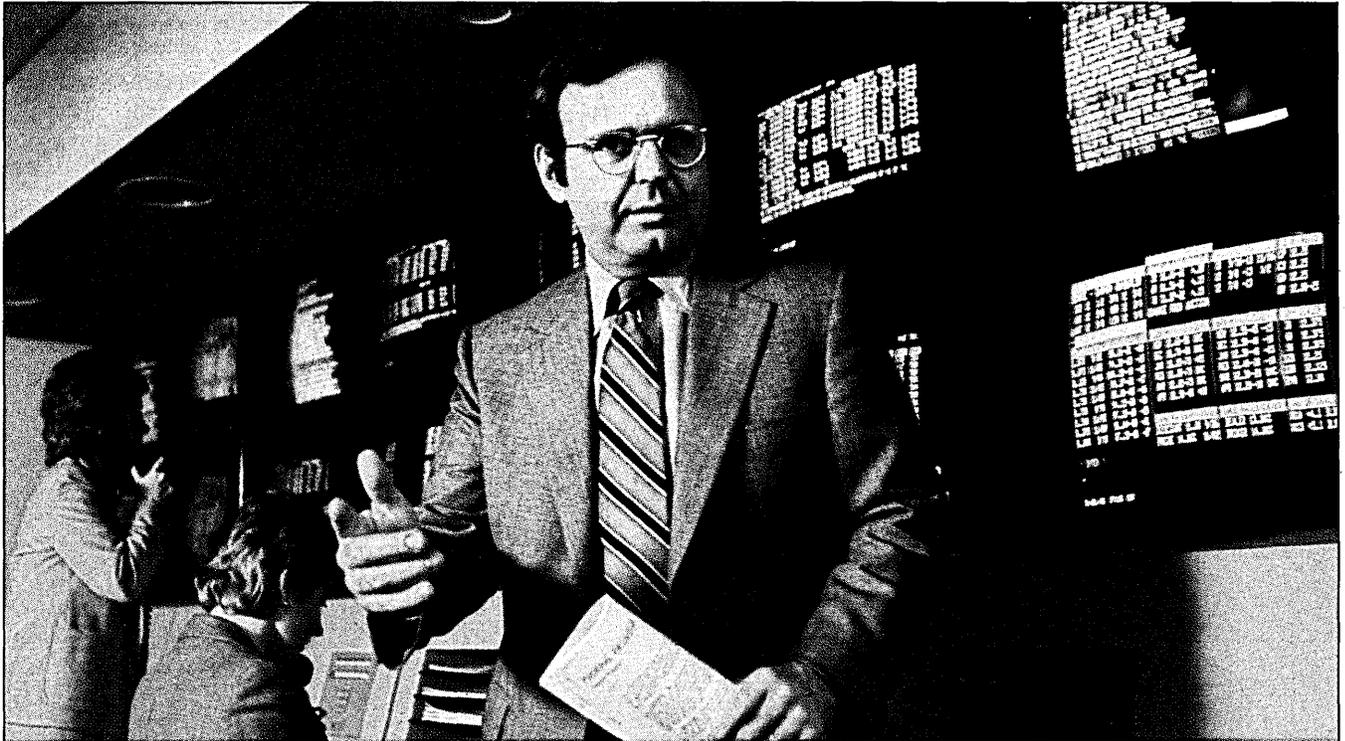
com, the telecomm subsidiary of the French PTT, said the participants were chosen from a receptive mailing group of 10,000. The group includes representatives from a range of ages, academic backgrounds, professional activities, and family sizes.

"Maybe we might regret the fact that the current sample . . . is hardly representative of France at large," said Mexandeau. "There are no fishermen, of course, just as there are no mountain dwellers . . . and we do not even have the factory workers that you would find in a suburb such as Aubervilliers. This would have been a negative factor if we had in fact intended to impose Télétel everywhere in France."

There were political overtones to Mexandeau's talk, just as there were to the very haste with which the inauguration was put together (little more than a week's notice to participating dignitaries and the press). "First we had to wait for Mexandeau's appointment," said a French Telecom spokesperson. "Then we had to get it done before the Bastille Day holiday after which Parisians, including the French press, vacate Paris for the summer. To wait until September would have been too late since there has been much speculation that the new [Socialist] government doesn't support the project."

Mexandeau was cautiously supportive. "Our politics aim . . . at the creation of telematics applications that would be guided by public opinion and judgment. We intend to act according to the advice expressed by the press and our members of Parliament. This is why the Télétel 3V test must be considered as a phase in the context of a process of discussion and agreement." He called for an "extensive debate" on the subject. "This is the only method that will enable us to establish a modus vivendi between the progress of technology and the rights and needs of citizens."

He talked about the "social question. What is the sort of society in which these avant-garde technologies—videotex today, and generalized telematics tomorrow—might project us? My personal opinion is that French Telecom has taken the risk



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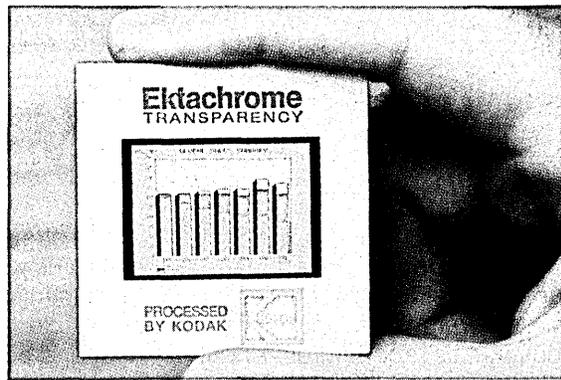
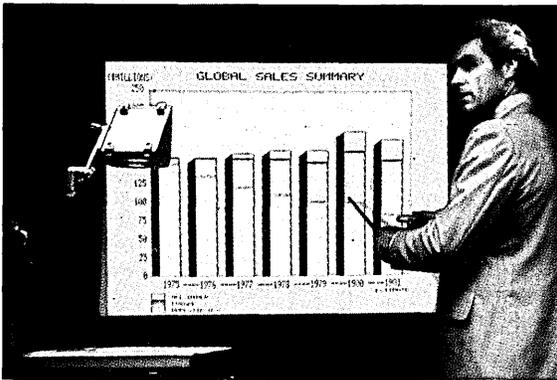
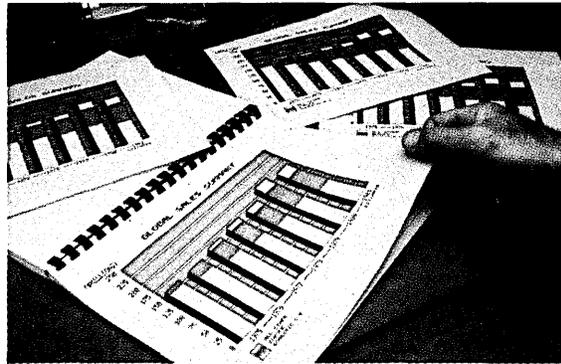
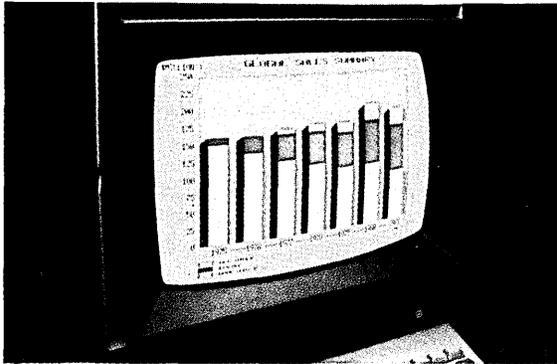
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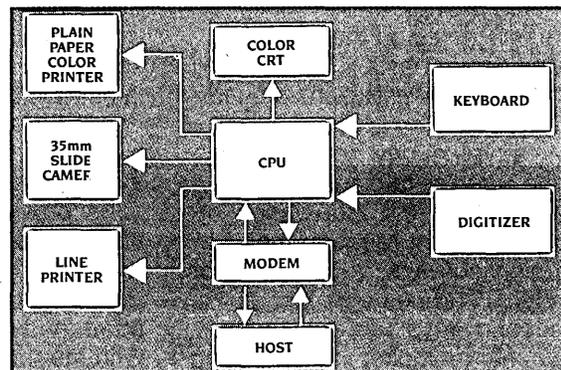
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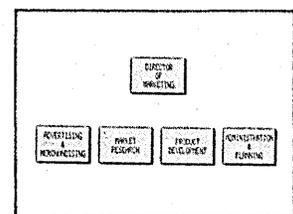
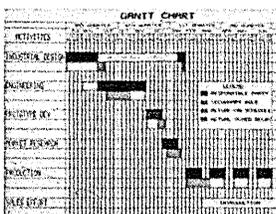
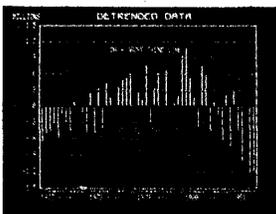
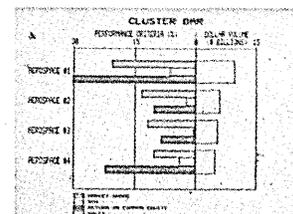
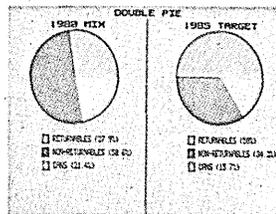
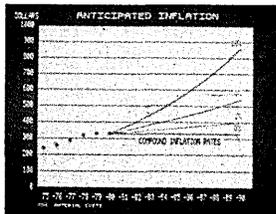
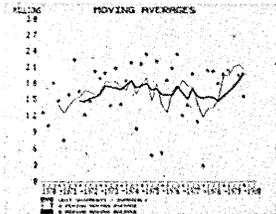
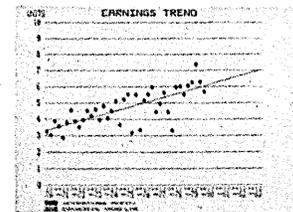
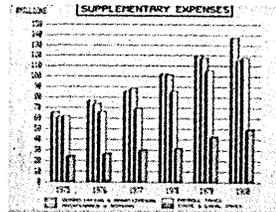
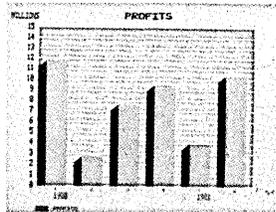
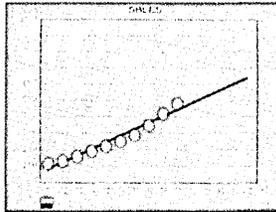
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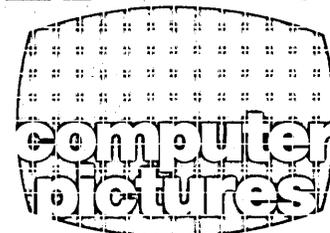


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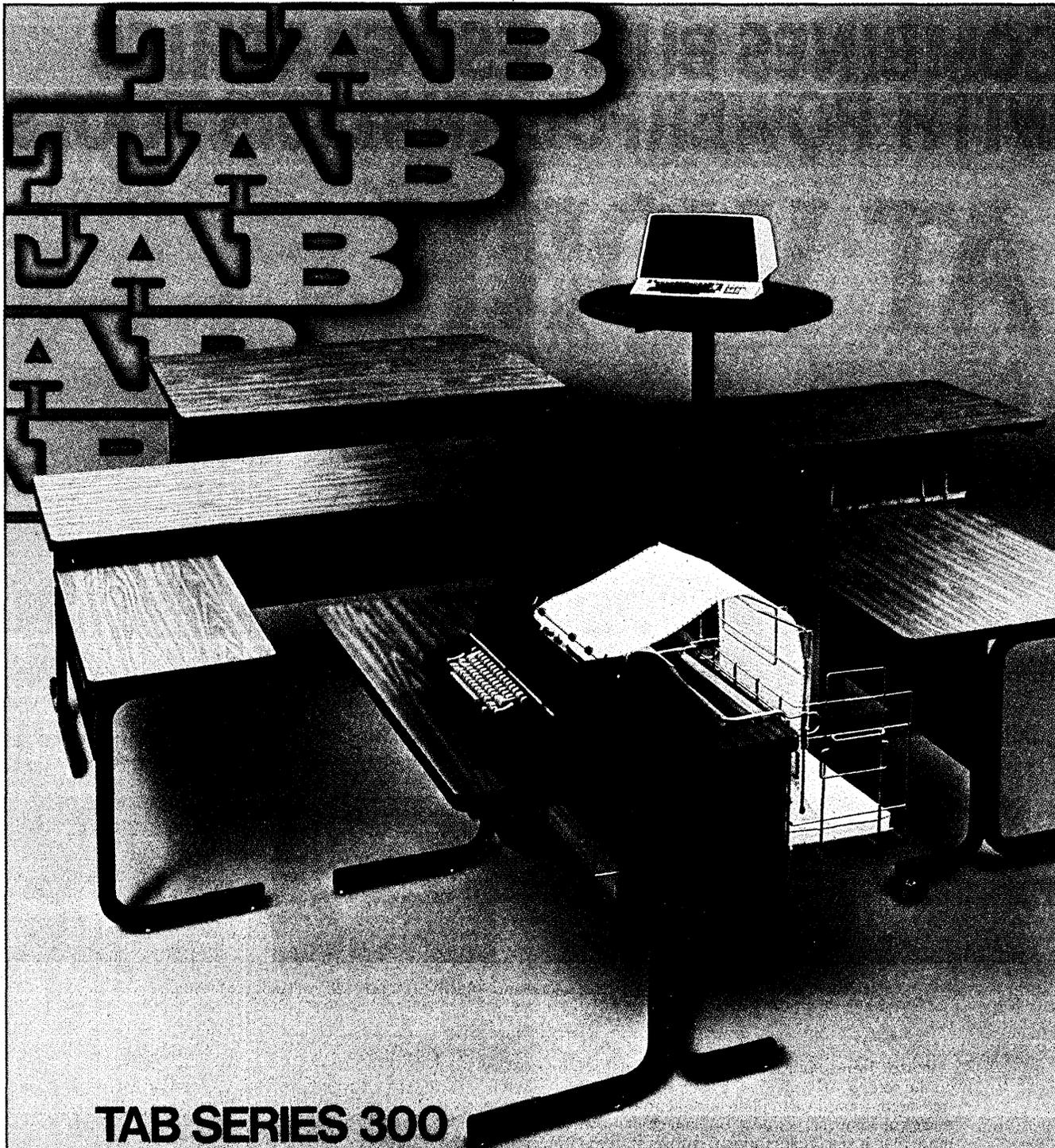
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NEWS IN PERSPECTIVE



POUR VOUS: In the Télétel test, there are some 60,000 precomposed pages that can be accessed.

of creating a rejection phenomenon by failing to draw a distinct line between dynamic action and authoritarian action."

Videotex and Télétel have been called the cornerstone of France's telematique program. Roy Bright, managing director, Intelmatique, the international marketing arm of the program, has described the project as one aimed at "bringing the advantages of computer and communications technology within the reach of everyone who has a telephone."

Télétel is based on France's Antiope standard but is an extension of it. Antiope is basically a broadcast teletex standard, one that has been licensed for use in tests in many other parts of the world, including one currently being conducted in Los Angeles

"French Telecom has taken the risk of creating a rejection phenomenon. ..."

(June, p. 63). With teletex, a user can select a page he wants to see, and a decoder will block out everything else from a given database. "But the database pages scroll on until the desired page is displayed," explains SBS' Serlin. "The selection is made at the user's tv set. The database doesn't know anything about it." This limits databases typically to 100 pages.

With videotex systems, the user keys in his choice, which is handled by a computer elsewhere. Videotex databases can be up to 300,000 pages in size. Télétel is a videotex offering.

Most of the 3V test households have been equipped free of charge with terminals that make it possible to use a standard tv set for the display of videotex information. Some people who do not own tv sets were provided with autonomous terminals including their own screens.

The users are asked to foot the bill for their actual use of the system: roughly a dime for five minutes of telecom line time, plus precisely defined access fees in the case of specific facilities offered by certain service providers.

French Telecom has opened the test "to all public or private organizations wishing to use this new communications tool, provided they are prepared to bear the costs of their participation and assume their responsibility as service providers."

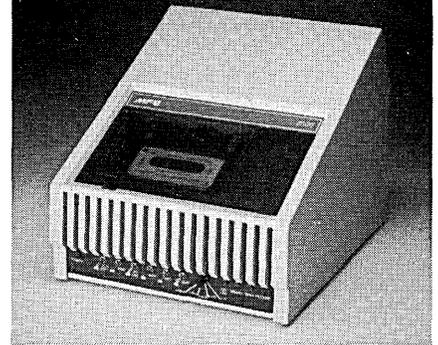
For the test, there are some 60,000 precomposed pages, together with several hundred thousand pages that might be composed according to the specific requests of subscribers. The system holds the timetables of 1,500 French trains, the references of companies, tradesmen, and all sorts of organizations in some 38,000 French cities, towns, and villages, as well as a complete list of all that is happening in Paris in the way of entertainment.

As for processing services, some 30 information providers are offering facilities for making purchases in mail order houses, making travel and accommodation bookings, playing computerized tv games, or taking lessons in a computer-assisted-instruction environment.

Each user is linked by telephone lines to Cii-Honeywell Bull Mini 6 computers in the Télétel computer center in Vélizy. This center puts the user in direct contact with the various videotex services that are provided.

These services are grouped as follows: Group I, software installed in the center itself; Group II, software installed within the geographical zone of the test but not in the center (these are linked to the center by private lines); and Group III, software installed outside the geographical zone of the test. These computers are connected

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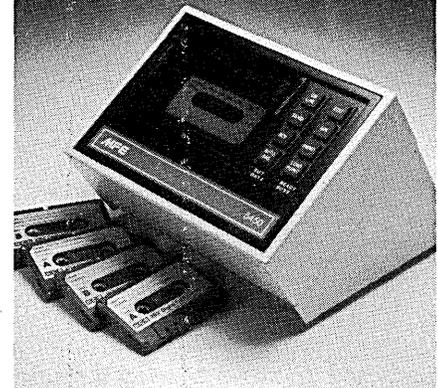
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NEWS IN PERSPECTIVE

to the center by means of the Transpac data transmission network.

French Telecom will hold small group meetings with participants on a regular basis, will make one-on-one contacts, and will periodically circulate questionnaires to get user feedback.

How do the users like it so far? They had been on the system one week at inauguration time. M. Vicari, who runs a small restaurant/bar on the outskirts of Versailles, was enthusiastic. Although the system is strictly for personal use right now, he looks forward to a time when he can use it in his business. He likes "the marketing aspect, the possibility of learning what it is people want and being able to stock what is already sold."

It is obvious Vicari is the principal user of the system in his household. His wife, a daughter 16, a son 14, a daughter 4, and a son 3, watched attentively but without comment as he extolled its virtues for a small press group. He said the two older children have "used it some," but the younger ones not at all. "The words [that you have to key in to make a selection] are too long for children." He would like to see selections made on the basis of the first three letters of a word.

Currently his favorite database for showing off the system is a Chinese horoscope. Given a complete birthdate, the system tells the user what kind of animal he is like, the positive and negative personality traits of this animal, and what is ahead for this animal in the current year.

On the practical side, Vicari likes

accessing those databases that deal with public administration. "In France, administration is complicated. It's difficult to find the right person to deal with. This makes it easier."

In the Vélizy home of a Parisian dentist, the wife uses the system for recipes, and once found a babysitter with it. The children like it for games.

In a smaller but longer-standing test, in Coral Gables, Fla., 30 terminals are being used on a rotating basis in 200 homes to

The system holds the timetables of 1,500 French trains.

access similar services. This test is based on the British videotex system called Viewdata (the original name of and the basis for Britain's Prestel). It is sponsored by Viewdata Corp. of America, a subsidiary of Knight Ridder Newspapers, Inc., in cooperation with AT&T. Although users are regularly polled in the market test, user reaction so far is considered proprietary information. That test will run through this month. Users can access 18,000 pages of data.

Mort Goldstrom of Viewdata Corp. of America said a more ambitious test will be launched in mid-1983, also in south Florida. This test will cover 5,000 homes and will involve a database of 75,000 to 100,000 pages. Users will be charged in this test, which isn't the case in Coral Gables. Goldstrom said AT&T will lease or sell terminals at rates yet to be determined. As for the test's duration, "It could last forever."

THE SIMPLEST VIDEOTEX OFFERING

One of the simplest forms of videotex offerings is electronic yellow pages.

But it has hit its own unique snags. A French test in the Ile et Vilaine region of Western France was only briefly mentioned by the new French Secretary of State in charge of the PTT during an inauguration of the country's 3V Télétel test.

Louis Mexandeau said only that the Vélizy test "must be associated with the trial of the electronic directory in Brittany." There are those who believe the new French government would like the Ile et Vilaine test to go away, seeing it as something that will deprive telephone operators of jobs.

The test, begun last May, followed an earlier test in the summer of 1980 in the coastal city of Saint-Malo. The current trial is supposed to extend to the end of this year and be followed by a final trial linking 270,000 telephone subscribers at the beginning of 1982. The ultimate goal was to have full implementation of a nationwide directory program.

In the U.S., directory programs have been opposed by newspapers that fear loss of advertising. AT&T ran up against such opposition in attempting to set up an electronic yellow pages test in Austin, Texas.

But Alan P. Brigish, president of Information Systems Marketing, Inc., a Wilton, Conn., company that specializes in the application of new technology (especially videotex) to information distribution, says, "Newspapers and telephone companies need not compete—their needs are different, but they have more to gain by cooperating." A report just released by his company said electronic yellow pages "will quickly become a reality when independent telephone companies work out a methodology for cooperation."

The report notes that even AT&T, clearly the major future player, does not have all of the pieces. Although beset by a web of legal, judicial and regulatory problems, AT&T eventually will emerge as the front runner, Brigish predicted, although legislation before Congress could bar AT&T from selling advertising in electronic form.

Because it will take another two to three years for the monolithic telephone company to get its act together, Brigish said, "This leaves a window of time for smaller, more entrepreneurial competitors to get together and position themselves to compete against the giant."

—E.M.

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SEPTEMBER 1981 85

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CIRCLE 78 ON READER CARD

NEWS IN PERSPECTIVE

User acceptance remains the key. In the early stages of the Coral Gables test, Dennis J. Sullivan of AT&T said initial developments of videotex systems "have neglected the consumer." He said the Bell System's objectives in the Coral Gables test are "to evaluate consumer interest in, need for, and acceptance of an interactive electronic information system."

On the technical side, France with Antiope, Britain with Prestel, and Canada with its Telidon videotex system are competing vigorously for world and particularly U.S. markets. Antiope is so far the leader, with an existing licensing agreement with CBS and one with NBC upcoming.

Prestel, the oldest, has had two disadvantages it is working to overcome. One is that Prestel is an alphamosaic system and not compatible with alphageometric Telidon and Antiope. British Telecom, however, has announced it will add alphageometric capability.

AT&T's proposed North American Standard for videotex, announced at the Videotex '81 conference in Toronto last May, accommodates both Telidon and Antiope. But the British have proposed to the U.S. Federal Communications Commission five levels of standards beginning with the basic and incompatible Prestel of today and going up to and beyond the alphageometric capabilities of the others.

Prestel's other disadvantage is that it isn't yet a "gateway" network. All service providers must deliver or transmit their databases to Prestel computers. With the other systems that are "gateway," providers

One favorite database for showing off the system is a Chinese horoscope.

keep their databases on their own computers and the systems provide switches to them.

Germany's Bildschirmtext system, which is based on a Prestel license, does offer gateway. The Germans developed gateway software for the Prestel system and are now selling it to the British, who in turn are expected to sell gateway by 1984.

SBS' Serlin isn't convinced that any of the three big offerings—Telidon, Prestel, or Antiope—will make it big in the U.S. He sees instead a growth in cable offerings and in the use of home computers rather than tv sets for information services terminals.

He said his company predicts that by the end of this year there will be more than 17 million cable households in the U.S. and it expects this to climb to more than 29 million by the end of the decade.

He said the only commercial videotex service (under his broad definition of the term) in the U.S. to date is a thing called Instant Update provided by the Professional Farmers of America via Radio Shack videotex terminals.

And he's closely watching Japan,

where a cable system called Video Response System has been in experimental stages for 2½ years and is in use internally at Nippon Telephone and Telegraph. "It does require that a customer have cable, and that's rare in Japan. But here . . ."

—Edith Myers

SMALL BUSINESS SYSTEMS

SUCCESS FOR THE UNDERDOG

Starting from scratch, two Japanese entrepreneurs have built corporations that compete successfully against old guard companies.

People who enjoy finding a chink in the armor, a crack in a monolith, an escape route for the enterprising underdog, will take delight in the success being enjoyed by two Japanese entrepreneurs. Both are in the small business computer market. Both are former employees of large, prestigious electronics companies. And both, starting from scratch in a nation known for its lack of venture capital, have built corporations that manage to compete successfully against not only the giant mainframers with their established network of sales and service outlets but also against the office equipment makers with their established clientele.

The first of these, Kazuo Maesawa, 36, is president of Japan Digital Laboratory, a company he formed when he was but 23 years old. Maesawa was an engineer with Hitachi, working on large-scale systems such as the one developed for the Japan National Railway. He says he left to develop a small-scale computer for use by small and medium-sized companies, bringing along a colleague from Hitachi who now manages JDL's manufacturing plant to the north of Tokyo. The new venture was funded by private sources to the tune of 1.4 million yen, which is less than \$4,000 at the exchange rate in effect at that time.

Their first machine, built from TTL discrete logic components, was priced at an exorbitant 15 million yen, almost \$42,000, which they understandably found very difficult to sell. The company went through about 10 or 12 iterations with new models before getting it right. They call the first big seller Model 1, of which they made about 1,000. Production of that model reached a peak of 100 a month, but from announcement date to the end of production was only 18 months.

The company experiences very

short production runs, averaging about six months, before having to come out with a new model of its small business computers. Maesawa blames this on computer demands for new features and new capabilities. He says the company is constantly improving its software to accommodate these demands. The latest feature is kanji processing, the handling of the complex ideograms adopted by the Japanese from the Chinese language.

But JDL, which has some 220 employees, has about an 80% share of its market—the small accounting company, typically a five-person office comprised of an accountant and four assistants. The company has focused its efforts on this one narrow market, which accounts for 80% of its sales, and has learned just about everything there is to know about the customers and their needs. The company's current product line consists of an entry-level machine priced at the equivalent of about \$9,000, but goes up from there to a deluxe system priced at around \$135,000. In this market alone the firm has an installed base of 3,000 machines.

In addition, it sells to the financial departments of small and medium-sized companies. It is a growing market and an increasingly important factor in JDL's growth, for it can lead to installations not only in accounting departments but also in other departments of those same companies.

With revenues last year of more than \$16 million, the company is said to enjoy a profit margin of from 20% to 25%. Maesawa says it has experienced as much as a 70% growth in one year, but he now sees it rising annually at a 30% rate. In the past, he



KAORU ISHIDA: "The U.S. market is the toughest; I hope we will crack that market pretty soon."

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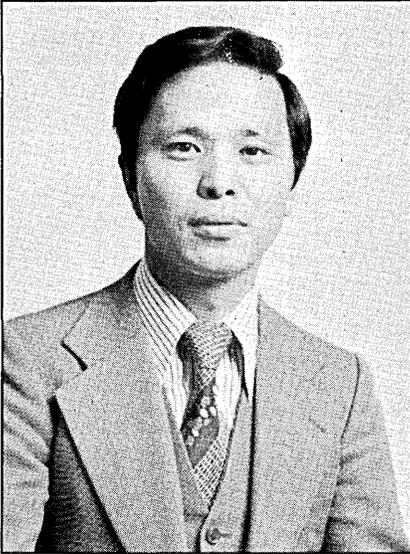
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CIRCLE 79 ON READER CARD



KAZUO MAESAWA: He says his company is constantly improving its software to accommodate customer demands.

says, accounting firms were heavy users of service bureaus, due primarily to the lack of low-priced machines. But now JDL gets about 25% of its new customers from those former bureau users. About a third of its systems are leased, the remainder recorded as purchases; of the latter, about half are outright cash purchases and the other half are extended credit. That credit is backed up by a bank, which vouches for the customer.

Maesawa, who pilots a Beechcraft Bonanza to get to his distant sales offices and customers, takes pride in the productivity of his employees. He says the industry average is to have one FE in the field for every 35 machines installed; JDL's ratio is one per 150. While the industry supposedly averages five or six sales per salesman per year, a typical JDL salesman closes 20 per year. Again, based on industry averages, it takes 300 programmers for every 150 machines sold per year; JDL does it with 20 programmers per 150 machines, according to Maesawa.

No less impressive is the story of Kaoru Ishida, eight years older than Maesawa. Ishida is probably Japan's largest exporter of small business computers. His company, Logic Systems International Inc., shipped some 2,000 of them to Europe last year and is expanding to begin producing 500 systems a month. All this by a company that has only 20 employees.

Ishida, who is an electrical engineer, was with Mitsubishi Electric when he joined Fairchild Semiconductor in Tokyo in 1970. He was transferred to the latter's facility in Mountain View, Calif., to work on the F8 microprocessor project. When he was sent back to Japan in 1973 to iron out some problems with exports to Japan, he left Fairchild to start LSI. He lacked the funding to start a hardware company, so he

got into software consulting, held seminars, and gradually got into hardware. He made microcomputer modules, then got into microcomputer development systems using the Intel 8080 chip. His firm's products since that time have been based on the 8080 and the Zilog Z80 8-bit microprocessor chips.

One of his early activities was the design of a small business computer, which a French company picked up and began manufacturing in France. The client later asked Ishida to design a new machine for them, one that would be made in Japan. A succeeding machine and variations on its theme, called the Model 7000s, are still being made by LSI, the latest featuring an 8-inch Winchester disk and having a multi-user, multitasking operating system.

Development of the 7000 began in May 1979 right after Ishida had returned from the Hannover Fair in Germany, and the first two production models were shipped at the end of the following August to the Sicob business machine show in Paris. In that three-month period, LSI designed the logic of the machine, purchased the CP/M operating system from Digital Research in Pacific Grove, Calif., modified it to run on its pro-

Kaoru Ishida of Logic Systems International is probably Japan's largest exporter of small business computers.

cessor, wrote the software that is resident in ROM, did all the purchasing of parts and components, and arranged for everything to be manufactured by outside contractors.

"That was the worst season for us," Ishida recalls in fluent English. At that time, the Space Invader video game was at the height of its popularity in Japan, and the makers of game machines were taking all the microprocessor, memory, and logic chips available. But by the time of the Sicob show in September, LSI had shipped 18 machines, more than 100 by the end of September. A month later, by the end of October 1979, the company had shipped about 50 of its double-sided, double-density floppy disk drives—and during a time when no American company had yet shipped any comparable 8-inch floppies and only a few Japanese companies had succeeded in doing so. In the initial 10 months of production, the company had shipped about 2,000 machines—and all this before a redesign occurred last year.

The company ships mostly to France but has begun to expand marketing to include other Western European countries. Ishida also has a representative in Chicago whose job is to find distributors in the U.S. and Canada. "The U.S. market is the toughest," he says in explaining the delay in getting started here. "I hope we will crack that market pretty soon."

Not surprisingly, Ishida says, "Our

greatest advantage is our ability to get high technology into production very fast." To illustrate this capability, he says last year his people worked on the redesign of the 7000 series, the new design of two other machines, the design of a POS electronic cash register terminal, and an industrial control system using a micro. He explains that while the small computers are its main product lines, accounting for 90% of sales, the company is also engaged in the design of industrial control systems, the design of a home tv game for one of Japan's largest toy manufacturers, and is supplying a small number of microcomputer modules to a large company for incorporation into the latter's spot welding machines.

LSI, only recently shipping small business computers to the domestic market, looks to enlarge this activity. Revenues from domestic installations account for 10% of the total. In its latest fiscal year, which ended in March, the company had revenues of \$10 million and net income of \$863,000, at a conversion rate of 220 yen to the dollar. All this with but 20 employees.

"I don't think it's smart to invest a lot of money in something like assembly, which can be done by many [outside] people," says Ishida. Japan, he explains, has many companies that are equipped to handle production, whether of subassemblies or entire systems. And yet, he says, he has the flexibility to handle demand for 50 units one month, a thousand the next. Production can be expanded that readily, he says.

—Edward K. Yasaki

MINICOMPUTERS

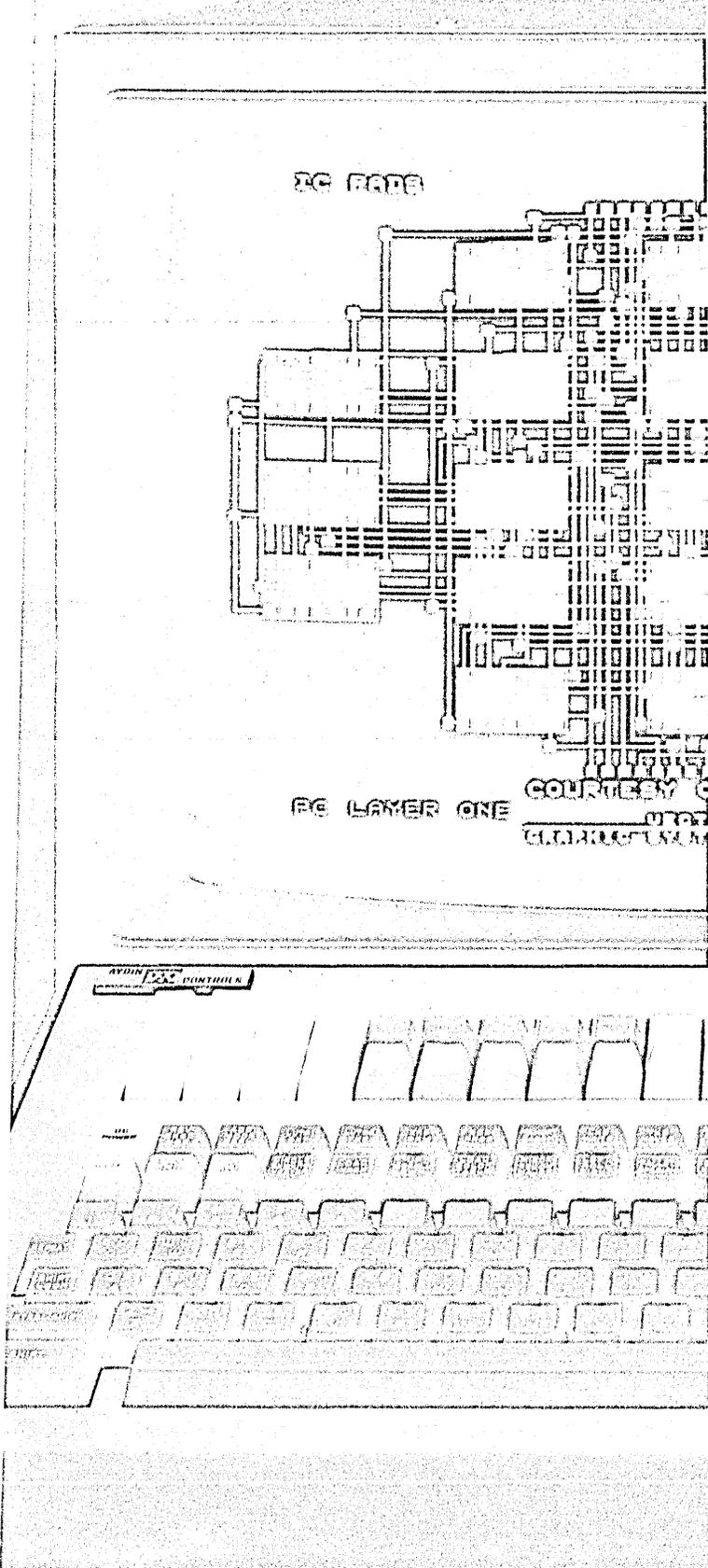
P-E GOES INTO BUSINESS

The former Interdata 32-bit mini company has had some upsets, but now it has set its sights on the soon-to-boom commercial marketplace.

Having established itself solidly in the scientific and simulation computing markets, Perkin-Elmer's Data Systems Group in Oceanport, N.J., has now set its sights on the commercial 32-bit mini marketplace. New machines, new software, and additional support and service offerings have been mobilized in the firm's strongest effort ever to gain a foothold in what promises to be one of the fastest growing segments of the systems business in the next few years.

The company, which grew out of the Interdata company formed more than a de-

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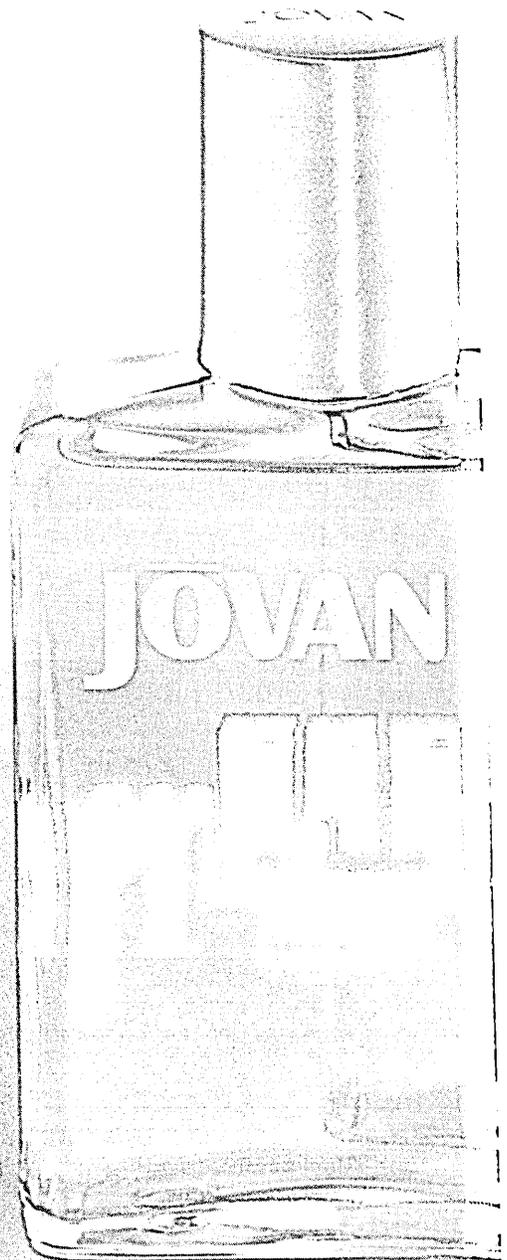
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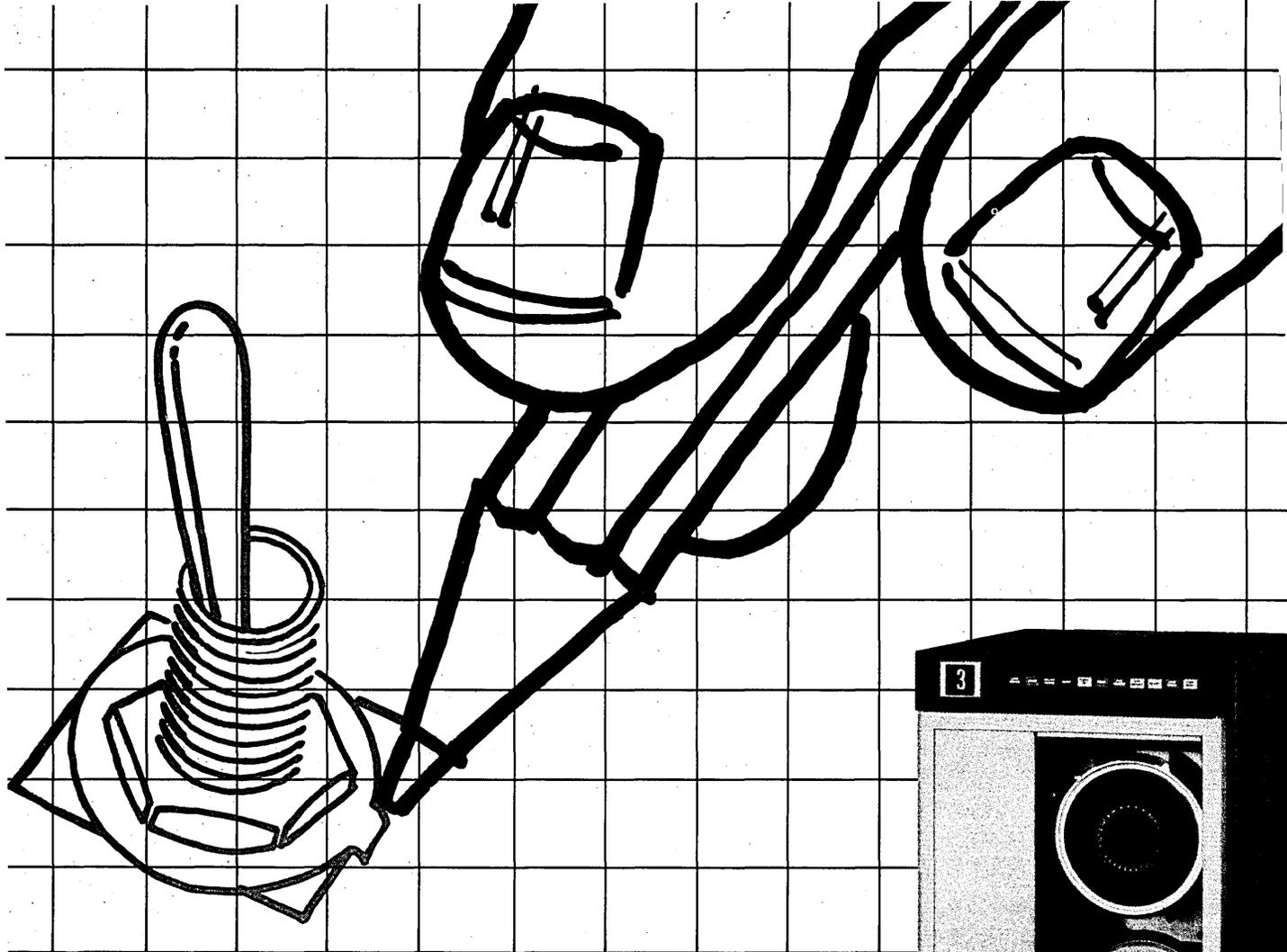
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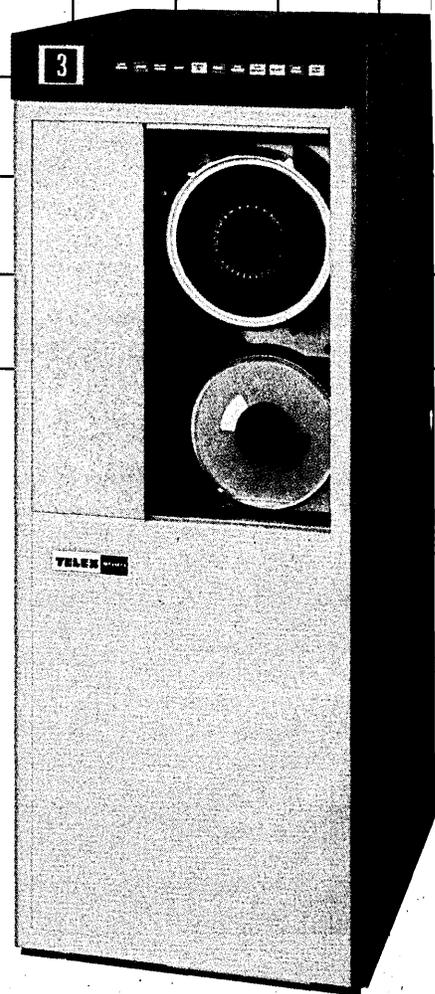
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NEWS IN PERSPECTIVE

cade ago, has had its ups and downs lately, seeing its crt terminals business fall by the wayside, its Memory Products division up for sale, and several high-level marketing executives leave. But, to focus its energies once and for all, it has formed a Business Systems division.

The new division, headed by Englishman Martin Waters, hopes to hit a number of specially selected market niches with enough force to beat out some large competitors: Digital Equipment, Data General, Tandem, and Hewlett-Packard, to name a few. The battle won't be an easy one, but Perkin-Elmer thinks it has gained enough

The firm has taken steps to educate potential customers on the advantages of 32-bit architectures, stressing bigger memories and more performance.

momentum in its scientific business to make a significant mark in the commercial sector.

With most projections showing a 40% annual growth rate for the 32-bit mini market, it is only logical for Perkin-Elmer to try for a piece of the big pie. But it will require some new marketing skills and support efforts for success.

"There is a risk in taking this approach," said William G. Moore, vice president in charge of the Computer Operations portion of Data Systems. "But we think it's worth it."

There will be, analysts claim, an increasing number of systems houses and end-users outgrowing 16-bit machines over the next few years. Many will turn to 32-bit cpus, which can provide additional processing power and price/performance with little retraining or software redesign.

Perkin-Elmer goes to great lengths to explain the advantages of 32-bit machines, both in a general way and in particular regarding its own products. The main advantage, it says, is that of superior memory addressing. A 32-bit word can be used to access up to 4,096 megabytes of main memory, while a 16-bit word allows only 64 kilobytes (without the use of memory bank switching). Additional addressing power comes in handy as minis are asked to handle larger databases, teleprocessing, timesharing and, most important to Perkin-Elmer's commercial thrust, transaction processing.

The other obvious advantage of the 32-bit systems is their ability to do more work in a single cpu cycle. On both these counts Perkin-Elmer has taken advantage of current technology to produce a line of systems that have fared quite well in the scientific marketplace where large data sets are manipulated at high speed. Its competitors have opted in some cases for virtual storage, with an accompanying drop in overall processor performance, to which Perkin-Elmer has replied with a series of benchmarks

showing its machines are better in cpu-critical applications.

But the world of benchmarks is one of never-ending controversy, and it will ultimately be the marketplace that will decide which firms will win in the 32-bit battle. Perkin-Elmer has pitted itself against some mighty contenders who appear to have a good head start in terms of experience in the commercial 16-bit marketplace and the resulting range of third-party-developed software.

Perkin-Elmer does not have the same contingent of systems houses producing software for its machines as do the two Massachusetts companies, DEC and DG, nor does it have comparable sales and service staffs. What it does have is expertise in specific market areas and, according to Moore, it will concentrate on those to establish a strong beachhead.

He cites banking, insurance, and stock trading as three likely areas of success for the Oceanport, N.J.-based Business Systems division, which is attempting to capitalize on successes attained at a number of commercial installations in the past six years or so.

One of the firm's biggest successes has been with Citibank, the New York bank that in the mid-'70s made a splash by replacing IBM mainframes with Interdata 32-bit minis in a stock transfer operation. The bank also has used Interdata/Perkin-Elmer machines in various other capacities, particularly at overseas locations.

The minicomputer company, which was named Interdata, had broken into Citibank primarily because of its machines' having an IBM 370-like architecture and programming environment and a COBOL compiler highly compatible with IBM's COBOL. Those two factors made it easy to move applications off IBM machines with little retraining of programmers.

At the time of the Citibank installation, which ran into its share of problems under the skeptical gaze of the banking and computing communities, Perkin-Elmer's business was predominantly in the scientific arena, as it is now. The firm enhanced the COBOL compiler over the years, but it wasn't until a transaction processing system, known as Reliance, was introduced that it could seriously consider getting into the commercial sector.

Reliance, designed to handle high volumes of transactions from many terminals at once, was introduced at the 1980 NCC and will be the keystone for the firm's entry into the business marketplace. Around it and working with it have been added several packages including RQL, a relational query language for database work, and, for the future, a number of packages to handle networking, more database, and other related tasks, say officials of the company.

The new Business Systems division, formed officially early this year but in the

works since 1980, is comprised of about 100 persons and relies on the firm's existing sales force, according to Moore. He noted, however, that in certain sales offices staff is being dedicated to commercial sales. The division is also offering lease plans for its equipment, something the Computer Operation didn't do previously.

Moore intimates that the division will make or break itself in the next six to nine months. During that period several new products, including a new low-end processor, will be introduced in order to help shore up product line weaknesses and provide business customers with a full range of offerings, Moore added.

The low-end machine is designed to be smaller than its main competitor, the Digital Equipment VAX-11/750 or "Baby VAX," while offering up to 4 megabytes of main memory in its single desk-like cabinet. It is slated for introduction this month at less than \$50,000 per system as a means of capturing business from systems houses that have outgrown 16-bit machines and are looking to move into the 32-bit arena. There promises to be much of that kind of migration, Perkin-Elmer says, and it is hoping to be there to capture its fair share.

One disadvantage the firm has against larger minicomputer makers is its lack of a big 16-bit customer base, but the firm expects to be able to make the most of the situation by emphasizing that its software is designed specifically to run on its 32-bit machines and no others. DEC and DG, for instance, and probably HP when it introduces its long-promised 32-bit cpu, have had to make their 32-bit software compatible with their 16-bit offerings.

Perkin-Elmer, on the other hand, claims to offer a high performance machine with high performance software for high

Its fight for a good piece of the 32-bit pie will not be an easy one, given the strengths of competitors DEC, DG, and HP.

performance applications, a combination that can't be beat. Reliance, for instance, is designed to handle up to 10,000 megabytes of on-line storage and 128 on-line terminal users and still provide quick response times.

Waters, who prior to becoming general manager of the new division was head of the British software development group that developed Reliance, is quick to point out that high performance systems won't sell without cooperation from third-party software developers. These include systems houses and end users (some of which, like Citibank, are large enough to support their own internal systems houses) that have developed industry-specific packages on Perkin-Elmer equipment. Waters says that he has spotted several such packages with great marketing potential but no deals have been

signed yet. He notes that the firm has some 300 customers that fall under the commercial designation.

"The main factors in our success will be software and the completeness of the software offering," Waters adds. "The customer wants a high probability of success."

Under his management the Business Systems division will grow "substantially" from its current roster of about 130 persons, Waters says, noting that an aggressive hiring campaign is under way to build on the "old line" personnel retained from the scientific side of the house.

While he declines to provide specific operating figures (it would be against corporate policy), Waters says that Business Systems is expected to contribute a third of Computer Operations' revenues in the coming fiscal year. His short-term goal, he says, is to bring that division's growth rate up to that of the overall 32-bit industry, or about 40% a year. With that done, Perkin-Elmer would be able to maintain and then increase its market share.

As a computer systems supplier, Perkin-Elmer has offered crt terminals, printers, disk and tape drives, and cpus with software. In recent months, however, it has cut out its oem terminal business and has put the West Coast Memory Products division up for sale. The terminals division continues to sell products to other Perkin-Elmer divisions, but it is not seeking additional outside customers, according to a spokesman.

The company has plans to pick up and support software packages developed by its end-user customers and systems houses.

In the Memory Products area, it has a fairly lucrative contract to supply IBM with tape drives for the Series/1 minicomputer, but it has fallen by the wayside in terms of high-technology disk drives. Industry observers expect the division to be sold by the end of the year.

Nonetheless, Computer Operations has been highly successful in the scientific/simulation computing markets, having won, for instance, the largest simulation contract of them all—a sale of more than 200 machines to Singer for B-52 simulators.

In its quest for expansion of scientific markets, the firm is looking to buy into or participate in a joint venture in the CAD/CAM market, one of the fastest growing segments of the industry.

Also, in an attempt to cash in on the Unix craze, Perkin-Elmer plans to offer the Western Electric-developed operating system as a standard product. Previously a third party, the Wollongong Group, offered a Perkin-Elmer version of Unix with success.

—John W. Verity

GOVERNMENT

NTIA STAKES ITS TURF

National Telecommunications and Information Administration is fighting to prevent its jurisdiction from being divvied up.

In the new hand being dealt at the Department of Commerce, the National Telecommunications and Information Administration may be lost in the shuffle.

Bills in the House of Representatives and Senate espousing the creation of new, Cabinet-level committees on international communications and information threaten large pieces of NTIA's jurisdiction. The organization is also struggling with the traders and economists in Commerce for control of the burgeoning international communications arena. And the replacing of former NTIA administrator Henry Geller with Bernie Wunder has caused loss of visibility and may harm the body's effectiveness, sources say.

"I don't think NTIA's going to be worth a damn under Bernie Wunder," a former high official there says. "He's got no leadership, no expertise, and no personal influence. His knowledge is extremely shallow. He's not respected as an authority and has no independent knowledge. He's a nobody. He was a run-of-the-mill staff person before, and he's acting like a staff person now for [Secretary of Commerce Malcolm] Baldrige."

"If NTIA loses this struggle in the international area," a Congressional source says, "it's going to be a second-rate part of Commerce. But if it wins, it will be a powerful player."

The staking of turf derives from a report last December by the House Government Operations Committee on the international information flow and the numerous barriers thereto. Among its findings was "the United States Government has no coordinated policy regarding barriers to international data flow. Neither does it have any coherent policy regarding particular barriers and the problems they create for the U. S. and its political, social and economic interests.

"The authority and responsibility to develop policy is divided among several agencies on a conflicting and often confusing basis. The absence of coordinated policy and policy development exists not only among, but within, agencies," the committee concluded.

In response, the House begat the International Communications Reorganization Act of 1981 (H.R. 1957). The bill establishes a Committee on International Communications and Information within the executive branch to be chaired by the United States Trade Representative (USTR). The Secretaries of Commerce, State, Labor, and Defense, the Chairman of the Federal Communications Commission, and the Director of the Office of Management and Budget would be the remaining members. A similar bill in the Senate (S. 821) establishes an International Telecommunications and Information Task Force, chaired by the Secretary of Commerce, to coordinate policy among agencies sharing responsibility for international telecommunications and information policymaking.

"The response of the executive branch agencies to these problems continues to be inadequate," the committee report says. "The Department of Commerce appears to have a greater interest in international communications and information issues at the senior levels of the Department.

"The International Trade Administration [ITA] within the department is com-

The International Trade Administration, with its background in trade policy, wants to be number one in international activities.

mitting more effort and interest to this area. The NTIA hopes to be able to commit more of its resources to these international questions. While such prospects are encouraging, the strength of the department's commitment and its viability within the new Administration remain uncertain."

Therein lies the battlefield. ITA, with its background on trade policy, wants to be number one in international activities. NTIA, based on its vastly superior communications expertise, thinks it ought to be calling the shots around the globe as well as the country.

"We feel communications is such an important item in international trade that it should be given special emphasis," says NTIA assistant administrator Dale Hatfield. "Others [namely Assistant Secretary for Economic Policy Ray Waldman] feel it shouldn't. We moved our internal money around to reflect its importance.

"I think the existing structure is adequate for handling the problems in international communications. We're not going to fight over turf. If Bernie thinks the authority ought to go somewhere else, he'll let it go. But there's no doubt we are reflecting the Secretary's position on international communications policies and issues."

Perhaps. The victor has yet to claim the spoils. But there is little doubt that NTIA is the administration's mouthpiece on domestic telecommunications policy. Wheth-

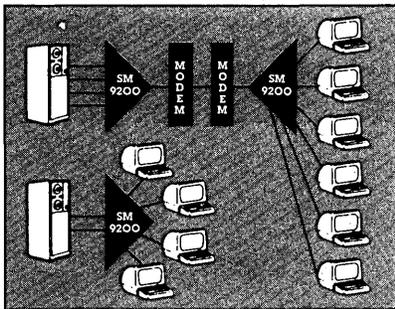


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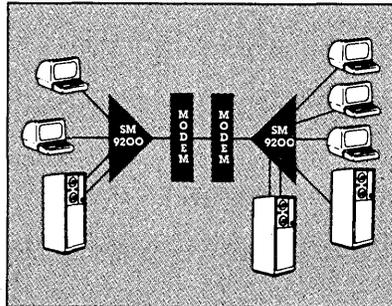
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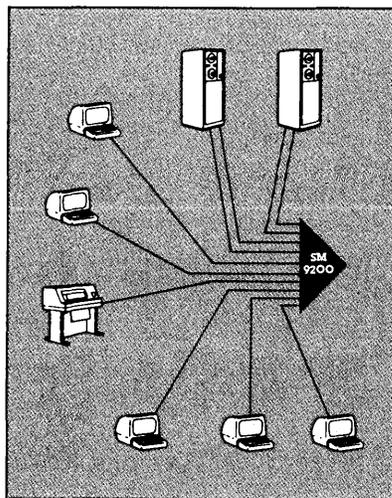
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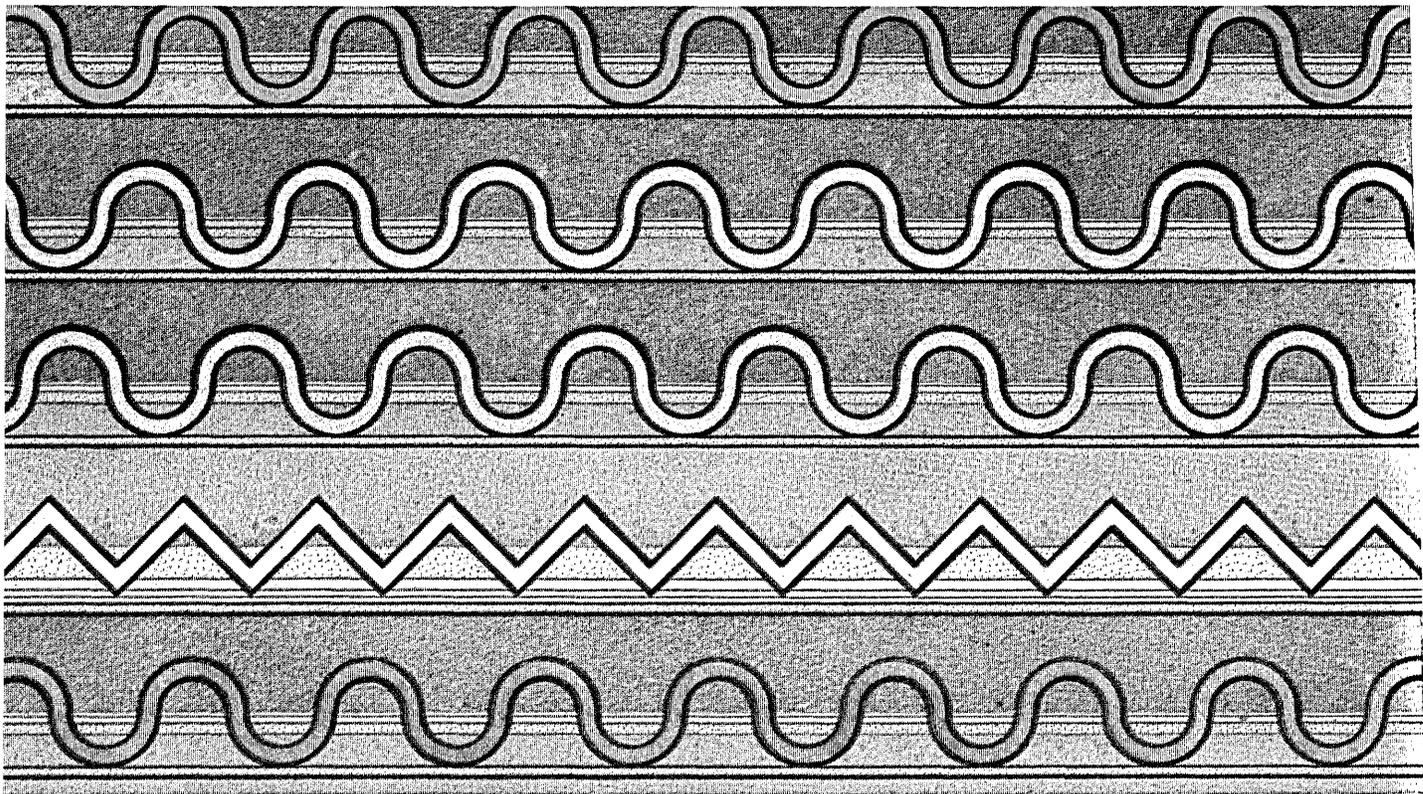


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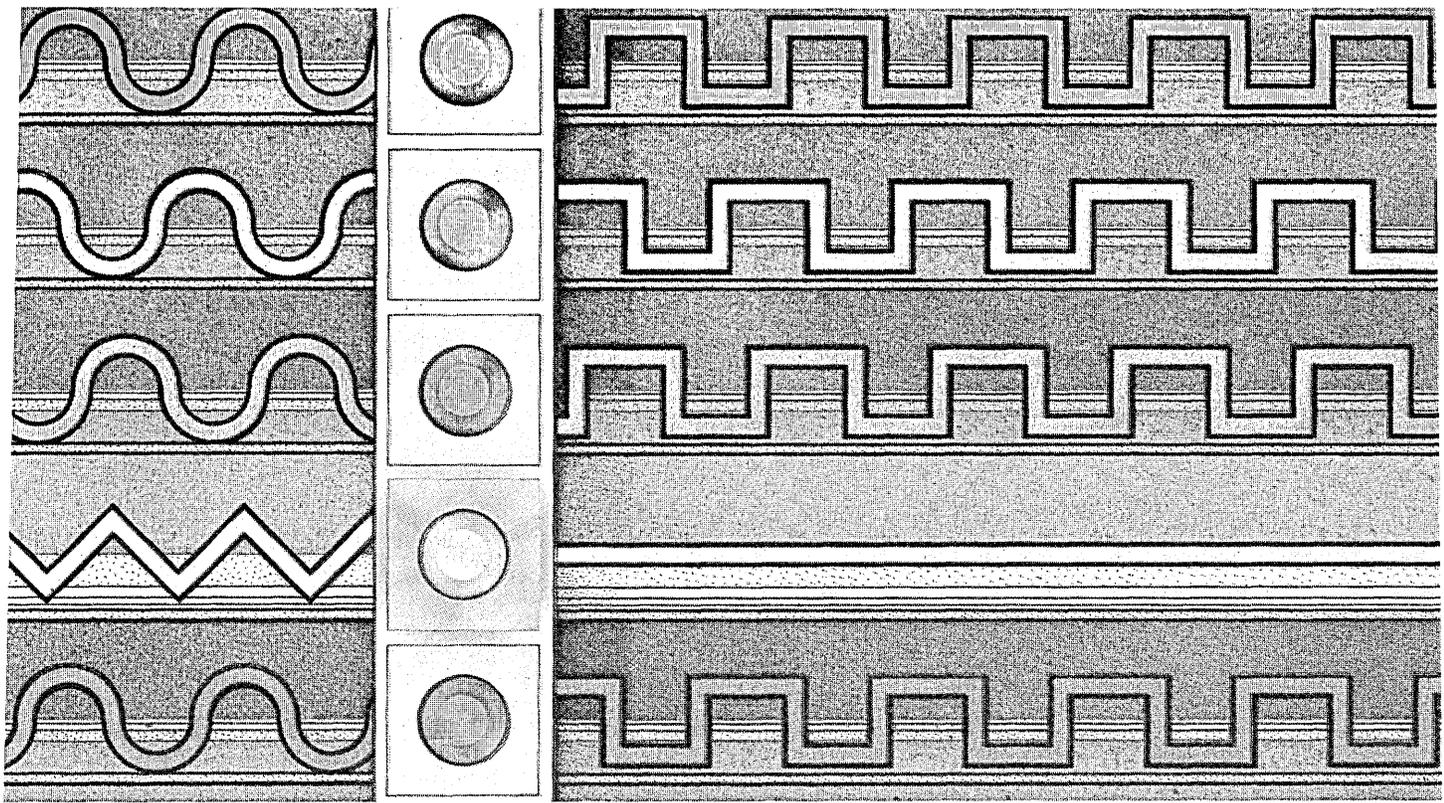
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NEWS IN PERSPECTIVE

er it is being heard as loudly as in the past is questionable.

Last year Geller was point man here, there, and everywhere during the protracted fight over proposed telecommunications legislation. When the Carter Administration needed a mouth, Geller's was always open.

By comparison, Wunder is invisible. He has made few public pronouncements, preferring to work within the hierarchy of Commerce. That does not necessarily indicate that NTIA's sphere of influence has decreased. It does show that NTIA has been so quiet it is hard to tell what it has been up to.

"By providing help and developing positions on legislation and Computer Inquiry II [the thrust of which it vigorously supports], we're showing what we're doing," Hatfield contends.

"The worst thing you can do to the telecom industry is have a lot of uncertainty," he says. "By having in the legislation [S. 898, the telecommunications bill] that terminal equipment can't be regulated, regulation doesn't creep back in. You can't have an industry operating under a cloud."

You can, however, apparently have NTIA existing under at least a mist. Its budgetary authorization has been changed from indefinite to year-to-year, perhaps matching the mood of fiscal austerity ruling Capitol Hill but possibly a harbinger of future diffi-

NTIA's budget authorization has been changed from indefinite to year-to-year.

culties. With some of its functions, although not those on which it spends most of its time and energy, possibly being transferred to a superagency, its jurisdiction—and influence—may well shrink.

"I think there's a healthy tension between the agencies," says another former high NTIA employee. "The Department of Commerce is populated by nincompoops and is generally stupid and paranoid. The Administration is taking the question of international trade and telecommunications seriously, and NTIA ought to be on point for those issues. They're positioned to do it as well as or better than anyone else."

"It's very hard for Commerce to play the role of executive branch spokesman for telecommunications policy," a knowledgeable source insists. "The Defense Department doesn't accept its leadership domestically; the State Department doesn't accept it internationally; and the FCC does its own thing and pays no attention."

"NTIA isn't going to improve the situation. It's already been downgraded by going from Geller to Wunder. The only way the organization can have clout is by virtue of its administrator's personality, and Wunder doesn't have it."

"Morale is rock bottom there."

—Willie Schatz

PATENT PENDING

While the patent office houses voluminous specifications on all dp developments, it is devoid of their application.

Within its walls are the origins of nearly all great technological leaps forward in the last two centuries. As Casey Stengel would say, you could look it up.

"We've got it all in here," says Commissioner of Patents and Trademarks Gerald Mossinghoff. "There's no mass storage technique used in the entire dp industry that doesn't reside in the patent office. The computer industry is well patented and very protective of its interests."

"The trouble is," Mossinghoff added, "the technology's on paper; it's always an idea that's going to be used elsewhere."

Maybe that's been true for the past 200 years. Probably not for the next 200.

Spurred by Section 9 of Public Law 96-517, the patent office will report to Congress by December 12, 1982 "a plan to identify, and if necessary to develop or have developed, computerized data and retrieval systems equivalent to the latest state of the art which can be applied to all aspects of the Patent and Trademark Office." Mossinghoff will attempt to translate into action the ideas his predecessors have approved. An office group has been studying the matter for six months. The public had its say at a July hearing and has been encouraged to keep talking.

"We are not doing nearly as much toward being a paperless office as we should be," concedes Mossinghoff, who was deputy general counsel of the National Aero-



GERALD MOSSINGHOFF: "We're the only patent office in the world where official opinions are handwritten."

navics and Space Administration (NASA) prior to receiving Senate confirmation in June of his new position. "We are way behind the bigger agencies and departments. We are not one of the more modern offices. Most of our automation is either nonexistent or primitive."

Two of five parts the in-house study group is examining approach modern times: those two relate to automation. Nonetheless, the proposed FY 82 automation budget of \$19.5 million, about 16% of the PTO's \$118.9 million total, probably won't push the patent office's progress along the automation time clock.

The Patent Application Locator and Monitoring (PALM) system tracks the current status of each of the 107,000 patent applications received every year. That's a

The Patent Application Locator and Monitoring (PALM) system tracks the status of each of the 107,000 patent applications received every year.

daily dose of more than 400 for each workday. By the end of 1982, PTO folks should be able to punch in the number of the application on a terminal and know its life history. The system, now half manual, still requires excessive maintenance and debugging.

The Trademark Registration Application Monitoring system (TRAM) performs the same function for trademarks. It follows half as many applications—55,000—but has a more complicated task. Unlike patents, which are inviolate for 17 years, trademarks last indefinitely but must be continually renewed and shown to be currently in use. Without such evidence, which is unnecessary for patents, the trademark is considered abandoned. Tracking thus requires far more time and monitoring. TRAM, now totally manual, is not expected to be on-line until the end of 1983.

That will still be several years ahead of any computerizing of patent and trademark searching and most automating of PTO communications with America at large.

Since the first patent was approved, 14 million American and 10 million foreign documents have accumulated in the examiners' files at the PTO. To make life somewhat more bearable, the information is broken down into a mere 108,000 subclasses.

And how are these historical treasures stored? They rest, appropriately enough, in "shoecases," cabinets with files two inches thick. They are available, in stacks which appear to have no horizon, to the public at no charge. Hardly a system to encourage file integrity. With luck, the patent for which you're looking will be in the right file, undisturbed. Much of what you need to know is on the front page, which has been computerized. Those tapes have been

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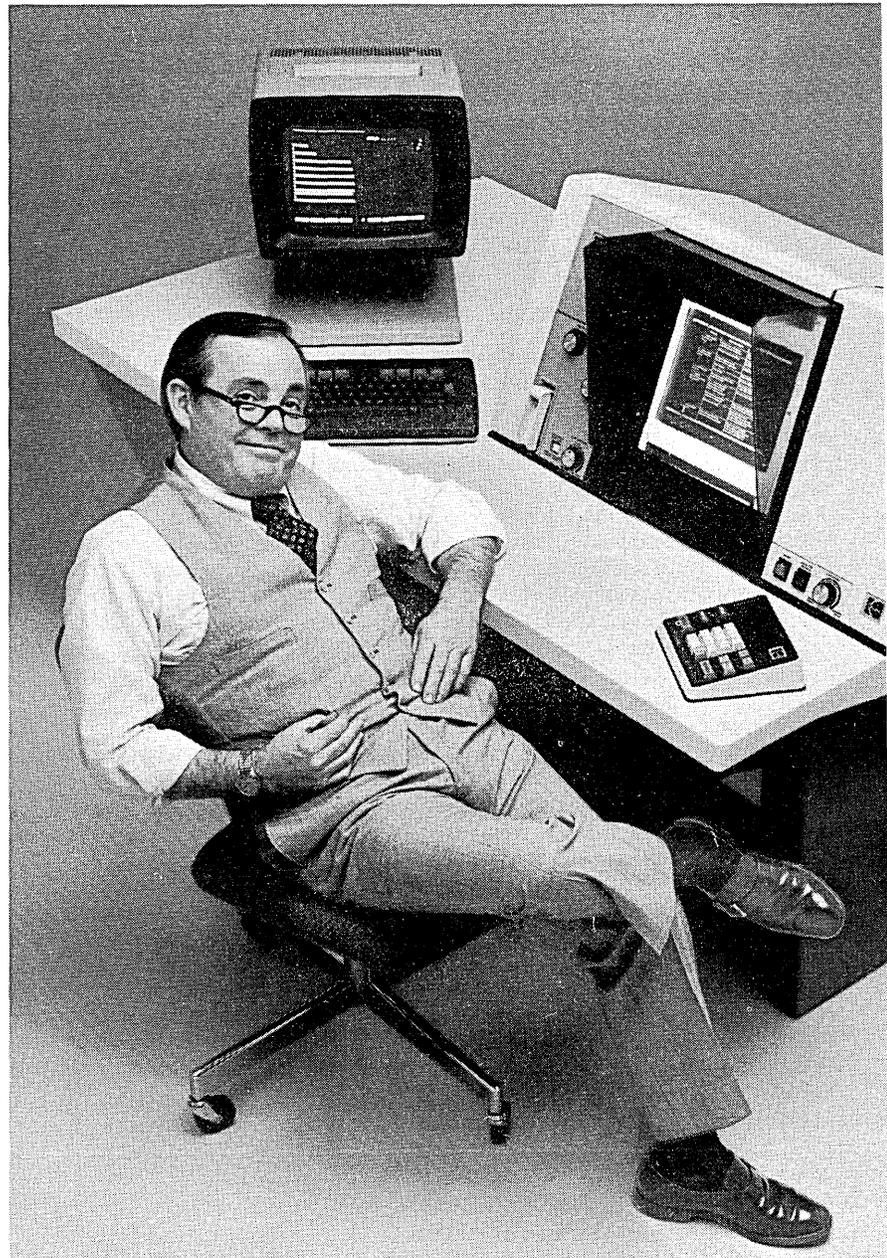
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NEWS IN PERSPECTIVE

stored since 1971. More often, the search may rival that for the Holy Grail. Laid out to end the papers would occupy three miles of shelves.

The computerized equivalent would be but a foot long. Only general-purpose digital computer and analog and digital converter patents are on an automated system. Those are put into a Computer Control Microfilm Search System (CCMSS). It isn't much, but it's all they've got.

"There's no doubt that automating those files is a Herculean task," Mossinghoff says. "Is full text search by itself a

Only general-purpose digital computer and analog and digital converter patents are on an automated system.

substitute for manual? No. What would it cost to put the stacks on computer? I can't estimate it, but it's a staggering amount, so everyone always says 'we don't have that kind of money' and that's the end of that.

"I don't think that's the right approach. You push hard to automate and do what you can. Those back files are going to be less and less relevant as technology moves forward. I don't know if we can totally automate the stacks. Full text search isn't possible in some instances, such as for a strange-shaped piece of metal. But it would be extremely useful in some areas, like electronics, which are well defined and have common vocabulary out of which you might be able to build a thesaurus."

Right now he'll settle for a few words. All "first actions" (the preliminary determination by an examiner of whether an application is patentable) now are handwritten by the examiner and mailed to the applicant.

"It's a national disgrace," Mossinghoff fumes. "We're the only patent office in the world where official opinions are handwritten. It's a national embarrassment to have things sent out like that."

The red face should vanish next March, when smart word processors will have been installed for all examining groups. The process should reduce sharply the time needed to search for comparable patents, an estimated four to six hours, as well as wipe out the hours required to produce handwritten responses.

"I want this to be a hands-on experience for the examiners," says Mossinghoff, himself a former examiner. "It's very important that we get them into the system so they can start to use it. It's an act of faith on my part that they'll very much appreciate it and take to it, among other reasons because they're real technologists. They're not drama or poetry majors. The person-machine relationship is very important. If they become unenthused early, we've created more problems than we've solved."

Then what they'll have is another

failure to communicate. The public has no trouble making its feelings known. It does so in 32,000 letters a day, 12,000 of which are orders for patent copies. But the PTO is hardly as prolific.

"Our methods are completely primitive," Mossinghoff admits. "They consist of mailing letters, taking phone calls, and having people walk into the search room in Crystal City [Va.]. That's it. That's how we communicate."

The first link in improving the chain will come at the end of the summer, when terminals will have been installed at all 35 Patent Depository Libraries (PDLs) around the country. That system still will require the laborious task of looking up the subclass, the number of the patent, and pulling papers individually. But a potential long-range payoff could come from establishing, through high technology from the likes of Satellite Business Systems (SBS), satellite search systems at the libraries, targeted for the next decade. Additionally, a mechanized search file would permit anyone with a terminal to access the system by satellite. There also is the possibility that, in the foreseeable future (i.e., 10 years), patents will be submitted in electronic form.

"Why not?" Mossinghoff says. "If you can get the graphics for the picture, that's all you need, and that certainly is within the capabilities of current technology. When NASA sends in a patent application, it comes off a word processor. Why couldn't they just send in the floppy disk they used to type it, rather than using their floppy disk to type paper, then send it to us so we can turn it back to electronic form and print it? The paper link is the weak one there."

In this case, the weak may well inherit the patents and trademarks. Electronic applications would be the leading edge of the leading edge. But until the disks have

By next March, the patent office expects to have smart word processors installed for all examining groups.

their day—and probably thereafter—paper is here to stay.

"One of the criticisms of the patent system, and I think it's justified, is that it's not used that much by researchers interested in state of the art," Mossinghoff concedes. "If they come up with something new, they don't think 'hey, I better check with the Patent Office.' One reason is they've got to come to Washington. Or they have to go to a PDL, or hire a search firm. But it's a mistake for them not to use it. The constitutional bargain is that in return for your technology, you get a 17-year monopoly."

"If they had terminals, they'd definitely take advantage of them."

The terminals are coming, however slowly. "The Challenge," Part I of the

PTO's proposed report to Congress, outlines extensive revisions to be made in data systems support, DBMS design, classification definition database, and mainframe augmentation and replacement.

"We've got to move now to keep options open," Mossinghoff says. "We're not going to pick something now that's going to be outdated in two or three years."

"The office isn't going to look a whole lot different in three years. We won't be mailing 'first actions.' We will have smart word processors. We will have a lot more terminals—being used, hopefully. PALM and TRAM will be finished. But the paper file is going to be around into the 1990s."

After 200 years, what's another 10?
—Willie Schatz

MICROCOMPUTERS

NEW MICROS DEBUT

The microcomputer arena, previously populated by a host of small companies, has drawn the sights of several very large companies.

The summer months have seen a new wave of small, desktop computers introduced by a number of companies that are attempting to position themselves in the office automation market. IBM, Xerox, Data General, and Hewlett-Packard have each come out with machines that are designed to sell for less than \$10,000. And, according to some analysts, these are only the first of many more to come.

IBM's latest, the System/23 Data-master, was a surprise to observers in that it wasn't the very-low-end machine that has been expected for so long under the code names Chess and Acorn. Instead, it appeared to be a repackaged version of the 5120, a desktop machine introduced over a year ago as a replacement for the older 5110.

The System/23 is a BASIC-only machine selling for as little as \$3,300 with no diskette or printer, but a typical system price goes for \$9,830, IBM said. The machine comes in a wide variety of configurations, with main memory ranging from 32K bytes to 128K bytes and diskette storage up to 2.2 megabytes.

IBM seems to have taken the 5120, dropped APL language processing, and added word processing. The word processing functions are added via an optional cpu card

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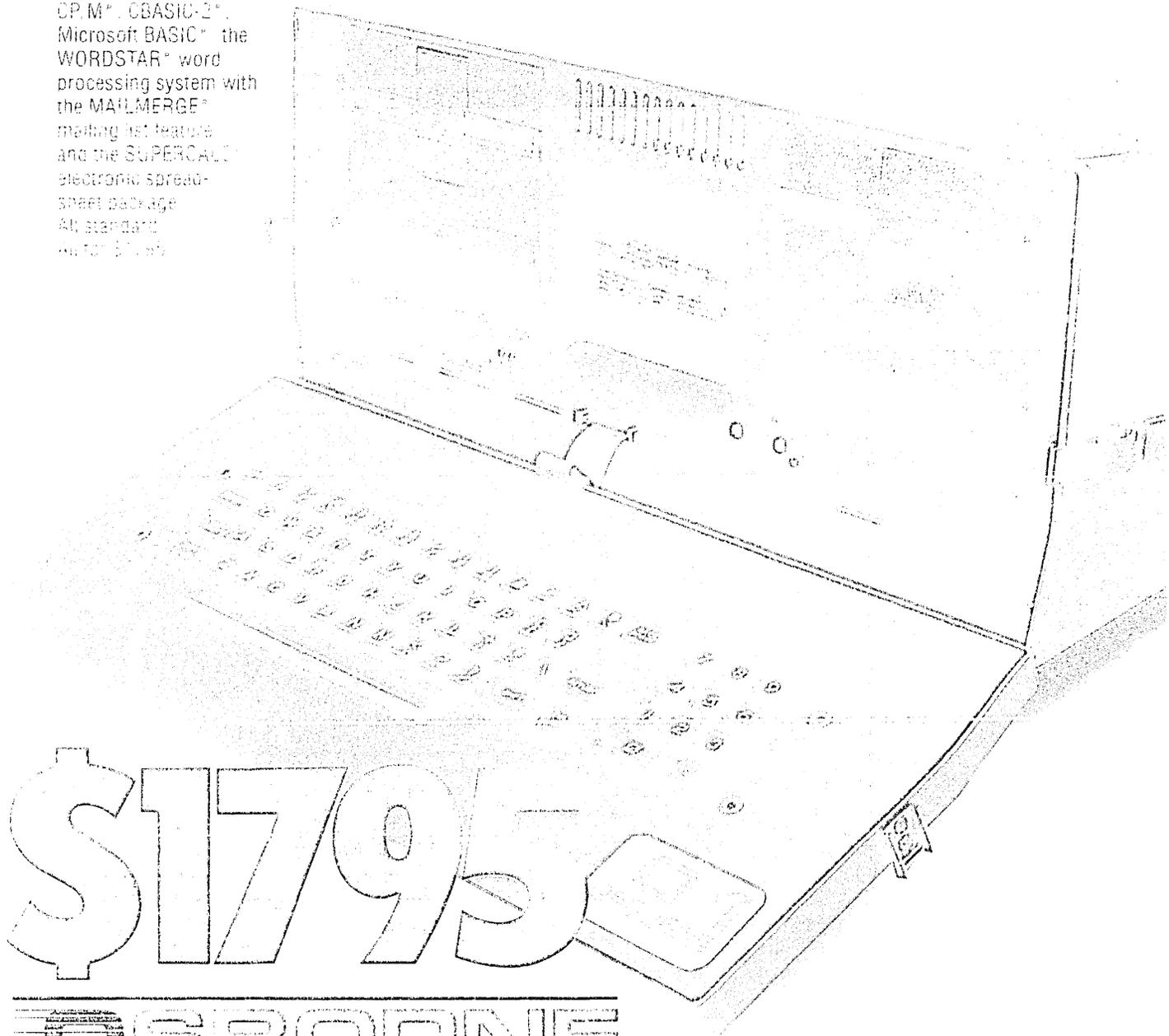
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NEWS IN PERSPECTIVE

which adds more than \$1,000 in hardware cost alone.

As for software, IBM offers a number of accounting packages for the machine, and program development aids and communications packages. Prices range from \$500 for word processing software to \$1,145 for Brads 3, a report generator similar to that offered on larger General Systems Division machines.

GSD said the new desktop model was upwardly compatible with BASIC programs written for the System/34 computer, prompting industry observers to speculate that third-party software developers will have a good market to sell into.

HP's new machine is the HP 125, a desktop model designed for personal use in technical and engineering applications. Standing in contrast to the firm's previous

IBM's Datamaster surprised industry observers because of what it isn't—the long-awaited personal computer developed under the code names Chess and Acorn.

model 85, the new 125 is not to be sold for accounting or database applications.

"Our sales target for these machines is primarily large manufacturing companies, industrial concerns like ourselves," said Jim Groff at HP's General Systems Division in Cupertino, Calif. "I've spent the last two months talking to a lot of those people about products like this and find case after case where they've bought literally hundreds of personal computers, one at a time, in those companies, with varying results."

Some of those users purportedly are disappointed with their newfound toys, while others are happier. Groff said the purchasing departments in some companies want to engage in volume purchases of small computers.

Some firms, he noted, are setting up internal consultancies to help employees buy machines. The firms hope to keep the variety of machines down to perhaps two or three models and to help users match equipment to their needs.

Groff cited a market study forecasting that some 600,000 small computers priced less than \$12,000 would be sold this year, and half of them are destined for the 1,000 largest U.S. industrial companies.

The HP 125 is described as the culmination of four things showing up in offices: the personal computer, word processor, business graphics, and the ubiquitous terminal. The single station machine handles all four functions and is aimed at the managers of small user departments, individual professionals, and even secretaries. An entry-level system is offered at \$6,960.

The machine uses two Z80 microprocessors. One, running at 4 MHz, handles

terminal functions, while the other operates as the cpu. The second microprocessor has 64K bytes of main memory and runs the popular CP/M operating system from Digital Research. The first language for the 125 will be BASIC.

HP emphasizes the new machine can operate as a standalone machine or as a terminal hooked into IBM or HP mainframes and/or networks.

IBM's new machine, the System/23, also operates as a terminal to larger systems, a trend that has been appearing in IBM computers across its product line. Even the Displaywriter word processing system introduced last year has communications facilities.

P. Martin Foley, corporate vice president and president of IBM GSD, said, "Datamaster combines data and word processing in a single product that will unlock the power of computing for tens of thousands of businesses that previously could not afford such a system."

The machine also comes into direct competition with the firm's Displaywriter, marketed by the Office Products Division. That system, also selling for under \$10,000 in most configurations, will soon have data processing capabilities added (Look Ahead, June), further fueling the interdivisional competition IBM is fostering.

OPD recently came out with a new weapon in the assault on the office, an enhanced version of the 6670 information distributor, a laser printer/copier/information switch. The new model, designated model 2, handles 9,600 bps communications lines and offers up to 20 resident software-based text fonts. It is also claimed to offer higher throughput.

Data General's new machine is the Enterprise 1000 system, a desktop model retailing for \$7,195 in its minimal configuration. Slated to be sold only through independent retailers, the system is an attempt by Data General to package its microNova microcomputer into a small business system. It will be offered with a number of generalized accounting packages as well as BASIC programming capability.

Xerox's new machine, the model 820, offers both data and word processing in

HP's new model 125 system is designed for personal use in technical and engineering environments.

a single package. The machine, sold as an answer to so-called personal computers from Apple and Radio Shack, will connect into the firm's Ethernet local network and will accept applications written for the CP/M operating system.

Observers point out that the key factors in the race will be software and distribution since just about everyone will have access to the same hardware technology.

Good software, designed well enough to take care of standalone as well as distributed processing, will be an essential ingredient for those vendors attempting to sell to small users as well as to large corporations. Distribution channels, retail and volume, also will have an impact on operating margins as the prices of systems drop.

Already new patterns are forming. IBM is reported to be negotiating for distribution through such large retailers as Sears and J.C. Penney, while Xerox has set up a chain of its own stores and is selling computers through office equipment dealers. Data General is moving hardware through independent dealers as well as its traditional channels of oems and systems houses. Radio Shack stores speak for themselves.

The marketplace is currently crowded with desktop machines, offered by the largest and smallest of vendors. That only a few of the many competitors will survive in the long run is perhaps the only sure fact in what promises to be one of the most exciting and complex periods of the industry.

—John W. Verity

STRATEGIES

MACHINES THAT LISP

New Lisp machines may become the personal computers of choice for the artificial intelligence community.

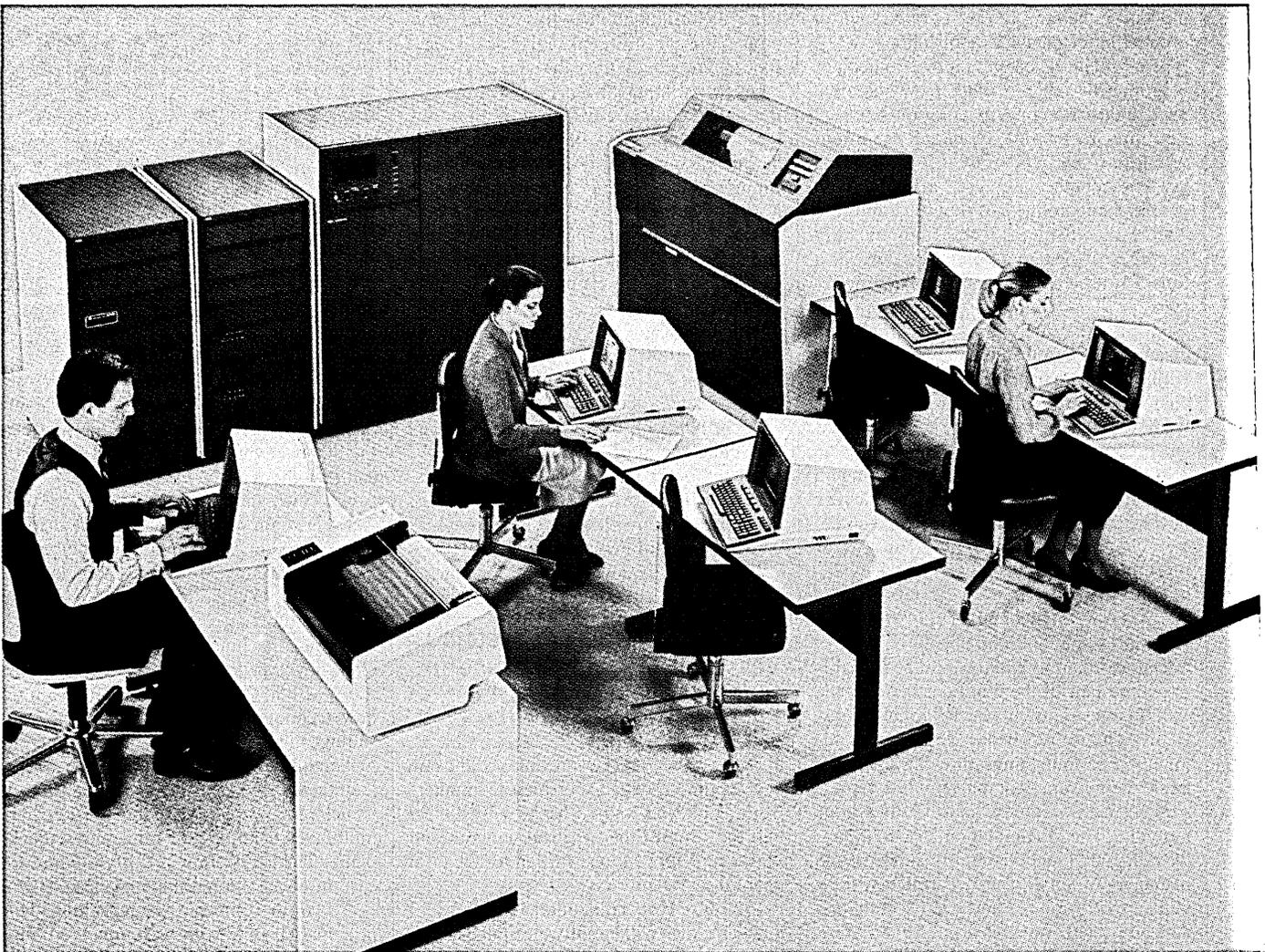
Lisp, the list processing language developed in the early '60s at MIT for artificial intelligence work, is moving out of AI labs and into the real world.

Two small companies incorporated last year, both with a foot firmly planted on each coast, hope to capitalize on that movement. They are LMI of Los Angeles and Boston, and Symbolics Inc. of Woodland Hills, Calif., and Cambridge, Mass. Both are selling machines based on the CADR machine developed to run Lisp at MIT in 1977.

Both firms concede there is little new technology in the machines they are selling, though Symbolics says it has reengineered the basic MIT hardware for greater maintainability, density, and reliability by repackaging wire-wrap hardware onto six multilayer cards which plug into a backplane. The cards allow board swapping for ease of checkout and maintenance.

Both companies have among their principals people who were involved with the Lisp program at MIT. At LMI, it's Richard Greenblatt, who joined MIT's AI laboratory

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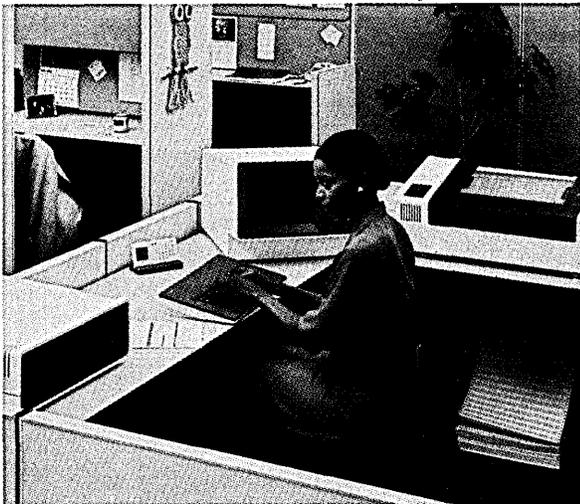
The subtle new styling is more than skin deep, it's ergonomic. With features like detachable keyboards and non-glare glass, every workstation can accommodate any operator in comfort. With less fatigue and eye-strain. New lines and colors blend into any office or computer-room setting. Eventually, the new styling and ergonomics will pervade the entire NCR product line.

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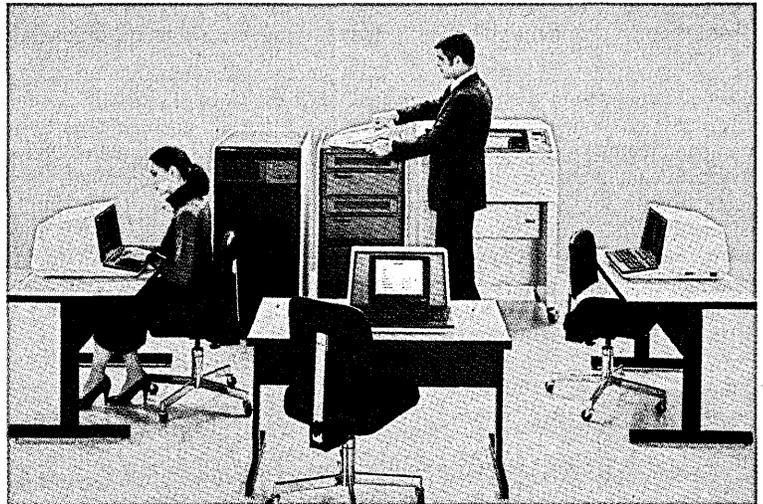
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I-9010



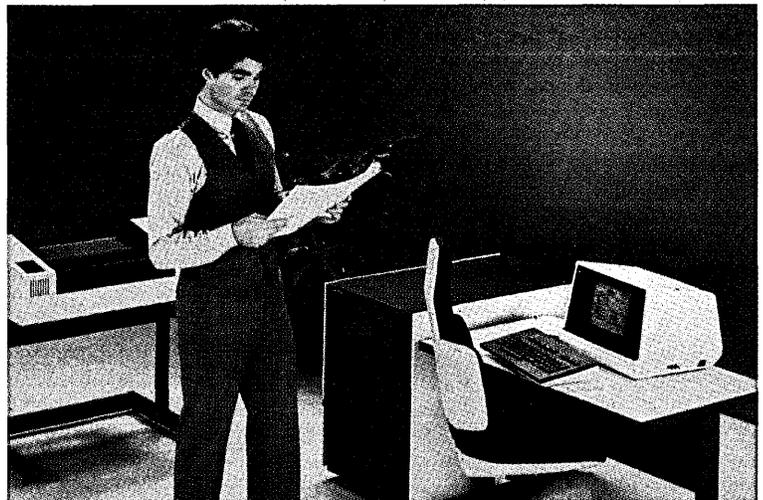
I-9040

The new I-9050 32-bit mainframe uses NCR's powerful Interactive Resource Executive operating software and provides up to three megabytes of memory. It increases NCR's interactive power spectrum 2.6 times.

The I-9040 is a powerful and versatile 16-bit minicomputer with up to 2 megabytes of memory. It features a smaller footprint and virtual memory technology based on the successful I-8400 architecture.

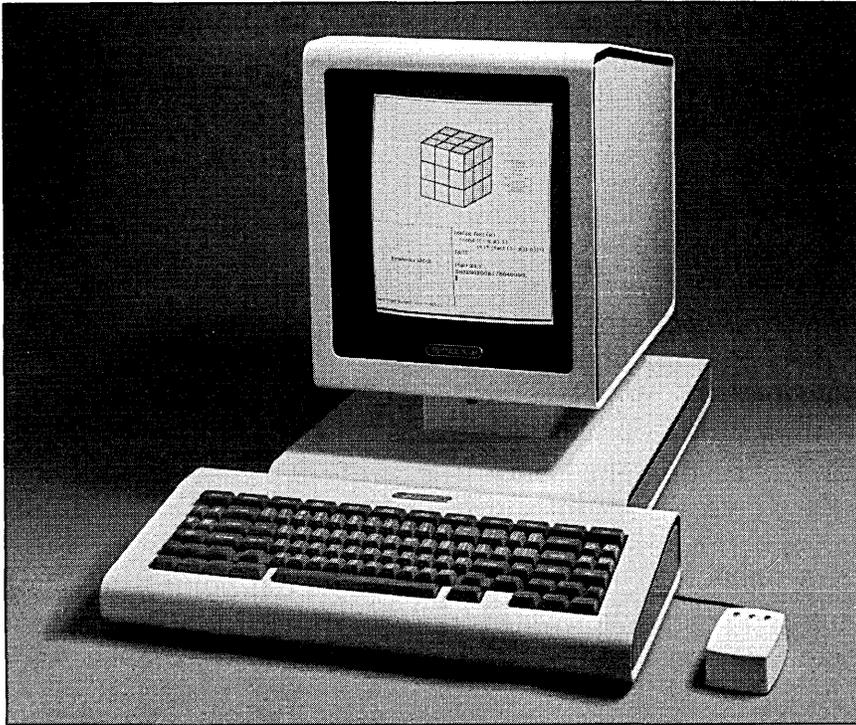
The I-9020 is a 16-bit general-purpose single-board minicomputer with main memory of half a megabyte. It features higher reliability, lower noise level and lower power consumption than its predecessor, the I-8200.

The I-9010 table-top 8-bit micro-oriented system offers advanced ergonomic design, multi-language support and communications capability. It is easy to operate and understand.



I-9020

CIRCLE 90 ON READER CARD



A PERSONAL COMPUTER for AI, the Symbolics LM-2 bears a striking resemblance to other machines of advanced design (note graphics, windowing, and mouse).

in 1966. He codedigned and implemented the Midas symbolic assembler, was the principal creator of the ITS Timesharing System, coauthored the original PDP-10 MacLisp compiler, supervised the design and construction of the CHEOPS chess processor, and authored MacHak VI, the first

Lisp started at MIT, and alumni spread the word.

computer chess program to exhibit a standard of play respected by tournament chess players.

"The inherent characteristic of Lisp programs," said Greenblatt, "is size and complexity. At present most Lisp programs are developed on DEC PDP-10 mainframes. We have created a machine in the format of a personal computer that provides up to 64 times the virtual address space and is optimized to run Lisp programs."

LMI calls its offering simply the Lisp Machine. Base price is \$80,000.

Symbolics' machine, called LM-2, sells for \$99,000 but the company is readying a "cheaper, better, faster" version it expects to have in beta test sites by the end of the year. This will sell for \$60,000.

Symbolics' principals are company president Robert Adams and vice president of engineering Russell Noftsker. Noftsker was a founder and the early manager of the MIT AI lab.

A recent addition to the Symbolics board of directors was Sanford Kaplan, consultant to and a director of Intel Corp. and retired senior vice president and director of

Xerox Corp. Kaplan and Adams worked together at Scientific Data Systems before that firm was acquired by Xerox.

While Greenblatt, Adams, and Noftsker got involved with Lisp on a straight line basis, F. Stephen Wyle, president of LMI, arrived by a more circuitous route. Wyle was looking for a business when he was introduced early last year to Systems Cognition, a Los Angeles-based company writing artificial intelligence software.

"They were operating on a PDP-10," Wyle said. "They ran out of memory and the cycle time was too slow." Systems Cognition president Alexander Jacobson learned of machine development at MIT and tried to get an MIT Lisp machine. But MIT would only license the machine, and on a nonexclusive basis. So Wyle and Greenblatt got a license and they were in business. Symbolics holds the only other license.

Both companies see a big future for their machines, primarily because they do symbolic or object-oriented programming. Symbolic computation is the processing of symbols and relationships rather than digits, characters, bits, and bytes. A symbol represents a real world object. Symbols and properties of symbols can be freely created and manipulated while the symbol processor worries about details.

"We have the capability to work with programs as data," said Henry G. Baker, Jr., director of marketing for Symbolics. "Mathmatics has been pushed to the limit." Baker thinks of the LM-2 as "the computer scientist's personal computer."

Both companies see their machines and the Lisp language as a tool for increasing programmer productivity. "It can make the guy doing the software five or 10 times as productive up front," said Baker. "You can have a programming team where the only live member is the lead programmer and the rest of the team is in the machine."

The two firms also see their machines as being useful in design work. "You can develop CAD [computer aided design] programs that can be used by non-experts in semiconductor chips," said Baker. "You build in the knowledge they need."

Wyle sees the machines as ideal in developing natural languages, particularly in CAI (computer aided instruction) applications.

Symbolics has had only two orders so far, one for two machines for Fairchild Camera and Instrument Corp. (one of which was shipped last month) and the other for an undisclosed quantity from an unnamed customer.

Fairchild, the semiconductor subsidiary of Schlumberger, is developing a fully equipped lab for broad-based research and development in artificial intelligence. Peter Hart, head of the Fairchild AI laboratory, said his company bought the machines "because of a commitment to provide a first-rate computing environment for our research in artificial intelligence."

LMI has sold 11 machines and delivered five. Its first two customers were Control Data Corp. and Texas Instruments, for two machines each. The Control Data machines were consigned to Systems Cognition, which is working on a project for CDC in teaching English as a second language.

Both LMI and Symbolics see their machines and the Lisp language as a tool for increasing programmer productivity.

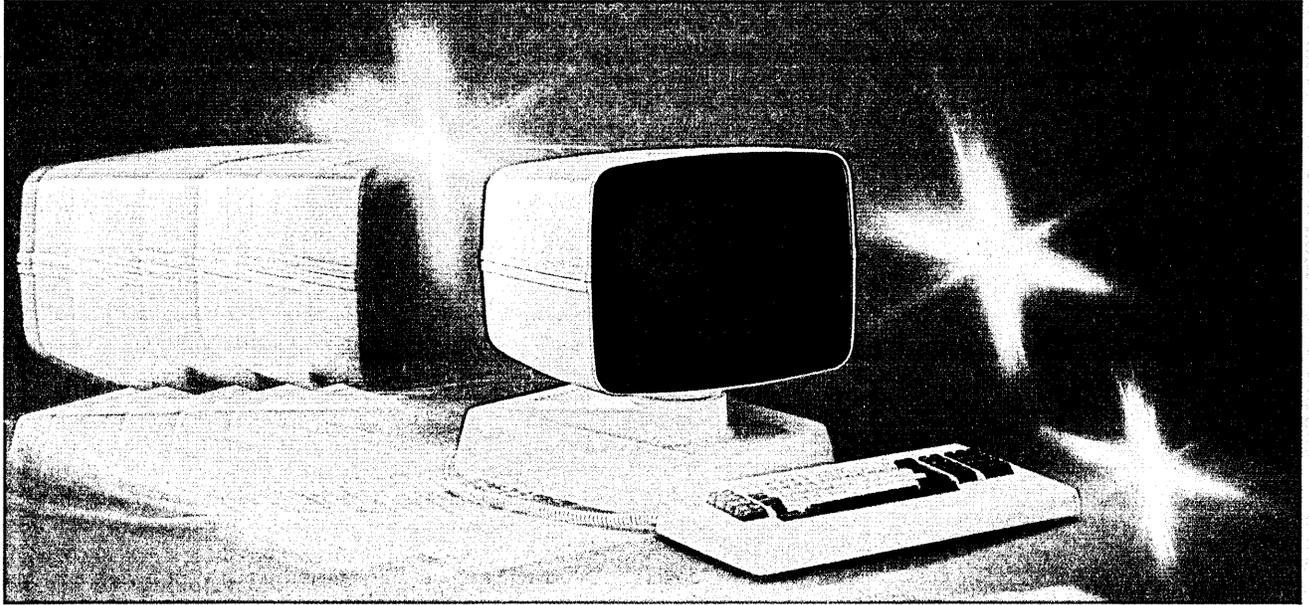
The fifth delivered machine went to Logo Computer Systems, Inc. of Montreal, which has a second machine on order. Logo, another MIT offshoot, offers educational tools for young children. The Logo language, developed at MIT, was a Lisp spin-off. Logo is using its Lisp machine in development of natural languages for education to be run on machines such as the Apple.

LMI is primarily held by Wyle and Greenblatt, with Systems Cognition holding a minority interest. Control Data has an option to buy a minority interest, Wyle said.

Symbolics started up with \$2.5 million in funding, \$2 million from three venture capitalists: American Research and Development, Boston; Memorial Drive Trust, Cambridge; and Patricoff Associates, New York. The rest came from the principals.

—Edith Myers

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CIRCLE 91 ON READER CARD

NEWS IN PERSPECTIVE

BENCHMARKS

DATA ENTRY EXIT: Univac agreed in principle to acquire Pertec's installed base of U.S. and Canadian data entry systems, effectively taking Pertec out of the end-user data entry market in those countries. The West Coast firm, now a subsidiary of West German Triumph-Adler, will continue to market systems overseas and supply Univac and others on an oem basis. The deal would cover some 1,300 systems at about 800 user sites. Ryal Poppa, Pertec chairman, said the reason for the sell off was current high interest rates. Univac said it plans to build on the data entry base, selling other distributed processing products.

OUSTED: Basic Four Information Systems president Ted J. Smith was removed from office after "disappointing" divisional performance over the past two years. The parent company, Management Assistance, Inc., replaced Smith with Stephen J. Keane, president of MAI's Sorbus service division. Keane has been credited with making Sorbus a strong company over the past few years. He was replaced at Sorbus by former senior vice president Ronald Wallace. Basic Four is MAI's biggest operation, providing the firm with 60% of its revenues. It had seen spectacular growth during Smith's tenure until 1979, when operating profits plunged.

EXODUS: More top officials at Centronics, the New Hampshire printer manufacturer, have left the company. Vice president of sales Jack Garrity, Quietwriter products vice president William Chalmers, and vice president of advanced development Charles Bickoff have moved on in the wake of top man Michael Kaufman's leaving several months ago. Garrity had no immediate plans, but Chalmers and Bickoff moved to Ohio Scientific, the microcomputer maker recently acquired by M/A-Com. Chalmers was named president of Ohio Scientific, while Bickoff's title could not be learned. The Quietwriter, a stroke-writing printing technique developed by Olivetti and purchased by Centronics in 1979, has been late getting to market in product form. Centronics, which has been showing a financial loss for several quarters, said it expects to get Quietwriter products to market late this year or early next.

LURE OF EMERALD ISLE: The Republic of Ireland is doing more than a bit to lure U.S. industry to the Emerald Isle. Ned Kelly, West Coast director for Ireland's Industrial Development Authority (IDA), said in midsummer that 10 West Coast U.S. corporations were planning to invest \$65 million in new or expanded manufacturing operations in the republic. Three of these are computer-related: Precision Monolithics Inc. (PMI), a unit of Bourns Inc. of Riverside, Calif., which will construct a manu-

facturing plant in Cork to produce integrated circuits; General Semiconductor Industries Inc. of Tempe, Ariz., which will invest \$7 million in a new manufacturing facility at Macroom, County Cork, to produce a range of semiconductor devices and silicon transient voltage suppressors; and Cado Systems Corp., Torrance, Calif., which will build a new plant in County Cork to produce microprocessor-based small business computer systems. And the Republic of Ireland, poor in natural resources, hopes to attract more U.S. software development efforts, Kelly said, with legislation which would treat software development as a manufacturing effort with all the tax breaks accruing thereto.

MAD DOGS AND ENGLISHMEN:

Geoffrey Salkeld, who headed Computer Automation's European marketing efforts for 10 years, managed in one year to beat out IBM in sales to seven of the 10 largest British corporations. The Irvine, Calif., firm hopes Salkeld can do the same in the U.S. He's new head of the company's Commercial Systems Division, which produces the SYFA family of distributed computer network systems. Salkeld doesn't like the term distributed processing. He likes to sell syfa's ability to do things that haven't been done before. "About 80% to 90% of what syfa systems are doing out there is new." He also feels that IBM's offering in the market (the 8100 series which he beat out many times in England) came from "mainframe thinking places." And he feels that in Europe "salespeople talk to the head office more often" and he's trying to see that that happens in CA here. His primary target initially: "any company with big inventories, where inventories mean money." CA is banking on the hope that what he did in Europe he can do here. The Commercial Systems Division has never been its most profitable.



GEOFFREY SALKELD: He beat out IBM in sales to seven of the 10 largest British corporations.

BROUGHT FORTH: A new firm, Technology Industries, Inc., of Santa Clara, Calif., has agreed to buy software developer Forth, Inc., of Hermosa Beach, Calif., for an undisclosed amount of stock. Technology Industries, formed by former Logical Machines Corp. president John Peers, intends to come out with a personal computer next year. Forth, a privately held firm, develops and markets the Forth programming language. Forth founder Charles Moore will continue as research director, it was said. Peers said he would soon reveal venture capital financing.

OLÉ: The Mexican government recently began requiring import permits for vendors of computers weighing more than 40 kilograms (88 pounds). This is on top of normal duties and taxes, according to George Baker, a San Francisco consultant. He calls it a step backwards from the recent trend toward trade liberalization. According to Baker, the computer import market south of the border is growing at an annual 20% to 30% rate. He cites Commerce Dept. estimates that say the market will reach \$185 million by 1982, and the U.S. can expect to garner 73% of that total. The largest segment is for medium and large-scale computer systems, followed by minis, then peripherals, and finally data communications equipment.

CHAPTER XI: After only two and a half years in business, Ruben Corp., a small business computer maker founded by Murray Ruben, has run into severe financial problems. The firm, which just recently brought out its first product, filed for protection under Chapter XI of the federal bankruptcy laws. Ruben, who was a director and vice president of technology at POS terminal maker Data Terminal Systems, had hoped to sell The Assistant computer for between \$40,000 and \$120,000. He said he was still interested in keeping the company alive and planned to lend it money from his own pocket.

FINALLY: After several months of unsubstantiated reports, IBM has done what so many expected it to do: thrown its support behind the X.21 and X.25 communications interface standards with products designed to connect SNA networks into public packet switching networks. The firm had previously offered X.25/X.21 products in Canada and France.

The new X.25 products for the U.S. are a software package for the 3705 front-end communications controller and a network interface adapter, which was described as converting X.25 to SNA protocols and vice versa. Initial versions of both products are to be available in the third quarter of this year. X.21 compatibility will be made available for certain models of the 3705, SNA models of the 3274/6 terminal, and the 8100 distributed processor. *

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The system architecture of the CompuStar is based on four types of video display terminals, each of which can be connected into an auxiliary hard disk storage system. Up to 255 terminals can be connected into a single network! Each terminal (called a Video Processing Unit) contains its own microprocessor and 64K of dynamic RAM. The result? Lightning fast program execution! Even when all users are on-line performing different tasks! A special "multiplexor" in the CompuStar Disk Storage System ties all external users together to "share" the system's disk resources. So, no single user ever need wait on another. An exciting concept... with some awesome application possibilities!

CompuStar™ user stations can be configured in almost as many ways as you can imagine. The wide variety of terminals offered gives you the flexibility and versatility you've always wanted (but never had) in a multi-user system. The CompuStar Model 10 is a programmable, intelligent terminal with 64K of RAM. It's a real workhorse if your requirement is a data entry

or inquiry/response application. And if your terminal needs are more sophisticated, select either the CompuStar Model 20, 30 or 40. Each can be used as either a stand-alone workstation or tied into a multi-user network. The Model 20 incorporates all of the features of the Model 10 with the addition of two, double-density mini-floppies built right in. And it boasts over 350,000 bytes of local, off-line user storage. The Model 30 also features a dual drive system but offers over 700,000 bytes of disk storage. And, the Model 40 boasts nearly 1½ million bytes of dual disk storage. But no matter which model you select, you'll enjoy unparalleled versatility in configuring your multi-user network.

Add as many terminals as you like - at prices starting at less than \$2500. Now that's truly incredible!

No matter what your application, the CompuStar can handle it! Three disk storage options are available. A tabletop 10 megabyte 8" winchester-type drive complete with power supply and our special controller and multiplexor costs just \$4995. Or, if your disk storage needs are more demanding, select either a 32 or 96 megabyte Control Data CMD drive with a 16 megabyte removable, top loading cartridge. Plus, there's no fuss in getting a CompuStar system up and running. Just plug in a Video Processing Unit and you're ready to go... with up to 254 more terminals in the network by simply connecting them together in a "daisy-chain" fashion. CompuStar's special parallel interface allows for system cable lengths of up to one mile... with data transfer rates of 1.6 million BPS!

Software costs are low, too.

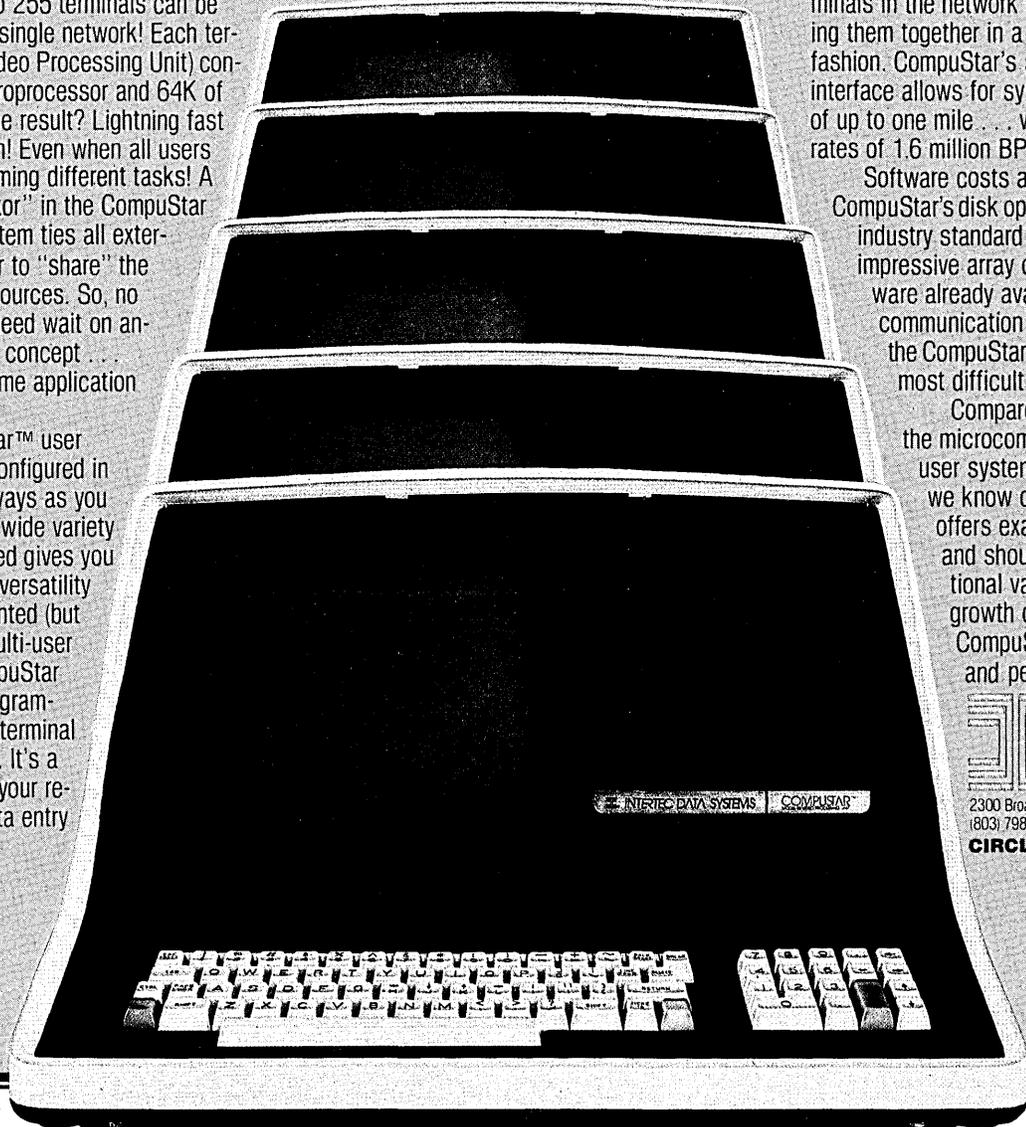
CompuStar's disk operating system is the industry standard CP/M*. With an impressive array of application software already available and several communication packages offered, the CompuStar can tackle even your most difficult programming tasks.

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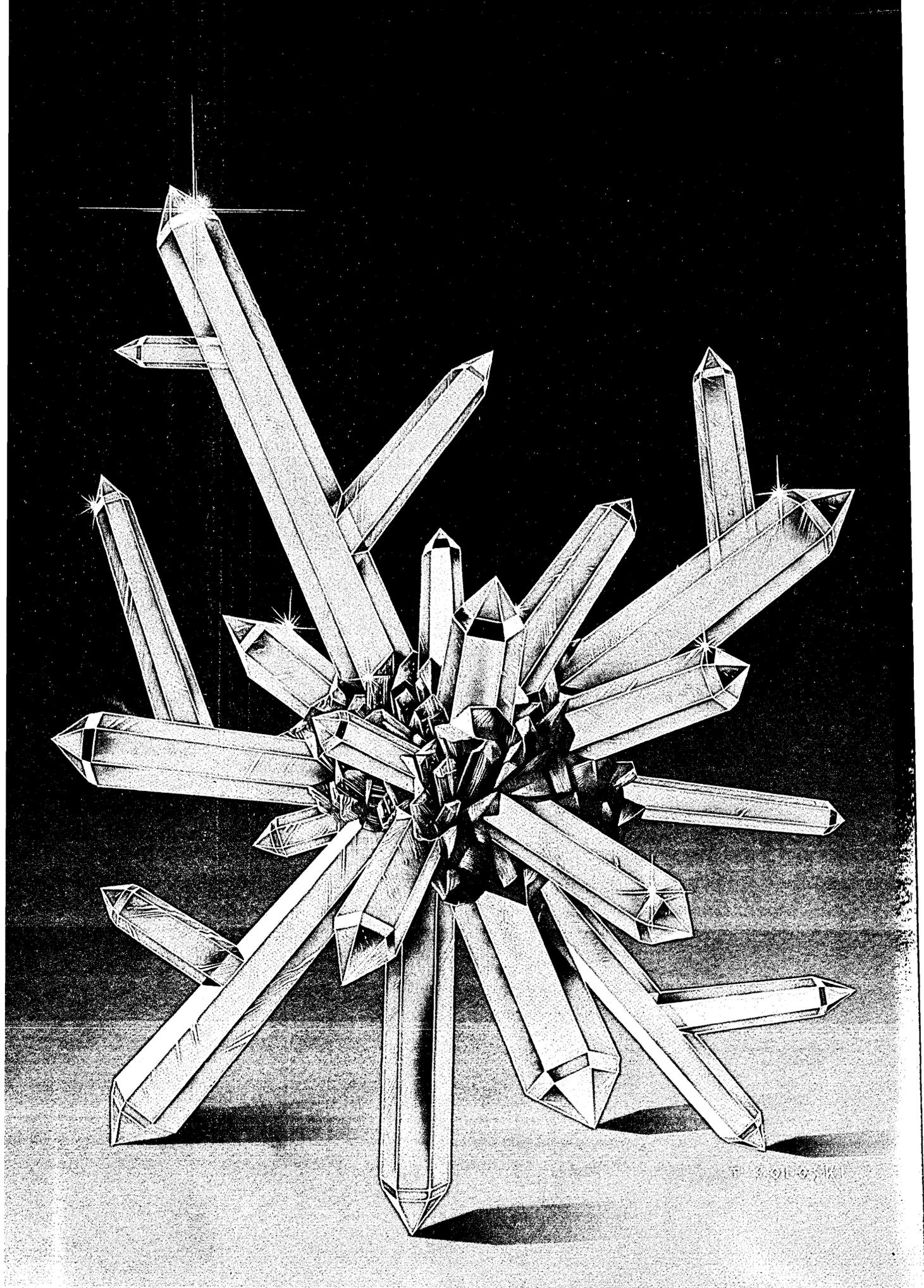
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П. С. ОЛ-ОС-К

The problems associated with VLDB systems are enormous, but a high level of professional skill is being devoted to solving them.

MANAGING THE VERY LARGE DATABASE

by Warren J. Polk and Kerry Byrd

More and more often, managers are faced with difficult decisions concerning the potential design and development of very large database (VLDB) systems. Beyond the cost and general complexity of such systems, their continuing operational importance to the user increases the need for system architects to base decisions upon the best knowledge available. The system architect therefore has the burden of working at a time when we are experiencing tremendous technological and conceptual changes in our database systems design and development resources.

Very large database systems being planned today must offer sufficient design flexibility to ensure future expansion and to accommodate coming technological advances. These design considerations should foster coming changes in an evolutionary manner, thus reducing the costly and often system-crippling choices implied in major, unconsidered, revolutionary change. There are a number of important technological, theoretical, and operational resources now emerging as cornerstones of our database alternative designs.

When one speaks of very large databases, at least three major topics emerge: Distributed Database Management Systems (DDBMS) (addressing the broadest range of real users); relational DBMSs (possessing great potential flexibility and power); and database computers (having high efficiency and large volumes of data).

Today, very large databases and their management cannot be explained by the three topical areas mentioned above. Each area holds promise, both independently and collectively, but each area has many unanswered questions. We have reached a point, however, where our research and our operational development are beginning to run in close association. We know, for instance, that distributed database management systems are more than just feasible; they are a necessary ingredient of VLDB systems in our immediate future. We know that the database computer, under various architectural constructs, is a

substantial resource in dealing with the problems of speed and data management within VLDB storage and retrieval systems. We also know that relational theory holds great promise in a number of areas associated with total systems architecture, ranging from the ease of user interface to cross-compatibility among different relational DBMS systems.

These resource areas address very important and very complex issues that we face in mastering VLDB systems, yet there is one other area we have not mentioned, and, unfortunately, we, as an industry, have not properly addressed: performance measurement. Few, if any, VLDB systems will come out of a can. They must be designed and integrated and, as far as possible, based upon rational measures of performance value gained for resource applied. Thus, it appears both reasonable and prudent that we add performance measurement as a technological concern and as an operational resource to our VLDB management future.

Of all the resources becoming available to the systems architect, perhaps the most powerful and broad ranging in terms of its application to very large databases is the emerging power of distributed processing and distributed database management. The concepts associated with distributed data processing systems have been with us for a number of years. Distributed processing networks are operationally successful in a number of areas, and a few systems are available that, to varying degrees, address the distribution and management of shared databases. The theoretical potential of universal database distribution and management and the attendant distributed processing theories have only recently become practical resources for tomorrow's designs.

Within the context of the real world, the processing capabilities and characteristics of a Distributed Processing, Distributed Database Management System (DP-DDBMS) offer the most accurate reflection of that world. As a user's functional and performance needs expand, contract, or change focus, so can a DP-DDBMS. Distribution (processing and database management), with its characteristic modular structure, allows for the changing of

major systems components (hardware and software) as support elements of an overall systems design. A distributed design drives the system, rather than a system (hardware and software) driving the design to accommodate component change requirements. A distributed design can live with different hardware, software, and even different database models (hierarchical, network, relational).

No unified theory for a system architecture has emerged as *the* distributed systems concept, although many are offered. There is, however, what might be considered the most comprehensive architecture—a distributed system where the database, or databases, may be distributed to, or among, all users and accessed by all users as needed. Research, as well as design and development, is now under way to place such systems in operation.

What, then, needs to be done to realize more complete distributional theory systems?

- Research concerning uniform or universal access languages
- Further design, development, and testing of global integrational architecture to deal with transparency among databases, concurrency management, failure transparency, and intercommunications loading

FOCUS ON HIGHER LANGUAGE

Research is becoming more focused on unified or universal database and system access languages. This concept of a higher order language holds that it is not necessary to develop a unique standalone language but rather a set of database facilities, or extensions, which can interact with at least three major database models: hierarchical, network, and relational.

The task of developing such a language, or languages, is rather complex, but the alternative—the development of some form of standardized DBMS—does not realistically fit a real-world environment of a great number and variety of existing DBMS systems and the functional differences between database requirements and the real world of diverse users. The case for a unified language, as opposed to a standardized DBMS concept, is further strengthened by increasing pressures

Performance measurement must be considered an operational resource in the VLDB management future.

to make database systems more transparent to the needs of different, individual users. (Standardizing DBMS systems to achieve distributional capability can tend to impose severe constraints upon user data structures and access capabilities.)

One of the central design features of a distributed database system is the technique employed in providing access to and from a database made resident in distributed—or separate—elements of a computer system. The problem, at its most basic level, is one of redundancy and the amount and character of redundancy that is distributed throughout the separate components of the system.

There are essentially two methods for providing computer coverage for all users to all data in a distributed system. The first and most obvious is a totally redundant system—all users having all data. This, amazingly enough, is occasionally very appropriate. (The integrity of such a system is complete in that the loss of one component of the system affects only that part and only in a transitory manner.) The second is partitioning the database among specified users and providing access to the totality of the data among all users. This becomes an exercise in cross-indexing for location, status, and function. Given differences in user functions with respect to the database, the crafting of intercommunication methods and comprehensive data management systems can lead to a highly responsive and cost-effective systems design.

In our own research¹ that dates from 1972, there has evolved the view that the application of distributed approaches is open-ended and very appropriate to handling large databases and different database structures and processing requirements within the same system. From the open-ended perspective, one can add, remove, and redistribute resources as required; evolve to new technologies through their gradual introduction; combine different data structuring and processing techniques (i.e., relational, network, etc.); and even deal with different computers. There is also no reason why one cannot construct a database computer using distributive processing techniques.

Are we talking about anything different from what we would normally do anyway? If we saturate or overload a system, we would get a bigger system (if one were available and we could afford it), or we would distribute the load between one or more systems. No matter how big a system you buy, you will end up saturating it, especially in the area of database systems. These systems are never "finished." They are constantly evolving and getting bigger. Not to consider distributive techniques in design of new systems or a way to evolve from current systems, or a way to introduce new technologies, is like saying you are going to ignore paying taxes.

Despite these issues, however, we are

not quite ready to spend our last dollar on developing a distributive database management system. The applications of distributive techniques are easy to discuss and to conceptualize, but most of what we need in order to construct distributed database systems is not available. Much progress is being made, such as uniform access to data, concurrency of data, and so forth, but these will probably not be available for three to five years.

Of relevance is our own research² in this area which focuses on connecting geographically distributed databases and computers. We divided the research effort into two segments.

First, we concentrated on the problems related to data location and description, concurrency of data, uniform data access, and basic network access protocols. We focused on these problems by keeping the DBMS and computer at each node the same.

Our approach dictated a DDBMS at each node of the network. This DDBMS was responsible for accepting a query in the database language of the node, locating the whereabouts of the appropriate data, parsing and preparing the query for processing at the required node, transmitting the query, and collecting and merging the answer. This research segment resulted in the development of a prototype of a distributed database management model. This model operates on a single computer in our laboratory; no operational version has been developed.

Second, we addressed the problem of having different DBMSs and computers at each node. This segment was mostly conceptual and we concluded that (1) the differences among computers was not a serious problem and serious research was not warranted and (2) a viable solution to the problem of different DBMSs had as a genesis the addition of a DDBMS either replacing or front-ending current DBMSs at each node.

We did not address the problem of performance. We focused on acquiring a better understanding of the problems involved in putting together these kinds of systems and, equally important, in testing them. New ideas, theories, and implementation approaches cannot be tested in an operational environment; it's too disruptive, too costly, and far too uncontrolled.

Research by Raymond A. Liuzzi³ and others clearly addresses the need to establish planned techniques and facilities to provide manageable test and operations facilities for database systems research.

As mentioned earlier, a great deal of effort is being made to develop distributed database management systems. For instance, the French National Institute for Research on Information and Automation (INRIA)⁴ has a very large and intensive program involving government, industry, and university resources. This project, called SIRIUS, has fos-

tered basic research, developmental systems, and pilot projects on fully distributed database systems.

SIRIUS-DELTA, a current project phase of DDBMS, is under design and development. "SIRIUS-DELTA is a completely distributed system . . . there is no master copy of data . . . there is no specific site or local system which plays a particular role in the distributed system."⁴ SIRIUS-DELTA interfaces with existing and largely unmodified databases and DBMS systems. The distributional interface is accomplished by the inclusion of three distributed processing and intercommunication elements:

- SILOS—handles data distribution
- SCORE—manages concurrency and failures
- SER—provides distributed execution and interprocessing transport

Project SIRIUS-DELTA, in examining the more complex world of large-scale, heterogeneous DDBMS systems from both a research and applications role, can provide valuable insight into our alternatives for architectural planning in the 1980s.

C. J. Date,⁵ of the IBM Santa Teresa Laboratory, is pursuing the problems associated with the differences among DBMS design concepts (hierarchical, network, rational and user access). Dr. Date proposes the development of a "Unified Data Base Language" (UDL) which can support the interface among different DBMS and "ease the problems of program portability and migration from one system to another." Essentially, Date has postulated a set of high-level language database extensions. UDL is not a standalone language but a set of database facilities that can be incorporated into a variety of host languages.

It is easy to see that the work of Dr. Date and others in trying to create noninterfering transparencies between differently designed database systems is a very powerful and needed tool for advancing distributed database management technology. Combine these language concepts (UDL is generally an approach) and hardware/software executive management architectures as proposed by Le Behan et al., and one begins to realize more fully the potential of the cost-effectiveness and user compatibility found in an environment subject to advanced distributed database management and processing.

Various bits and pieces of a fully distributed database management system are, today, seeing the operational light of day. We do not currently have, however, any fully operational large-scale DDBMSs that can deal with heterogeneous DBMSs. We do have sufficient insight, experience, and near-term research results to allow advanced architectural planning for fully distributed database management systems.

Much of the theory of distributed systems has been with us for over a decade.

Research is becoming more focused on unified or universal database and system access languages.

During this time, the various elements of distributed theory have been under research and development. Technological advances have made available the hardware to handle very large database systems cost-effectively. These, combined with user needs, assure that increasing mergers between research and operational design will occur and that DDBMS will play a much larger role in the coming systems.

DATABASE PRACTICE, THEORY

More and more database systems are said to be "relational" databases. Yet, it is noteworthy that advanced research on relational database theory is also being undertaken throughout the world. What is going on?

Basically, people are beginning to apply a concept of database design and access that has been around since 1970. At that time, E.F. Codd⁶ proposed that the precise nature of relational mathematics could be applied to the structure of tables, or files, thus creating a unique mathematical identifier for each file. Each identifier was driven not by the constraints of the sequence, formulas, or logic of the data processing design, but by the very presence and potential of the data. If there is an axiom concerning database design, it is explained by relational database theory, which stipulates that if real relationships exist among stored data, then identification can occur, and that given such identification, retrieval can occur as a function of these identified relationships. In essence, function follows form.

The most common phrase associated

with a relational database is that it is "user oriented." To a systems designer-programmer, this can often mean, from a systems standpoint, very "cumbersome and inefficient," and "incredible cross indexing and interminable search times." To the user, it may mean, "No matter what I want, I can get it."

The user-oriented nature of a relational database is nothing more than a mirror of the user's view of how a query may be structured as an answer. The answer construct, containing discrete items of data, relates precisely to data stored in the database. Thus, the relationship between what is stored and how it is stored is not a precise analogy to the query structure, or the data structure, but to the answer structure. Essentially, the system searches and retrieves only under the constraints of what may be allowed by identified relationships in data, not by constraints to predefined search-and-retrieval protocols.

A query to a relational database first establishes an equation that represents the data type or character needed. This expression can also stipulate manipulations to such data that may be desired or necessary to the answer. Since each data item found in a relational database has the potential for unique identity, the query specifications can be expressed uniquely and precisely in algorithmic formulas for search and retrieval. Each algorithm is derived from a refining process of seeking to reduce a given search routine to its least complex and most precise reflection of the relationship between the identified existence of data and the answer desired.

The power of a relational database

system lies in its reversion to precise and unique mathematical identifiers for stored data—and its precision and flexibility in revealing said data in highly variable and uniquely specified forms. Unfortunately, few, if any, relational database system implementations can function at the full potential of relational theory. The sophistication of the high-order interface language protocols and the dynamic, almost self-evolving, search algorithms may require some new element of hardware and software to realize the full relational model potential.

Relational database designs are, however, evolving in a number of areas and at various levels of sophistication. The upper end of the model scale might well be in work being done on System "R"⁷ at IBM, San Jose.

If System R is not the first implementation of the relational approach, it is perhaps the most intensive and comprehensive relational work to be undertaken. System R addresses the full architectural spectrum of design:

- HOST language interface
- Query facilities
- Data manipulation and definition facilities
- Data control facilities
- Query optimization
- Modification control (Cursor)
- Simulation and interface of nonrelational DBMS
- Relational storage system management

System R appears to be fully functional in a test and evaluation environment, but it has not been placed in an operational mode.

An offshoot of System R is a new system from IBM known as the SQL/Data System⁸ (SQL, pronounced "sequel"). The system, available only for DOS/VSE systems (regrettably), is a unified data definition and data manipulation language which previously served as a developmental component for System R. Dr. E.F. Codd⁶ of IBM indicates "... that perhaps the most outstanding feature of SQL/DS is support for automatic navigation to the target data. Thus, the user accesses data ... by specifying what he or she wants, not how to get it."

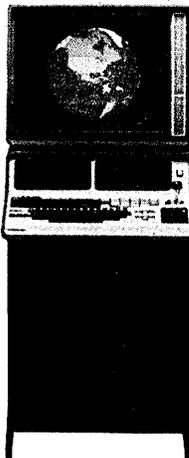
There are many other systems emerging as relationally "oriented" database management systems which, while holding great promise, are not at a stage of development and operational experience to allow anything but a case-by-case review to determine their future merit. For example, we cited IBM's sophisticated System R as an upper end of a scale of emerging relational systems. At perhaps another end of the scale is a recently introduced relational DBMS for microcomputers: dBASE II. This is an assembly language relational database management system for the CP/M-QS. The system appears to provide a very high order of user flexibility and, as a result, should find a great variety of applications.⁹



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THE BREAKTHROUGH

System R may be the most intensive and comprehensive relational work to be undertaken.

SPECIAL PURPOSE DEVICES

Database computers are special-purpose devices designed to perform common data management operations efficiently. Generally, the database computer (DBC) is a computer designed to implement many of the traditional software database management functions in hardware, thus theoretically increasing system performance and capability. Database computers are a fact of today's very large database architecture and technology. Their importance to us appears to be very closely tied to the management requirements associated with VLDB systems, where speed, efficiency, and strengths of the database computer, are paramount. Conventional computer systems tend to be ill-suited to the VLDB environment. The database computer attempts to overcome the deficiencies that may be associated with conventional architecture by placing special-purpose functional architecture (SPFAS) as close as possible to the data source and by designing the architecture to handle different functions of data management simultaneously. Today at least, these DBC architectures emerge predominately as custom machines designed to function within a specific DBMS environment. As our knowledge of DBC technology grows, so will our efforts to develop what might be termed universal DBCs.

Dr. David J. Dewitt¹⁰ of the University of Wisconsin indicated in a recent IEEE conference panel that a "universal database machine can indeed be designed and constructed." Dewitt believes that a universal database machine "will be a marriage" of two approaches—"processor per track" and "associative" processing.

Roger L. Haskin¹¹ of the University of Illinois holds that "different applications (i.e., formatted vs. textual databases) seem to require specialized machines" and that standardization on a universal design without more experience "is premature."

Haskins and Dewitt were both responding to a panel question that asked if there would be a database machine for all applications or if there must be different machines for different applications. From their presentation, it appears that both men believe a universal database machine could be put together sooner or later. It is also significant that they view relational theory as an underlying element of any such systems. This suggests perhaps that universal database machines to evolve might be universally bound to relational theory.

We foresee the possible development of a universal DBC that is an integrated DBC capable of matching the specific database system(s)—hierarchical, network, and/or relational—to specific applications. It is entirely possible that such a computer could be constructed using the distributed concepts pre-

viously presented. We share the concern of Haskin that standardization may be detrimental to our effective utilization of a potentially powerful resource.

There are, however, a number of specialized database computers in operation today. Among the more noteworthy are database machines performing text retrieval functions concerning court decisions and, in the federal government, message and memoranda files. In the case of the court decision database, the database exceeds 30 billion characters and grows at a rate of approximately 100 million characters per month.¹⁰ Because conventional general-purpose digital computers are not able to deal effectively with such large quantities of data in a time-to-search mode, special-purpose functional architectures were developed in lieu of software to function as back-end support to a host system. The database computer (SPFA) essentially presearches and validates query data requests and releases data to the host only when hits have occurred. Efficiencies are gained through a variety of methods, including separate SPFAS for directory processing, the reduction of intermediate result storage and re-fetching via the interconnection of merge processors in the form of a tree (usually a binary tree), and the implementation of Finite State Automation (FSA) devices to serve the specific type and character of stored data¹³ (i.e., single words, fixed and variable-length terms, and continuous word phrases).

A different approach to a more generalized DBMS system using a DBC might be the IDM 500¹³ "DBMS in a box." The IDM 500 is an "intelligent database machine" which operates as a "special purpose relational database processor." Britten Lee, Inc., of Los Gatos, Calif., the offerers of the system, summarize their system as follows:

"The relational data model was chosen because it is easy to understand, supports a high level language interface, and can reduce application software costs.

"The relational model easily supports a nonprocedural interface. The user only specifies what is wanted ("Print the July sales total")—not how to get it. The query language is based on University of California at Berkeley's QUEL and on the IBM Research's (San Jose) SQL-2.

"IDM speed is limited by the speed of the secondary memory. One reason for the long delay between the first ideas for database machines and the first commercial system is that processor technology would not support the high speeds necessary to process the data as it comes from the disk. IDM is able to process a disk block as it is read. By the time the one block is under the read head, the previous block is processed.

"The IDM maintains a fast memory cache so the time to execute a command can

be made much faster than disk access times if the data is in the cache. . . .

"The overhead of communicating with the IDM is closely related to the length of the command. IDM allows transaction commands to be stored in memory. The user program can run a stored transaction by simply naming it and supplying the appropriate parameters. This facility provides a low-overhead mechanism for running frequently used, standardized transactions.

"The IDM also contains many user facilities, such as nonprocedural language (Intelligent Database Language); a complete indexing system; constraints to limit access to relations, portions of relations, specific records; a view mechanism to allow alternate definitions of relations or collections of relations; random access files creation; and an integrated data dictionary."

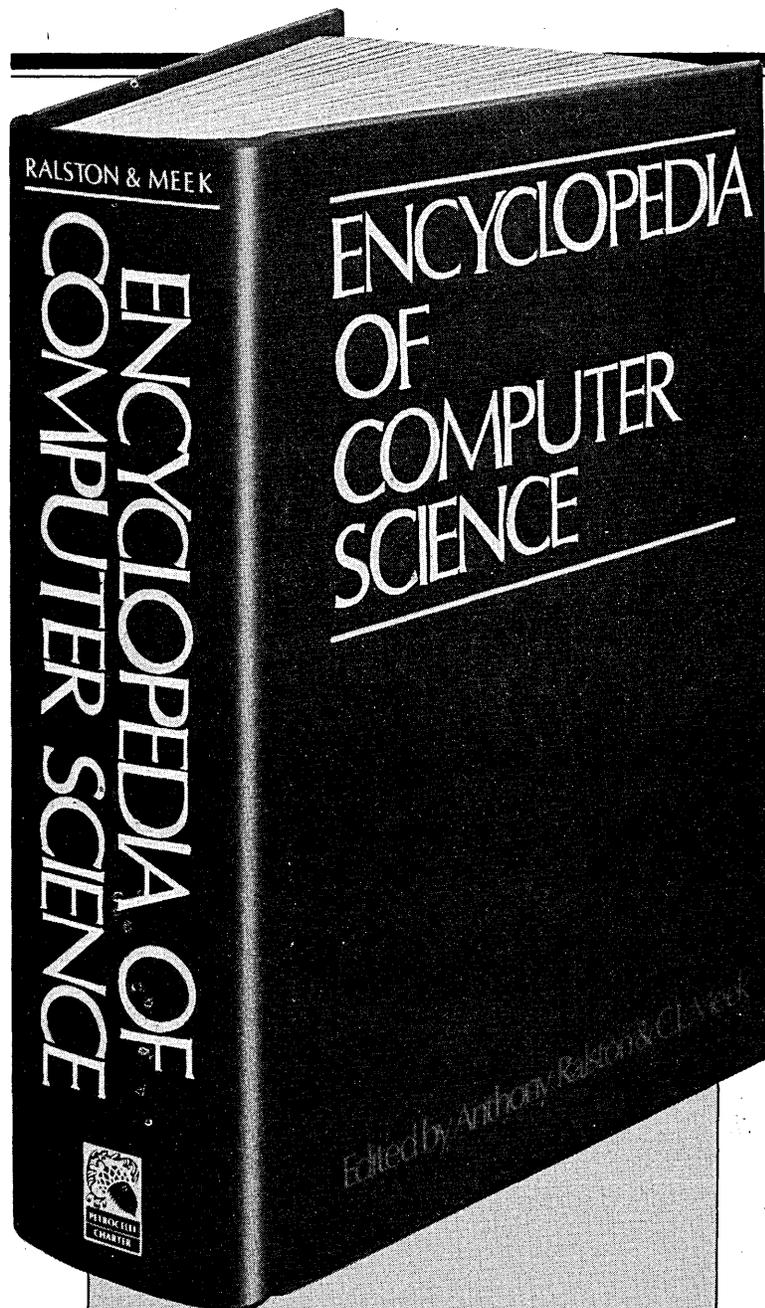
DataBase computers are an emerging component of our database management technology resources. A great deal of experience needs to be gained before "universal" DBC applications can become a normal component of our VLDB architectures.

DATABASE PERFORMANCE

Performance is an important issue in the design and operation of a database system. Every aspect of the design and operation must be analyzed to determine its performance contribution, or lack thereof, to the total system. This is a very complex problem, and there are enough differences in database systems to make it difficult to establish a general approach. Performance complexity can be seen from some of the aspects that must be considered, such as access strategies, database structure, selection and design, index selection, reference patterns and buffer management, buffer space size, real memory size, database allocation into storage devices, operating systems and hardware. The performance influence of each aspect must be understood if reasonable decisions concerning design or improvement alternatives are to be made.

If a concern for performance is a concern for the interrelationships of systems components, then the issues that impinge upon VLDB design vastly compound the level and intensity of component interaction and the performance resulting from such interaction. That is, a fully distributed database system is alive with critically interacting systems and subsystems. A database computer is predicated upon achieving performance gains via purposeful and controlled interaction within a system. Performance, the very measure of our design, eludes us once we move to build, change, and operate our systems. We cannot afford to neglect this issue when we speak of our future systems. Performance measurement must remain with us as we de-

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The performance influence of many aspects must be understood if reasonable decisions concerning design or improvement alternatives are to be made.

sign, build, operate, and change our VLDB system.

Performance issues must be broadened to include multicomputer and multiprocessor configurations. Very large database designs will include such configurations (i.e., database computers, back-end computers, and special function computers), and the real time performance issues are present in these configurations just as they are in a single computer system, but in a more complex form. We must deal with issues such as interprocessor interference and interprocessing deadlock. It appears that if you increase your computer resources and distribute the processing work load, the performance will be improved. There are two things wrong with this assumption. First, there are so many ways to introduce complexities that you could end up worse off than when you started (i.e., increased instability, processes getting in the way of each other, etc.) and then spend more money to correct it. Second, unless you have established a baseline performance, you can't be sure you have improved the performance at all, not to mention receiving the paid-for improvements.

Most performance modeling deals with specific improvements and not with the interaction of all performance aspects. This can be shown in modeling efforts reported by Chen.¹⁴ He cites the development of a large-scale simulation model that has the following major components: application program model, database system model, operating system model, and hardware model. He notes that not many such models have been developed and that those that have are not general purpose. For instance, he reports on the development of a simulation model to evaluate the performance of a relational database system (SQL) running under IBM's VM/370, and focuses on the performance implications of different interfaces of the database system with the operating system. He also cites a similar model developed to evaluate design

alternatives to eliminate a performance bottleneck in the area of concurrent database update.

One can conclude from this and other work that for the foreseeable future there will not be a general-purpose database performance model. It appears that there is also no concerted research effort under way in this direction. That notwithstanding, system architects and designers cannot afford to design and construct large database systems without some type of performance model. There are just too many factors that interrelate and influence each other. The problem is even more complex because there is very little operational experience in performance evaluation of distributed systems and multicomputer configurations.

Experimentation with existing DBMS is an area that needs attention and contains valuable information to improve the design and performance of current and future database systems. C. C. Gottlieb¹⁵ found the task to be sizable. He regards experimental work on operational databases to be in a position similar to what it was more than 10 years ago. Initially, it was difficult to collect required data. Hardware and software monitors were developed, and most recently, methods of collecting the data, have been built into the computer systems. He concludes that experimental observations on databases will be harder and more expensive to get than those on an operating system.

Gottlieb also points out that we must learn what to observe. It's difficult to take snapshots (time-restricted, function-restricted photographs) of very large databases, and of their indices, directories, and data dictionaries as often as one may need. Nevertheless, we must find ways to do it. We need to develop tools and techniques for collecting and analyzing data on operational systems.

System architects and managers need to be in a position to evaluate alternatives for improving the performance of DBMS oper-

ations in either the design stage or the operation stage. This is particularly true in very large database systems. In selecting a particular alternative, we want the best performance, least cost, and greatest capability. This is one area of research that should receive the highest priority because it is important for us to know, before the fact, if a recommended change will produce the desired results and, if these results are worth the cost.

There are two types of performance monitoring and analysis needs. The first type—system resource monitoring—is concerned with collecting the data necessary to optimize or tune a particular system, both hardware and software, for peak resource efficiency. The data collection for resource monitoring and subsequent analysis is available and well understood by the industry.

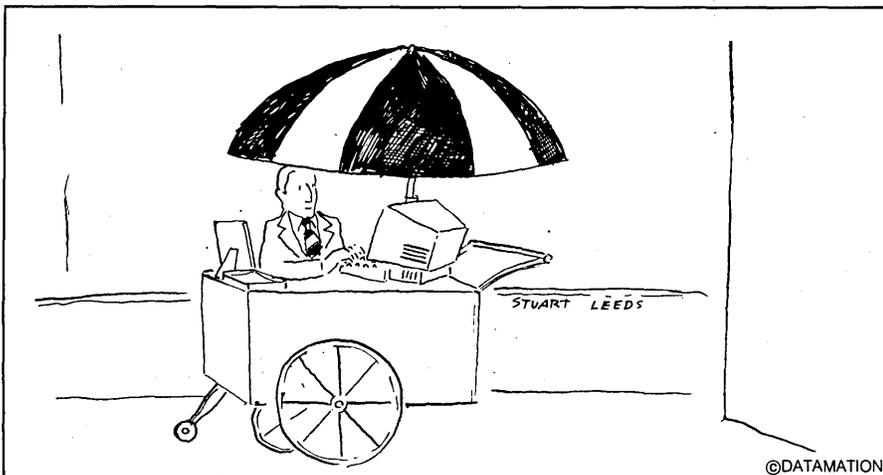
A companion to the first type and equally important is data collection and subsequent analysis related to designing a DBMS or to improving the performance of an existing DBMS. For instance, to what extent can performance be improved by altering a database structure or changing to a completely different data structure, such as network to relational? At what point do indices degrade, rather than improve performance? Is a database computer worth the investment for the performance improvement one will get from it? Is an architectural reconfiguration worth it?

These and other issues are beginning to receive a lot of attention. Needless to say, it's about time. We can't afford to wait until a system is developed to find out that we missed the performance mark or to go through a major upgrade to find out that we didn't solve our problem. We need to be in a better position than we are today to make intelligent decisions about what to do.

As mentioned earlier, there is a serious gap in performance measurement and evaluation of distributed configurations. Some research is under way in this area, but not much help is forthcoming soon. One thing is certain: system architects and researchers must work more closely together. Operational programs should have companion research programs, addressing the near-term goals and the other the long-term goals.

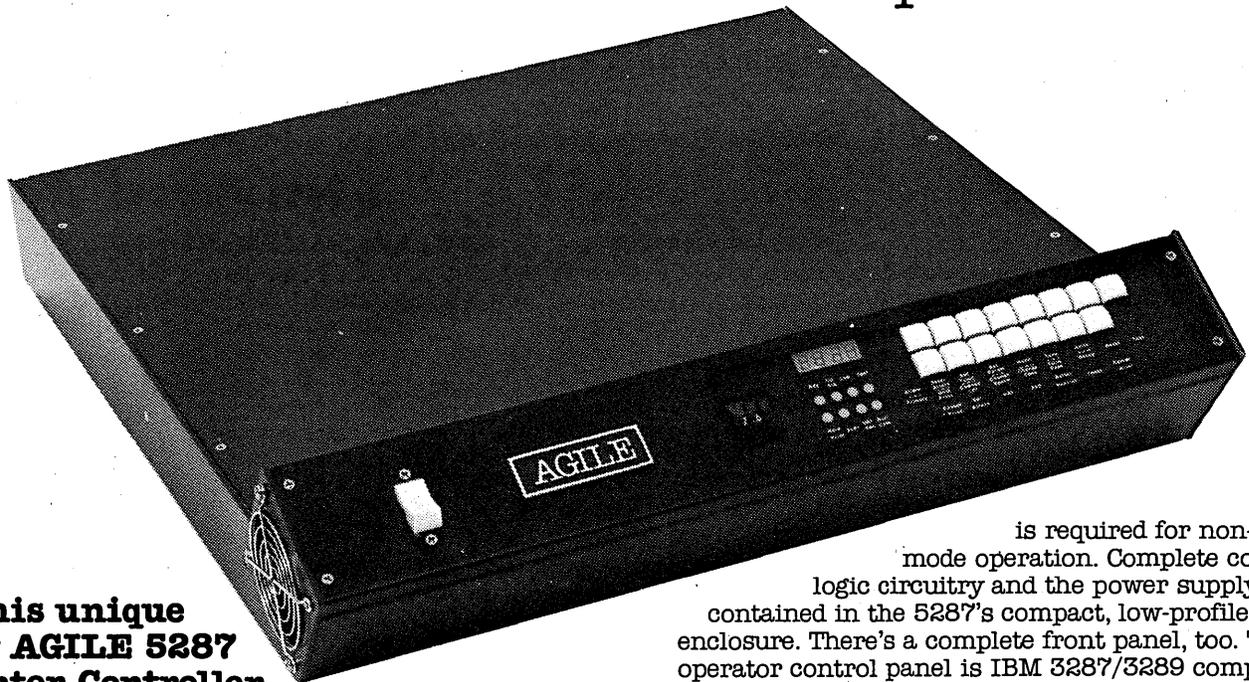
In examining the record of past and present research and current operational systems, one cannot help but be impressed with the magnitude of the problems associated with very large database systems. Equally impressive is the level and character of professional skill dedicated to the resolution of these problems.

Perhaps one of our most encouraging findings is that research appears to closely mirror the scope of VLDB system design alternatives and operational environments. We also feel that far too few system architects

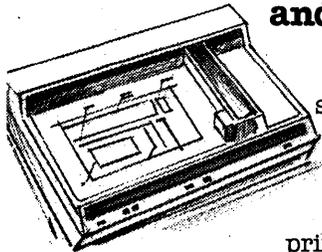


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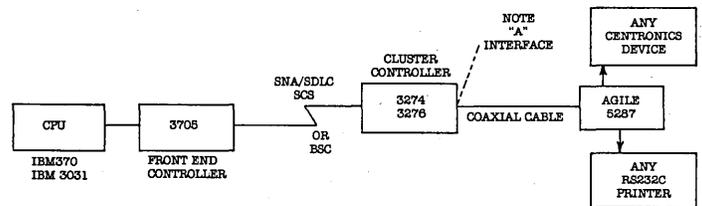
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and the format and operation of front panel switches approximates IBM 3287/3289 functions and physically implements 3287/3289 switches and indicators. All software and applications programs that currently support the IBM 3287/3289 printers will directly support the AGILE 5287 controller as well.

The 5287 Printer Controller Interface models are type "A" devices and each includes case, front panel, and power supply. The 5287-2 provides the RS232C interface port, and the model 5287-3 provides the standard Centronics port. Other standard codes may require an NRE. All the details are available — right now — from AGILE, as is all the help. Most important, AGILE is providing the 5287 Printer Controller. Immediately. Use the coupon below . . . now . . . or call toll-free:

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We face today the problem of doing for ourselves what we have done for others.

currently appreciate the nearness with which research stands to our operational environment. We, as an industry, face today, the difficult challenge of maintaining a careful balance between applying our known technological resources and applying our emerging, often embryonic, technological resources. As industries go, the field of computer sciences is truly a chronologically youthful industry. Yet the pervasive growth of our industry has,

in many areas, given us a professional maturity seldom found in most other fields. It has been our task to integrate our "new" technology. Historically, we have been successful at dealing with such technological management. We face today the problem of doing for ourselves what we have done for others, that is, to be agents of change internally and externally to our professional world.

We have suggested in this article that

there are at the least four areas that today pose as both answers and problems regarding our future VLDB systems. No one area is paramount, rather each is but one component of many that represent the universe of VLDB systems. What is important is that each of these areas represents a very high order of technological and professional development and skill, that the realities of VLDB systems require a high order of such resources, and that we must recognize, understand, and apply these resources if we are to succeed in serving both our industry and our clients. One cannot but be reminded of the buggy whip industry, and more recently the U.S. auto industry and its restrictive views on change.

The application of new ideas, theories, and technologies to reduce cost, improve performance, and provide more capability is obviously important to our clients. It is equally important to our industry and to our country if we are to maintain our leadership role and competitive position. *

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Kerry Byrd is a partner of Armstrong, Byrd & Associates, Washington, D.C. He is also a senior research consultant on advanced systems and technology with Inco, Inc.

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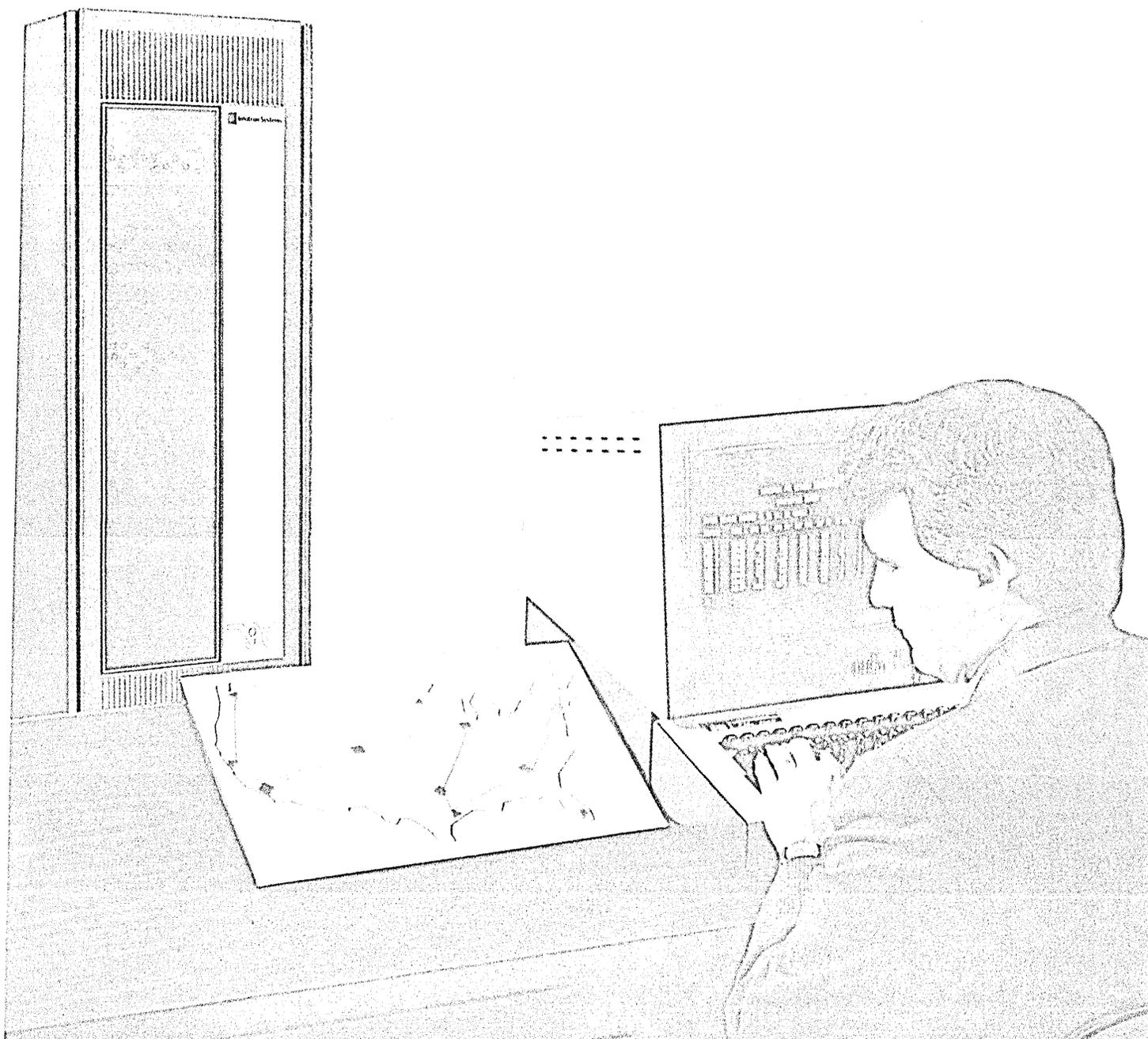
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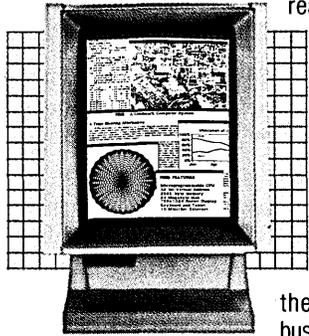
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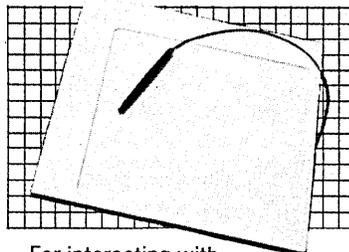
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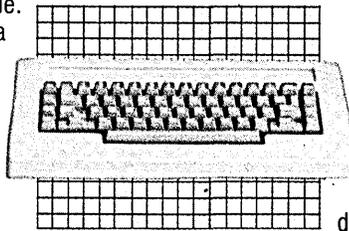
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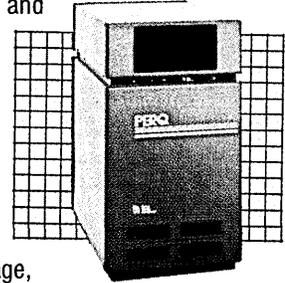
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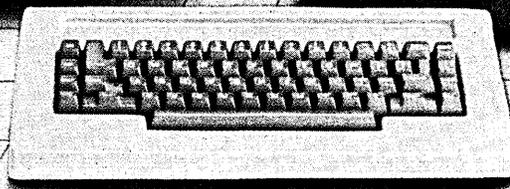
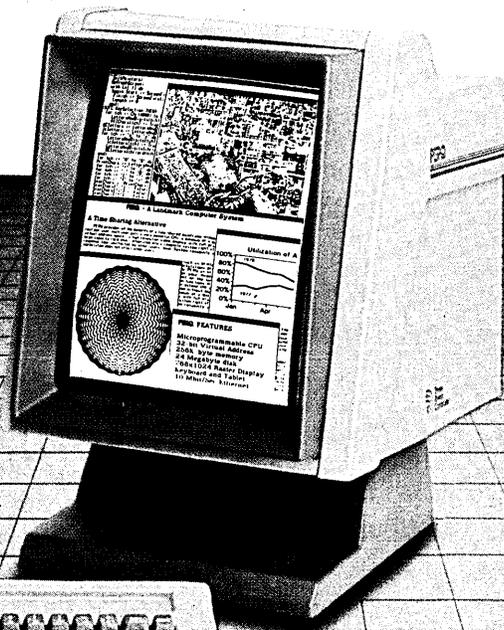
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The dp manager who separates the DBMS from the applications systems solves the problem of how much DBMS technology to use while waiting for the ideal products to mature.

HOW TO UPGRADE A DBMS

by Has Patel

The DBMS dream has several expectations: cost-effective application systems development, flexible applications, independence between a user and a program and between a program and data, and provision for supporting integrated systems to reduce duplicate definitions and data storage.

How close have we come to the dream? The view from the commercial bottom line shows most organizations unable to justify the development and daily operation of DBMS-based application systems.

Many vendors are spending lots of time and money on products such as natural languages, relational DBMS, bubble memory, information resource management systems, content-addressable sequential memory, and database machines to fill the gap between the expectations and the realities.

In the interim, while waiting for these products to mature, the dp manager confronted with decisions to use or increase the use of DBMS technology has several problems.

How can he be committed to a system that may soon become obsolete? What are the conversion problems? Will it be cheaper to convert to improved DBMS technology? How will his DBMS system integrate with other new developments? Which direction will his hardware vendor take? His DBMS vendor?

The solution is for the manager to plan his dp environment in such a way that DBMS is separated from the applications systems. This is accomplished through the use of the data dictionary/directory (DD/D) approach.

In order to achieve this separation, four areas must be considered (see Fig. 1): data structures design, database I/O, data communications I/O, and DBMS schema/subschema generation.

To deal effectively with these concerns, the dp manager must establish a model of the dp operations environment to determine the problems that may exist (see Fig. 2).

FIG. 1

A TYPICAL (SIMPLIFIED) DAY-TO-DAY PROCESSING ENVIRONMENT FOR DBMS-BASED APPLICATIONS SYSTEMS

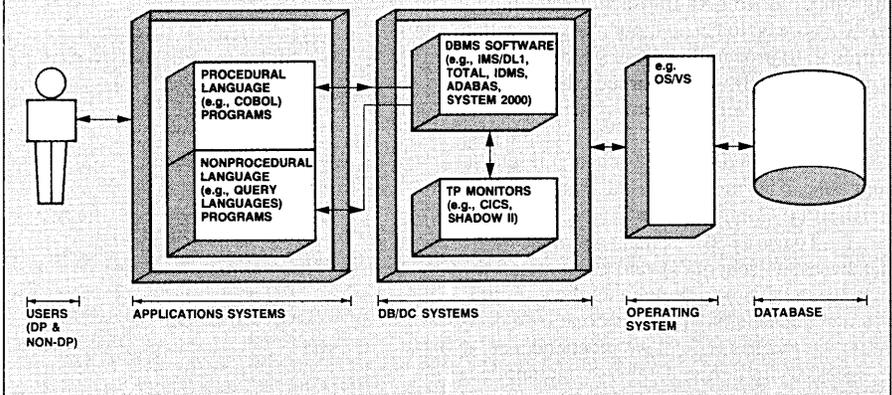
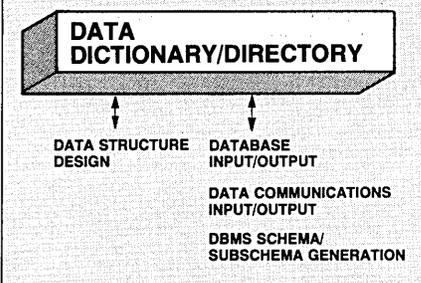


FIG. 2

AREAS THAT LINK DBMS TO APPLICATIONS SYSTEMS



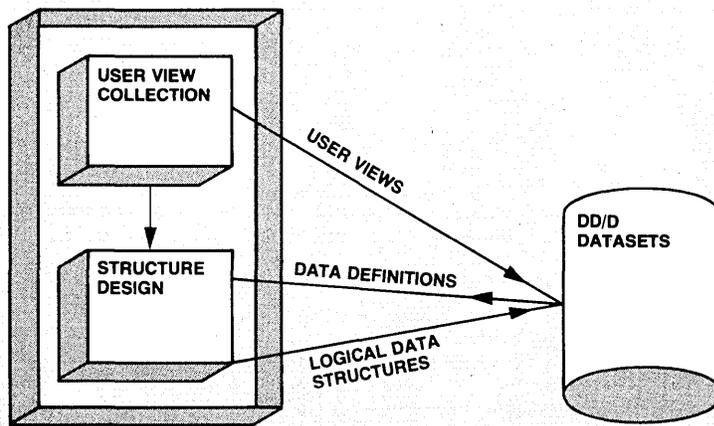
The following definitions and explanations apply to the understanding of Fig. 2:

- **User**: Any person using an application system with a DBMS. May be either dp (e.g., application programmer) or non-dp (e.g., accountant).
- **Applications**: A set of procedures (including procedural or nonprocedural programs) to achieve a given set of results.
- **DB/DC Systems**: Database/data communications systems. The major software components of DB/DC systems are the database management system and teleprocessing (TP) monitors.

During the systems design phase, designing data structures usually means designing data structures for the DBMS software installed by the user. For example, hierarchical structures for IBM's IMS/DLI, Codasyl-based

FIG. 3

LOGICAL DATA STRUCTURES DESIGN



structures for Cullinane's IDMS, network structures for Cincom's Total, or even data structures suitable for a relational DBMS. Here, the emphasis is placed on the DBMS rather than on designing logical data structures that satisfy all user needs, are stable, and are independent of physical DBMS implementation. Logical Data Structures Design (LSD) is the method by which emphasis is moved from DBMS to the design of data structures with the qualities listed above.

DBMS access by an application program, for I/O, is controlled by issuing calls using the data manipulation language supported by a given DBMS. For example, DL/I calls for IMS. This makes the program dependent on the DBMS. To make the program independent of the DBMS, a method that supports an independent data manipulation language and controls its relationship to a physical DBMS can be developed. We call this method Database Input Output Control (DBIOC).

Since data communications is closely related to DBMS processing, a dp manager should also consider relationships between an application program and data communications I/O. In the datacom environment, an application program becomes a transaction or message processing program with the following functions: to start transaction and initialize work areas; to get an input message from a terminal; to process the message; and to send a reply to the terminal. In order to be independent from a given datacom system (such as CICS, ROSCOE, SHADOW), it is necessary to achieve independence in each of the above functions. This method we call Data Communication I/O Control (DCIOC).

To use a DBMS, a manager must define databases. ("schema") and the part of the database relevant to a given application program ("subschema"); this is done by a definition language. To achieve independence, it is necessary to define databases and application programs in a language that is independent of any DBMS implementation and then to translate these independent definitions to a physical DBMS definition language. We call this LPM (Logical/Physical Mapping).

Data Dictionary/Directory is a tool for the management and control of a corporate data resource (Table I, p. 132). Within the dp department, a DD/D with a wide range of facilities can be used during all stages of the system development life cycles. Table II (p. 132) shows some examples of DD/D applications during these cycles.

Now, we will illustrate the roles of the DD/D in implementing the four methods.

The underlying concept of logical data structure design is to produce data structures of maximum stability representing multiuser views of a given set of data items which are independent of any DBMS, i.e., a perfect logical design. Fig. 3 shows a relationship

FIG. 4

DATABASE INPUT/OUTPUT CONTROL

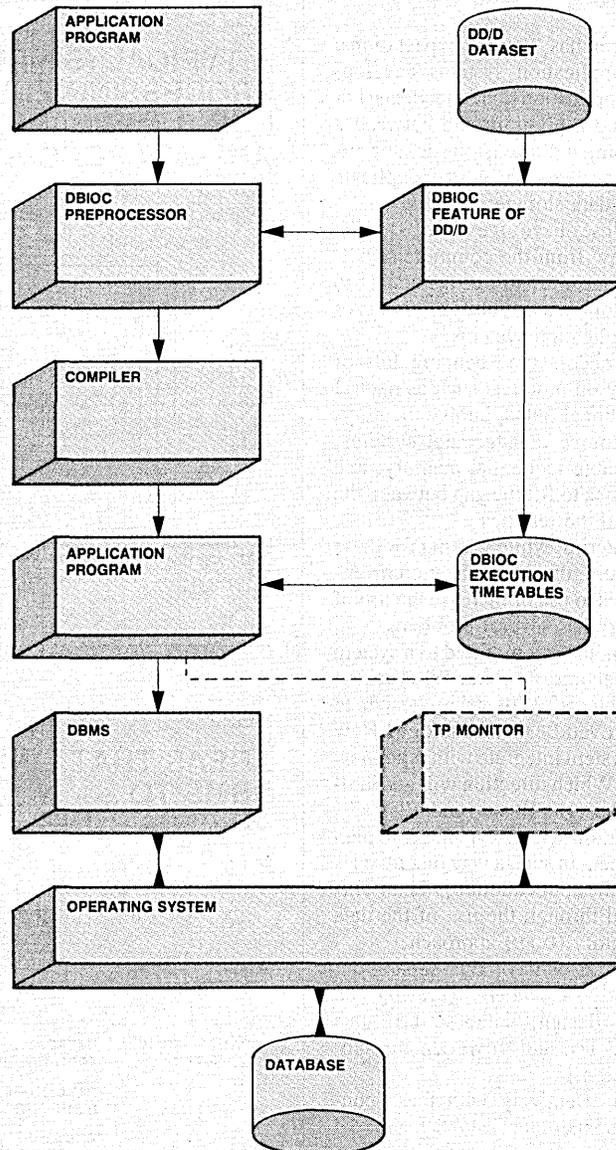
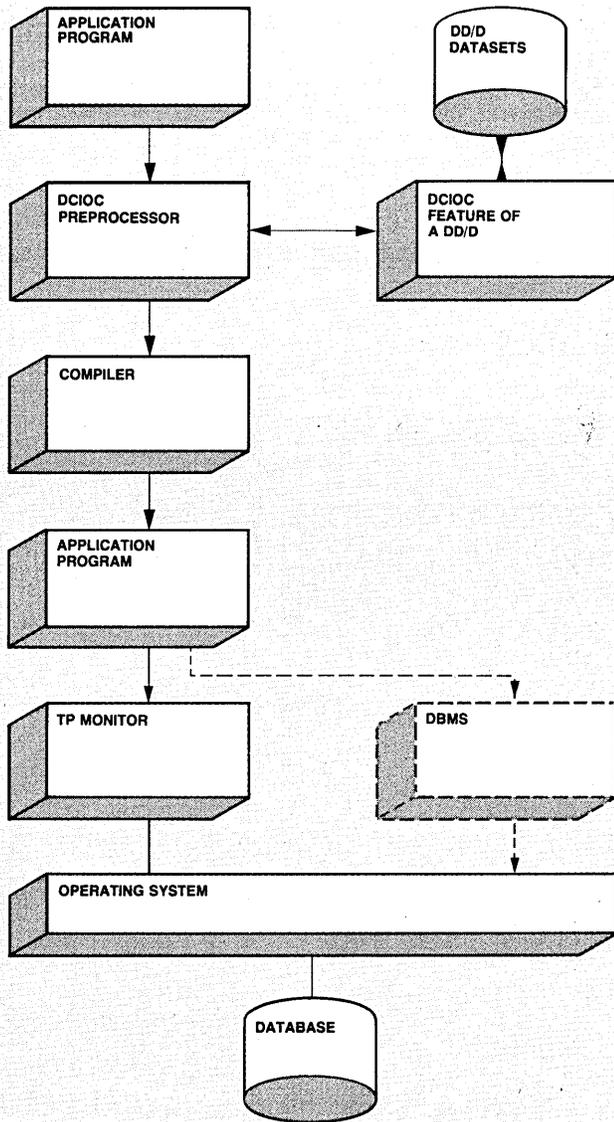


FIG. 5

DATA COMMUNICATION INPUT/OUTPUT CONTROL



between DD/D and the two most important stages in the logical design process—user view collection and data structure design.

User view collection consists of determining the data structure need of different users, for a given application system, drawing schematic diagrams of the data elements and their relations, and recording collected data in a standard form.

Data structure design is combining user views within a single structure of data items; editing for errors, omissions, and inconsistencies; and eliminating nonessential elements. It also includes deriving normalized representation of data structures, producing design reports, and recording logical data structures in a standard form.

A technique for implementing database I/O control using DD/D is illustrated in Fig. 4. The following activities are included: storing data definitions, (with attributes and relationships) in DD/D, writing application programs using a common data manipulation language, and processing the application programs using a DBIOC precompiler.

Major functions of a precompiler:

1. Read input application program.
2. Convert the common DML statements to the form that is required by a DBMS host language interface, for example, converting common DML statements to COBOL DLI calls for IBM's IMS.
3. Obtain information on the relationship between logical and physical DBMS data structures from DD/D.
4. Perform consistency checks and generate an application program that contains DML statements supported by the DBMS which is to be used, and written in the language used to code the applications program.
5. Compile and run the program.

Data Communications Input/Output Control (DCIOC) can be implemented by the use of DD/D (Fig. 5):

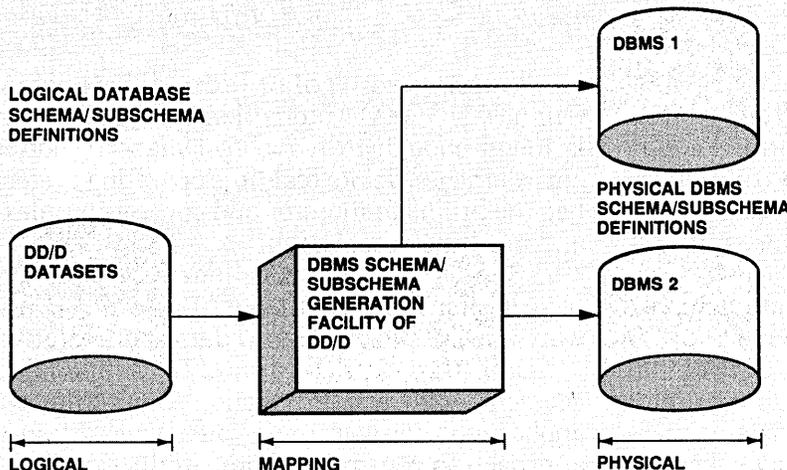
1. Using a common message manipulation language, code the program.
2. Using a DCIOC preprocessor, convert the common manipulation language specified requirements to the given teleprocessing monitor requirements.
3. Compile and run the program.

The use of DD/D in Logical/Physical Mapping is shown in Fig. 6. The following activities apply:

1. Using a DD/D data definition language, define logical databases.
2. Using DBMS schema/subschema generation facility of the DD/D, generate DBMS schema/subschema definitions.
3. Implement DBMS.

FIG 6.

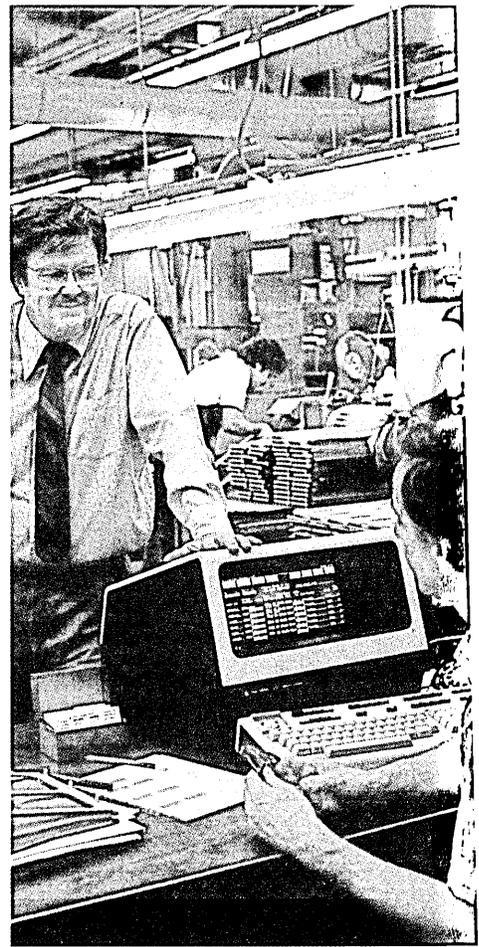
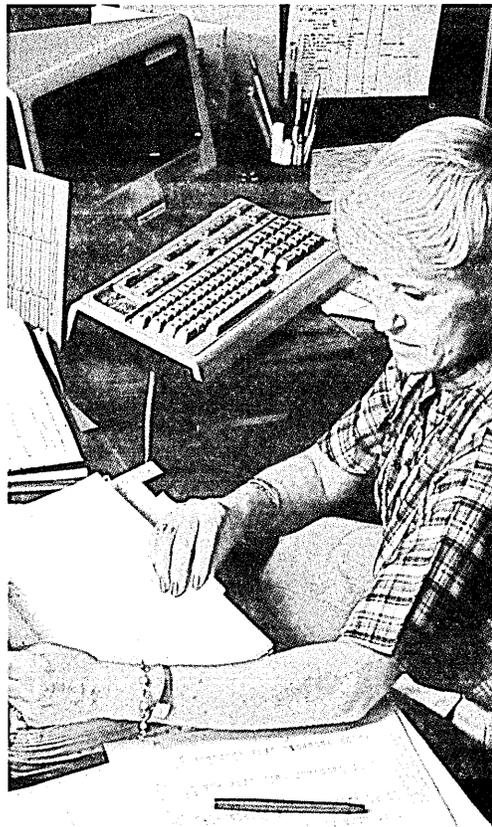
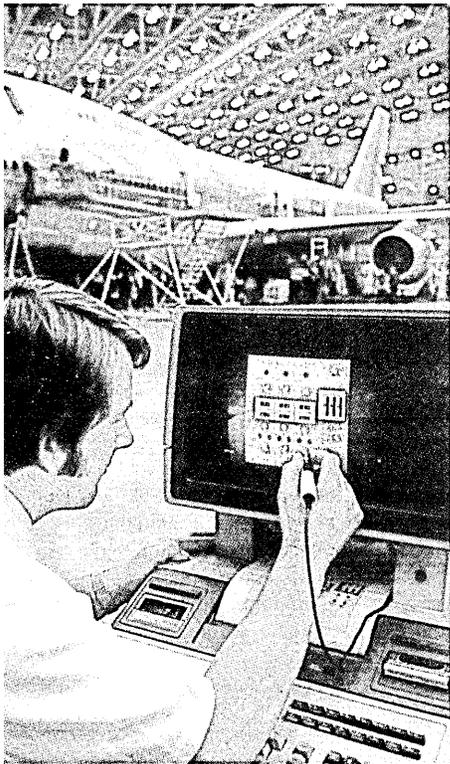
LOGICAL/PHYSICAL MAPPING



Has Patel is manager of product planning for MSP, Inc., Lexington, Mass., a software firm specializing in information resource management.

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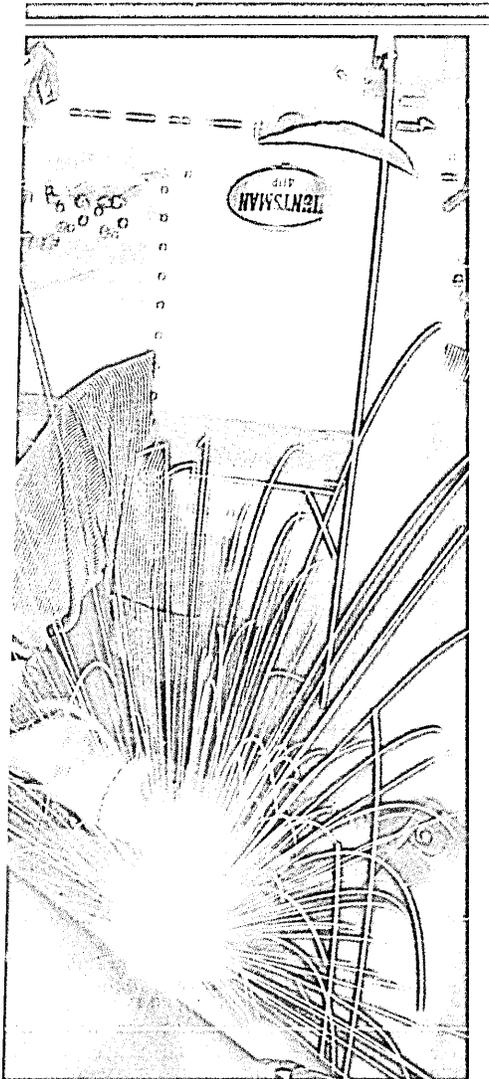
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The data dictionary/directory is a tool for the management and control of a corporate data resource.

TABLE I

DEFINITION OF DATA DICTIONARY/DIRECTORY

REPOSITORY

Repository for entities, relationships, and attributes

Entities—anything that is of interest to an organization

Relationships—associations between two or more entities of interest to an organization

Attributes—properties of an entity

PROCESSING AND CONTROLLING

Processing and Controlling information about structure and usage of entities, relationships, and attributes

Processing—What, where, how, report, update, delete, add, transfer, map, etc.

Controlling—Password, security, access, usage, restrictions.

POSSIBLE DD/D CONTENTS

- Data definitions (for example, item, element, group, form, screen, report, document, dataset and database definitions)
- Process definitions (for example, systems, job, procedure, transaction, job-step, etc., definitions)
- Relationship between data and data (for example, report A contains item B)
- Relationship between process and process (for example, system P consists of job-steps X,Y,Z)
- Relationship between data and process (for example, item C is used by program K)
- Security information
- Cataloging (for example, programs A, B, and C are catalogued under WEEKLY because they are run at the end of a week)
- Narrative documentation (for example, system description, input documents and related input control procedures, output documents and related output control procedures, record and file layouts, database contents, code definitions, error handling procedures, batch control forms, program specifications, test data specifications, operations and recovery instructions, report distribution)

TABLE II

SYSTEM DEVELOPMENT LIFE CYCLE

STAGE

**Organization needs analysis/
determining requirements**

System analysis/design

Programming/testing

System implementation/running

**Overall (applicable to all system
development life cycle stages)**

EXAMPLE APPLICATIONS

Converting business plans to information plans
Data analysis
Function analysis

Designing logical data structures
Designing transactions/programs
Database and/or conventional file design
Impact analysis

Generating data validation coding
Generating record layouts
Program generation
Generating test data/database
Maintaining relationship between "test" and "live" programs

Tool for conversion and migration from one level of technology to another
Change and impact analysis
Generation of DBMS schemas/subschemas parameters
Generation of parameters for report writers/query systems
Direction and control of networks
Collection and analysis of utilization statistics
Supervision of DBMS security and integration
Control of program libraries
Maintenance and retrieval of "disaster recovery plans"
Software version control/operations environment control

Unique source of all documentation
Edp auditing tool
Standards enforcement
Control mechanism
Communications aid between dp and non-dp personnel

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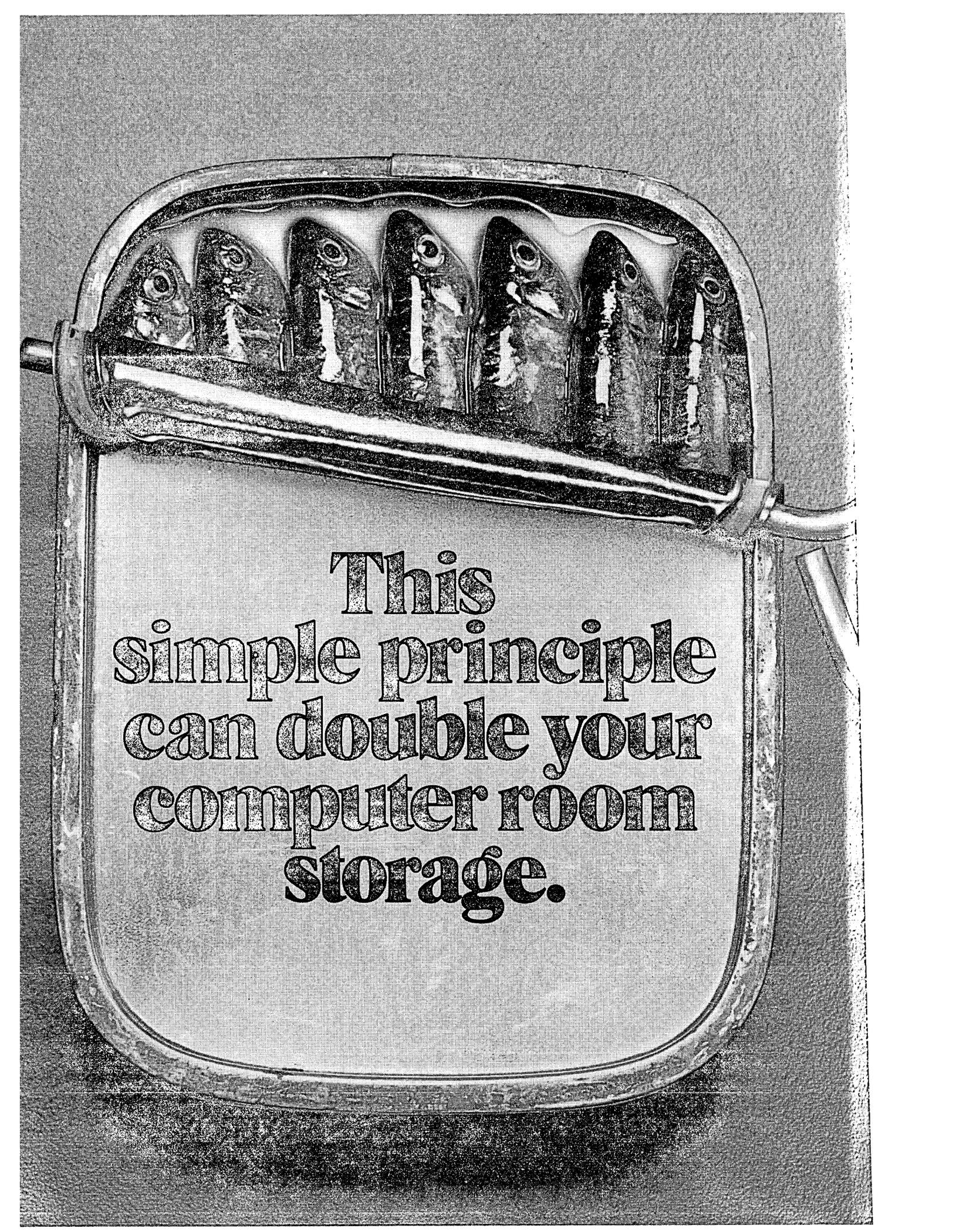
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computer room
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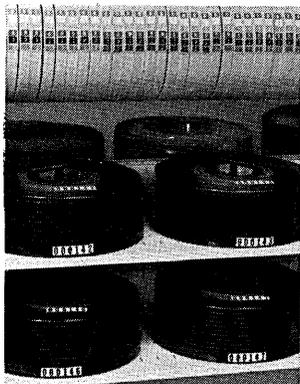
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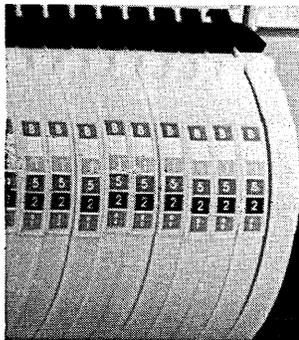


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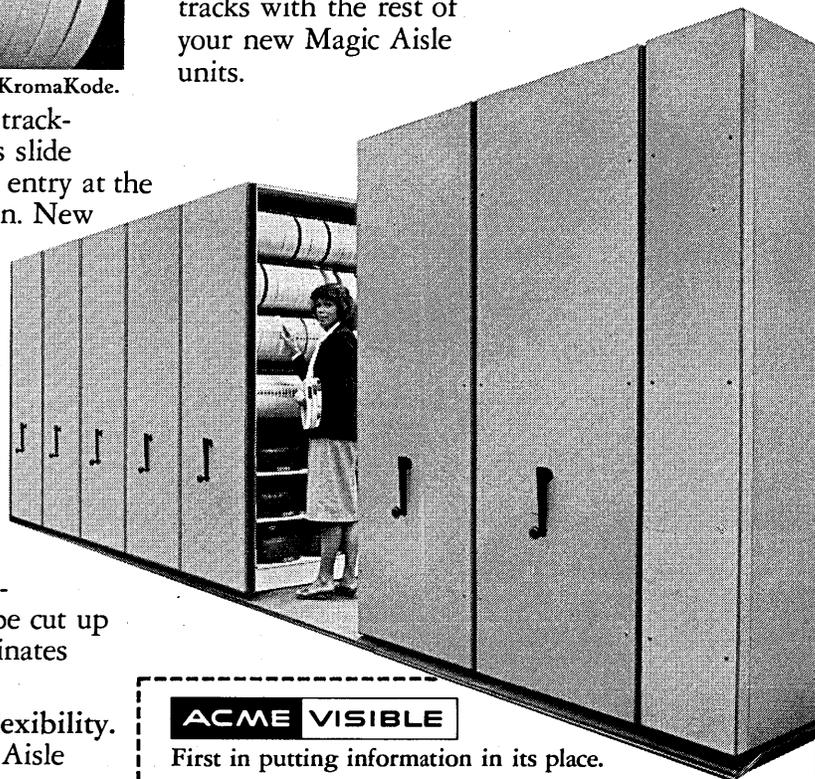
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QUADRASYNC/B™ (4-LINE DL11 REPLACEMENT/EIA)

INSTALLS IN: All PDP-11's; 4-lines per SPC slot at one unit load to Unibus. **DATA RATES:** 7 independently selectable baud rates for each of 4 channels (150-9600). **ELECTRICAL:** EIA standard RS232C (Modem control not supported). **VECTOR/ADDRESS SELECTION:** Vector and address values to be set on boundaries of 008 or 408. 16 continuous word address for Vector or Address.

QUADRASYNC/C™ (4-LINE DL11 REPLACEMENT/CL)

INSTALLS IN: All PDP-11's; 4-lines per SPC slot at one unit load to Unibus. **DATA RATES:** 7 independently selectable baud rates for each of 4 channels (150-9600). **ELECTRICAL:** 20MA current loop (Send : Receive). **VECTOR/ADDRESS SELECTION:** Vector and address values to be set on boundaries of 008 or 408. 16 continuous word address for Vector or Address.

QUADRASYNC/E™ (4-LINE DL11-E REPLACEMENT)

INSTALLS IN: All PDP-11's; 4-lines per SPC slot at one unit load to Unibus. **DATA RATES:** 7 independently selectable baud rates for each of 4 channels (150-9600). **ELECTRICAL:** EIA standard RS232C - with modem control. **VECTOR/ADDRESS SELECTION:** 16 continuous word address for Vector or Address - starting values selected on any boundary.

QUADRACALL™ (4-LINE DN11 REPLACEMENT)

INSTALLS IN: All PDP-11's; 4-lines per SPC slot at one unit load to Unibus. **PERFORMANCE:** Interfaces up to 4 Bell 801 ACU's with Unibus enabling any PDP-11 to dial any DDD network number to establish data link. **INPUT/OUTPUT:** 5-input signals from ACU are handled by EIA RS232 receivers. 6-output signals are transmitted using EIA RS232 drivers. **VECTOR/ADDRESS SELECTION:** Allows selection of device address and vector by use of pencil switches.

ABLE DV/16 (16-LINE DV11 REPLACEMENT)

INSTALLS IN: All PDP-11's; in less than one half the space of DV11. **DATA RATES:** 16-line throughput of up to 30,000 char/sec (19.2K baud full duplex for each line) total. **PROCESSING ADVANTAGE:** Word transfers (in lieu of byte DMA) permit user to operate within one half the DV11 bandwidth for data transfers. **OPERATING ADVANTAGE:** User may mix sync and async lines in combinations of 4 or 8 lines with modem control and full system software compatibility with all DV11 performance features.

ABLE DZ/16 (16-LINE DZ11-E REPLACEMENT)

INSTALLS IN: All PDP-11's in any standard hex-width SPC slot; takes half the space at half the bus loading imposed by the DZ11-E. **DATA RATES:** All 15 standard DZ11 baud rates (50-9600). **IMPLEMENTATION ADVANTAGES:** On-board pencil switches allow address and vector selection flexibility without the need for jumpers. Data format is program-selectable for each channel.

SCAT/45™ (ADD-IN FASTBUS MEMORY)

INSTALLS IN: PDP-11/45, -11/50 and -11/55. **EXPANDS IN:** 32K word increments/board. One-half of the available Fastbus space will accept full 124K word complement. **ADDRESSES ON:** Any 4096 word boundary across entire 124K word range. User has full memory complement at 330 nsec cycle-time memory instead of 32K word limitation imposed by the computer manufacturer.

CACHE/45™ (CACHE BUFFER MEMORY)

INSTALLS IN: PDP-11/45, -11/50 and -11/55. **CAPACITY:** 2048 byte (1K word). **ENHANCEMENT FACTOR:** Run time reductions to 50% (100% speed improvement) are achievable. **CACHE PARITY:** Automatically goes off-line in event of any data error. **RANGE SELECTION:** User may optimize hit ratio by upper/lower limit switch settings. **SPECIAL FEATURE:** Cache/45 can be enabled via software or console switches.

CACHE/434™ (4K WORD CACHE MEMORY)

INSTALLS IN: PDP-11/34 and -11/34A without using any additional backplane space! **CAPACITY:** 8192 byte (4K word). **ENHANCEMENT FACTOR:** Run time reductions to 40% (70% speed improvement) are achievable. **CACHE PARITY:** Automatically goes off-line in event of any data or address error. **RANGE SELECTION:** User may optimize hit ratio by upper/lower limit switch settings. Cache action monitor indicates hit rate.

CACHE/440™ (4K WORD CACHE MEMORY)

INSTALLS IN: PDP-11/35 and -11/40 without using any additional backplane space! **CAPACITY:** 8192 byte (4K word). **ENHANCEMENT FACTOR:** Run time reductions to 40% (70% speed improvement) are achievable. **CACHE PARITY:** Automatically goes off-line in event of any data or address error. **RANGE SELECTION:** User may optimize hit ratio by upper/lower limit switch settings. Cache action monitor indicates hit rate.

EMULODER™ (ODT/BOOTSTRAP LOADER REPLACEMENT)

INSTALLS IN: PDP-11/05, -11/10, -11/35, -11/40, -11/45, -11/50 and -11/55. **MECHANICAL:** Dual width card replaces standard Unibus termination; requires no additional backplane space. **OPERATING ADVANTAGE:** Provides fixed console emulator (ODT) and bootstrap loaders for DL11, PC11, RF11, RK06, RK11, RP04/05/06, RP11, RS03/04, RX11, TC-11, TM11 and TU16. **SPECIAL FEATURE:** Performs memory diagnostic each time a boot operation is done from ODT.

QNIVERTER™

(Q-BUS TO UNIBUS CONVERTER OR UNIBUS TO Q-BUS CONVERTER)

INSTALLS IN: LSI-11, LSI-11/23, PDP-11/03 and PDP-11/23 via quad-width card. **APPLICATIONS:** Allows Unibus-compatible controllers and memories to be used with LSI computer systems, or LSI-based peripherals to be used with PDP-11 computer systems. **FEATURES:** Supports features of LSI-11/23 including the full 128K address capability.

REBUS™

(BUS REPEATER - DB11 REPLACEMENT)

INSTALLS IN: All PDP-11's; without using any additional backplane space. **MECHANICAL:** One dual-width card plugs into the same pair of connectors as the Unibus extension cable which is then plugged into the REBUS connectors. **COMPATIBILITY:** Allows for 18 additional bus loads and 50 foot bus extension. Requires no software changes. Bus cycle time unaffected for devices on CPU side of REBUS - increased by 250 nsec max. for devices on outboard side.

DUAL I/O™

(GENERAL INTERFACE-DR11-C REPLACEMENT)

INSTALLS IN: All PDP-11's; in any SPC slot via quad-width card. **APPLICATION:** Dual I/O is equivalent to two (2) DR11-C's and provides the logic for program-controlled parallel transfer of 16-bit data between two (2) external user devices and a Unibus system. **OPERATING ADVANTAGE:** Provides user the hardware/software equal to a dual DR11-C in one-half the space and one-half the bus loading of DR11-C's.

INTERLINK/UNI

(DR11-B AND 1/2 DA11-B REPLACEMENT)

INSTALLS IN: All PDP-11's in any SPC slot via hex-width card. **APPLICATIONS:** Provides full DR11-B (DMA INTERFACE) and one side of DA11-B (UNIBUS LINK) capability on a single card. **OPERATING ADVANTAGES:** Requires only one hex-width card in each computer to effect link vs. full four-slot system unit per computer. Exhibits one bus load. Directly software transparent as a DR11-B replacement or when expanded to DA11-B equivalency.

BUSLINK/UNI, LSI OR U TO Q (CPU TO CPU LINK; UNIBUS TO UNIBUS; UNIBUS TO Q-BUS OR Q-BUS TO Q-BUS)

INSTALLS IN: All PDP-11's and/or LSI-11's via pairs of hex-width, hex/quad-width, or quad-width cards and supplied cables. **APPLICATION:** Provides full DA11-B (Unibus or Q-bus link) compatibility on single cards. BUSLINK operates at DA11-B transfer rates over distances of up to 50 feet. **OPERATING ADVANTAGE:** Requires only one card per CPU to effect link at minimal bus loading vs. full system unit per computer.

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**For applications where preplanning is difficult,
these new systems provide ease of use for
everyone from the database administrator to the
uninitiated end user.**

THREE RELATIONAL DBMS

by E. Martin Dieckmann

Most major commercial database management systems (DBMS) now offer at least a high-level query language facility and several offer programming productivity aids. Most of these large DBMS, such as TOTAL, DL/1, IDMS, ADABAS, and System 2000, however, are still somewhat complicated to learn and use and are generally not very flexible when it comes to data definition modification. Systems such as FOCUS and RAMIS II combine high-level facilities and overall ease of use, but these systems do not offer dynamic data definition modification.

Recently, several relational DBMS have become commercially available or have been announced for release.¹ The three systems under consideration here—INGRES from Relational Technology, Inc.; ORACLE from Relational Software, Inc.; and SQL/DS from IBM—offer high-level facilities, ease of use, and flexibility in data definition modification. These systems are not necessarily designed or intended for very large volumes of data or for high update transaction volumes. They are intended for applications where preplanning is difficult and they are expected to provide ease of programming and, in general, ease of use for everyone, from the database administrator to the uninitiated end user.

These three systems are striking in their similarities. They differ more in the degree to which they have implemented certain facilities and capabilities than in the array of facilities offered. In the case of ORACLE and SQL/DS that is not surprising, since they are both heavily influenced by IBM's research relational DBMS, System R. Also, INGRES and

System R were developed mostly in parallel (and in close geographical proximity) by a group of developers who knew each other and periodically exchanged ideas.

The similarities also stem from the nature of the relational model and the access facility used by all three systems, the relational calculus. In both the model and the access facility the emphasis is on ease of use and flexibility in data definition modifications. For example, in the relational model, no embedded logical links between data are employed. All navigation between logically related tables is accomplished through the comparison of attributes with the same data type. This, together with the fact that all data definitions are obtained at execution time in all three systems, allows for the dynamic definition of new attributes (except in INGRES) and new tables (in all three systems) without requiring a reload of any data or necessitating the interruption of other users. Once a new column has been defined in ORACLE or in SQL/DS, values for the new attribute will be stored in existing free space if available, or in an overflow record connected to the original record by a fragmentation pointer when no free space is available. This method of storage is essentially the same as that used to accommodate variable-length fields and compression found in most current DBMS.

QUERY, NONQUERY COMMANDS

The systems also resemble one another in their use of the relational calculus, which is particularly adaptable to the incorporation of user views into a query. In all three, views are defined in the same manner as a query, and may be incorporated into any query once they are defined and saved in the systems' data dictionary. These views may be used for security by restricting the user's access to certain data, and they are particularly useful in simplifying queries, thereby making the nonprocedural, high-level

relational calculus even easier to use. As an example, hierarchical and network structures may be made to appear to the end user as flat files. This shifts the concern for navigational retrieval from the programmer and end user to the database administrator. A similar but more limited capability is now beginning to appear in some major DBMS, such as TOTAL, System 2000, and IDMS. An additional navigational retrieval facility offered by ORACLE provides commands to deal easily with a bill-of-materials structure.

The relational calculus may easily be included within other, nonquery commands. All three systems have many-record-at-a-time on-line delete and update commands which select tuples in the same manner as a query. This type of facility greatly reduces database updating time and complexity.

There are some differences among the systems in the way they have implemented the relational calculus. SQL/DS uses the Structured English Query Language (SEQUEL—now called SQL), ORACLE uses an almost identical version of SQL called SEQUEL 2, and INGRES uses a version of the relational calculus called QUEL (QUERY Language). SEQUEL has been criticized for being unnecessarily confusing because it expresses some multiple relation queries that require a hierarchical nesting of separate queries. For example, in order to list employee Jones's department name, the nested SQL command is required:

```
SELECT DEPT — NAME
FROM DEPT
WHERE DEPT — NUM =
  SELECT EMP — DEPT — NUM
FROM EMP
WHERE EMP — NAME =
  'JONES'
```

On the other hand, QUEL has been criticized for complicating simple queries somewhat by introducing a relation reference variable not required by SQL. The above query in QUEL would be stated as:

1. Some other DBMS are erroneously referenced as relational DBMS. A relational DBMS is one whose underlying model is relational (i.e., a collection of tables with no logical pointers connecting them) and which has a data language equivalent to the relational algebra or to the relational calculus, which is the same thing. E.F. Codd goes a step further, and defines a fully relational system as including insert-update-delete rules.

The three systems differ more in the degree to which they have implemented certain capabilities than in the array of facilities offered.

```
RANGE OF E IS EMP
RANGE OF D IS DEPT
RETRIEVE (D.DEPT __ NAME)
WHERE E.EMP __ NAME = 'JONES'
AND
E.EMP __ DEPT __ NUM =
D.DEPT __ NUM
```

Notice that the logic of this retrieval is more easily expressed in QUEL. The relation reference variable as defined in the RANGE statement, however, is always required in QUEL, while SQL uses the FROM clause and requires no such reference so long as only unique field names are used in a query. It should be noted that the nesting of queries shown in the SQL example is required only for some of the queries which involve more than one relation, and that the QUEL RANGE statement need be defined only once in a session for a relation.

All three systems offer the arithmetic functions SUM, COUNT, AVG, MIN, MAX, and qualification clauses within the query to evaluate these functions on aggregations. For example, the department number and average salary of employees within a department for all departments with more than 20 employees may be displayed using the following SQL command:

```
SELECT EMP __ DEPT __ NUM, AVG
(SALARY)
FROM EMP
GROUP BY EMP __ DEPT __ NUM
HAVING COUNT (*) > 20
```

This query in, say, a CODASYL DBMS requires some fairly complex programming. In addition to this aggregation selection capability, INGRES offers a special string searching capability, a QUEL string substitution facility, and a command buffer building and editing capability not offered by the other systems.

COMMAND IN HOST LANGUAGE

The three systems share another important characteristic, namely, the embedding of their command structure in the systems' supported host languages. Each system allows on-line commands to be executed from host languages in an almost identical manner. Special provisions are required to deal with the many-record-at-a-time commands, and each system provides for run time variable value substitution. SQL/DS and INGRES provide preprocessors, while ORACLE currently provides a somewhat more complicated call structure. (A preprocessor is planned for Version 3 of ORACLE.) SQL/DS also is currently the only system that allows an application program to accept and execute a user-entered command at execution time, thereby providing for the possibility of program control of user queries. INGRES does provide for partial run time command specification.

As a result of this common embedding

of on-line commands in host languages and of the relational calculus structure, run time binding of column names referenced in commands to physical field names through use of the systems' data dictionaries is accomplished for application programs in a manner analogous to the execution-time binding of the on-line commands. This results in a high degree of data independence, contrary to the situation found in most DBMS, and, therefore, less program maintenance and recompilation. But this type of run time binding also has some disadvantages: working storage for retrieval values will generally be programmer defined, as opposed to being copied from a COPYLIB or data dictionary; the potential for data dictionary control of application programs is diminished; and there is an inevitable impact on command execution performance.

Each of the systems has its own method of query optimization. IBM has incorporated sophisticated access optimization from System R into SQL/DS. Included in this is a feature of the host language preprocessor that stores in the data dictionary optimized object code access modules which are executed at run time by application programs. This feature has been implemented in a manner that does not require program recompilation when access paths are modified. Rather, access paths are redefined (if necessary) when dynamic data definitions or index modifications are made.

INGRES uses a complex algorithm that decomposes queries into simple pieces. Temporary relations and temporary dynamic restructuring of relations are used to process queries when this is advantageous.

ORACLE has introduced two performance enhancement features not found in the other two systems. Data from different tables that are logically related may be placed physically near to one another. For example, information about a department and its employees may be stored on the same page or on pages close to one another. The second performance enhancement results from extending a user's address space to include ORACLE whenever ORACLE is called by an application program, thereby decreasing the intertask communication requirements found in many DBMS that run on IBM-compatible hardware.

In general, there has been much discussion about the performance characteristics of relational systems. There are, at this time, no widely accepted benchmarks comparing these three relational systems to each other or to other commercially available DBMS. It is extremely difficult to define a comparative benchmark of this kind because so much depends upon the type of application, the type of query and update, and the hardware and software environment. It is especially difficult in this case since these systems run on different hardware: ORACLE and INGRES on VAX ma-

chines under VMS, and SQL/DS on IBM 370 and 4300 hardware under DOS/VSE. Moreover, SQL/DS is just now entering beta testing. A general indication of relational DBMS performance may be obtained from performance figures recently published for System R.²

BRIDGES TO OTHER SYSTEMS

The issue of bridges between different DBMS or between query languages or report writers and DBMS has been receiving increasing attention. This is due to the large conversion effort usually required when migrating from one DBMS to another, and to the desirability of using high-level query and report facilities which may not be offered with a production DBMS. Several bridge facilities are currently offered by various systems, but the three relational DBMS described here offer only limited bridging capability.

For example, Cullinane Database Systems offers TOTAL and DL/1 Escape facilities which allow TOTAL or DL/1 application programs to access an IDMS database without conversion. Version 5.7 of IDMS will permit VSAM files to be defined as part of an IDMS database. CINCOM Systems is developing a logical view capability which will make the underlying DBMS transparent to the user. EASYTRIEVE, MARK IV, RAMIS II, and FOCUS offer the ability to use their query language and report writers to access data stored under several other DBMS and also under various operating system access methods.

Of the three systems being considered here, only SQL/DS offers a direct bridge feature, which is DL/1 DOS/VSE extract facility whereby requests for data from a DL/1 database may be queued and executed at a specified time using VSE/POWER. This facility consists of a DL/1 database description capability in SQL/DS, a DL/1 extract component, and an SQL/DS load component, where the SQL/DS target relations have been previously defined. Additionally, CICS/DOS/VSE users may apply updates concurrently to both a DL/1 and an SQL/DS database, with the assurance that either both updates or neither will be successfully completed.

As an aid to implementing a general bridge facility, all three systems offer utilities that load flat files directly into relations, thereby allowing the user to extract summary or detail data from other systems and to make them available for query using the high-level facilities offered by these systems. *

2. "Support for Repetitive Transactions and Ad Hoc Queries in System R," *ACM Transactions on Database Systems*, vol. 6, no. 1, March 1981.

Dr. Dieckmann is a consultant with Arthur D. Little, Inc., Cambridge, Mass. He specializes in database management and data dictionary systems.

RELATIONAL COMPARISONS

The following charts offer a detailed comparative analysis of these three relational DBMS. The information was derived from currently available manuals, and, for ORACLE and INGRES, has been verified by the vendors. IBM has responded to a list of questions, but has not reviewed the information in its entirety.

	INGRES	ORACLE	SQL/DS
VENDOR	Relational Technology, Inc.	Relational Software Inc.	International Business Machines
Main Location	2855 Telegraph Ave., Suite 515 Berkeley, CA 94705 (415) 845-1700	3000 Sand Hill Rd. Menlo Park, CA 94025 (415) 854-7350	Armonk, NY 10504 (914) 765-1900
Branch Locations	None	Hartford, Conn. Washington, D.C. Toronto, Canada Contracted affiliates in several foreign countries	Major cities and foreign countries
COSTS			
License Fee	\$30,000	\$48,000-\$96,000*	\$300 monthly
Maintenance Fee	\$3,000/year	\$2,400-\$4,800*	\$105 for monthly local support
Training Costs	\$600/day + T&L	NC	not yet announced
Consulting Costs	\$400/day + T&L	\$680/day + T&L	not yet announced
Lease Option	No	Yes	Lease only
INSTALLATIONS			
First Installed	March 1981	June 1979	Beta test in August 1981 First public release planned for February 1982
Number Installed	15	80	
OPERATING ENVIRONMENT			
Cpus, Operating Systems and Core Requirements	VAX-11 under VMS. 180K bytes of shareable instructions + up to 90K bytes per user. The user core requirements normally run in much less core.	VAX under VMS; PDP-11 under RSX-11M, IAS, UNIX, RSTS (min. 1/4 MB core): 200K bytes + 8K bytes per user IBM under VM/CMS, MVS, VS1, and DOS will be available with Version 3 (December, 1981). *Dependent upon cpu	IBM 370 and 4300 computers under DOS/VSE
Teleprocessing Interfaces	VMS	VMS CICS with Version 3	CICS/DOS/VS for on-line access VSE/ICCF for program development and batch program running.
DATA TYPES	1, 2, 4 byte integer; 4, 8 byte floating point; fixed length characters up to 255 bytes.	Character and numeric are the only internal data types supported. Character fields are variable length, up to 255 characters. Numeric data are stored as 64-bit floating point numbers which ORACLE converts on output as necessary.	2 and 4 byte integer, packed decimal, double precision, fixed and variable length character up to 32,767 bytes.

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- 12 Tab controls, including column and field tab stops, and tab with justify
- 13 Erase controls
- 12 Edit controls, including the ability to locally rearrange data on the screen
- 13 Send controls and modes, including Meta Key Mode for 8-bit data transmission
- 10 Print controls and modes, including local and remote copy, and print format control
- 11 Receiving modes, including slow scroll and pause
- 11 Operator convenience modes, including selectable cursor
- 6 Setup lines permit review and control of terminal modes, send and print parameters and diagnostics
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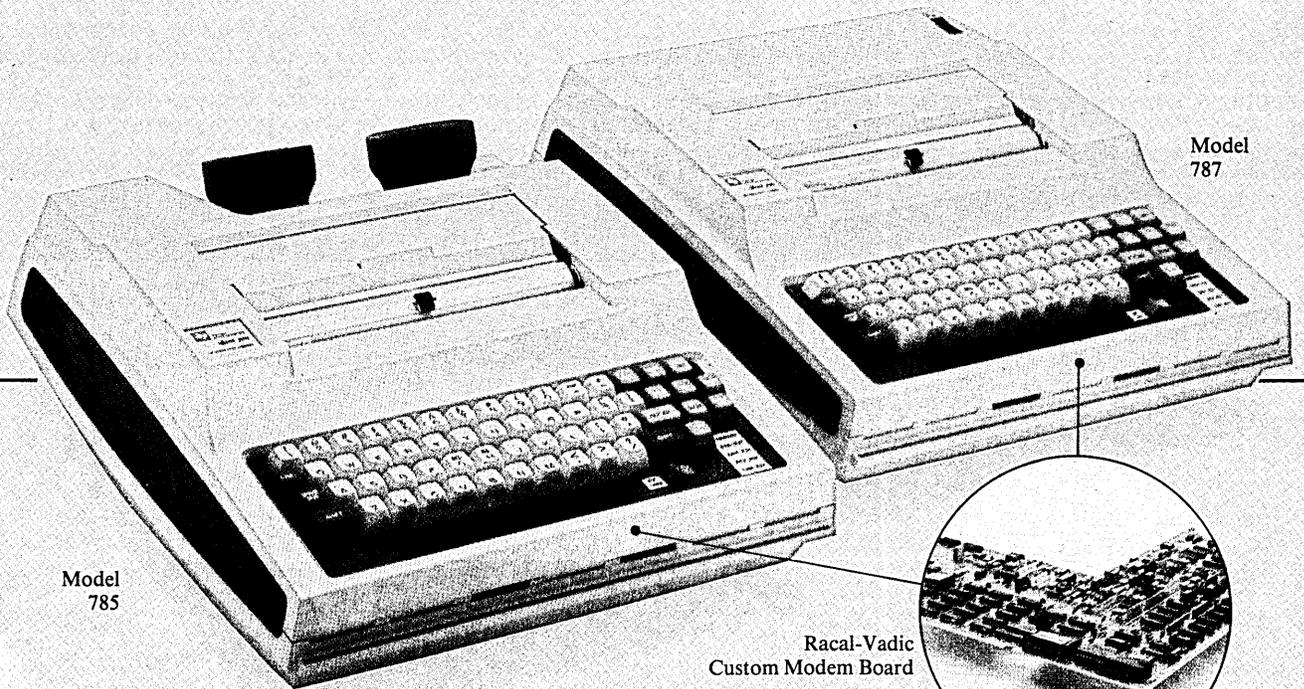
RELATIONAL COMPARISONS

	INGRES	ORACLE	SQL/DS
DYNAMIC DATA DEFINITION	The CREATE command creates a new relation definition in the dictionary and initializes a HEAP table.	NOTE: The following three commands perform updates to the dictionary only. The INSERT and UPDATE commands applied to these logical structures will result in physical storage. The CREATE TABLE command defines a new logical table for a database. The EXPAND TABLE command logically adds a column to an existing TABLE. The DROP TABLE command logically removes a table from a database. This command cannot be executed if there are views using the table definition.	The CREATE TABLE command defines a new logical table for a database. The ALTER TABLE command logically adds a new column to a table. The DROP TABLE command logically removes a table from a database.
SECONDARY INDEXING	Any number of indexes per relation with up to 6 columns per concatenated key may be established dynamically with the INDEX command.	Any attribute may be indexed as part of the CREATE TABLE and EXPAND TABLE commands. Version 3 will offer a CREATE IMAGE command with a UNIQUE option for the key values and the ability to index concatenated keys.	Any column(s) may have an index with up to 16 columns per concatenated index key. The commands CREATE INDEX and DROP INDEX provide dynamic index creation/deletion capability with a unique key value option for creation.
HOST LANGUAGES	"C" FORTRAN Pascal	COBOL PL/1 Assembler FORTRAN "C" Pascal	COBOL PL/1 BAL
PHYSICAL IMPLEMENTATION Storage Organization and Access Methods	All data are stored in tables (relations) with fixed or variable length rows. A database consists of one or more relations. Tables are stored using any one of the following access methods: ISAM Indexed Sequential Access Method CISAM Compressed ISAM HASH Random HASH storage structure (duplicate keys allowed) CHASH Compressed HASH HEAP Sequential File CHEAP Compressed HEAP HEAPSORT Sorted HEAP with duplicates eliminated CHEAPSORT Compressed HEAPSORT	All data are stored in tables (relations) with variable length rows. Each table is contained in a logical storage area referred to as a Segment. Segments may span physical files. A database is made up of one or more Segments. Indexes are stored in compressed B-Tree structures in separate Segments.	All data, indexes, and logs are stored in VSAM ESDS files with tuples stored as variable length records. A logical area, called a DBSPACE, may span several files, and a table plus its indexes must be contained within a DBSPACE. Each DBSPACE contains a multiple of 128 Pages (a Page = 4K bytes), and it may contain up to 255 tables. Each database has a directory to store logical to physical mappings and physical storage descriptions. DBSPACES are created with the ADD DBSPACE command.

RELATIONAL COMPARISONS

	INGRES	ORACLE	SQL/DS
Physical Data Sets	One data set per relation.	There is a complex mapping between tables and files which is partially user controlled (refer to example in the article).	A table plus its indexes may be stored across one or more VSAM ESDS files, called DBEXTENTS. DBEXTENTS are initialized with an IBM VSAM utility and with the ADD DBEXTENT command.
Free Space Control	Fill factors may be specified for some access options.	No free space control currently.	Users may control free space with a parameter in the ACQUIRE DBSPACE command.
Compression	The compression access method options remove all trailing blanks and leading null characters.	Trailing blanks and leading zeros are automatically suppressed. Indexes use forward and backward compression.	Data compression is not employed.
OPERATING CHARACTERISTICS			
Multiuser	Each user has own virtual copy of INGRES.	Multiple simultaneous batch and on-line updates and queries.	SQL/DS work in a multiuser mode in its own partition. Access is via cross-partition links. In single user mode, the using program resides in the same partition. CICS access to SQL/DS is through a special routine called the resource manager, which runs in the CICS partition.
Multithread	Full batch and on-line multithread capability through VMS.	Full batch and on-line multithread capability with overlapped I/O operations controlled by the ORACLE kernel.	SQL/DS is multithread.
Buffer Control	Shared buffer pooling is available with Version 1.2 (August 1981). No user control over buffer size.	Virtual buffer paging uses an LRU caching algorithm. There is some user control over buffer size. Shared buffer pooling is used.	Shared buffer pool sizes may be set at initialization.
RECOVERY AND INTEGRITY			
Logging	A two-phase commit protocol is used on all updates to maintain integrity. An "intentions list" is saved until all updates from a command have been completed. No other logs are kept. Version 1.3 will offer before and after image logging.	After-image journaling only, at the block level. Before images will be logged in Version 3 according to current plans.	Before and after images are logged onto one or (optionally) dual logs. Archiving may be done during regular operation.
Checkpoints	No checkpoint capability is provided. A checkpoint capability is planned for Version 2.0, January 1982.	ORACLE provides no checkpoint commands other than the BEGIN and END TRANSACTION lockout commands described below.	A logical work unit may be defined using the COMMIT WORK command by interactive or batch users. This retains locks and

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RELATIONAL COMPARISONS

	INGRES	ORACLE	SQL/DS
Integrity	<p>Locking is internally controlled on a command basis. All resources are obtained and locked before updating begins.</p>	<p>All updates are performed in core buffers, and the updated blocks are written to the database at the end of a command or at the time of an END TRANSACTION command. ORACLE performs all row locks automatically when an UPDATE command is issued. The BEGIN TRANSACTION command permits table locks for read and/or update, and the END TRANSACTION command releases these locks. These locks may be set during read only queries to assure that no updates occur during the period of retrieval.</p>	<p>maintains integrity by rolling the transaction back if it is not successfully completed. When no logical work units are specified, each command is automatically assumed to be a logical work unit by SQL/DS.</p> <p>Locks are automatically set by SQL/DS within a logical work unit. Exclusive locks are set at the page level (default) on all updates for public DBSPACES and at the DBSPACE level for private DBSPACES, and shared locks are placed on all other records read within the logical work unit. Users may adjust the granularity of locks in a public DBSPACE to a row or DBSPACE level. Also, users may override the automatic locks and specify their own table or DBSPACE locks with the LOCK command.</p>
Recovery-Restart	<p>The RESTORE utility must be run to recover from an operating system or INGRES crash using roll-back. Data storage damage must be restored to the last save without any roll-forward capability. Version 1.3 will offer a roll-forward capability and a user controlled backout facility.</p>	<p>No automatic restart, JNL utility must be used for roll-forward recovery from a previous save. An automatic transaction level restart capability is planned for Version 3.</p>	<p>Automatic roll-back of unsuccessfully completed logical work units (above) and a user controlled ROLL-BACK WORK command provide transaction recovery. Automatic roll-back of uncommitted logical work units and automatic roll-forward for all committed but uncompleted logical work units in the event of a system failure are performed at system restart. Also, there is a roll-forward capability starting from a reloaded archive.</p>
Semantical Assertions	<p>The DEFINE INTEGRITY command specifies single variable integrity constraints for REPLACE and two variable constraints for APPEND commands expressed using a qualification clause. Invalid updates are not performed, but no error message is given when an invalid value is encountered.</p>	<p>NOTE: The following commands will be implemented in Version 3. The ASSERT command specifies valid column values or ranges, and it checks new values for a field against the existence of that value in another field. The TRIGGER command will perform predefined "ripple" updates which are logical consequences of certain updates.</p>	<p>The NOT NULL option in CREATE TABLE prohibits null values to be entered into a field.</p>

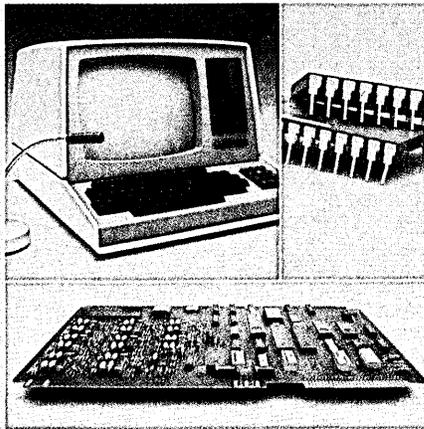


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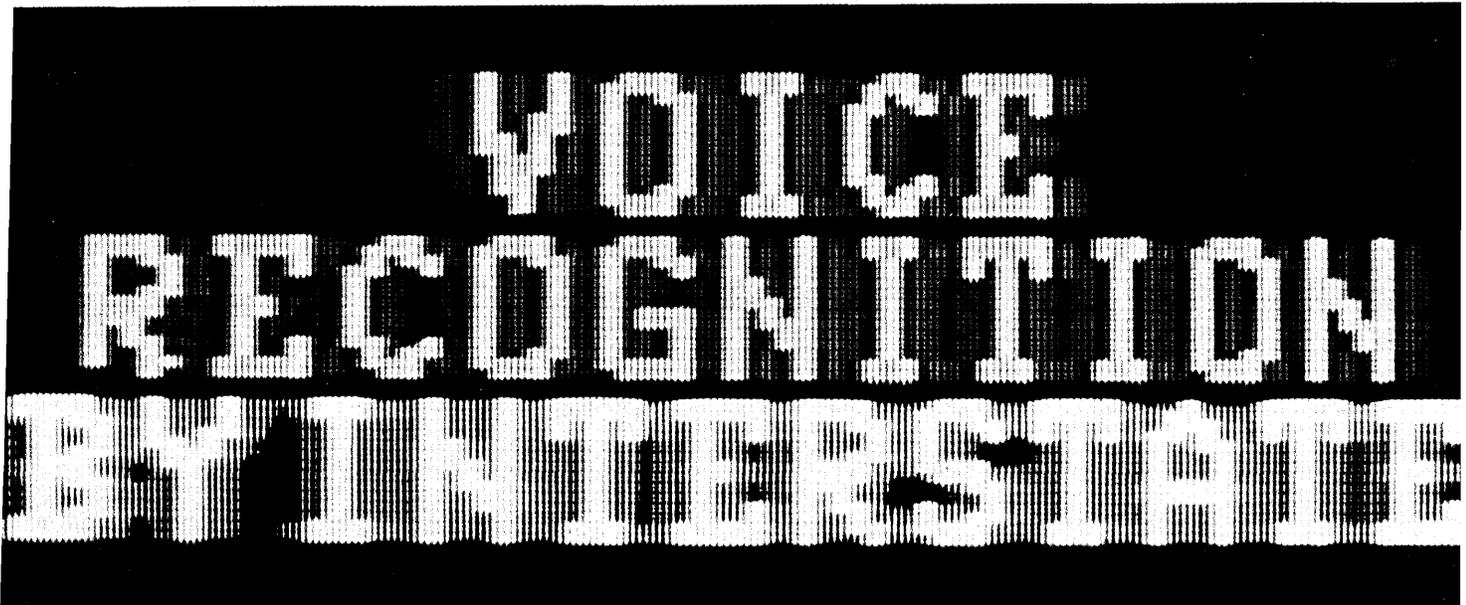
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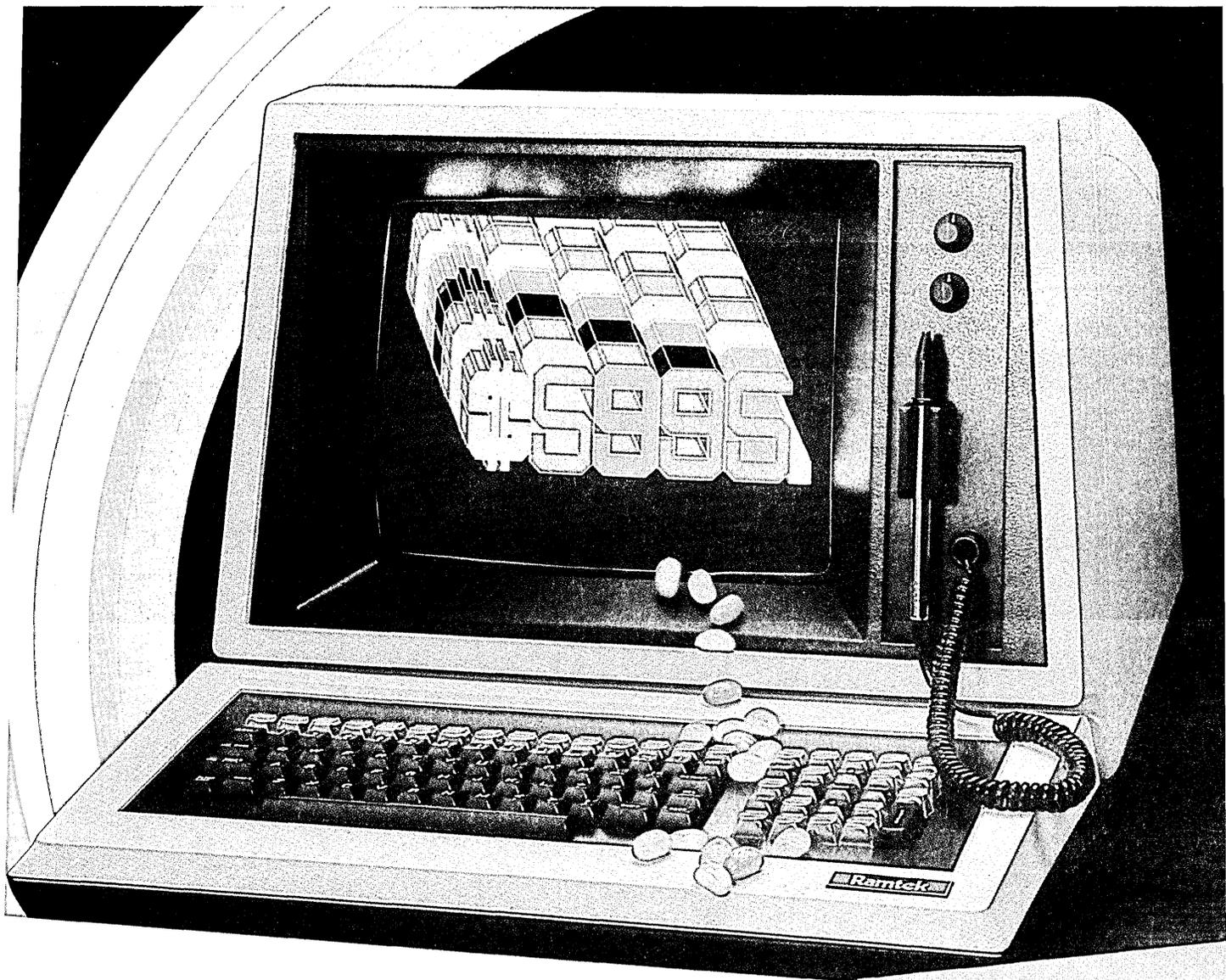
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RELATIONAL COMPARISONS

	INGRES	ORACLE	SQL/DS
UTILITIES	<p>1. COPYDB—Copies INGRES files to operating system files and vice versa.</p> <p>2. CREATEDB—Creates a new database in the dictionary or modifies the dictionary definition of an existing database.</p> <p>3. DESTROYDB—Destroys a database physically and in the dictionary.</p> <p>4. PURGEDB—Purges all system temporary and expired relations.</p> <p>5. RESTORE—Recovers from an INGRES or VMS crash.</p> <p>6. SYSMOD—Modifies system relations to improve performance.</p>	<p>DBF—Establishes, modifies, and deletes databases at the operating system level (except for deletes) and from the ORACLE System database dictionary.</p> <p>EXP—Unloads selected database tables and/or views onto sequential files.</p> <p>IMP—Reloads previously unloaded tables and/or views.</p> <p>ODL—Loads operating system files into ORACLE tables.</p> <p>JNL—Applies journal files to an inconsistent database.</p>	<p>DBS—Loads/appends/unloads data from/to a table/view. It also processes batch SQL commands.</p>
SPECIAL FEATURES	<p>MONITOR—The interactive terminal monitor provides for the building, modifying, saving, and executing of QUEL commands. It includes a parameterized macro facility.</p> <p>The following special facilities will be available by January 1982:</p> <ul style="list-style-type: none"> a. Report Writer (August 1981) b. Forms Generation Package (October 1981) c. Full screen query update forms facility (October 1981) d. Statistical Subsystem e. Graphics Package 	<p>Text-Formatting-Utility (FMT)—Creates a formatted output file from a text input file with special formatting commands. May be used with RPT or as a standalone word processing utility.</p> <p>Report-Writer-Utility (RPT)—Used with FMT (above) to interpret and execute report generation programs.</p> <p>Interactive Application Facility (IAF)—An on-line interactive facility to generate full screen applications using VT100 terminals for query, update.</p> <p>User-Friendly Interface (UFI)—This facility provides for the building and execution of SEQUEL 2 command files and it performs some terminal output formatting.</p> <p>An application program may have up to 255 databases open at one time.</p> <p>Version 3 of ORACLE will be completely compatible with SQL/DS in that application programs written for SQL/DS will be immediately operational (after reloading) on an ORACLE database. Plans are to include all SQL/DS facilities in ORACLE.</p>	<p>Interactive SQL Facility (ISQL)—A terminal control facility which provides for display control, elementary report writing, saving, and running SQL commands and routines, canceling commands and extracting data from DL/1 databases.</p> <p>Extract Facility—This facility uses ISQL Commands to copy data from a DL/1 DOS/VS database into a SQL/DS database under the same VSE operating system. Extracts are queued for later execution and go into previously defined tables.</p> <p>Preprocessor (PREP)—A host language precompiler described in the article.</p>



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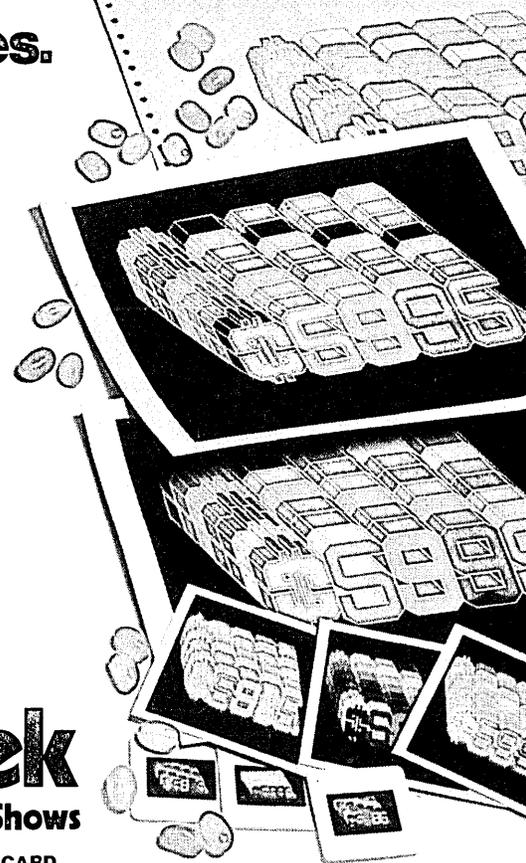
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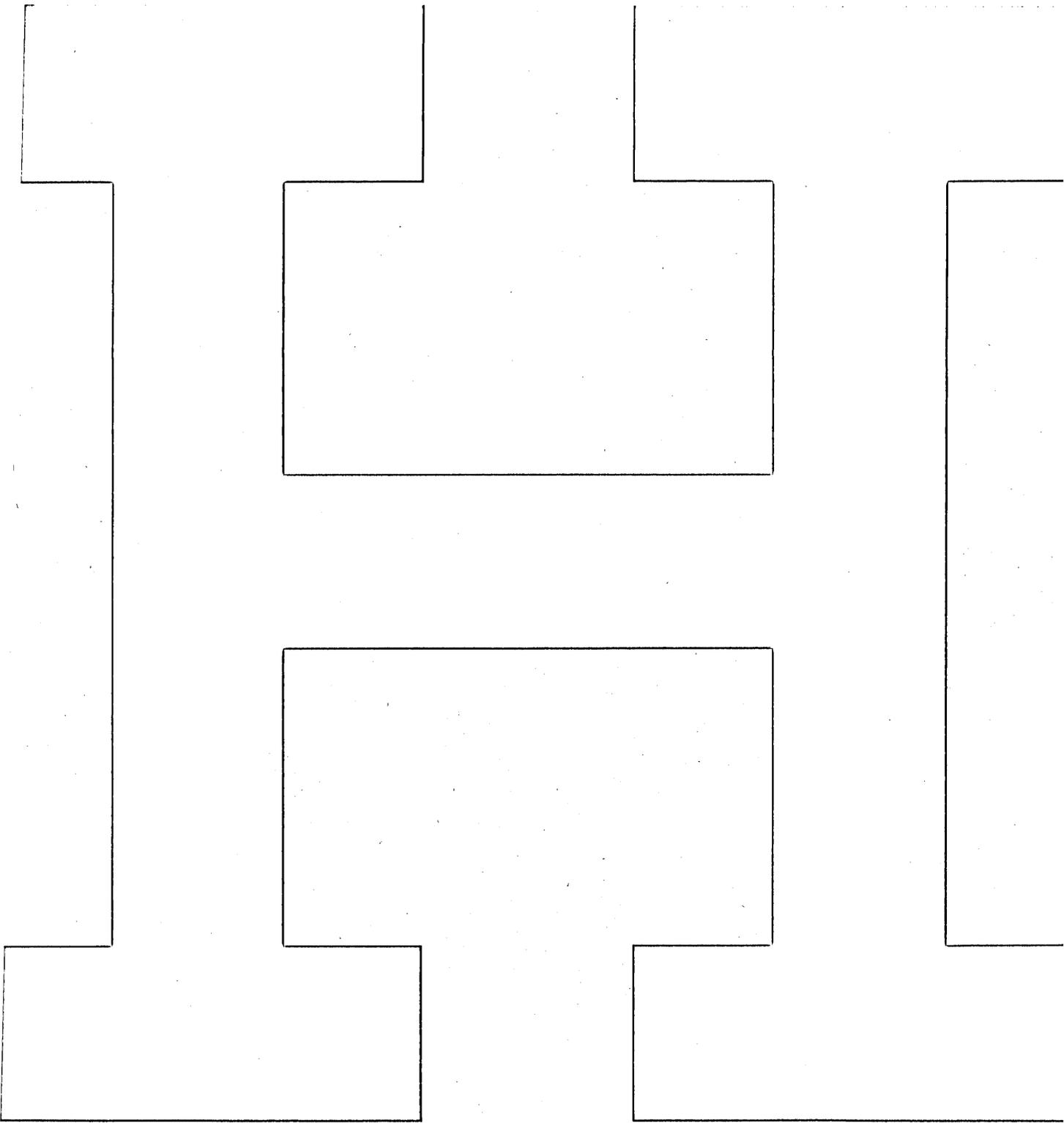
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RELATIONAL COMPARISONS

	INGRES	ORACLE	SQL/DS
SECURITY	<p>The user who defines a table or a higher authority (see below) may use the DEFINE PERMIT command to authorize retrieve, replace, delete, or append privileges to other users (defined by their log-in name) at the column or table level or at any level that can be specified using the WHERE clause, but not at the view level. Logical terminals and time/day may also be specified.</p> <p>There is a hierarchy of authority recognized by INGRES, with a System Administrator (Super User) at the top of all databases, a Data Base Administrator in charge of each database, and then the table creator at the lowest level.</p>	<p>The user who defines a table may use the GRANT command to authorize table modification and read, insert, update, and delete privileges to other users at the column or table level, at the view level for READ, and at the column level for UPDATE. The REVOKE command removes these privileges.</p> <p>The DEFINE USER command admits users to a database who supply the correct user name and password. This command may be issued only by the user who defines the database, and it does not authorize any of the privileges of the GRANT command. The password may be changed using the PASSWORD command.</p>	<p>The user who defines a table or the DBA may use the GRANT command to authorize table modification, further GRANT authority, and read, insert, update, and delete privileges to other users at the column, table, or view level. The REVOKE command removes these privileges.</p> <p>Note that only the table/view creator or a user with DBA authority (see below) can DROP a table/view.</p> <p>The GRANT command may also be used to authorize RUN privileges on programs.</p> <p>There are three other privileges that may be authorized with the GRANT command. These are:</p> <p>DBA Authority—the highest authority</p> <p>RESOURCE Authority—authority to allocate resources such as CREATE TABLE and ACQUIRE DBSPACE. DBSPACE may be public or private; the latter restricts user access.</p> <p>CONNECT Authority—Authority to use ISQL, to use the DBS utility, and to preprocess and run SQL/DS programs.</p>
DATA DICTIONARY	<p>This consists of several relations that describe a database. They are part of the database and may be accessed just like any of the other database relations. The data dictionary will be extended in Version 2.0 to include users and passwords.</p>	<p>ORACLE provides a data dictionary with information on tables, columns, users, passwords, and other database characteristics. It may be accessed just like any other ORACLE database. In fact, ORACLE is recursive as regards dictionary access, thereby eliminating the need for any special dictionary access software. This is stored as part of the user database. There is also a system directory database called ORACLE, which stores information about databases and is always established at installation time.</p>	<p>The SQL/DS Catalogs form an active dictionary facility stored with the database which reflects data definition and access information. It may be accessed and updated by users with proper authority just like any other SQL/DS tables. The dictionary also provides for a synonym-handling capability for simplifying the use of SQL commands.</p>



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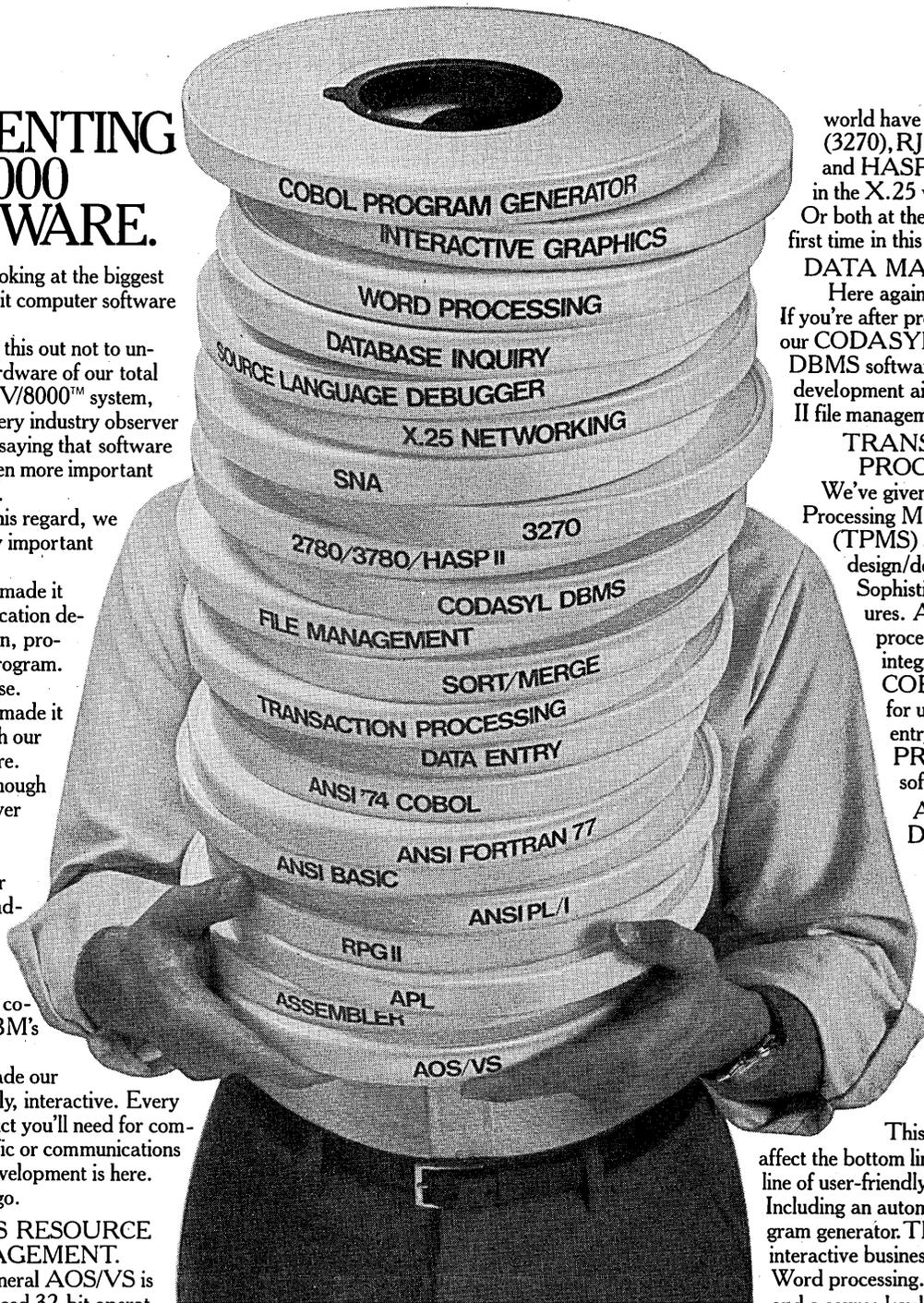
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Fifty companies currently offer a total of 54 database management systems.

THE DBMS MARKET IS BOOMING

**by Peter Krass
and Hesh Wiener**

DBMS vendors and users alike agree that the market for the systems is going to take off during the 1980s.

Edward Cherlin, for instance, expects the DBMS market to grow at a compounded 30% right through 1989. Cherlin is a senior analyst at Strategic, Inc., the San Jose, Calif., market research organization. He puts the current market at something like \$500 million a year. By the end of the decade, he figures, the total expenditures on software plus hardware (which means database engines, not the mainframes they hang on) will be in the neighborhood of \$4 billion. He believes that the database machine portion of that total will be \$1.2 billion.

Slightly less optimistic figures were developed by New York's Frost & Sullivan. F&S predicts that, excluding hardware, the DBMS market will take another three years to reach the half-billion mark, and that it should hit \$1.8 billion by the end of the decade—a 25% to 35% annual rate of growth. When F&S researchers asked vendors and users to guess at the market's potential, they got growth estimates running from 18% all the way to 45% per year from vendors; users believed that growth would be a more modest 10% to 20%.

In looking at the market, F&S believes that a distinction must be made between vendors of software alone and companies that provide both systems and DBMS software. The captive DBMS products run, naturally enough, only on vendor machines and plug-compatible units; independent software houses generally offer their packages in versions for more than one type of computer.

In 1979, F&S found, captive DBMS accounted for \$61.6 million in sales, or about 45% of all DBMS sales the research house

recorded. Independents did \$75.4 million in business, 55% of the total. But currently, says F&S, rapid growth in the acceptance of DBMS packages from the computer manufacturers has put the captive market ahead of the independent market in terms of revenue shares. By 1983, F&S calculates, the market, which will be above \$410 million, will be 70% captive (or about \$290 million) and 30% independent (\$125 million). The shift will continue, F&S asserts.

The key vendors, by sales, are IBM, Cincom, Cullinane, Intel, Software AG, and Infodata. They had 80% of the market in 1979, or a combined sales value of about \$110 million. IBM's two most popular products, IMS and DL/1, rang up sales of \$49 million; Cincom's Total brought in \$30 million; Cullinane's IDMS accounted for \$13.9 million; Intel's System 2000, \$10 million; Software AG's Adabas, \$8 million; and Infodata's Inquire, \$3.5 million.

Ranking by installations comes out differently, because pricing of various packages runs over a considerable range. Of some 11,000 systems F&S says were installed by the end of 1979, Cincom accounted for 2,700 sites. The two IBM products combined for a total of 2,100 users; Software AG had 375 sites and Intel's System 2000 was used by 280 shops.

*

The following is a complete list of DBMS vendors and their software products, arranged alphabetically by vendor name. The DBMS system appears after the vendor's name and access information. The list includes a description of the product, the hardware and operating systems required, prices, and the estimated number of users.

Much of the list is from Datapro's report on Data Management, #D30-100, dated January 1981, and is used with the permission of Datapro Research Corp., Delran, NJ 08075.

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DBMS 2 (DATA BASE MANAGER VERSION 2)

DBMS 2, a DBMS for Modular Computer systems, is comprised of a library of FORTRAN subroutines. It maintains and allows access to data records in an ascending sequence by key. It does so by way of random access of data structures stored in disk memory. In order for users to design and operate their own customized reports and applications programs, the system's file structure and record descriptions are relatively simple.

DBMS 2 runs on Modular Computer's MODCOMP II, IN, and Classic systems utilizing the MAX III and IV operating systems. Source languages are FORTRAN and Assembler.

Pricing is based on the user's hardware configuration; ADP says a typical system can be purchased for about \$52,000. First installed in 1978, DBMS 2 now has an estimated five users.

ADMINS, INC.

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ADMINS

ADMINS is an applications development and management system, a productivity tool for business data processing applications. Typically the sole applications tool at a given site, it is designed for file management, report writing, financial analysis, word processing, and relational file operations. To date, over 200 different applications have been implemented on this system.

There are two versions, ADMINS/11 and ADMINS/V32. The former can be used on DEC's PDP-11 minicomputers, while the latter is designed for use on DEC's VAX-11 minis. The choice of operating systems: RSX-11M,

IAS, and VMS. Source languages are FORTRAN and Macro, and there is a minimum hardware memory requirement of 128K bytes.

Pricing is based on the cpu that is used. Two typical prices have been provided by the vendor: on a VAX-11/780, the system costs \$75,000, and has a \$7,500 yearly maintenance fee; on a PDP-11/44, the cost is \$50,000, with a \$5,000 yearly fee for maintenance.

ADMINS was first installed in October 1974. Today, there are about 100 users, 75 on PDP-11s and 25 on VAX machines. The vendor expects that to flip-flop within the next few years, as the PDP series ages.

ADVANCED DATA MANAGEMENT

15-17 Main St., P.O. Box 601
Kingston, NJ 08528
(609) 799-4600

DRS

Advanced Data Management's DRS database management system comes in three versions: DRS/11 for DEC's VAX and PDP-11/23 minicomputers; DRS/90 for use with Sperry Univac's 90/60, 90/70, and 90/80 computer systems; and DRS/6000 for use on CDC's 6000, 7000, and Cyber computer systems.

DRS is an interactive system that provides data retrieval, ordering, reporting, and updating. System features include multiple search strategies and text manipulation and search. Options include a database graphics output function, called PLOT, and an interactive report writer, called RPW.

System costs and the number of current users are unavailable.

AMCOR COMPUTER CORP.

1900 Plantside Drive
Louisville, KY 40299
(502) 491-9820

AMBASE

AMBASE is a data-independent DBMS for use with DEC's PDP-11 minicomputers. The system features centrally located data definitions, called schema; this allows applications programs to be developed and modified without redefining or changing data files.

Features include control of order of data entry, password security, and a multiuser environment protocol. The number of simultaneous users is dependent only on the limitations of the hardware used. In addition, the vendor says, any record can be accessed in no more than four seeks.

AMBASE can be used on any PDP-11 mini with at least 128K bytes of memory and running on the RSTS/E operating system. Two source languages are used, BASIC Plus and BASIC Plus II. AMBASE has a purchase price of \$17,500, which includes the cost of one year of maintenance. First installed in January 1979, the system is now used at an estimated 15 computer sites.

APPLIED DATA RESEARCH

Datacom Division
8515 Greenville Ave., Suite 101
Dallas, TX 75243
(214) 349-1101

DATAKOM/DB

DATAKOM/DB is a relational database for large

IBM computer systems; it uses an inverted file structure. The system has been designed as an aid in the definition, development, implementation, processing, and maintenance of both batch and on-line database operations.

Both random and sequential accessing of data are supported by multiple keys or search arguments. Application programs, written in ALC, COBOL, or any language supporting a CALL facility, are independent of logical or physical data storage, as data access is at the element, rather than record, level.

Included in the system is a full set of utility programs to define, establish, and maintain the database. Other features include new data storage techniques that allow broad options for record size and space management, support for all available disk storage devices, and support of the user's compression or encryption routines. Options include the DATAQUERY query language, which operates on-line with the DATAKOM/DC data communications system.

DATAKOM/DB can be used on IBM's 360, 370, and 303X systems running the DOS, DOS/VS, OS, and OS/VS operating systems. For the DOS environment, DATAKOM/DB has a purchase price of \$43,000; the OS package can be purchased for \$52,000. Both prices include maintenance and five days of training. Multi-site, multiproduct, and payout lease terms are also available from the vendor.

To date, there are an estimated 350 users of DATAKOM/DB.

BANGOHIO CORP.

770 West Broad St.
Columbus, OH 43265
(614) 463-8357

DIRECT

DIRECT is a procedural database manager for Honeywell's 600, 6000, and 66 systems. It provides multiple random retrieval keys, random retrieval using partial key values, sequential retrieval, duplicate keys with facilities to handle them, variable-length records, multiuser access, and support of the user's COBOL applications programs. User training is said to take less than one day.

DIRECT can be used on Honeywell configurations running on the GCOS operating system. It has a purchase price of \$14,400; rental runs at \$480 a month. To date, there are an estimated seven users.

BURROUGHS CORP.

Burroughs Place
Detroit, MI 48232
(313) 972-8068

DMS II (Data Management System II)

Designed for use with Burroughs' own computer systems, DMS II is comprised of a COBOL (RPG on the B 1700 and 1800 computers) interface and a data and structure definition language called DASDL. The latter provides logical descriptions of data sets and subsets as well as mapping of data onto physical structures. Several retrieval methods, including indexed sequential and bit vectors, are supported.

Data may be structured in links, hierarchical structures, network structures, or ring structures. In addition, two members in a

set can be related to one another in one of five different ways: unprotected links, verified links, self-correcting links, symbolic links, and counted links.

Interfaces are provided to COBOL, ALGOL, PL/1, and RPG user languages. DMS II also prevents simultaneous updating of a record when multiple programs are accessing the database.

DMS II can be used on the following Burroughs machines: B 1700/1800, B 2800, B 4700/4800, B 6700/6800, and B 7700/7800, all running on the MCP operating system. There is a minimum memory requirement of 180K bytes.

DMS II can be acquired with a single payment, entitling the user to unlimited use of the system. The one-time cost for B 1700/1800 users is \$13,520; for B 2800/3700/3800/4700/4800 users it is \$16,880; and for B 6700/6800/7700/7800 users it is \$26,980.

In addition, DMS II carries an annual maintenance fee as follows: \$1,352 for B 1700/1800 users; \$1,688 for B 2800/3700/3800/4700/4800 users; and \$2,698 for B 6700/7700/7800 users.

There are currently an estimated 70 users of this DBMS.

CENTURY ANALYSIS, INC.

114 Center Ave.
Pachero, CA 94553
(415) 680-7800

PLUS/4

This DBMS is designed to be used with NCR computer systems. It is a multithreaded system that supports both random and generic retrieval of data. It can be used without reformatting existing files. PLUS/4 is comprised of five subsystems: an index subsystem, a library retrieval subsystem, a data movement subsystem, a file access subsystem, and a utility subsystem.

PLUS/4 can be used with NCR's computer systems from the Model 101 up, running under the B1, B2, B3, and B4, and VRX operating systems and with at least 64K bytes of memory. Source language for the DBMS is NEAT/3.

PLUS/4 can be purchased for \$11,000; this price includes one year of maintenance and training for two people. After the first year, maintenance is billed at \$90 per month.

The number of users is unavailable.

CINGOM SYSTEMS

2300 Montana Ave.
Cincinnati, OH 45211
(513) 662-2300

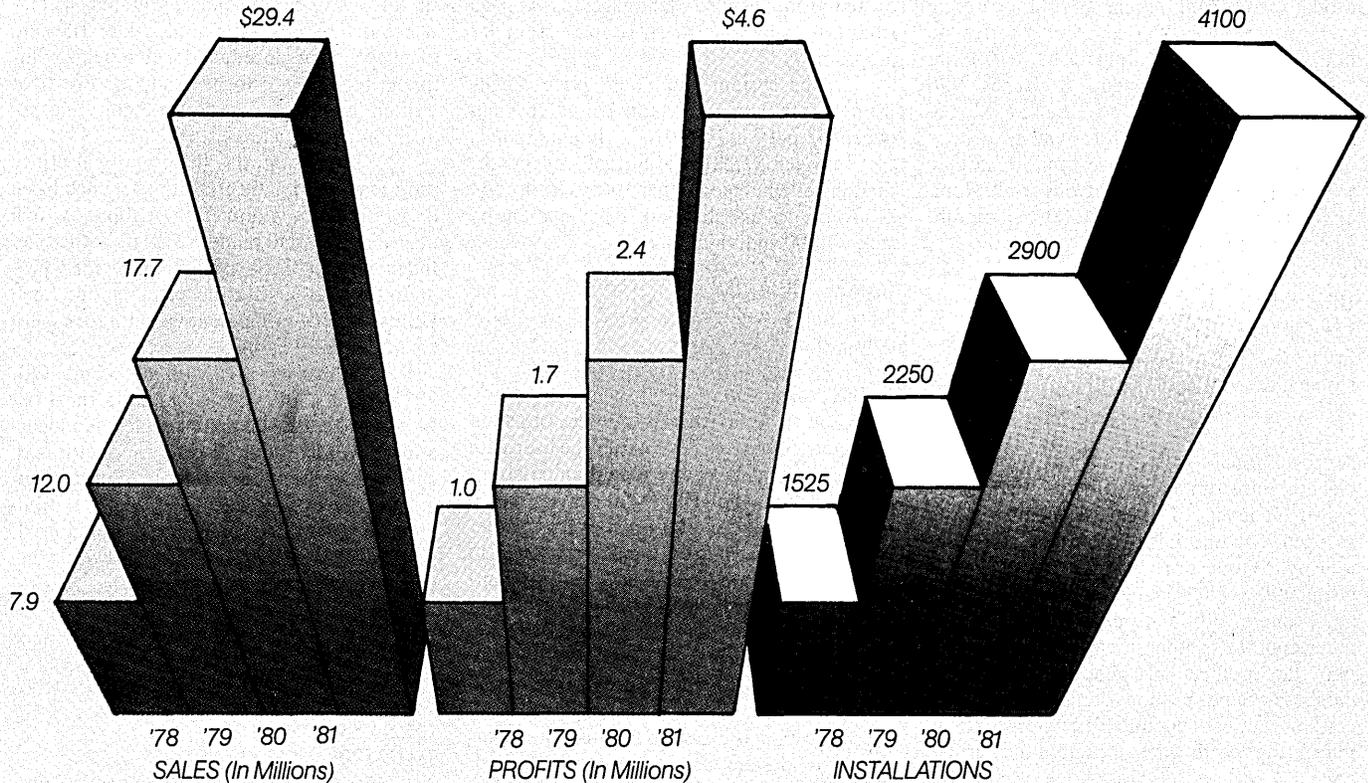
TOTAL

TOTAL is designed for use on computer systems from IBM, Honeywell, Sperry Univac, CDC, DEC, Harris, Varian, and Interdata. It provides facilities for generation of a complete database that permits automatic cross-referencing among data records.

TOTAL is composed of three phases: 1) generating programs that control the database structure; 2) preformatting the disk areas; and 3) controlling the access to the database.

The system permits the establishment of two types of records: single-entry, or master, records, and variable-entry records. Re-

BENEFIT FROM OUR GROWTH.



We're pleased to report that Cullinane Database Systems, Inc. has had another outstanding year. The financial results include a 66% increase in revenue to \$29,351,000 and an 89% increase in profits to \$4,544,000. The number of product installations worldwide grew from 2900 in 1980 to 4100 for 1981.

Our financial success benefits every Cullinane software user. We invest 11% of our revenue into research and development. This commitment helped make our Integrated Database Management System (IDMS) the most powerful DBMS in the world. IDMS is the dictionary-driven DBMS that installs quickly, is easily understood by non-DP management and greatly increases your DP staff's productivity.

Our financial resources and manpower helped us to acquire and introduce this year our first application product—the Customer Information System (CIS). CIS is the first banking system designed expressly for bankers. It puts vital information about bank customers at the fingertips of management and marketing.

In addition, we acquired a comprehensive manufacturing system called the Cullinane Integrated Manufacturing System. CIMS allows manufacturing managers to take control by giving them a tool for more efficient production, inventory and financial management.

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Mail to: Rosalie Cope, Cullinane Database Systems, Inc.
 400 Blue Hill Drive, Westwood, MA 02090
 Phone (617) 329-7700

DM 9/81

Database: Cullinane

CIRCLE 122 ON READER CARD

ardless of the type chosen, records form a file, or data set.

A TOTAL database is made up of multiple data sets. Linkages can exist between any master file and any variable-entry file. Files can be part of more than one database as well. Because it utilizes multiple paths of access by way of a network structure, TOTAL requires less disk storage than many other DBMS systems.

TOTAL can be used with IBM's 360, 370, and System/3 computers running the DOS, DOS/VS, OS, and OS/VS operating systems; with Honeywell's Series 200/2000 running Mod 1 (MSR), Mod 2, and OS/2000 operating systems; on CDC's 3000 and Cyber series; on DEC's PDP-11 minis running the RSX-11D, RSTS/E, and IAS operating systems; on Harris' V70 series; and on Interdata's 7/32 and 8/32 running the OS/32 MT operating system.

Purchase costs range from \$13,500 to \$30,000, depending on hardware used. Rental ranges from \$450 to \$1,000 per month. There are an estimated 611 TOTAL users.

COMPLETE COMPUTER SYSTEMS

159 Gibraltar Rd.
Prudential Business Campus
Horsham, PA 19044
(215) 441-4200

CREATE

A turnkey DBMS, CREATE can be used on Data General minicomputers. It is designed for users of all levels of expertise; beginners are assisted with tutorials. Too, users' responses to English questions trigger the system to write code, which is then accessible via crts and printers. While this code can be tied into other code to become part of a turnkey system, the user can also choose to establish databases, input routines, reports, word processing routines, and other functions without interfering with the programmer-written code.

Other features include the ability to integrate a new file with other CREATE functions, various levels of data security, and multi-indexed sequential files.

CREATE can be used with Data General's Nova 2/10, 3/12, 3/D, and Eclipse systems, with at least 32K bytes of memory. The license fee for CREATE is \$18,000, and includes the cost of maintenance. First installed in 1975, CREATE is now used at an estimated 23 sites.

COMPUTER CORPORATION OF AMERICA

675 Massachusetts Ave.
Cambridge, MA 02139
(617) 491-7400

MODEL 204 DATABASE MANAGEMENT SOFTWARE SYSTEM

Utilizing a proprietary inverted file access method, MODEL 204 DBMS runs on large IBM systems and IBM-compatible machines. It provides users with all the facilities required to perform complete database functions: rapid multikey access, a high degree of data independence, and others. It also features an English-like user language that includes a report generator and a text editor for on-line use. The user language is available for use in either

batch or on-line modes.

MODEL 204 supports data independence. The programmer does not need to know file structures, format, or location of stored data, and fields may be added, deleted, or modified without file reorganization. Up to 999 users can simultaneously access up to 512 files to the field level.

MODEL 204 may be used with IBM's 360, 370, 303X, and 4300 systems, as well as on compatible systems. With IBM machines, OS, OS/VS, and DOS/VS are the required operating systems. At least 250K bytes of memory are required. MODEL 204 files may be accessed from the user language, as well as from COBOL, FORTRAN, PL/1, and Assembler programs.

The system's purchase price ranges from \$60,000 to \$170,000; leases cost between \$2,640 and \$6,970 a month; rentals cost between \$2,316 and \$6,558 per month. First installed in November 1969, MODEL 204 is now used at an estimated 70 installations by some 4,000 individual users.

COMSHARE, INC.

3001 South State St.
Ann Arbor, MI 48106
(313) 994-4800

QUESTOR

Available as a timesharing service, QUESTOR is a relational DBMS. It provides the user with a system for data entry, data manipulation, reporting, and analysis. Data can be entered from either the user's terminal or from a file. Data record keeping is handled by an ADD command, an EDIT command, or a full complement of other data management commands. Analytical capabilities include graphs, histograms, regression, n-way analysis of variance, cross tabulation, factor analysis, cluster analysis, and basic statistics.

Pricing is based on the amount of storage used, the amount of cpu time required, and the amount of log-in time. The vendor was unable to give an estimate of the average monthly or yearly charges. There are an estimated 100 users.

CONDOR COMPUTER CORP.

3989 Research Park Drive
P.O. Box 8318
Ann Arbor, MI 48107
(313) 769-3988

DATABASE MANAGER-1

DBM-1 is designed for use on Cromenco hardware systems. It organizes and processes data while allowing management personnel to display information.

Special programs can be written in FORTRAN, BASIC, COBOL, and other programming languages; by doing so, the user achieves flexibility for providing information to managers at all levels. English-like commands and keywords are used. DBM-1 also includes a text editor for word processing, programming, and other applications.

DBM-1 can be used on Cromenco's System/3 with at least 64K bytes of memory and running on the CDOS operating system. A perpetual lease costs \$10,000. First installed in April 1978, DBM-1 now has an estimated 10 users.

CONSOLIDATED BUSINESS SYSTEMS

P.O. Box 6183
Elmwood Park Station
Omaha, NB 68106
(402) 393-0313

DA1

DA1 is a general-purpose DBMS designed for use on smaller IBM DOS systems. It uses a schema/subschema approach to database control; the system records and files are defined by control cards stored in what is called a Source Statement Library.

Programs run on DA1 access the database request data by way of CALL statements. In this way, application programs specify which database is to be used, which files are to be opened or closed, and which fields within the records are to be read, modified, or written. DA1 supports both random and sequential file structures.

The system has three optional utility programs, used in the transition to a database: the File/Index Formatting Utility, which opens indexes and random disk files; the File/Index Load Utility, a high-speed load program for random disk files; and the File Load Utility, a disk-to-tape copy routing used for backup and reloading.

DA1 can be used with IBM's 360, 370, 303X, and 4300 systems running the DOS, DOS/VS, DOS/VSE, and DOS-replacement operating systems; it can also be used with IBM-compatible hardware systems. Source languages are COBOL and Assembler. A minimum of 18K bytes of memory is required. DA1 was first installed in March 1977. Today it has an estimated 10 users.

CONTROL DATA CORP.

8100 34th Ave. South
Minneapolis, MN 55440
(612) 853-8100

DMS-170

DMS-170 is designed for use on CDC's Cyber 170 computer system; it combines some previously available CDC software modules with new database management abilities, forming a relational DBMS. The system incorporates the CODASYL Database Task Group functions plus some unique extensions. Five access methods are supported: sequential, indexed sequential, direct, actual key, and relative.

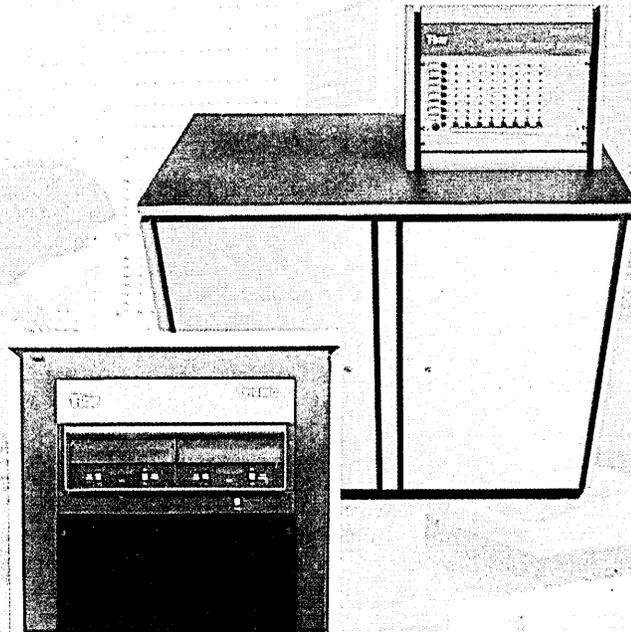
Under DMS-170, relationships among data sets are established according to the relational data module. In other words, records located in different files can be associated through implicit relationships, rather than through predefined hierarchical structures or embedded chains and pointers.

Files can be accessed directly by programs written in COBOL, FORTRAN, ALGOL, Compass, and the Record Manager Sort/Merge program.

DMS-170 can be used on the CDC Cyber 170 running on either the NOS I or NOS/BE1 operating systems. Users are charged for two utilities: the data description language, which permits descriptions to be specified for the schema of the entire database, and which has a license fee of \$4,120 and can be rented for a \$120 initial fee and \$100 a month thereafter; and the database control system, which

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(203) 834-8368

controls all access to the database, and which has a license fee of \$25,730 and can be rented for an installation fee of \$530 plus \$630 per month. To date, there are an estimated 50 installations of DMS-170.

GRI INC.

2570 El Camino Real
Mountain View, CA 94040
(415) 941-4646

CREATE/3000

CREATE/3000 is a relational DBMS that can be used on Hewlett-Packard's 3000 computer series. It provides automatic linking between data located in the file and its name and location. Other features include an English-like query language, a message subsystem to provide system status and error diagnostics, and macro commands that operate on an entire file or set of files.

Other features available include alterable key field values, a dynamically alterable index structure, and conditional data retrieval with expressions.

CREATE/3000 can be used on HP systems running the MPE III operating system, and has SPL as its source language. Library routines may be called from programs in COBOL, BASIC, FORTRAN, and SPL. At least 150K bytes of memory are required.

The purchase price for CREATE/3000, which includes one year of maintenance and complete documentation, is \$10,925. To date, there are an estimated 40 users.

GULLINANE DATABASE SYSTEMS, INC.

400 Blue Hill Drive
Westwood, MA 02090
(617) 329-7700

IDMS

IDMS is designed to be used on IBM hardware, and conforms to the CODASYL Database Task Group Language specifications. It is comprised of a schema data description language, a subschema data description language, a device/medial control language, a data manipulation language, and the DBMS modules. It also includes a data dictionary system.

Special features include path calls, multiple dictionary support, high-speed terminal response time, reentrance, record journaling, concurrent update prevention, and automatic recovery with warm start. That last feature allows, in the event of an individual program failure, unaffected programs to continue normal processing.

IDMS has a teleprocessing monitor, IDMS-DC, that provides a data communications capability to be integrated with the DBMS.

An optional shared database system allows applications programs running on more than one cpu to access and update a shared database. Data integrity is guaranteed; there is also a full recovery capability at each cpu for application program and machine failures.

IDMS can be used on IBM's 360, 370, 303X, and 4300 systems running the OS, DOS, VS(E) counterparts, and VM systems. Source language is Assembler.

IDMS carries a license fee of \$55,000. Options run from \$10,000 for the DMS inter-

face to \$25,000 for the central version. Maintenance is free during the first year of use; after that, the annual fee is equal to 10% of the license fee. First installed in May 1973, IDMS is now installed at over 1,000 sites.

DEDICATED SYSTEMS, INC.

180 North Michigan Ave., Suite 2200
Chicago, IL 60601
(312) 372-4222

DMS/1700

DMS/1700 can be used on Burroughs systems, specifically the B 1700 series. It is compatible with all of Burroughs' software and programming languages that the B 1700 supports. Features of the system include unlimited multiple-keyed files, self-reorganization, optimal data access speed, and compatibility with Burroughs utilities.

DMS/1700 can be used on Burroughs' B 1710 and 1720 computer systems, running on the MCP operating system. Source language can be any Burroughs-supplied compiler language.

Purchase prices are as follows: \$5,000 for single sites, \$25,000 for unlimited use. Documentation and three man-days of training are included at no extra cost. The first DMS/1700 system was installed in July 1975; the number of users is unavailable.

DIGITAL EQUIPMENT CORP.

146 Main St.
Maynard, MA 01754
(617) 897-5111

DBMS-10/20; DBMS-11

DBMS-10/20 supports hierarchical data structures in simple tree format or in more complex network structures on DECsystem-10s and 20s. It provides a high degree of data independence from physical devices as well as from user application programs. Relationships are defined by chained pointers.

The system's features include a database control system that permits concurrent retrievals to the same data areas, a protected update option, privacy of data within the database, and support utilities.

DBMS-11 is an implementation of the CODASYL database language specifications. It provides facilities for programs written in PDP-11 COBOL, FORTRAN, FORTRAN IV-PLUS, and other host languages that support a CALL statement.

The system utilizes the concept of sets. Within a set, one record type functions as the owner, and one or more record types function as members. Within this context, hierarchical, network, partially inverted, indexed, and bill of material databases can be defined.

DBMS-10/20 can be used in the TOPS-10 and 20 systems environments; source language is MACRO. A single use license costs \$30,000. First installed in July 1973, DBMS-10/20 now has an estimated 125 users.

DBMS-11 can be used on DEC's PDP-11 minicomputer series, under the RSX-11M and IAS operating systems. There is a minimum memory requirement of 256K bytes. The license fee is \$16,500. The number of DBMS-11 users is unavailable.

ELS SYSTEMS ENGINEERING

P.O. Box 12415
East Cleveland, OH 44112
(216) 481-1261

PRODUCT 3

PRODUCT 3 can be used on computer systems made by DEC, Perkin-Elmer, and Modular Computer Systems. A general-purpose DBMS, it provides several data management and file access methods specifically designed for both real-time and on-line systems.

The system is comprised of three subsystems: KEYCHAIN, which provides all physical input/output and implements all access methods and basic functions; RECREATION, a series of utility routines used to create, recover, maintain, and analyze the database; and HLGPM, a general-purpose symbolic macro-generator technique that aids in data description and programming.

PRODUCT 3 can be used on DEC's PDP-11 series running on the RSX-11D, RSTS/E, RT-11, and DOS operating systems; Modular Computer's Modcomp IV running on the MAX IV operating system; and Perkin-Elmer's 7/16, 7/32, and 8/32 systems running on the OS-32-MT and OS-16-MT2 (special order) operating systems. There is a minimum memory requirement of 6K words.

A single system end user license is \$1,900 for source locations; oem multiple licenses are \$6,000 for source locations. PRODUCT 3 was first installed in November 1972; today it has an estimated 12 users.

GENERAL ELECTRIC CO.

Research & Development
P.O. Box 9
Schenectady, NY 12301
(518) 385-8409

MADMAN

MADMAN is a multiaccess DBMS for DEC's PDP-11 minicomputer series. It constructs, updates, and accesses databases that contain not only data but also various relations existing among the items of information. This can be carried out on-line, in real-time, and by many simultaneous users. MADMAN contains two languages: a data description and a data manipulation language. The first describes the format of the database and the access privileges given to users; the second allows individual application programs to update and access the database.

Other features include concurrency control to accommodate multiple users, a rollback function, on-line dumping, and system operation measurement facilities.

MADMAN can be used on PDP-11 minis running the RSX-11D operating system and equipped with at least 22K bytes of memory. A perpetual license costs \$20,000 for the first cpu, \$10,000 each for the second and third cpus, and \$7,500 for each subsequent cpu. The number of users is unavailable.

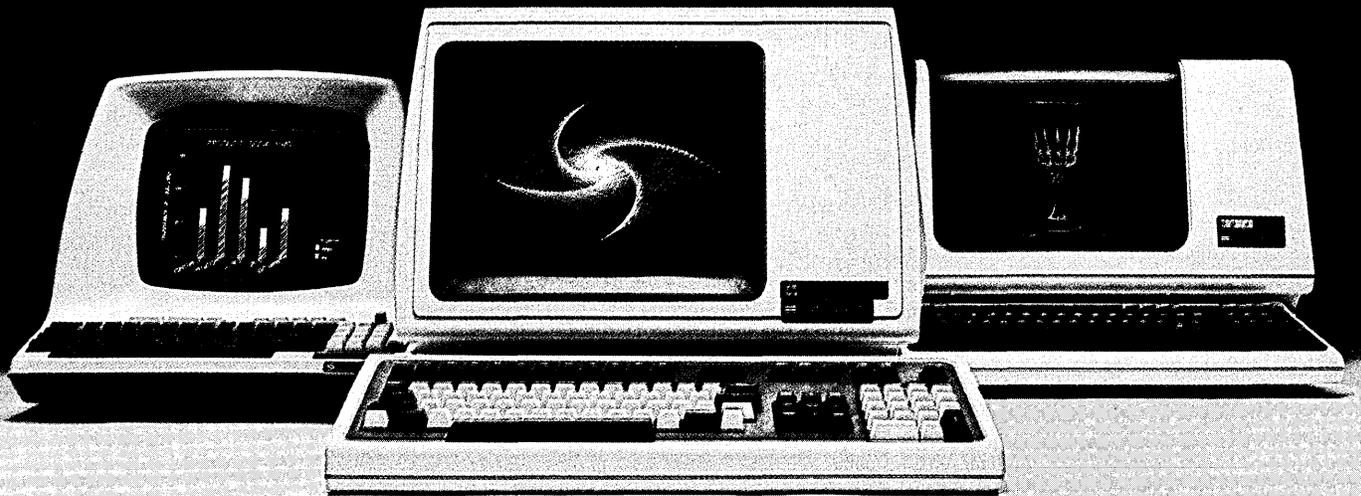
GLOBAL PARAMETERS

1505 Ocean Ave.
Brooklyn, NY 11230
(212) 252-5002

GLOBAL

GLOBAL is a DBMS for microcomputer systems

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CIRCLE 124 ON READER CARD

that are based on either the 8080 or Z80 microprocessors and that run on the CP/M operating system. It can be used for maintenance of lists, comparative analysis, and data file maintenance.

GLOBAL has CBASIC as its source language; it can be linked to programs in most languages commonly used on micro systems. Options include additional modules, such as inventory, order entry, graphics, and a report writer.

Systems utilizing GLOBAL must have at least 40K bytes of memory. The DBMS is available for purchase at \$295. The number of users is unavailable.

GRW SYSTEMS INC.

1274 Geneva Drive
Sunnyvale, CA 94086
(408) 745-7720

MARS (Multiple Access Retrieval System)
MARS is a DBMS for experienced applications programmers who need to create files, describe fields, and write custom programs, all in a hurry. It is comprised of several standard subroutines that allow data manipulation functions without extensive programming. The subroutines allow a program to access several data sets simultaneously; this allows rapid cross-referencing of data.

MARS is designed as the basis for turn-key applications packages, such as general accounting, inventory, and sales projection.

MARS can be used on the BTI 4000 and 5000 series computers. Timesharing is also available. The purchase price, which includes one year of maintenance, is \$5,000. There are now an estimated 30 MARS installations.

HEWLETT-PACKARD CO.

1501 Page Mill Rd.
Palo Alto, CA 94304
(415) 856-1501

IMAGE

IMAGE is a general-purpose DBMS that uses a network structure as its database organization. The system allows data to be related logically between data sites; this minimizes data redundancy and eases the job of information retrieval. IMAGE can operate concurrently in both terminal and batch environments.

The system is comprised of four components: a database definition language, which describes data items, data sets, data set relationships, security and storage requirements; a database management subsystem, which is actually a set of library routines that aids in accessing and maintaining data; database utilities, which are used to create, maintain, and restructure the database, and to back up data; and a database inquiry facility, which allows nonprogrammers to locate, report, and update values within the database by using English-like commands.

IMAGE/3000 can be used on HP's 250, 300, and 3000 systems running on the MPE III, BASIC/250, and AMIGO/300 operating systems. Pricing is defined as part of the fundamental operating software and is included in the system's cost. It now has over 3,000 users.

IMAGE/1000 is designed for use with

HP's 1000 computer series. Its purchase price is \$3,500 or \$2,500, depending on features. IMAGE/45 can be used on HP's System 45 computer systems and has a purchase price of \$5,250. The number of users of IMAGE/1000 and 45 is unavailable.

HONEYWELL INFORMATION SYSTEMS, INC.

200 Smith St.
Waltham, MA 02154
(617) 895-3247

I-D-S/I and II

Integrated Data Store/I is an enhanced version of I-D-S, a DBMS developed by General Electric Co. for describing, creating, and managing a database. It uses a list structure to define master/detail relationships, chaining characteristics of each field.

It uses a set of English-like statements to describe, create, and process the database. Additionally, an I-D-S/COBOL language is supplied by Honeywell for applications program development. This language includes a section containing record and file descriptions, and record relationships.

I-D-S/II supports an integrated database environment with several sophisticated software modules. These include translators for defining the database and media environment and for defining and validating database subsets, run-time database control subroutines, and others. Features include data independence, variety of data structure, interactive access, data security, and hardware independence.

I-D-S/I and II can be used with Honeywell's Series 6000, and 60 Level 66 under the GCOS operating system. Version I comes bundled with hardware systems; version II has a monthly license fee of \$400. There are an estimated 20 users of I-D-S/I and II.

DM-IV (Data Management-IV)

DM-IV is an on-line, integrated DBMS that allows direct data extraction and updating from databases with various file organizations and data structures. It is CODASYL-oriented and includes common data definition languages for describing schema and sub-schema views of integrated and indexed data files.

A DM system is made up of five functional modules: the data manager, the transaction processor, the query reporting processor, the procedural language processor, and a batch interface for COBOL-74.

It can be used on Honeywell's Series 60 Levels 66 and 68 computers running on the GCOS operating system.

A complete system has a monthly license fee of \$2,525. A migration system for users of the vendor's I-D-S/I DBMS costs \$500 per month. There are an estimated 400 users of DM-IV.

IBM CORP.

1133 Westchester Ave.
White Plains, NY 10604
(914) 696-1900

IMS (Information Management System)

IMS is IBM's principal DBMS; it can be used on

the company's 360 and 370 series systems running OS, DOS, OS/VS, and DOS/VS. It is available in several versions, permitting operation in either real or virtual storage and in either batch or on-line environs. IMS allows users to generate and access a database with automatic cross-referencing among data records.

IBM describes the system as an interface between the user's application program and the operating system's data management facilities. The user employs utility programs to describe the data as seen by the system, and the logical data structure as seen by an application.

IMS is a host language system. Application programs access data through Data Language/1 commands.

IMS/VS operates under the OS/VS1 and OS/VS2 operating systems. IMS-2, a similar package, operates under the OS/MFT or OS/MVT systems; with fixed pages, it can run under OS/VS1 or OS/VS2. Both offer on-line message processing and have an optional data communications feature.

A full line of IMS utility programs is provided to describe the database structure, create and reorganize the database, recover and reconstruct data, specify security control, and analyze the system workload.

Both IMS/VS and IMS-2 come in two basic configurations: database system only and database system with data communications. The DB system handles input job streams by batch scheduling, while the DB/DC system schedules work based on input messages.

IBM charges a monthly license fee of \$646 for OS and \$950 for VS. There is a minimum memory requirement of between 24K and 400K bytes, depending on the version used. There are an estimated 1,300 installations.

GIS/2 (Generalized Information System)

GIS/2 is designed to enable non-dp professionals to maintain and extract information from 360 and 370 series databases. It does this by providing them with a high-level language that handles multifile data requests with extensive logic and computational requirements.

Data requests can be entered directly into the computer either on a batch basis or by way of remote terminals. In addition, GIS/2 provides sets of routines that enable the creation, maintenance, and retrieval of data sets.

The basic package has been designed for retrieval functions in batch mode. Eleven options provide for specific output reports, a file modification capability, arithmetic statements, and more.

Users of GIS/2 can describe new and existing files without extensive programming; these file descriptions allow users to address the contents of files via symbolic names.

GIS/2 can be used on IBM's 360 and 370 computer systems equipped with at least 124K bytes of memory, three disk drives, and one tape unit, and running on either OS or VS.

IBM charges a monthly license fee of \$520 for the OS version, and \$907 for the VS

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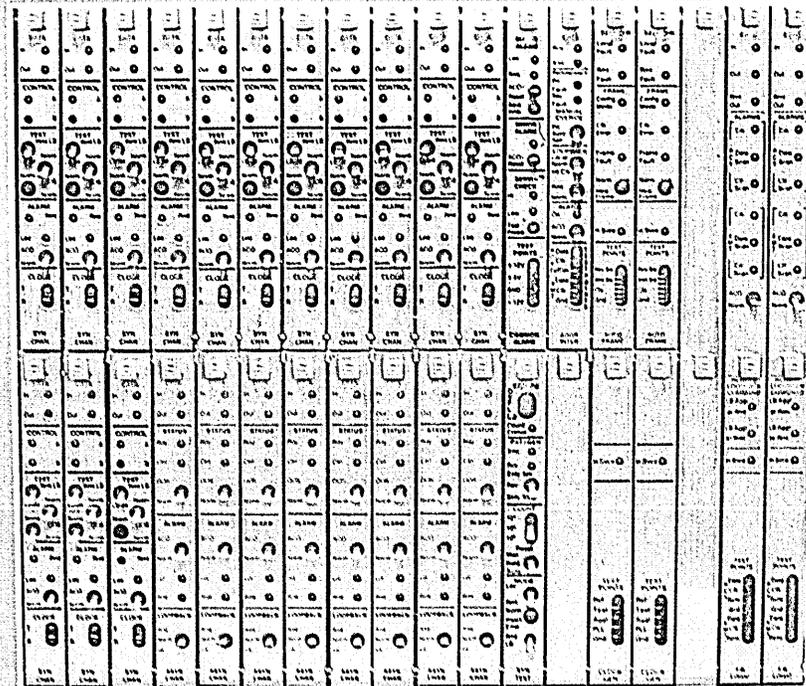
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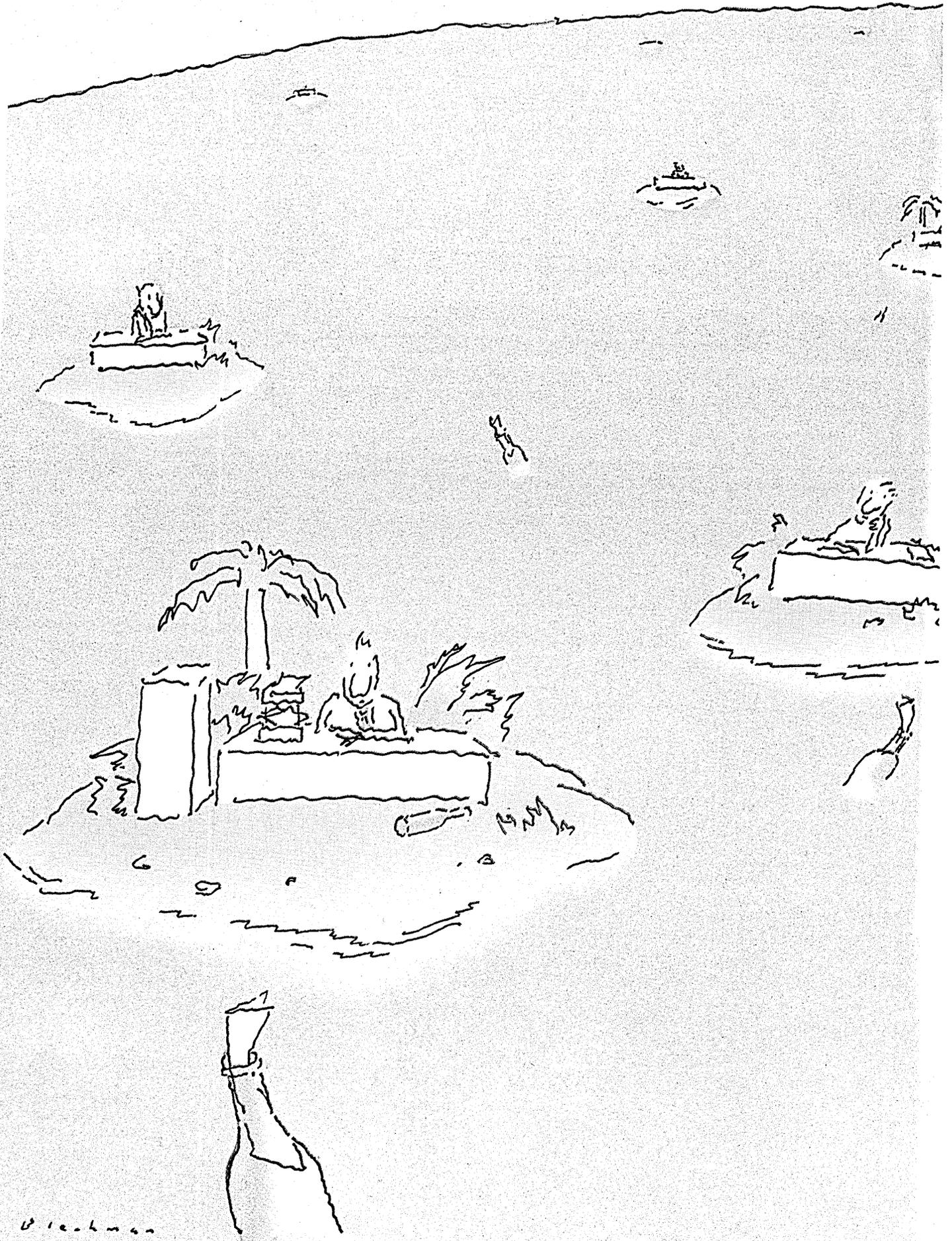


For more information contact the experts at

**General DataComm Industries
(Canada) Ltd.**
104-1220 Innes Road
Ottawa, Ontario K1B 3V3
(613) 745-9174

General DataComm Industries, Inc.
One Kennedy Avenue
Danbury, CT 06810
(203) 797-0711
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General DataComm (UK) Ltd.
Toutley Road
Wokingham, Berkshire
RG11 5QN, England
44 734 791444



W. Leckman

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The IBM logo, consisting of the letters 'IBM' in a bold, sans-serif font with horizontal stripes through the letters.

General Systems Division

CIRCLE 126 ON READER CARD

version. Options include the DL/I query support feature, which has a monthly license fee of \$170, and an advanced query function for VS, which costs \$238 per month. Other options range in cost from \$22 to \$595 per month.

The number of users is unavailable.

DL/I/DOS/VS

Data Language I/DOS/VS is designed to assist users in implementing database processing applications. With it, users can describe database structures, create databases, access and maintain data, reorganize databases, and recover and reconstruct data.

The system acts as an interface between application programs and database management services, independent of storage media programming considerations. The user describes the physical structure of the database and then provides multiple descriptions of the logical data. Two general organizations are permitted: hierarchical sequential, for sequential or index-sequential; and hierarchical direct, for direct or index-direct.

The system has several optional features, including generation of a database log for recovery and buffering capabilities to retain frequently requested data-records.

DL/I/DOS/VS is designed to allow easy upgrade to IBM's IMS/VS. It can be used on IBM's 370 line; such systems need at least 98K bytes of memory and must run on DOS/VS. The system carries a monthly license fee of \$315. There are an estimated 800 DL/I installations.

SQL/DS

The SQL/Data System is a new IBM product, a relational DBMS introduced in January 1981 and slated for first installation in February 1982. SQL (pronounced "sequel") stands for structured query language, although the product is more than a query language.

SQL/DS can be used on IBM's 370 series Models 138, 145, 148, and 158, as well as on its 3031, 3033-S, 4311, 4341, or compatible machines supported by VSE/Advanced Functions Release 3.

To the user, data stored in the SQL/DS database appears as if it is structured in two-dimensional tables. The user does not need to specify how data is stored. Additionally, SQL/DS has an extract function that allows it to copy data from a DL/I database into its tabular form.

One of the more impressive features of SQL/DS is what IBM calls automatic navigation to the target data. This means that the user gains access to data by specifying what data is required, not how to get it. Users don't need to know how data is physically represented; thus, nonprogrammers can use SQL/DS without too much difficulty, and application programmers can concentrate on the essential logic and data requirements of their applications, rather than on the details of data representation.

SQL/DS has been designed for use with intermediate systems using the DOS/VSE System Control Program. As such, it complements both DL/I and CICS.

A basic license for SQL/DS will go for \$300 per month; support for the program will

be priced at about \$105 per month.

INFODATA SYSTEMS, INC.

5205 Leesburg Pike
Falls Church, VA 22041
(800) 336-4939

INQUIRE

INQUIRE is a DBMS for users of large IBM systems. It allows users in batch and teleprocessing environments to create new databases and to query and report from one or more databases without writing programs.

Databases can be created independently. As well, they can be logically related as queries are executed, without fixed or predetermined pointers. Multi-database processing permits searching and reporting on up to 32 databases simultaneously.

An optional text processing feature includes proximity searching, thesaurus browsing, and indexing control over single or multiple databases.

INQUIRE can be used on IBM's 360, 370, and 303X series under the MVS, VS/1, MVT, and VM/CMS operating systems. There is a memory requirement of at least 150K bytes.

Infodata Systems charges \$120,000 for purchase of a full DBMS. Subsets are available starting at \$70,000, and monthly plans are available. First installed in July 1969, INQUIRE is now installed at an estimated 175 sites.

INTEL CORP.

Commercial Systems Division
P.O. Box 9968
12675 Research Blvd.
Austin, TX 78766
(512) 258-5171
SYSTEM 2000/80

A recent version of the old MRI System 2000 DBMS, SYSTEM 2000/80 is a generalized DBMS known for its ability to run on varied hardware systems. The first DBMS successfully installed on an IBM 4341, it supports operating systems on machines made by IBM, Sperry Univac, and CDC.

It can be interfaced with Intel's data dictionary and data communications facility, and allows users to establish an interface with IBM's CICS or SDA's Intercomm telecommunications monitors through its communications interface.

It can also be interfaced with four programming languages—COBOL, FORTRAN, PL/1, and Assembler—as well as with self-contained languages. These include an on-line query/update facility (QUEST) and a report writer.

Pricing for a license is as follows: for CDC's 6000 and Cyber series, the fee is \$70,000 for the database manager alone; for IBM systems running the OS/VS operating system, the cost of the basic product is \$60,000; for use with IBM systems using VM/CMS, the cost is also \$60,000; for use with Univac hardware under OS/1100, the cost is \$70,000. IBM systems need at least 256K bytes of memory; CDC systems need at least 32K bytes; and Univac systems need at least 22K bytes.

There are an estimated 70 users of SYSTEM 2000/80.

INTERNATIONAL DATA BASE SYSTEMS, INC.

2300 Walnut St.
Suite 701
Philadelphia, PA 19103
(215) 568-2424

SEED

SEED is a fully integrated, transportable, CO-DASYL-compliant DBMS for hardware made by IBM, DEC, CDC, and others. In fact, it can run on almost any system that supports FORTRAN. SEED supports hierarchical and network structures, and provides both schema and sub-schema views.

Options include the HARVEST query language, the B 100M report writer, the GARDEN data manipulation language, and the SPROUT transaction processor.

SEED's license fee—depending on hardware configuration—ranges from \$14,000 to \$35,000. It can be used with DEC's DECSYSTEM-10 and 20 and PDP-11 minis running TOPS, RSX, and UNIX operating systems; on IBM's System 370, 303X, and 4300 running on OS, VS, CMS, VM and TSO; on CDC's 6000 and Cyber series running on Scope, NOS, KRONOS, MAX IV; and on Modular Computer's Modcomp IV and Classic systems.

SEED's first installation goes back to February 1977. Today, it is installed at an estimated 70 sites.

LOGICA, INC.

341 Madison Ave.
New York, NY 10017
(212) 599-0828

RAPPORT

RAPPORT is a relational DBMS designed for use on any hardware system that supports FORTRAN and direct-access disk input/output. It has been installed on over 30 different configurations, including hardware systems from IBM, DEC, ICL, Univac, Honeywell, Data General, and Burroughs.

RAPPORT's features include an interactive query language, complete backup and recovery capabilities, multiuser concurrency control, and data security. In addition, its relational structure enables users to design applications requiring complex, one-of-a-kind queries. Data is produced in tabular form.

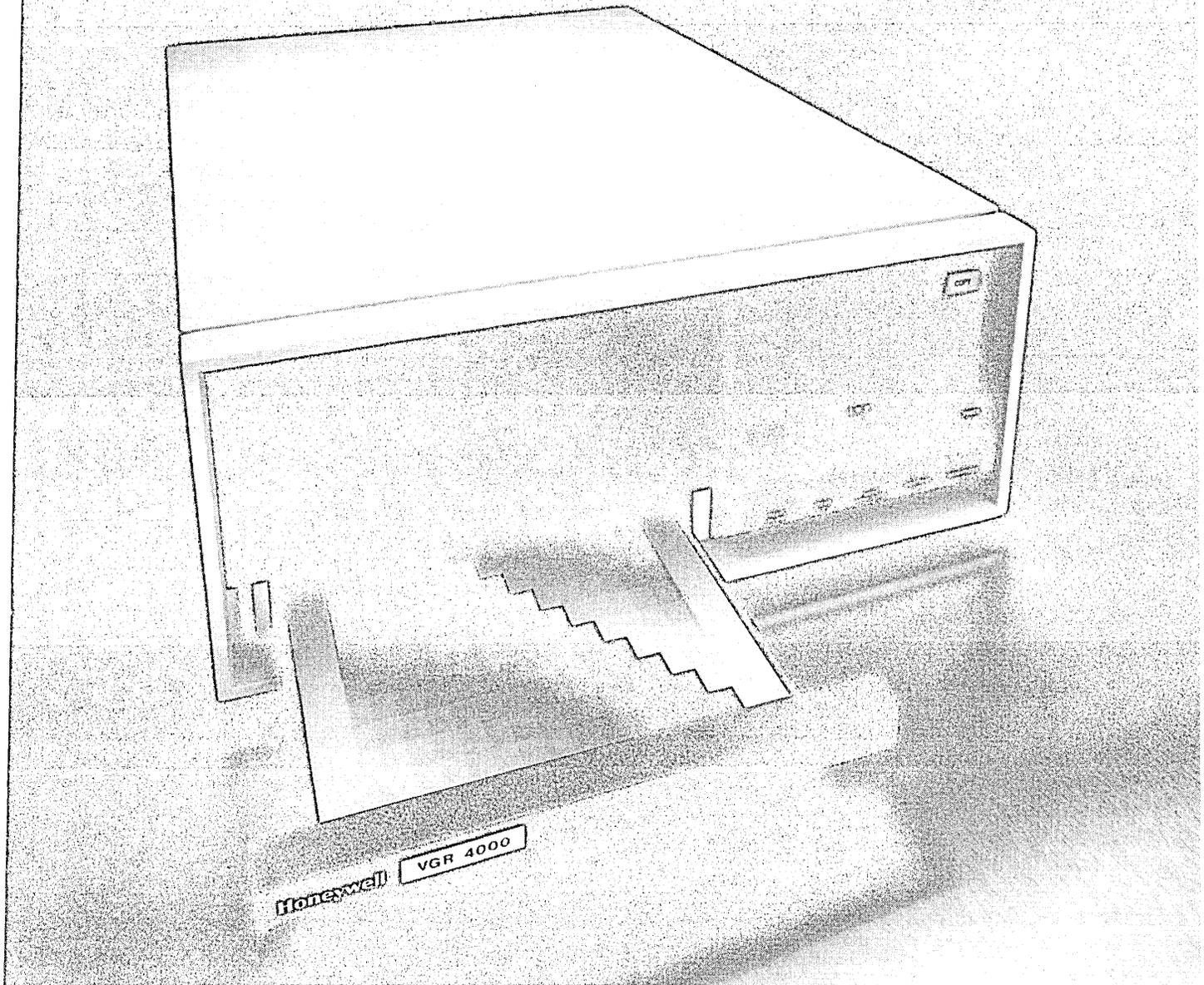
RAPPORT was designed for war game simulation conducted by the British Ministry of Defense. Since then, it has been used for typical business applications; management of data relating to the exploration and production of hydrocarbons is one example.

A RAPPORT license fee runs from \$12,000 to \$44,000, depending on features. This includes one year of maintenance at no extra cost.

A partial listing of the systems on which RAPPORT has been used includes DEC's VAX-11/780 and PDP-11, ICL's 1900 and 2900, IBM's 370 series, Univac's 1100 series, and Data General's Nova and Eclipse machines.

Introduced in the U.S. in 1979, RAPPORT is now installed at 80 sites. It has recently become available to DEC VAX users of the Innovative Analysis timesharing service.

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operation, the compact VGR 4000 can be used on a desk top or rack-mounted, taking up only 7" of front panel space.

Honeywell's VGR 4000 is the latest advance in video-input hard-copy reproduction systems, built by the people with the most fiber-optic CRT recorder experience in the field.

To get the whole story on the VGR 4000 and how it can meet your needs, call Durke Johnson at 303/773-4700. Or write Honeywell Test Instruments Division, Box 5227, Denver, Colorado 80217.

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PHONE (714) 292-1711

CIRCLE 128 ON READER CARD

MATHEMATICA PRODUCTS GROUP, INC.

P.O. Box 2392
Princeton, NJ 08540
(609) 799-2600

RAMIS II

RAMIS II is an information storage and retrieval system used with large IBM systems. It provides for the design and operation of information systems in batch, on-line, and time-sharing environments. It includes DB management functions, an English-language report generator, a run executive that supervises the sequence of activities and makes decisions based on operating sequences, and a host language interface for COBOL, FORTRAN, BAL, and PL/I.

The system is made up of five integrated systems. These handle the database, records management, report generation, programmer interface, and executive functions.

RAMIS II may also be used with other DBMSs such as TOTAL and IMS where records can be passed along for record processing.

RAMIS II can be used on IBM's Model 360, Model 40, and up, and on its 370 series from Model 135 up; required operating systems are DOS, OS, and VS. With the optional TSO function (which incorporates features that give immediate error diagnostics and which simplifies operation of the system), HASP, VM/370, and CP/CMS are acceptable.

The basic package, designed for use in batch mode, carries a \$20,000 license fee; a 36-month lease costs \$840 per month. Interactive RAMIS has a \$32,000 license fee and a \$1,350 per month charge on a 36-month lease. Subsystems can be licensed as well, costing between \$2,000 and \$10,000. They can also be taken on 36-month leases, for between \$50 and \$425 per month.

Introduced in 1969, the system is now installed at an estimated 90 sites and has 500 timesharing users.

MICRO DATA BASE SYSTEMS, INC.

P.O. Box 248
Lafayette, IN 47902
(317) 742-7388

MDBS

MDBS is a full network-oriented DBMS for microcomputers that are based on either the Z80 or 8080 microprocessors and that run on the CP/M operating system. Features include hierarchical and network data structures, fixed and variable length records, and multiple levels of read/write protection.

MDBS also contains a data definition language analyzer/editor which permits users to work interactively with the system to create database specifications. Data management routines perform finding, adding, and deleting of records; fetching and storing of data items; and traversing the data structure.

For 8-bit micros, a complete system costs \$1,500; for 16-bit machines, \$2,000. There are an estimated 700 users of MDBS.

MICROSOFT

10800 NE 8th, Suite 819
Bellevue, WA 98004
(206) 454-1315

MICRO-SEED

An implementation of the SEED DBMS, Micro-SEED is a system for microcomputers that are based on either the 8080 or Z80 microprocessors. The system supports both hierarchical and network data structures, and provides both schema and subschema views.

Micro-SEED is comprised of three parts: a data definition language processor, which checks and compiles a schema table; data manipulation language subroutines, which can be invoked from FORTRAN or Assembler language programs to retrieve and update a database; and the database initialization program, which prepares disks for the loading of the database.

Micro-SEED has a purchase price of \$1,500, which includes three months of maintenance at no extra cost. At least 48K bytes of memory are required, as is some sort of disk storage.

The number of current users is unavailable.

MINI-COMPUTER SYSTEMS, INC.

399 Fairview Park Drive
Elmsford, NY 10523
(914) 592-8812

FACTMATCHER

Factmatcher is an information management system that can be used on Mini-Computer Systems' Micos 200 computer running on the MICOS operating system. It is a turnkey system that incorporates DB management, information retrieval, and text editing in a single, shared-logic system.

Features include a simple query language, a dictionary facility, a word processing function, and a communications facility. The last feature permits text to be transferred, displayed, or printed at any local or remote Factmatcher workstation.

Users need hardware systems with at least 64K to 256K bytes of memory; these systems must be equipped with disk or tape units, printers, and terminals. Source language is Extensive BASIC.

In a configuration that includes both hardware and software, the purchase price is between \$90,000 and \$320,000. The number of users is unavailable.

MINNESOTA DATASYSTEMS, INC.

750 North Arm Drive
Mound, MN 55364
(612) 472-3033

MINDS

MINDS is a DBMS for BTI 4000, 5000, and 8000 computer systems. It generates fixed-field, fixed-record data files. Two input modes are used: a prompt mode, in which all input is preceded by a query, and a transaction mode, in which data in an expected order are separated by an arbitrary delimiter character.

MINDS provides facilities for changing, adjusting, updating, and deleting information, as well as for sorts that are specified by the user, and reports.

There is a minimum memory requirement of 64K bytes. MINDS's purchase price is between \$3,000 and \$5,000, and leases are available. First installed in March 1977, MINDS is now used at an estimated seven sites.

NATIONAL INFORMATION SYSTEMS, INC.

20370 Town Center Lane, Suite 245
Cupertino, CA 95014
(408) 257-7700

DPL (DATA PROCESSING LANGUAGE)

DPL is a DBMS for use with DEC's DECSYSTEM-10 and 20. It features interactive data entry, information retrieval, report generation, updating, sorting, and data validation.

The system processes standard DEC files sequentially or by using one of its built-in indexing methods. Files can contain multiple record types, repeating fields, and fixed or variable length records.

DPL is currently a major product on a timesharing service with over 100 users. Versions for use on systems made by IBM and Sperry Univac, and on DEC's VAX series, are planned. Purchase price is \$38,000; rental comes to \$1,875 per month. Lease options, as well as education discounts, are available from the vendor.

NATIONAL TECHNICAL INFORMATION SERVICE

Computer Products Support Group
5285 Port Royal Rd.
Springfield, VA 22161
(703) 487-4763

MIDMS (MACHINE INDEPENDENT DATA MANAGEMENT SYSTEM)

MIDMS is a generalized DBMS developed by the U.S. Defense Intelligence Agency for batch work. It is written almost completely in COBOL and can be classified as a formatted file system. This means it contains variable length records which contain fixed, periodic, and variable data sets.

MIDMS allows users to structure a file, add data to the file, maintain data, retrieve data, and format data into a report. All functions are addressed by way of an easy-to-use language.

MIDMS can be used on IBM hardware systems from the 360 Model 50 up. It carries a sales agreement price of \$540. The number of installations is unavailable.

PRIME COMPUTER INC.

40 Walnut St.
Wellesley Hills, MA 02181
(617) 237-6990

DBMS

An advanced implementation of CODASYL recommendations and specifications, DBMS can be used on all of Prime's computer systems. It is comprised of five functional modules: a data definition language translator, an on-line interactive database administrative command processor, a reentrant data manipulation language command processor, COBOL and FORTRAN IV data definition language translators and preprocessors for translating data manipulation languages into host language constructs.

Prime's DBMS users can describe, create, manipulate, and maintain structured databases for many applications. Data structures can be singular, ordered, tree, hierarchical, network, or cyclical.

DBMS has a purchase price of \$34,000.

Maintenance is an additional \$2,000 per year. In addition, four man-weeks of training are provided free of charge. There are now an estimated 150 users of Prime DBMS.

RELATIONAL SOFTWARE, INC.

3000 Sand Hill Rd.
Menlo Park, CA 94025
(415) 854-7350

ORACLE RELATIONAL DBMS

ORACLE is a relational DBMS for IBM, IBM-compatible, and DEC computer systems. As the relational title implies, the user of ORACLE deals only with flat files—a two-dimensional view of the data. Users are not limited to predefined structures or access paths. The system's relative simplicity allows nonprogrammers to develop ad hoc requests.

ORACLE has been written in the "C" programming language. It contains full data security and complete recovery and backout facilities. Other features include an integrated data dictionary, an interactive applications facility, and an interactive dialog, by which applications are defined.

Applications include automatic generation of correspondence interleaved with data, printed forms, and summary reports.

ORACLE can be used on IBM 370 and compatible computer systems as well as on DEC's PDP minis running the RSX, IAS, UNIX, and DEC VMS operating systems.

For IBM and compatible systems, ORACLE has a purchase price of \$96,000 and a lease price of \$4,000 per month. For DEC minis, the purchase price is \$48,000 and the lease price is \$2,000 per month. There are an estimated 25 users of ORACLE.

RELATIONAL TECHNOLOGY

2855 Telegraph Ave., Suite 515
Berkeley, CA 94705
(415) 845-1700

INGRES (INTERACTIVE GRAPHICS RETRIEVAL SYSTEM)

INGRES is a relational DBMS that began as a prototype at the University of California in Berkeley back in 1974. In a commercial version, it was first installed in beta test sites in December 1980, and in a customer site in March 1981. Now, its vendor will support the system for use on DEC's VAX computer systems running on the VMS operating system.

Users of INGRES access the database by placing query statements directly in application programs. There is no need to memorize subroutines. Application programs can be written in FORTRAN and Pascal; the vendor expects to add this capability in COBOL, BASIC, and PL/1 by the end of 1981. Other features now in the works include a report writer, graphics, statistics, and various interfaces.

INGRES carries a \$30,000 license fee. There is an annual renewal fee of \$3,000, which includes the cost of updated documentation. INGRES has been installed at an estimated 15 sites.

RLG CORP.

1760 Reston Ave.
Reston, VA 22090
(703) 471-6860

UNIBASE

UNIBASE has been designed to be used with DEC's PDP-11 minis running on the UNIX operating system. It is a multiuser, fully inverted DBMS comprised of three subsystems: a query language/report generator, a file management system, and a support utility package.

UNIBASE users can create, organize, maintain, and analyze large databases.

The system uses a query language called UNIBASIC, which is a superset of BASIC. This permits database search, update, and report generation, and can be used in both batch and on-line modes.

The file management system contains a host language interface, providing access to the database from programs in the "C" language and in UNIBASIC.

A perpetual license costs \$25,000 for a single copy. A one-year lease, again for a single copy, costs \$1,000 a month. Discounts on multiple copies are available. For the first year of a perpetual license, and for the duration of the lease, maintenance is free. The number of users is unavailable.

SCIENCE MANAGEMENT CORP.

1011 Route 22, P.O. Box 6800
Bridgewater, NJ 08807
(201) 685-9000

IDOL

IDOL is an on-line applications-oriented DBMS and documentation control system for minicomputers. First developed for use on Basic Four minis, it has since been expanded for use on systems from five other vendors.

An established hierarchy of functions, through which all processing is controlled, is provided by each set of functions having its own selector screen and subselector consisting of processing steps.

Once the required functions are defined, documentation, including report directories, document narratives, file layouts, and data entry dictionaries, can be produced.

IDOL can be used with MAI-Basic Four systems running on the BB III operating systems; on IBM's System/1 running on the RPS operating system; on REXON systems running on the RECAP operating system; on Pertec's Model PCC 2000 system running on the MTX operating system; on the ONYX Model C8002 running on the UNIX operating system; and on Mercator's MBS 3000/4000 systems running on the 4.0.4 operating system.

IDOL carries a license fee of \$4,000 for the first package (either the DBMS or the business BASIC interpreter) and \$1,000 for each package thereafter. The system was first installed in July 1977; it is now handled by some 200 dealers and has been installed at over 600 sites.

SCIENTIFIC INFORMATION RETRIEVAL, INC.

P.O. Box 1404
Evanston, IL 60204
(312) 475-2314

SIR (SCIENTIFIC INFORMATION RETRIEVAL)

SIR is an integrated DBMS for large IBM and CDC computer systems. It supports hierarchi-

cal and network file structures. SIR can establish an interface directly with statistical programs, and then can process data and provide statistical analysis on the information.

Features include data compression, multiple record types, a data definition language, and data editing. The system also provides data security at the item and record levels.

SIR can be used with IBM's 360 and 370 computers equipped with at least 400K bytes of memory and running on the OS or VS operating systems. It can also be used with CDC's 6000 and Cyber series computers with at least 50K octal words of memory and running on all CDC operating systems. SIR is also available from several timesharing services.

On lease, SIR costs \$5,000 a year. First installed in January 1977, SIR now has an estimated 60 users.

SHIPPING RESEARCH SERVICES, INC.

333 Clay St., Suite 2600
Houston, TX 77002
(713) 751-2675

SIBAS

A general-purpose, distributive DBMS, SIBAS can be used on computers from IBM, Sperry Univac, DEC, and CDC. It offers complete separation between data description and data manipulation languages, as well as several access paths to records.

Application programs may be written in FORTRAN, COBOL, ALGOL, SIMULA, PL/1, and Assembler. Application areas include government administration, research, banking, and health services.

Features of the system include a restructuring facility that allows database redefinition and the ability to reflect the data structure as it generally appears to the user.

SIBAS can be used on IBM's 360 and 370 series running on the OS/VS operating system; on Univac's 1100 running on the EXEC 8 operating system; on DEC's DECSYSTEM-10 running on MONITOR; and on CDC's Cyber 70 running on the NOS or NOS/BE operating systems. Minimum memory requirements are 128K bytes for IBM computers, 23K bytes for Univac, 23K bytes for DEC, and 28K bytes for CDC computers.

SIBAS can be purchased for \$40,000. A six-month lease is available for \$1,300 per month. First installed in 1974, SIBAS now has an estimated 40 users.

SOFTWARE AG OF NORTH AMERICA, INC.

11800 Sunrise Valley Drive
Reston, VA 22091
(703) 860-5050

ADABAS (ADAPTABLE DATA BASE SYSTEM)

ADABAS is a popular DBMS with several utility programs used under IBM operating systems. ADABAS-M runs on DEC computer systems.

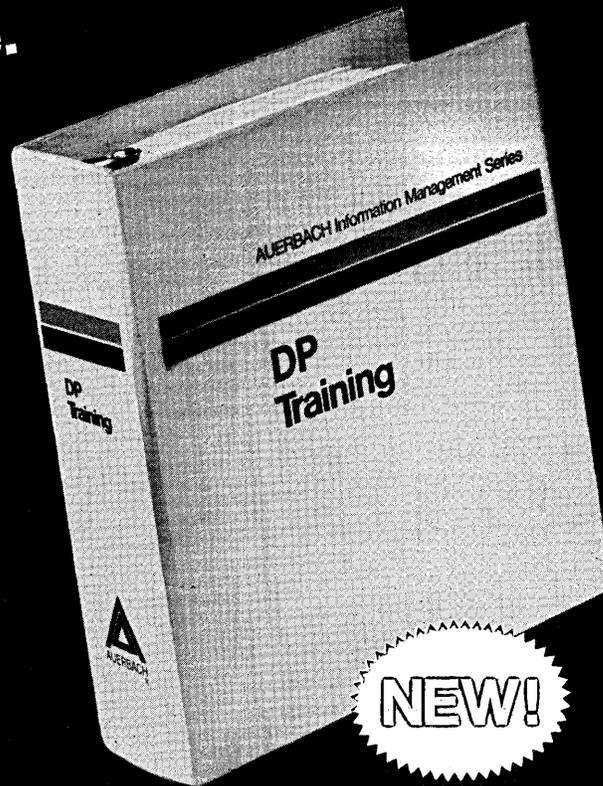
ADABAS operates as a host language system; an English-like query language, ADASCRIP, is supplied, as is a report generator, called ADACOM. The system includes interface modules for other products, such as Com-plete (a teleprocessing system), Intercomm, CICS, TSO, and Task/Master.

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Features include a data compression algorithm, separation of physical data storage from the representation of logical relationships, generation of high-level interface routines for application programs, an integrated data dictionary system, and full restart/recovery capacity.

ADABAS can be used with IBM's 360, 370, 303X, and 4300 systems running DOS, OS, MVS, and VM operating systems, as well as on all IBM-compatible computer systems. Its purchase price begins at \$99,000. ADABAS-M can be used on DEC's PDP-11/34-70 and VAX computer systems; its purchase price is \$40,000.

First installed in July 1972, ADABAS now has an estimated 850 installations. ADABAS-M now has an estimated 25 users.

SOFTWARE HOUSE

1105 Massachusetts Ave.
Cambridge, MA 02138
(617) 661-9440

SYSTEM 1022

A general-purpose DBMS for the DECsystem-10 and 20 computers, System 1022 operates both as a self-contained package and in the host language environment with COBOL, FORTRAN, or Macro interfaces.

Features include a multiple inverted file structure that permits the user to designate inversion on key fields. By linking data sets together across common inverted keys, hierarchies and network structures are supported.

As a self-contained system, System 1022 must be used on computer systems with at least 15K bytes of memory. The system's purchase price is between \$17,000 and \$54,000, depending on the hardware used. Rental, lease, and discount rates are available as well. System 1022 is also available from several timesharing services, including Tymshare, ADP, and CompuServe. Including timesharing customers, there are now an estimated 500 users of System 1022.

SOFTWARE CLEARING HOUSE

6188 Cleve Warsaw
Cleveland, OH 45238
(513) 451-6742

SYSTEM/C

System/C is designed for use on computer systems made by NCR and Criterion. It supports both the 1978 CODASYL Journal of Development standards and the 1980 ANSI revision of those standards.

The system runs in a multithread, reentrant mode. Two levels of record-level lockout, read-only and read-for-update, are provided. The system's compilative nature aids in debugging by handling all error checking, address resolution at compile time.

Options include INFORM, an interactive inquiry tool, and INPUT, a utility for programmer-oriented databases.

System/C can be purchased for \$19,000. A 12-month lease goes for \$795 per month. The system's two options, INFORM and INPUT, cost \$5,000 and \$3,000, respectively.

First installed in December 1978, System/C has an estimated 14 users.

SPERRY UNIVAC DIVISION

Sperry Corp.
P.O. Box 500
Blue Bell, PA 19424
(215) 542-5081

DMS (DATA MANAGEMENT SYSTEM)

DMS can be used on Sperry Univac's 1100 and 90 computer systems. The DBMS is comprised of a data definition language, a data manipulation language, data management routines, and a data management language.

DMS aims to provide data, program, and device independence, to reduce redundant data, to provide equal ease of data using any of several search keys, and to provide the ability to select from and use any of several access techniques to the database.

The database structure is defined by schema, which are created using the description language. After the database is designed, the data administrator commits the design into the data description language. The source images are then processed by the schema processor. Subschemas are produced similarly by using the subschema processor.

With DMS/1100, programmers may freely intermix COBOL, FORTRAN, and PL/1

data manipulation languages with the respective source language statements.

DMS/1000 can be used on Univac's 1100 computer running on the 1100 OS operating system. There is a monthly lease fee of \$750. There are now an estimated 500 users of DMS/1100.

DMS/90 can be used with Univac's Series 90 computers with between 131K and 262K bytes of memory and running on the OS/3 or vs/9 operating systems. It is supplied to Series 90 users without charge. There are an estimated 50 users of DMS/90.

TEXAS INSTRUMENTS

Digital Systems Division
P.O. Box 2909
Austin, TX 78769
(512) 250-7867

DBMS-990

DBMS-990 can be used on TI's DS990 computer systems. It supports commercial database applications and acts as a tool for organizing and centralizing data files.

DBMS-990 utilizes the document concept to allow data access in a format that is commonly associated with business documents. Thus, the user can concentrate on data access requirements instead of on physical access requirements.

The database is thought of as a collection of business documents, such as invoices. Each document is then seen as a logical record divided into lines, groups, and fields.

Under TI's DX10 operating system, DBMS-990 can be used with TI Pascal, COBOL, or FORTRAN applications. Under TI's DNOS operating system, it can be accessed by applications in COBOL and Pascal.

DBMS-990 can be used on TI DS990 models with more than 10 megabytes of disk storage. A minimum of 192K bytes of memory is required for DX10 execution; a minimum of 256K bytes is required for DNOS execution.

The system has a license fee of between \$2,650 and \$3,350, depending on hardware and system features. The number of users is unavailable.

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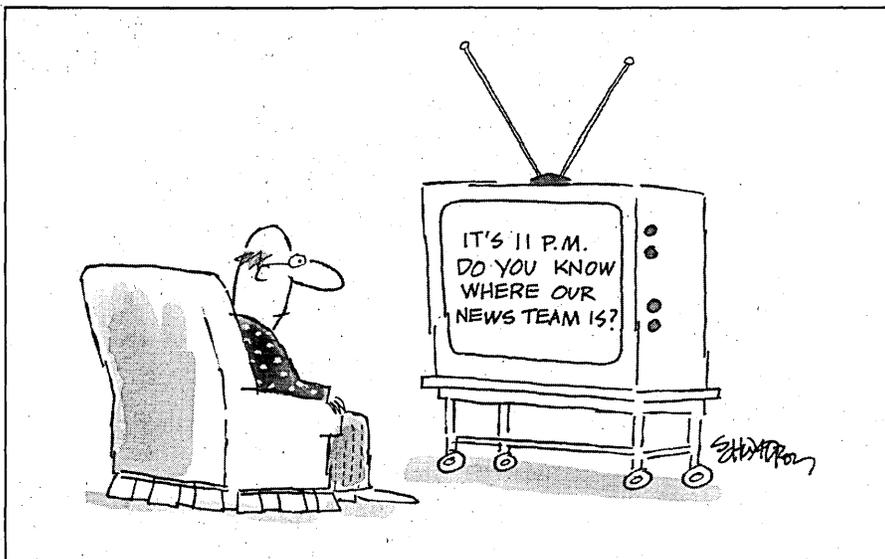
3501 S. Corona St., Suite 5
Englewood, CO 80110
(303) 761-2722

SUPERSETUP

Supersetup is a DBMS for users of Data General computer systems. It has been designed for users without a great deal of dp experience. Both single and multiple databases may be created, and data is maintained through interactive maintenance routines. These are capable of altering the allowed field within the database. In addition, security techniques can limit access to the database.

Supersetup can be used on DG's Nova and Eclipse computers running on the RDOS and AOS operating systems. Nova systems must have at least 64K bytes of memory, and Eclipse systems need at least 256K bytes.

The system has a license fee of \$2,500. First installed in January 1978, it now has an estimated 25 users.



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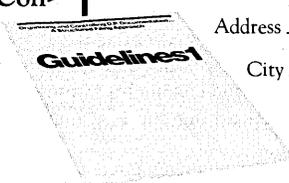
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Using external sources may provide a simple, cost-effective answer for new systems development.

THE HIDDEN COSTS OF IN-HOUSE DEVELOPMENT

by Barry A. Whitesides

"We're going to do it in-house."

Translation: "I can do it cheaper myself." Sometimes that's true, but more often it only appears to be true. The hidden costs of every internal operation are left out of the computation.

When confronted with a \$20,000 estimate for a 450-hour task, a manager may think, "I can get a pretty good programmer for a whole year for \$25,000." And after he finishes this project, he can work on another and be miles ahead. Maybe so. Maybe not.

If you have a small shop, you will most likely turn to a professional recruiter. Larger companies will have personnel departments that will write and place newspaper ads and conduct screening interviews. But whether the money is spent in salaries, ads, relocation expenses, or commissions—you pay it.

To recruit a senior programmer at the \$25,000 level, you can expect to pay 25% of the first year's salary (in this case, \$6,250). And if you are recruiting a real talent, you can expect to replace him in a year or two because there is a shortage of computer expertise. Not only is there a recruitment expense, but it is a recurring expense.

You will also have to pay social security, medical and disability, pensions, education reimbursement, Christmas bonuses, vacation, holidays, and sick leave. The costs vary from company to company, but they account for a significant percentage of total compensation. Benefits may exceed 30% to 40% of base salary.

For our subject, at \$25,000:

Monthly Benefits (estimate)	
Social security (employer's contribution)	\$250+
Medical/disability (employee dependent coverage)	35
Vacation (two weeks)	85
Pension (10% of gross used)	80
Education (reimbursement budget)	200
	<u>50</u>
	\$700 or 34%

Dental, sabbatical, and employee thrift plans, the employee's age and pension plan benefits design, bonus, and profit sharing can have additional impact.

An employee must have a desk or office space. Current commercial rental runs around \$1 per square foot per month (factoring the costs of common facilities, taxes, custodial, and furnishing expenses are additional). Parking facilities or passes are frequently additional expenses as well.

100 sq. ft. at \$1/sq. ft. NNN lease	\$100
taxes, insurance, custodial, maintenance, and repair	30
Parking	<u>N/A</u>
	\$130 a month

Expansion of the programming staff is frequently accompanied by changes in hardware or configuration: conversion, new application, company growth, and the implementation of on-line systems demands both software and hardware resources. The new programmer is therefore usually familiar with the system you had or the system you will have—rarely both. He will require hardware education, application education (what your company does), software education (how to use the new database), and he will have to learn your methodology (or unlearn his old one). One month is probably a minimum estimate of the requirement.

There will probably be course fees from the manufacturer, and your time and other staff members' time will be involved. There may be some productivity that first month, but if they are enrolled in off-site education, there may be no productivity. Course fees (estimated in lieu of internal education estimates): \$1,500.

The dp manager usually assumes that the risks of selecting a software house and selecting an employee are about the same. It isn't necessarily so.

Even after the most careful screening, an employee unqualified or inappropriate for a position is sometimes hired. Because of the long learning curve, it may be 60 to 90 days

before the manager is even aware he has a problem. If an outside firm can't do the job, payments can be withheld, and past payments recovered. If an employee can't do the job, you just write the investment off, start over again, and pay for unemployment claims.

The risk factors are compounded with communication errors, lack of documentation standards, and system scheduling. If the employee works second shift for testing, or is developing applications unfamiliar to his supervisor, detection of problems can be a long time coming.

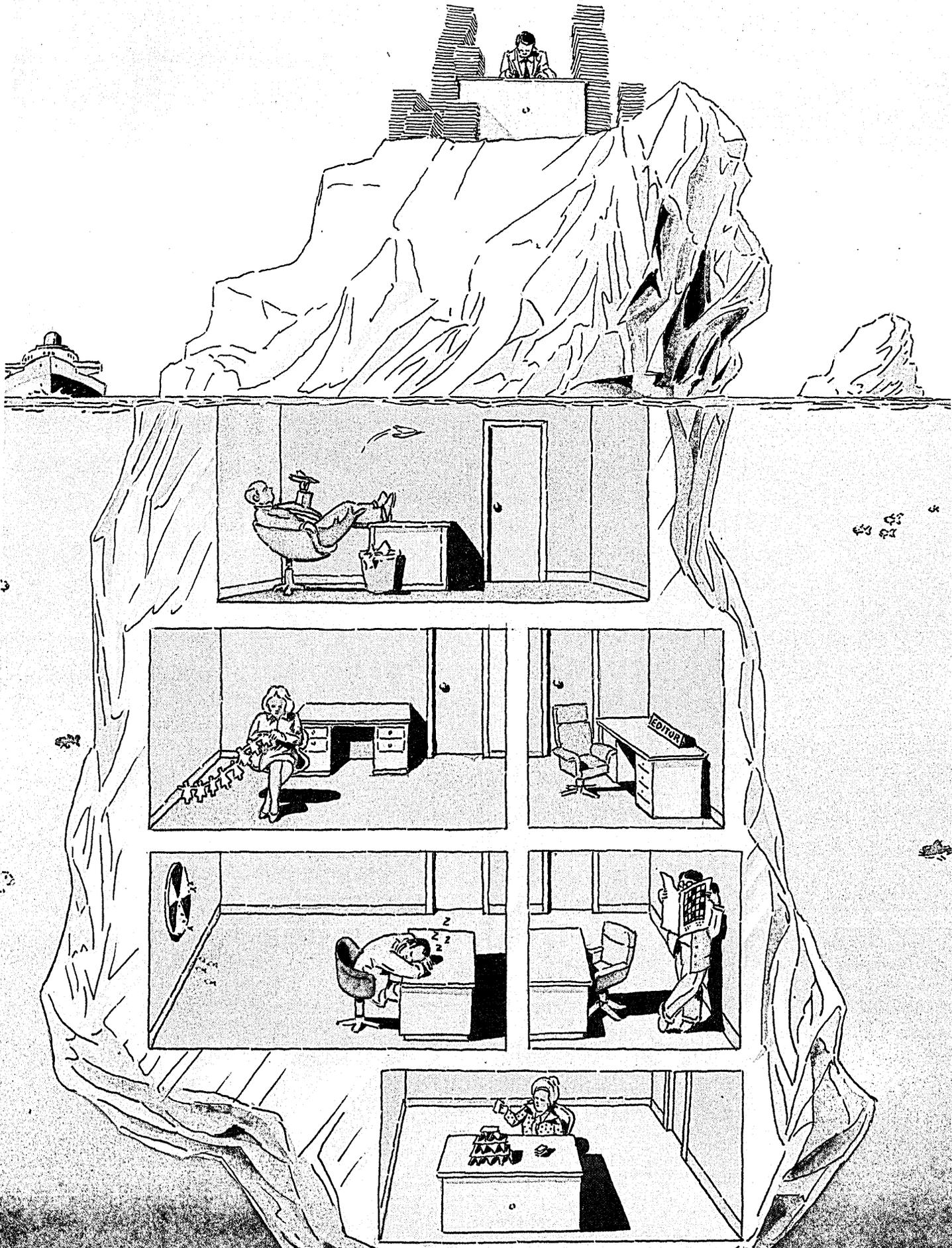
All of these costs are borne by the employer. Assuming conservatively that one in 10 employees doesn't work out, and it takes 90 days to detect, a month to try to correct, and another month to find a replacement (if you can recover the agency commission), we can infer an arbitrary 5% of gross compensation as a budget expense for the "risk" of the wrong man.

There are real cost savings in using an outside vendor. These are usually not considered in the decision of internal versus external development.

A software house can devote more than one programmer to a project; a single employee can only devote himself. A consultant/vendor gets paid at completion, and has an extra incentive to finish and move on. A software house may have utilities or a "skeleton system" which enhance programmer productivity. A software house may have computers available strictly for systems development and testing. Since you are implementing a new application for a reason (cost savings, better control, etc.), there is a real dollar value to an earlier implementation. If there is a projected annual savings of \$24,000, then implementing the solution 60 days earlier is worth \$40,000.

The estimate you received from the software house was expressed in hours and dollars. Most people believe that the hours will hold constant whether the programmer is internal or external. It depends. Software companies direct the use of their own comput-

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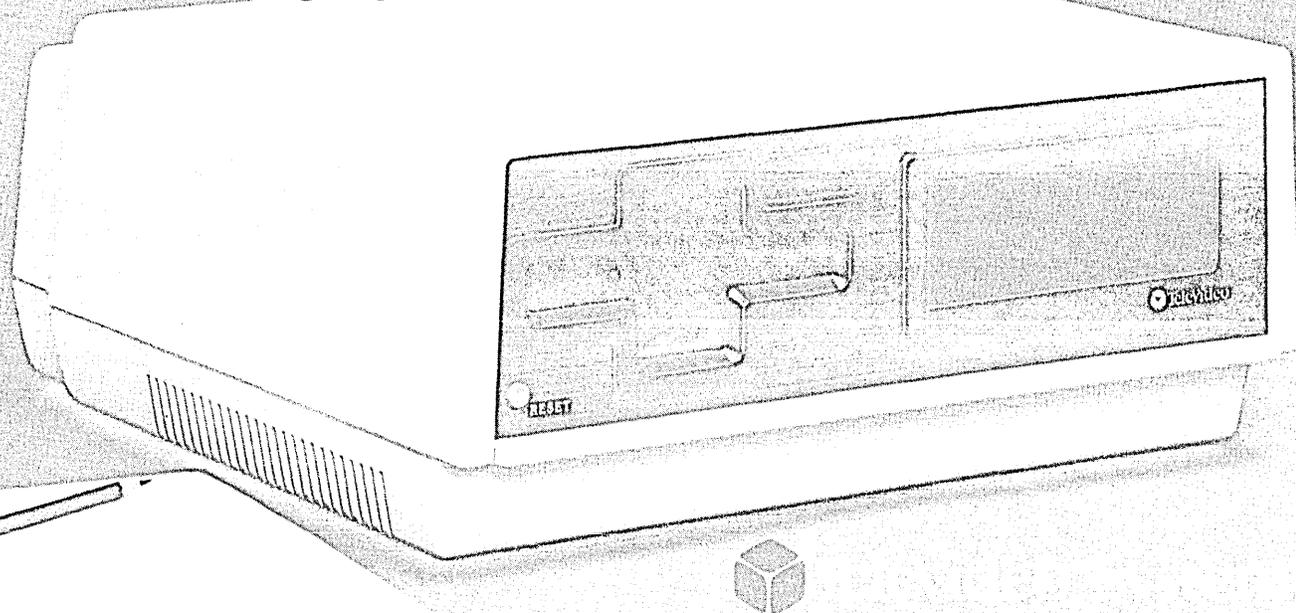
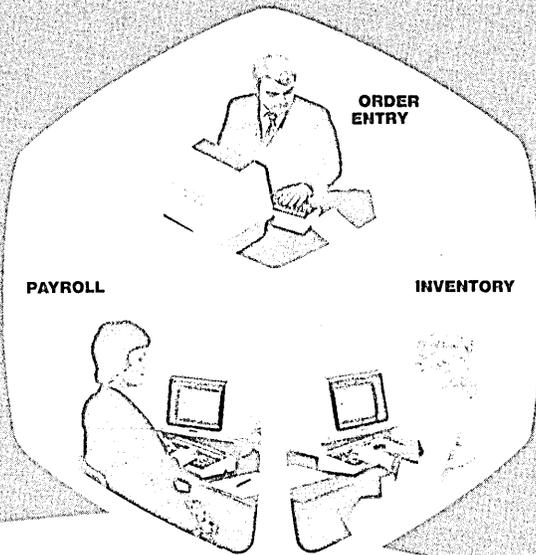
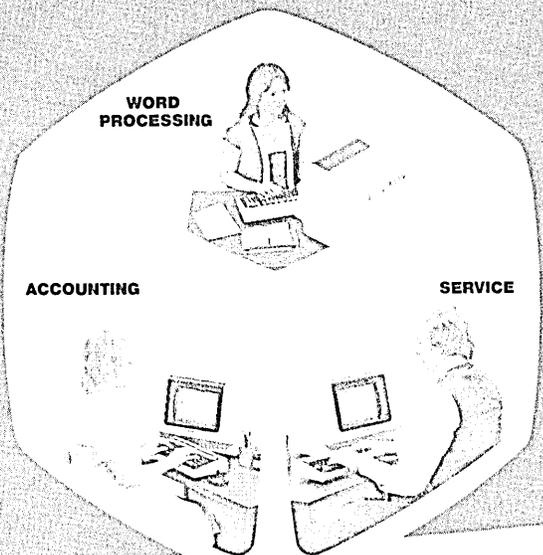
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ers, internal documentation standards, conventions, and utilities to their own profitability. In two words: employee productivity. Test time and programming become production priorities because they generate revenue. Doing it well, doing it right, and finishing it completely are necessary to get new business and to move on to new income. The internal programmer has to buck the production schedule. He "only" has another job to do after this one, and therefore no incentive to work efficiently to get to it. Rarely is day-shift, on-line resource available for new applications development.

The internal programming staff is generally perceived as an "open resource" to the company. Each department head competes for his "share" of the resource, and the integration of these competing priorities is acrimonious at best. A cost can be established (in total) and weighed. The result is a quantifiable priority structure.

Simultaneously, dp is perceived as a cost center but not a profit center. While users are competing for a limited resource, management may work at cross-purposes, trying to restrict the dp budget. This makes it difficult to keep salaries on a par with the marketplace (thereby accelerating turnover), keeping staff size down (thereby extending development lead times), and putting the dp manager under pressure from both sides. By using external development, the dp manager becomes an internal consultant assisting the department heads in defining problems. He screens the software developers and manages the installation. Costs of development, now quantifiable, can be passed on to the departments. Data processing can easily account for the production activity, and is now in a position to measure production efficiency as a profit center.

Since the system is developed externally, the software house is responsible for cross-training support personnel. This represents a cost avoidance to the customer which would otherwise be paid in wages to other staff members.

The use of external sources for system development may provide an extremely cost-effective, simple answer for new systems development. The startup or hire costs for a new employee give a heavy front-end load to the cost of hiring a new programmer for a single application.

Additionally, the case of external developers can bring in a variety of resources and experience levels to address each system individually. When a new employee is hired, he may be an expert on the first system, and a rookie on the next. The software house brings a variety of skills to bear on each problem, and produces significant advantages in management control. *

Barry A. Whitesides, a graduate of Stanford Univ., began his dp career as a system engineer for IBM. He has worked in various technical and representative capacities, and is now with Data Processing Services, Inc., a software consulting firm in Orange, Calif.

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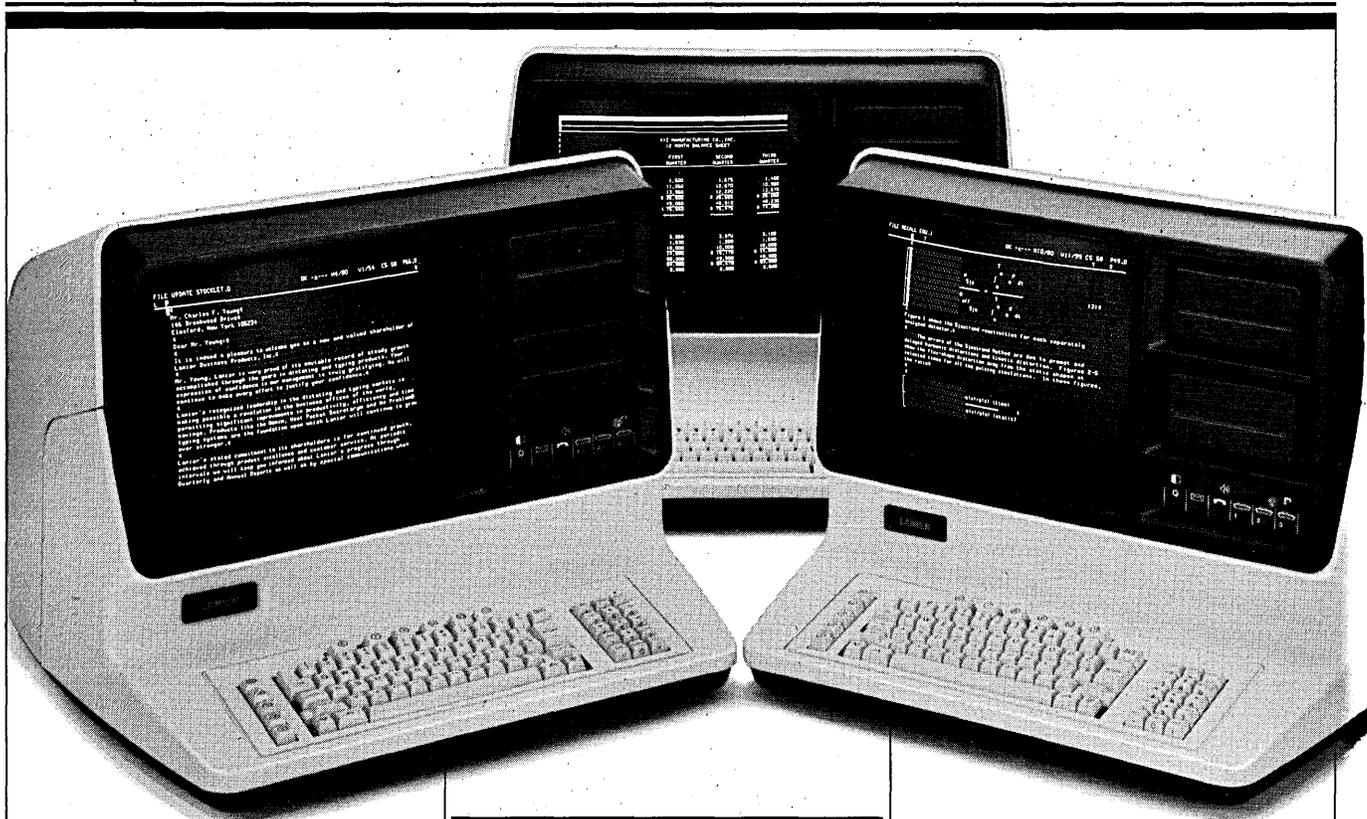
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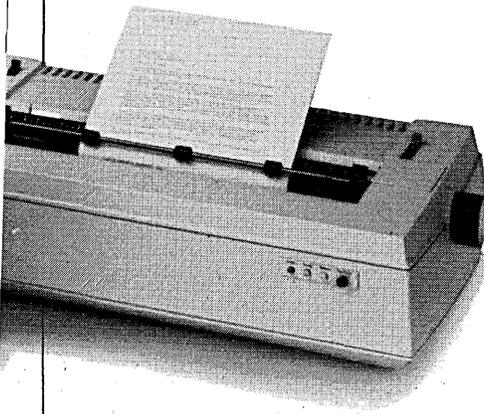
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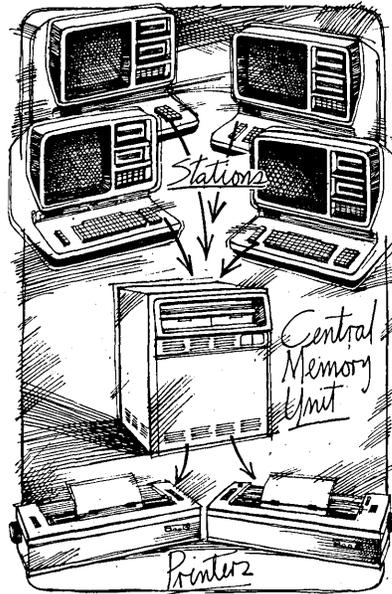


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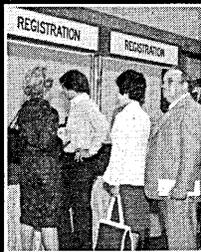
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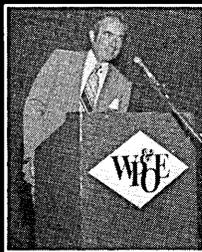
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Despite claims to the contrary, no accurate method exists to predict time and manpower needed to develop a software system.

MAKING SOFTWARE DEVELOPMENT ESTIMATES "GOOD"

by Andrew B. Ferrentino

A software system was estimated to require 30,000 lines of source code and an 18-month development period. Six weeks before the scheduled delivery date, it was reported to be progressing according to plan. Two weeks before the scheduled delivery, project management reported that the estimated size of the system had been revised to over 100,000 lines of code. Delivery would be delayed at least one year. Sound familiar?

There are many reasons for such a disaster. One reason, possibly characteristic of most such projects, is the manner of interpretation and use of estimation by the project management. The problem begins with the failure to recognize the difference between estimation parameters, such as system size (measured in lines of source code), and the product of the development process, namely the system itself. When this distinction is lost, development progress is measured in terms of lines of code generated rather than the more concrete notion of functions fully implemented. Project progress, then, is measured as:

$$\frac{L_G}{L_E} \times 100\%$$

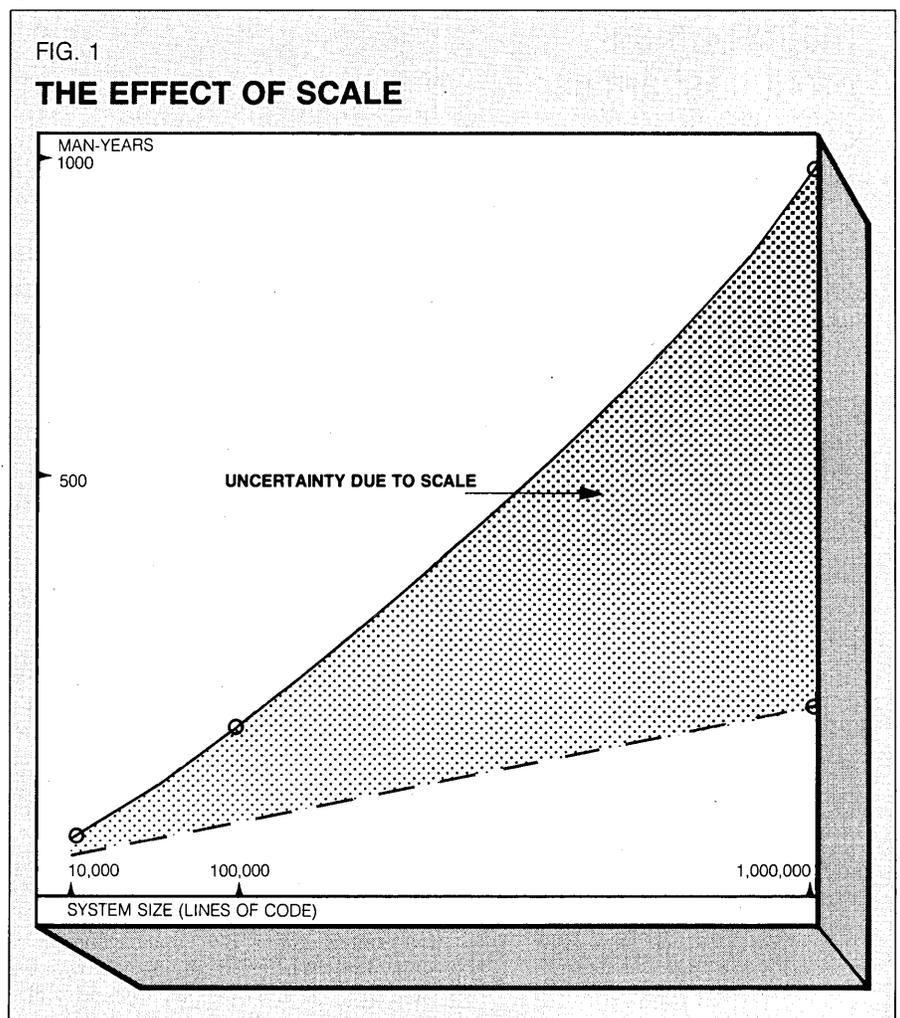
where L_G is lines of source code generated to date and L_E is total lines of source code originally estimated.

Applying this progress measure in the context of the horror story cited above, the following analysis might plausibly explain what happened. Six weeks before scheduled delivery, the number of lines of source code was 29,000, thus

$$\frac{L_G}{L_E} \times 100\% = \frac{29,000}{30,000} = 97\%$$

Project management may then have concluded that they were right on schedule even though many of the programmers on the project knew that, based on real progress, the end was nowhere in sight. The real progress is measured on the basis of the implemented, tested and documented functions, irrespective of the original estimate of system size.

FIG. 1
THE EFFECT OF SCALE



If we could accurately predict the size of the system at the start of the project, lines of code generated would be an accurate measure of project progress. However:

1. Accurate estimation is not attainable in the current state of software engineering.
2. Some of the management pitfalls ensue from assuming that accurate estimation is possible.
3. There is a management approach to software development that can increase our

success rate.

In essence, estimation is an educated guess at the time and manpower needed to develop a system. Although this guess can be quantified through analysis or statistics, it is still a guess. Despite claims to the contrary, there is no method to accurately predict the time and manpower needed to develop a software system. The parameters we use to compute our estimates, e.g., system scale, error removal, programmer productivity, and requirements stability vary enormously.

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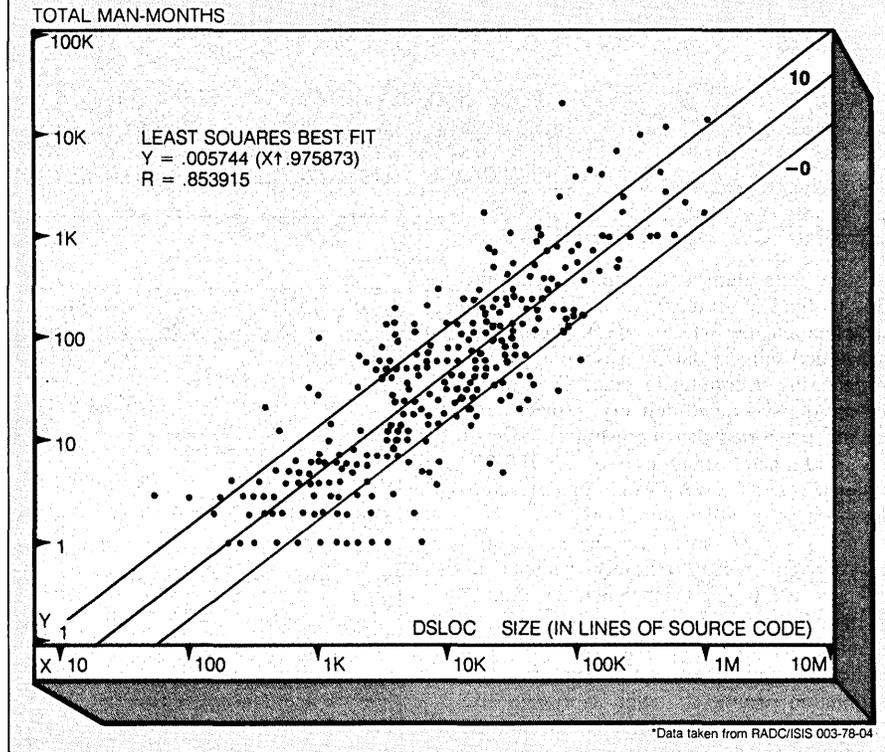
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Cost of error removal can vary widely, from as little as 5% to 10% to as much as 50% to 60% of total development cost.

FIG. 2
DEVELOPMENT RESOURCE UNCERTAINTY
TOTAL MAN-MONTHS VS. DSLOC



EFFECTS OF SCALE

As the size of a system increases, the resources required to develop the system do not increase linearly. Rather, they may increase exponentially, as shown in Fig. 1. The more people required to do the job, the greater the required interaction. The number of possible interactions increases in a squared relation with the number of people, i.e., with N people, there are $(N^2 - N)/2$ possible interactions. To manage these interactions, personnel must be increased.

If it were possible to eliminate the added interactions, the number of people required might increase only linearly with system size. The use of good design principles, such as decomposition, can result in designs where small task groups can independently develop parts of the system. The design of the system, then, and the degree to which the organization can be structured to mirror the design decomposition, can result in substantial resource savings. The cross-hatched area of Fig. 1, represents the variability associated with system scale.

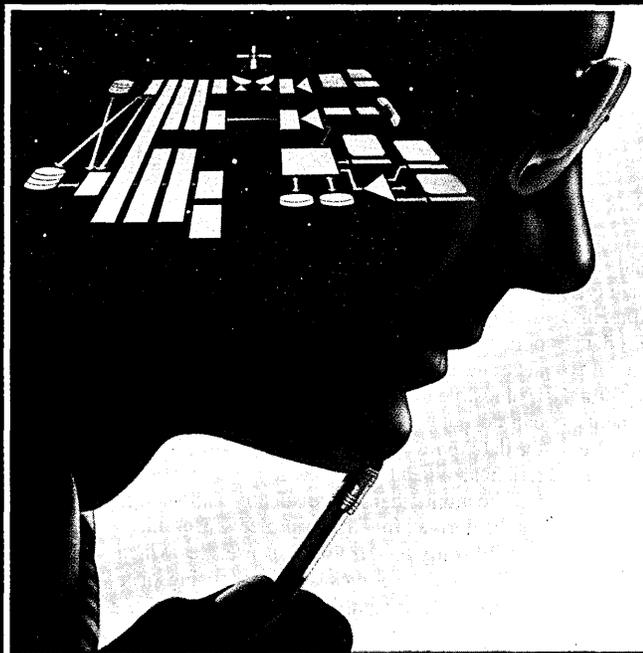
The cost of error removal can vary widely. Error removal costs can be as little as 5% to 10% or as much as 50% to 60% of the total development cost. One factor determin-

ing the cost of error removal is the degree to which system testing is used. If system testing is the sole means of error removal the cost will be high, as most errors are introduced early in the development process and the cost of removing an error increases the longer it remains undetected.

The most difficult aspect is individual programmer variability. Many controlled experiments have tried to gauge this variable, and although the quantitative results differ, they are all consistent in demonstrating great variation from one individual to another. Below are typical ranges of variation from a representative sampling of programmers working on identical problems:

CODING TIME	25:1
ERROR REMOVAL TIME	26:1
Size (lines of code)	5:1

Despite this tremendous variation we tend to treat one programmer like another in estimating resources. To get the most productivity from a group, individual strengths must be identified and matched to the work. Because this is impractical for most projects, average productivity figures must be used in estimation. This introduces a large margin of uncertainty.



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Because optimizing programmer productivity is often impractical, average productivity figures must be used in estimation.

If the requirements for a software system are well defined at the start of the development cycle and remain fixed throughout, the development resources should be much smaller than if the requirements are ill-defined or continually changing. Unfortunately, the latter is usually a fact of life. Good techniques for managing change are required if development costs are to be minimized.

One downfall of development projects is management that thinks requirements can be fixed at the start and kept constant. We had the unfortunate experience of being part of a project on which several million dollars were expended but which never progressed beyond the requirements phase. In this case, the customer was not willing to proceed with design until the "complete" requirements were specified. Because of the complexity of the problem, this was impractical and led to the failure of the project. With large systems (especially pioneers) requirements can rarely be fixed at the start. There is a continual learning process that causes change.

Requirements widely affect the development resources. If the development project team cannot effectively manage changing

requirements, resource utilization will be unpredictable.

Fig. 2 shows actual development project statistics indicative of variability.* For 100,000 lines of code systems, note that the development resources vary from approximately 100 to 10,000 man-months—two orders of magnitude. It is difficult to assert that accurate estimation of development resources is plausible in the face of this data. In fact, we can do better than the range shown because the data represents projects of varying characteristics. When these characteristics are taken into account, then a statistically valid range can be derived for similar projects. But this is possible only in a *statistical* sense, i.e., when dealing with averages. When focusing on a specific project anything can happen, including complete failure.

HIND-SIGHT ESTIMATE

The size of a system may have been estimated to be 80,000 lines of code but the completed system contained 175,000 lines of code. Was the original estimate no good? In hindsight one can say what the "correct" estimate should have

been, but this is another way of saying that one can make an accurate estimate. The following anecdote shows that even in hindsight there is no correct estimate.

A system development job was bid and won for a fixed price of \$250,000. After contract award the winning company learned that the next lowest bid was \$1.2 million. An audit was immediately called and the professional audit team reported that indeed the system would cost over \$1 million to develop. To salvage the effort, a small, experienced team was assigned to the job. It endeavored to use all the best software engineering practices and management controls to develop a good design, control change, and reduce the impact of error. The system was developed for \$300,000.

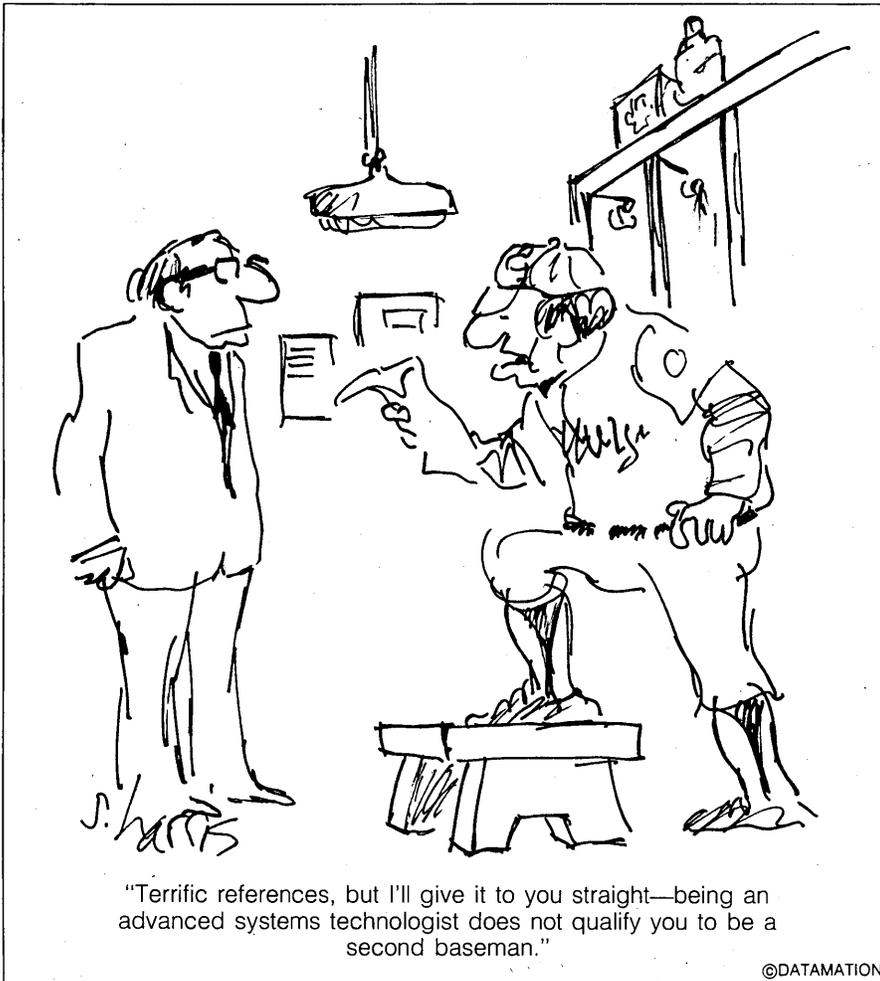
Now, in hindsight, which was the correct estimate: \$250,000, \$300,000 or \$1.2 million? If the audit had never been performed but the team still managed to do it for \$300,000, would the project have been considered a success? Or could the job have been done for \$100,000? Or was it really a success after all?

None of the above statements are "correct," for a different team using different techniques may have performed the job for \$1.5 million. The same team with the same techniques may have done the job for \$600,000 if it had made a bad design decision requiring later correction. We can't make good estimates, but we can make estimates good.

It is imperative, then, to manage development projects in order to make estimates good. To accomplish this, a combination of management and software engineering techniques must be brought to bear, such as:

- Well-defined milestones: specification complete, coding complete, unit test complete, etc. must be used as the means to measure software development progress against budget expended.
- The concept of software development in increments (or releases) of increasing functions will provide a framework for controlling the impact of changing requirements.
- The application of advanced designed techniques such as information hiding and abstract machine hierarchies give rise to good designs.
- Verification techniques such as formal walkthroughs and informal proof techniques help to identify errors soon after they are introduced.

Andrew B. Ferrentino, vice president of Lesko/Fox Associates, Washington, D.C. management consultants, has had over 15 years' experience in the analysis, design, implementation, and management of communications/computer-based systems.



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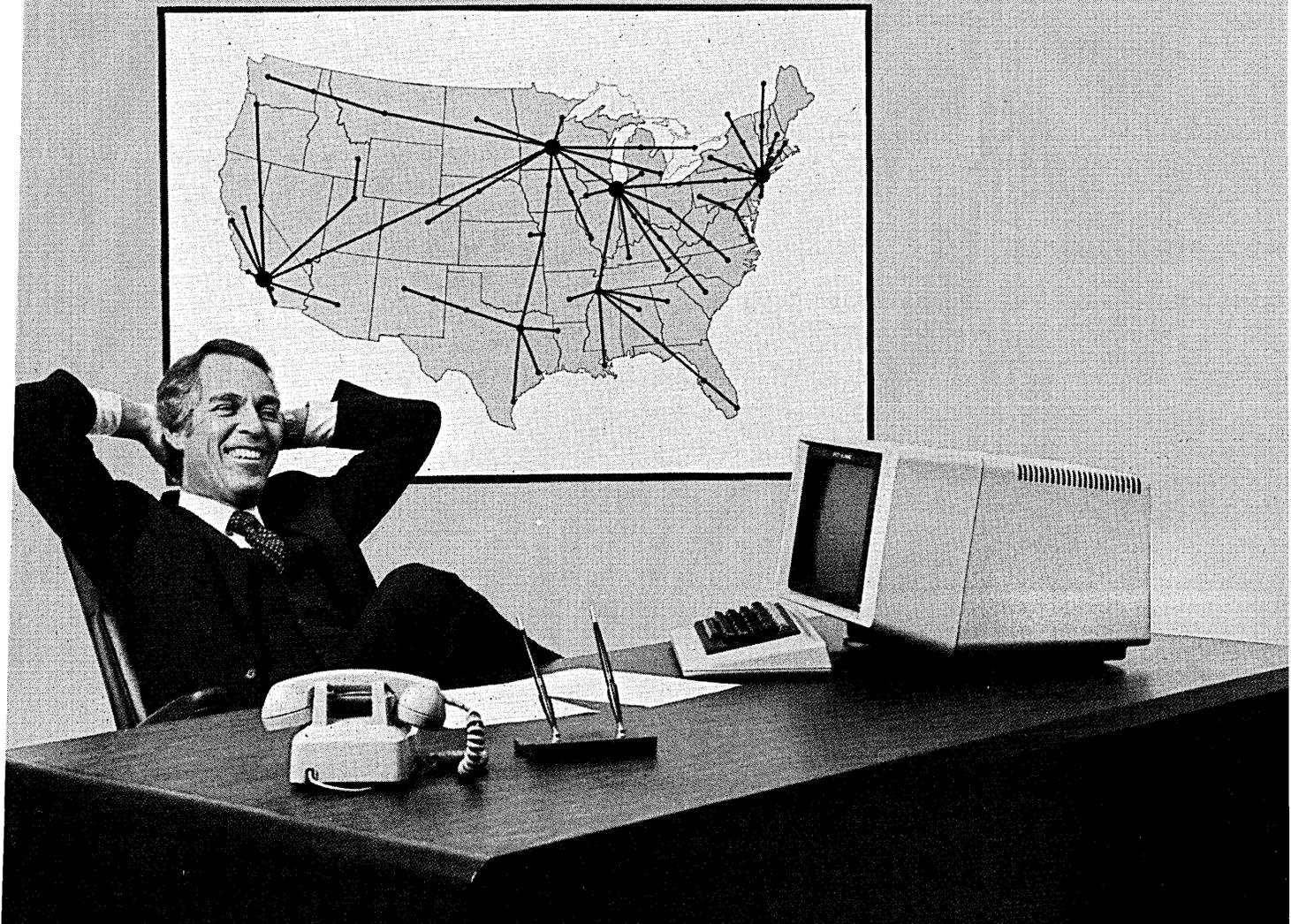
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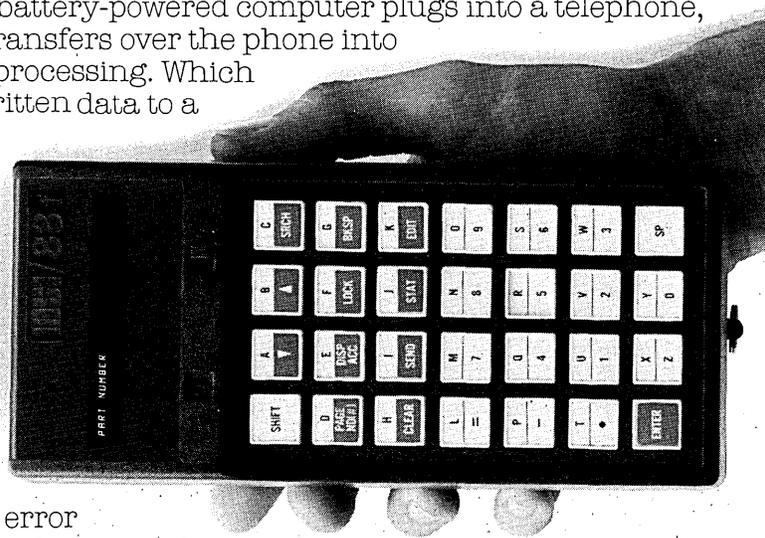
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If documentation is good, it will follow the principle of "dog-eared is beautiful."

THE DO'S AND DON'TS OF DOCUMENTATION

by Lindsay Wilson

The meeting had just started and already the man was the picture of despair.

"That's it!" he said, pointing accusingly at a four-foot-high stack of printout. "That's the documentation the software company sent when we bought its package four years ago. You think anybody's ever read it? You think anybody's ever tried?"

The man was an executive for a major film corporation and was responsible for keeping tabs on worldwide film distribution. He had no quarrel with the software package itself. The senior programmers had been making quick, successful modifications to it ever since it had been integrated into the system. The package had delivered what had been promised, and the programmers had been able to expand and manipulate it without stumbling over the software.

But the corporation's department lines had been redrawn. Now that each European branch was to be responsible for its own distribution, the executive had to ship large sections of the home-based dp system overseas, with explanations, of course.

"Send the Europeans that stuff," the senior programmers said, referring to the man-sized pile of paper. The programmers could not be coerced into further documenting the system. The 175 pounds of explanations had been on shelves in the data center, had been moved to a side room, had migrated unused through several floors, and had finally come to rest in the conference room.

The new software marketing firm had lots of office space and four pieces of furniture. But its contracts were in order because it had customers who had already paid for the firm's accounting package. The authors of the system presented a thoroughly documented flow of programs that marched through general ledger, accounts receivable, accounts payable, and cost accounting, and produced summaries and reports along the way.

"If the documentation doesn't cover it," said one author of the package, "my partner or I can explain any routine in any module you pick out." They knew their material cold.

"The time period accounting people have been screaming for years," the systems designer at the television news corporation said. "Their data processing was set up in—get this—1966, and the system always worked. It requires almost no maintenance. But the way things were done in '66 has gotten so time and core consuming that redesigning that system is now my top priority."

The COBOL system in question included such quaint touches as having daily edit and audit reports sent halfway across the city to be hand corrected by the accounting department. The hand corrected copies were sent back to the data center, cards with corrections were punched, and the edit/audit was run again and again until the run was error-free.

The classic definition of "documentation"—1) supplying of documents or supporting references; use of documentary evidence; 2) the documents or references thus supplied; 3) the collecting, abstracting, and coding of printed or written information for future reference—would cover computer language reference books, most written explanations accompanying hardware, almost any book that IBM puts out, green and yellow cards, dictionaries of dp terminology, and, in short, everything dp people use for reference that they do not generate themselves.

What about the documentation companies produce themselves? Just a mention of the word brings groans of boredom.

The existence and organization of documentation varies enormously from corporation to corporation and often from department to department. But the larger and more complex a system is, the bigger the job. I consider any documentation produced in-house to be "live," that is, subject to the same maintenance, revisions, and even redesigning that the system itself goes through. Documentation coming in from the outside, such as PL/1, language books, etc., is "reference."

If "reference" documentation is long, overly detailed, and somewhat heavy, that is not unexpected. It is somewhat in the nature of PL/1 language books to be boring and for IBM software manuals to be excruciatingly detailed. "Live" documentation, how-

ever, is meant to be used, not simply referenced. If it's cumbersome or difficult, it's no good. Some types of "live" documentation will get used far more often than others, but the principle remains the same: dog-eared is beautiful.

HOW TO DOCUMENT IN-HOUSE

Documentation produced in-house may include variations on the following:

System documentation: specifications, modular flowcharts, file layouts, report log and report samples, system narratives, JCL logs, program library logs.

Program documentation: source documents, source listings, program narratives, summaries of program logic, listings of program subroutines, user guides.

Operations documentation: run books, run logs, file libraries, instructions on report balancing.

Software subroutines: processing summaries catalogs.

It would be ideal if all categories were covered in a corporation's dp division and if a permanent staff were assigned to keep up with the maintenance of the documentation. No more and no less is required, but in this still unenlightened decade, gigantic corporations try to make do with one documentation consultant or a small staff of technical writers.

Going back to the film executive with the unwieldy software documentation: whoever bought the original package was doubtless impressed by its sheer poundage. It was probably assumed that there would never be any problems.

After having established that he had been sending out portions of the film distribution system in modules of five to 10 programs, for an on-line system, we told him to forget his existing documentation and to stick with user guides. Like many dp managers, he did not realize that there are many ways to document and that a standard user guide minimizes length and detail.

For his purposes, users, by definition, did not have to know anything about software or programming logic. Since systems and programming authority remained in New York, the European accountants auditing the

If confronted with 175 pounds of paper, stop everything and shop around.

film distribution would be performing easily controlled updating and balancing.

What are the points illustrated by this scenario?

1. "Documentation" is extremely varied.
2. Size means nothing. Examine closely any documentation for hardware or software. If you can't follow it, bear in mind that you'll have to have it rewritten if you ever need to explain the system in detail to anyone.
3. Keep track of modifications and add them to the existing documentation. If you ever have to explain the system to anyone and the maintenance programmers are no longer there, you're in trouble.
4. Stop everything and shop around if confronted with 175 pounds of paper.

USER GUIDES AND MAPS

The budding software company knew exactly what it needed for its system: a user guide. The company described its typical user very precisely and demonstrated that it didn't need program documentation: comments, file layouts, cross-referencing of routines, report layouts, and narratives were all in place for 50 interlocking modules. The company wanted a writer to extract everything that would directly concern a user at a terminal, and to put it all into manual format for marketing.

Companies in this situation should be aware of five rules when soliciting a writer:

1. Ask to see samples of his work.
2. Define the user's needs exactly and avoid wasting time by going off on a tangent. (Is the user guide also a training manual? If so, more detail is called for, and this must be

SAMPLE ACID TEST FOR DP MANAGERS

If given a week's time, could you answer these questions on systems and programming?

1. How many systems do you have? How many programs in each system?
2. What languages and hardware are involved?
3. How many off-line jobs/job streams/production runs are executed per day, per week for each system?
4. How many reports are produced? How many of these can be eliminated?
5. Without notice, can you demonstrate (with charts and reports, or on-line) any and all of your systems to a top executive from an outside division?
6. If the auditors show up today, are you ready?

7. Is your system affected by obsolete methods or material which can be eliminated from processing?

8. Do you know when all the files in your system are updated?

9. Do you know, at least in paragraph form, what each program in your system does?

10. Do you know what each of your programmers did today or this week? Is anyone keeping track?

If you can't answer at least half the questions positively, you are headed for problems. Up-to-date documentation is every system's safety net. Don't wait until you're buried in paper, relying heavily on maintenance programmers at \$300 a day, or you're given a deadline by the auditors.

decided on at the beginning.)

3. Establish the level of detail you want. For example, will all possible error messages be listed, or only those to which the user can respond?

4. Establish the tone or style of writing.

5. Don't count on the writer for details such as formatting and paragraphing; these are usually done by a typesetter.

In the third scenario, that of the systems analyst required to redesign the ancient time period accounting system, the need was for "temporary" documentation, compromise in favor of time and effort. Normally, we would go through each listing, producing summaries of program logic and listing the subroutines and the use of any in-house soft-

ware routines. We would have source documents and report samples for each program, and we would provide file layouts, narratives, and, finally, a flowchart showing the whole system.

But wanting to avoid unnecessary detail of any kind, we started with a map of the system that underlined every repetitive aspect of processing, every laborious card-to-tape procedure, every old sort-and-merge program. We concentrated on revealing everything that appeared redundant or overly long and involved. Most of the tape files had virtually identical formats, and extracted five file layouts instead of 18. Samples of all 42 reports, but not the program logic that produced them, were provided. (The system had undergone minimal maintenance, and we assumed that endless "move to" statements were not of interest.) The systems analyst was then able to pinpoint any questions he had, and further documentation consisted of listing the calculations made in the reports and noting when and where updating occurred.

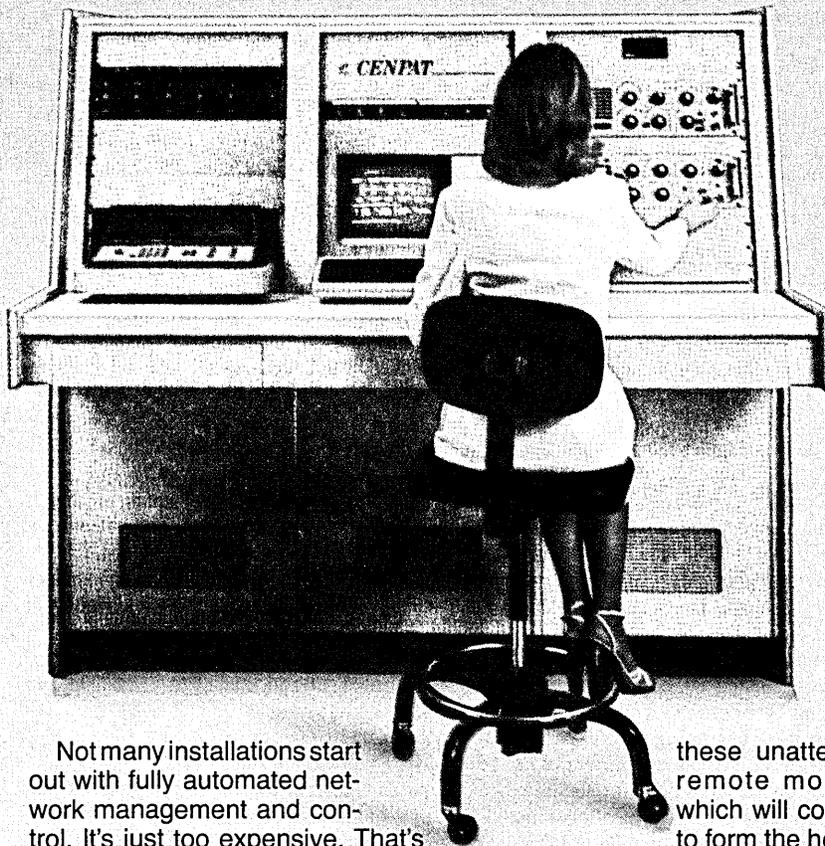
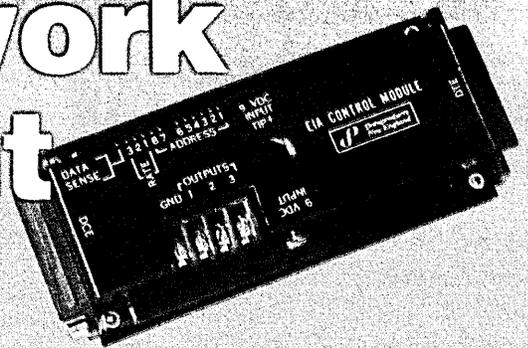
A note on redesigning a system without documentation: many corporations have sleeping systems—no maintenance, no trouble, no documentation, just old. The discovery that nothing is written need not be reason for panic, but a technical writer with some systems background is probably required. The priorities are to keep a broad view of the system and to avoid most detail.

In deciding whether or not your systems need documentation, there is more involved than trying to export, market, or redesign segments of processing.

Lindsay Wilson is the *nom de plume* of the manager of a team of documentation specialists and systems analysts who work under contract for several major corporations in the northeast U.S.



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CIRCLE 139 ON READER CARD

In four years the personal computer industry grew from \$65 million a year to \$600 million.

A HISTORY OF RABBITS

by Everett T. Meserve

The computer industry is like a jungle—rich, alluring, competitive—filled with wildlife vying for resources and territory. Large mainframes are the dominant denizens, formidable as elephants; smaller systems are cunning and quick, like the big cats; and minicomputers, like bold tribes of orangutans, are adept at finding niches and defending them.

Fair enough. But what about all these rabbits we suddenly find underfoot? They're breeding rapidly, and it looks as if it's going to be impossible to ignore or eliminate them. They're not all that powerful, but the damn things are everywhere. Where did they come from, and where do they belong?

Although 1975 is considered the birth year of the U.S. personal computer industry, it was in the summer of 1977 that the industry's dramatic growth began. It was then that Apple Computer introduced Apple II, Commodore introduced the Pet, and Radio Shack introduced the TRS-80 Model I. Radio Shack's announcement of a personal computer of even minimal capability for \$600 startled the electronics industry. Within the next few months, demand for the TRS-80 far exceeded any expectations that Radio Shack had. By the end of 1977, the waiting period for a TRS-80 was approaching three months, and potential users continued to place \$100-plus deposits on equipment they had never used and, in many instances, had never seen. Demand that may have been triggered by Radio Shack was shared by Apple, Commodore, and others, and throughout 1978, demand for personal computers exceeded supply. Apple, Commodore, and Radio Shack moved to increase product output, but this was not enough, and many new microcomputer hardware manufacturers were born to help fill the gap. Not all the manufacturers were entirely new. At least two companies—MITS/Altair

and IMSAI—were among the pre-1977 industry suppliers. Some others who joined the ranks during this time were Exidy, Bally, Video Brain, Processor Technology, Cromemco, Ohio Scientific, and Southwest Technical Products.

The primary customers through 1978 and into 1979 were computer hobbyists and other technologically sophisticated people who were willing and able to create computer programs for their hardware. By mid-1979, it became evident that only a limited number of such users could and would justify the purchase of a personal computer costing between \$600 and \$2,000. Although very little hard information existed about end-user applications, some vendors noticed that personal computers were beginning to be used by individuals in small businesses for operation and analysis, rather than solely for technical or hobby applications. Also, educational institutions, helped by government Title IV Vocational Educational Act legislation, became recognized as potential users. Finally, a significant new category of business professional users was created by the introduction of a powerful software program which greatly facilitated the creation and manipulation of business/financial worksheets.

What of the mass consumer? The question calls to mind products made by Atari, APF Electronics, Texas Instruments, or Mattel, with first introductions in 1979. Actually the first consumer-oriented personal computer was introduced in late 1977/early 1978 by Video Brain Computer. Despite this early product introduction, the consumer market has not flourished with the same intensity as other segments. In fact, the consumer segment has been characterized by late product introductions, false starts, distribution channel experimentation and test marketing, overpriced hardware, overoptimism (including from this industry watcher), and in gener-

al from the lack of compelling applications. Several vendors have thrown their hats into the ring only to have them tossed back; the viability of this industry segment remains unproven.

CREATION OF AN INDUSTRY

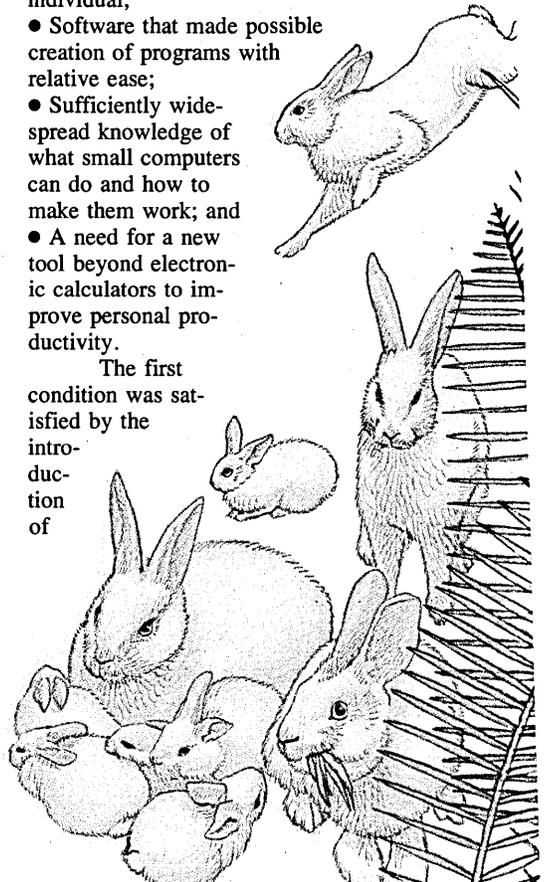
at the right time to create this new industry:

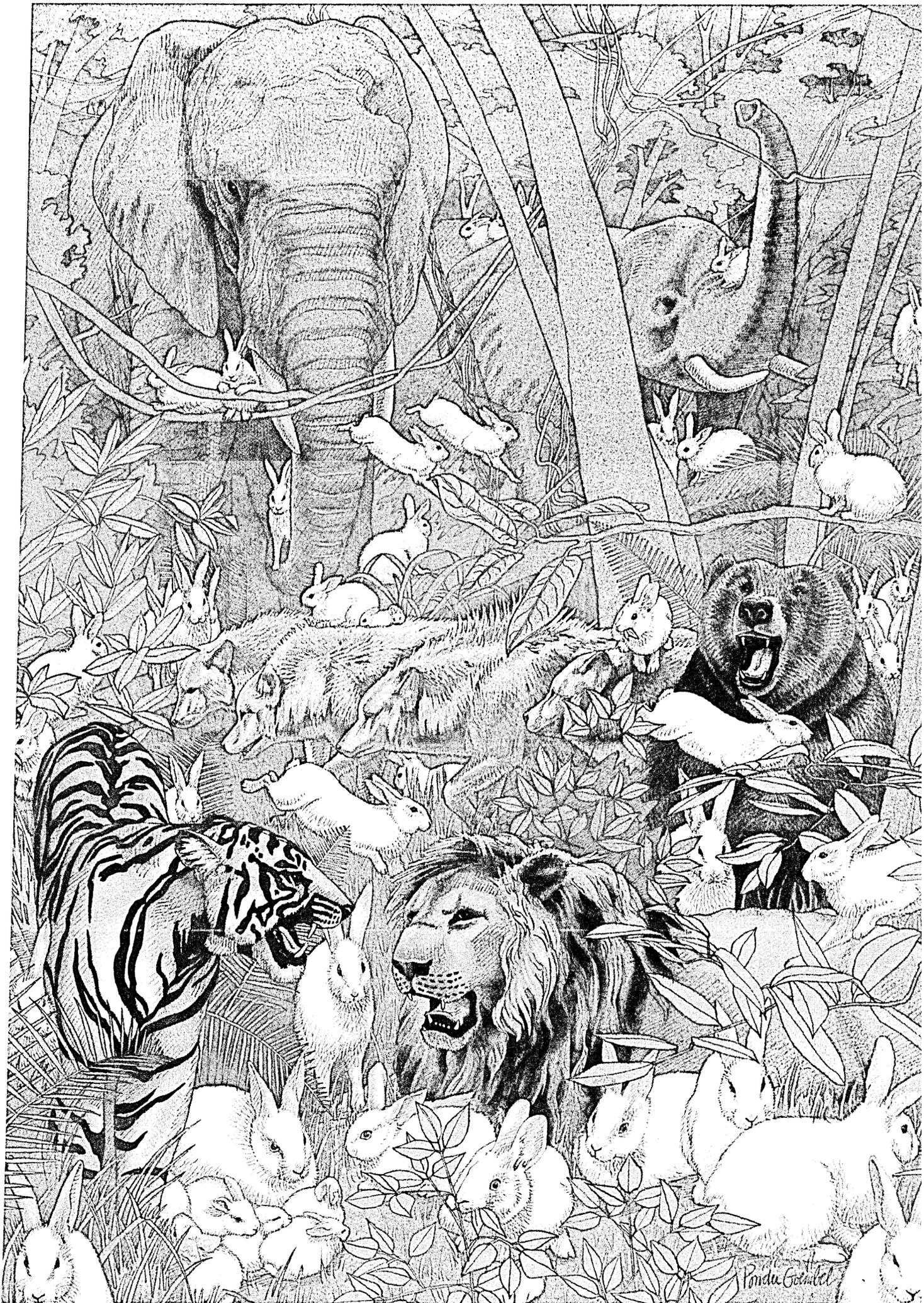
- The availability of a useful hardware system that could be economically justified by an individual;
- Software that made possible creation of programs with relative ease;
- Sufficiently widespread knowledge of what small computers can do and how to make them work; and
- A need for a new tool beyond electronic calculators to improve personal productivity.

The first condition was satisfied by the introduction of

In looking back, it's possible to discern four major elements which existed in the correct proportions and

ILLUSTRATION BY PONDER GOEMBEL





Panda Gumbel

The personal computer industry of 1980 can be divided into seven strategic market segments.

microcomputer-based hardware in the \$600 to \$1,000 range. This was made possible not only by the computational power of the microcomputer chip, but also by low-cost semiconductor RAM working memory, mass memory storage via cassette tape recorder, use of a standard off-the-shelf keyboard, and easy availability of a display device, the tv screen.

If programs for early personal computers had had to be written in microcode or machine language, there would have been a significant barrier to gaining the interest of anyone but a few enthusiasts. The existence of the BASIC programming language broke down this barrier. Later on, even easier methods for communicating and interacting with personal computers (e.g., VisiCalc, a software package which allows users to easily create "electronic" financial worksheets) would be developed to perpetuate industry growth.

If minicomputers and other small computer systems had not demonstrated what small computer systems could accomplish and taught users how to make such systems perform, it is unlikely that significant number of people would have recognized the value of low-cost personal computer hardware.

While the early development of the personal computer industry was closely tied to the novelty and "can do" capability of the hardware, it quickly became evident that the machines could do a lot to improve productivity. The electronic calculator, and its more sophisticated preprogrammed and programmable versions, provided numeric productivity improvement over pencil and paper and slower mechanical devices. The personal computer extended this capability by adding even more powerful capabilities—e.g., text format programming, large display, graphics, communications, and mass memory storage.

By 1977 the infant industry was already worth about \$65 million per year. At the end of 1978, annual shipments were approximately \$170 million. Two years later, in 1980, annual shipments by microcomputer/personal computer manufacturers for U.S. consumption had reached approximately \$600 million. In 1978, micros accounted for less than 1.6% of the total U.S. computer hardware industry; by the end of 1980, they were a respectable 4.4%. As might be expected of an infant business, growth rates in the early years were spectacular—203% a year between 1977 and the end of 1980. But dollar sales don't tell the whole story. If a comparison is made on the basis of units installed, then the acceptance of this new tool becomes more evident—8% of the total computer industry in 1977 and 36% in 1980.

For a given business, how can you distinguish one strategic market segment from another? One method is to determine

whether they differ in the following attributes: competitors, criteria by which customers make purchase decisions (basis of competition), customers, market offerings (product, service, terms), applications, distribution channels, and stages of business maturity.

SEVEN MARKET SEGMENTS

Using these attributes, the U.S. personal computer industry of 1980 (defined as microprocessor-based systems priced between \$500 and \$15,000) can be divided into seven strategic market segments—hobbyist, consumer, very small business, technical/professional, business professional, education, and industrial/oem.

The hobbyist was the first customer of the personal computer industry. Typically, he purchased and used equipment for the enjoyment of creating, learning, and experimenting with computers. There was little need to provide other than basic hardware and software building tools.

At the end of 1977, when the hobbyist-dominated marketplace began to exhibit saturation characteristics, vendors looked elsewhere for growth, specifically to the mass consumer and very small business user. These two kinds of user differ from the hobbyist in at least one important way: they focus on individual application program solutions rather than equipment and operation. For example, while the hobbyist experiments and creates, the consumer is only interested in what the equipment and software are ready to do for him. He does not want to learn about hardware. The consumer looks for a combined hardware and software package that may be used for personal enjoyment (entertainment or games), learning (education drills or learning games), personal management (record keeping, cataloging, or computation), or for future monitoring and controlling of other equipment (appliances, security devices, lights, furnace, water heater).

Approximately 3 million businesses in the United States have annual sales of under \$500,000 and employ fewer than 10 people. These businesses include local retailers and tradesmen, small manufacturing companies, and service organizations. Such small firms are facing growing demands for information—demands generated by both legislation and by internal needs to operate more efficiently.

Three current means of processing this information are manual record keeping, remote electronic record keeping (through service bureaus), and in-house computer capability. Very small businesses are looking to the \$5,000 to \$15,000 personal computer system as a cost-effective alternative. While the application requirements of these businesses are similar to those of larger organizations, very small businesses typically require small-

er databases and less complexity.

Like the consumer, the very small business user is concerned with what the computer system can do to solve applications problems. Programming is typically viewed as a necessary evil. Emphasis clearly is on applications-oriented equipment and software rather than on creation and experimentation. During early market development of the very small business user segment, some business users were also computer hobbyists. Available applications programs for this segment include payroll, inventory record keeping, project costing, cash and checking account management, calculation of time-payment sales, and income tax calculations.

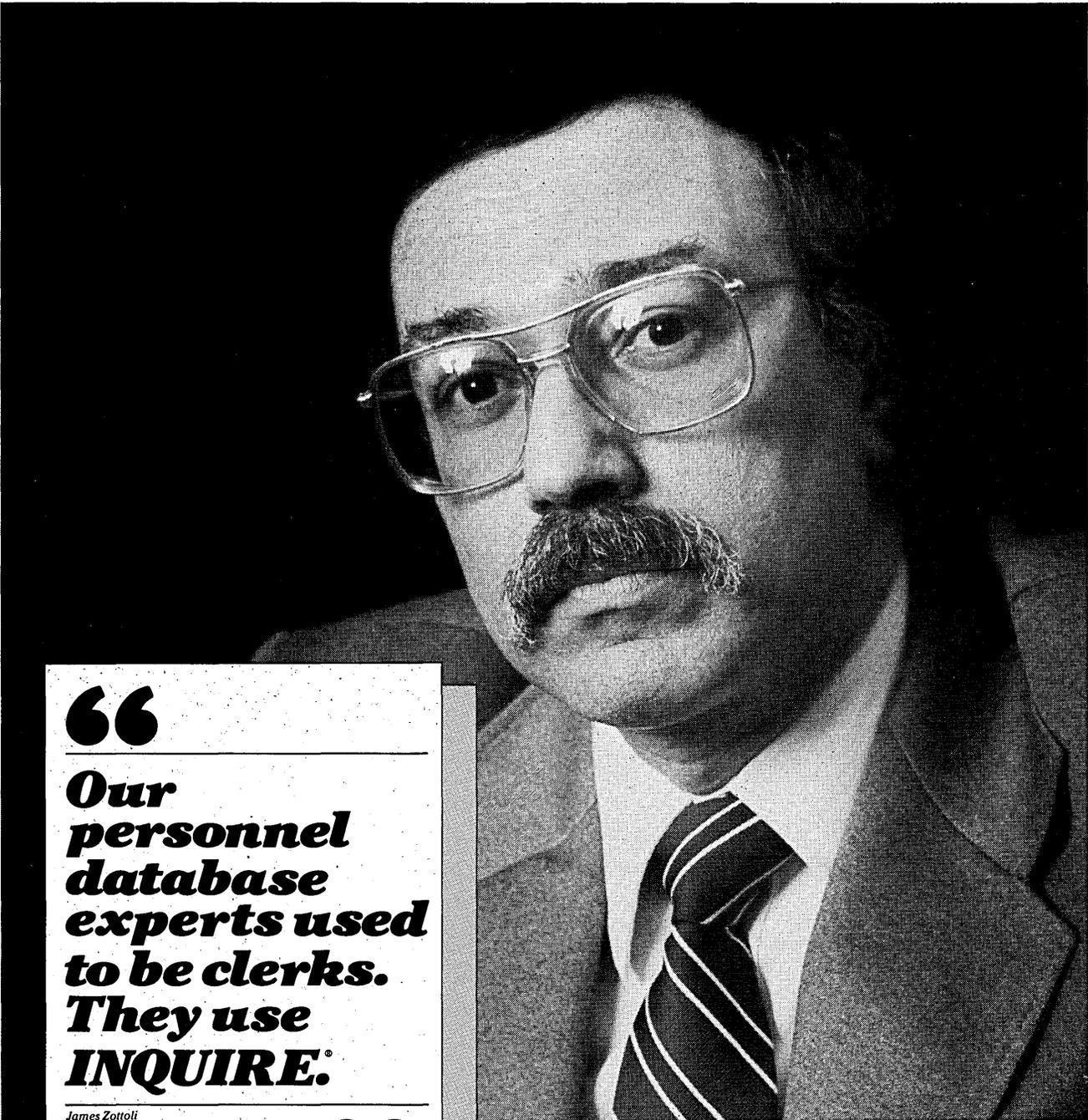
The technical/professional market segment combines some of the technology characteristics of the hobbyist and the applications orientation of very small business users. Technical users are primarily engineers and scientists who use the personal computer as a professional tool to aid in design analysis or to monitor or control experiments. These users are frequently technologically skilled and therefore capable of selecting personal computer hardware and creating applications software. However, their final objective is the solution of application problems, and while they may be interested in hardware they have little time to spend developing programs.

Business professional users are somewhere between the technical professional and the very small business user. Their application interest is manipulation of business information, frequently to perform analysis. Some may possess technical skills similar to those of the technical professional, but most do not. This segment includes such users as business analysts, operations and market researchers and accountants.

Two years ago, education would not have been a unique strategic market segment of the personal computer industry. While personal computers were being sold to educational institutions, purchasers were mostly technologically skilled people who used hardware as an experimentation tool or to teach computer programming. This has changed.

Nowadays, customers in the education segment include individual schools or learning institutions and educational agencies that buy collectively for institutions or state agencies. Personal computers are used both to teach programming and to aid in other kinds of instruction. They are found at all educational levels—from elementary school through university.

A less recognized but important and growing strategic segment of the personal computer industry is the industrial end user. This group consists primarily of manufacturing organizations that purchase personal computers for in-house designed process control systems, data logging, or manufacturing



“

Our personnel database experts used to be clerks. They use INQUIRE.[®]

James Zottoli
Senior Systems Programmer
Corporate Computing Center

”

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CIRCLE 151 ON READER CARD

While the personal computer industry of the '70s was built on hardware, the competitive battlefield of the '80s will be controlled by software and distribution.

monitoring. A companion to the industrial end-user category is the original equipment manufacturer that purchases personal computers and builds them into hardware that is sold to customers. Examples include very small business computer systems and machine tool controls manufacturing. This segment is a close relative of the technical/professional since the users are technologically knowledgeable, and capable and willing to develop required applications programs.

Table I presents a few characteristics of each of the personal computer industry's strategic business segments, and Fig. 1 shows the stage of maturity for each of these segments as of the end of 1980.

In Fig. 1, it can be seen that the consumer segment has yet to emerge from its embryonic stage; whether this will happen within the next three years is still not clear. The education segment, traditionally conservative and now more financially restricted, is likely to move slowly. If the hobbyist segment has not yet reached its peak, it is inevitably moving toward it and will probably achieve it within the next two or three years. The business professional segment has only recently emerged from the embryonic stage but has moved rapidly into its growth phase. The very small business (VSB) user segment has also only recently changed from the embryonic to the early growth stage. This segment will move slowly because of its inherent conservatism and the significant user education still required. Technical/professional and industrial/oem segments will continue to employ personal computers as productivity or operational tools. This group is also the most likely to adopt new kinds of hardware that will compete with existing personal computers.

Two industry segments—business/professional and consumer—face extraordinarily dynamic futures because less than 2% of potential business users and less than 1% of potential consumer users have been reached. It will be interesting to see how the various manufacturers go about penetrating these two segments. As they scramble for position they will do well to remember that, while the personal computer industry of the '70s was built on hardware, the competitive battlefield of the '80s will be controlled by software and distribution. *

Everett T. (Bill) Meserve has followed the personal computer industry for Arthur D. Little clients since 1978. For 17 years prior to joining Arthur D. Little, Meserve was an industry operating manager at TRW, Bunker Ramo, and General Instrument. He has an MBA in marketing and finance from the University of Southern California and a BSEE from Louisiana State University.

TABLE I

PERSONAL COMPUTER STRATEGIC MARKET SEGMENTS

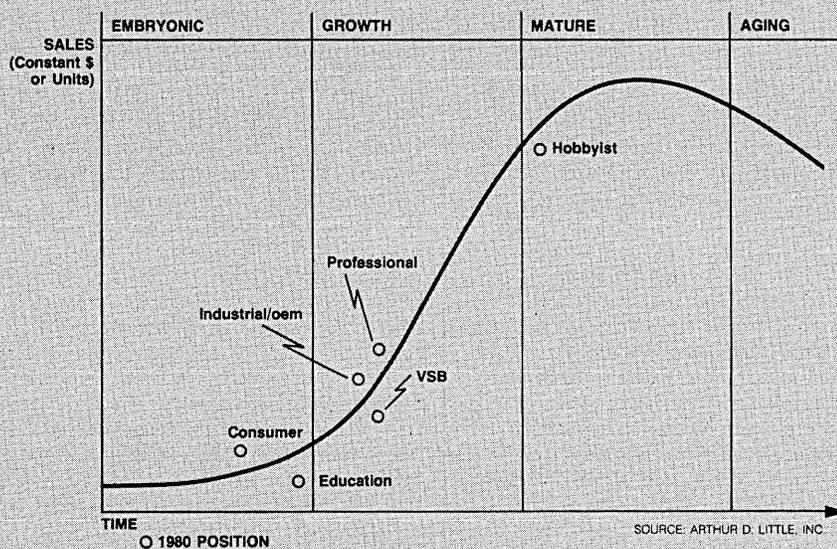
SEGMENT	APPLICATION FOCUS	HARDWARE PRICE 1979-80
Consumer		
Adults	Education	\$500-\$1,100
Children	Entertainment	
Mass Population	Personal Management	
Technology-Based Users		
Hobbyist	Hobbyist-Experimentation Creation	\$1,000-\$4,000
Professional		
Technical	Professional—solution of individual application	
Business	Problems related to pro- fession	
Very Small Business		
Retailers	Business management	\$4,000-\$15,000
Service organization	operation	
Small manufacturers		
Education		
Elementary & high school	Computer Instruction programming	\$600-\$1,500
University	Computer Aided Instruction	
Commercial	drills	
Industrial/Oem		
Process/plant engineers	Process monitoring/control	\$600-\$2,000
Electronic equipment suppliers	Quality control Resale	

SOURCE: ARTHUR D. LITTLE, INC.

CHART BY CYNTHIA STODDARD

FIG. 1

PERSONAL COMPUTER MATURITY



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FORTRAN Language Development
Programming Publications
Assurance*

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Development

*Logic Design
Microprogramming
Simulation
Diagnostic Generation*

Qualifications:

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Component Procurement

*Product Engineers
Quality Assurance Engineers
Test Equipment Engineers*

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(Quality Assurance Engineers)—BSEE, BS Physics, or BS Computer Science or Operations Research required; 2-5 years experience in Semiconductor Manufacturing and knowledge of Statistical Analysis, Process Control and/or Component Test Philosophies.

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Systems Technology Assurance*

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(Power/Thermal)—BS or advanced degree in Engineering with related experience in Power area.

(Systems Technology)—BS or advanced degree with recent experience in Packaging development, assurance of quality.

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CIRCLE 154 ON READER CARD

A personal computer may help an executive understand what the dp pro has been pushing for years, but it probably won't give him access to corporate data.

YOU MEAN I CAN'T JUST PLUG IT IN?

**by Peter Krass
and Hesh Wiener**

"Hi! I'm Dick Cavett and I want to tell you about my Apple. . . ."

"For less than \$600 you can get a complete Radio Shack. . . ."

"Xerox introduces its personal computer for. . . ."

Before the year is out, thousands and thousands of executives, heeding the call of ads like these, will have tucked tiny computers under their arms and carried them into business offices. These new users want in on what they perceive as a good thing at a fair price. They imagine—with the help of Madison Avenue—that they will be able to ask their little computers all kinds of questions that begin "What if." They expect that answers will appear on their screens.

This isn't going to happen. Not now, anyway.

If personal computers are the future, data processing departments are going to have to put the future on hold. Because data processing departments can't answer the question "What if all those tiny systems ask our mainframes 'What if?'"

It's not only the difficulty of supporting hundreds of terminals. It's not only the lack of software to handle inquiries from nontechnical users. It's the problem that comes up right after somebody gets an answer, and decides he could get a better one by adding more facts to the available data. For organizations just beginning to experience the costs and the benefits of information that is recognized as a resource, the implications of the personal systems can be terrifying.

But, terrifying or not, those personal systems keep coming in, as do calls from nontechnical executives to the departments running the mainframes. Is this bad? Not necessarily, because a side effect of all the hubbub is that information users are asking top management for new and better systems. Whether the personal computers will figure in corporate data systems remains to be seen, but the seemingly universal awareness of computing that small systems have engen-

dered may help to break the ice that separates data processing departments and the "outside" corporate functions.

"The personal computer helps the executive understand what data processing professionals have been pushing for years," says Howard Levison, who manages information processing at Depository Trust Company, the captive bank of the New York Stock Exchange. "The acceptance of the personal computer makes it clear that technology is catching up to the concepts we professionals have studied and planned for."

When the executive with a micro calls up and asks for access to corporate data, however, he's liable to be disappointed. "Hooking personal computers into a large system is just not as easy as it sounds," says Levison.

Depository Trust is at least in a position to provide information to some kinds of terminals; the organization has put its key files under the jurisdiction of a database management system. The DBMS makes it possible for new applications to use information collected for existing (or anticipated) jobs. In the case of Depository Trust, the DBMS system is Software AG's Adabas, running on a pair of IBM 3033s, but the situation would be the same whatever the package and whatever the computer it ran on. The company is able to support some 300 terminals, which are tightly controlled by the central dp department.

Things have gone a bit further at some of the companies that depend on Depository Trust for banking services, the Wall Street brokerage houses. Investment is booming, and stockbrokers are going for anything that can help them do a better job for more clients. Enter the personal computer, to applause from brokers who seem to think the little systems are the best thing since capitalism.

For starters, it doesn't take much of a machine to store and retrieve client portfolio information, and the business, which runs on phone calls between brokers and investors, goes very nicely when all the facts are in front of both parties. But moving from a single-user computer to a fully integrated trading system is quite another matter.

At Merrill Lynch & Co. (a holding

company that owns Merrill Lynch, Pierce, Fenner & Smith), lots of people are bullish on personal computers. Nearly 200 small systems are in the hands of various executives; more are being brought in all the time. Most of them are used by stockbrokers, called account executives by Merrill. So far, the systems are not part of the electronic network that links 8,600 brokers who work at 476 offices around the world. It's not yet clear to Merrill that all these little machines ought to be tied together.

What Merrill is doing today, propelled in part by its growing ranks of high-powered and high-technology-oriented executives, will probably serve as an example for some companies. Other organizations, though, are finding different ways of using computers to support sales forces. In many environments, keeping things up-to-the-minute has nothing to do with personal computers, nor is it likely that it ever will. There are good reasons for this.

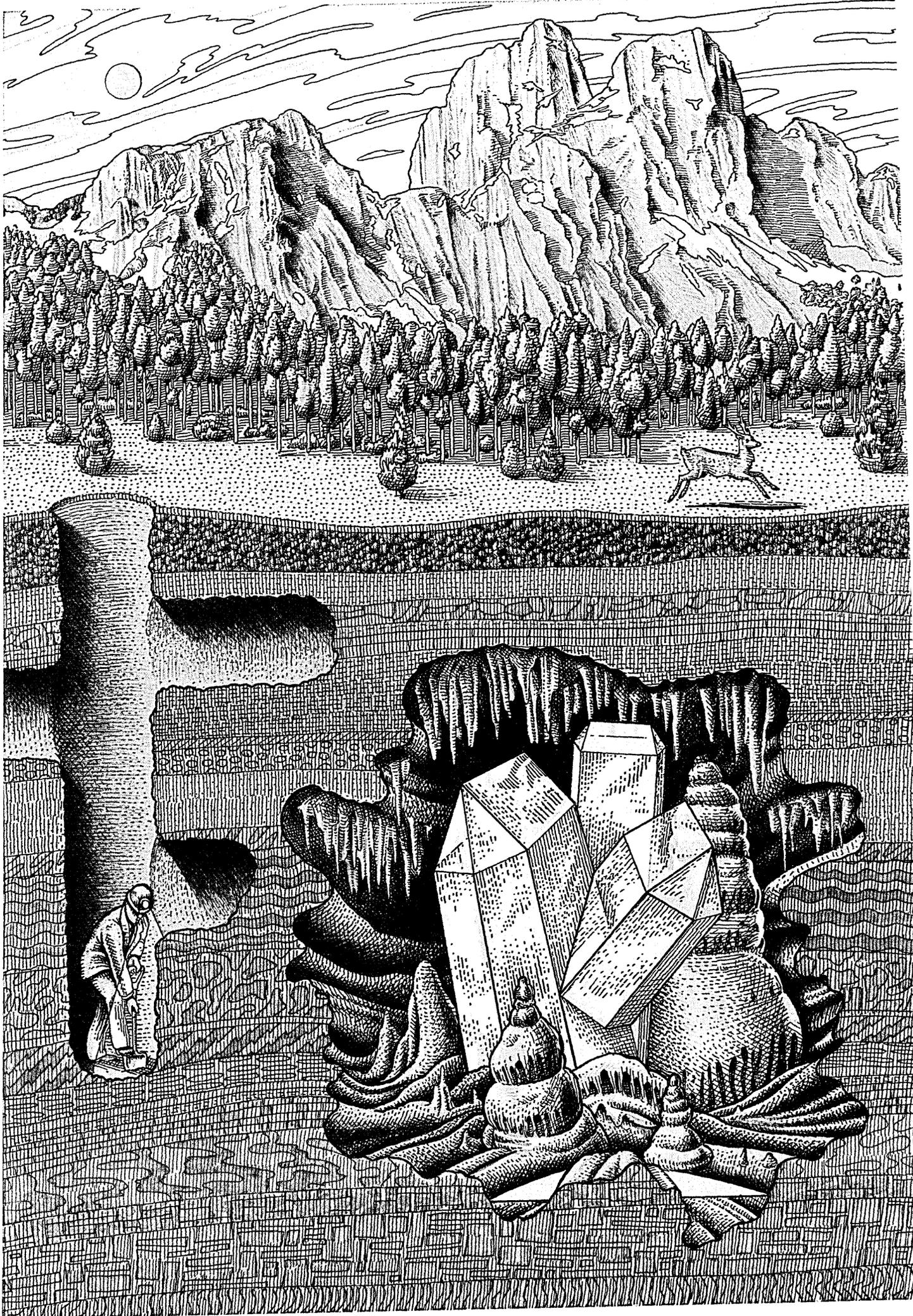
WORKING WITH AN ASSET

Information is now generally recognized as a valuable asset. Collecting, preserving, organizing, and dispensing that asset is an important job. As companies seek to put information directly into the hands of the people who use it, the risks associated with information processing mount up. Errors may appear instantly all over an organization. Problems may cause other problems in a chain reaction. At the same time, the risks of on-line information processing come with their rewards. Businesses that give their executives what it takes to make decisions will get those decisions made, and, in many cases, a lot faster.

Further, the tools with which various risks are managed are growing more abundant and increasingly sophisticated. A whole field has sprung up in computing to deal with the management of information assets, and it is growing. Database administrators and their colleagues have the ear of general management. When the issue of a mainframe's being allergic to Apples comes up, it can be examined and dealt with in a spirit of cooperation.

For newcomers to this world of data-

ILLUSTRATION BY ED LINDLOF



For newcomers to the world of databases there are seemingly endless problems.

bases there are seemingly endless problems. Many of the issues are old hat to more experienced shops, but the differences in style and substance among business organizations makes for confusion. As neophytes gain hands-on experience with personal computers, some of the confusion should abate, but right now even the big vendors, faced with differing demands from their customers, seem to be having a hard time making clear and simple distinctions among various ways of managing data. The systems vendors may offer several types of DBMS software, several ways of building terminal networks, and several schools of thought when advice is sought. So, consultants have emerged whose experience includes work with a variety of organizations and a wide range of resources and goals.

One such consultant is Hal Urbach, who heads DBD Systems, Inc., of Rockville Centre, N.Y. His clients are primarily big companies in very different kinds of business, such as Chase in banking, United in air travel, Mobil in energy, plus a group of government organizations. One of Urbach's jobs is to serve as a middleman between a company's information users and that same organization's data processing departments. The considerable impact of personal computers on business has become apparent to him during the last couple of years.

"The world is changing, but data processing is not always amenable to swift change," he observes. "The information user agrees that things have changed, but the computing professional may resist. 'How can it change,' the professional asks, 'when I need firm specifications and a clear set of requirements?' This makes for a big gap in understanding and communication.

"While the data processing professional can easily understand why the users in his company want micros on their desks—the pros might well like to play around with the little systems themselves—they have a hard time understanding the appeal of the small machine when the big system they have spent years building is there to support the user.

"To the professional, a micro is a computer that fits only when it can be brought under control of the central data processing organization. And it's not necessarily good for everyone to have a little system on a desk if it is going to be used incorrectly."

Suppose a nontechnical executive in your company visits a computer store. He'll most likely get a sales pitch that includes some kind of information retrieval and on-line file updating. The computer seller will punch in a name and a short file will appear on the micro's screen. A little data will be entered. A printer will chatter, maybe producing a bill of lading or some such document. End of demo.

The next week, that potential user is

on the phone with corporate data processing asking for all kinds of on-line services, whether or not his company has the hardware and software it takes to deliver. The data processing manager may well be flattered; up to now that executive probably didn't even know he was alive. At the same time, this could be cause for anger or resentment; where were all these executives when the data processing department tried to build a committee to study corporate information needs?

The lay user is also unlikely to have any idea just how expensive it can be to build up a large system that is capable of supporting a big database. The hardware required to support a terminal—whether a personal computer or not—can cost five, 10, even 20 times as much as the terminal itself. This is particularly true when the central system is supporting diverse applications; costs per terminal are lower if a system is built to handle a dedicated workload.

There are also expenditures for a DBMS package, related software, and the top-notch people it takes to make on-line systems work. In Hal Urbach's view, the non-hardware items at a large installation will add up to seven figures: "The bottom line is going to be somewhere from \$2 million to \$5 million over a five-year period."

When micros come in, the costs of using them as part of a corporate scheme have to be allocated. The judgment regarding the value of a responsive information system must be based on the way the availability of information affects the business. In the end, it may turn out that the executive with the personal computer and the data processing department have exactly the same goals; what is often harder to get agreement on is a plan for achieving them.

DBMS IS NEEDED

When a company wants its executives to have access to a diversity of facts and figures, the data processing organization will have to choose a database management system. (It's possible, of course, that different groups of users will end up with different DBMS packages, but that is less common than a single package being accepted as a standard.) The DBMS sits between the applications programs that the user sees (or a query language the user sees) and the data itself. The DBMS gets the data for the user. Oddly enough, although a DBMS is a software package that can be bought on a roll of mag tape, it is not a program alone. A DBMS involves a way of dealing with data as well as a means of performing useful work.

If data is thought of as the collection of books in a library, a DBMS involves the acceptance of a method of organization—like the Dewey decimal system—as well as the establishment of a standard means for locat-

ing data, such as the library card catalog. The methodology and the implementation must fit together, and the pair must fit not only present corporate needs but, as well as is possible, anticipated future needs. Once a company adopts a DBMS, it is very expensive and difficult to change.

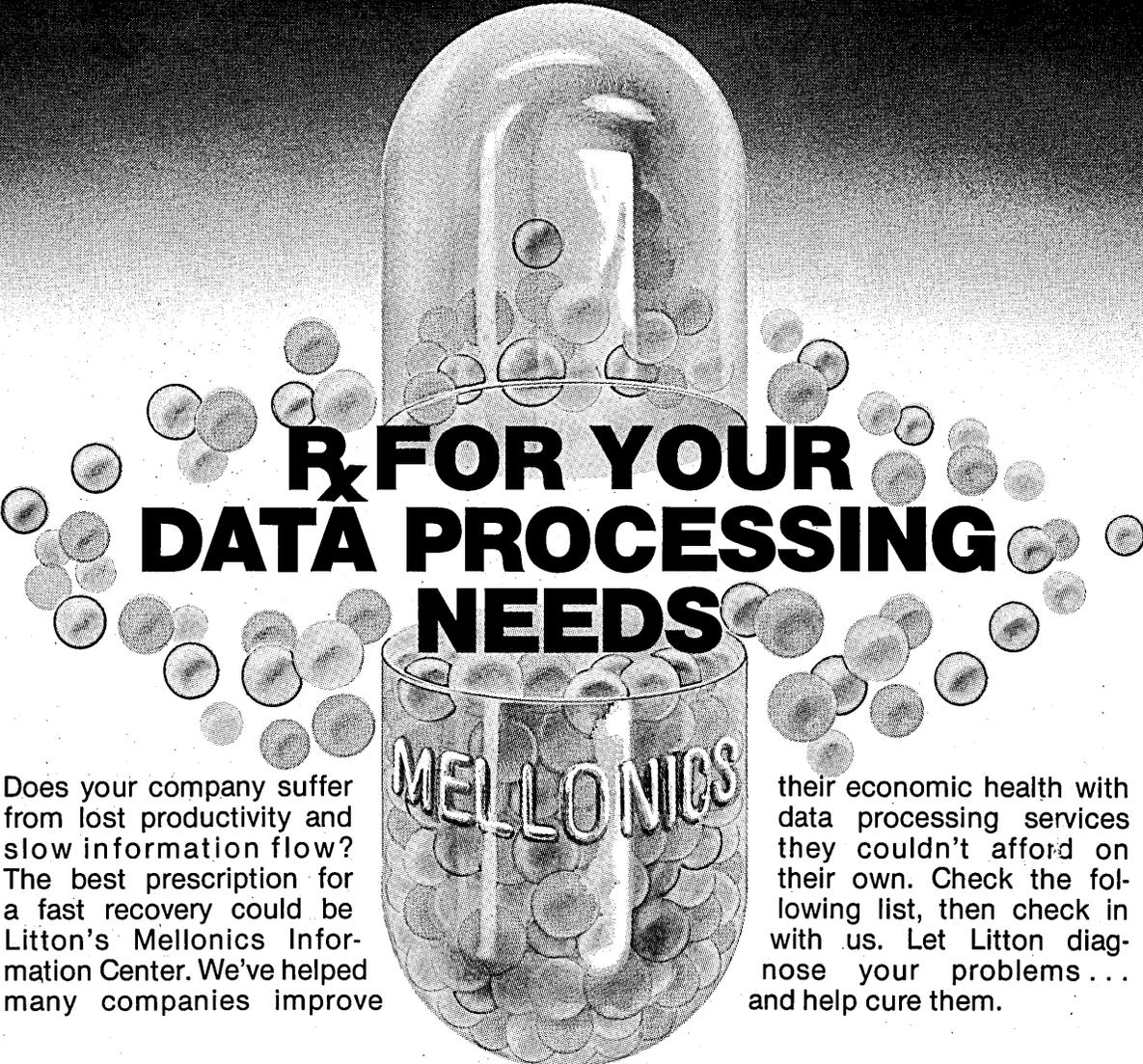
As faster and more terminal-oriented systems become available, the types of DBMS in use are changing. Currently, the big move for new applications and companies now going to interactive computing is a kind of system called a relational database. It appears that relational approaches to the problems of corporate information resources will increasingly take hold as interactive systems blossom. However, older ways of providing access to DBs may remain more efficient for many sites; additionally, their age means that they have fewer bugs and that many more professionals are familiar with them. Most experts on the management of DBs seem to agree that the value of a relational system is greater when the types of inquiries to a system have less uniformity or involve unanticipated ways of looking at data.

To return to the library analogy, most users today are satisfied with the equivalent of a library card scheme. Information may be viewed via titles, authors, or subjects. But an archivist who wants to preserve books published in a given year may find the card system cannot answer the appropriate questions. If a library had card files organized the way a relational database is set up, the date of publication could serve as a key to book locations in the library. Obviously, such a system, which would help the archivist, would be more cumbersome for the librarians to maintain and for most library users to apply to their problems. Add to the date reference facts on books like the colors of their covers, the number of pages they have, the year they were acquired by the library, the rate at which they are checked out, and so on, and you can see the advantages as well as the inherent costs of a relational scheme.

What is making the relational database take off faster is the declining cost of processing and storage as well as the increased interest in access to corporate information from users who only recently wanted little or nothing to do with a computer, let alone a terminal on a nearby desk.

Current opinions about relational database systems vary considerably. Vendors dedicated to one or another type of product present good arguments for their methods of organizing and providing access to corporate data resources. Vendors with more than one product may answer questions differently, depending on how the questions are asked and who asks them.

"There is still a great need for what we call a production database," says Bob Gold-



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It's not necessarily good for everyone to have a little system on a desk if it is going to be used incorrectly.

man, a senior vice president of Cullinane Corp. "This means a DB that handles facts for the general ledger, inventory, and other backbone applications. But there are plenty of micros out there, and computing in general is getting cheaper. People want to get at the corporate database, and they want a private database, too. We shouldn't ask if one type of DBMS will replace another. There are different needs that require different types of systems."

But the movement toward distributed databases and diverse on-line users will stimulate the move toward relational systems. "Some departments," observes Intel's Jerry Spencer, who heads the company's software market development, "have personal computers all over their offices. This creates a problem for the dp department. It's hard to draw a line. On one hand, you improve productivity; on the other, there's a big system that has to be managed efficiently."

To an extent, DBMS functions are being merged into hardware, as IBM has done with its System/38. In other cases, products like Software AG's Data Base Machine allow DBMS developers to add physical equipment to a user's site that enables the access to a DB to occur with less loading of a big mainframe. But making things cheaper or faster does not solve the administration problem.

Dr. E.F. Codd, who played an important role in the development of IBM's relational DBMS, SQL/DS, says that bringing end users in touch with data "will be a major activity in the '80s." But, he adds "the switchover to relational systems will be very gradual."

FACING THE FACTS

Even if the database systems are there for getting at facts, the problems of controlling what belongs in the DB and how it gets there will persist. If anything, the issues will grow more serious as micros appear in more and more offices.

"The key issue," advises Hal Urbach, "is to integrate the micro. You can certainly program such a machine to look like a terminal and hook it up. But then you also have to examine the whole system architecture and decide what rights these machines have and what functions you want them to perform.

"You can say no when somebody asks to hook up. But it won't work. You'll have people sneaking these systems in by the back door. You might start with a word processor, and before you know it it's grown into a data processor and somebody wants to use it to communicate."

Without careful management, says Urbach, the result will be "chaos." Eventually, somebody has to decide which programs, which data, and which equipment are to be used for a given application. Putting off the decisions, he adds, won't make them easier. Nor will a delay make life easier for the data processing department trying to build a database that will work today and tomorrow. Some big companies that formerly tried to delegate everything in an effort to decentralize have turned around and are now struggling to bring their shops to order.

The job, as defined by Merrill's John

Chatfield, an executive involved in database administration, includes not only gathering data and putting them in the right files in the right way, but also preserving their integrity and consistency. Along the way, the use of a DBMS minimizes redundancy so that the corporate information resources can grow without excessive waste of storage resources. In short, data processing departments have to make sure that the use of a DBMS minimizes redundancy so that the corporate information resources can grow without excessive waste of storage resources. In short, data processing departments have to make sure that the use of a DBMS package fulfills the claims generally made for the software itself.

At Merrill, where there are dozens of micros, the problems have all been faced, which is not to say they have been solved. The company seems to be coping with the stockbrokers who have put micros in their offices and with the problems of corporate databases all at the same time.

The Merrill answer, so far, has been to help the account executive with a micro but to keep that small system away from the corporate data. The personal machine is run as a standalone.

In a broker's office, an Apple might sit on a desk beside a Quotron terminal and a telephone. Each is completely independent of the other; the network, if you will, is established in the mind of the broker. Should you call your broker, the micro will be used to retrieve and display your investment portfolio. If you ask for a quote on some stock, the broker will get that from the Quotron. And if you want more information about the quoted company, the Quotron, which is linked to the on-line stock market system the vendor manages as well as Merrill's central data systems, can provide Merrill's up-to-the-minute view of the company's condition. The data on the Quotron screen may be sent to a local printer or, if the report is quite long, to a central printing area that will mail you the report as it comes off the line with other similar documents. Once you act, the broker will update your file in his personal system but will use the centrally controlled Merrill network to process your transaction.

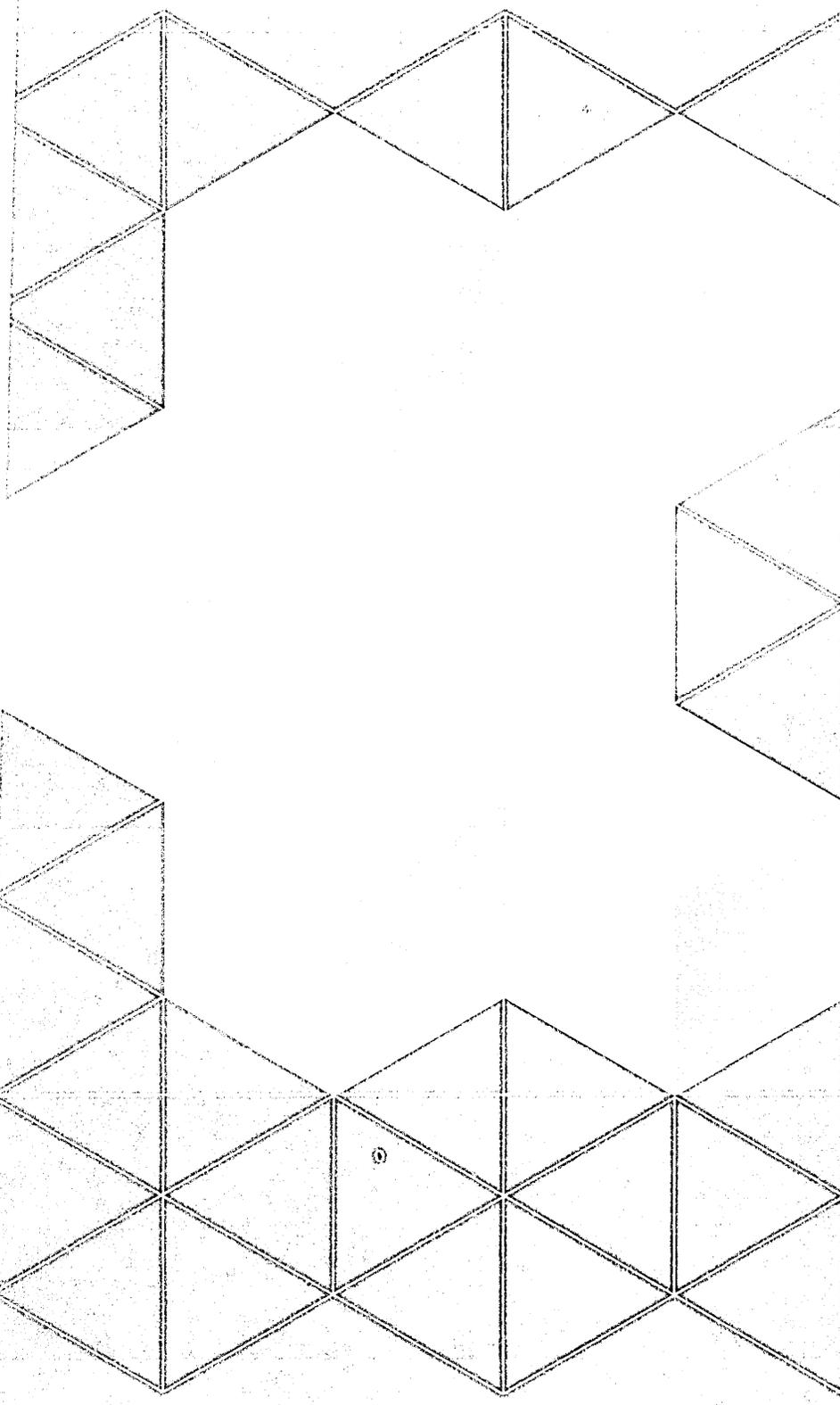
At Merrill, Ritch Gaiti, a computer expert who spends part of his time managing automation in branch offices, is the person who helps that broker pick a personal system, keep it productive, and understand its limitations. These limitations include those imposed by technology as well as those imposed by Merrill Lynch.

Why two terminals to help one person do what seems to be one job?

"When you're dealing with money," says Gaiti, "you want to be able to control everything tightly. For us, the personal computer is best used in what we call 'island



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The problems of controlling what belongs in the database and how it gets there will get more serious as micros appear in more and more offices.

situations. ' While we are thinking about integrating these small machines with our central systems, we are not now planning to use them for processing. That is, we may use them only to help us share our information with account executives and ultimately with our clients. '

In order to help executives prepare for whatever is coming as a result of inexpensive small systems, Gaiti has organized a system that keeps micro users posted. This effort is officially unofficial, as the personal machines are generally brought in by executives under their own initiative and Merrill is not yet committed to a companywide program involving them.

"Our account executives are not data processors," Gaiti explains, "nor should they be. But we do have to educate them about the technology they are considering using. So we run a hotline that enables brokers to get answers to technical questions and to express their wishes. We try to help them improve the service they provide to clients.

"We are also developing some application programs for personal computers, although our executives are using software bought outside or written by individuals in the

company. These applications we are developing are done in BASIC so they can run on different machines. We try to narrow our efforts to the most popular systems; in our case these are units from Apple and Radio Shack.

"We also publish a newsletter for interested account execs. It helps them select hardware and software and, more importantly, to understand the little machines they often see and sometimes have. The main purpose of the newsletter is to prevent our executives from trading one set of problems for another.

"We only suggest things to do at this point. Merrill is not trying to dictate to its executives, although at times you might say we do come in with a little persuasion."

Gaiti may find himself in an adversary relationship with his own company's database administrators. Ironically, because one of his roles is to take part in corporate systems development, Gaiti may find he is "in an adversary relationship" with himself.

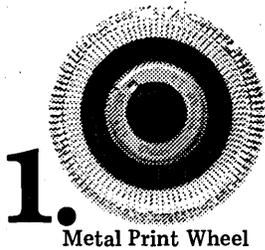
Will there be an all-in-one personal system for Merrill executives?

"Right now," observes Gaiti, "there are too many alternatives. If we cast any

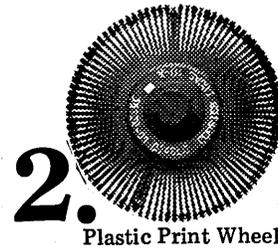
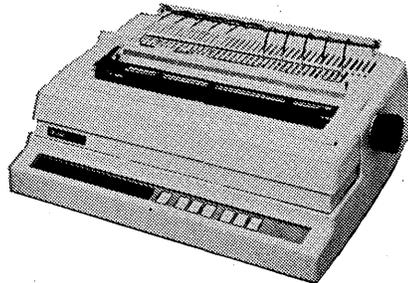
decision in concrete we'll probably find out that we've committed ourselves too early. This does not mean we are without a direction, but it does mean that we recognize that some of what we are doing is, at best, intelligent guesswork. We know we can't always be perfectly right; we most certainly are not going to be dead wrong.

"As technology moves ahead, we hope to be in the right place. It's like catching a ball. You want to be where it will land, not where it is when you see it. In our business that means that we will most likely end up with personal terminals, plus local processing on turnkey minis in each office. We'll have made the right decisions regarding the corporate database. Each executive—and his personal system—will pass along the information it needs to." *

Peter Krass and Hesh Wiener are, respectively, managing editor and publisher of Technology News of America. The New York company produces an international computer news service and two monthly newsletters, *Computer and Communications Buyer* and *Mainstream*.



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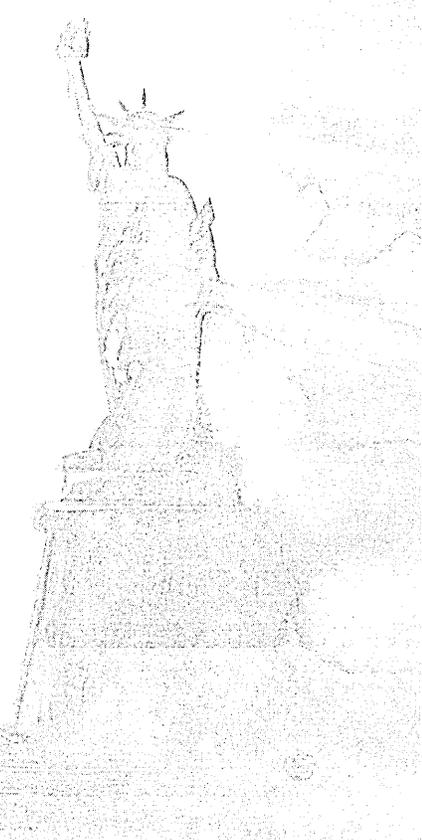


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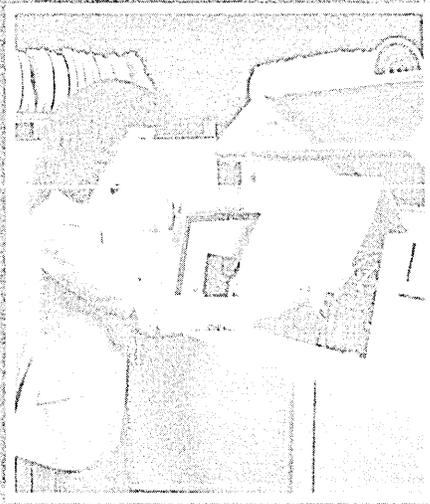
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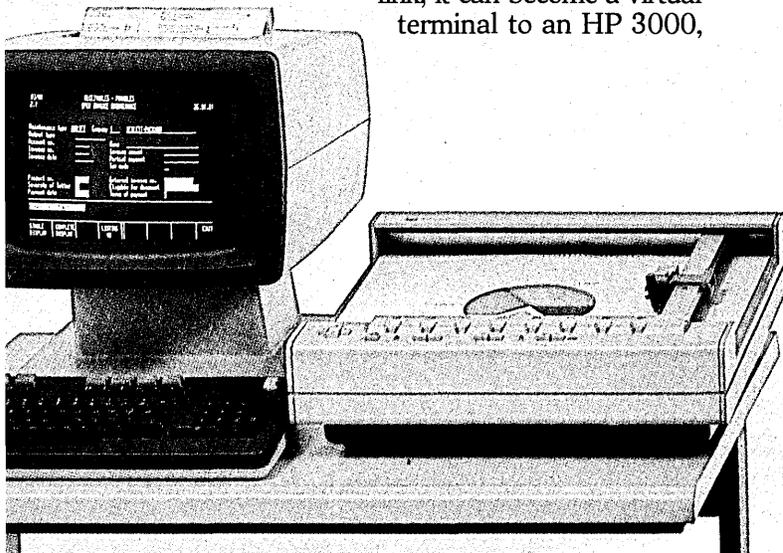
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To improve productivity, the quality of code being created, not the quantity, should be emphasized.

REVERSING THE PRIORITIES

by Leon Presser

The decreasing cost of hardware has made it attractive to apply computers to an increasing number of applications. However, applications require appropriate software, and software is produced by programmers.

Programmer productivity is customarily measured in lines of code generated. In the early days, a programmer produced 400 to 500 lines of code per year; today's programmer creates 1,500 to 2,000 lines of code per year. While such estimates vary widely, the pattern is clear: in the last 30 years, the productivity of programmers has only increased by a factor of 3 to 5.

There is a further complication. The quality of software is so poor that a large portion of a firm's programming staff is dedicated to maintaining existing software: that is, correcting malfunctions or modifying existing programs. A recent study estimated that 30% to 40% of the available programming time is spent in maintenance activities.

This is The Software Problem.

An analysis of software development practices shows that the software industry lacks methodology and tools, and consequently, it is highly labor-intensive—an embarrassing situation for an industry that encourages the automation of others. This problem is exacerbated by the current shortage of programmers and their spiraling salary demands. Also, examination of university programs in computer science shows that, with few exceptions, the graduates are poorly prepared.

The foreseeable future appears bleak unless action is taken to address the problem. The software problem can be summarized as low productivity (both in quality and in quantity). A second look at the problem reveals a fundamental deficiency: lack of methodology and tools for software management, development, and maintenance.

It appears that current work focused on improving productivity defines productiv-

ity as increasing the *quantity* of code, rather than emphasizing the *quality* of what is produced. Our experience indicates those priorities should be reversed. It is more cost effective to improve quality than to increase quantity.

In order to place programmer productivity in a clear context let's consider the following scenario.

A programmer joins a company that has just procured a computer and embarked on a software effort. We will assume that the programmer has completed all necessary training before reporting to work. Furthermore, we will assume the programmer will generate, on the average, P lines of code per unit time, let's say per year.

The first year the programmer generates P lines of code of a certain quality. During the second year, the programmer dedicates part of his time to maintaining the code generated during the first year, and the remaining portion of his time to generating new code.

The third year, the programmer devotes time to maintaining the code generated during the first two years, and so on. Assume that the code generated by the programmer is of a constant quality Q . We can obtain an indirect but pragmatic measure of the quality of the code being generated by determining the amount of time the programmer is dedicating to maintenance activities.

We will define a *loading factor* F as the reduction in programmer productivity per unit time due to the maintenance load. The loading factor is represented as a fraction of P . For example, if our programmer had an initial productivity during the first year of $P_0 = 2,000$ lines/year and on the second year the programmer only produced 1,300 lines of code, then we say that the loading factor, F , was 0.35 and that it degraded productivity by 700 lines of code. That is, we are representing here the cost of maintenance as a certain amount of degradation in programmer productivity. Thus, cost of maintenance is mea-

sured here in lines of code that were not generated.

It is revealing to tabulate, over a 10-year period, the amount of code being produced, as well as the cumulative cost of maintenance for this simple example where $P_0 = 2,000$ lines/year and $F = 0.35$:

Year	Yearly Lines of Code Produced	Cumulative Maintenance Cost in Lines of Code
0	2,000	0
1	1,300	700
2	845	1,155
3	549	1,451
4	357	1,643
5	232	1,768
6	151	1,849
7	98	1,902
8	64	1,936
9	41	1,959
10	27	1,973

The above tabulation is shown in graphical form in Fig. 1. As previously mentioned, programmers are spending 30% to 40% of their time in maintenance activities. That is why we employed a loading factor of 0.35 in the above example. For our purposes, it is not too important whether the programmer is fixing problems or improving the software. High quality software should have few problems and/or should require minimal effort to modify. Returning to our small example we are led to the following observations:

1. The productivity curve and the cumulative maintenance cost curve intersect at approximately the 20th month of employment. This is a critical time line: *it is the time when a programmer "crosses over" and begins to spend more time in maintenance of old code than in creating new code.* Examination of a large number of resumes reveals, personality and economic issues aside, that there is a strong correlation between this time line and the time when a programmer moves to a new job.

ILLUSTRATION BY NANCY FOURNIER/PHOTOGRAPH BY STEVE COOPER



High quality software should have few problems and should require minimal effort to modify.

2. When a programmer resigns, his maintenance load has to be apportioned to other programmers, thus accelerating the resignation of new hires or crippling the effectiveness of the established programmers. These events could lead to a programming staff that is totally consumed in maintenance activities unless remedial action is taken by management, such as returning the code early in its potential life span, with consequent economic impact. However, the early retirement of code creates the need for new software development; a vicious and costly cycle exists.

It follows that a most immediate objective should be to move the cross-over point to the right. Let us derive a formulation for the cross-over point, C , in terms of the productivity, P , and the loading factor, F , we obtain:

$$C = \frac{-0.69314}{\ln(1-F)}$$

We note immediately that C is independent of P . That is: for a fixed value of F , C is unaffected by variations in P . This represents a principal contribution; hence, we will restate. The above formula indicates that if we maintain the quality of the code produced at a constant level, but double the amount of lines of code produced, the point in time at which the programmer enters the "boredom region" will not change; however, the amount of code to be maintained will increase an amount proportional to the increase in code produced—thus, intensifying the magnitude of the problem. Figs. 2 and 3 emphasize the point. Fig. 2 is similar to Fig. 1 except that the initial productivity is doubled to 4,000 lines/year while the loading factor F remains fixed at 0.35. Fig. 3 is similar to Fig. 1 except that the loading factor is cut in half to 0.175 while the initial productivity remains fixed at 2,000 lines/year.

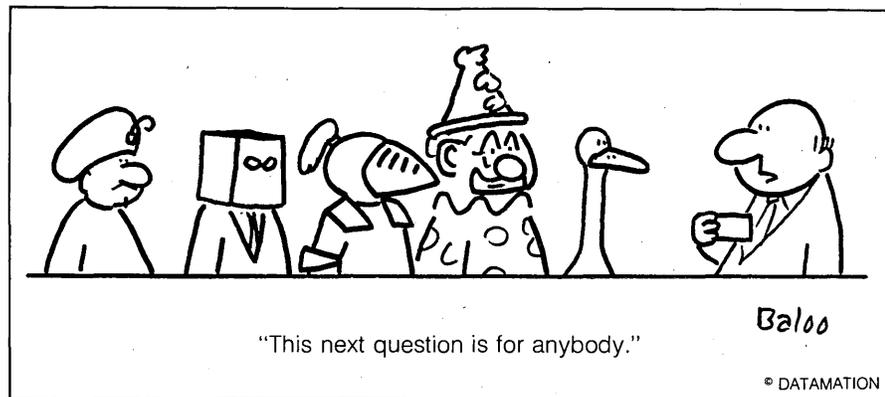
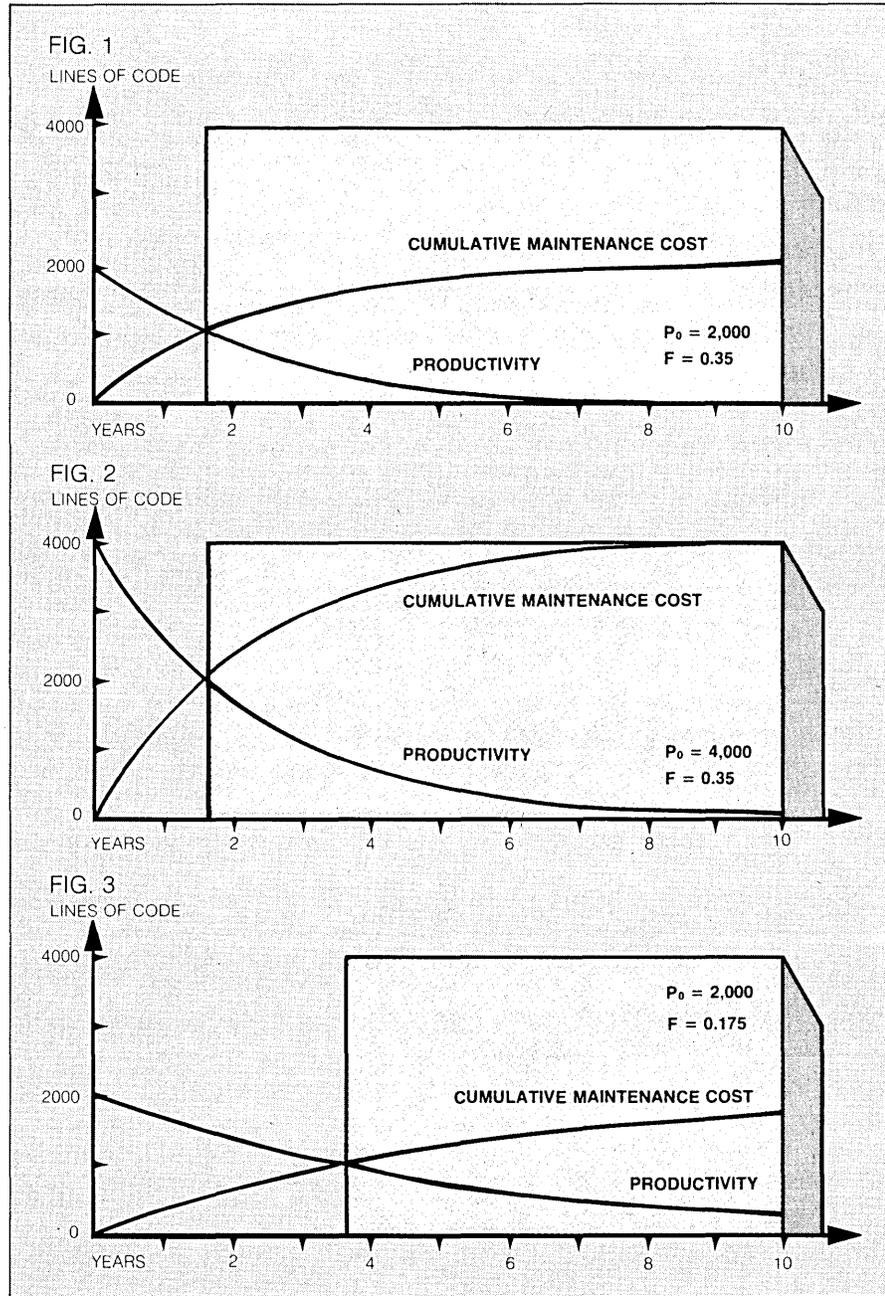
Observe that the cross-over point is at 19.3 months in both Figs. 1 and 2, but in Fig. 3 it is at 43.23 months. Also note that reducing the time spent by our programmer in software maintenance, from 35% to 17.5%, moved his cross-over point by 24 months.

Therefore, current software productivity efforts should be centered on improving the quality of the code being created and not the quantity. As we improve the quality (i.e., decrease the value of F), and move the cross-over point to the right, a time will arrive when it will be cost effective to address the quantity factor.

Now is definitely not the time. *

***Support Costs Soar," DATAMATION, pp. 42-43, February 1981.

Dr. Presser, a former University of California faculty member, is founder and president of Softool Corp., a software company in Santa Barbara, Calif.



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THEORIES OF PRODUCTIVITY ANALYSIS

by Robert W. Osborn

While hundreds of different things are measured in the dp industry, productivity is not: it is calculated, and the few people who boldly state a number for productivity generally concede their metric is not really adequate.

The software salesman who guarantees his customer a 300% productivity increase may be talking about development time or rate, while the customer interprets it to mean overall cost savings—a potentially costly mistake.

Yet "productivity" is a powerful, useful word. Having a metric, however inadequate, allows one corporate executive to boast that his software development staff has experienced a 20% increase in productivity as a result of new methods and tools (some of which were doubtless sold by his company). It causes another to lament that the industry is only increasing in productivity at the rate of 3% a year, despite the availability of the new tools. Recently, certain customer-provided information led IBM to conclude that a 170% overall productivity improvement was theoretically possible.¹ These figures are not comparable, however, since different metrics were used.

Figures of production tell how much is produced, while productivity tells how well resources have been used in producing it (and perhaps how useful the result is). To be productive, one must be both efficient ("acting in such a way as to avoid loss or waste of energy in effecting, producing or functioning") and effectual ("accomplishing the desired result or the fulfillment of a purpose or intent especially as viewed after the event").

At first glance, it would seem the definition is reasonable and broad enough to apply to software projects. The problem is in quantifying and measuring the terms "capacity," "unit," "effort," "effectiveness." Programmers are not merely producing products, they are creatively solving problems. A productivity measure is ideally a single number, an index, which intuitively should have the following properties:

1. Be objectively measurable

2. Be objectively comparable among companies, divisions, projects, and people

3. Be comparable over time

4. Distinguish product characteristics from productivity

5. Get larger as things get "better"

6. Predict production—at least on the scale of No. 7

7. Use the broadest possible relevant resources

8. Cover both efficiency and effectiveness

One view of worker productivity is the relation:

Units output = Productivity \times Time or $U=PT$, where Time is the elapsed time. Productivity thus has dimension 1/time, and is directly measurable by a count of units output. If productivity varies, the slope (dU/dT) is an absolute measure of improvement, and the curvature (d^2U/dT^2) is the rate of improvement.

The equation is fine for repetitious tasks with measurable output, but does this definition of productivity apply to software?

If one breaks down the software into its simplest parts to get a measure of units output, the productivity metric becomes (almost) the familiar lines of code per man-month (LOG/MM). There are three assumptions in this measure: we know how to count lines of code; the product is a program (and only a program); and we can use productive time instead of elapsed time.

The last one is usually assumed in the dp shop, although to the user/client any time spent away from his pet project is nonproductive. The first two are debatable. The literature for any one of the languages reports at least six different ways of counting code. There exists no objectively defensible comparison between the 160 or so languages being used. Even going one step further (and comparing bytes of object code) is so highly dependent on the compiler (or interpreter), programming style, etc. that comparisons are dubious.

In terms of the criteria above, the metric LOC/MM is known to violate No. 2, probably No. 7, and usually No. 8. Prediction, as

per criteria No. 6, is also highly dubious.

Capers Jones at IBM² recommends using the reciprocal of the above measure: man-months effort per thousand lines of code. He argues that this is more reliable and simpler to deal with arithmetically; columns detailing effort in various activities can be summed.

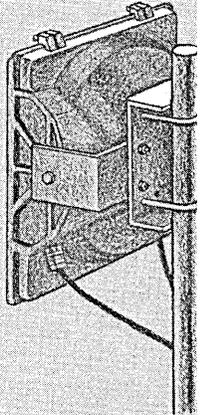
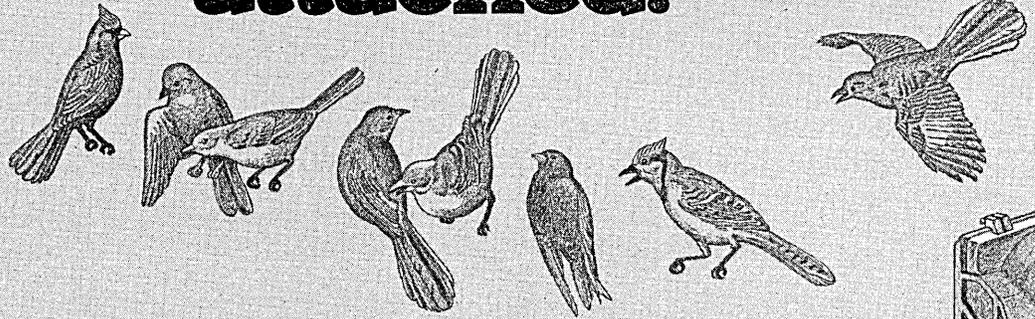
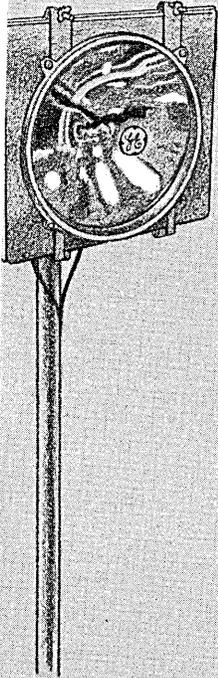
The principal reason for its increased utility is that man-months effort per K lines of code is a cost unit, and not a work unit. It does not imply that the person doing the work is actually writing code—so it accounts for indirect tasks like documentation and even for slack time—and it will work for modular programming with reused modules. The disadvantage is that it still uses the program size as a normalization base, and wide variations occur. For example, figures of \$8 to \$10 per line are not unusual for a straightforward dp application, but IBM reportedly spent over \$200 per line in developing VTAM.

It can be argued that any productivity metric that is solely dependent on sheer program size (even for normalization) not only ignores nonprogram outputs, but also ignores the complexity of the project. The RADC database of software projects³ shows a variation of over 1,000 in LOC/MM for all completed projects.

Trevor Crossman at the Standard Bank of South Africa⁴ defines productivity in terms of primitive subprogram function rather than lines of code. In data from 10 large in-house COBOL systems, developed for both minicomputers and mainframes, Crossman found a simple linear relation between number of functions and total project development time. Crossman argues that the subprogram approach avoids having to make subjective assessments of program complexity or programmer ability. In addition, it is measurably influenced only by "breakthrough technology," while allowing straightforward comparison between projects and installations (without the problems of comparing different languages or line-counting methods). Finally, it allows confirmation of estimates. Capers Jones agrees that this metric is more acceptable than lines of code, and it may



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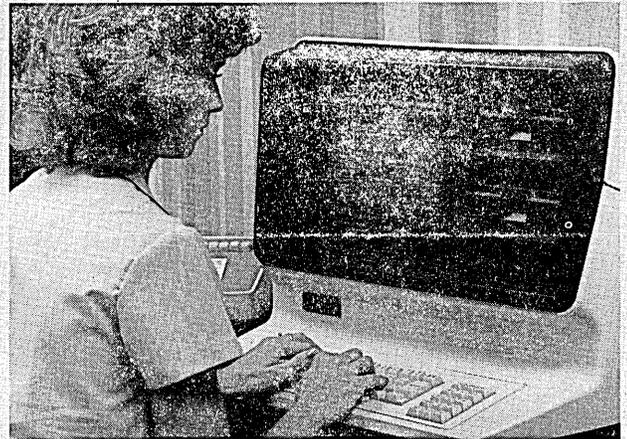
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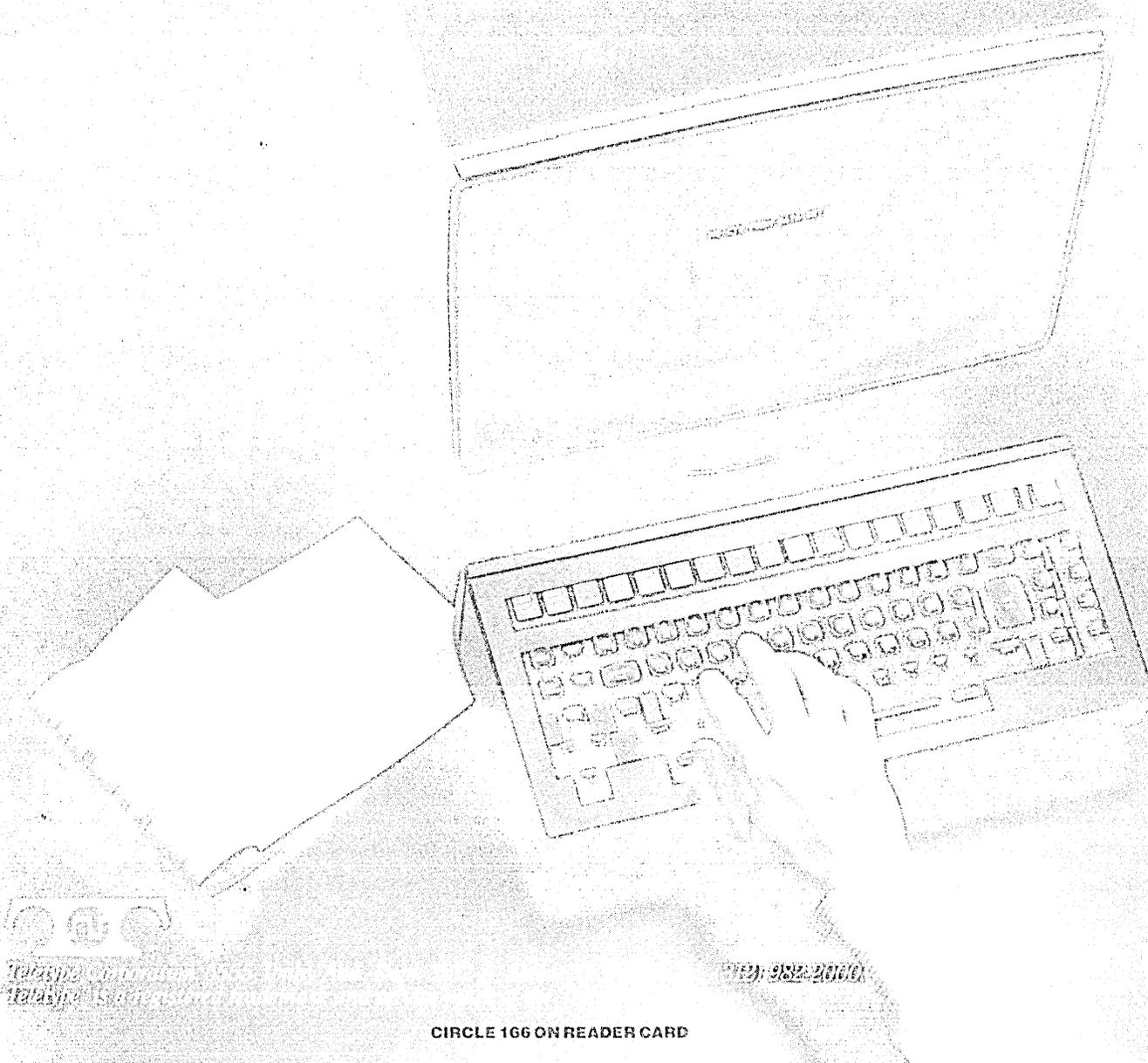
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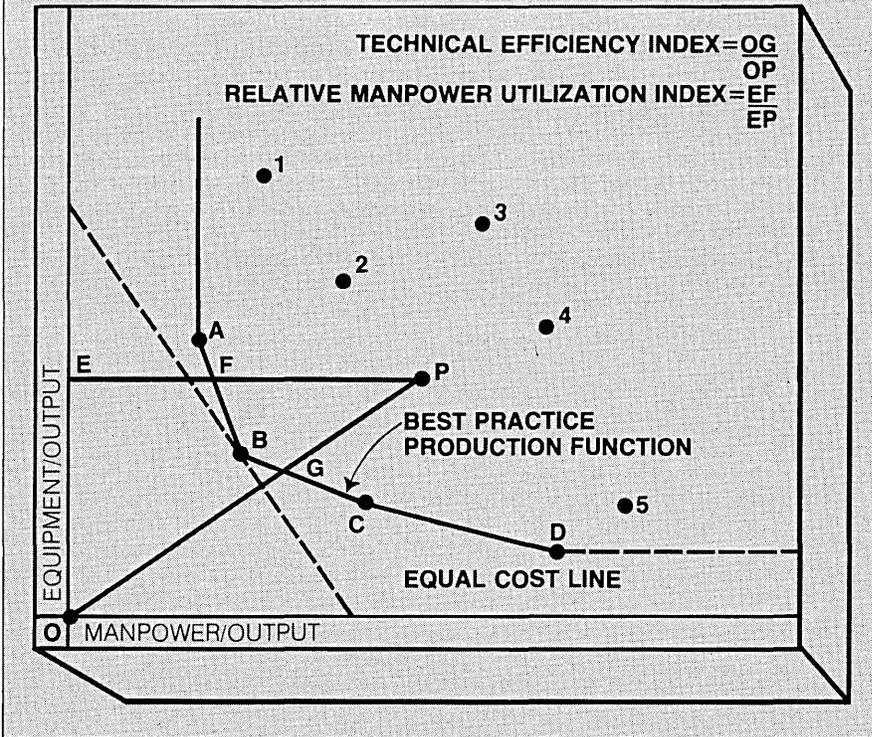
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Programmers are not merely producing products, they are creatively solving problems.

FIG. 1

CONSTRUCTION OF INDICES FOR EVALUATING OVERALL ADMINISTRATIVE SYSTEM PERFORMANCE



become the standard if IBM's efforts in this direction gain industry acceptance.

COST VS. BENEFIT

Perhaps the $U=PT$ relationship is fundamentally inapplicable. The manufacturing industry does not

examine the products but concentrates instead on the primary goals of cost savings and profit. Productivity is thus redefined:

Profit (or Benefit) = Productivity \times Loss (or Cost)

Some industry measures are:

- Global factor productivity or gross inefficiency: the ratio of gross output to total factorial inputs (capital, labor, external purchases)
- Total earnings productivity or conversion efficiency: the ratio of total earnings or engineers' added value to the total conversion costs
- Added value labor productivity: the ratio of economic added value or net output to internal expenses
- Total factor productivity: the ratio of profit to total factorial inputs
- Conversion profit productivity: the ratio of profits to conversion costs
- Labor profit productivity: the ratio of profit to labor costs

These measures have not been applied

in the software industry although more and more sophisticated attempts are being made, particularly in project costing and cost-benefit analysis. This lag is partly due to the fact that unless the product is sold in a competitive market, the value-added benefit is hard to measure.

A cost-benefit measure is appealing because it allows the dp manager to say: "Despite some high development costs, my department overall saved the company X dollars this year while helping it to give better service to customers."

Edward Nelson⁵ offers a good perspective. Ratios, he argues, are to be avoided in studies of cost-effectiveness, because optimal ratios, like optimal computer programs, are usually not the primary goals per se—and this distraction can lead to ridiculous conclusions. "For example, the selection of a house on the basis of the least cost per square foot could result in the choice of a \$500,000 mansion rather than the \$25,000 bungalow that may more closely meet the real needs and budget of the purchaser.

"Because absolute magnitudes are important, the general statement of the criteria appropriate for cost-effectiveness studies distinguishes the following:

1. Fixed gain, variable cost: re-

sources are added to the various alternatives up to the point where each alternative accomplishes the objective; the best alternative is that with the least absolute cost.

2. Fixed cost, variable gain: the alternative that accomplishes the most objectives at a given cost chosen.

3. Maximize absolute difference between benefit and cost."

The goals determine the measure.

The relationship between productivity and effectiveness must be examined for the three cases just mentioned. Since our earlier definition couches productivity in terms of efficient use of resources, labor-intensive production must be judged primarily on the basis of speed. Effectiveness is related to both the quality of the product and its utility. Quality, however, must be enforced by some external standards and is unrelated to productivity per se.

If the product (software or documentation, say) takes additional time or resources to match the standard (acceptable error rate, say), then productivity is lower, according to the above definition. Even on the routine and repetitive automotive assembly line, the cars must meet factory specifications before they are counted as part of the day's output. Improvements in productivity come when easier, faster, or cheaper methods are used to increase quality.

The "utility" may, or may not, be a part of productivity, depending on the organizational (or project) goals. If a task must be done, then both utility and quality are based on external standards, and the most productive method is the one with the least cost. If utility is to be maximized, then a measure of utility is a part of productivity, which is then increased by choosing alternatives that give the most benefit. The difference between benefit and cost are simply maximized, and efficiency and effectiveness play equal roles. If a company's measure were cost/benefit or even net savings per elapsed time, the user and ultimately the whole company would be involved in the analysis.

Benefit analysis encourages the dp department to increase "productivity" by careful selection of projects as well as by efficient development. It encourages effectiveness—or reliability—at the same time, if costs of maintenance are considered. If nothing else, it encourages the collection of all costs in the software development, including the heretofore hidden ones.

But the measure cannot predict yield. It cannot assess productivity improvement tools, since one component of the equation (the "benefit") is outside the sphere of influence of the programmer or development group. Since new tools involve purchase and retraining costs, the measure tends to discourage innovation.

Benefit analysis encourages the dp department to increase productivity by careful selection of projects as well as by efficient development.

BEST PRACTICE FUNCTION

The "best practice production function" may offer some help for interrelating the productivity of several departments or companies. Nelson⁶ has applied this concept to the computer industry. First noting that the computer programs are almost never an end product but rather the means by which computers are used to achieve other purposes, he avoids a direct focus on either the hardware or the programs. If there is more than one input factor (e.g., personnel and hardware) and if an objective measure of the system's output can be devised, we can use the economist's "production function" to formulate indices to compare with each other and with an optimum.

The ratios of each productive agent to output can be plotted (Fig. 1); in this example, I/O statistics of 10 different companies are shown. The "best practice production function" is the concave curve joining points A and D; these firms show minimum use of resources per unit of output. The slope of the production function indicates, in this case, the rate of substitution of labor for capital. Investment in system changes can be expected to result in total cost savings up to that measured by the difference between current operations and the best-practice target. The index values must reflect the disparity between the points. The first that is proposed

here is the Technical Efficiency Index, measuring (in the sample graph) the success of system P relative to the best-practice point G in producing maximum output from a given set of inputs. This index makes it easier to compare very disparate systems.

The second is the Relative Manpower Utilization Index, a measure of the degree to which manpower expense can be reduced (within the limits of the technology), assuming that equipment expense remains constant. The work cited has had some confirmation in an early analysis of several U.S. life insurance companies. Nelson uses the Relative Manpower Utilization Index to show that administrative costs can be reduced 50% for the average company, providing these companies manage their business so as to achieve the performance already demonstrated by their peers.

Two metrics are needed to gauge productivity: effort per normalized output and cost/benefit.

If the systems development (SD) group develops and enhances prespecified software within a given budget, then it is the efficiency of that production which is the sole measure; this is measured in cost per unit output. This case is the classic "fixed gain, variable cost" situation.

If the SD budget is allowed to change (usually upward) to meet company needs, and

if there is always a backlog of software projects (a three-year backlog was cited in one industry survey), then the situation approaches the economic "variable cost, variable gain" situation in which both efficiency and utility play equal parts. The sole measure in this case is benefit minus cost, and the objective is to maximize the difference. The goal of the dp department here is to save the company money.

In practice, neither budgets nor production are completely constrained or unconstrained, so both sets of measures are important in assessing productivity.

"Effort per normalized output" cannot be used to assess efficiency improvements resulting from new tools or techniques until a suitable normalization metric which combines size and complexity is found. In practice, we fall back on stepwise linear regression on an expression of the following form:

$$\log Y = A + \sum B_i \log x_i + \sum C_j \delta_j(0,1)$$

where Y is project cost, x is the numeric project characteristic (e.g., lines of code), and delta represents the presence or absence of nonnumeric characteristics (e.g., use of assembler).

Efforts continue to reduce or eliminate some of the software life-cycle phases, particularly programming, testing, and maintenance (postinstallation fixes, anyway). Use of module libraries and automated aids for program construction are in vogue.

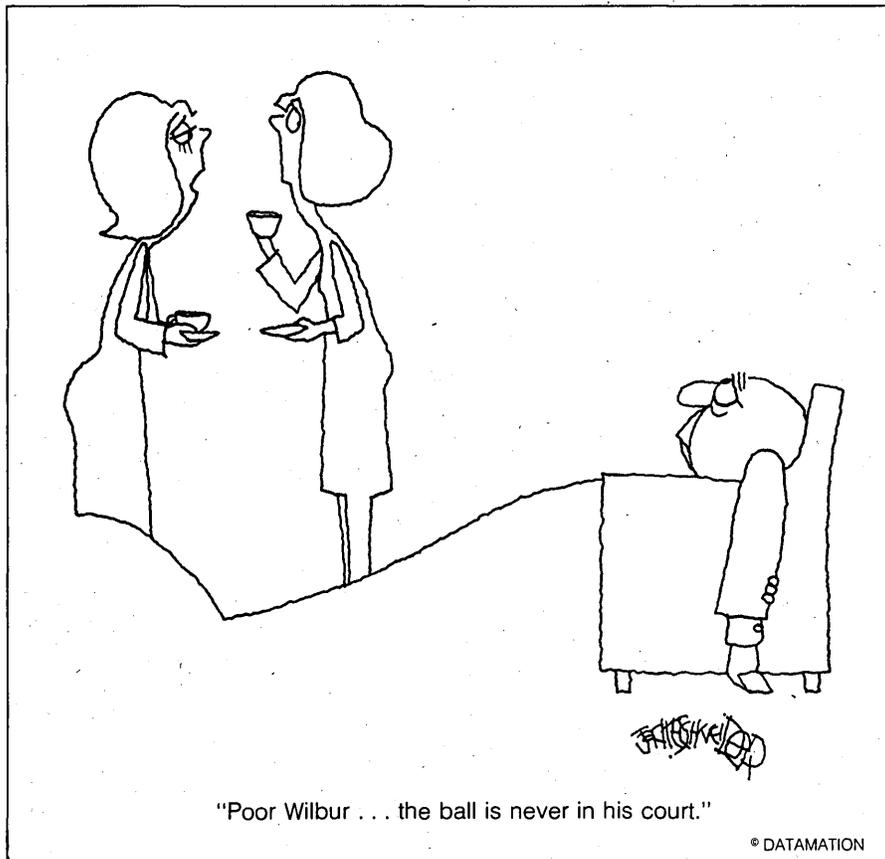
It may be that programmer productivity can be substantially improved by eliminating the programmer.

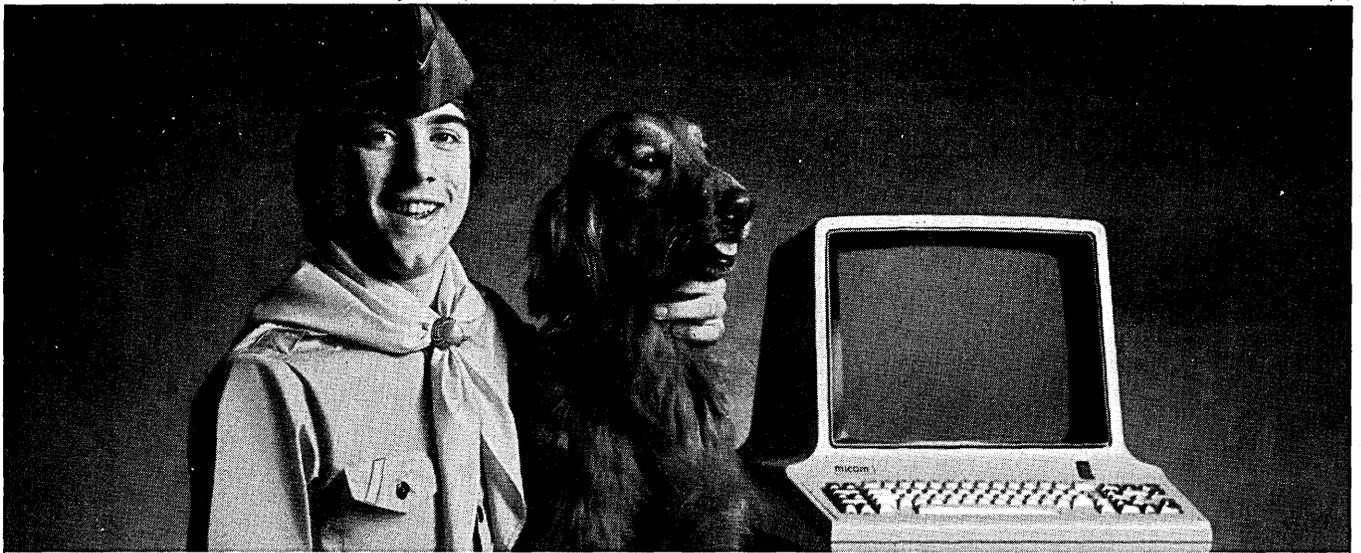
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Dr. Osborn, currently an independent management consultant on project methodology, has worked with computer application software development for 15 years. Previously, he was a technical advisor to Xerox Corp., assistant director of computer services at York Univ., and a project manager at Bell Northern Software Research, Toronto.

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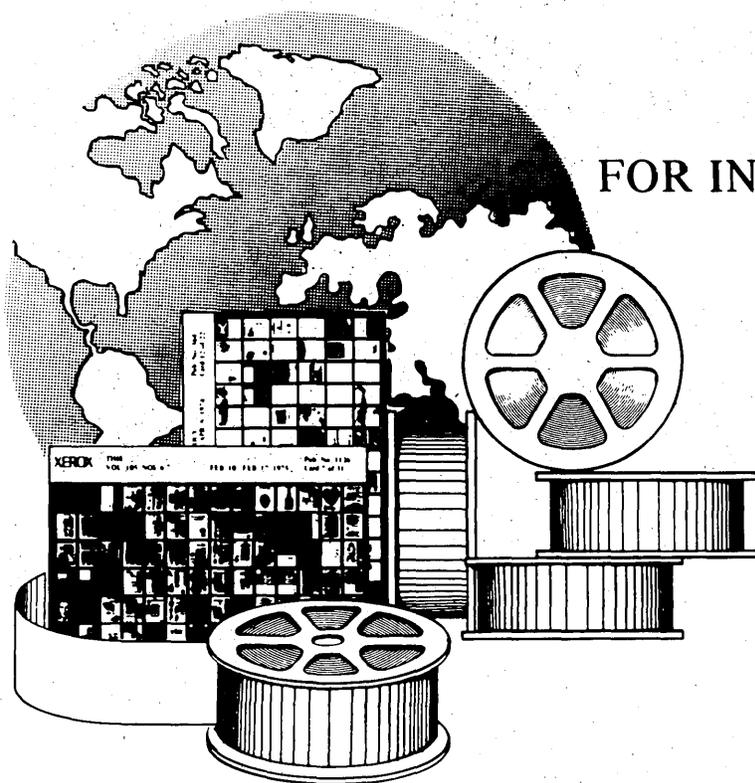
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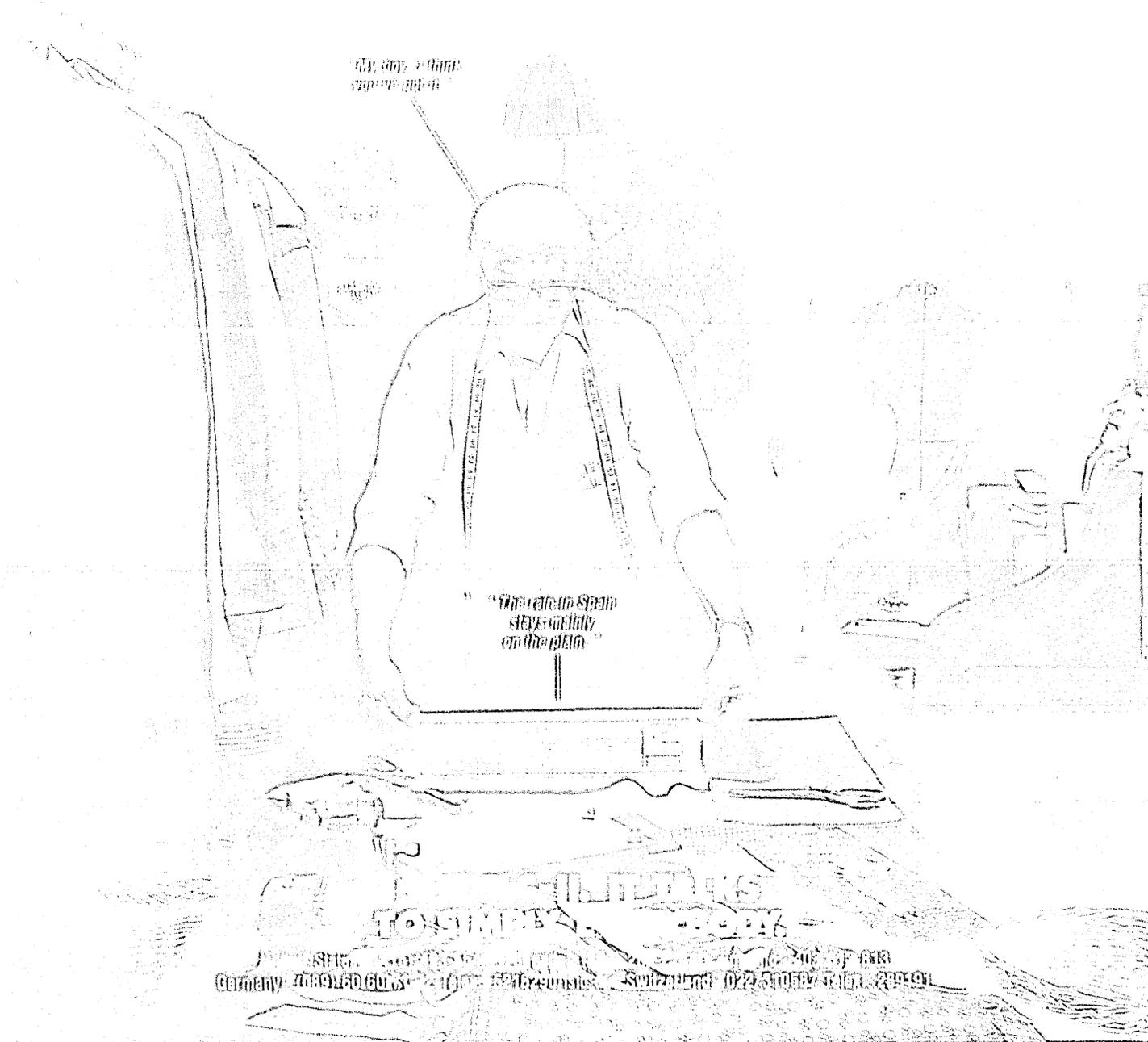
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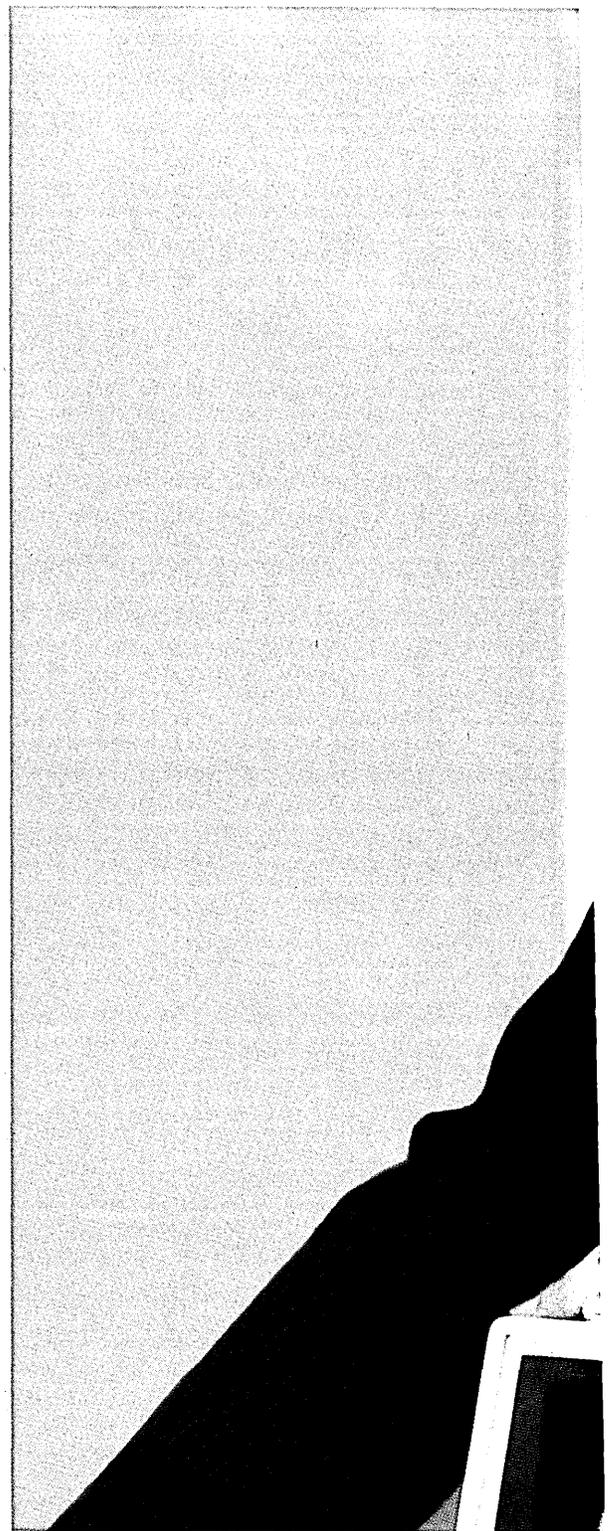
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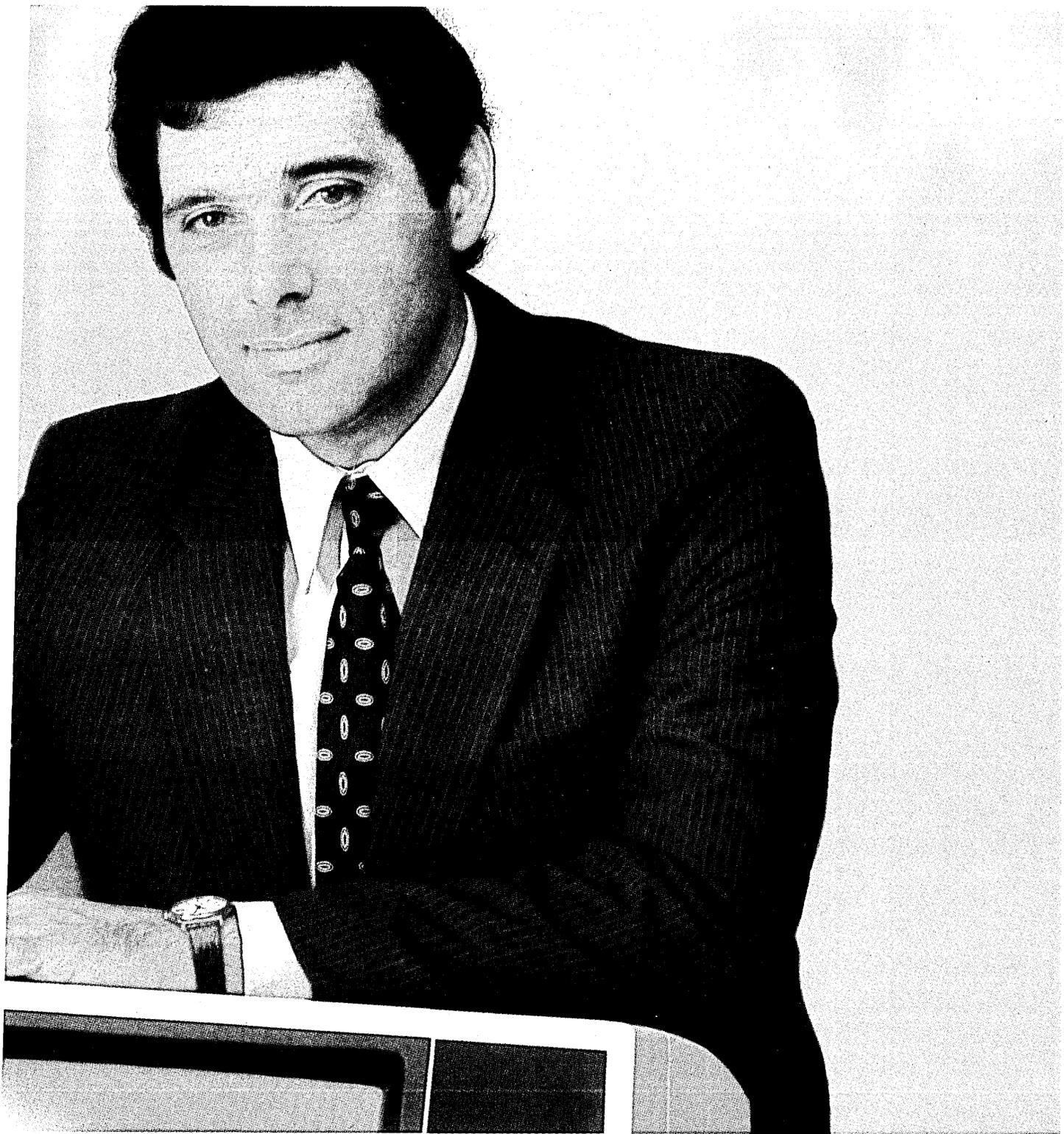
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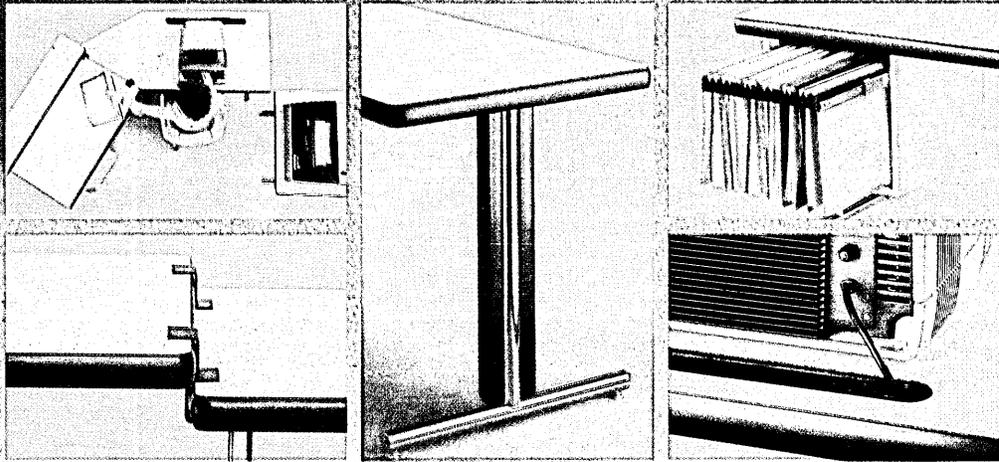
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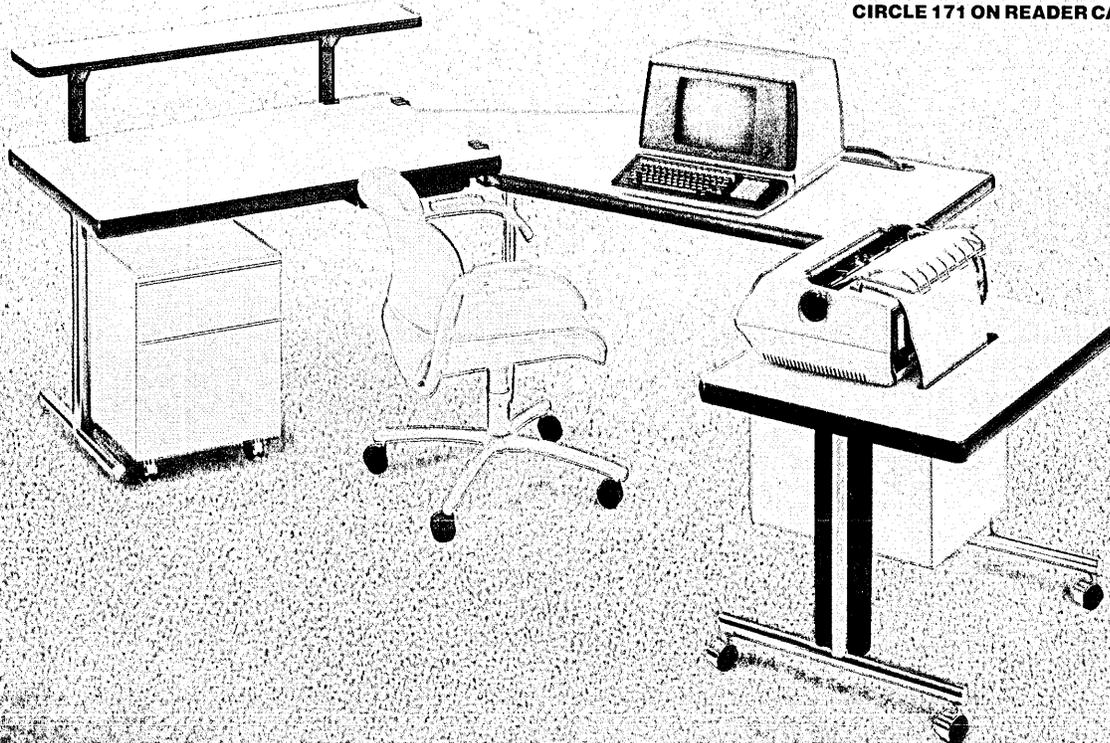
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PEOPLE

NOT WHAT HE HAD PLANNED

This isn't exactly what he had planned.

Like all conscientious graduate students in the early 1950s, Bob Coyer was certain he was going to be a teacher. Oh, he had dabbled in some esoteric areas, such as human factors engineering, while studying at the University of Buffalo, but his primrose path led only to the classroom. Besides, what's a future PhD in psychology to do?

So when St. Lawrence Univ. called with a job offer, Coyer accepted. He trekked across the wilds of upstate New York and entertained ideas of spending the rest of his days in Canton, hard by the Adirondack Mountains.

Then the university suggested he write a book. He had begun a human factors engineering course at St. Lawrence and had written a paper about it. Suddenly, he was more than an obscure professor at a remote small school. Publishers, advances in hand, were knocking down his door.

"I told them to forget it," says Coyer, now vp for tax and telecommunications policy of the Computer and Business Equipment Manufacturers Association (CBEMA). "I was disenchanted with the academic life and the terribly low pay. It fell behind in my priorities."

That project was permanently exiled shortly thereafter. In 1956, RCA, aware of Coyer's World War II Air Force experience in electronics and radar, as well as graduate school performance in helping an aviation company develop for the Navy an all-weather helicopter, wanted to add him to its ranks. It might have been the easiest sale in the company's history.

"I was fascinated with the guy who offered me the job," Coyer says. "He was also a human factors engineer, and the job seemed much more of a challenge than writing a book. It was the best decision of my professional career." It was also a decision that has taken him on a long and winding



ROBERT A. COYER: "My career is studded with taking chances, going into something that is a little bit outside my immediate past."

road from the private sector to consulting to the government and back.

"I was plunged right into the engineering environment," Coyer recalls. "These were really classy, capable engineers, involved in information systems, radar training, and many other fascinating aspects of electronics. They were skeptical of psychological-type engineers, like me. But over the years they became very dependent on us and recognized our contributions to the massive information systems RCA was building."

As a human factors engineer, Coyer's contribution was to narrow the chasm between man and machine. He had to remind the engineers that the working world is not populated by their clones; that what is transparent to engineers may be opaque to others.

"The job was reconciling human sensory and motor capabilities with machines," Coyer says. "What man could do best, delegate to him; what a machine could do best, delegate to it. But you could optimize the interface by proper design of the instruments."

But even interfaces can't be optimized forever.

After his fifth year, some former

RCA employees who had begun their own planning and research corporation sought his services. He told them thanks, but no thanks. Clearly not ones to take a hint, they returned the next year, and this time Coyer succumbed to their charms.

"Things were getting a little dull around RCA," he admits. "They'd just put in a \$1 billion ballistic missile early warning system, and I had the satisfaction of seeing my ideas actually put into place. That was, in a sense, all over. So again the sirens lured me—this time to Hawaii to work on a new project.

"My career is studded with taking chances, going into something that is a little bit outside of my immediate past. It follows a risk situation—after I've got one thing knocked, I try something else."

This "something else" lasted five years. Coyer traveled the world, analyzing almost all aspects of the Navy's information systems. After three years, he and Arthur Young and Co. felt the first pangs of a mutual admiration society. True to form, Coyer let the idea germinate for a year before agreeing to terms in 1968.

While there, he gradually drifted into more and more dp, including a herculean study for New York State on how to automate its vital statistics and records. He also worked for Vico Henriques, a previous acquaintance and now, as current president of CBEMA, the man primarily responsible for Coyer's present employment.

A General Services Administration recruiter eventually caught up with Coyer, but naturally failed to land him on the first attempt. Coyer was a candidate for director of the newly formed dp piece of an umbrella organization called the Office of Federal Management Policy. He sent in a resumé, didn't hear anything for months, then suddenly was scheduled for an interview.

"They offered me the job, it sounded interesting, and so I took it, in 1974," Coyer says. "I really wasn't looking to leave, as I hadn't been in any of my other jobs. I've never really set time-limits. I've never sought anything and never actively sought change. In fact, I've purposely pushed some of them away.

"I'm not one of those who wakes up in the middle of the night and says, 'that's it, I'm gone.' I walk around and poke it with a

PEOPLE

stick to get the courage to rationalize the move. Then I talk to people, subtly, and enlist their support if I'm really interested."

Within two years, Coyer had experienced the nadir and apex of life in the bureaucracy. The Office of Federal Management Policy was yanked from under him, victim of a jealous congressional appropriations committee which refused to fund it because the Office of Management and Budget had transferred some of its responsibilities to GSA without the committee's approval.

While people were laid off, transferred, RIFed (bureaucratese for "reduction in force"), and, as Coyer says, "fell through the cracks somewhere," he and his intrepid band survived intact and surfaced in GSA's Automated Data and Tele-Communications Services (ADTS) division.

Coyer's first assignment there was the infamous "long-range planning." Taking it literally, he directed the production of a two-inch report on "Future Courses of Action for ADTS."

"It was a hell of a report," he boasts, "one of the only ones I've ever seen that drew an unofficial commendation from OMB."

Coyer's official commendation was a promotion to assistant commissioner for policy and planning; then, for his final eight months there, a jump to acting deputy commissioner. While in those positions, he strove valiantly to streamline the agency's procurement process (DATAMATION, Dec. 79.)

"I was afraid I was going to become what I detested in some bureaucrats," he confesses. "The 'ho-hum, I'm-safe, the-last-guy-that-signs-it, it's-his-problem, not-mine' attitude.

"I had to consciously fight it. It's so easy not to return phone calls. I'd get calls from little people, someone out in Arizona, who'd say 'where's my procurement?' If they knew the system, they wouldn't dare call me. Out of desperation they'd call my number and I'd take the call. They were so grateful. They'd made 18 phone calls before that and been kissed off on every one.

"I was afraid I would get calloused and not answer the phone."

His skin hadn't thickened quite enough so he wouldn't entertain thoughts of becoming commissioner of ADTS. He had all the qualifications—support from industry and the agency, although some hardliners regarded him as an industry apologist; impeccable Republican credentials, which he had never hidden; seven years' experience, and a justifiable reputation as a man who could shred red tape with the best of them. With commissioner Frank Carr, a Carter appointee, sure to leave, the ascent of the crown prince seemed for the asking.

Characteristically, Coyer never said a word.

"I had a lot of people from the agen-

cy and industry say, 'I assume you're going to go after that job,' " he admits. "I was even starting to contemplate the changes I would make. But I had no real ambition to become commissioner. I thought I was contributing quite a bit where I was and making significant changes there that were long overdue.

"But I guess if this opportunity at CBEMA hadn't opened up, I would have shot for the commissionership and probably would have gotten it. Still, it wasn't enough to deter me from the attractions of returning to the private sector, taking a risk again, and immersing myself in areas of uncertainty where I have to play catch-up."

Why alter a successful pattern and practice? The 55-year-old ice hockey freak (he plays three times a week and recently had a cast removed from his fractured foot—three weeks earlier than the doctor had ordered) has come full circle. Surely CBEMA will be wiser for his unique perspective of GSA, just as GSA will be well served by Coyer's presentation to it of industry concerns and problems.

Hardly the kind of future he envisioned when he told the publishers to take their money and run.

—Willie Schatz

NOT A RETIRING SORT

Francis V. Wagner likes the idea of retiring, but not of retirement.

In fact, most friends and acquaintances of the 65-year-old vice president of Informatics Inc., Woodland Hills, Calif., would describe him as the least retiring person they had ever met.

But he is officially "semiretired," though no one seems to know exactly what that term means. "All it means is that I'm 65," quipped Wagner at a recent meeting of the Digital Computing Assn. (DCA), where he was well roasted by fellow old-timers in the computer industry.

Wagner added that his semiretirement means "all I'll do is work my 60 hours each week, and then I'll be through."

At a later semiretirement party given for him by Informatics at the posh Riviera Country Club in Pacific Palisades, Calif., Informatics president Walter Bauer talked about the problems of replacing Wagner at Informatics by recalling an old Casey Stengel baseball joke. As Bauer told it, Stengel benched a left fielder who had goofed once too often and went out to play left field himself—only to goof just as badly. When he returned to the bench, Stengel was told



FRANK WAGNER once said of an Informatics product: "That's about as likely to succeed as it is likely that computers will be sold in Radio Shacks."

by the left fielder, "You didn't do any better than I did."

"Yeah," replied Stengel, "you've fouled up left field so badly, nobody can play it."

Bauer and Wagner first met when Bauer came West from the University of Michigan to run the Ramo Wooldridge computer operation. Bigwigs in Los Angeles computing circles, says Wagner, thought RW would have been better advised to pick "a sophisticated type from among our ranks."

"We were all prejudiced against Bauer before we even met him," Wagner recalls, "but he took care of that by proving to us that flattery will indeed get you everywhere. One by one, he took us local experts to lunch and asked our advice. We were eating out of his hand in no time."

Wagner was then looking for someplace to go from North American Aviation where he'd worked for 18 years, and where "I suddenly realized I was the only one reporting to my boss who had no chance of taking his place. I was a computer specialist." Independent software companies were beginning to emerge, and he decided to take a close look at them.

In March of 1962, Bauer and others formed and incorporated Informatics. In April, Bauer approached Wagner about joining them. "It took me three micro-seconds to make up my mind."

Wagner is a man who makes impor-

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Also available through AJ subsidiaries in Ottawa, Ontario; Paris, France; Shepperton, Middlesex, U.K.; and distributors throughout Europe.

 **ANDERSON
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PEOPLE

tant personal decisions in three microseconds . . . especially decisions to change the course of his professional life. The course of this life has veered many times, and, while it wasn't always his decision to change direction, he always picked the new direction—and almost always within three microseconds.

Wagner has been in on a lot of beginnings, in the data processing industry and outside it. He was in on the first use of digital computers in the aerospace industry. He was in on the inception of DCA and the organization of SHARE, the IBM user group. To data, he is SHARE's only individual member; all other memberships are held by companies.

Raised in the heart of Manhattan, Wagner credits the high school he attended with "forming my whole outlook on life." But the determination that was to characterize his professional life must already have been implanted because not every student who wanted to could attend New York City's Regis High School. The totally endowed Jesuit-run school was tuition-free, and competition for entrance was intense. From 1,000 applicants for each freshman class, only 100 could be accepted and half of these were "thrown out" during freshman year. His wasn't the typical preparatory education for a potential computer professional, but then, what could be? In those days there was no computer profession.

He was allowed to matriculate at Manhattan College, despite the fact that he lacked the required high school science course, something Regis didn't teach. He agreed to satisfy this requirement during his undergraduate years and did so by taking the second half of high school physics and chemistry courses. He passed the Regents examinations (a New York State requirement in every secondary school subject) in both, and no one was aware he hadn't completed both halves of both subjects.

Wagner thoroughly enjoyed his four years as a nonresident student at Manhattan College. "I was living two lives. New York City is greater than any classroom. I reveled in it . . . the theater, concerts, music, politics [he was a member of a Tammany Hall Democratic Club]." He also put his spare time to profitable use serving as a sort of guard/guardian on a school bus which transported the sons and daughters of wealthy families to and from private day schools. This didn't last too long because, "I put one noisy little monster down too hard and he told me he'd have his father get me fired. He did, and his father did."

He was graduated from Manhattan in 1938 with honors and a degree in structural design. Though times were tough, he managed to land a job as a junior site engineer for a heavy construction company. He worked on building foundations for the New York World's Fair, and when that job was completed, he was laid off. He'd been told he would earn \$15 per week and was shocked when he received his first pay check for only \$14.85 . . . something called Social Security had been deducted.

Next came pavement pounding, then an engineering job with the City of New York in which he worked, among other things, on the Sixth Avenue subway and became "an expert" in compressed air tunneling. He got to use this expertise on the city's Midtown Tunnel and then on the Brooklyn-Battery Tunnel. He managed concurrently to attend New York University at night and received his MME degree from its College of Engineering in 1941.

World War II stopped work on the Brooklyn-Battery Tunnel, and Wagner went to work for an engineering consulting firm, where he "fell in love with floating dry docks."

This romance ended when "the challenge was gone" and he went to work for Brewster Aircraft in aircraft structural

design. A political scandal took care of both the company and Wagner's job, and "I found myself a relatively experienced aircraft structural engineer without a job in wartime. I received offers from every major aircraft company in the United States."

He chose North American, he says, because he liked the people and their airplanes. He joined the company in 1944 and was responsible for project management of the structural design, analysis, and testing of many aircraft, culminating with the F-86 Sabrejet. Like many others in those days, he was, he says, "faced with the big problem of getting the drawings out the door."

"We all began to realize simultaneously that there were, over there in the accounting department, tab machines which could help us with our arithmetic. This was how engineering computing got started in the aircraft industry . . . to get the drawings out the door."

"And then came the day [and he still has the artifact] I received a written order authorizing me to use the machines to solve all digital computing problems of my department to the tune of 100 to 200 hours per month."

He recalls being invited with other Southern California aircraft engineers to meet with IBM representatives in 1946 at Los Angeles' Chapman Park Hotel. The engineers were asked what they needed and were told what IBM could do for them. An indirect result of this was the CPC machine developed by IBM and installed at Northrop Corp. in 1950.

Next came the 701. North American ordered one and decided a "full-time guy" was needed to head up engineering computing. Wagner was offered the job but decided he didn't want it because "after all, I was a structural engineer." The boss said, "I think you do want it, Frank." In three microseconds, Frank decided he did. Before a year was up he was hooked.

Wagner is a man who likes to make predictions. He once predicted that every business enterprise would be dependent on on-line computers by 1978. He looked for government regulation of IBM by the same year. And he's been quoted as saying of one Informatics product, "that's about as likely to succeed as it is likely that computers will be sold in Radio Shacks."

But he has been right on some predictions, such as the slow growth for custom software and rapid growth for software products. He has predicted that ultimately the dp industry will become the largest in the U.S.

He likes to define things too. John Postley, an Informatics vp who preceded Wagner in semiretirement, said at the Informatics party, "Frank has a definition for everything. His definition for bridge is a game of skill when he's winning and a game of luck when he's losing."

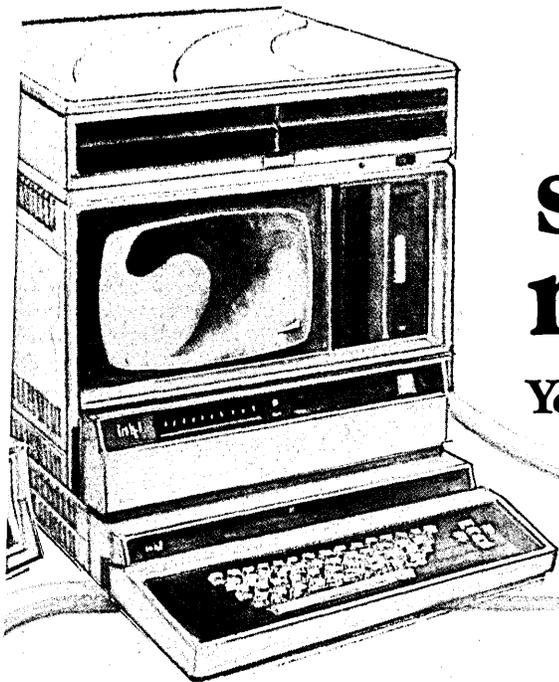
—Edith Myers



"That was the best presentation I've seen in years."

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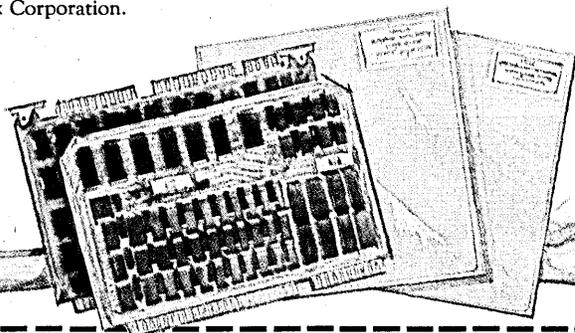
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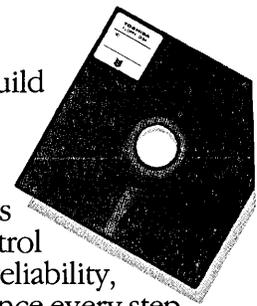
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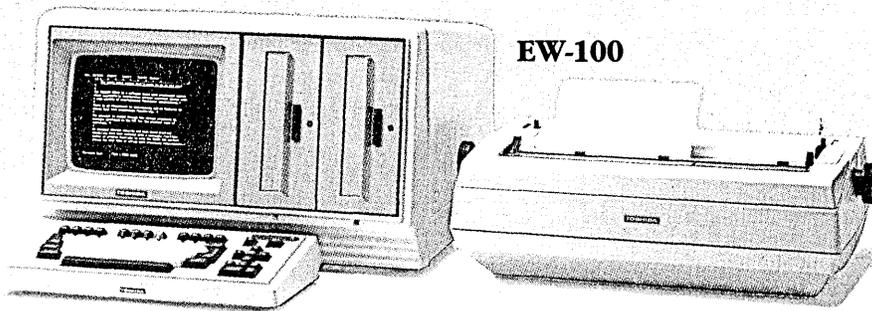


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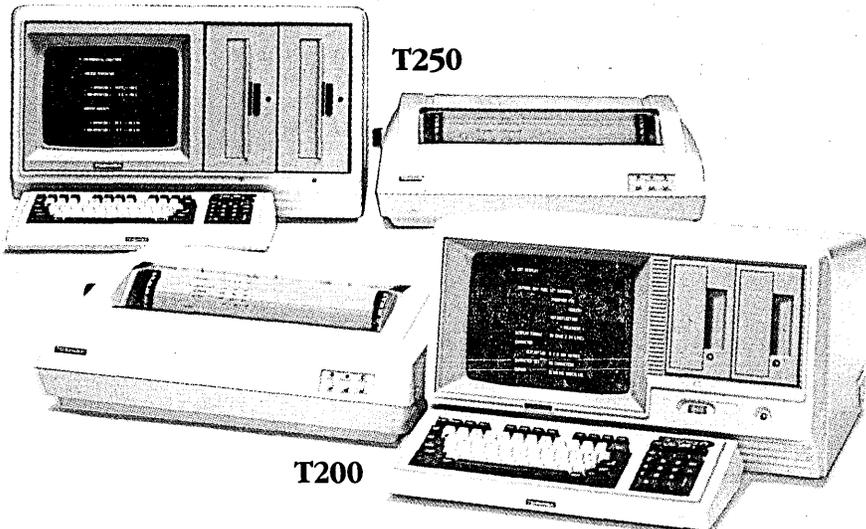
Word Processor



EW-100

EW-100

display capacity: 80 characters × 24 lines
floppy disk: 8"
storage capacity: 300KB × 2,
1MB × 2
type of printer: daisy-wheel printer
printing speed: 45 characters/sec.
print pitch: 10/12/proportional spacing



T250

T200

T200/T250

Hardware

memory: 64KB
display capacity: 80 characters × 24 lines
floppy disk: T200: 5 1/4"
T250: 8"
storage capacity: T200: 280KB × 2
T250: 1MB × 2
printing speed: 125 characters/sec.
characters per line: 136 characters

Software

CP/M®, Microsoft BASIC-80, CBASIC™

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CIRCLE 174 ON READER CARD

HARDWARE

OFF-LINE

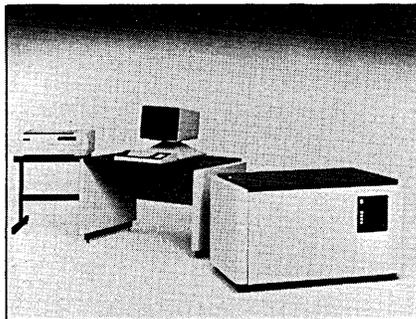
The Computer Store, Inc., an East Coast computer retailing chain (not to be confused with the first personal computer store of the same name located in Santa Monica, Calif.), has begun to use a four-level pricing structure. Having observed new types of customers evolving, the chain has implemented the "Thrifty Purchase Plan" for sophisticated single-system buyers who don't require extensive hand-holding. Service and support for these customers will be charged separately. The two additional classes of buyers are the \$50,000 multi-unit customer and the \$100,000 volume purchaser. The chain will continue selling to the single-system buyer who pays retail prices and receives backup service and support from the local store.

A letter of intent for a licensing agreement between Zilog and Advanced Micro Devices was recently signed. Under the agreement, AMD will make and sell a new 32-bit micro being developed by Zilog, as well as virtual-memory versions of the existing 16-bit Z8000 micro. In turn, Zilog will be licensed to manufacture some advanced telecommunications products and several of AMD's proprietary peripheral devices and single-chip microprocessors. The two companies also will collaborate on the development of new peripheral devices for microcomputers.

Lear Siegler has cut the list prices for its ADM 3A and ADM 5 Dumb Terminals. The 3A is now \$595, a \$300 cut from its previous price of \$895; the ADM 5 now costs \$645, down from \$995.

SMALL SYSTEMS

MDS Qantel, the year-or-so-old combine of Mohawk Data Systems and Qantel, has released two new entry-level systems in the



Qantel line. The Systems 22 and 23 are compatible with all existing Qantel applications packages, and they can be field-upgraded into larger Qantel Series 200 and 300 systems. Systems 22 and 23 have been designed for both standalone and network applications; they are the first systems in Qantel's product line to offer both Winchester and floppy disk storage.

System 22 has 64KB of main memory, 10MB of Winchester disk storage, a 650KB diskette drive, 90cps printer, and one display terminal. This system sells for \$19,950. System 23, configured like the System 22 except that it has 20MB of hard disk and a 150cps printer, sells for \$23,950. Deliveries are planned before the end of this year. MDS QANTEL INC., Hayward, Calif.

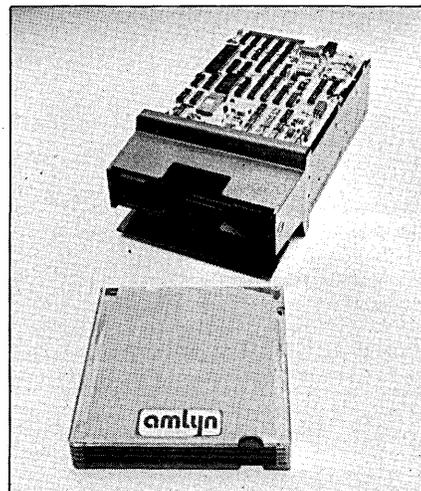
FOR DATA CIRCLE 301 ON READER CARD

FLOPPY DRIVES

Amlyn, a new company in San Jose, has developed a pair of five-inch diskette drives (using autoloading five-diskette cartridges) as its first products. With a maximum stor-

age capacity of up to 8MB per five-diskette cartridge, the Amlyn drives are offered in two models: the 5850, which is functionally compatible with Shugart Associates SA850 double-sided, double-density drives, and the A506, which is compatible with controllers that interface Seagate Technology ST506 five-inch Winchester disks.

In the 5850, each diskette can be addressed as a separate SA850 drive. The A506 maps each recording surface of the Seagate disk onto a diskette; since the Seagate has four recording surfaces, the fifth diskette in the A506 cartridge is available for additional data, such as operating system code. Due to the difference in rotational speeds, the A506 operates at one-tenth the transfer rate of the Seagate Winchester. Both drives use an Intel 8051-based controller, and each can read diskettes written by other drives in standard track densities such as 48tpi, 96tpi, or 100tpi. For reasons of reliability, the drives are not designed to



HARDWARE

HARDWARE SPOTLIGHT

WORD PROCESSING

A pair of word processors (or office automation workstations, if you prefer) and a clustered controller and mass filing system debuted in Syntrex's booth at the recent word processing show in Atlanta. Sporting astrological names—Aquarius I and II and Gemini—the product line is yet another effort to automate paper processing and filing.

If Syntrex can gain a firm foothold in the office automation market, it should be able to give some long-established vendors a run for their money. The Aquarius I and II can operate standalone or in conjunction with the Gemini. Priced in the \$5,000 ball park, Aquarius I includes a 25-line display, 50 pages worth of diskette storage, and connection to a Syntrex, IBM, or Olivetti electronic typewriter which can be used both as keyboard and printer. The document-oriented word processor uses a natural language filing system consisting of drawers, folders, and documents. Cross-indexing by document name, author, location, and description simplifies retrieval via any combination of descriptors. Word processing may be performed on documents as wide as 200 characters, with automatic on-screen justification, automatic centering over pages or columns, and automatic left and right indents. The screen displays an accurate print image, including justified text, underlines (single and double), and bold print. A HELP command and an UNDO feature are provided, while a statistical package is optional. With a connection configured for a Syntrex Aries or Olivetti electronic typewriter, the Aquarius I sells for \$4,790 plus \$20 per month for software. A version for connection to an IBM electronic typewriter is

\$4,990, plus the \$20 per month software fee. With a movable keyboard and port for a daisywheel printer, the unit sells for \$5,190 plus software fee. Up to four units can share a daisywheel printer; they can be upgraded to the Aquarius II and they are available without diskette storage for use in configurations with the Gemini.

Aquarius II adds multiple window editing capabilities and Fastpath, which al-



lows the user to enter a single command to interrupt a current job, process a priority request, and then return to the point where editing left off in the original job. Aquarius II also offers "red lining," where deletions are printed overstruck with hyphens, and new text is printed with an overline, allowing much faster proofing of draft documents. (Of course the overlining and overstruck characters are removed for the final printing.) The Aquarius II also has automatic footnote handling (and renumbering), keeping the footnote on the same page as its reference, and breaking long footnotes over

onto the next page. Automatic paragraph numbering in a broad range of styles, including spelled out numbers, also is provided. A standalone Aquarius II with a 25-line display, dual diskette drives with a total capacity of 180 pages, and a connection for a Syntrex or Olivetti typewriter sells for \$6,190, plus \$25 per month for the software. A version for use with an IBM typewriter is \$6,390, plus software fees. With keyboard and printer port, the Aquarius II sells for \$6,590, plus software charges.

Gemini is Syntrex's electronic filing cabinet that can serve up to 14 Aquarius workstations. Using a redundant architecture, Gemini provides Winchester disk storage for up to 60,000 pages of text. Called the Always Up design (for which Syntrex acknowledges the contributions of the NASA space program and Tandem Computers), the system continually monitors itself. Both identical halves of the Gemini respond to user requests, making duplicate copies on separate disks and verifying integrity as documents are requested. The "Service Genie" automatically initiates a call for service if one side fails; meanwhile, processing continues. The automatic call for service also provides the customer engineer with diagnostic information. Syntrex says that most users won't be aware of a failure until the repairman telephones to arrange a convenient time to repair the unit. A small Gemini with 7,500-page capacity sells for \$26,900. A 15,000-page system with eight Aquarius workstations and six printers is said to come in at under \$100,000. SYNTREX INC., Eatontown, N.J.

FOR DATA CIRCLE 300 ON READER CARD

write data in these formats, although diskettes may be read and then rewritten in the Amlyn format. Evaluation units are currently available, with production scheduled to go into full swing by the first calendar quarter of next year. Pricing, although not firm, is reported to be slightly more than \$800 per unit in orders of 500; cartridges containing five diskettes are expected to sell for roughly \$35. AMLYN CORP., San Jose, Calif.

FOR DATA CIRCLE 302 ON READER CARD

COMMUNICATIONS

In a pair of related announcements, Wang Laboratories entered both the local networking and digitized voice markets. WangNet provides a broadband coaxial cable-based local networking architecture, while the Digital Voice Exchange (DVX) provides voice message store and forward capabilities analogous to electronic mail. Deliveries of the various components comprising the two systems will be spread over the 1982 calendar year, beginning in the January/February time frame.

WangNet currently uses about a

third of the available bandwidth of its coaxial cable. This is further divided into three bands: the Wang Band, the Interconnect Band, and a Utility Band. Wang Band operates at up to 12Mbps, linking hundreds of Wang Office Information Systems, 2200 Series small business computers, and larger VS systems. As with a number of other coax-based local networking systems, the Wang Band uses Carrier Sense Multiple Access with Collision Detection (CSMA/CD) allowing high-speed burst transmissions. Wang systems connect to the cable using a Z80-based Cable Interface Unit (CIU) to handle data packet assembly and disassembly, as well as error and flow control. The CIU will sell for \$3,800, and will become available in the fall of next year.

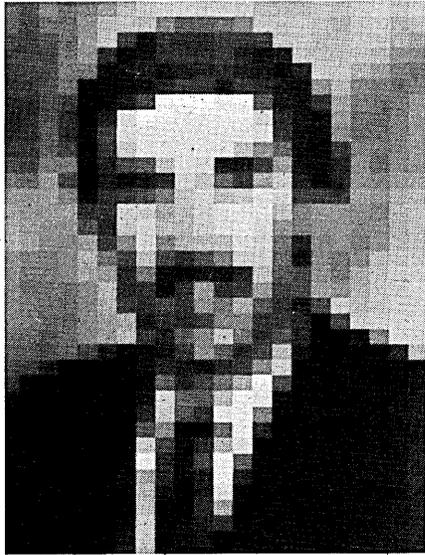
The Interconnect Band allows any RS232- or RS449-compatible device, whether from Wang or another vendor, to communicate over dedicated (similar to leased lines) or switched (similar to dial-up) links. Up to thirty-two 9600bps links and sixteen 64Kbps links are supported in the dedicated mode, and up to 256 switched circuits are

available. For dedicated circuits, users will need fixed frequency modems, to become available in the first quarter; 9600bps modems sell for \$850, while 64Kbps modems are \$1,200. Switched channels require frequency agile modems for attaching devices to the cable, and a DataSwitch for control functions. With availability slated for June, the DataSwitch (which can control simultaneous operation of all 256 circuits) will sell for \$12,000, and the modems will be \$1,250.

The Utility Band can carry seven video channels, each operating at the 6MHz bandwidth of a standard television signal. This band is provided for whatever use a customer may care to make of it; Wang offers no hardware for the Utility Band.

DVX lets users create Voicegrams called in from any Touch-Tone telephone. Using digitized voice, DVX allows immediate or deferred delivery of messages. From a telephone, the user supplies an ID code, optional password, and a destination telephone number or numbers. DVX allows recording of messages as long as 90 seconds.

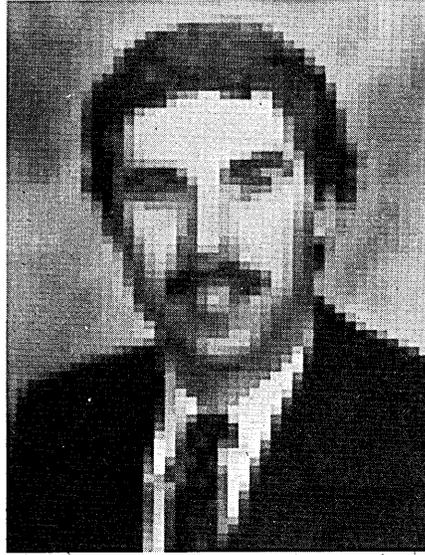
Micro computer software company gets macro results.



"Software is the hottest segment of the personal computer industry. After all, it's the software that solves problems. And Business Week has precisely the type of readers who are looking for solutions to the kinds of problems we solve. Top and middle management of corporations. That's why right from the start we committed a substantial portion of our marketing budget to advertise in Business Week. And we're very pleased with the results. Since our first insertion, our monthly sales have more than doubled."

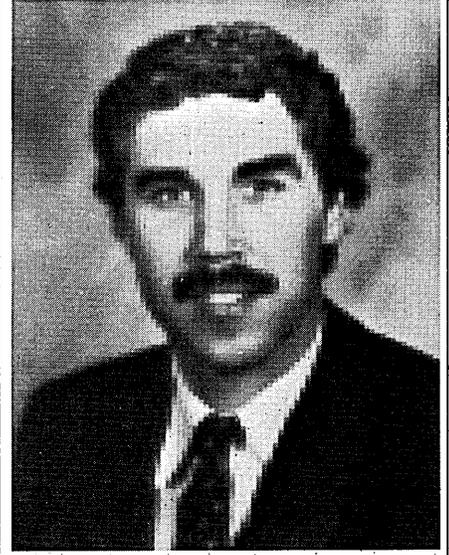
James M. Dow, President
Microcom, Inc.

When Microcom began in 1980, the Boston-based manufacturer of personal computer software wanted to spread the word to corporate



managers about its first product—an electronic mail package for Apple™ computers called Micro-Courier™. Not only to managers who already have Apples,™ but to the fast-growing market of managers in corporations who are thinking of buying personal computers to help them and their staffs do a better job.

For Microcom's Jim Dow, Business Week brought his market into focus. Business Week has a take-action audience of over 6 million corporate decision makers. And they look to Business Week to keep them informed on computer developments. Business Week is the only general busi-



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HARDWARE

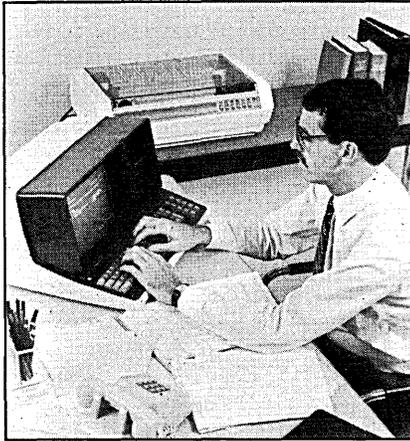
The system can be configured with from four to 16 lines, in groups of four. Each group reportedly can accommodate 200 users. Up to four 300MB disks may be attached to the system for storing messages. Shipments are to begin in the first quarter, with prices starting at \$125,000. WANG LABORATORIES, INC., Lowell, Mass.

FOR DATA CIRCLE 303 ON READER CARD

SMALL COMPUTER

Data General has thrown its hat into the very small business system ring with its introduction of the Enterprise 1000 system. Beginning this month, the Enterprise should be available through independent retailers, sparing DG the overhead of a direct sales effort; hardware support will be taken care of by DG's staff of field engineers. Dealers will provide the first line of software support, backed by telephone assistance from DG Enterprise specialists. To cover the age-old problem of training, DG has developed videodisk training programs.

Retailing for \$7,195, the Enterprise 1000 comprises an integrated, micro-Nova-based desktop computer and a separate bi-directional 150cps printer. The desktop computer package includes processor with 64KB of RAM, video display, keyboard, and two dual-density minifloppies (each capable of holding 358KB). Working with the Big Eight accounting firm of Ernst and



Whinney, DG has developed a number of accounting applications packages, each with a suggested \$1,000 retail price. The offerings include accounts receivable and order entry/inventory control initially. DG's Business BASIC is available in both run-time and developmental versions for users who want to write their own programs. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 304 ON READER CARD

COMMUNICATIONS

Exxon Enterprises' affiliate InteCom has been marketing its Integrated Business Exchange (IBX) Series 40 voice and data switching system for two years. Now the

firm sees a growing market for local area networking support, leading to the introduction of a series of packet switching controllers. The first entry in the new InteNet line is the 3270 InteNet Packet Controller (3270 IPC). Priced at roughly \$10,000, the 3270 IPC isn't limited to simply linking 3270-type devices to hosts; it provides format and protocol conversion allowing up to 16 ASCII terminals and other diverse devices to access host-based applications designed for 3270s. Communicating with the host at speeds up to 9600bps in bisynchronous format, the 3270 IPC appears as an IBM 3271 Model 2 Control Unit. Users needing access to 3270 applications can request a circuit through the IPC. If one of the eight or 16 IPC ports is available, the link is made; otherwise, the user gets a busy message. The user can then opt to come back later and try again, or the request can be queued for the first available port. And since the user's terminal is a standard ASCII crt, it can be used to access non-3270 systems, such as outside timesharing services, by bypassing the 3270 IPC. The IPC supports all common 3270 features such as formatted pages and protected field. It also simulates light-pen operation and provides accounting information. Future IPCs are planned for other local networking schemes, including Z-Net and Ethernet. INTECOM INC., Dallas, Texas.

FOR DATA CIRCLE 305 ON READER CARD

THE
LONG
and
SHORT
of it...



LDM 404B

Are your needs between long distance and Limited distance? Gandalf's answer is the LDM 404B—a medium distance modem designed for metropolitan areas where range beyond that of a typical short haul modem is needed. This unit, built for FDX synchronous communications at 4800 bps, operates over a 4-wire voice grade 3002 circuit (conditioned or unconditioned). For use on "T" carrier and most other carrier systems. Interface meets EIA RS232C and CCITT V.24 requirements.

andalf

Gandalf Data, Inc., 4019 S. Noel Avenue, Wheeling, Illinois 60090 Tel: (312) 541-6060

Gandalf Data Communications Ltd., Gandalf Plaza, 9 Slack Road, Ottawa, Ontario, Canada K2G 0B7 Tel: (613) 225-0565

Gandalf Digital Communications Ltd., 4 Cranford Court, Hardwick Grange, Warrington, Cheshire, England Tel: 09-0276-28527

CIRCLE 176 ON READER CARD

Do you know where DBMSs will be in 1985?

CCA, the leader in software for information storage and communication, invites you to a free seminar on "DBMS in the '80s." The seminar will discuss:

...would you like to
go to a *Free Seminar*
and find out?

- The major challenges confronting data processing executives in the 1980s.
- How CCA's Model 204 DBMS—the most advanced DBMS available—is being used by America's leading corporations to meet these challenges.
- How CCA's Distributed Model 204 DBMS, the world's first general-purpose distributed DBMS, will tie together databases residing on different machines and make the location of data transparent to the user.

- How CCA's VIEW System uses graphic interfaces to provide the user with "keyboard-free" interaction for Model 204 databases.

Free Seminars will be offered on the following schedule.

To reserve your space at the free seminar, call Theresa Pinheiro at 617-491-7400.

September	October	November
10 Albuquerque	6 Houston	12 Salt Lake City
10 Phoenix	8 Orange City	17 St. Louis
16 Baltimore	14 San Antonio	18 Atlanta
16 Oklahoma City	14 Richmond	19 Stamford
17 Tulsa	15 New Orleans	
17 Philadelphia	15 Washington	
22 Minneapolis	20 Columbus	
24 Pittsburgh	22 Raritan	
29 Des Moines		

Computer Corporation of America

Cambridge, New York, Houston, San Francisco, Chicago, Washington, Los Angeles/International Affiliates: Tokyo, London, Berne, Milan, Toronto

CIRCLE 177 ON READER CARD

HARDWARE

CRT STANDS

Wright Line, manufacturers of office filing systems and furniture, has introduced a new line of "workstations" for use with display terminals and microform viewers. The product family has been designed with the user in mind, with each model providing varying degrees of adjustment for operator comfort and efficiency.

The line comprises three basic designs. For terminals that are used intermittently, there is a basic, fixed height workstation (with limited adjustment possible through the use of leveling glides). For more heavily used terminals, a second model offers unlimited height adjustment (using a hand crank) in the range of 25 inches to 31 inches. The high-end workstation has dual surfaces, allowing the operator to position the keyboard and screen at the most comfortable level. It also lets the user independently vary the distance between keyboard, display screen, and operator's sitting position. This third model, referred to as the "universal workstation," also can be adjusted to tilt the screen forward or backward into the most comfortable viewing position for the user. All of the furniture has been designed with rounded corners and edges, low-glare work surfaces, and the provision to accept many accessories, such as wiring channels, foot rests, keyboard wrist rests, modesty panels, and angled connectors for

clustering workstations. Prices for the line begin at \$245.

Wright Line says that its new family of workstations can be configured to conform to the ergonomic regulations of virtually any country, state, or other standard-setting group. WRIGHT LINE INC., Worcester, Mass.

FOR DATA CIRCLE 313 ON READER CARD

The Distributed Communications Processor/20 (DCP/20) is the second member of Sperry Univac's new family of communications processors for networking under the company's Distributed Communications Architecture. The modular DCP/20, which



joins the previously-announced DCP/40, uses the vendor's Telcon software, allowing the DCP/20 to fit a variety of applications. Capable of simultaneously supporting time-sharing, transaction processing, and remote job entry, the DCP/20 can operate as a front-end on the vendor's 1100 series and Series 90 mainframes. The unit can also operate as a remote network processor. In addition to handling a wide range of communications rates and terminal types, the DCP/20 provides network control functions allowing communications managers to tailor their networks to specific needs. The system itself consists of a processor, local storage, and communications line modules. Asynchronous, synchronous, and wideband transmissions can run to 64Kbps. Both character-oriented protocols and Univac's Universal Data Link Control procedure are supported. Up to 45 communications lines may be supported by the DCP/20, according to Univac. Deliveries are to begin next month; a basic DCP/20 sells for \$45,800, or can be leased for \$960 per month on a five-year contract. Maintenance is \$215 per month. SPERRY UNIVAC, Blue Bell, Pa.

FOR DATA CIRCLE 307 ON READER CARD

OFFICE AUTOMATION

As foretold in our May News In Perspective, Burroughs has made its leap into the integrated office systems market. The OFIS 1

\$595?



\$595!

Yes, it's true.

The best selling terminal in its class now has the best price in any class.

That's the only way we could've improved our Dumb Terminal™ video display. We had already done everything else so well that the Dumb Terminal was renowned the world over. With over 150,000 shipped, and more on the way every day.

So now you can buy the ADM 3A for a mere \$595 (quantity one), and the ADM 5 for a paltry \$645. But don't let the price tags fool you. They're the same, dependable Dumb Terminals they've always been. We didn't change that.

The ADM 3A still has all the same reliable features that made it a best-seller. And the ADM 5 has even more operator conveniences. Like reverse video, reduced intensity and reverse video/reduced intensity. Limited editing with erase to end of line and erase to end of page (which reduces the load on your host computer). A gated extension port. Even a full integral

Information System hinges on the electronic filing cabinet engineered by System Development Corp., known under the trade name of the OFISfile. Additionally, there's the OFISdirector, a CP series-based communications processor, and other existing Burroughs equipment, including word processors, terminals, and OCR devices, all re-named with an OFIS prefix.

The OFISfile uses a proprietary searching technique which reportedly does not require coding keys supplied by a user when filing a document. Retrieval may be by name, date, word, or phrase, with the OFISfile correctly handling misspellings and alternate word forms such as plurals. Users can make general requests such as "all my memos to the marketing vice president," or specific requests such as "my memo to Lamont Cranston regarding the status of the Shadow Project as of the end of FY80." All documents matching the search request will be displayed sequentially on the user's terminal screen. Up to eight simultaneous operating terminals may be entering information into the file or retrieving data. Search and display transactions run at up to 9600 bps with locally connected terminals located within 100 feet of the OFISfile, or 1000 feet using a short-haul modem. Remote access is possible using a standard external modem. A basic OFISfile, priced at \$59,400, includes 80MB of disk (about

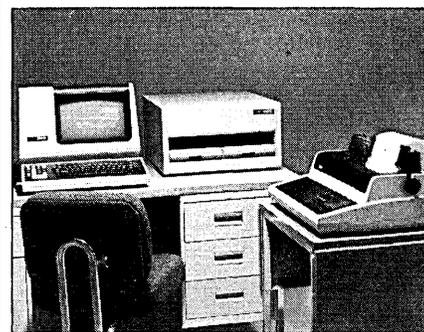
40,000 pages of text) and eight communications ports. Doubling the disk capacity brings the price up to \$79,200. Options include eight additional communications ports (\$2,000) and cartridge tape for backup (\$3,000; including controller).

The OFISdirector can support several OFISfiles, making their contents available to multiple users. It can also provide a link to other departments equipped with OFIS I systems. It can communicate with computers (with appropriate software packages), and it can support shared use of printers and OCR equipment. A basic OFISdirector uses four internal processors, and comes with 360KB of main memory, 19MB of disk, 1MB of floppy storage, and two communications lines; this system sells for \$33,500. A larger system, priced at \$60,000, uses six processors, 753KB of memory, 77MB of disk, 1MB of diskette storage, and 12 communications lines. Optional software allows communications with Burroughs computers and IBM equipment. Electronic mail and other packages are offered. BURROUGHS CORP., Detroit, Mich.

FOR DATA CIRCLE 308 ON READER CARD

WORD AND DATA PROCESSING

With many computer companies introducing small systems for both word and data processing (and some word processing vendors admitting that a change of system dis-



ette will allow their machines to perform data processing), we rather like the Work Processor trademark Digital Equipment has coined for its DECmate multipurpose system for small businesses. Based on an enhanced version of the venerable PDP-8 with 32K words (remember that the 8 has a 12-bit word), the DECmate runs an improved version of DEC's word processing software. It can also handle data processing applications, many of which are available through DEC; list processing; sorting (both numeric and alphabetic); and communications. Operating system support is provided by COS-310 or OS/78. DECmate's standard display is a VT100 crt, which can display 24 lines of 80 characters or 14 lines of 132 characters. Auxiliary storage is provided by RX02 dual diskette drives (1MB per dual-drive unit) and RL02 removable cartridge disks (up to four

numeric keypad. And they said it couldn't be Dumb.

So there you have it. The same two proven Dumb Terminals, two new low prices to save you even more money.

And when you think about it, saving money is a pretty smart idea.

Contact your nearest Lear Siegler Authorized Distributor or: Lear Siegler, Inc., Data Products Division, 714 North Brookhurst Street, Anaheim, CA 92803. 714/774-1010. TWX: 910-591-1157. Telex: 65-5444. Regional Sales Offices: San Francisco 415/828-6941 • Los Angeles 213/454-9941 • Chicago 312/279-5250 • Houston 713/780-2585 • Philadelphia 215/245-1520 • New York 800/523-5253* • Boston 617/423-1510 • Washington, D.C. 800/523-5253* • Orlando 305/869-1826 • England (04867) 80666.

*800 numbers also include states of: CT, DE, MA, MD, NY, RI, VA and W.V.



**LEAR SIEGLER, INC.
DATA PRODUCTS DIVISION**

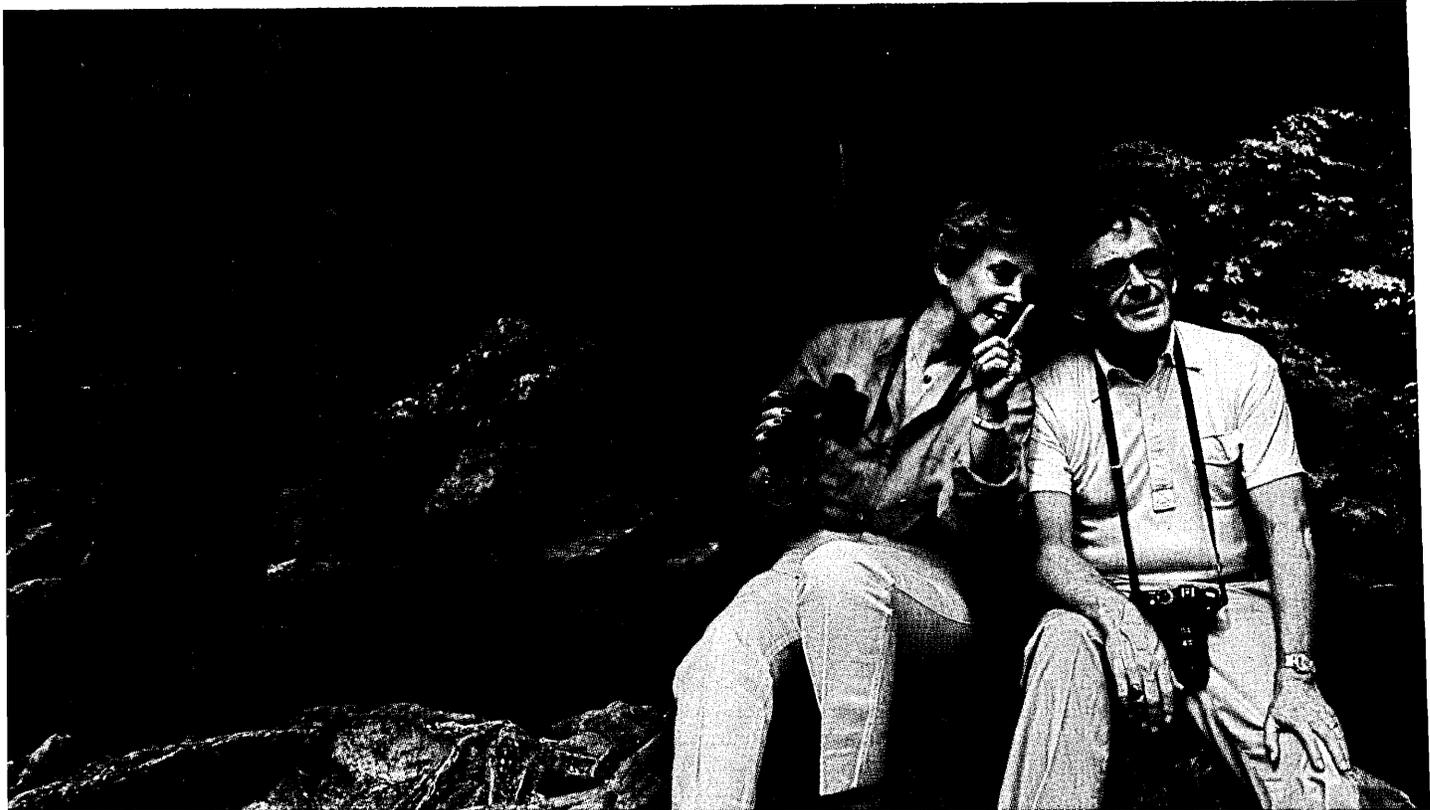
Dumb Terminal is a registered trademark of Lear Siegler, Inc.
Quantity One U.S. Prices.

\$645?



\$645!

CIRCLE 178 ON READER CARD



Attention: Engineers Age 40 and Up

Tackle a challenging new job in Saudi Arabia now—you can retire on easy street later.

Retirement incomes that sounded princely a few years back are beginning to look paltry in today's economy. And they may be hopelessly inadequate in tomorrow's.

What can you do about it? Come to work for Aramco in Saudi Arabia.

Just compare these Aramco benefits with what you're getting now.

Collect more extras you can put right in the bank

First, you get a tax-protected bonus of up to \$5,000 as soon as you join us.

You can join an automatic payroll savings plan in which Aramco matches up to 6 percent of your salary (the match begins at 50 percent and escalates up to 100 percent after ten years of service).

And you participate in Aramco's retirement income plan.

Earn a whopping tax-protected pay premium

We start you off with a base salary that compares with any in the oil industry.

We also give you a cost-of-living differential in Saudi Arabia so that the higher costs of things like food come out of our pocket, not yours.

The best part is our premium for overseas employment. This is *fully* sheltered from all taxes.

We pay you a 40 percent premium on the first \$30,000 of base pay—plus a 20 percent premium on the next \$20,000. Maximum is \$16,000 per year.

Tuition and board anywhere in the world for high schoolers

High school students get their educations in Europe, the United States, anywhere. We pay 80 percent of all tuition and board (up to \$5,350 annually) for three years of high school.

We also pay air fare for high schoolers visiting parents in Saudi Arabia—three trips per year. (The same goes for air fares for college students but they get fewer trips.)

Youngsters from kindergarten through the ninth grade attend our American-style schools in Saudi Arabia.

Free trip home every year—long vacations

You get 40 days of paid vacation every year—plus an average of 12 holidays every year—plus weekends.

You get a travel allowance every year, too. This is equal to the economy round-trip air fare between Saudi Arabia and the U.S. or Canadian city where you were hired. Good for you *and* your family. Every year.

Where you go is your business. Is it any wonder that so many Aramco people get to see Europe, the Orient, the *world* on their annual leaves?

Free life insurance and health care

You're automatically covered with a life insurance policy the day you join Aramco. No cost to you.

You can also buy extra insurance up to thirty times your monthly salary for about 34¢ a month for every thousand dollars.



Will your retirement home be near some mountain greenery, or farther south within the Sun Belt, or on the shores of the Pacific? Aramco's big bundle of benefits will help you secure it sooner than you think. See below.

All your medical needs are free while you are in Saudi Arabia — even your prescriptions.

Unlike medical care, dental care is not free for Aramco employees. However, the costs are comparable to what you'd expect to pay back home.

A chance to save huge sums of retirement money

We can only give you a bare idea of how the money can multiply over a 10-year span. For the sake of illustration, let's add up the fortunes of an engineer working for Aramco in Saudi Arabia making \$35,000 U. S. in base pay, with no raises for the 10 years (not likely!). Remember this is just a hypothesis.

Right off, you see that our imaginary engineer in Saudi Arabia can gross

around \$149,000 more. The amount saved out of that grand total is strictly up to the individual.

But look at that \$130,000 premium. Whatever the dollars work out to in your case, please remember that this is the bundle which is totally tax-protected.

This graph doesn't show what you save on medical expenses, it doesn't show the allowances on your children's education, it doesn't show the travel allowances which cut down on vacation costs, it doesn't show the retirement benefits you may accumulate.

What it does show is that you have the chance of a lifetime to save a really important amount of money.

A sensible way to check out the new lifestyle

Everyone in Saudi Arabia lives within the letter of the local law. (No alcohol, for instance.)

But the Americans and Canadians eat steak and french fries, they go golfing and sailing and water-skiing, they tend their nice suburban houses.

While the lifestyle is easy, sometimes living so far away from relatives and friends can be difficult for some. That's why we've begun a new policy. The Aramco overseas tryout.

If you don't want to move your whole family over at once, come and work for us on bachelor status for one year. We'll fly you home three times so you can keep the family informed about

your adjustment to life in Saudi Arabia. Then at year's end or sooner all of you can decide whether the life is for you or not.

Take on job challenges you thought you'd never see again

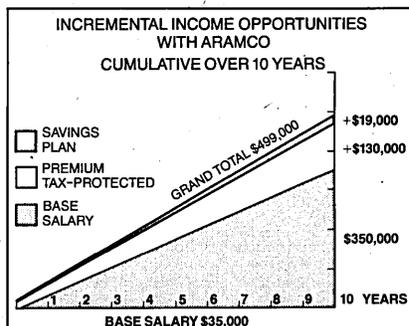
Aramco is the world's largest oil-producing company. So the job opportunities for experienced engineers are boundless. You can stay within your specialty—or you can expand into new territories.

Here are the engineering job categories we're interviewing for right now: Project Management & Construction • Oil & Gas Operations • Facilities Planning • Corrosion Control • Inspection • Resources Planning • Exploration & Development • Maintenance

(PS. Our opportunities are open to qualified engineers of *all* ages.)

Interested? Call our 24-hour line any day: (713) 750-6965—if you wish, call toll-free, (800) 231-7511 between 7 A.M. and 5 P.M., Monday-Friday, Central Time.

If you prefer, send your résumé in full confidence or write for more information to: Aramco Services Company, Department DM0901ML04A, 1100 Milam Bldg., Houston, Texas 77002.



This is not an offer or an indication of wage scales. It is merely a hypothetical example of how your gross income can accumulate dramatically when you work for Aramco in Saudi Arabia. Employees are not fully vested in the savings plan until 60 months of continuous service. All projections subject to change.

ARAMCO
SERVICES COMPANY

CIRCLE 179 ON READER CARD

HARDWARE

drives, each with 10MB capacity). Printers offered include the LA34-WA 30cps dot-matrix printer with graphics capability, the bi-directional LA120-RA 180cps dot-matrix printer, and the LQPSE 45cps letter quality printer. Two serial communications lines are optional; communications modes supported are asynchronous, byte-synchronous, and bit-synchronous. In its basic configuration, the DECmate includes a dual diskette subsystem and an LA34 printer. Prices start at \$6,795; marketing will be through DEC's word processing sales force and the company's computer stores. DIGITAL EQUIPMENT CORP., Merrimack, N.H.

FOR DATA CIRCLE 309 ON READER CARD

WORD PROCESSING

Although it seems to beg comparison with the Typewriter, we just can't bring ourselves to put the Micom 1001 up against



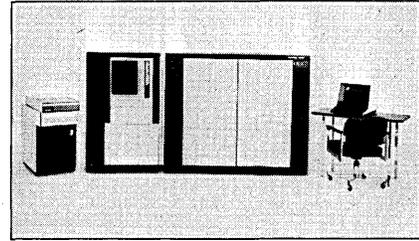
Sony's tiny contender. Philips Information Systems bills its Micom 1001 as a keystroke capture device which captures text on preformatted miniature cassettes, each capable of holding 20 pages. The 1001 resembles a typewriter (with additional function keys), but in place of a platen there's a 40-character LCD display. Operating from standard wall-outlet power, the Micom 1001 allows text entry, simple corrections and insertions, and information transfer to other Micom machines via an integral RS232 interface. Note that as of announcement day, there is no way to produce local hardcopy from the 1001, nor any way to send the text on a cassette to a word processor without using a 1001 to do the actual reading. In short, the 1001 is a \$1,295, 18-pound, 4 by 20½ by 12½-inch input device for larger Micom word processors. PHILIPS INFORMATION SYSTEMS, INC., Dallas, Texas.

FOR DATA CIRCLE 310 ON READER CARD

COMPUTER

Systems Engineering Labs has topped its computer line with the 32-bit Concept 32/87, a system built with Emitter Coupled Logic and said to be capable of performing more than 3.6MIPS. The ECL-based cpu has a 75nsec cycle time and four-stage instruction pipeline, and uses a two- or four-way set associative cache memory and a hierarchical memory system. Performance is further

enhanced through the use of an I/O processor that off-loads the cpu of I/O functions, freeing it for computation. The Concept 32/87



can be configured with either 16KB or 32KB of cache, and both from 1MB to 16MB of main memory.

Compatible with other members of the Concept 32 series, the 32/78 uses the vendor's MPX-32 operating system, and can be programmed in FORTRAN and other languages extant for earlier members of the family.

Prices start at \$235,000 for a basic system with 1MB of main memory, 16KB of two-way associative cache, integral single and double precision floating point processor, I/O processor, diagnostic processor, two floppy drives, and crt console. The same configuration with 32KB of four-way associative cache carries a \$265,000 price tag. SYSTEMS ENGINEERING LABORATORIES, INC., Fort Lauderdale, Fla.

FOR DATA CIRCLE 311 ON READER CARD

OVERKILL?

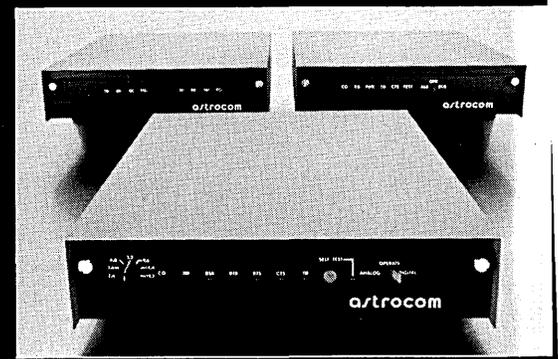
Beware wasteful modems. Modem overkill can waste big money. Yours. It happens, for example, every time someone specifies a \$6000 modem for an application that could be served every bit as efficiently by a \$700 Astrocom SH. Wherever shorter distances are involved, you can save thousands of dollars at each location by not overbuying (or overleasing) modem capacity. And still have all the modem power you need, with optimal test features designed in. Just remember Astrocom's SH96 (asynchronous) and MOS/2 (synchronous) Limited Distance Modems. And the Astrocom Modem Emulator, which takes the place of two modems in applications 200 feet or shorter. Our band of knowing, happy repeat customers have saved their companies *millions* with these products since we pioneered their development. Designing out expensive overkill is inherent in our approach to designing solutions.

CIRCLE 180 ON READER CARD

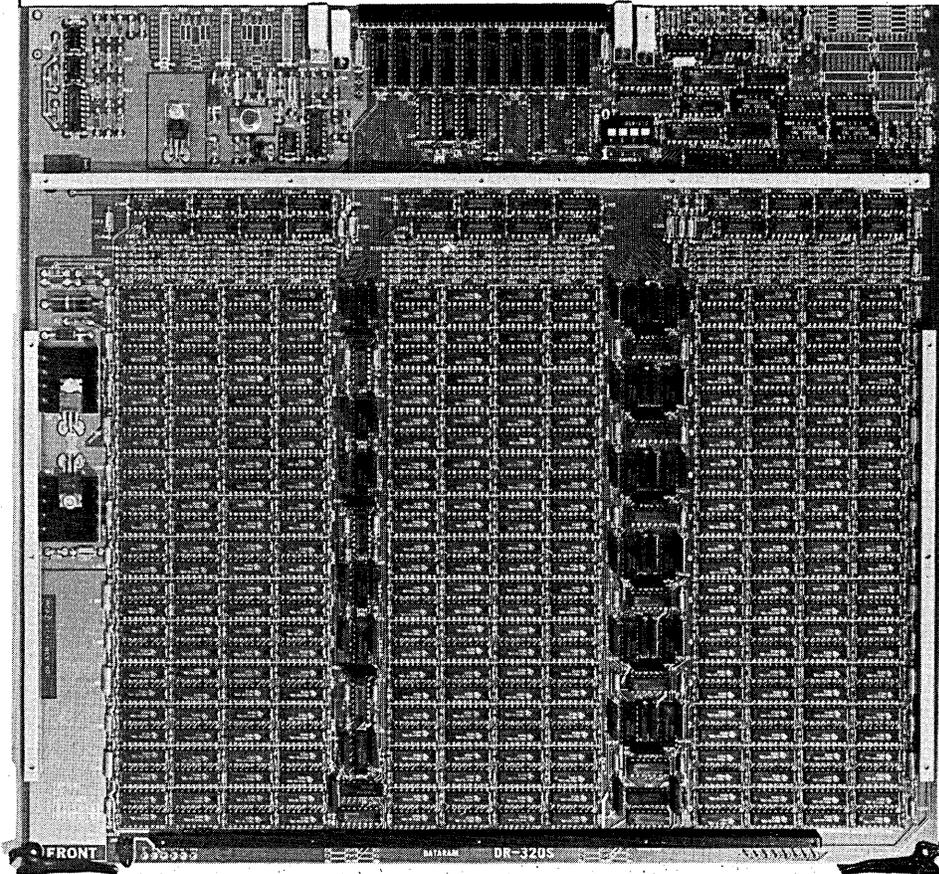
For more information, write: Astrocom Corporation, 120 West Plato Boulevard, St. Paul, MN 55107. Or call toll-free 1-800-528-6050, Ext. 1103. (In Minnesota, call 612-227-8651 collect.)

astrocom corporation

Delivering solutions in data communications



512KB ADD-IN FOR PERKIN-ELMER 3200



- Memory capacity up to twice the comparable P-E storage module
- Substantial price savings
- Compatible with Perkin-Elmer 3220 and 3240
- 256KB and 512KB configurations
- LED indicators to aid troubleshooting
- Test points available
- Switch-selectable address selection
- Address up to 4.0MB

Dataram Corporation introduces another first for users of Perkin-Elmer minicomputers — the 512KB DR-320S semiconductor ADD-IN, the first 3200 Series-compatible semiconductor ADD-IN to be offered by an independent memory manufacturer.

The DR-320S continues the Dataram tradition of providing Perkin-Elmer compatible products at the industry's lowest cost/bit. Products that are not only compatible, but which offer additional features.

For example, the 512KB DR-320S, which occupies only one slot, offers twice the memory capacity of the comparable 256KB Storage Module (Model 35-694) available from Perkin-Elmer. The DR-320S operates in conjunction with the Perkin-Elmer

Memory Interface Board contained in the host 3200 Series minicomputer.

The DR-320S is internally configured as a 128K x 39 bit (32 data + 7 ECC) memory to provide the 512KB capacity. A 256KB version of the DR-320S is also available. The DR-320S employs 16K RAMs having a 150 nsec access time to meet the speed requirements of the 3200 Series minicomputer. Tri-state receivers and drivers are used to transfer data between the DR-320S and the memory interface board.

In addition to 3200 series memory products, Dataram also offers core memory modules for older Perkin-Elmer/Interdata machines as well as BULK MEMORY Disk Emulation Systems for the full family of Perkin-Elmer minicomputers.

Canada: Ahearn & Soper Ltd., 416-245-4848 • Finland: Systek OY, (80) 73 72 33 • France: YREL, (03) 956 81 42 • Hungary/Poland/Rumania: Unitronex Corporation, WARSAW 39 6218 • Italy: ESE s.r.l., 02/607 3626 • Netherlands: Technitron b.v., (020) 45 87 55 • Sweden: M. Stenhardt AB, (08) 739 00 50 • Switzerland: ADCOMP AG, 01/730 48 48 • United Kingdom: Sintrom Ellinor Ltd., (0734) 85464 • West Germany: O.E.M.-Elektronik GmbH, 07 11-79 80 47 • Yugoslavia: Institut "Jozef Stefan", 263-261 • Australia/New Zealand: Anderson Digital Equipment, (03) 544-3444 • India: Infosystems Private Limited, 79281 • Israel: Minix Computers & Systems Ltd., 03-298783 • Japan: Matsushita Electric Trading Co., Ltd. 06 (282) 5111 • Taiwan: Rabbit Associates, Ltd., 7219573-5 • Hong Kong: Automated Systems (HK) Ltd., 5-630256-9 • Malaysia: Automated Systems (M) Sdn Bhd., 773777 • Indonesia: P. T. Daya ASL, 584306 • Singapore: Automated Systems (PTE) Ltd., 2354133

I'd like to learn more about Perkin-Elmer compatible memory:

- 3200 Series Disk Emulation Other
 Please send information.
 Please have a salesman contact me.

Name _____

Title _____ Phone _____

Company _____

Address _____

City _____

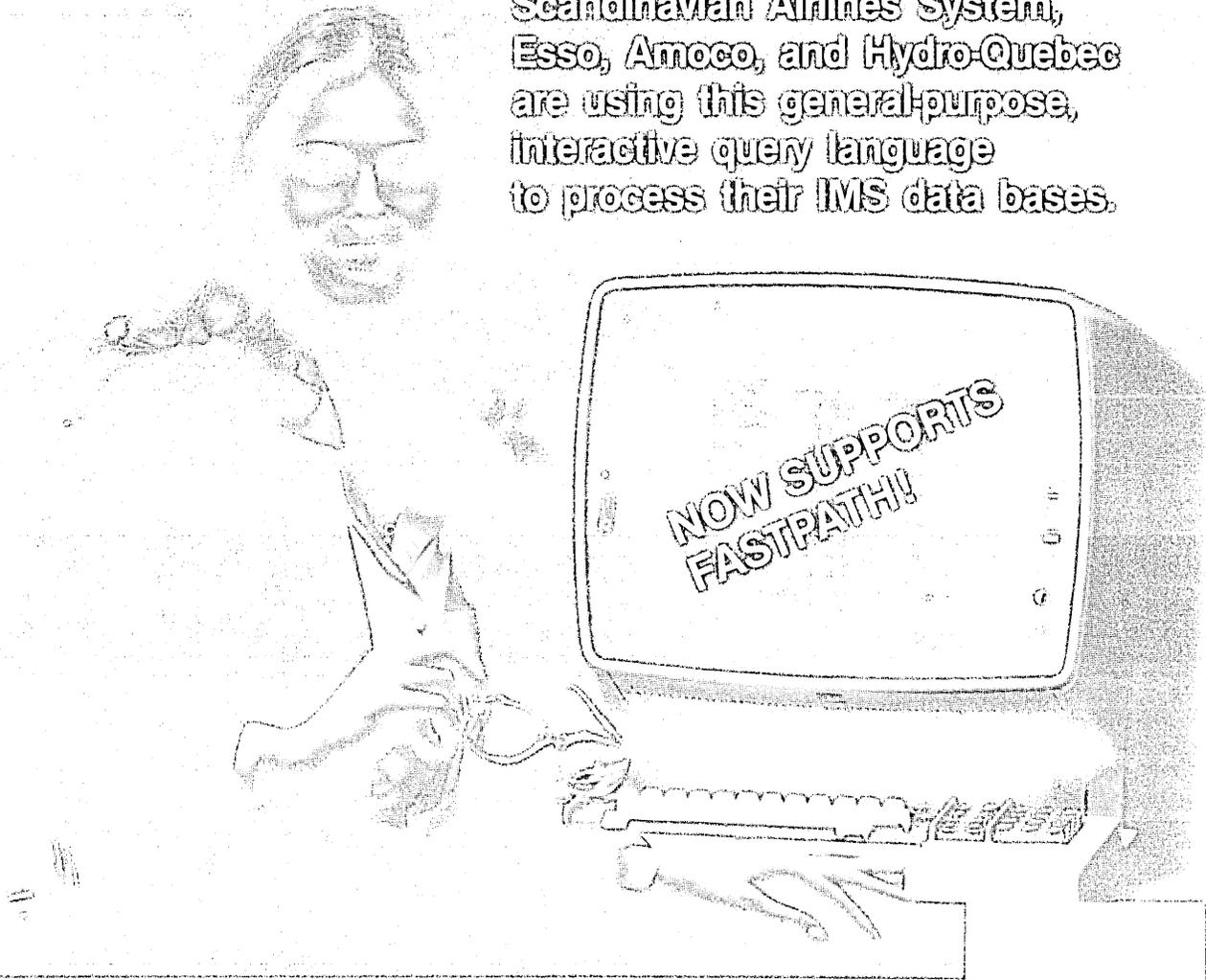
State _____ Zip _____

DATARAM CORPORATION

Princeton Road
 Cranbury, New Jersey 08512
 Tel: 609-799-0071 TWX: 510-685-2542

CIRCLE 181 ON READER CARD

ASI/INQUIRY: Companies like Hughes Aircraft, Scandinavian Airlines System, Esso, Amoco, and Hydro-Quebec are using this general-purpose, interactive query language to process their IMS data bases.



And here are three productivity-boosting reasons why.

1. ASI/INQUIRY Is Easy To Learn and Easy To Use.

Because inquiries are stated in simple English, nonprogrammers can learn to use ASI/INQUIRY quickly. DL/1 structures are completely transparent to the user. You need not understand the complexities of multipathing or multiple data base access. Comprehensive diagnostic messages simplify error correction. ASI/INQUIRY automatically displays data in the appropriate format—horizontal, vertical, or overflow. Or you can specify any desired screen format. Repetitively executed queries can be saved in an on-line catalog. New release 5 features include the ability to defer query execution to batch and a powerful user exit facility.

2. ASI/INQUIRY Assures Faster Access and Response Time.

ASI/INQUIRY lets you access your DL/1 data bases through IMS or TSO faster and more efficiently. That's because it eliminates need to write and debug those highly procedural programs usually required to access data bases. ASI/INQUIRY operates as an IMS message processing program executed from any IMS DB/DC-supported terminal. Execution priority is dynamically controlled through automatic program message switching. High initial priority assignment assures fast response. Priority is then automatically adjusted to the rate that to-be-displayed data is encountered, which optimizes *load leveling* of IMS DB/DC resources.

3. ASI/INQUIRY Provides Complete Security.

Built-in safeguards protect data at the system, terminal, and data base levels. Data base administrators define the data bases users can access, their passwords, and the terminals from which individual data bases can be accessed.

Learn why ASI/INQUIRY is more heavily used than any competing product. Call or write—today!

Applications Software, Inc.
21515 Hawthorne Boulevard
Torrance, CA 90503
(213) 540-0111

Member SIA  Software Industry Association

CIRCLE 182 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

Manual madness has come and gone (thank goodness), but examples of humor still trickle in. In Elias Awad's Automatic Data Processing, Laurel Gealt of Philadelphia found the following example of a COBOL IF-Statement: IF CUSTOMER=GANGSTER MOVE 'NO CHARGE' TO EXPLANATION.

Intel's Commercial Software Systems Operations (nee MRI) has begun OEMing its System 2000/80 DBMS to vendors of applications packages who can then sublicense the software directly to their customers. Pacifica Management Systems of Burlingame, Calif., is Intel's first OEM customer. PMS uses System 2000 in its Job Applicant Tracking System for large corporations. Under Intel's agreement, PMS and software vendors can sell packages with the required System 2000 DBMS capabilities integrated into their system. Intel gets a royalty for each installation, but it is only a small percentage of the DBMS's full price. No precompilers or database definition capabilities are included in the DBMS package shipped to users, so the System 2000 database can only be used by the application in which it is imbedded. Customers can upgrade at a later date to a full System 2000/80 DBMS by going to Intel for a license. Part of the royalty previously paid will be applied to the license fee for the full DBMS.

Here's an unwritten variant on manual madness for those of you who have IBM electronic typewriters. For a free advertising message, move the carrier to position zero, hold down the shift key and then hit the "code" key followed by two c's.

FREEBIE

There's no such thing as a free lunch, but if you're willing to spend \$7.50 for the media and handling, the PDP-11 Software Exchange will ship you a "free" Macro-11 file transfer program that allows bidirectional transfers of ASCII data files between CPUs. That \$7.50 will get you source code and documentation on an RX01 diskette; a hardcopy listing of the program and documentation can be had for \$2 postage and handling. PDP-11 SOFTWARE EXCHANGE, Norcross, Ga.

FOR DATA CIRCLE 326 ON READER CARD

VSAM UTILITY

Described as "a high-performance, low-overhead utility to build VSAM alternate indexes," Quick-Index is said to sort and load alternate indexes in 20% of the elapsed and CPU times required by IDCAMS BLDINDEX.

The utility does not need a VSAM data space for sorts, and it can build multiple indexes with a single pass through the base cluster. Users can specify key values, such as blank fields, that will not be included in the new index. Indexes can be constructed from multiple, noncontiguous fields in the base record. Indexes created with the deleted user-specified index option and multifield indexes cannot be included in an upgrade set. VSAM Quick-Index is priced at \$3,000 for OS/VS installations and \$2,600 for DOS/VS/VS users. SOFTWORKS, INC., Clinton, Md.

FOR DATA CIRCLE 327 ON READER CARD

COMMUNICATIONS

Vector Graphic's Remote Batch Terminal Emulator (RBTE) software allows any of the vendor's systems to communicate among themselves or with data and word process-

SOFTWARE SPOTLIGHT

VSAM INTERFACE

Shortly after IBM announced VSAM, at least one programmer decided it would be easier to learn and use. So, working in assembler, he coded VIM, the VSAM Interface Module, which provided a simplified interface using a consistent calling sequence that could be invoked from assembler, PL/I, and COBOL applications. As the programmer moved around, he took VIM with him, and it went into use at a few large installations. It wasn't sold; it was just a tool that he and his co-workers used. Then ISL International learned of VIM, got together with the author, and now they've started marketing the package to any interested sites that use VSAM.

VIM includes full VSAM capabilities, including reading backwards, asynchronous requests, skip-sequential, and the rest. It dynamically handles run-time index and data buffer allocations, record length deter-

mination, and other functions that can be more efficiently done during program execution. VIM invokes standard VSAM macros and it can operate in batch or on-line environments. Since it was designed for ease of use, new users can learn VIM in short order. ISL states that VIM will provide a minimum 30% increase in the productivity of programmers developing systems using VSAM, with potentially greater increases for programmer trainees. Perhaps more impressive is ISL's claim of a minimum 25% VSAM run-time reduction, with reductions of more than 60% for applications making heavy use of asynchronous and skip-sequential accesses. The VIM package is available for \$8,000 for the first copy and \$6,000 for additional installations. Lease plans are offered, as is a 30-day trial evaluation period. ISL INTERNATIONAL INC., New York, N.Y.

FOR DATA CIRCLE 325 ON READER CARD

SOFTWARE AND SERVICES

ing systems from other vendors. RBTE allows emulation of a number of IBM remote batch terminals, including the 2780, 3780, 2770, 3741, and 2961. Intended primarily for remote job entry and file transfers, the RBTE package requires the use of synchronous modems and a minor (\$100) modification to Vector Graphic's Bitstreamer Interface Board. Communications over dial-up lines can run to 2400bps, while 9600bps operation is possible over conditioned leased lines. The software sells for \$500. VECTOR GRAPHIC, INC., Westlake Village, Calif.

FOR DATA CIRCLE 330 ON READER CARD

FINANCIAL SYSTEM

Working with the accounting firm of Coopers & Lybrand, Software International has developed Fiscal DSS, a totally integrated package comprising General Ledger, Accounts Payable, and Purchase Order Control; the system runs on IBM mainframes and HP-3000s. Originally marketed to governments—federal, state, and municipal—Fiscal DSS is now being offered to commercial users.

The on-line system, which can operate with any interactive crt, tracks purchase orders from the requisition stage all the way through to the general ledger. The entire process is divided into three major stages: decisions, actions, and results. When the

decision to make a purchase has been made, a purchase request is entered into the system. The request then awaits approval, which involves checking the appropriation budget of the account and calculating the available balance. Checking the budget can be performed as a simple inquiry or with automatic approval if the funds are available. If approved, the money is committed and a purchase order is cut. When an order is delivered and the invoice arrives, an accounts payable record is created and the commitment is reversed. Accounts payable then cuts a check. Finally, the system produces financial statements. While the system provides many standard reports, it also offers a report writer that permits users to create their own special reports. Long-term lease prices for Fiscal DSS range from \$75,000 for the HP-3000 to \$125,000 for an IBM OS or DOS system running CICS. SOFTWARE INTERNATIONAL CORP., Andover, Mass.

FOR DATA CIRCLE 328 ON READER CARD

PASCAL COMPILER

The Computer Systems Div. of Harris Corp. has developed and is now offering a fully supported Pascal compiler for the company's entire line of minis—from the Harris 80 up through the 800. The language is said to be a complete implementation of the Jensen-Wirth Pascal Report, along with

enhancements conforming to the International Standards Organization 1980 Draft Proposal.

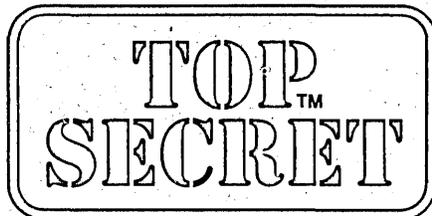
Both interactive and batch environments are supported. The compiler itself is reentrant, as is the object code generated. Since the compiler generates relocatable object code, separate compilation is possible. Subprograms written in other languages, such as assembler or FORTRAN, also can be linked into Pascal at load time. During program development, extensive run-time checking can be invoked, making it easier for the programmer to find undefined variables, indexing violations, invalid pointers, and other errors. Harris Pascal licenses for \$5,000. HARRIS CORP., Computer Systems Div., Fort Lauderdale, Fla.

FOR DATA CIRCLE 331 ON READER CARD

WP PROGRAMMING

CPT Corp, the Minneapolis word processor maker, has developed Shortcut, a new software feature for the company's top-of-the-line CPT 8100 word processors. Using the "program" key on the 8100's keyboard, an operator defines new functions including arithmetic and decision-making. Shortcut doesn't bear much resemblance to conventional high-level programming languages; rather, it seems closer to a key-stroke programmable calculator. CPT says that experience in beta testing indicates that operators

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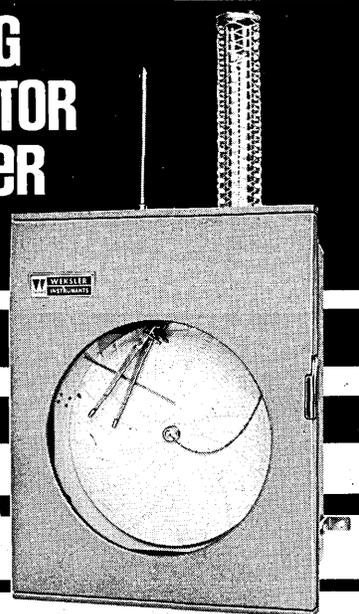
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SOFTWARE AND SERVICES

can easily learn Shortcut. In one instance, a CPT spokesman said, a word processing operator was able to implement a Shortcut program in significantly less than the day and a half it took an experienced FORTRAN programmer to code the same function.

Used in conjunction with CPT's existing MathPak number processing software, Shortcut can branch on mathematical comparisons. Shortcut programs can be linked with jump or call commands, and programs can include stop or pause commands to interrupt the program so the operator enter new information or instructions. Typical applications include calculating price discounts bases on volume, identifying line items outside a specified variance from budget, etc. Shortcut and MathPak will be offered jointly for a suggested retail price of \$500. CPT CORP., Minneapolis, Minn.

FOR DATA CIRCLE 329 ON READER CARD

SCREEN FORMATTING

Easy-Screen is MSA's latest on-line capability for accounting users of MSA's on-line systems. It permits the customer to define new screens as needed by accounting and financial management, and it can be used to modify the standard screens delivered with MSA application packages. Designed for the end user, Easy-Screen allows rapid design of screens for extracting information from

an application's database. It also allows specification of calculations to be applied to the extracted data prior to displaying results for management. An obvious use of Easy-Screen's ability to modify standard application screen formats is translating prompts from English into another natural language. In its initial release, Easy-Screen will work with MSA's Accounts Payable, Financial Information, and Control System, Fixed Assets Accounting, and General Ledger packages. MSA says it plans to make the facility available for all of its products in the future. The package operates under CICS/OS and CICS/DOS. Licensing runs \$10,000 for use with a single application and \$5,000 for each additional application. MANAGEMENT SCIENCE AMERICA, INC., Atlanta, Ga.

FOR DATA CIRCLE 332 ON READER CARD

ACCOUNTING

For its 600 Series of computers, Nixdorf released three accounting packages—General Ledger, Payroll, and Accounts Payable—which can be used as standalone applications or combined into an integrated system. Aimed at small to medium-sized businesses just beginning to computerize their accounting functions, the three packages run on the models 600/35, 45, and 55 under the DPEX operating system. Each of the three packages carries a one-time license fee ranging from \$2,000 to \$2,500.

The General Ledger application can accommodate the needs of a single corporation, a multidivision company, or a company comprising a number of corporate groups. Up to 1,000 profit centers can be defined, each of which can, according to the user's financial structure, have its statements incorporated into reports on multiple corporate levels. Financial statements covering the company's current financial position, including current month, year-to-date, and budget figures, along with comparative figures for the previous year, are produced in a general format. The user can set up his own chart of accounts and describe the layout of accounts on the financial statements.

Accounts Payable classifies its input into five classes: invoices, prepaid invoices, debit and credit memos, adjustments to existing invoices, and manual or hand payments. For financial planners, the package can generate aged balance due and cash requirement reports. A number of check writing options are provided.

Payroll handles checks, tax calculations, deductions, tax reports, and check registers. Special reports can be produced showing vacation summaries and sick pay, department statistics, and employee phone directories, as well as entry edit and file listings. NIXDORF COMPUTER CORP., Burlington, Mass.

FOR DATA CIRCLE 334 ON READER CARD

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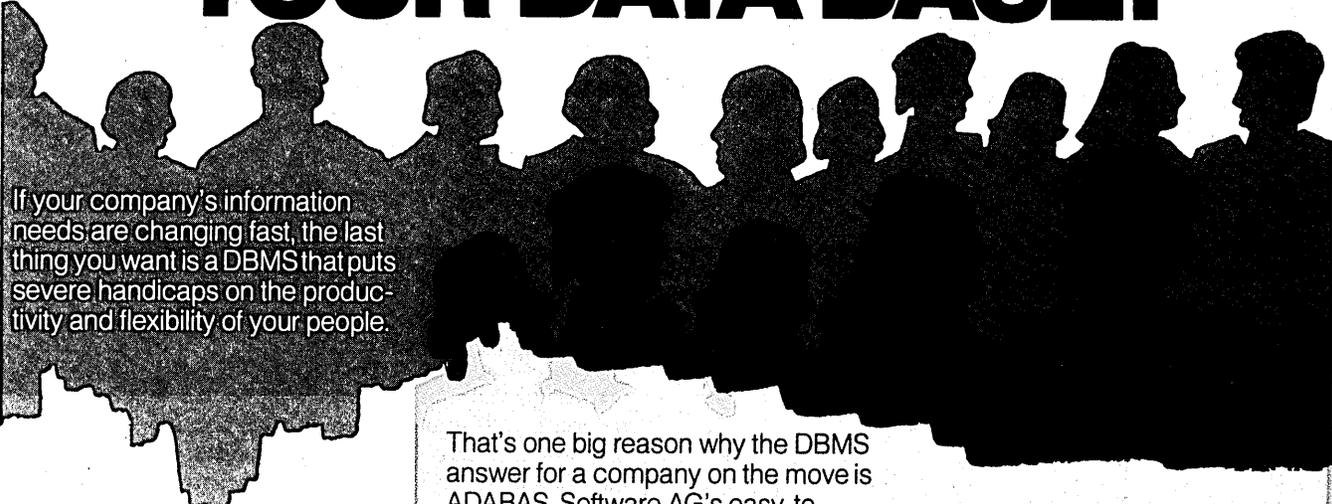
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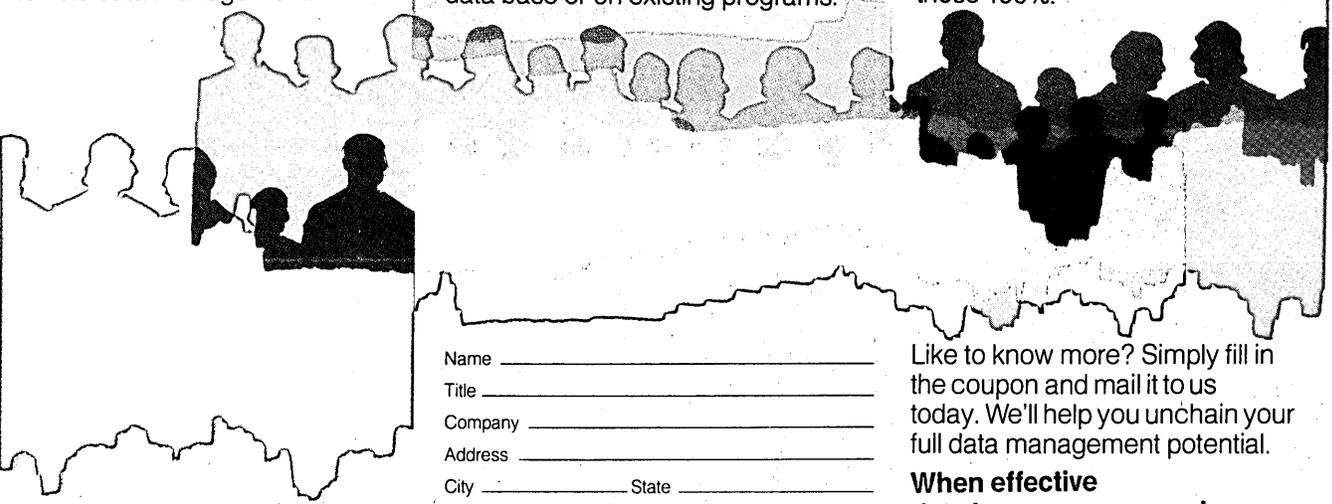
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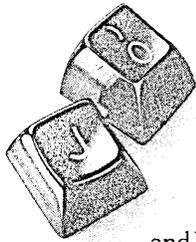
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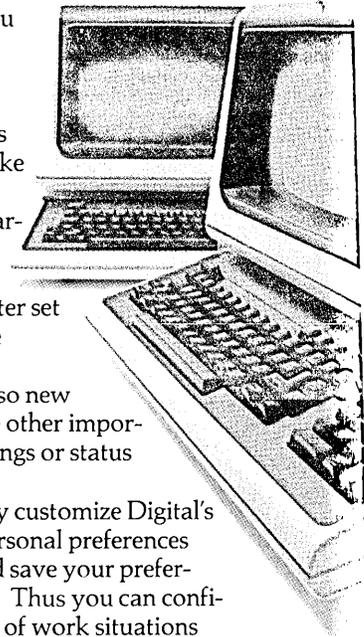
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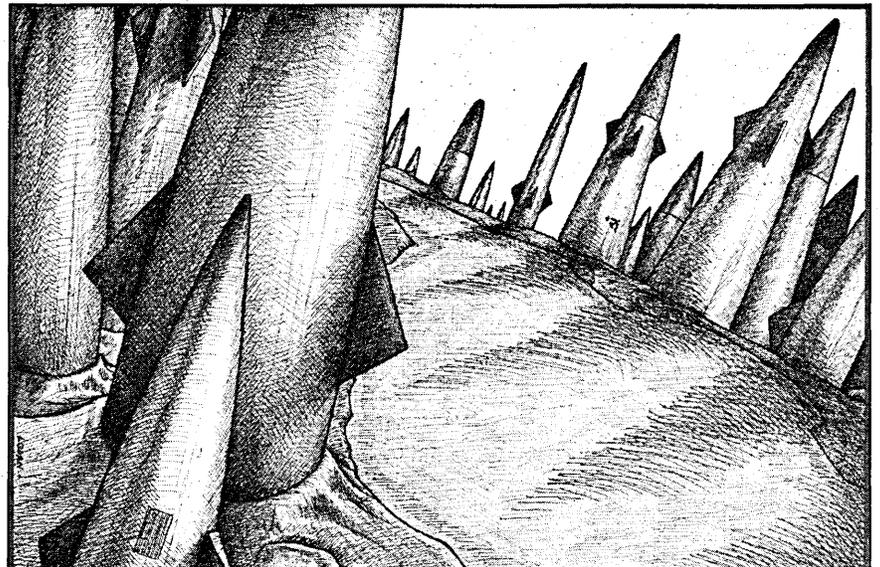
JOHN VON NEUMANN AND NORBERT WIENER: FROM MATHEMATICS TO THE TECHNOLOGIES OF LIFE AND DEATH

by Steve J. Heims

J. D. Bernal has noted that during war there are generally three kinds of potential weapons researchers: those who join in such activity because of the superior interests of the state, those who will have nothing to do with war work or preparation, and finally, the larger body whose participation depends on the circumstances of the war. John von Neumann belonged to the first class of scientist; Norbert Wiener exemplified the second. Intending to instruct by means of contrast, Steve J. Heims has written a book comparing the lives of these two men.

Heims's premise, as presented in his preface, is sensible enough: "... the maximal acceleration of the nuclear arms race is dreadful, and, in the light of foreseeable probable consequences affecting future generations, grossly inhuman." This forms the basis for a comparison of the particular moral weight of Norbert Wiener and John von Neumann, as roughly considered through their activities from 1935 to 1955. The book is large and well documented, representing a great deal of research, and Heims does a right proper job presenting von Neumann's and Wiener's professional work in a limpid and accurate fashion. He offers cogent definitions of, say, Brownian motion and zero-sum game theory. There are distressing sections, notably those containing the author's attempts at psychoanalysis, but overall the book is well made.

In his autobiography, the mathematician Stanislaw Ulam noted: "Wiener was a true eccentric and von Neumann was, if anything, the opposite—a really solid person." Differences between the two scientists abound. Von Neumann spent years at Los Alamos urging the development of atomic weapons. Wiener, after serving in



ballistics testing during WWI, refused to participate in any further military research, preferring instead to develop technology for prosthetic limb devices and hearing aids. Wiener was the Missouri-born and Massachusetts-bred champion of the human use of human beings, while von Neumann was the often aloof, luxury-loving son of a well-to-do Budapest banker. Wiener's father Leo, a prominent linguist who forced his son to scholarship, reared him in the company of such illustrious colleagues as William James and W.F. Osgood. Von Neumann, on the other hand, was first attracted to business and turned to mathematics only at his father's prompting. Von Neumann was a polite and gregarious host; Wiener was the archetypically clumsy and myopic professor for whom social situations were often strenuous and painful.

The two were often ideologically antipodal as well. Where Wiener called for social homeostasis, von Neumann concerned himself with the analytical possibilities of automata. Where Wiener refused to include himself in most professional or political groups, von Neumann hobnobbed with privileged members of the Eisenhow-

er-era military-industrial complex.

Heims has at least made his bias apparent. But his empathy for Wiener, however understandable, is so thorough that it has the effect of undermining his argument. One wishes that von Neumann could have served as a subtle foil in such a comparison, rather than as a morally feeble straw man. No such luck; Heims is vehement and unrelenting.

Norbert Wiener was concerned, far more so than von Neumann, with the relation of man to state. He was wary of power and strove to remove himself from any relation to it. While von Neumann considered the state as a rational arrangement devised for the common benefit, Wiener saw a system where "political leaders may attempt to control their populations . . . through political techniques as narrow and indifferent to human possibilities as if they had, in fact, been conceived mechanically." Wiener detested the cupidity and materialism of his people. He was suspicious of the military and moneymaking segments of American society. He saw a lopsided oligopoly where weapons meant profits. Wiener did not share in the belief that the Soviet's interests

SOURCE DATA

were universally opposed to America's. Nor did he embrace the belief in unmitigated technological progress. Wiener could demarcate, as few others of his position or time could, the limitations of science.

Von Neumann was born in Hungary in 1903. It was not until 1931, when he became a member of the Princeton faculty, that he lived regularly in the U.S., and one gathers that his understanding of America was never quite complete. Eager to affirm loyalty to his newfound land—and to manifest his desired Americanism—von Neumann became a vigorous supporter of nuclear weaponry. He was a man almost intolerably rational and rigid, and was frequently indifferent to the frailties of those around him.

During his tenure as the commissioner of the U.S. Atomic Energy Commission, von Neumann allied himself with proponents of the private development of nuclear power. He described himself as "vio-

lently anti-Communist and a good deal more militaristic than most," and has been quoted as saying, "I don't think any weapon can be too large." He sought war with the Soviet Union, viewing the U.S. as axiomatically good while attributing immense and sinister power to the Soviet Union.

As Heims explains, to Hungarians of von Neumann's time, Russia was the Antichrist, and although von Neumann's *Anschauung* appears lunatic today, in the context of his historical epoch it becomes more comprehensible. Along with many members of his generation, he considered a preventive war against the U.S.S.R. as an acceptable, even preferable, option in 1950. This does not necessarily entrench him with antinomian blackguards; dropping the bomb on Hiroshima in August of 1945 may not have been necessary for victory, but it demonstrated to the world—and to Stalin—America's "naked power."

Even though he recognized the de-

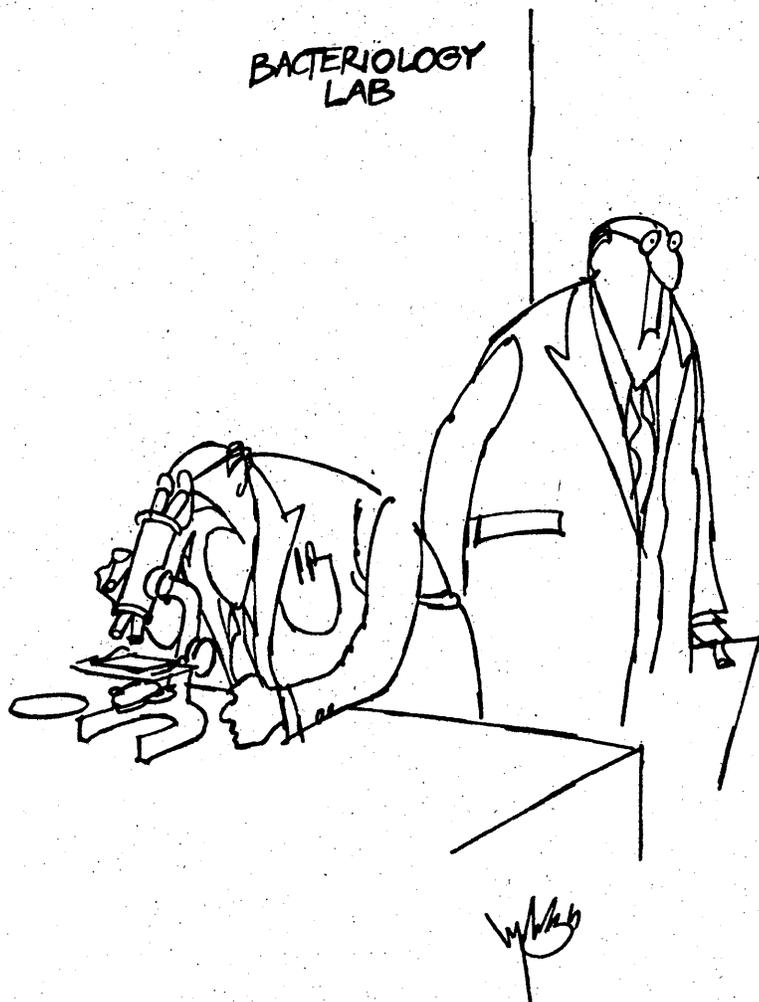
struction such a war would cause, von Neumann felt that some kind of victory was possible. Death was an adjunct to war; greater bombs meant only greater death. Von Neumann accepted nuclear war almost casually, as a millennialist might accept Armageddon. In a nearly mystical sense, beyond any mundane considerations of self-aggrandizement, the superbomb was for von Neumann an alchemical way to supercede time, a contrivance for salvation.

It is difficult to feel sympathy for von Neumann. His admiration for military men is confusing. Persons such as Admiral Lewis Strauss are not of von Neumann's stature, but von Neumann was a man fascinated by power and by those who wielded it. In many ways an exceedingly formal man, von Neumann, unlike Wiener, didn't have the capacity to parley with waiters or listen to porters. Yet in those brief glimpses that Heims offers of von Neumann as a wild driver, a wearer of party hats, a fancier of lewd limericks, he becomes a human figure.

Nowhere is this more evident than in Heims' description of von Neumann's death in February 1957. The analytical von Neumann gone mad in his struggle with cancer reminds us of the strange punishment that reason is unto itself. Admitted to Walter Reed Hospital in April 1956, a painridden von Neumann was assigned orderlies with top security clearance, "lest in his distraction he should babble classified information." Until his death, as his friend Edward Teller wrote, "von Neumann suffered more . . . than I have ever seen any human being suffer." Still, he died seemingly unstung by remorse.

A proper contempt for politics is expected from the Baconian scientist. A politician's concerns are worldly and temporal, far removed from the dual Parnassus of utility and progress. Yet political matters can no longer be entrusted solely to the politician. No single event emphasized this more than the 1952 testing of the first hydrogen bomb at Elugelab in the Marshall Islands. With the hindsight afforded by 35 years, the physicists' determination to develop the hydrogen bomb seems horrible indeed.

But scientists have always worked with technicians in making weaponry. Consider Archimedes' long-range burning glass setting fire to enemy sails in Syracuse harbor. Bacon allowed for "ordnance and instruments of war and engines of all kinds" in his *New Atlantis*. Much of admitted technological value has its derivation in war research. Certainly von Neumann's aggressive affection for nuclear weaponry is not to be revered, nor, by any but the most devious reckoning, is Wiener's outspoken pacifism to be derided. But, as with all moral considerations, the distinction between right and wrong is never so emphatic. Morality has a dynamic as well as a duality of its own, which often makes caustic determinations like Heims's appear shallow and incom-



" . . . watch, that wide receiver in motion! . . . where's the pass rush?! . . . sack 'em! . . . he's out of the pocket . . . watch out, he's running with it! . . . bringing up the secondary! . . ."

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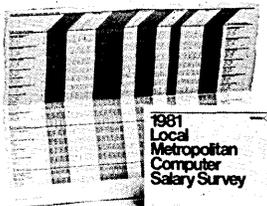
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plete. To divide the development of nuclear weaponry into two Zoroastrian camps—with Wiener as the Mazda and von Neumann as the Ahriman—is to reduce such complex issues as liberty and freedom to their lowest levels. Precisely because Wiener's and von Neumann's characters fit so neatly into an arrangement of light and dark must one be wary. Still, Heims's book, with its sententiousness forgiven, is an effective effort at establishing a human vantage for considering the development of any weaponry, however terrible. MIT Press, Cambridge, Mass. (1980, 547 pp., \$19.95).

—Leopold Froehlich

THE COMPUTER IN THE SCHOOL: TUTOR, TOOL, TUTEE edited by Robert P. Taylor

Imagine a civilization where all communication is verbal and where reading has just been discovered and put into use. This is the analogy made with our society and the computer by Arthur Luehrmann in *The Computer in the School: Tutor, Tool, Tutee*. The book is a compilation of articles and talks by pioneers in the field of computers in education.

Robert P. Taylor has compiled works by Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert, and Patrick Suppes. The 19 papers yield an ex-

tensive overview of this important field to anyone presently working or interested in this area.

The treatment is exhaustive. It describes the revolution in computer hardware which makes microcomputers and microprocessors readily available to school libraries and other educational institutions. The book also discusses the changes in education and learning philosophy spurred by the use of computers, and how the teaching community and society in general will be affected by the increasing influence of these devices.

The editor, Robert P. Taylor, is the director of the program in computing in education, Teachers College, Columbia University. He helps to clarify this complex field by categorizing the use of the computer in terms of tutor, tool, or tutee. These designations are both interesting and useful.

The "tutor" aspect of computer use is generally called computer assisted instruction (CAI). The computer, programmed to interact with the student, can quiz him and evaluate his answers. It can be used to teach definitions, drill on rote material, and lead the student to correct solutions with hints, encouragement, and emphasis. Statistics concerning the speed with which the user is assimilating information can be kept, as well as absorption rate, and how effective the programs are in teaching the material.

As a "tool" the computer has varied uses. It can be used in almost every discipline from mathematics and logic to music and philosophy. The computer can act as a calculator or a device to draw graphs, and can present audiovisual material.

In the use of the computer as a "tuttee," the conventional roles of student and computer are reversed. The user does the teaching and the computer is the pupil. Anyone who has tried to convey information to someone knows that for the process to be effective, the instructor must be fully conversant with his subject. In trying to teach a computer, the student must be able to organize the work methodically and logically and must present it clearly and effectively. In the process, the student obtains the useful benefit of learning how to use and feel comfortable with one of the more ubiquitous and important tools of modern society.

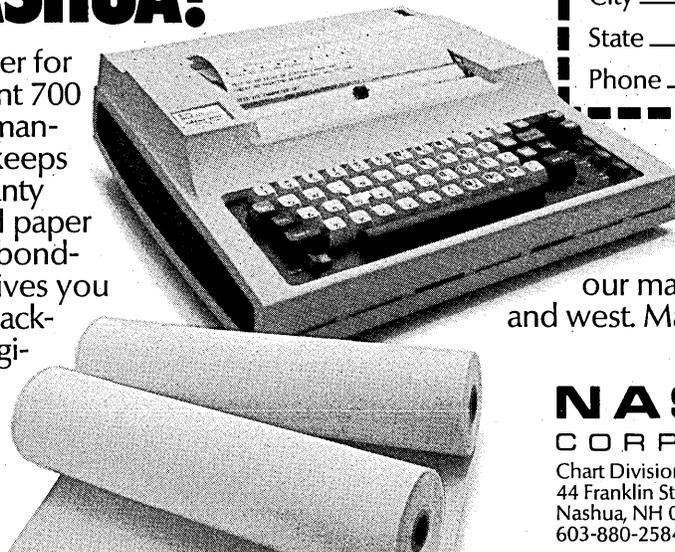
The men whose contributions appear in the book are innovators in the use of computers at all levels of the educational structure, from elementary school to the university. Their statements are strong and assertive concerning the value they place on the use of computers in teaching.

Alfred Bork, a professor of physics at the University of California at Irvine, is deeply involved in CAI and has done extensive work in the development of computer software. He has organized a large and com-

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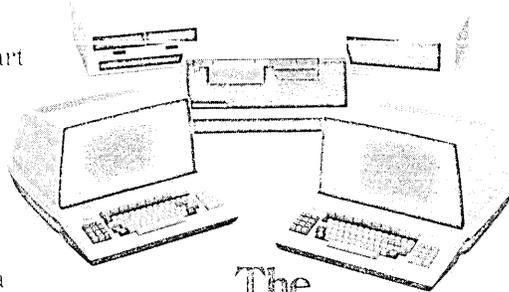
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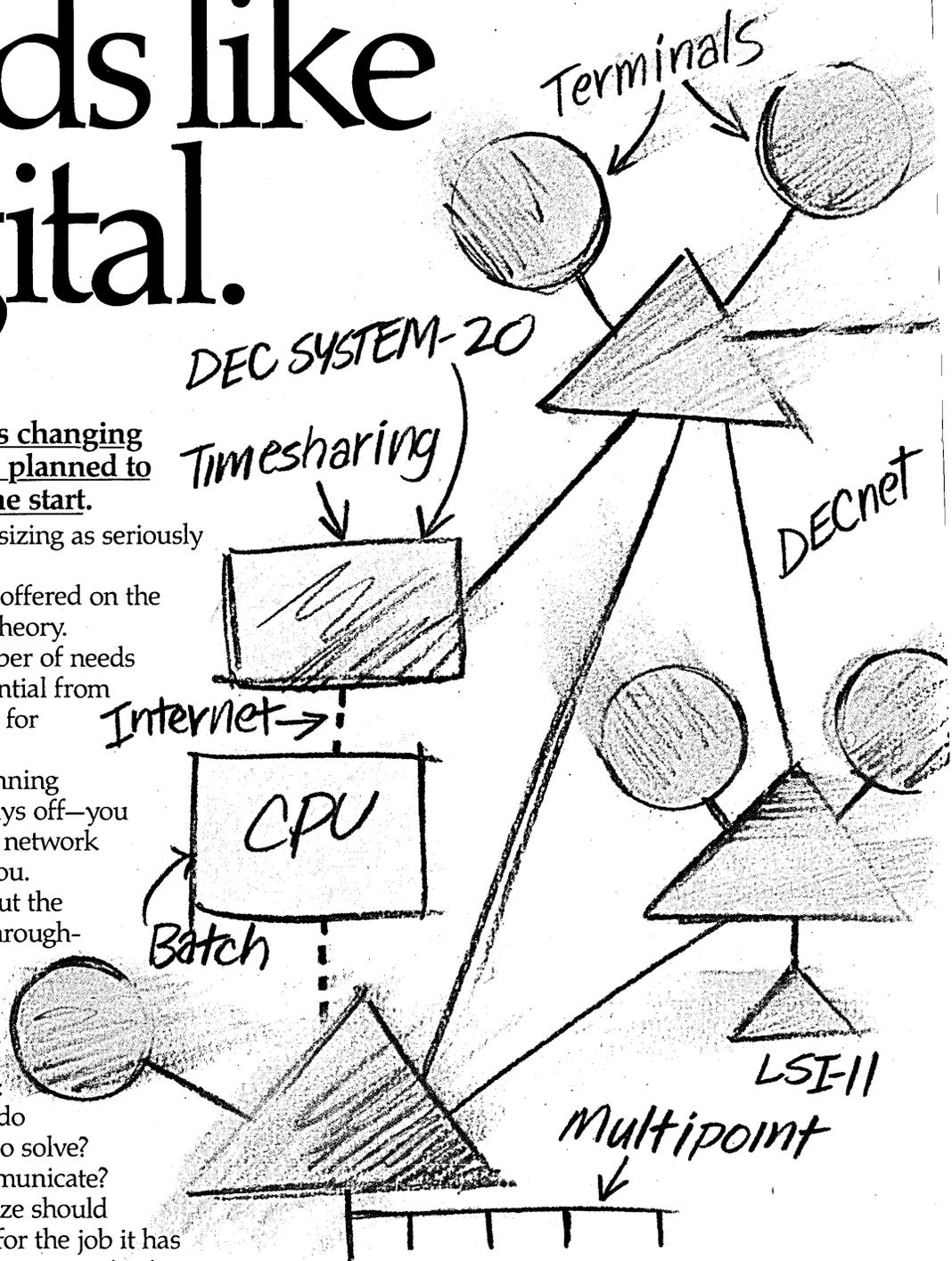
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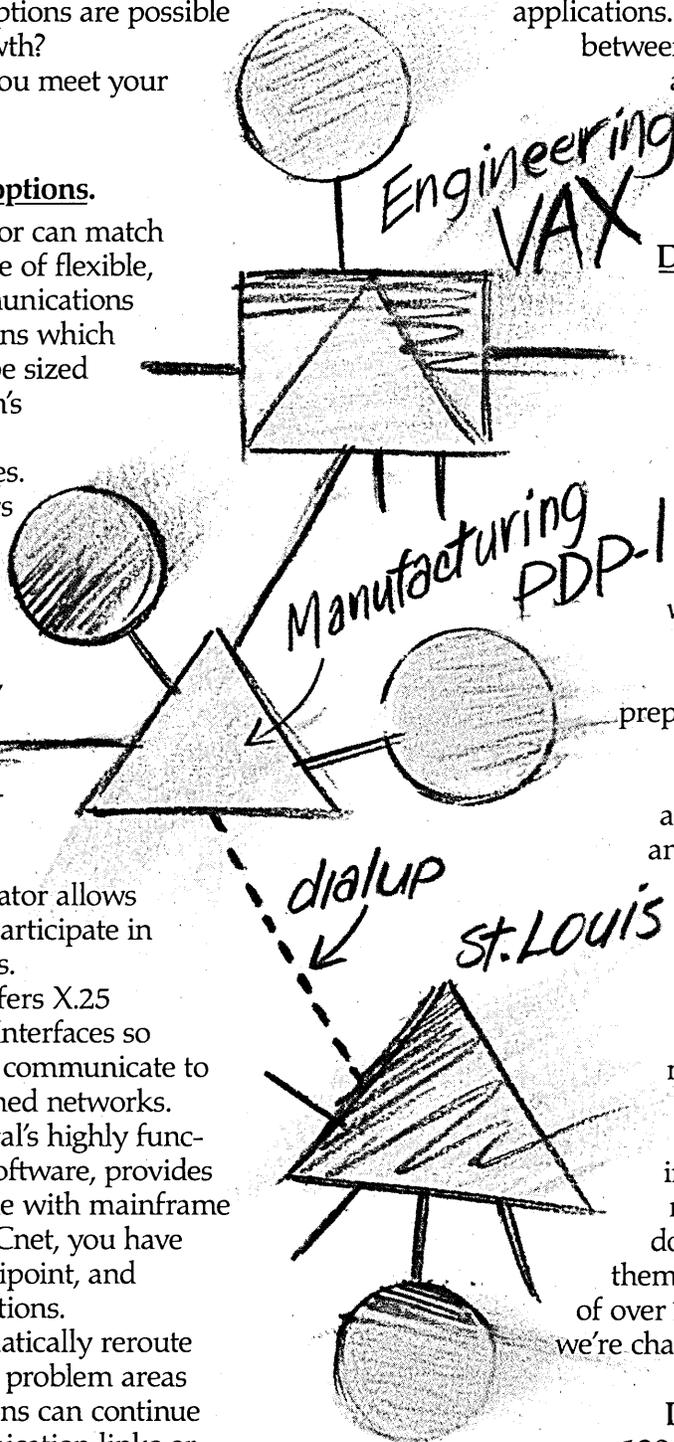
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prehensive teaching facility at the university which uses the computer to help in teaching undergraduate physics. Bork's approach is pragmatic and scientific. He describes in great detail how to prepare dialogues between computer and student and how to employ the graphics capabilities of the device to this end. The programs' interaction with the student is described, as is the way the computer can be used to reinforce the learning procedure. He shows how to use software to obtain statistics about the student's progress, and indicates how these can be useful to address the user's needs and evaluate the effectiveness of the programs. The purpose of his work is to implement the use of the computer as a tool to augment current educational methods.

Thomas Dwyer is a computer science professor at the University of Pittsburgh, where he teaches university and high school students. He urges the heuristic use of the computer in education and advocates that the entire philosophy of education and teaching he reviewed. Dwyer believes the schooling process should help each student form his own learning procedure and attitude. He believes an open-ended educational process should be developed, tailored to the individual, to permit development of creative capabilities and potential. Professor Dwyer states that the computer is ideally suited to these objectives; his own work

demonstrates that this approach is both effective and productive in educating high school students.

Seymour Papert, with MIT, is widely known for his work relating computers to the education of young children. He states that "computation is the richest known source of educational ingredients." Papert asserts that the computer has a profound impact by elucidating many concepts in psychology, linguistics, logic, etc. He is strongly convinced that the child can use the computer as a unique tool with which to teach himself how to learn and think logically and creatively. He also advocates an open-ended heuristic approach to education, and his articles are among the most technical in the compilation.

Patrick Suppes is a professor of philosophy at Stanford University. He directs the Institute for Mathematical Studies in the Social Sciences and has done extensive CAI work in elementary and remedial math and language instruction. Professor Suppes has worked with elementary school children (including kindergarten and first grade students), and he presents detailed descriptions of the educational materials and programs used with these children. He talks about CAI's effect on teachers and their functions, and how curriculums from the elementary to university levels will be affected. Suppes' work at Stanford with gifted children, the

disadvantaged, and the handicapped is presented in the book.

Arthur Luehrmann is associate director of the Lawrence Hall of Science of the University of California's Berkeley campus. Previously at Dartmouth, he was involved in incorporating computing into the academic mainstream. He is a "tutee" man and argues that the computer is a most powerful learning device, and that its development can be put on a par with the development of reading and writing. The parable alluded to at the beginning of this review concerning a society in which all communication is verbal, including teaching, is his.

The fable indicates how at first reading and writing was considered a threat to teachers and the establishment, misunderstood by the masses who hired readers and scribes to read and write for them. The printed word and its associated skills, however, slowly became one of the most powerful developments for the education and advancement of the masses. His little story is amusing, and emphasizes that the computer is an invaluable tool whose use is just starting to be felt in all aspects of our society.

The Computer in the School: Tutor, Tool, Tutee is of interest to a wide range of readers. There are, however, other aspects of this work to be mentioned: it permits the reader to see how an important technological and intellectual development begins and

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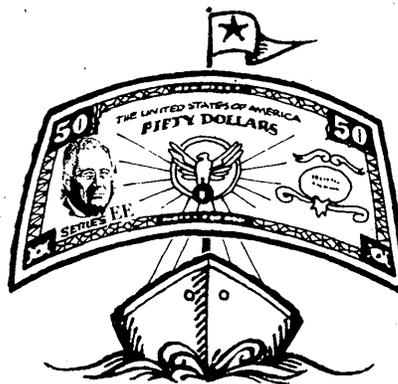
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Successful candidate will need a minimum of 7 years of systems support, including at least 3 years supporting MVS. You must also be familiar with SMP-4 and JES2. TSO support and NJE support would be helpful, as would ACF2.

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involving treasury, industrial relations and payroll areas.

We also need Commercial Programmers having a minimum of 3 years' experience, and familiarity with PLI, TSO, IMS DB/DC, OS utilities, and MARK IV/SAS. You will be responsible for developing and maintaining software in our operations, purchasing and traffic systems.

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how it progresses from its inception. It also illustrates how great intellects and pioneers develop basic principles and original concepts at the introduction of a major new discipline. Teachers College Press, New York (1980, 274 pp., \$14.95).

—Irving Lazar

REPORTS & REFERENCES

NOT FOR OEMs ONLY

The third annual *Directory of Systems Houses & Minicomputer OEMs* is available from Sentry Database Publishing. Over 1,500 systems houses are listed, as are the OEMs and other systems integrators who purchased 87,000 minis, micros, and small business computers. Each listing includes company address, phone number, top five execs, product descriptions, application expertise, annual sales, number of employees, founding year, and the make or model of each computer purchased. The directory also contains a section on market statistics, trends, and competitive rankings of the major OEM computer and peripheral suppliers. One helpful feature is the four-way indexing used in the directory. Systems houses and OEMs can be located by application specialty, CPU brand, city, and company name. The directory can be obtained from the publisher at 5 Kane Industrial Dr., Hudson, MA 01749, for \$347.

HEADS UP

The Semiconductor Industry Association has prepared a report on the present status of the American semiconductor industry. Entitled "The International Microelectronics Challenge," the report stresses the fact that the U.S. must bolster its competitiveness in this marketplace. Major policy recommendations are made by the association, including changes concerning international trade, capital formation, and innovation and human resources.

With regard to human resources, the report recommends increases in both industry support of university research and university microelectronic education. Some international trade recommendations listed were the reduction of U.S. and Japanese duties to 4.2% by April '82, the reduction of European Community duties to under 8%, and strict enforcement of all codes set by the Multilateral Trade Negotiations. The report is 44 pages, and sells for \$10 a copy. Contact the SIA, 20380 Town Center Lane, Suite 155, Cupertino, CA 95014.

TOP 100 SURVEY

Reprints of the DATAMATION Top 100 survey of data processing companies, which appeared in the June issue, are now available at \$5 a copy. Contact Donna Lyons, DATAMATION, 666 Fifth Ave., New York, NY 10103, (212) 489-3489.

VENDOR LITERATURE

DATA EXPRESS

The vendor is a Hewlett-Packard Systems Users' Group member, and is offering a handbook detailing the applications and advantages of the Data Express stat mux in HP systems. Implementation information, typical data communications costs, and glossary of terminology are included in the handbook by COMPRE COMM, INC., Champaign, Ill.

FOR DATA CIRCLE 350 ON READER CARD

POWER ISLAND

"Power Island" is a computer power distribution center described in an eight-page brochure by Sola Electric, a unit of General Signal. Operating characteristics, design features, and, of course, end-user benefits are outlined in the release. Specs can be found on p. 7, and there is a comparison between conventional and Power Island installations on the last page. SOLA ELECTRIC, Elk Grove Village, Ill.

FOR DATA CIRCLE 351 ON READER CARD

STRUCTURED FORTRAN MODULES

The vendor has developed Functional Blocks, a method of structuring standard FORTRAN modules. To help you decide if you want to purchase the \$15, 84-page brochure that explains its method, Comp-Aid

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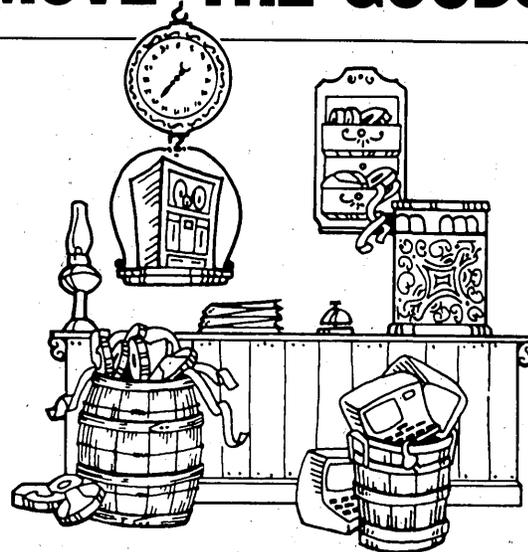
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SCIENCE/SCOPE

In a major advance in computer-aided design (CAD) that eliminates the need for breadboard models, Hughes engineers have created software that checks integrated circuits. The CAD module, called VISTA, tests all hardware from transistors through logic gates, registers, chips, or an entire system. It can test circuit functions and timing parameters, and can help develop and verify system software and test algorithms. The module includes a virtually new simulation language based on PL/1. The CAD module will be used in developing very large-scale integrated circuits for missiles and other military electronics.

An all-optical digital computer has been demonstrated at Ohio State University using a liquid-crystal light valve. This unique Hughes device accepts optical images and replicates them on a completely separate light beam from an arc lamp or laser. The device uses technology similar to that of liquid-crystal watches. Optical equivalents to electronic logic gates and flip-flops were constructed with the light valve much as transistors are used in an electronic system. Computers that use photons instead of electrons would be smaller and faster.

A safely concealed gunner could guide a missile toward a battlefield target with a new fiber-optic communications system. The concept calls for a missile with an imaging seeker in its nose to be fired toward an enemy force. What the missile sees is relayed back to the gunner over a glass thread that pays out from a spool in the missile's aft end. The cable, unlike ordinary wire, can transmit broadband signals required for video. The gunner looks at a display and picks a target. Guidance commands are transmitted automatically to the missile over the fiber-optic link. Hughes and principal subcontractor ITT Electro-Optical Products Division are developing the Integrated Fiber-Optic Communications Link for the U.S. Army for possible use in a low-cost anti-armor missile.

Hughes Ground Systems Group, the world's leader in ground-based automated air defense control systems, is currently staffing for opportunities in the field of automated large-scale command and control information systems. Immediate challenging positions exist for systems engineers, software engineers, operational requirements analysts, telecommunications systems engineers, and programmers. If you are interested in advancing your career, please send your resume to Hughes Ground Systems Group, CCIS Employment, Dept. SE, P.O. Box 4275, Fullerton, CA 92634. Equal opportunity employer. U.S. citizenship required.

The thrust of a spacecraft ion engine has been increased fivefold through simple modifications. Hughes scientists, working under a NASA contract, made the improvements on a model of the 8-centimeter thruster built for flight test on the U.S. Air Force SAMSQ-601 spacecraft beginning in 1983. The increased thrust was obtained by raising the discharge power from 18 to 124 watts and slightly increasing the beam voltage. Thermally conductive attachments were added to the vaporizers to provide heatsinking in the more severe thermal environment. Also, the diameter of the electron baffle was increased to stabilize the discharge voltage during operation at high beam current.

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will send you a copy of the table of contents and some excerpts from the brochure. COMP-AID, Corpus Christi, Texas.

FOR DATA CIRCLE 352 ON READER CARD

DEC TALKS TURKEY

According to Digital Equipment Corp., compatibility will help change the way the world thinks about computers. DEC is offering a 32-page brochure entitled "Compatibility" as an introduction to the company, its products, services, and its "capabilities for keeping pace with a changing world." Emphasis is on software and hardware compatibility and communication between Digital's different series of computers. The company's business, industrial, and research activities are also described and illustrated with photographs. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 353 ON READER CARD

IMAGING MADE EASY

The IP6400 image processing system is described by DeAnza Systems, Inc. in a six-page, two-color brochure. Specific uses for the product and detailed information on the different units that comprise the system are listed. The back panel of the foldout brochure contains system specs, and inside there is a chart on video output control and a block diagram of the IP6400. Options include a digital video processor, graphic

overlay channel, hardware cursor generator, and video signal digitizer. DEANZA SYSTEMS, INC., San Jose, Calif.

FOR DATA CIRCLE 354 ON READER CARD

THE TOAST OF INTEL

The vendor has released a three-page fold-out booklet entitled "The Software Celebration: System 2000/VSE." Complete with champagne bottle, glasses, and confetti, the booklet describes the system's capabilities and stresses its "forte as an application development tool." INTEL CORP., Austin, Texas.

FOR DATA CIRCLE 356 ON READER CARD

DYNAMICALLY SPEAKING

Software Dynamics is offering a May 1981 version of its software catalog. The 14-page catalog describes 6800/6809 microprocessor software, including single and multiuser network operating systems, BASIC compilers, assemblers, editors, word processing, and accounting software. SOFTWARE DYNAMICS, Anaheim, Calif.

FOR DATA CIRCLE 357 ON READER CARD

NEW DYL IN TOWN

"The English Language Report Writer, Utility and Programmer Aid" is just another name for DYL-280, released earlier this year by Dylakor. The company offers a seven-page booklet that breaks down the functions

by name (i.e., a report writer, a programmer aid) and illustrates each function using charts and "pretend" computer printouts. The booklet contains a good amount of company praise, but is easy reading and informative. DYLA KOR, Granada Hills, Calif.

FOR DATA CIRCLE 355 ON READER CARD

PRO PRO-LOG

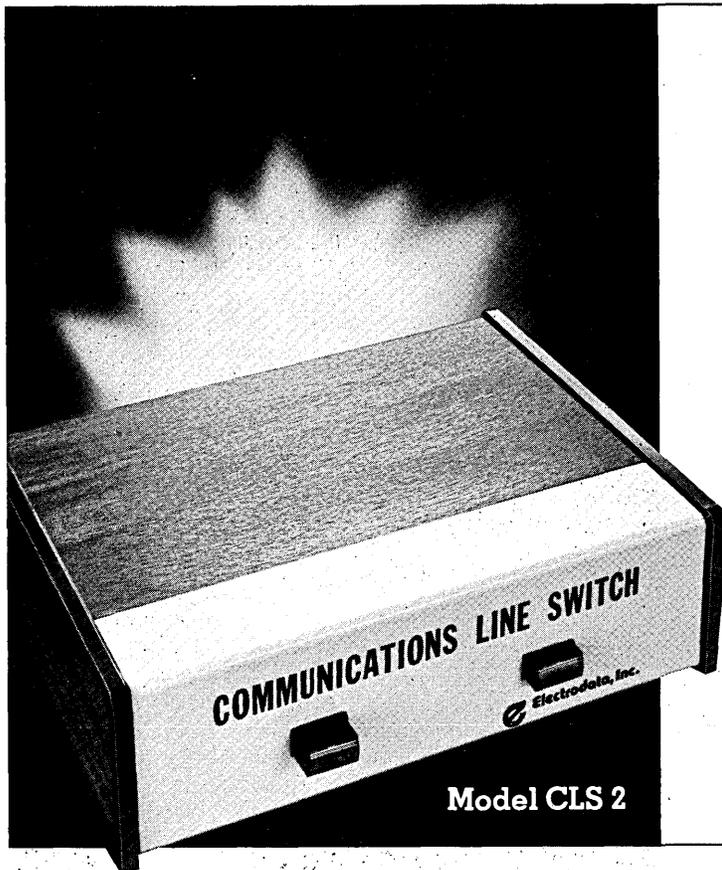
The vendor has released a manual for the model 7303 STD BUS keyboard display card explaining to users how "almost anyone can use" the 7303. There are chapters on purpose and main features, installation and specs, operation and programming, and operating software and maintenance. Charts and figures abound, making this manual helpful, while the body of the text is easily comprehended, the company asserts. PRO-LOG CORP., Monterey, Calif.

FOR DATA CIRCLE 358 ON READER CARD

THE SCOTTISH LINE

Offering much more than just Scotch tape, 3M's Data Recording Products Division released a new catalog listing its full line. Each item is briefly described under the headings of diskettes, data cartridges, disk packs, computer tape, personal computing cassettes, and accessories. 3M, St. Paul, Minn.

FOR DATA CIRCLE 359 ON READER CARD

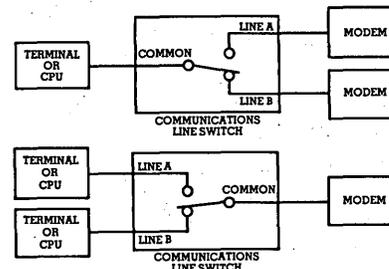


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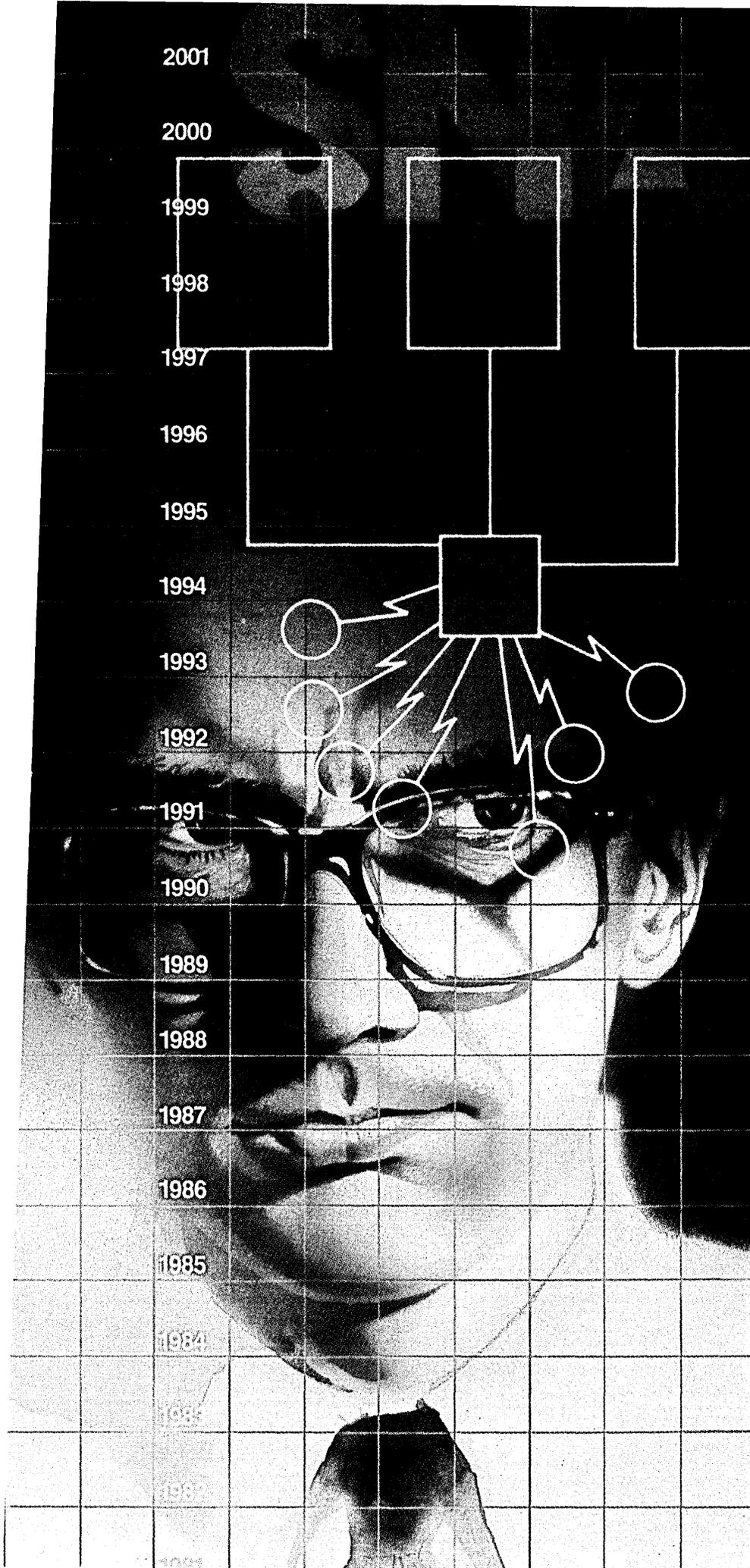
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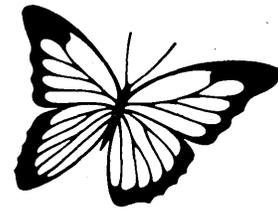
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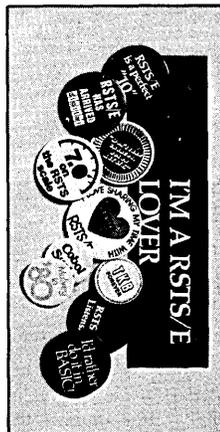
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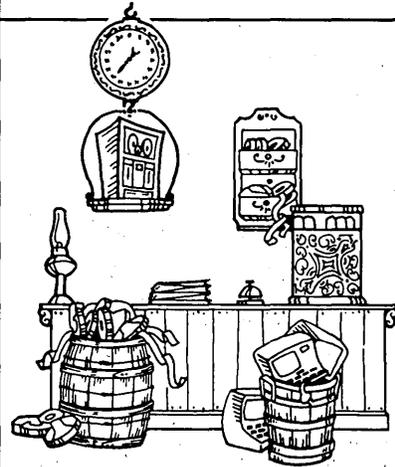
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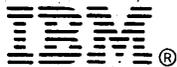


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THE ANTIPODAL LANGUAGE

*"How wondrous this, how mysterious!
I transfer files, I lose information."*

—TRANZ-AC SHUN GE Dynasty 1956

Before proceeding to expound upon the teaching of DBMS, let me answer some of the questions frequently raised by critics concerning the real nature of DBMS.

Is DBMS a system of database management, highly programmable and profoundly versatile, as most computer languages are?

We find in DBMS all the philosophies of the East crystalized, but this ought not to be taken as meaning that DBMS is a language for ordinary applications. DBMS is decidedly not a system founded upon logic and analysis. If anything, it is the antipode to logic, by which I mean the practical mode of thinking. There may be an understandable element in DBMS, for DBMS is the whole database, and in it we may find a great many DO loops; but the database is not a composite thing that is to be divided into so many files, leaving nothing but discernible information behind.

DBMS has nothing to teach us in the way of intellectual analysis, or even "what-if" analysis, nor has it any nested statements which are imposed on its records for acceptance. In this respect, DBMS is quite chaotic if you choose to say so. Probably DBMS users may have sets of rules, but they have them on their own account, and for their own benefit; they are not directly bound to methods of other languages. Therefore, you will not encounter financial models, report writers, dogmatic software manuals, nor are there any symbolic expressions that the database administrator might consistently use.

If I am asked, then, what DBMS is, I would answer that DBMS teaches nothing except that each user must assume the yoke of responsibility for his own information. You create your own database. Whatever subroutines there are in DBMS come out of one's own mind. We teach ourselves; DBMS merely points the way. Unless this pointing is teaching, there is certainly nothing in DBMS set up as concretely pointing the way to information. There is neither denial nor affirmation in DBMS. You receive neither a yes nor a no in response to a prompt, no editing capabilities, no ad hoc analysis, no financial modeling, and no loading procedures. You are responsible for your own information, which shatters the illusion of programming being in the hands of the computer company that originally demonstrated DBMS to you.

To the keen-minded executive intent on delivering a timely,

accurate business plan that is sensitive to market fluctuations, the philosophy behind DBMS may seem esoteric. But, as you will see, DBMS is already a step behind the times in terms of a higher consciousness about software development, and so, if you cannot grasp the essence of DBMS, you are even further behind on the road to knowledge about computer systems.

To know a thing, we must first return to its source. So, to understand how DBMS works, we must search through the dog-eared pages of the first manual produced on this subject, the *Dharmapattva Administrator's Procedures Manual* (Obscurity Press, 1957) in which we find a passage concerning the interface between Tranz -Ac Shun and the Master Tape, about the nature of data in all facets. Tranz -Ac Shun was foolishly "educated" in the logical retrieval methods of FORTRAN, COBOL, BASIC, JPL, and ISAM, and so was tenaciously opposing a new way, a truer way to the database. Here is an excerpt from the exchange:

Master: You are prepared to enter the database?

Tranz -Ac Shun: Yes, I contain all the necessary subroutines. I just have to worry whether or not I will have enough core buffer to accept the transfer of files from the system.

Master: Do you really understand how database management works?

Tranz -Ac Shun: Yes. You hire a programmer schooled in FORTRAN, support customer databases, and have all the nested routines necessary to handle all contingencies.

Master: See what your compiler is telling you? You are confusing the intricacies of the language with the nature of the experience. A database does not really exist as a cohesive whole; that is the illusion. Especially in this place.

Tranz -Ac Shun: Master, what is the way? Our customer is complaining that the program keeps bombing and that they have market quotes from 1949 spitting out on the terminal.

Master: I will explain the true way it is. It may seem like a new way to one like you, entangled within the web of logic, but it is actually an old way. I call it DBMS.

Tranz -Ac Shun: DBMS? Can you edit files? Does it work with custom databases? Is it subject to batch processing or do I have to eat ham and Swiss again tonight?

Master: DBMS accepts what is. It does not impose itself on the database. You see, the database is actually a chaotic entity out there, and in fact, contains nothing. That is where the customer is fooled; he still believes in the illusion. The only structure that a database has is the one that the customer believes is there. It is a construct of the

READERS' FORUM

mind, an abstraction. I will explain the dynamics of DBMS so even an uninitiated tape like you can interface.

The database is a chaotic mess. With DBMS, you allow the user to create his own structure. It is empty, like the abyss, the great void where no light or update rules apply. The system prompts the user for information about records, data items, etc., because that's what the shortsighted fool believes is happening. In actuality, there are no records, no data items. These are handles which we give entities so that the customer is placated.

Once a database structure exists, it is ready for loading purposes. So he loads all kinds of crazy information and he expects that mess to make some kind of sense when he asks for it later. He must realize that he had all the information he needed in the first place, he is complete, but he still insists on having a database to

accommodate it. The user cannot see it; he is blinded by the illusion.

Conventional database management systems must work with the established structure. DBMS allows the user to reroute his way through the nonexistent database. All that is necessary is that the user accept that he can change his entry point any time he wants to. But he won't. He has been habituated into believing that there is a structure, so that is all that he can see. In DBMS, all a user has to do to retrieve from a different portion of the database is to redefine his subschema. He is still caught in the illusion of a structured database, but what the heck, there's nothing we can do about that. Let him believe there are such things as records and data items. As another Master Tape once printed out:

"One might as well burst out laughing."

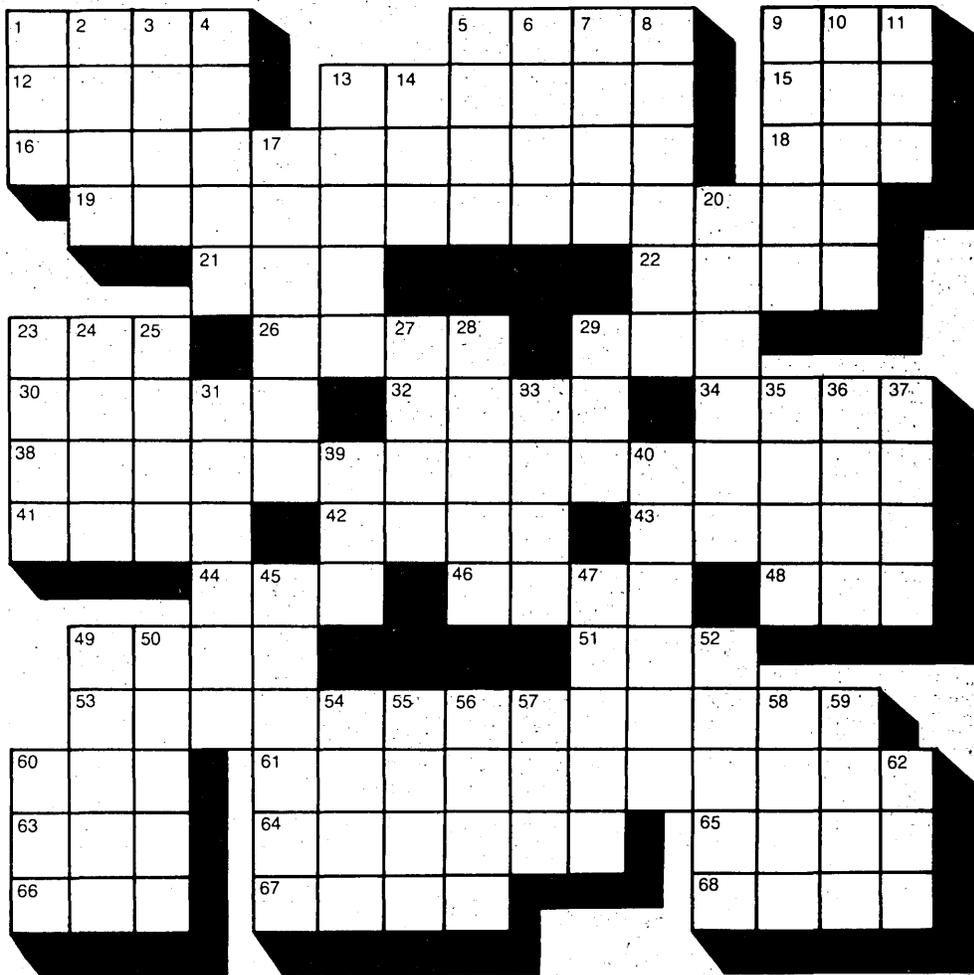
—Joseph Rich
Fairfield, New Jersey

DATAMATION CROSSWORD

DUPLICATE BRIDGE By Brian Burke

ACROSS

1. More counterpart
5. Raise
9. New Haven athlete
12. Zone
13. It _____ the cask
15. Chap. and _____
16. The Tournament
18. Cuttlefish secretion
19. The Partners
21. I set in motion (past tense—Lat.)
22. Strawberry
23. Pitcher Medich
26. Fleming et al.
29. Military award: abbr.
30. Erich Raeder concern
32. Daybreak in Dijón
34. Verboten
38. Name of the game
41. Abound
42. Romanov, for one
43. Useful
44. Bat wood
46. Bowery punk club
48. Rocky _____
49. Type of bet
51. Pasture
53. The Contract
60. Mother's instruction
61. It's part of the game
63. Succeeded H. C. H.
64. False wings of a bird
65. Let it _____
66. Four o'clock potato
67. Furnish with a roof
68. Totals



DOWN

1. Common follower
2. Son of Aphrodite
3. Evening, in Evria
4. Ointment
5. Fishing fly
6. Two-word resume for Jean-Claude Killy
7. Ukrainian capital
8. Records
9. Lupone vehicle

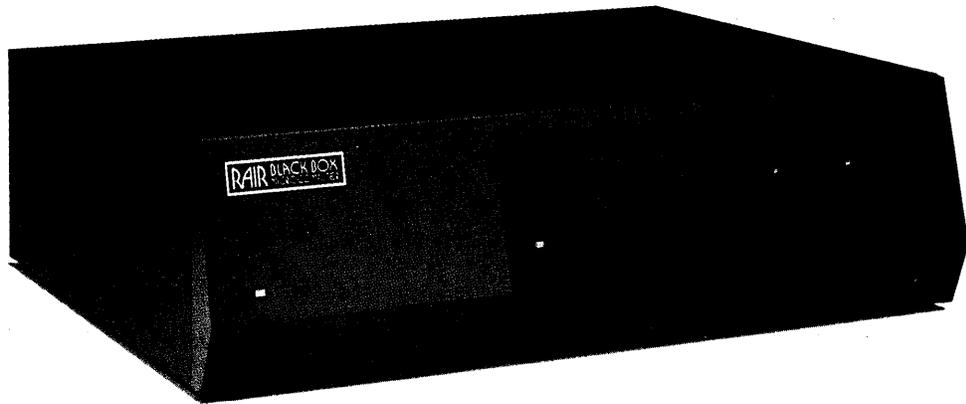
10. Vladimir Ilyich Ulyanov, a.k.a.
11. Annoy
13. Fetal sacs
14. Fiscal watchdog: abbr.
17. Finger: comb. form
20. Chickadee or wren, e.g.
23. Tubular channel
24. Double-reed woodwind
25. Strive successfully
27. Carps
28. Word with poison or tanner's

29. Ult. mon.
31. Indian language of Bolivia
33. Art Buchwald offering
35. Lively: musical abbr.
36. Word with corn or conveyer
37. Applications
39. _____ degree
40. Happy warrior
45. Site of the battle of Hastings
47. European kite
49. Call this itself
50. Non plus _____

52. Greek marketplace
54. White or Blue
55. Same: comb. form
56. Blunt
57. Woody's lady
58. City in Oklahoma
59. Foxx
60. Newt
62. _____ judicata

Solution on p. 280

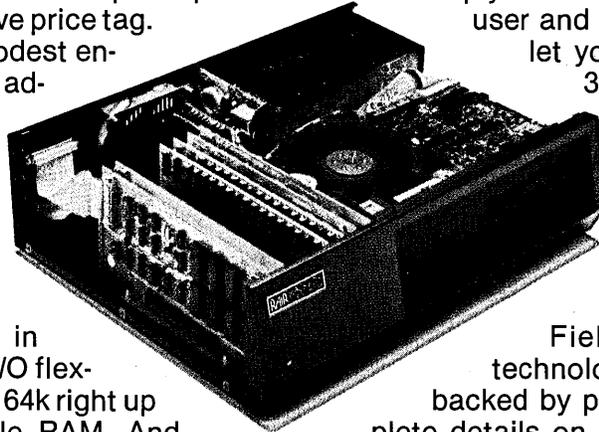
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READERS' FORUM

POWER TO THE PROGRAMMER

Judging the effectiveness and progress of a software development project is a difficult task. Each project is unique, having its own form, its own variables, and its own impediments to a successful and timely completion. It seems that only years of experience and practice can permit a software manager to gauge accurately the time required to complete a project and to submit a realistic schedule. By providing a professional, healthy, and well-run environment with access to all the necessary tools, a manager can help ensure that the department can meet that schedule.

All software development projects divide neatly into three phases: conception, implementation, and test. Programmers are most productive and efficient when the project moves quickly and consistently from one phase to another. Breaks in the development cycle for one reason or another are distractions which impede the department's progress. But the break which causes the most frustration and is the most damaging to morale is also the most common: a programmer not being able to work because of lack of access to a computer.

I am in the fortunate situation of managing a software department where each programmer has a desktop microprocessor-based system. Classic software management problems attributed to work frustration caused by lack of computer time simply don't exist. Each programmer is able to develop, compile, debug, and test his work and maintain, without breaks, the natural project development cycle. In addition, each programmer can write and edit the necessary documentation using word-processing software, and the documentation can be distributed on media for everyone's use. Programmers are better able to structure their own work and accurately plan their schedules because they always have access to a computer.

The ability to supply each programmer with a computer has helped us recruit good people, and turnover within the department is consistently much lower than in the rest of the industry.

By working this way, we have discovered a number of ways to use our microprocessor systems efficiently.

Each system is initially configured to operate as a standalone computer containing two 5¼ inch flexible disks, crt, keyboard, and integral dot-matrix printer. The units also have an RS232 interface and 48K of RAM. Resident software includes the operating system, system utilities, interactive debugger, assembler, linker, and high-level languages.

In structuring our work methods around the availability of these systems, we've found that they are useful in three ways. First, the systems are used, obviously, to develop software that is intended to run on these or other similar systems. This kind of software typically includes system utilities and specialized applications (such as word processing, communications capabilities, and emulators). All the necessary work can be done very easily by a programmer working on his own system. The software can be tested by another programmer working on another identical system, and the integrity of the development cycle is maintained.

Secondly, programmers can develop software that will eventually run on intelligent "black boxes." Typically, the black boxes are dedicated device-and-process controllers and are used in many consumer and industrial products. With the latest and best of the new products being technology-driven, the microprocessor is in the driver's seat. When scheduling the development cycle for producing software for these devices, the manager can assume that the software can be written, debugged, and initially tested on a user-friendly micro. When the software is ready for final test it is transported to the black box and run in the box's normal working environment. Trying to develop software for the black box by

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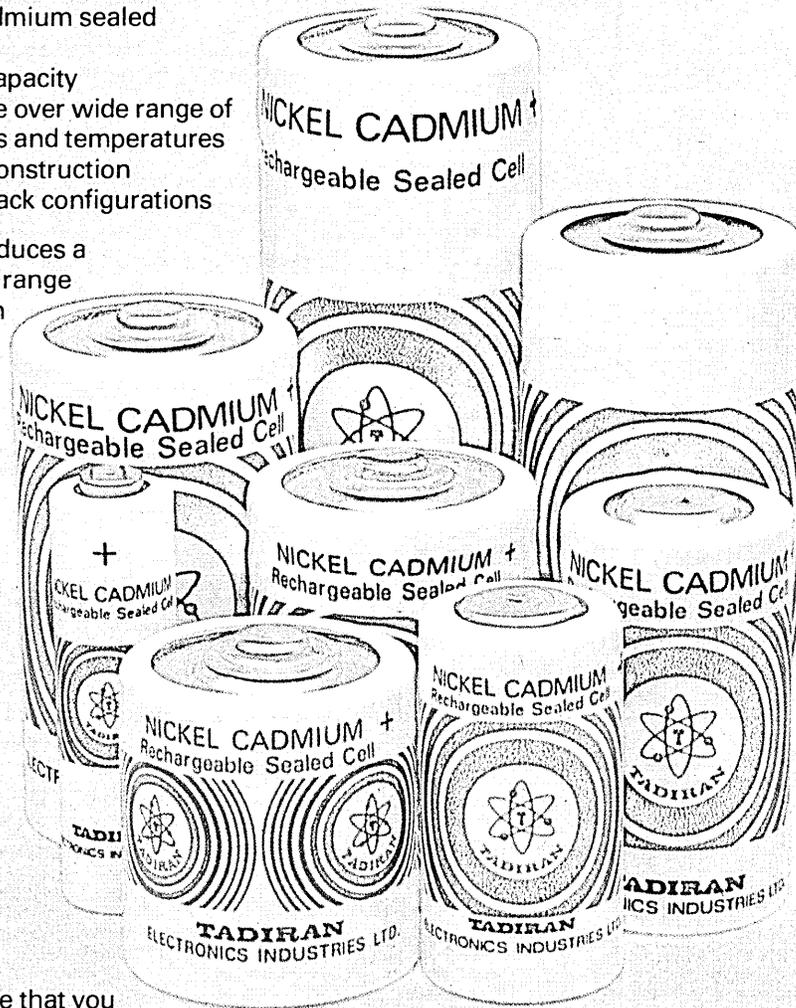
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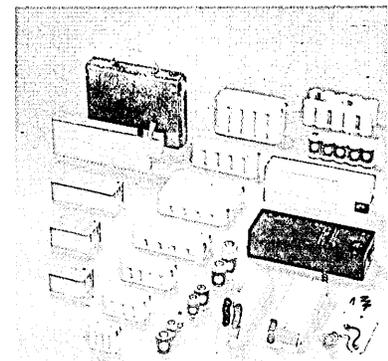
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READERS' FORUM

writing code at the black box itself is a frustrating task, obviated by developing the software on the microcomputer.

Third, software that will eventually run on a mini or a mainframe can be developed on the micro. Source code is written and edited while the micro operates in a standalone fashion. When the programmer has completed a program or module, he sends it over to the host via the RS232 line and uses the micro as an intelligent terminal. The source is compiled and debugged on the host and then the micro goes back to the standalone mode and the source code is edited locally.

The benefit of this scheme is that the programmers do not use the valuable and expensive resources of the host for tasks which require only the resources of the micro. This frees the host for efficient processing without being severely overburdened with housekeeping and routine maintenance tasks. All the programmers in the department can work simultaneously because at any one time most of the programmers need not be on-line to the host.

Another benefit to this scheme is that when the host is down (as is inevitable), many of its functions may be offloaded to a micro and the development cycle is less severely impeded. The local storage at each micro provides backup for each programmer's work, so when the host goes down, it doesn't take a few days' work with it. Having to reconstruct work after a system crash no longer has to be one of the accepted, unpleasant programming chores.

To prevent a programmer from working because a computer is not available is an obvious waste of an employee's time and energy. On the other hand, providing each programmer with a microcomputer system improves the department's work conditions, resulting in increased productivity, improved morale, and decreased turnover. With the systems costing about \$6,000, this capital expense is a sound investment.

—Harvey Stone
Woburn, Massachusetts

WHY NOT?

During the 96th Congress in the Judiciary Committee hearings on the 1980 Communications Reform Act, arguments for and against restructuring AT&T by divestiture of its new unregulated communications subsidiary were presented. There were no questions on the necessity of restructuring the communications industry, but only upon assuring fair competition in the industry by requiring AT&T divestiture. Such AT&T divestiture of unregulated communications subsidiaries seems clearly the most logical means to assure a free and competitive communications industry because of the many subtle forms of cross-subsidization available to AT&T including:

- Advertising—the unregulated phone company . . . a subsidiary of AT&T.
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- People—who really believes personnel promoted between AT&T's regulated and unregulated subsidiaries will forget their previous jobs and not pass competitive information?

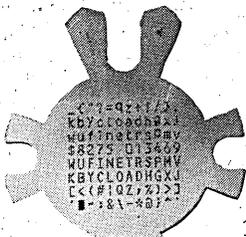
Certainly, the current regulatory environment places seemingly unfair business constraints upon AT&T when compared to other firms in the communications industry. However, if the same constraints were placed on every firm, it would be like feeding an elephant and a bunch of ants from the same dish. AT&T's foray into the packaged computer software industry illustrates this point well. The revenues AT&T receives from its software sales are insignificant to AT&T, but would add considerably to the sales revenues of any other firm in that industry. What is a few hundred million in revenues to AT&T? How could that possibly worry firms in an industry unrelated to communications? Even with a full divestiture, both the new AT&T clone companies would be giants in their portions of the communications industry.

During the hearings, the FCC [Federal Communications

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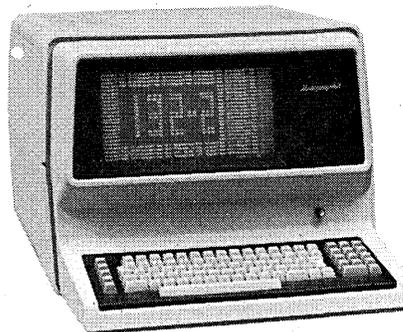
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Commission] said that without divestiture additional personnel would be required to monitor AT&T's regulated and unregulated subsidiaries and thus assure that cross-subsidization did not occur. AT&T would also need added personnel to assist the new FCC personnel with their monitoring tasks, and to compile data in answer to the FCC's questions.

This most certainly has the beneficial effect of reducing unemployment, but who will pay for these added federal and AT&T employees? Yes, the federal government and AT&T will pay their salaries. Then they in turn will pass these costs onto the taxpayer and the telephone subscriber. Without AT&T divestiture, we will see higher taxes and telephone costs.

Why not require AT&T divestiture? The usual answer: costs for rural telephone subscribers would increase unfairly. Ridiculous. This argument is based upon the premise that all costs for telephones throughout the nation are averaged to determine a base rate for telephone subscribers. This is why a call from a pay telephone costs 10¢ in rural New York State, 15¢ in Silver Spring, Md., and 20¢ in Arlington, Va. Since the telephone facilities (plant) serving rural America were built in the '40s, '50s and '60s, their cost was paid in '40s, '50s and '60s dollars. Thus, the charges for rural service should be inexpensive when compared to the charges for facilities and services built on today's costs. Further, unless the existing facilities are destroyed, telephone service to rural America will continue as before, uninterrupted by divestiture. Remote areas requiring new service might consider accommodating their communications needs by purchasing citizens' band radio equipment.

The FCC has not found in similar cases that AT&T's arguments justified its position.

Why not require AT&T divestiture? If AT&T is required to divest, will anyone lose a job? No. If AT&T is required to divest, will competition in the communications industry be increased? Yes. Will this increased competition save telephone subscriber money? Yes. In the short term AT&T will spend money to complete the divestiture process. However, since both Microwave Communications Inc. (MCI) and Southern Pacific Communications Corp. (SPCC)



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offer long distance toll service competitive with AT&T at lower costs, I believe that AT&T divestiture would lead to lower telephone and communications costs.

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Pete Moulton
Columbia, Maryland

THE ORACLE AND THE ENTREPRENEUR

So, you're going into business, son, and you have climbed my mountain to beg from me, the Oracle, a sip from Wisdom's fountain;

Come in, my lad, and be at peace; drink deep of Jasmine Tea; and I will tell you all I've learned of Life and History.

For I have made it big, my son, I've tasted fiscal heaven; and then, of course, there was the time I went Chapter Eleven.

Now the building blocks of Industry since Neolithic time have been limited to just these eight, and they are called "The Prime":

A good idea, commitment, and a dedicated team of loyal, competent people who would realize their dream;

Sufficient funds to bring it off, a massive dose of pluck, and you have the magic recipe; the rest is, frankly, luck.

(Before I vacate this last point, a word to all Beginners: if the team you're with was out before, it helps if they were winners.)

Now separate your private world from that of your profession; don't mix your families, lives, or friends, or personal possession.

If you must move from one dimension to escape your devils, you'll need a safe place to regroup, so live on several levels.

Walk wide of Texas MBAs, in business they excel; and if they claim they're "country boys," break loose and run like hell.

Beware of Wall Street lawyers and their legalistic tricks; (I think I knew a straight one once; he died in Fifty-Six).

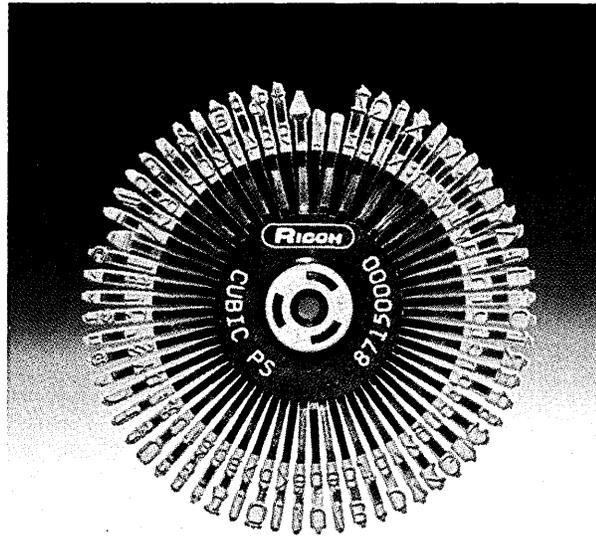
Look closely at investors who with gold and jewels come laden; they'll help you like that Roman guard helped out that Sabine maiden.

Be trusting of your fellow man, be open, honest, frank; but it's smart to sit in corners and keep money in the bank.

And now you know it all, my son, your consciousness is raised; but stay and sit a moment yet, your eyes are somewhat glazed.

I've told you every truth save one; with this your outlook's sunny: if you ever get the chance, my boy, be smart and marry money.

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CLOSING THE SOFTWARE GAP

"Software gap" refers to the widening difference between the amount of code required for dp applications and the net code-generating capability of all available, qualified dp personnel.

Discussions about the gap are peppered with statements such as, "There are 568,000 applications software professionals today. The demand is such that we are going to need 14 million by 1990."

This statement misses two factors which will close the predicted gap. One of these is the supply side factor, and the other is the demand side factor.

The cause of cost in systems is their basic complexity. Requirements to handle complexity often mean requirements for time, talent, intelligence, and money, because we face a basic limitation in our ability to understand complexity: we can only consider about seven, plus or minus three, factors at any one time.

If we can reduce system complexity, we can increase the speed and quality of systems we design. For this reason, most systems are designed, coded, and regarded as a set of building blocks (typically defined as functional modules, programs, and/or subsystems).

These building blocks increase in functional capabilities, however: from a concern with each bit in early computer days, the blocks we deal with have increased to assembler, high-level, and very-high-level languages, and from there to standalone modules and, now, to whole programs defined by a single variable name. As this has happened, it has become possible to grasp the true nature of a complex system. Development aids help to formulate the definition of a system as an "N-skeleton" system (where "N" is usually less than 10) rather than a (more commonly used) "X-line" system (where "X" may be 5,000 to 1 million).

By using such large yet flexible building blocks, it is possible to define more function with less code. By thus increasing the scope of the building blocks, we decrease the number of instructions per function, increase the number of functions per design unit, and thereby end up with comprehensible representations of functionally complex systems. We are much closer to the psychological limitation we face of contemplating only seven, plus or minus three, factors at one time.

Such developments may permit producers of software products to increase the lines per day output of programmers by several orders of magnitude, and to decrease the lines per function required to accomplish a given task by maybe an order of magnitude. These

WILL THE SOFTWARE GAP WIDEN?

THE ANSWER MAY LIE IN A DISTINCTION BETWEEN
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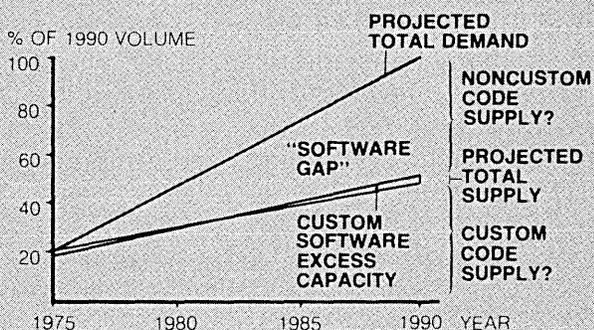
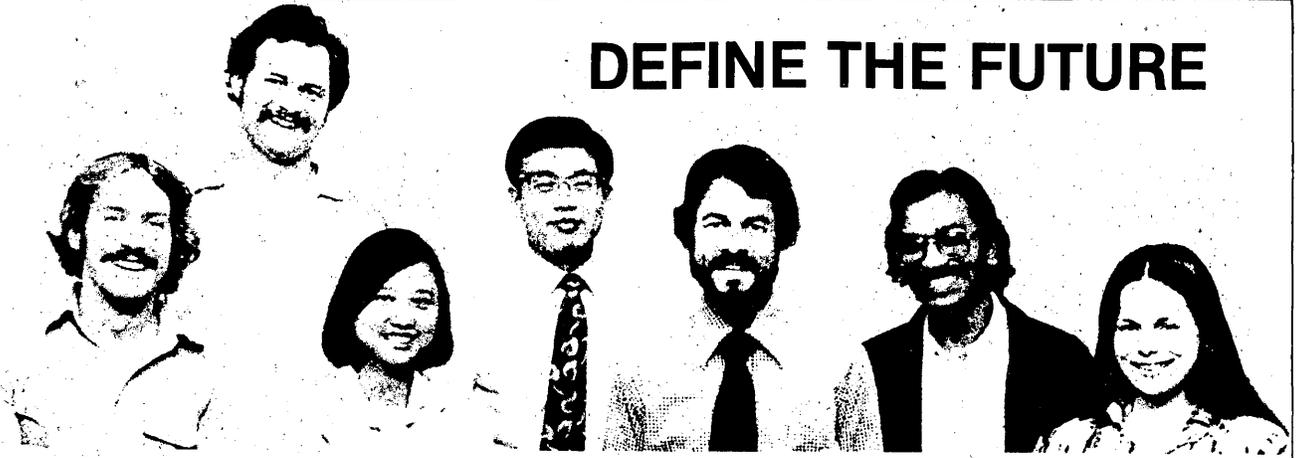


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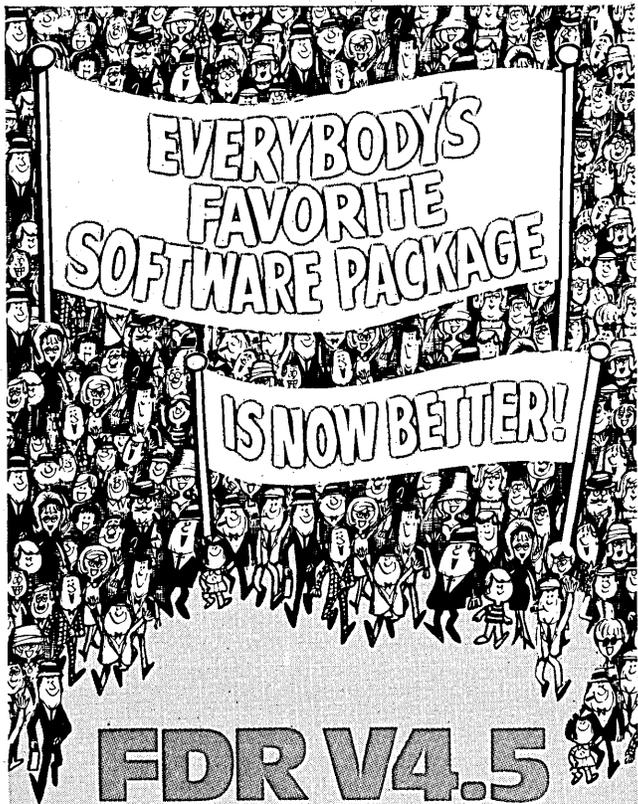
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changes will dramatically increase productivity as related to cost and time investments to produce new code. Systems development will occur in a small fraction of the time it currently takes. The code will be more generalized, less customized, and yet achieve the same functional objectives. It will boost supply dramatically.

Demand for software will increase. There is, however, a crucial distinction between a need for custom software and a need for any working software.

Many users would prefer custom software, even with its high cost and (often) low reliability. As software suppliers become better at recognizing the differences between good custom and good generalized software, packages will become more reliable, maintainable, and generally better than custom-coded systems.

As packages get better, more users will willingly seek them out. And, as with book publishing, the marginal cost of producing an extra copy will dictate that suppliers get into the market with low prices and seek to appeal to a broad audience once demand is high.

As a result, while demand for software increases, demand for custom software may stay the same or perhaps even decrease. It is only the custom software that is labor-intensive.

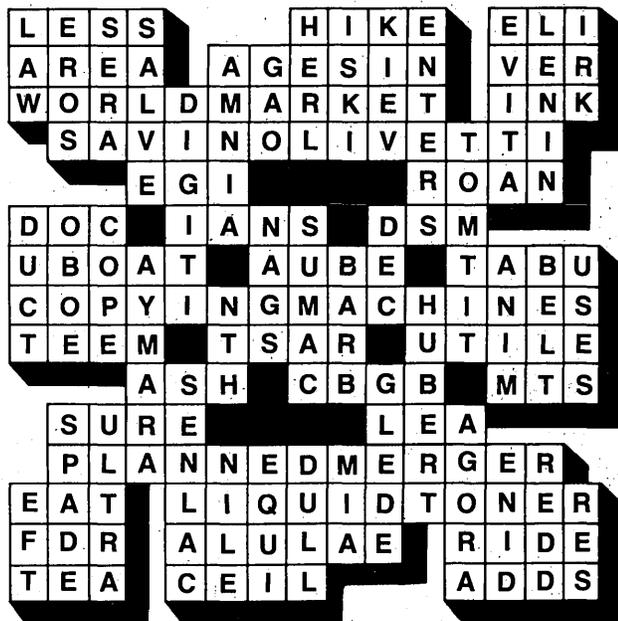
Predictions about a continuing widening of the software gap seem to assume that increasing demand will be for new code, and that productivity as it relates to the creation of new code will not increase dramatically. Both of these assumptions may be erroneous.

Net demand for new software may actually decrease because of the acceptability and cost-effectiveness of applications packages; thus, the demand will soften even while total demand for software increases greatly. And the ability to cost-effectively produce new code may increase greatly because of the use of bigger building blocks. Such blocks will be represented by very-high-level language commands and by system development packages which are predicated on the use of skeletons and limited-purpose (i.e., screen and report layouts only) machine-generated code.

Thus, it seems possible that in the custom software market net demand will not increase as quickly as will the number of dp professionals and the per capita productivity of dp workers. In spite of a huge increase in overall software demand, the software gap may disappear.

—Sandy Linthicum
Greensboro, North Carolina
Jeff Long
Chevy Chase, Maryland

Answer to puzzle on p. 266



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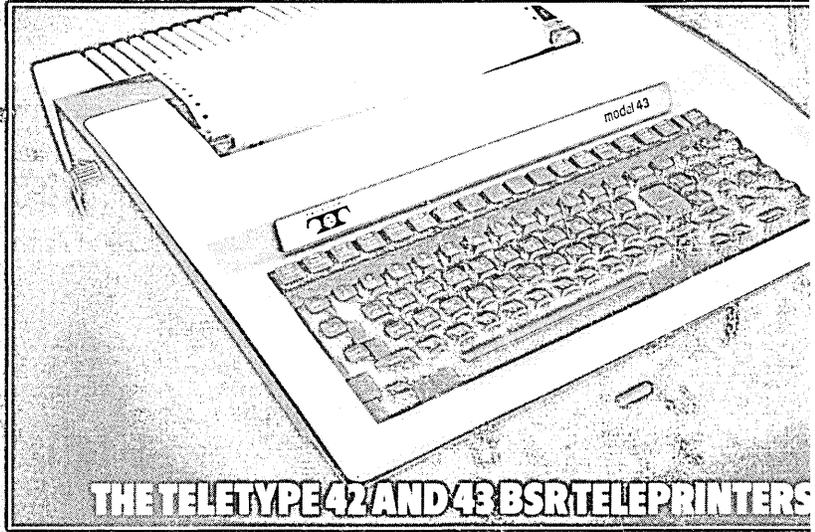
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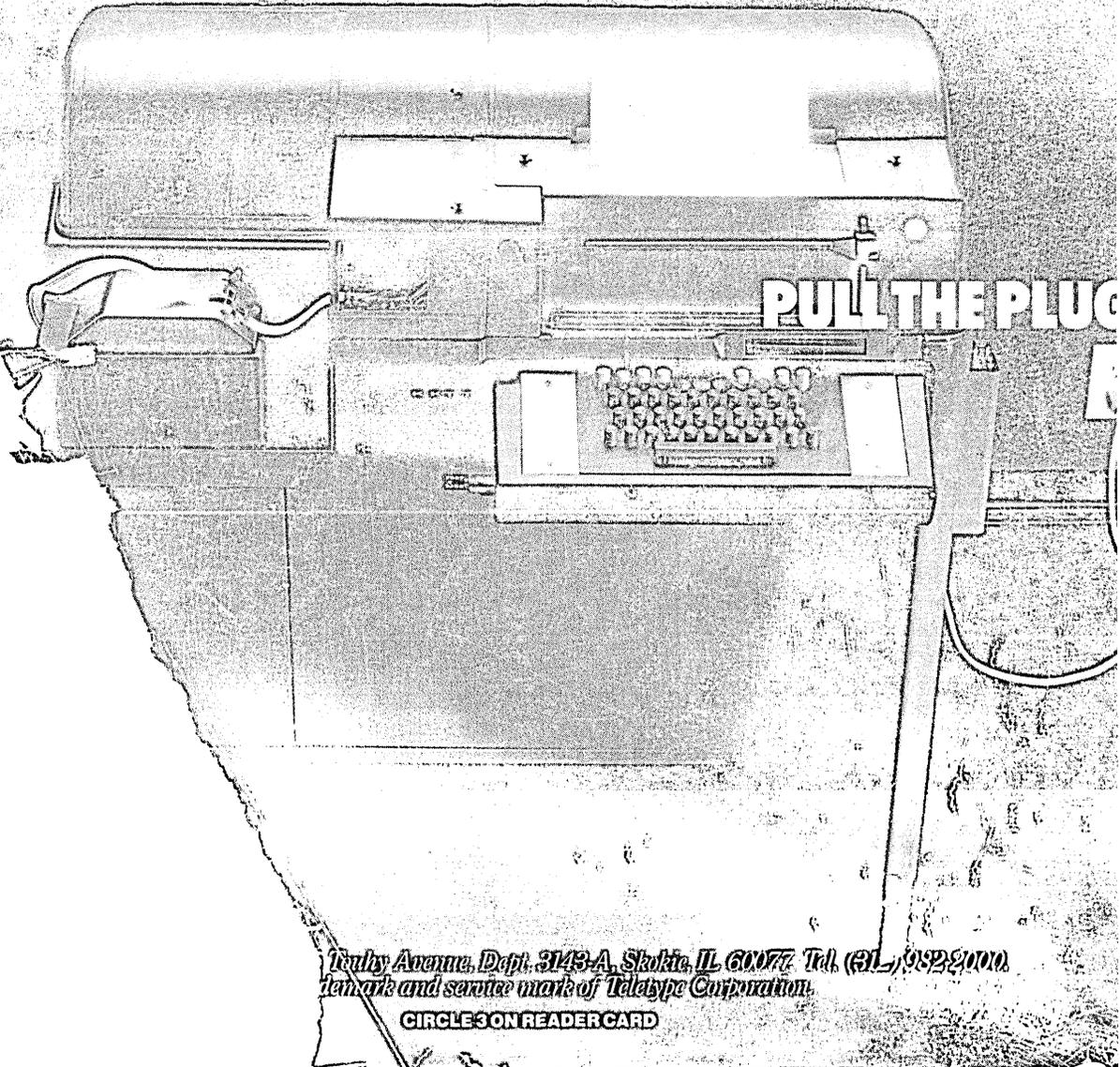
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