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ITERATIVE DEVELOPMENT
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TO ENLIGHTENMENT

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Command ==> ■ Define Mode

		YEAR_1	YEAR_2	YEAR_3	YEAR_4
TAXRATE	Tax Rate	22	22	22	22
INFLATE	Inflation Rate	0	7	8	6
D_UNITS	Delta Units	0			
D_PRICE	Delta Price	0			
UNITSOLD	Units Sold	50,000	57,500	66,125	76,044
PRICE	Selling Price	8.50	9.00	9.50	10.00
REVENUE	Revenue	425,000	517,500	628,187	760,437
RAW_MAT	Raw Material	150,000	184,575	229,242	279,446
DIR_LAB	Direct Labor	100,000	123,050	152,828	186,297
PACKAGE	Packaging	25,000	30,762	38,207	46,574
DISTRIB	Distribution	37,500	46,144	57,311	69,862
GROSS_P	Gross Profit	112,500	132,969	150,600	178,258
FIXED_C	Fixed Costs	40,000	40,000	40,000	40,000
NET_BTAX	Net Before Taxes	72,500	92,969	110,600	138,258
TAXES	Taxes Payable	15,950	20,453	24,332	30,417
NET_INC	Net Income	56,550	72,516	86,268	107,841

Financial Spreadsheets on the IBM 3279.

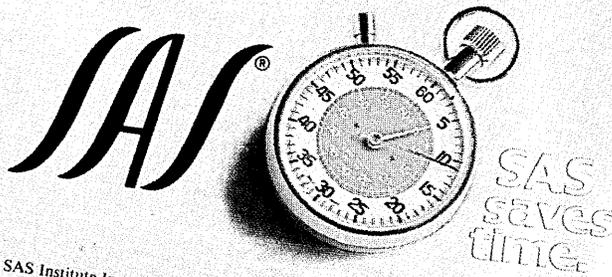
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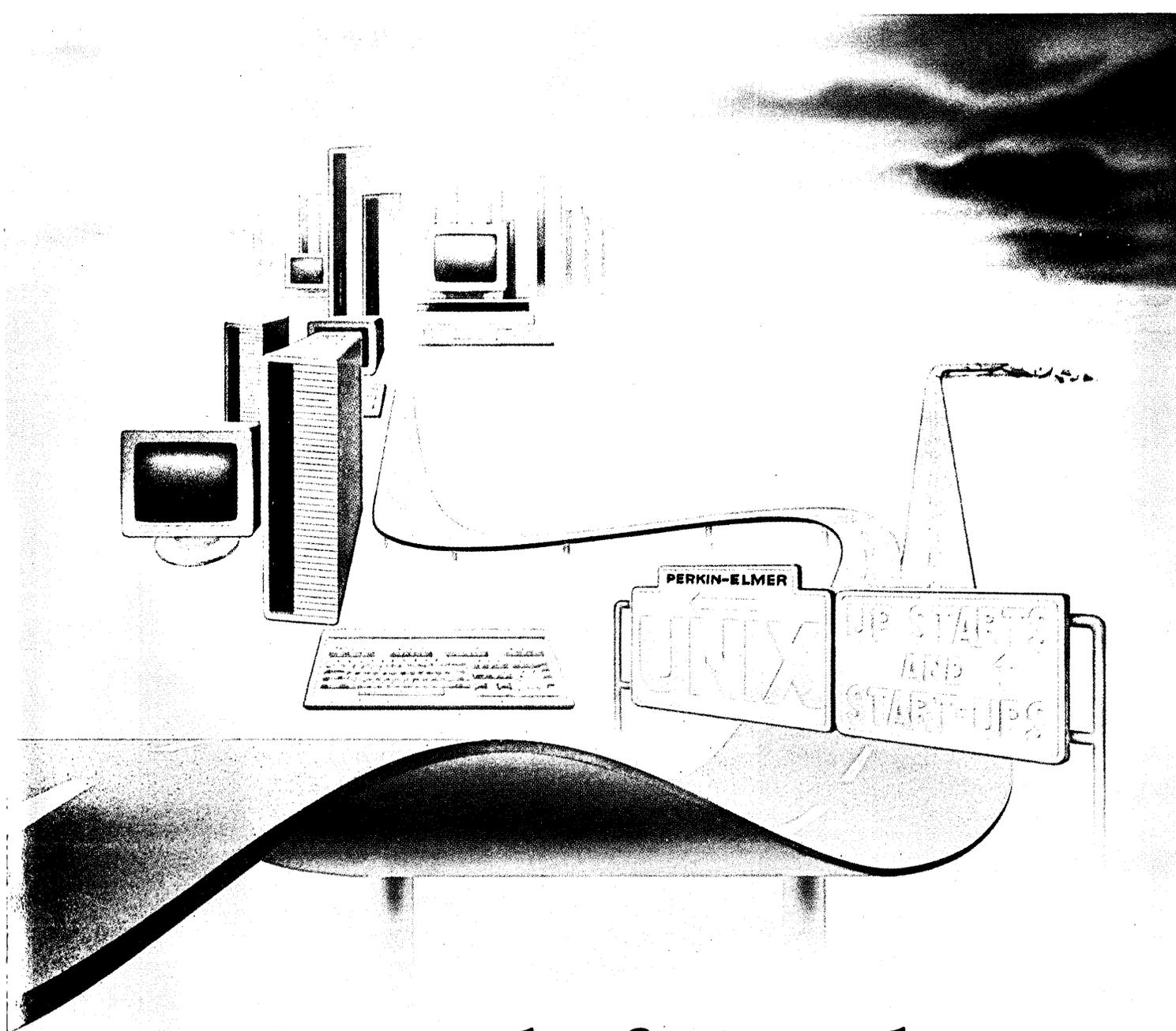
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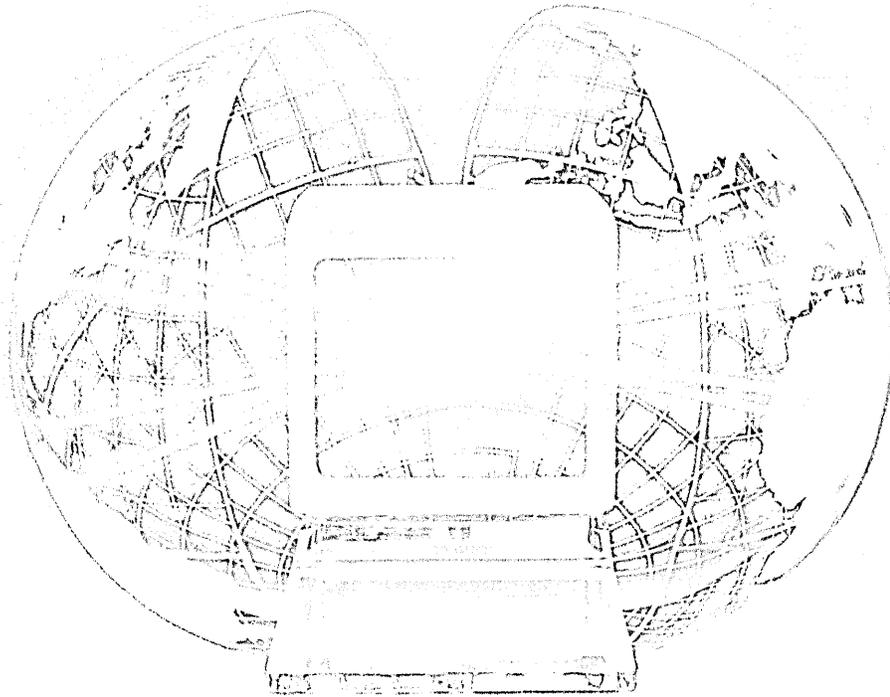
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DATA MATION

FEBRUARY 15, 1985/\$3.00 U.S.A.
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FEATURES

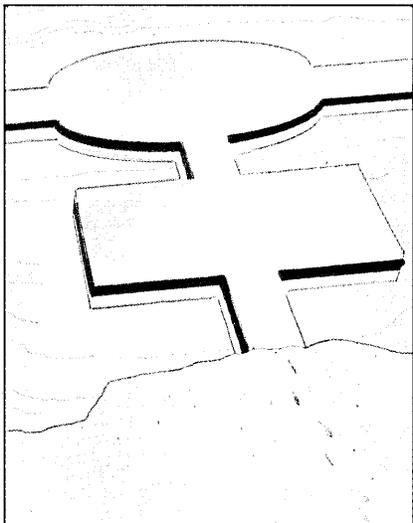
30 IN FOCUS

Is it a savior for hard-pressed programmers or a trumped-up lab curiosity? Whatever it is, asks R. Emmett Carlyle, will buying and selling the new reduced instruction set computer be a "Risc-y Business?"

84 CLOSING THE SOFTWARE GAP

John W. Verity

Concerned with the common acceptance of programming errors, and with the effect that has on industrial development, eminent theorists are touting mathematical methods as the most effective programming tools.



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Ronald L. Cullum
Command-level languages can be used to develop high-quality systems in substantially less time.

102 MEASURING APPLICATIONS DEVELOPMENT PERFORMANCE

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The function points technique provides the applications manager with a measurement strategy that has meaning both within and without the department.

112 DEVELOPING PC APPLICATIONS

David Dee

As the microcomputer shifts out of the shop and onto the desktop, applications development becomes personalized.

120 DISOSS: THE TRUE PATH TO ENLIGHTENMENT

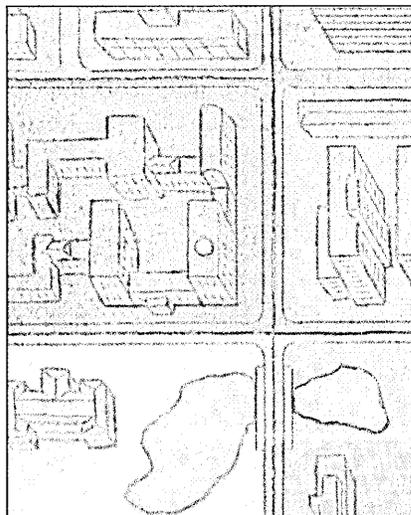
In the beginning was the computer. But office automation was without form, and void. And the spirit of Blue moved upon the face of the office, and said, let there be DISOSS. And it was pretty good.

127 MESSAGE FROM MANAGUA

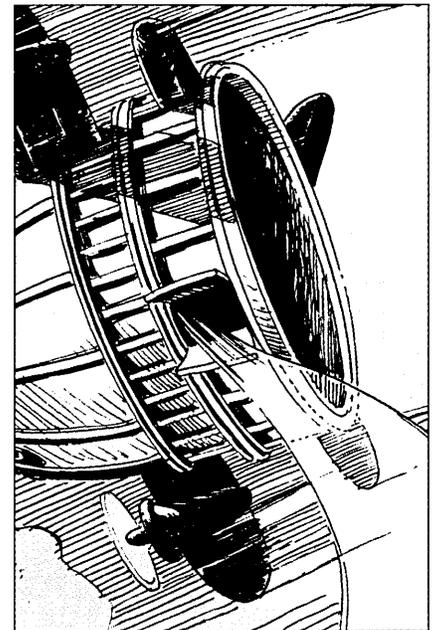
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One member of a kind of Computer Peace Corps mission to Nicaragua tells what it was like providing technical assistance in a country at war.

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Ohio State University successfully expanded its computing from one centralized center to include a number of separate departmentally owned facilities, each with one or more computers.



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COVER ILLUSTRATION BY ANDREA BARUFFI

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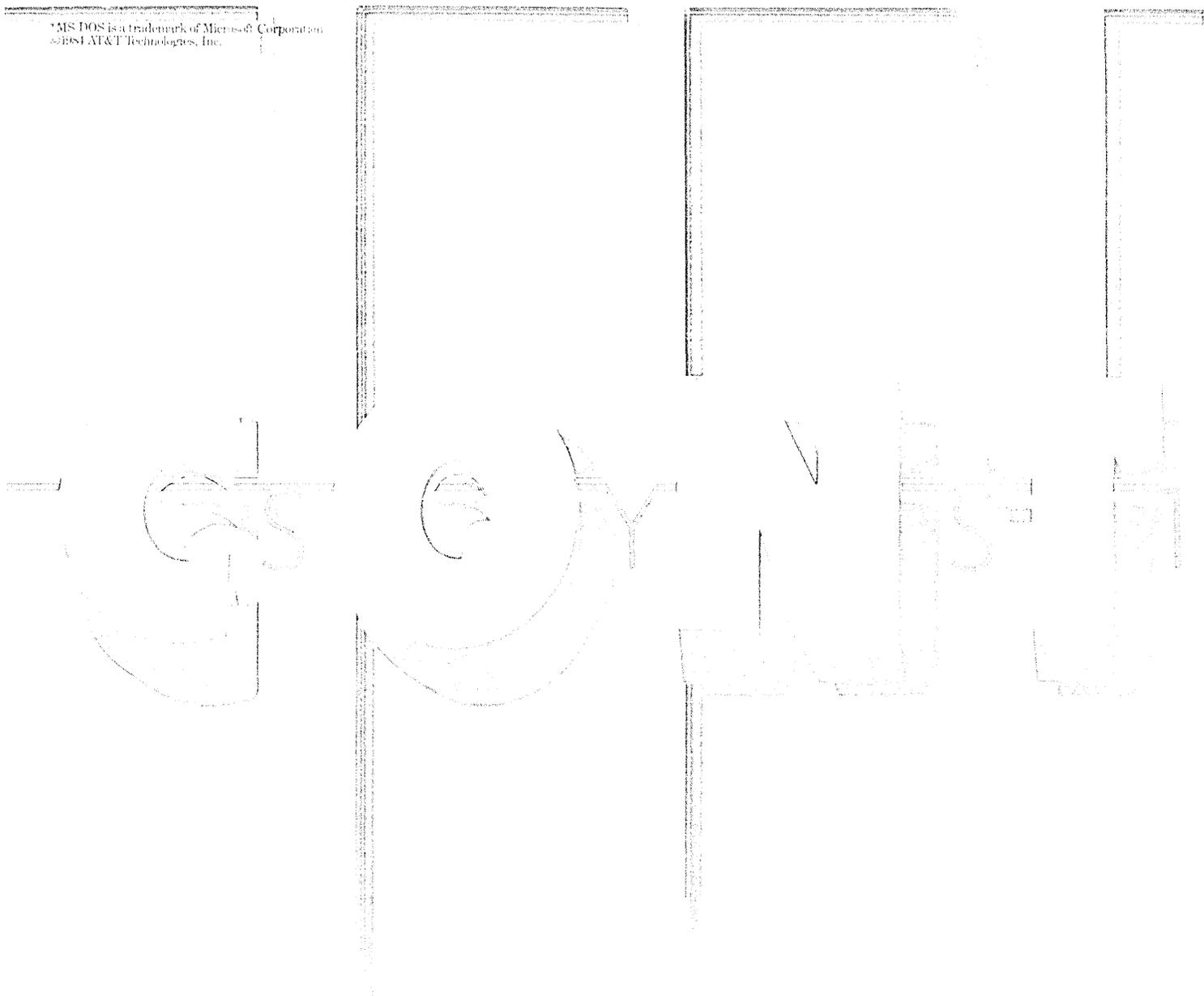
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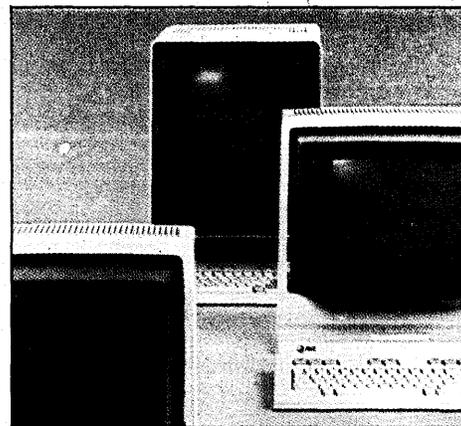
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Twenty Years Ago/Ten Years Ago

LOOKING BACK

THE FUTURE OF THE SWITCHING COMPUTER

February 1965: DATAMATION featured a look at the future possibilities of message-switching computers linked to international communications networks. Dr. H.F. Mitchell Jr., a vp of the Bunker-Ramo Corp., Canoga Park, Calif., gave his thoughts on what life in the tomorrowland of communications would be like.

By 1970, said Mitchell, users would communicate with their computers and the rest of humanity using essentially the same equipment. As the dial gave way to buttons and low-cost crt units were added, the telephone would have all the facilities needed to communicate with any person or computer in the world.

Mitchell cited Project Mac at MIT, where 100 users from all over the world had access to the 7094 installed in Cambridge, Mass. He also discussed the consoles in many military headquarters with which operators were able to call upon vast data banks that were constantly being updated, permitting the operators to provide on-the-spot calculations for critical military needs.

The day was not far off, said Mitchell, when a business manager would be able to sit at his desk and, through his console, have access to "the whole gamut of management information being produced by computers anywhere in his organization."

A scientist or researcher who wanted to know about the latest published literature in his specific field would be able to interrogate a remote library and be given complete data on all articles of interest.

The current status of anything in transit, such as freight, partially assembled goods, material in process, travelers, aircraft in flight, ships at sea, or satellites in space, would all be systematically and automatically reported to computer cen-

ters from which human inquiries from any place on earth could immediately be answered.

Individuals would be able to keep records of their finances at the computerized bank of their choice, and creditors could ascertain their solvency at any time, from any place.

Finally, said Mitchell, vehicular traffic over congested routes (air, automobile, and railroad) would be controlled through computers, switching from center to center as the vehicle traversed its route. Human piloting of trains, cars, and planes would be restricted to the uncongested roads and air spaces.

Not all examples were "blue sky," said Mitchell; they had all been accomplished at least in the laboratory. Cautiously, though, he added that a number of problems would have to be solved before these services would be economic and feasible.

THE FUTURE IS HERE

February 1975: People were still piloting their own cars and planes, but H.F. Mitchell had not been too far off, as evident in this issue of DATAMATION.

Featured stories included articles on networked minicomputers, such as "A Hierarchical Network" by R.L. Ashenurst and R.H. Vonderohe. The coauthors discussed interactive terminals and their corresponding system support, which allowed convenient remote access to centralized facilities; the availability of low-cost minicomputers; and the possibility of distributed computing through networks. Other articles included "A Ring Network" by David J. Farber, "A Local Network" by William Wulf and Roy Levin, and "A Virtual Channel Network" by A.G. Fraser, which analyzed the switched data communications system operating at Bell Labs' Murray Hill, N.J., location.

—Lauren D'Attilo



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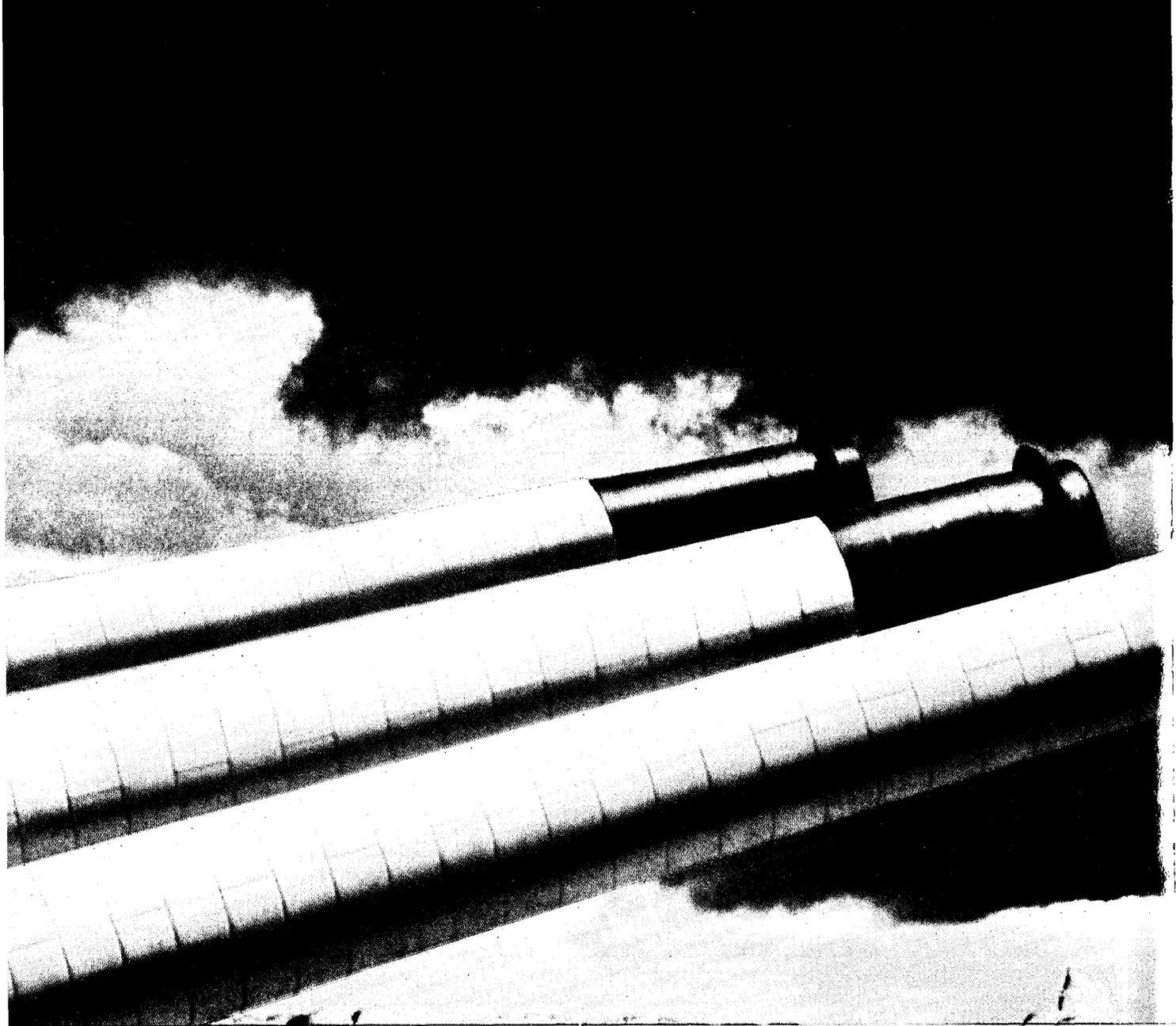
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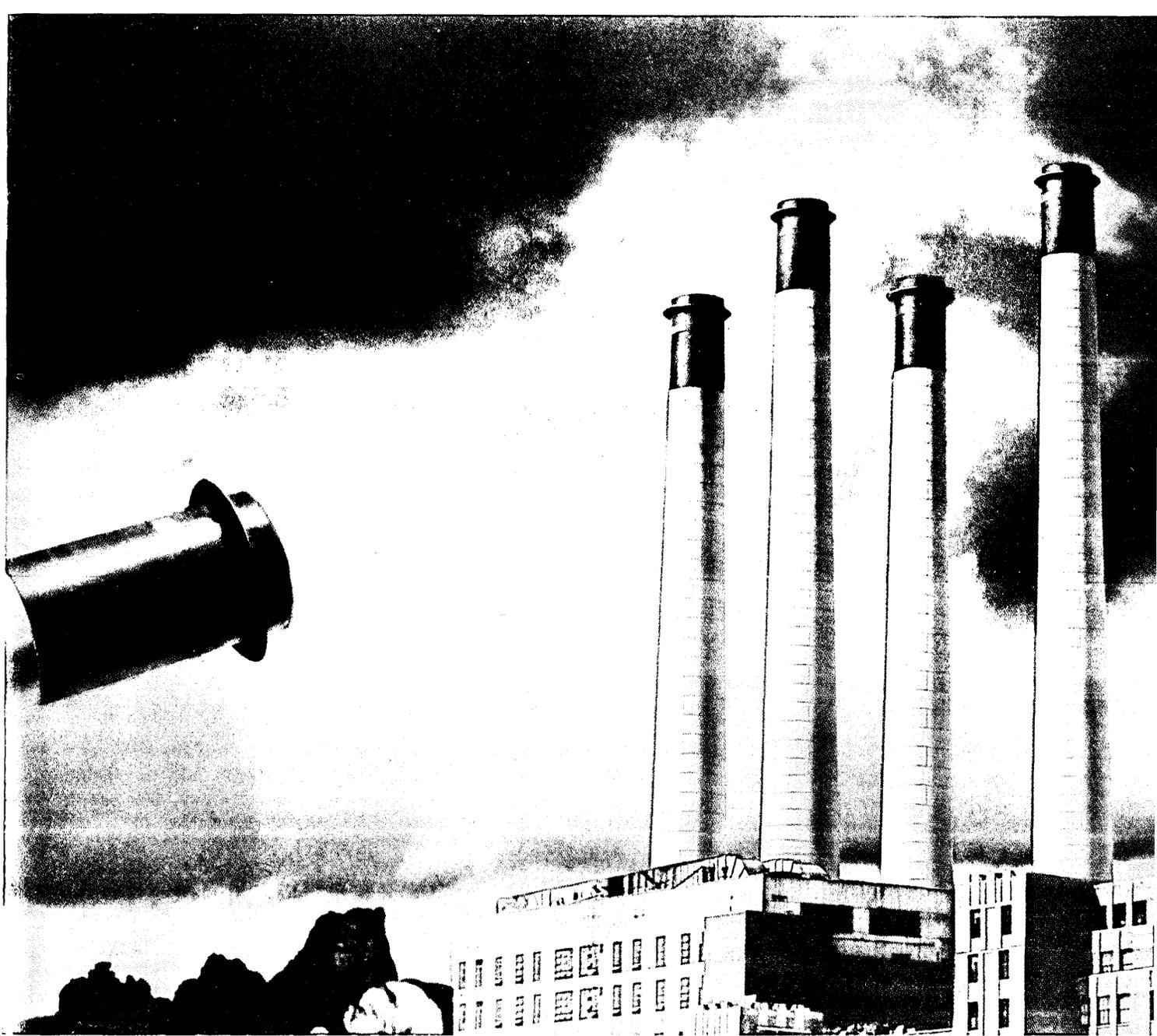
To be competitive, you need the most advanced computer system to maximize productivity. For engineering design, factory automation and manufacturing and planning control. Which is why companies with

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CIRCLE 8 ON READER CARD

LOOK AHEAD

IBM TO
LICENSE
UNIX?

The careering bandwagon of support for the Unix operating system appears to be approaching warp speed. Incredible as it may sound, there are rumors that International Business Machines may soon offer System V support across its product line. Although it seems inconceivable that Big Blue would want to even think about supporting an operating system created by its archrival, AT&T, we hear that active negotiations are now under way at the highest levels for an extensive licensing agreement between the two corporate superpowers. One clear sign of a forthcoming concord between the two: Microsoft and Intel, intimate associates of IBM, recently said that they would support System V.

PRIME TO
ENTER FT
BIZ

The new top-of-the-line 9955 supermini from Prime Computer, Natick, Mass., will soon be joined by multiprocessor versions of Prime's 50 series, which are targeted at the fault tolerant market pioneered by Tandem Computers Inc., Cupertino, Calif. The new Prime systems will use already developed networking software called Ringnet. Prime's new corporate strategy is to make inroads into the transaction-processing market, in addition to continuing its efforts in CAD/CAM.

NEW PBX
FROM
PHILIPS

Later this month Dutch electronics giant Philips will unveil a new digital PBX family, which it designed to be a major building block in the company's "sophomation" integrated office systems strategy. Developed independently by Philips in the Netherlands, the new line is called Sopho-S, and it will support from 100 to 20,000 lines. The Sopho will have its first public showing at the Hannover Fair in mid-April. While the system will eventually be sold on the international market, none of the PBXs have yet to receive approval from European telephone authorities, and it may be six months before the first systems can be installed.

COMPAQ HAS
PC AT
CLONE

Any day now Compaq Computer is expected to announce major additions to its line of personal computers for business. Look for a combination telephone and desktop pc from the Houston-based company first, followed by a notebook-sized, lap-top clone of the IBM PC. Later this year the high-flying company, which had more than \$300 million in revenues last year, is expected to introduce a desktop clone of the IBM PC AT, the multi-user machine running Intel's top-of-the-line 286 microprocessor. Currently its top-of-the-line

LOOK AHEAD

LOW COST NET/ALERT COMING

DeskPro has enjoyed vigorous sales due to the scarcity of ATs, but the machine may not have a long life if Compaq introduces an AT clone. The price/performance of the AT relative to the DeskPro doesn't give Compaq very much room to maneuver.

Next month expect Avant-Garde Computing Inc., Mt. Laurel, N.J., to offer a lower-cost version of its flagship data network management system, Net/Alert. By unbundling the features of its top-of-the-line system, which includes a Perkin-Elmer supermini, the fast-growing company can cut the price more than 50%. While the typical Net/Alert system cost was around \$400,000 a year ago, and a \$75,000 version for systems with as few as 16 datacom lines was recently introduced, the company will soon cut the price to between \$30,000 and \$40,000, according to Wall Street sources.

LOCKHEED FLYING INTO SW

After failing in the hardware business, expect Lockheed Corp., Burbank, Calif., to further expand its software and services operation. Along with its Dailog Information Services Inc. database subsidiary and its Getex security software, the aircraft giant has quietly acquired an equity position in Inference Corp., a Los Angeles-based artificial intelligence software firm. We understand that an acquisition of Metier Management Systems, another software firm, is under way and that more acquisitions are planned.

ATM FROM JAPAN

The beleaguered survivors in the saturated market for automated teller machines are about to be joined by the Japanese. A new American subsidiary of Omron Tateisi Electronics has an ATM with up to 1 megabyte of memory and is controlled by an IBM PC. This will come as a substantial blow to the domestic vendors, led by Diebold Inc. of Canton, Ohio, and IBM, as their ATMs require minicomputer strength intelligence in addition to the 8-bit or 16-bit microprocessors embedded in each box.

RUMORS AND RAW RANDOM DATA

IBM has a hush-hush group of value-added resellers trying to sign up orders in the People's Republic of China. The all-American, seven-company squad irks overseas vars, who have been blocked from participation. . . . Bell Labs recently transmitted data at a record rate of 4 gigabytes, error free, over a single strand of fiber-optic cable, over a distance of 117 kilometers, without a repeater. . . . Executec Corp., Dallas, vendor of integrated microcomputer software, is willing to talk about site licenses to big customers.

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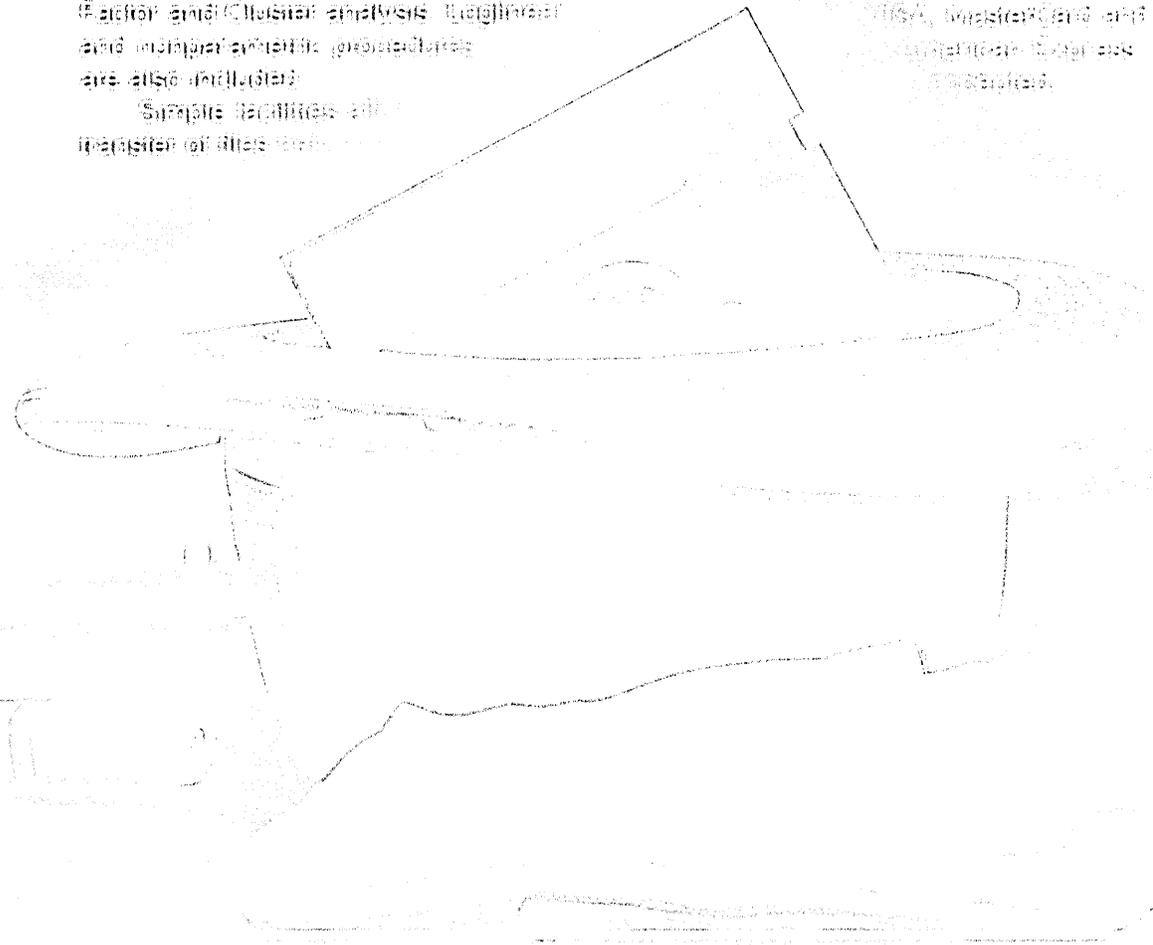
Statistics range from simple
descriptive to complex multivariate,
including multiple Regression, ANOVA,
Factor and Cluster analysis. Regression
and multiple variable procedures
are also included.

Simple facilities allow
regression of data from

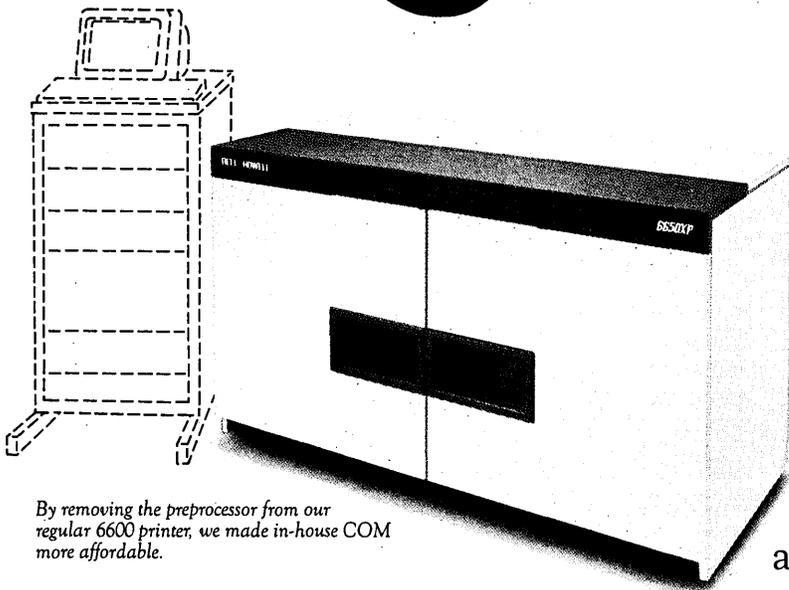
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CALENDAR

FEBRUARY

INFO/Central.

Feb. 20-22, Chicago. Contact Show Manager, INFO/Central, 999 Summer St., Stamford, CT 06905, (203) 964-8287.

INFO SOFTWARE (Information Management Exposition & Conference for Software).

Feb. 20-22, Chicago. Contact Cahners Exposition Group, 708 Third Avenue, New York, NY 10017, (212) 661-8010.

Computer Business Graphics.

Feb. 20-23, Fort Lauderdale, Fla. Contact Carol Every, Industry Representative, Frost & Sullivan, 106 Fulton St., New York, NY 10038, (212) 233-1080.

MACWORLD Exposition.

Feb. 21-23, San Francisco. Contact World Expositions, Mitch Hall Associates, P.O. Box 860, Westwood, MA 02090, (617) 329-7466.

MICAD'85.

Feb. 25-March 1, Paris. Contact World Computer Graphics Association Inc., 2033 M St. NW, Suite 399, Washington, DC 20036, (202) 775-9556.

MARCH

INTERFACE.

March 4-7, Atlanta. Contact The Interface Group, 300 First Avenue, Needham, MA 02194, (617) 449-6600.

COMPUTER FAIR, 1985.

March 19-21, Hamilton, Bermuda. Contact Mrs. Kaye Harries, Executive Director, P.O. Box 1479, Hamilton 5, Bermuda, (809) 298-0745.

ARTELL '85 (International Symposium on Artificial Intelligence Systems and Software Development).

March 26-28, Philadelphia. Contact John B. Bidwell, CEM, Associate Manager, ARTELL '85 Symposium Headquarters, Access Conference Associates Inc., P.O. Box 160, Gaithersburg, MD 20877, (301) 921-9424 or (301) 921-9425.

APRIL

Gulf Computer & Office Show.

April 2-4, New Orleans. Contact Gulf Computer & Office Show,

119 Avant Garde Circle, Kenner, LA 70065, (504) 467-9949.

UNIX Systems Exposition '85.

April 2-4, Paris. Contact Network Events Ltd., Printers Mews, Market Hill, Buckingham, MK18 1JX, England, tel. (0280) 815226, or Gin Piau, 272 rue de Faubourg Sainte Honore, 75008 Paris, tel. (1) 776 75 06.

1985 Hannover Fair.

April 17-24, Hannover, West Germany. Contact Hannover Fairs Information Center, P.O. Box 338, Route 22 East, Whitehouse, NJ 08888.

MAY

Scientific Computing and Automation Conference and Exposition.

May 1-3, Atlantic City. Contact Expocon Management Associates Inc., 3695 Post Rd., Southport, CT 06490, (203) 259-5734.

EXPO L.A. '85 (Cash Management Information Exposition).

May 7-8, Los Angeles. Contact Shel Kaplan, Executive Director, Cash Management Association of Southern California, P.O. Box 60270, Los Angeles, CA 90060.

Personal Computer Exposition/Conference.

May 8-10, Montreal. Contact Personal Computer Association, 20 Butterick Rd., Toronto, Ontario, Canada M8W 3Z8, (416) 252-7791.

Interconnections '85.

May 15-17, Los Angeles. Contact the Independent Computer Consultants Association, P.O. Box 27412, St. Louis, MO 63141.

The Southern California Computer Faire.

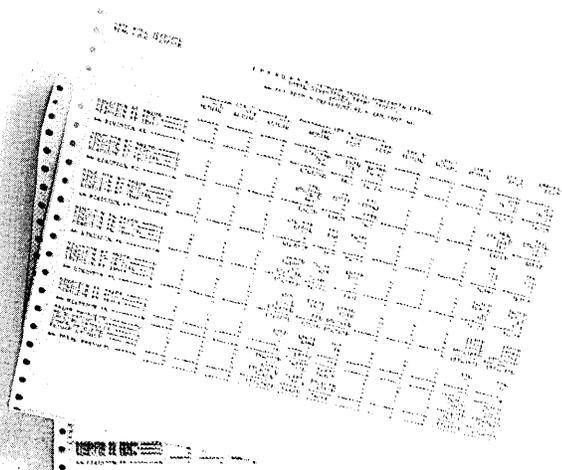
May 16-19, Los Angeles. Contact Computer Faire Inc., P.O. Box 106, Newton Highlands, MA 02161, (617) 965-8350.

1985 Trends and Applications Conference.

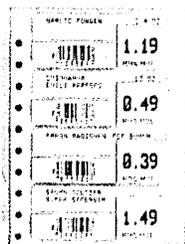
May 21-22, Silver Spring, Md. Contact Madeleine R. Sparks, Trends & Applications 1985, c/o Systems Development Corp., 4810 Bradford Blvd., Huntsville, AL 35805.

International Computer Trade Show Europe Software+.

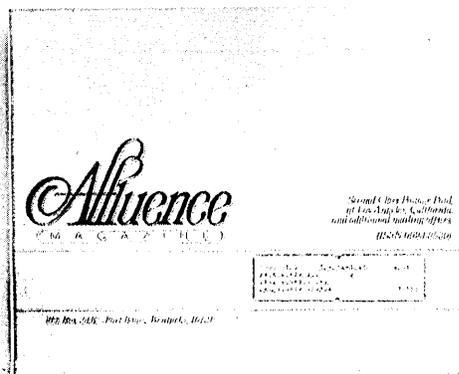
May 22-24, Utrecht, the Netherlands. Contact Royal Netherlands Industries Fair (Jaarbeurs), P.O. Box 8500, 3503 RM Utrecht, the Netherlands, tel. (030) 955 911, telex 47132.



BP-2000 HIGH SPEED BAND PRINTER



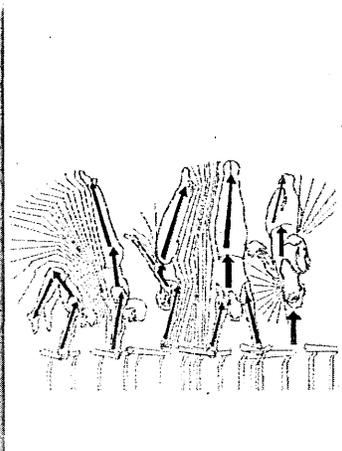
M-100L MATRIX PRINTER



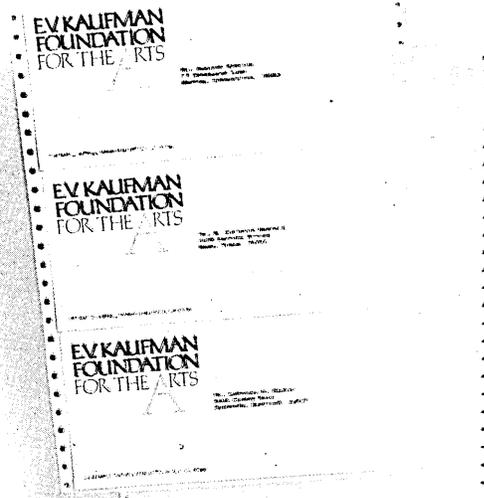
B-600 MEDIUM SPEED BAND PRINTER



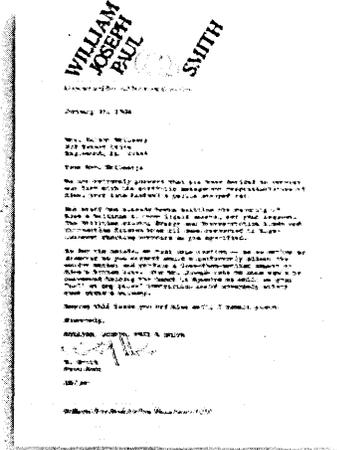
8010 MATRIX PRINTER



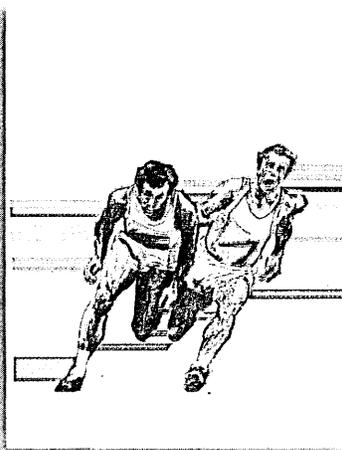
8020 MATRIX PRINTER



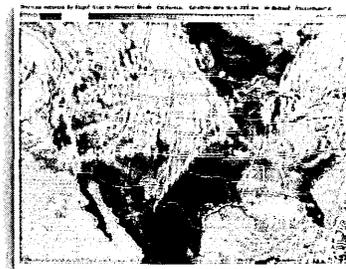
DP-55 DAISYWHEEL PRINTER



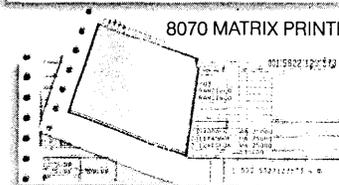
DP-35 DAISYWHEEL PRINTER



8050 MATRIX PRINTER

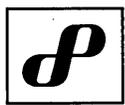


8070 MATRIX PRINTER



M-120 MATRIX PRINTER

...and so on.

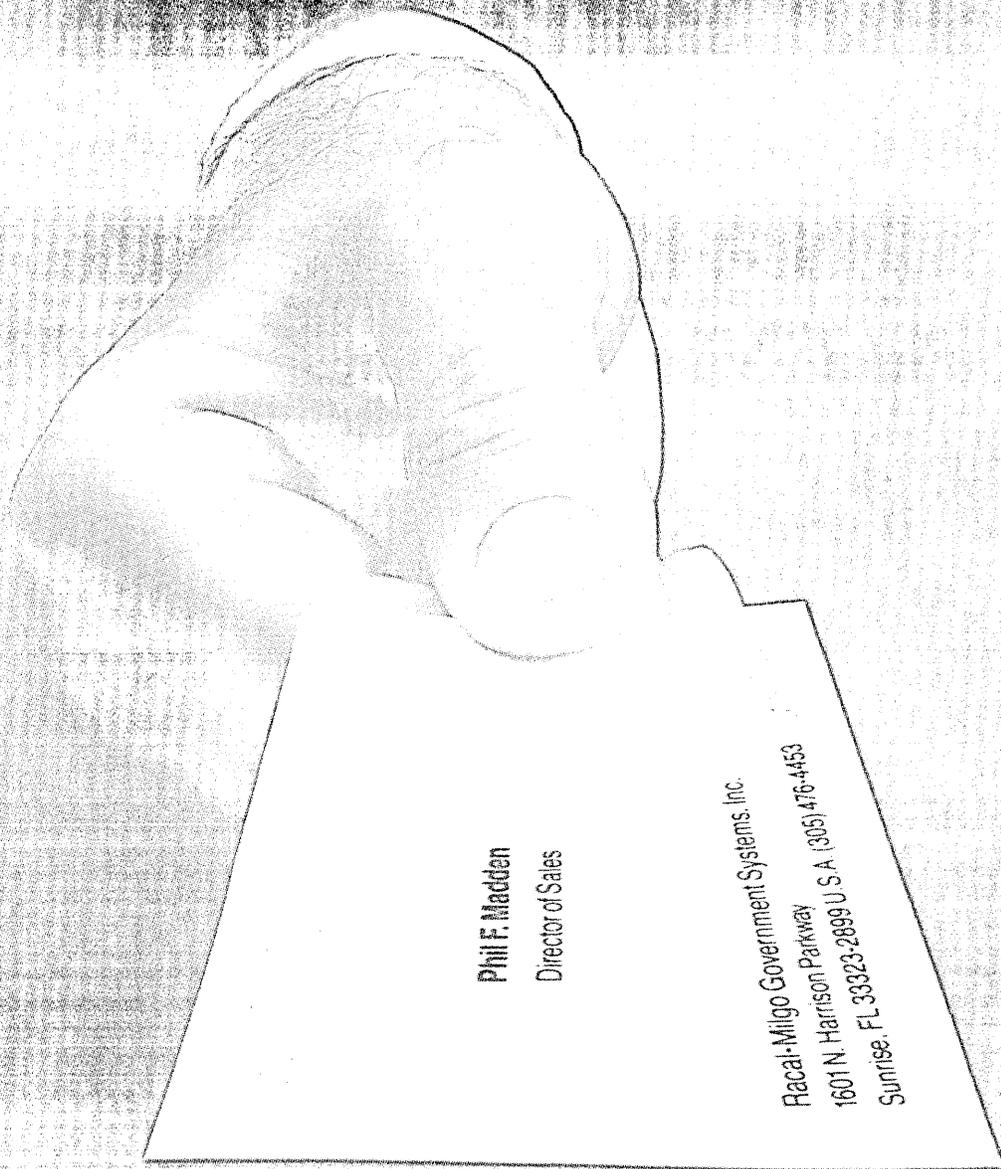


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Phil F. Madden
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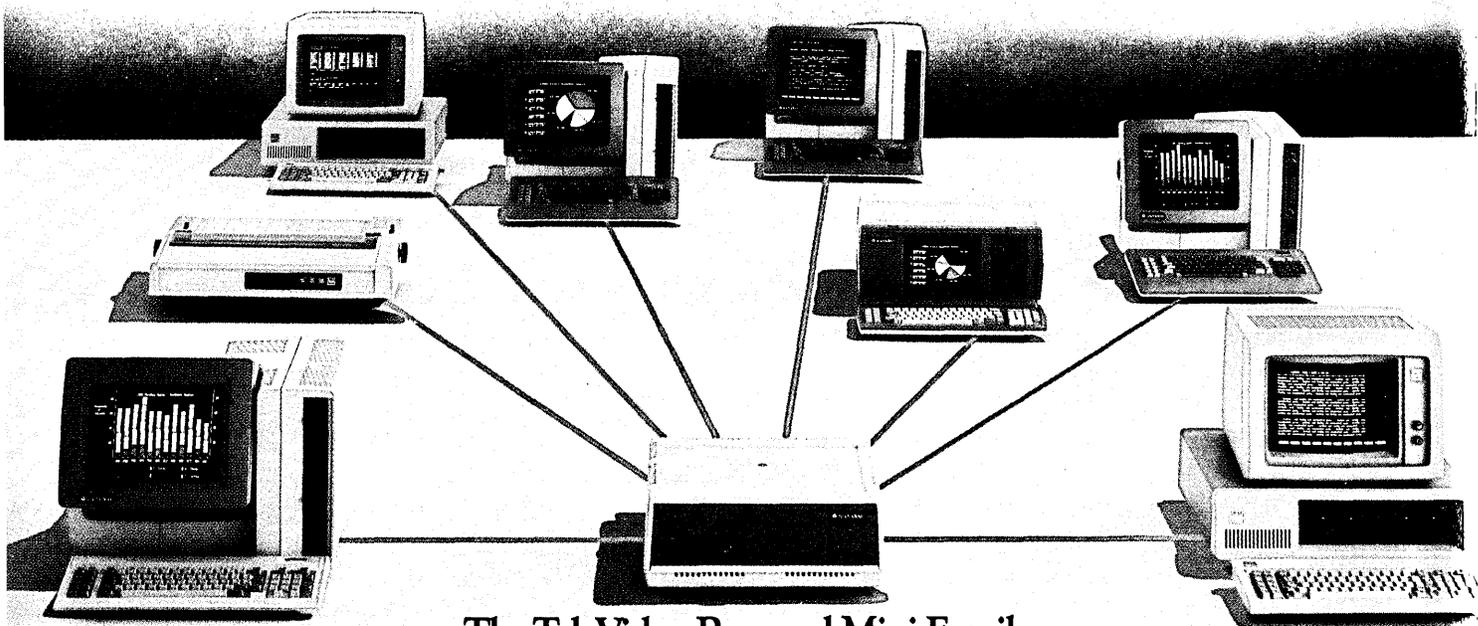
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LETTERS

BLUE NOTE

I'd like to set the record straight on "IBM's Epistle" (Look Ahead, Sept. 15, p. 13). Epistle is an expert system designed to assure the linguistic quality of documents by checking word choice, grammar, readability, tone, and style against a set of standards. At this time, the system is a research prototype and runs on mainframe CMS operating systems.

Epistle provides an extraordinary intelligent function for word processing, in a comprehensive approach based on AI and computational linguistics. Epistle is not a system to do formatting as you claim; it is not a "dead ringer for the OPS-2000" of Interleaf Inc., as there is no overlap in our function and theirs.

LANCE A. MILLER
Manager
Language and Knowledge Systems
IBM
Yorktown Heights, New York

PERSONALITY PLUS

While I was pleased to see an article on personality and data processing in your magazine ("The Intuitive Computer Programmer," Oct. 15, p. 137), I must take issue on several points. First, the Keirseley Temperament Sorter is not "a short form of the Myers-Briggs Type Indicator." Although the sorter is based on the same theory as the MBTI and the items are similar in format and style, the MBTI is supported by almost 40 years' worth of research on its reliability and construct validity. If Keirseley has obtained reliability and validity data on his sorter, he has not published them. It is not known exactly how often the Keirseley sorter and the MBTI produce the same result for the same people. The MBTI reveals my introversion, for example, and the Sorter does not.

Another reservation I have is the sampling method. The subjects are said to be "volunteers" and to come from four computer installations. How were these "volunteers" chosen? Why only 27? Did the subjects say yes when asked to participate, or did they offer in response to a general announcement? What jobs do they hold—are they all programmers?

(The text seems to indicate so, but it is not clear.) What is their application area? The State Treasury and the Internal Revenue Service probably involve business and financial systems; the College Coordinating Board and the Education Agency seem likely to be concerned with administrative and perhaps educational systems. Although the results of this study might be generalized for business and administrative dp personnel, I doubt they can be extended to include the scientific computing community.

I look forward to seeing further discussion of personality and computer professionals. Thank you for bringing it to the attention of your readers.

ELIZABETH A. BUIE
Computer Sciences Corp.
Beltsville, Maryland

SOFT NEWS II

In regard to Merrill Flood's letter (Dec. 1, p. 15), I might report that I happened to attend a conference in Dublin in 1977 on direct broadcasting by satellite, where I learned that the word "software" has apparently long been used by the broadcasting industry to denote the stuff they feed to their hardware, i.e., their programming.

NELSON M. BLACHMAN
GTE Sylvania Government Systems Corp.
Mountain View, California

FORTUNATELY

Although it is indeed an honor to be mentioned in your publication, I must take exception to the reference to Fortune Systems in the Dec. 1 Look Ahead (p. 9).

I assume this item referred to the merger talks and loan agreement Fortune made with North Star Computers. As a publicly held company, it is a matter of public record that we did enter into merger discussion with North Star and that these discussions ceased as of Sept. 14, 1984. Your reference to "a major software development effort having collapsed after the company spent more than \$3 million" can only be a misunderstanding on your part. Our interest-bearing loan for \$3.75 million has been well explained in public documents and has nothing to

do with software development. Our interest and cooperation with North Star activities continues positively in a number of areas.

As we enter 1985, Fortune is positioned to be a strong contender in the multi-user microcomputer market. We have had a very positive response to our new product line of workstations announced this last November, and we will be introducing new software and hardware enhancements in the new year.

JAMES S. CAMPBELL
President
Fortune Systems Corp.
Redwood City, California

AI CRAZE

It is interesting to note that many of the allegations made in "The Overselling of Expert Systems" (Nov. 1, p. 76) apply equally to other areas of programming. The current craze over Unix and C, for example, has its share of cryptic (if not glamorized) synonyms and reinvented constructs. The "exec" program is now a "shell script" and we "pipe" instead of "spool" or "queue" a file. It has yet to be proved to me that C, when used as a high-level language for scientific programming, is better (i.e., more cost-effective) than FORTRAN in terms of the required learning curve, program development time, and maintainability of code. Nonetheless, the marketplace decides to what extent Unix, C, AI, ham, or CAD/CAM will sell.

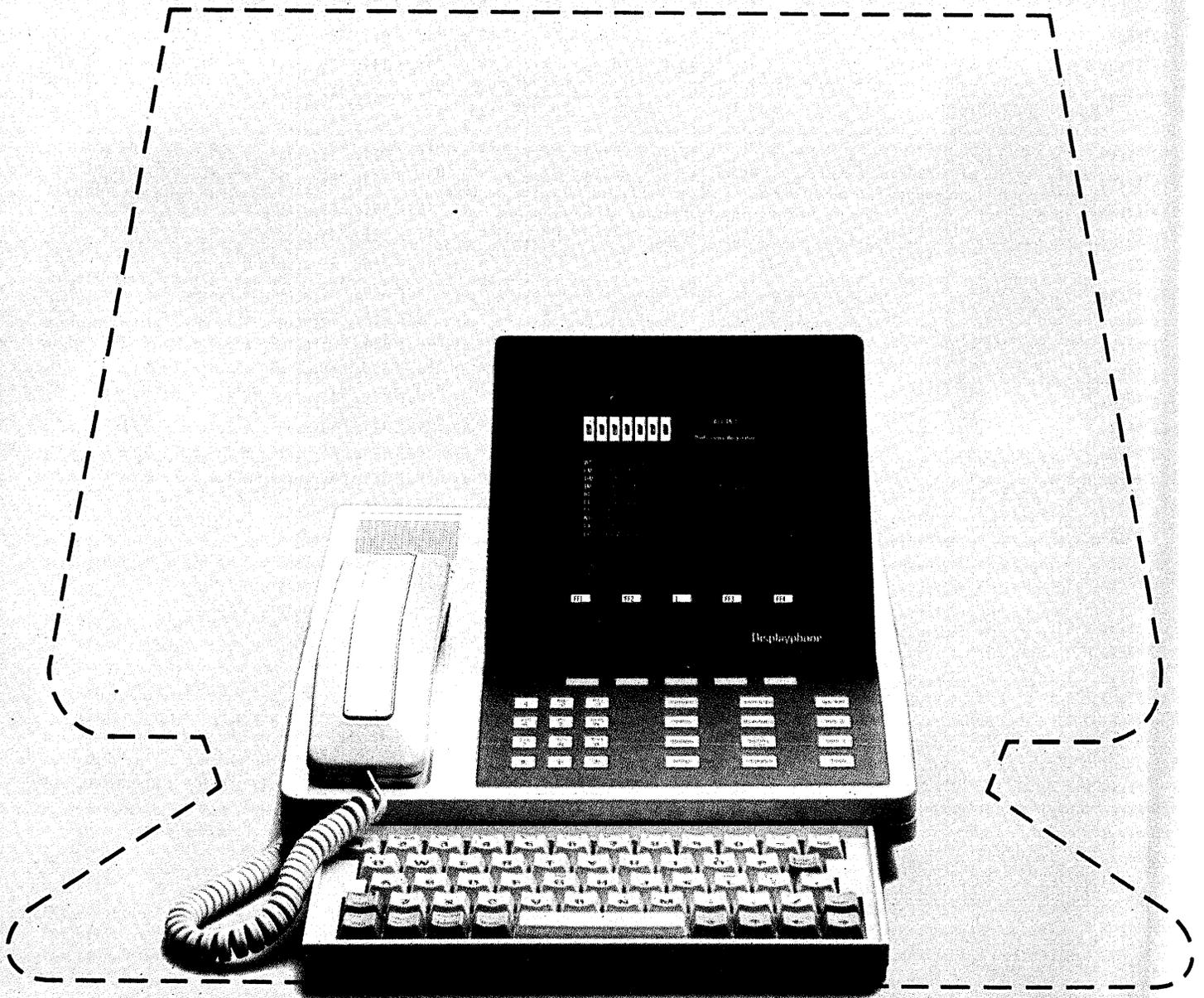
The unresolved difficulty I have with AI is its definition. I have not yet found the criterion for differentiating AI software from the other kind. Perhaps someone should write an expert system to make that judgment for a given piece of software!

GEDIMINAS A. CAMPE
Newtown, Connecticut

CORRECTION

Apple Computer Inc. is selling 1,000 Macintosh personal computers to General Electric Information Services, not 10,000, as reported in the Jan. 1 Look Ahead. The machines will be linked on GEISCO's proprietary error-free protocol.

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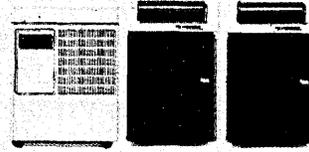
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NARROWING THE TECHNOLOGY GAP

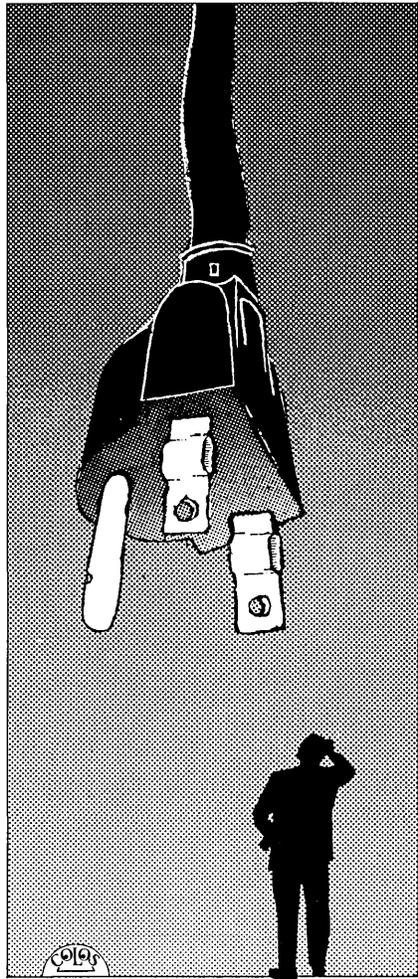


ILLUSTRATION BY FRANCOIS COLOS

Bit by bit the technology gap between the industrialized powers and third world nations is growing. In real time and real terms, the high-tech have-nots are falling further behind in the race to computerize and modernize.

The front-runners in that race are of course European countries, the U.S., and Japan, nations that have pioneered and profited from the production and use of state-of-the-art computer and communications technology. These three computer powers have captured more than 90% of the worldwide sales of dp wares—a staggering statistic with staggering implications.

The economic and social rewards of technology should be shared with the developing world. This is a responsibility that most nations recognize but few practice. One country that has tried to lend a helping hand is France. Three years ago, the World Center for Computer Science and Human Resources was set up in Paris under the patronage of President François Mitterrand. The center, which hoped to help third world nations develop appropriate applications of computer technology, suffered from internal politics. Nevertheless, the ambitious scheme was a step in the right direction.

Other steps in that same direction have been taken by the United Nations, which over the years has launched various initiatives to promote technical cooperation among developing countries. Another organization that has fostered and fueled cooperation is the Intergovernmental Bureau for Informatics (IBI) in Rome.

In America, meanwhile, efforts to share the computer wealth have been few and far between. One exception is TecNICA, a nonprofit San Francisco group that packed a team of dp technicians off to Nicaragua last August to help train and troubleshoot in the war-torn country (see “Message from Managua,” p. 127).

TecNICA’s “computer peace corps” came to Managua to teach classes in database management, structured programming, and microcomputer repair. All these basic courses were desperately needed in a country starved for software and skilled personnel.

The TecNICA technicians also gave advice to Nicaragua’s National Office of Informatics (DNI), the government agency responsible for coordinating computer procurement and maintenance. Charged with formulating the country’s overall informatics policy, DNI is clearly no pushover. It’s asking the right questions, even if it’s not always getting the right answers.

Some of those key questions address social and cultural concerns. No longer content to have computers just for computers’ sake, Nicaragua, like all third world countries, wants to make sure the technology it decides to implement is appropriate to its needs and culture.

Such concerns have largely escaped multinational vendors that have peddled their computer age products on third world turf, paying little attention to local priorities. This was also the message at a Latin American unification conference held last May in Colombia. In a plea for South-South cooperation, the conference issued a declaration that pushed Latin independence in the informatics realm. Summing up the current state of technology transfer, the declaration noted that “most Latin American countries have been passive recipients of informatics and acted as markets or users. Any technology transfer to them has been purely operational and not creative.”

Regional cooperation in product and software development could remedy this. That’s what the Latin accord calls for and hopes for. Underlying those hopes is the stark realization that high tech must be a high priority for any country that wants to survive economically.

Survival is in fact very much a social issue in developing nations. A poster pinned to the wall in a Nicaraguan classroom says it all: “To become a technician is not a credential for acquiring privileges, but a social responsibility.” Let’s hope the rest of the world shares that responsibility. ©

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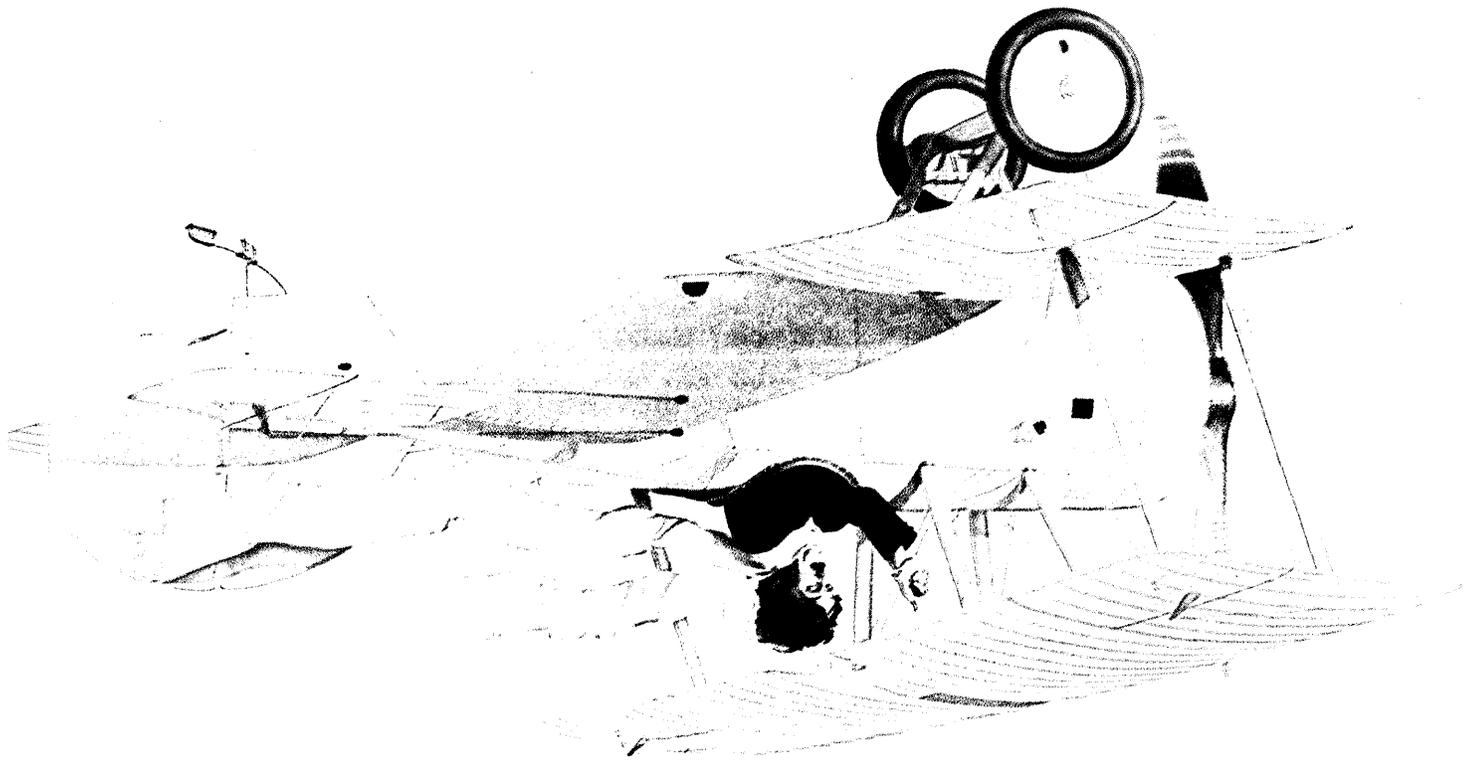
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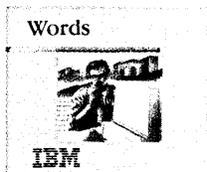
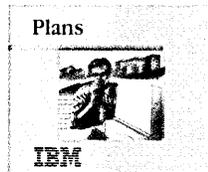
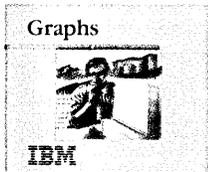
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RISC-Y BUSINESS?

Reduced instruction set computers are faster than a formula one racer. But can you use one to get to work?

by R. Emmett Carlyle

What many see as the first major new architectural concept in 20 years is about to blaze across the computer industry like a comet. Its coming has been announced and its way has been prepared by zealous researchers and academics who are already generating something of the religious fervor characteristic of Unix. Academia has even come up with a catchy label for its creation: RISC, for reduced instruction set computer, which opens itself to much playful interpretation.

RISC advocates see their architecture as a savior for hard-pressed programmers everywhere. Of course, for every hero there must be a villain. For RISC proponents this dark side comes in the form of traditional architectures from IBM, Digital Equipment Corp., and the leading semiconductor houses, which the advocates describe as unnecessarily complex. RISC appears to herald a return to a lost age; to a clear, unpolluted architecture; and to a technical wisdom that alone makes things simple. In contrast, IBM's 360, which fathered the current trend toward complex hardware, is painted by RISCers as bloated by the accretions of the years, by layer upon layer of extra logic and microcode.

Critics of RISC, and there are many at this stage, describe the approach as a trumped-up lab curiosity—"strictly a niche product." The truth, as usual, lies somewhere between the two. For now, at least, the momentum is with the RISCers. This promise of a return to Eden, in architectural terms, tugs at the heart if not the head, and there are already numerous startups eager to capitalize on that wave of sentiment. For these ventures RISC architecture provides a ready-made marketing banner for a host of new techniques that aren't necessarily pure RISC at all.

RISC plays a part, albeit a small one, in Convex Computer's new FORTRAN-optimized vector processor. The Richardson, Texas, company used RISC to help it build a system that claims one third of Cray 1's performance for one tenth its price.

Then there's Pyramid Technology Corp.'s 90X, which at its 1983 announcement was described as the first "commercial implementation of a RISC architec-

ture." But purists point out that the Mountain View, Calif., company had to resort to the more conventional complex instruction set computer (CISC) technology to provide traditional large system features such as floating point and heavy I/O processing.

Another new venture, MIPS Computer (which, like Pyramid, hails from Mountain View, Calif.), has shied away from complete systems altogether, preferring instead to build RISC processor boards for oems. Prospective customers are Apollo Computer Inc., Chelmsford, Mass., and Sun Microsystems Inc., Mountain View, Calif., which are trying to boost the performance of their desktop workstations.

Convex's cofounder and systems architect, Steve Wallach, quips that there will soon be as many flavors of RISC—high RISC, low RISC, no RISC, etc.—as there are of Unix. "Though early players seem to be sincere, you should expect the bogus and farfetched implementations as well," he adds on a more serious note.

These many RISC flavors stem in large measure from the wide range and number of instruction types that a cpu can respond to, which taken together create an instruction set. CISCs often have more than 100 different kinds of instructions; VAX supposedly has 300 plus. RISC machines, though, usually feature fewer than 50 instructions. As already indicated, the two architectural approaches are fundamentally opposed: CISCs tend to implement their high-level language statements in hardware, RISCs in software.

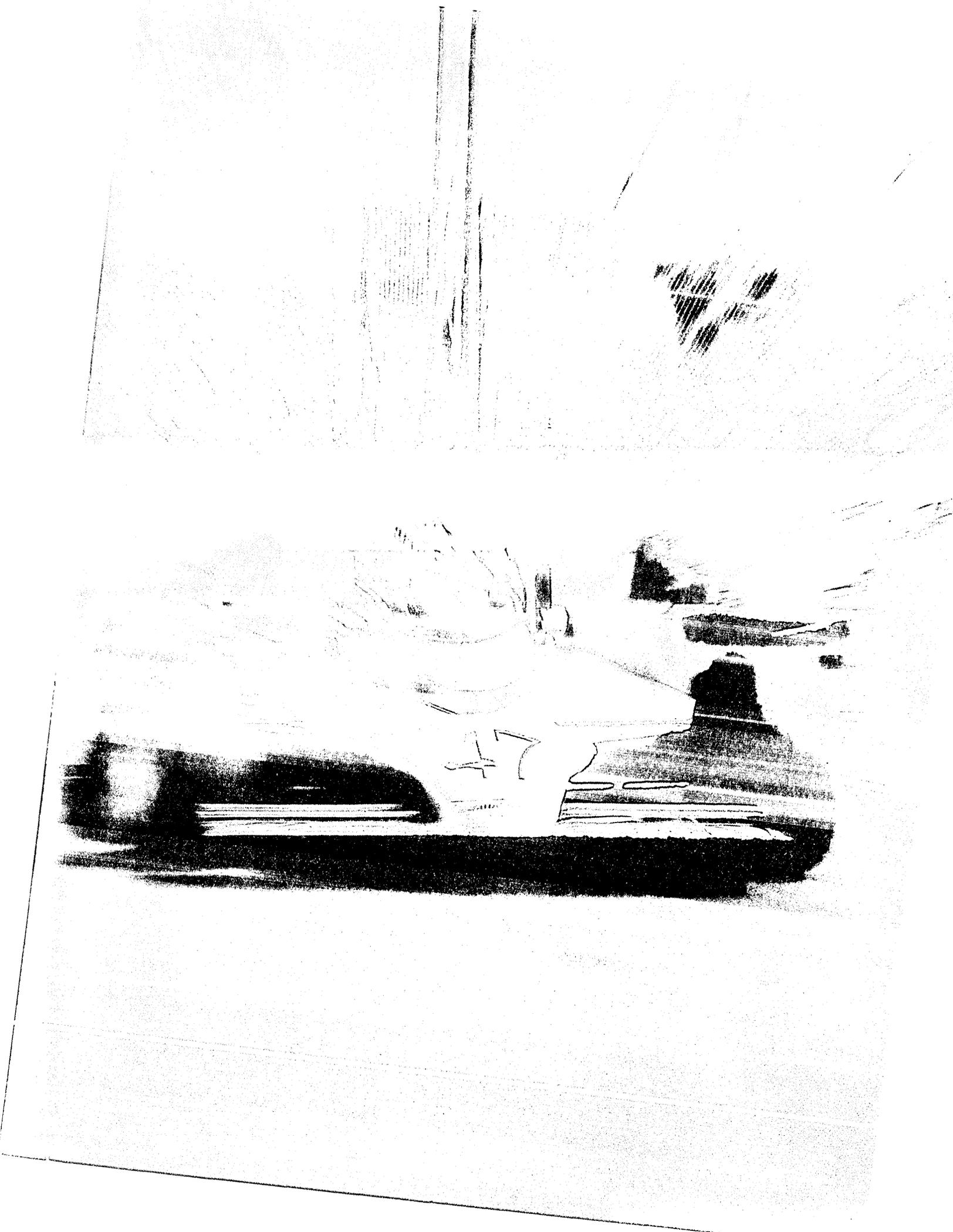
Thus, the rule according to Wallach is, "Make the instruction set too simple and performance suffers. Make it too complex and performance suffers."

This cost/performance trade-off—the gray area, if you will—has proved

"Though early players seem to be sincere, you should expect the bogus and farfetched implementations as well."

of vital interest to IBM. Although personifying everybody's idea of the dark, complex side, this Darth Vader of the industry knows better than anyone what it takes to make gray. IBM's researchers at its Thomas J. Watson center, Yorktown Heights, N.Y., were the first to build a RISC architectural prototype—though they are not not always given credit because of IBM's disinclination to toot its own horn in public about proprietary technology.

IBM is known to be harboring a number of powerful RISC cpus, descendants of its original 801 prototype, which was built eight years ago. Sources point to a 10MIPS, 32-bit ECL supermini and a sin-



IN FOCUS

gle-board VLSI version—each of which runs its customers' mammoth libraries of 370 programs. Furthermore, IBM's 801 RISC processor has been running on several IBM machines internally for five years, according to Rebecca Hurst, a researcher at Yates Ventures, Palo Alto, Calif. "It could be announced soon as part of a new Series/1 and possibly a powerful new office workstation, but neither of these offerings will be described as RISC computers," she predicts. The company's extensive plans for RISC also include its use as an emulator to allow incompatible architectures to talk to each other.

Other sources also reveal that IBM's 801 will play a major role in IBM's

Wallach said he doesn't know whether it is possible to handle COBOL without departing from pure RISC principles.

upcoming new mainframe family, Trout, particularly as an arithmetic and I/O processor.

After 10 years' worth of RISC development, IBM is clearly in no hurry to get these products to market. IBM offered no official comment on the delay, but a clue was offered by George Radin, IBM fellow and head of the 801 development. He said the easy part was to build a fast RISC-based cpu. "What's much harder is to define your cpu instructions, storage hierarchy, and I/O architecture in such a way that the cpu won't idle while waiting for storage access."

With its 370/CISC architecture, IBM has proved itself a genius at getting data in and out in support of a large number of devices. Its corporate customers tend to be I/O-intensive, and COBOL has been their language of choice. As a result, a cpu boost alone from RISC may bring little or no benefit to these commercial customers. Since IBM's stated goal for its new RISC architecture was to discover a better cost/performance vehicle for high-level languages than its 370/CISC, its solution must include COBOL optimization.

In contrast, the seminal work down at the University of California at Berkeley—where Professor David Patterson coined the terms RISC and CISC and a RISC-1 prototype was developed in 1981—has stressed only cpu optimization. This is understandable when you consider the thinking behind prototypes from IBM, Berkeley, and Stanford.

"The universities have stopped well short of delivering a complete architecture," said DEC VAX designer and visionary engineer C. Gordon Bell. "But IBM cannot afford to." Bell stressed that a RISC architecture must encompass the memory management and I/O portions to be complete. "The universities are only

interested in building a fast cpu engine for Unix and its C programming language, and thus comparisons with existing commercial architectures are misleading."

Such benchmarks do exist and show, for example, that UC Berkeley's RISC-1 successor, the 32-bit NMOS RISC II, does run the Unix C compiler more than twice as fast as the VAX 11/780; and the Stanford RISC micro reportedly can run Pascal programs more than five times as fast as a Motorola 68000. But as far as Bell is concerned this is like comparing apples and oranges: "VAX was not built from the same technology as RISC II; and even if it were, the only fair comparison should be on overall performance including floating point, virtual memory, I/O, and COBOL."

Charles Ross, a senior associate at software development company Centennial Systems, Rockville, Md., also warns potential customers not to be mesmerized by benchmarks. They always depend on how the dueling systems are configured. "I know of a case where a VAX 11/750 outperformed a VAX 11/780 by 2.5:1 on an I/O benchmark," he recalls. "But a peek under the covers revealed that the 750 had a Massbus and was configured for heavy I/O support. The 780 just had a Unibus. You can make stats say anything you want." Ross adds that the dangers are even more apparent at a university test site "since machines are isolated from the commercial world."

Ross's opinion is important because Centennial was an early buyer of the Pyramid 90X RISC system and has had a chance to compare it with the VAX 11/780 in a commercial environment. Centennial's own suite of office automation software is offered on the 90X (under Unix 5) to its client, the federal government. "We can confirm that the RISC cpu is faster than the VAX cpu, twice as fast. But even with microprogrammed I/O extensions to the RISC processor and a faster disk drive, there is no appreciable improvement over VAX on I/O intensive applications," Ross reveals.

Ross's advice to potential RISC buyers is, "Know your workload and how it is configured. If it's centered around the cpu (as in university, scientific/engineering, and software development markets), RISC is for you. If it's centered around COBOL and I/O, as with corporations, RISC alone isn't enough."

So far no new venture (Pyramid, Ridge, Inmos, Convex, MIPS Computer, and soon, DataFlow) has developed a machine up to a COBOL/RISC. Wallach said he doesn't know whether it is possible to handle COBOL without departing from pure RISC principles. Famed as he is as the principal engineer of Data General's Eagle in Tracy Kidder's best-selling *Soul Of*

a New Machine, Wallach certainly didn't wish to try, and considers FORTRAN a more lucrative port of call. Patterson believes a pure RISC/COBOL is possible, but he won't build it. "The universities are not interested in COBOL," he said.

Pyramid's marketing director, John Hime, has a different story to tell. If the company wishes to continue its early penetration of commercial accounts, COBOL support will be essential. He revealed that Pyramid was working on a RISC/COBOL but wouldn't elaborate. Given Wallach's lukewarm feelings about a COBOL/RISC processor, Hime may wait a long time before he has a commercial box to market.

COBOL optimization could be one reason for IBM's delay in entering the market, says Bell, who is now designing fault-tolerant and other types of new computers at Encore, Wellesley, Mass. There are probably other reasons for this delay "including self-impact." IBM has the most to lose in the CISC versus RISC skirmish, should it turn into a war. Hundreds of billions of dollars have been invested by IBM and its customers in the 360/370-CISC architecture, but so far its base is not under siege by the new RISC ventures.

The same cannot be said of the industry's number two vendor. While Unix, the RISC mainstay, is just a word at IBM mainframe sites, it's a potent reality in DEC's minicomputer world. DATAMATION's survey shows that 20% of responding minicomputer sites used some

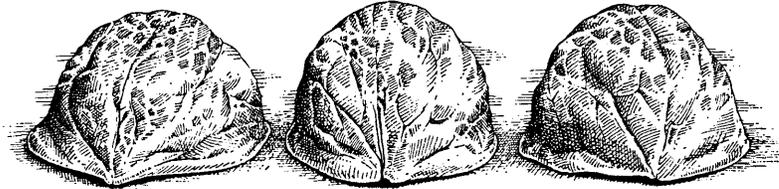
"Know your workload and how it is configured. If it's centered around the cpu, RISC is for you. If it's centered around COBOL and I/O, RISC alone isn't enough."

form of Unix in 1984 (see "Upstarts Outshine the Stars," Nov. 15, p. 34). "All of these customers and the many more that will follow are potential RISC upgrades if it can be shown that the architecture's cost/performance characteristics exceed VAX," suggests Hurst of Yates Ventures. "For this reason the prime focus for virtually all the RISC startups to date is DEC's VAX community of 10,000 customers and 30,000 machines," she says.

Other supermini companies such as Hewlett-Packard, Data General, and Prime are also at risk, and thus are becoming conversant with the new architectural approach. DEC and HP are known to be developing RISC architectures for the top of their lines.

HP's effort, Spectrum, gains its name from an ambitious attempt to build a single architecture stretching from handheld calculators to large systems,

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WHAT IS A RISC MACHINE?

RISC is a fascinating by-product of the industry's evolution to portable high-level software. Without high-level languages, sophisticated compilers, the ubiquitous Unix control program, and VLSI to run it all on, there would be no Reduced Instruction Set Computer and no RISCers.

"These fundamental shifts in technology made it all possible," says Robert Paluck, president of one highly capitalized new heir to these trends, Convex Computer, Richardson, Texas. For decades, user programs and their host hardware have been intimately entwined. For a user to maintain software consistency across a product line, there had to be hardware consistency from his supplier. The user was conditioned by his hardware architecture, and his programs reflected this. The only programming languages were low-level binary codes, a representation of the computer, not the person. They were not portable.

With the advent of high-level languages, users could have a software system that represented a solution to a problem independent of any machine. These languages weren't conceived with any computer in mind, and in theory are portable. But to a computer, high-level programs are alien things. There is an enormous difference in meaning between what the high-level programmer is saying and what makes sense to the computer hardware. This so-called "semantic" gap is the root cause of all programming problems. And so, understandably, the industry has thrown itself into the creation of a bridging medium: compilers and interpreters that translate high-level languages into machine languages.

"Compilers are getting so sophisticated," says Paluck, "that they produce machine [or object] code that is close to the best handwritten equivalents. Most programmers don't have to worry about the hardware details anymore. Now they need only look at the system through a high-level language."

"With high-level software the difference in instruction sets is invisible to the end user," explains Rebecca Hurst, an analyst at Yates Ventures, a market research firm in Palo Alto. "He doesn't care either way, as long as his programs run faster and costs are contained."

The beauty of compilers is that they not only liberate high-level program-

mers by bridging the semantic gap and hiding hardware details from view, they also free the hard-pressed hardware designers as well. Thus the whole CISC versus RISC debate is really the issue of which of these two architectural approaches makes the the best use of compilers.

CISC designers working with hardware such as the 370, VAX, Motorola 68000, and the Intel 286 have attempted to raise their instruction sets to the semantic level of the desired programming language. To achieve this they've added large numbers of "complex" instructions. These include high-level language statements embedded in hardware and dozens of addressing modes created in the storage hierarchy. A CISC compiler considers the many cases presented by the instruction set and performs a large number of memory transfers in executing an instruction. Thus, several machine cycles are usually required.

What sparked IBM's 801 RISC development was a healthy distrust of complex, high-function instructions, whether realized by random logic, microcode, or both. IBM's rule of thumb, according to project leader and now IBM Fellow George Radin, was that any instruction that can't be executed in one single cpu cycle or sequence of simple instructions—so-called "primitives"—must be an object of suspicion. "It should only be retained if the frequency of use justifies its cost, and provided it doesn't slow down the primitive instructions," he says.

IBM's studies showed that primitives such as LOAD, STORE, BRANCH, COMPARE, and ADD are by far the most frequently used instructions. So, rather than slowing down the cpu by adding extra logic and microprogrammed levels, the 801 team reprogrammed these complex instructions as software subroutines which, like the primitives, could still be executed in one cpu cycle.

Radin's claim, since echoed by other researchers and RISC venturers, is that such a RISC design makes compiler writing much easier by simplifying the number of different cases presented by the instruction set. In addition, customized sequences of primitives are supposed to execute much faster than complex instructions, and compilers can use them more efficiently to generate optimized machine code.

RISCers at the University of California at Berkeley also have focused on the creation of multiple registers, or information holding switches, in the cpu to optimize compilers. Register-to-register operations that never leave the cpu greatly reduce the number of memory references in the storage hierarchy that the compiler would have to access. They also speed up the cpu, according to benchmarks that show that register-to-register operations are eight times faster than main memory operations.

Another secondary RISC element is the traditional architectural technique of "pipelining," a method of organizing instructions so that they flow smoothly and predictably at greater speed. RISCs can use pipelines to greater effect than CISCs, say experts, because their instructions are generally one size, and all execute in one data cycle. This eliminates many code sequences that don't follow a predictable pattern, as with CISCs.

All the new RISCs coming on the scene use one, or a combination of all three, of these architectural techniques. In practice, the amount of venture capital raised will tend to determine which technique is used. Pyramid built its system from a whopping 528 registers, but used off-the-shelf TTL circuitry. Using the Gordon Bell maxim of "Buy a VAX to beat a VAX," Convex used its superior funding to invest the \$750,000 needed for a VAX circuit design system for its sophisticated new CMOS circuitry. The Stanford University spin-off, MIPS Computer Systems, chose instead to use its funding to create a software-controlled pipeline technique.

RISCs will continue to burst on the market in all shapes, sizes, and flavors. As to which is better, CISC or RISC, who knows? Who cares? Maybe the intellectuals—certainly not the end user; it's all transparent to him. The richer but more complex function sets of CISC offer the COBOL, I/O, and floating point support essential to high-performance commercial applications. So far, no pure RISC design has been equal to this task, which isn't to say that one never will be. IBM's RISC team seems intent on not deviating from strict RISC principles. But others don't have such scruples.

The likeliest outcome is a marrying of the two techniques; a CRISC, if you will. —R.E.C.

one which maintains compatibility with existing HP products. The first part of the grand design to be revealed, sources claim, will be a high-end upgrade for HP's 3000 series customers, a 5MIP to 6MIP cpu that will run their programs unchanged. Other sources add that HP is using software emulators linked to a reduced in-

struction set machine, which enables it to run the standard assemblers of its 100 series micros and 1000 series minis, and helps solve the compatibility and maintenance problems that have plagued the company.

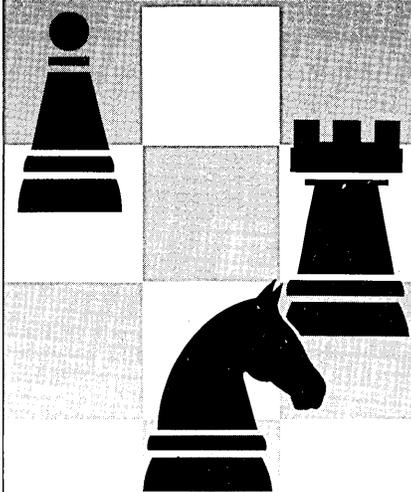
The key to Spectrum is a new proprietary integrated circuit technology,

NMOS3, which has permitted HP to scrap a 32-bit replacement for the 3000, known as Vision, and move straight to a 64-bit word cpu. Sources also reveal that the new cpu is built from tightly coupled microprocessors, which offer dramatic cost/performance improvements over conventional cpu design. It is unclear

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whether HP engineers are trying to couple its high-performance, 32-bit micro to achieve the 64-bit word, or are using another type of design scheme. Spectrum is now in the hands of an estimated 500 developers at nine field divisional labs throughout the country. One should expect some similarities with IBM's 801 RISC design since HP is known to have recruited several of IBM's key people from that project. This has led to further speculation from insiders that HP is using Spectrum to forge greater compatibility with IBM products.

HP refuses to confirm or deny that RISC and the multimicroprocessor cpu are

HP "needs something dramatic to change its engineering image and help it break into commercial markets such as OA."

key ingredients of Spectrum, labeling all reports speculation.

It's clear that Spectrum is risky in every sense of the word, but as one source says, "The company needs something dramatic to change its engineering image and help it break into commercial markets such as office automation." The scale of the project has already led to management problems and delays, outsiders say. While the company was aiming for an early 1986 announcement, sources are now talking about late next year as the earliest release date. So far, HP chief executive John Young will only say that his company is "succeeding in meeting the challenge, but is not yet ready to describe the results obtained."

Many experts are convinced that HP is getting in over its head and playing a game of "bet your company" reminiscent of IBM in the 1960s. "The company cannot afford to fail," Bill Easterbrook, computer industry analyst at the Wall Street brokerage firm Kidder Peabody, adds ominously.

Digital's position also seems especially perilous because it's generally accepted by customers and experts alike that its VAX architecture is running out of gas after six years (see "Open Season on DEC, Dec. 15, p. 40).

"It took DEC six years to squeeze a fourfold improvement out of the VAX 11/780's ECL technology," says Pyramid's John Hime, "and most engineers I've talked to feel that DEC might squeeze out another 4MIPS at best because of problems in ECL cooling and pipelining the instruction set any further."

Hime is convinced that the mini-computer giant could do much better with RISC. "We used the same circuitry as DEC's VAX 11/785 and built our computer out of three boards rather than DEC's 25." Hime estimates that only 10% to 20% of

the electronics in the 11/785 is doing useful work. "The rest is the fat that DEC's CISC approach has created and has to carry, and you know as well as I do that when you get too fat you can't run as fast."

It should be stressed that some of this excess microprogramming is unavoidable. "All VAX customers are paying for compatibility with DEC's old PDP base, many of whom could care less about it," says Hime.

The same could be said of Data General's MV 10000 line topper, which must of necessity run Nova binary code circa 1969, adds another observer.

What DEC and the others must now face is the fact that the state of the art in software and computer science is evolving rapidly with RISC offering the latest stepping-stone. Several software developments now demonstrate the customer's ability to move easily from one hardware architecture to another: Unix on DEC machines, IBM's 801, all the micros running CP/M and MS/DOS, various portable compilers, and so on.

The result, says Encore's Bell, is that today's critical business decisions are based more on the software interface the user sees and much less on the hardware. "This was always true in the past, of course, but at that time the hardware and user programs were more closely entwined and the customer was locked into one vendor's architecture."

Now the scene is set for the final act in the ongoing process of separation between high-level user software and hardware: freeing the customers from any architectural dependence whatsoever. Encore, Bell revealed, is adding two more architectural levels to the traditional three of cpu, storage hierarchy, and I/O.

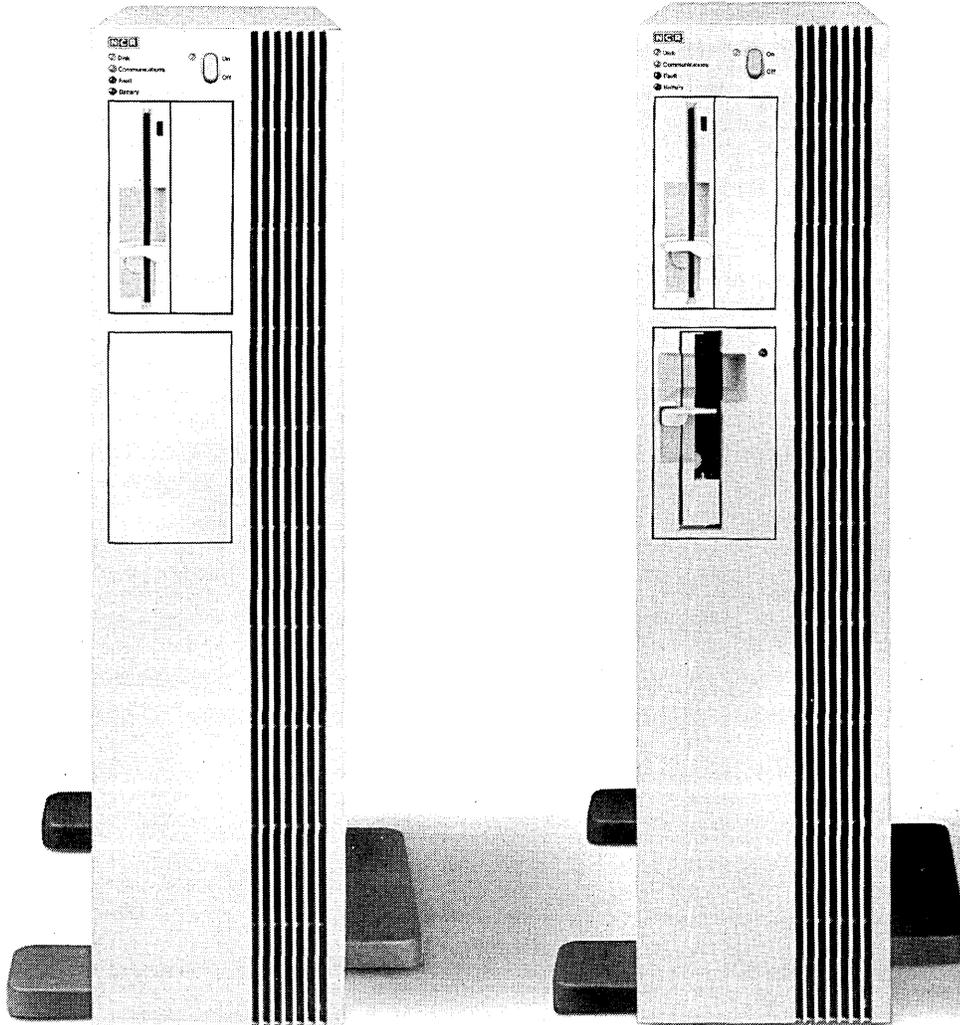
"We used the same circuitry as DEC's VAX 11/785 and built our computer out of three boards, rather than DEC's 25."

He refers to them as interactive I/O and file I/O.

All Encore's modules are written in C with no machine language programming of any kind and no commitment to any single architecture. Bell describes his RISC processor board "as just a component." And yes, he says without elaborating, "Encore has a sound solution to the COBOL problems." In what amounts to a "Lego" offering, Encore will offer these five architectural modules to the customer so he can configure his own architectural analogy of his corporate personality. "This is the highest level of all," says Bell, "because the architecture can change as his information processing demands change." ©

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NEWS IN PERSPECTIVE

PROCUREMENT

WHAT PRICE ITC?

Repealing the investment tax credit may raise computer prices, but that may not affect users' buying patterns.

by Willie Schatz

After what seems to have been a rather useful life, it may be time to say farewell to a good friend of high-tech industries. This friend's funeral, however, will be neither funereal nor expensive. All costs will simply be passed on to the next user.

"The investment tax credit [ITC] is gone," a key staffer on the House Ways and Means Committee predicts. So are a great number of other sections in the Internal Revenue Code (IRC), according to the Treasury Department's terribly exciting tome, *Tax Reform for Simplicity, Fairness and Economic Growth*. Whether one, some, or all of Treasury's revisions will metamorphose from theory to reality depends upon how President Reagan's Cabinet interprets them.

Washington was still scratching its collective head in interpreting the Treasury proposal when Reagan traded Donald Regan for James Baker, further clouding the proposal's chances of becoming reality. Regan, who in his previous life as Secretary of the Treasury was the author of the tax proposal, switched offices with Baker, formerly White House chief of staff.

"I think this has to help the proposal," the House staffer says. "How can Reagan say he wants it, and then turn around and dump on his new top guy?"

He can't. Even still, Reagan has hardly fallen head over heels for the tax reform plan, the general concepts of which he was expected to make the cornerstone of his State of the Union address. There was also speculation that when the going got tough, he would get going and leave the hard decisions to Congress. Still, no one is betting a first-born child on the ITC living past its proposed Dec. 31 demise.

"The President really should put tax reform on the back burner and focus on the budget deficit," says Rep. Ed Zschau (R-Cal.). "If you don't want to focus on the budget but want to appear as if you're doing something for the American people, then you talk about tax reform."

Actually, to hear the Treasury talk about it, one wonders how the ITC ever saw the light of day. "The investment tax credit," says the department's tax reform proposal, "creates an investment incentive that favors some forms of economic activity over others, discriminates among taxpayers within a single industry, and encourages tax-motivated, noneconomic behavior.

"Because the investment credit is generally limited to investments in tangible personal property, it favors capital-intensive industries over labor-intensive industries. Thus, startup, fast-growing, and [money-losing] corporations typically derive less benefit from the credit than existing, profitable corporations in the same industries."

So why has the ITC been a part of the IRC since 1962? For starters, it reduces purchasing costs by from 8% to 10% on qualifying equipment. That's mostly "tangible personal property," which in-

"We obviously know the ITC is a benefit, and we do take it into consideration, but it's not a significant factor."

cludes computers and peripherals. So it's been there for the taking.

But big purchasers of computer equipment may not have snapped up the ITC to the utmost degree. "It never has been a major factor in deciding whether we should buy a system," says William Sumner, director of management information systems for Bullock's, a department store chain based in Los Angeles. "We obviously know it's there. We also know it's a benefit. We do take it into consideration, but it is not a significant factor."

Sumner is far from alone. "You don't really gain all that much," says Dan Roberts, manager of the management consulting department at accounting firm Deloitte, Haskins & Sells, Los Angeles. "If a company decides to buy a \$5 million system, they're going to buy it regardless of the ITC. The \$500,000 [savings] isn't a pittance, but it will not be the basis of the decision. Business needs determine buying patterns."

But will business needs still be the primary factor if the ITC should no longer be in the IRC? The Treasury Department thinks so. It argues that "new high-tech industries will benefit from tax reform" owing to "more productive investment, more useful output, and faster economic growth. Repeal of the investment tax credit would result in more equitable and neutral tax treatment of business taxpayers by eliminating the preferential tax treatment for investments in certain types of assets."

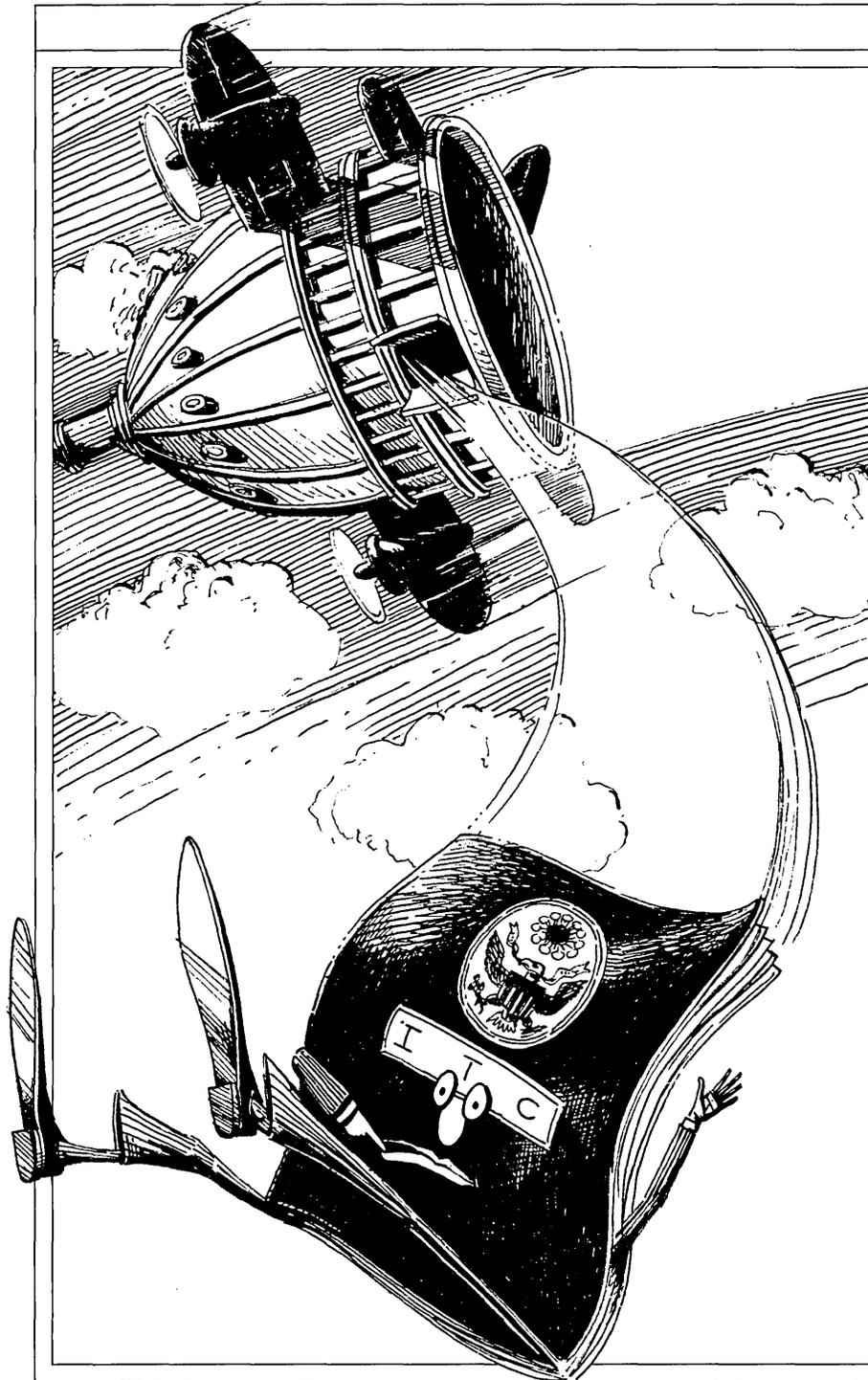


ILLUSTRATION BY JAMES R. JONES

With the ITC in effect, taxpayers are encouraged to invest in activities eligible for the ITC rather than in activities which, without tax considerations, might produce a greater economic return on that investment. In other words, Treasury is arguing that firms may now be passing up computer equipment in favor of other equipment with better tax benefits, and that without the ITC, companies will be more likely to invest in computer equipment if the benefits sufficiently outweigh the costs. Overall, the department says, "Aggregate business investment should not be diminished."

Still, most computer equipment

qualifies for an ITC, and eliminating the credit will mean that computer equipment will cost 8% more than it has under the ITC. This is doing the computer industry a favor? Well, maybe. It depends on

Computers will be less affected than other industries, because their benefit/cost ratio is so high.

which side you're on. If you're a user, you're clearly going to get used. After all, it's not likely that suppliers will eat their customers' effective 8% cost increase. If you're a vendor, your guess is as good as anyone else's.

One Wall Street analyst, Peter Schleider of L.F. Rothschild, Unterberg, Towbin, believes there could be decreased customer demand in the CAD/CAM/CAE industry based on the repeal of the ITC, the lengthening of the depreciation schedule in the Accelerated Cost Recovery System (ACRS), and the increase in the capital gains preference tax to 49% from 20%.

Frederic H. Cohen, also with Rothschild, says, "Historically, the ITC has played a significant role in users' propensity to add to investments, and this was traditionally highlighted by relative strength in the fourth calendar quarter. While the elimination of the ITC is, on balance, a negative [for computer systems vendors] it should be weighed in the context of a dynamic industry where demand is propelled by other incentives as well." That is, the net cost to users will go up, which should hurt industry vendors, unless other factors come into play. Rothschild sees the repeal of the ITC as a small benefit, however, for the software and services industry, where the ITC less frequently applies.

"There are two ways to look at this," Zschau says. "To what extent is the ITC helpful in the financing of and investing in high-tech companies? It's not a big deal. The research and development credit is much more important, which is why I'm glad the Treasury wants to extend it through 1988.

"The next question is what does the ITC do for your market? Who buys from you? If they buy for investment, it could be more important than the high-tech people realize. When viewed from an industry standpoint, it's more important than when it's viewed individually."

On a company-by-company basis, the ITC isn't causing anybody to lose sleep. But if it disappears, the times will be a-changin'.

"There's going to be a large transition effect," contends Leon Taub of Chase Econometrics, an economic forecasting firm in New York. "Sales of equipment for business investments will fall. Computers will be less affected than other industries, because their benefit/cost ratio is so high and companies are introducing them as fast as they can absorb them.

"People may say it doesn't make a difference," the economist continues. "But investment is going to be cheaper in 1985 than in 1986. If a profitable corporation doesn't take advantage of that, it's crazy. If the ITC is repealed, you're going to see a surge of buying in '85, especially later in the year, then a sharp decline in '86. The gradual recovery will start in '87. So '85 gets a single push up, while '86 gets a double push downward."

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CIRCLE 20 ON READER CARD

NEWS IN PERSPECTIVE

Begging your pardon, sir, but there are several companies that say '85 isn't going anywhere.

"I just don't see it having an impact," says the MIS vice president of a New York investment house. "If repeal were going into effect on Dec. 31 and you have your board of directors' approval to purchase a system, you might make the buy on Dec. 31 to get the ITC. But I doubt very much anyone would rush a proposal to the board just to get the ITC. I'd rather get it right."

And Harold Baeverstadt, corporate director of information systems at Sundstrand Corp., Rockford, Ill., says, "We're not going to buy more mainframes anticipating repeal. We're going to make our decisions based on need. If we anticipate needing something in January or February, we might move it up to December" to use the ITC. "But we're not about to stock up," he adds.

"We still need equipment to get the job done," says Ed McConville, controller of the Consumer Foods Division at General Mills. "I'd still like to think we would move ahead with our acquisitions. But it probably means marginal acquisitions will be scrutinized more closely and some of them will not be made."

What probably will be made is more money, especially by lessors. Under the current ITC, a lessor has two choices. It can forego the ITC advantage by passing it through to the lessee, with the lessee having to pay for the gift in the form of higher lease rates. On the other hand, if the lessor chooses to take the ITC itself, that manifests itself in the lessee's lower rate and inability to take the ITC. With no ITC, it's not exactly clear what will happen here. Users will suffer, but lessors may not necessarily gain from that.

"There will be a decline in the leasing market," says Paul Oosterhuis, counsel for the CBEMA tax committee. "It's going to be significant. Stretching out the ACRS and repealing the ITC has to hurt the lessors."

Yet "the single biggest impact on prices will be the repeal of the ITC," says Frank Chatrier, executive vice president of financial services at CMI, a leasing company less dependent on ITC transactions than it used to be. Some of the company's leases use "income funds," a capital-raising technique almost entirely independent of the ITC.

"It's going to increase lease rates by 10%. What used to cost 92 cents will cost \$1. There's going to be a permanent change in the pricing structure which will be detrimental to users. Budgets will be impacted, too. Everybody will be paying 10% more. The decision matrix for dp guys to acquire equipment will be much tougher."

One leasing company thinks the bonanza begins at home. "This would be a benefit for leasing companies and detrimental for users," contends Bob Snyder, vice president of Comdisco, Rosemont, Ill. "If they take away the ITC, we'll need a dramatic increase in lease rates to make up the yield. I think that will happen, because customers are still going to need equipment. Business will decrease only if there's a decrease in demand for computers. And that's not about to happen."

None of this may happen. Then again, all of it may happen. The whole affair probably depends on the President. If he pushes hard, the proposal lives. If he walks away, it dies.

"Reflexively, people's first reaction is that it can't pass," a knowledgeable House staffer says. "But maybe it can. I just don't know if these guys can vote against their own interests. I'm also not sure that voting to repeal the ITC is against their best interests. If they lose it and the ACRS here, they'll just go offshore. They'll get the credit in that country, then come back here and be taxed at 33% [the proposed corporate rate]."

"If the whole package falls apart, all bets are off. Then we'll just go back to what we've been doing for the last three years—fighting like cats and dogs, cutting a little here and there."

So much for reform. ●

MAINFRAME LINKS

MICRO TO M'FRAME BLUES

Despite all the hoopla, most dp managers are still looking for an acceptable micro-to-mainframe link.

by Paula S. Stone

About micro-mainframe links they'd read in the press, Upon implementation, they'd found only a mess.

The trade press is glutted with products claiming to be the gateway to transporting dpers into a brave new world characterized by trouble-free and secure micro-to-mainframe connections. However, as Carleton Corp., Boston, put it aptly in its Christmas poem takeoff on Clement Moore's *A Visit from St. Nicholas*, the reality is not quite as pleasant as the promoters would have data process-



ERDEI OF HUGHES is replacing the 3101 emulator with Relay because of its superior file transfer and switching capability.

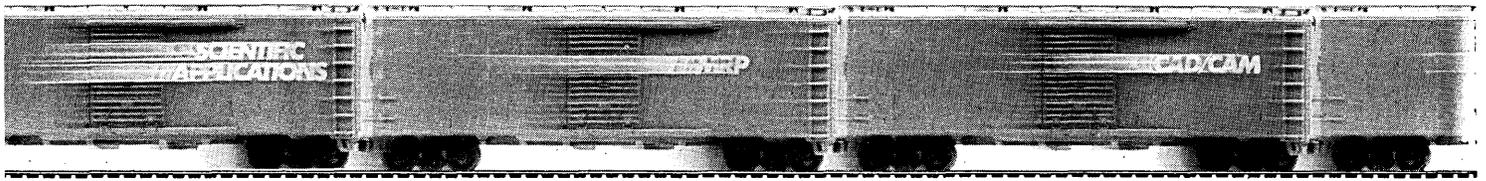
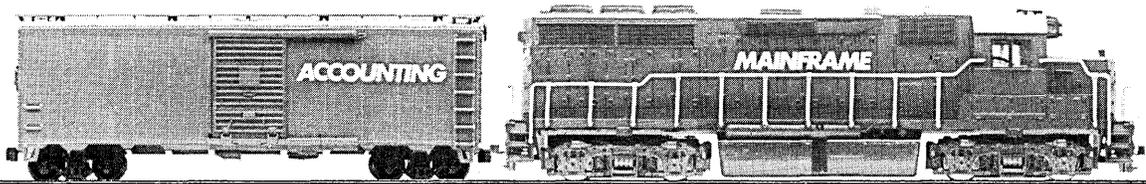
ing managers believe.

While many companies are prepared to make the heavy investments in both dollars and time to implement a suitable micro-to-mainframe link, the currently offered packages lack polish, a wide variety of features, and a reasonable price, according to a new mail survey and a random telephone poll of DATAMATION readers. Now that the IBM PC and its plug compatibles are the mainstays in the offices of corporations around the world, the need to go beyond standalone units is paramount. And though linking these micros to mainframes is at the top of the list of dp managers' priorities, most are waiting patiently for the market to stabilize.

The experience of James Bird, director of information services of \$5.6 billion General Mills Inc., Minneapolis, is a typical result of current conditions. "I've been wanting to make micro-to-mainframe investments for the last year," he says. "We've found that while there has been a lot of press and talk about micro-to-mainframe communications, there don't seem to be many people who are doing it successfully. My reaction was one of disappointment, particularly when you relate it to the number of products that seem to be available."

Bird's observation seems to illustrate the statistics of DATAMATION's 1984 survey on micro-to-mainframe links available as of December. Roughly a quarter, 27.1%, of the 642 respondents are currently using a micro-to-mainframe link; the highest concentration is in manufacturers of durable goods, 35.6%, and consumer goods, 29%.

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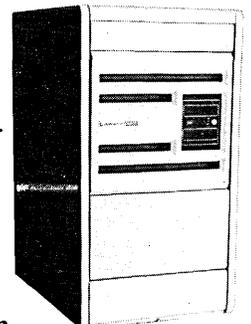
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NEWS IN PERSPECTIVE

The interest in advanced mainframe-based products has been less than enthusiastic: only 22% of the affirmative respondents are using products from the leading mainframe software suppliers. On-Line Software International Inc., Fort Lee, N.J., with 8.6% of the installations, and Cullinet Software, Westwood, Mass., and McCormack & Dodge, Natick, Mass., with 3.4% each, head the list. Most respondents are using terminal emulators, such as the Irma board products from Digital Communication Associates, Norcross, Ga.

Looking at the subset of dp centers for the Fortune 1,000 industrials and Fortune 400 financial and other services sectors, the percentage using micro-to-mainframe links increases sharply, to 43%, but the level of commitment to the big packages from the big vendors is almost identical with that of the overall population, 20.2%.

Such percentages were not surprising to officials at Cullinet and On-Line Software. Cullinet president Bob Goldman states that "while a lot has been said about micro-to-mainframe links, the products are just becoming available. Dp departments are beginning to set up their environments to use them."

Jack Berdy, president of On-Line

FIG. 1

PERCENTAGE OF MICRO-TO-MAINFRAME USERS (BY VENDOR AND FIRM SIZE)

	ALL COMPANIES (174)	LARGE COMPANIES (114)
ADR	1.7	1.8
CINCOM	1.1	0
Cullinet	3.4	3.5
Informatics	.6	0
Information Builders	2.3	2.6
McCormack and Dodge	3.4	5.3
MSA	1.7	1.8
On-Line Software	8.6	7.9
Other	78.7	79.8

Software, is more pragmatic. "The links are getting more attention and lip service than the number of people using them," he concedes. "Large companies with lots of micros are standing back and using study groups to analyze the data before making a commitment. Conflicts of interest and questions about security also slow the process. Smaller companies usually don't need it or don't know how to use the links yet. When they do they want to be able to move a file to a pc."

Berdy predicts "more implementation and commitment to a direction," i.e., product and/or product line, later this year or early in 1986. Berdy's optimism may be short lived, however, since dp managers frequently exhibit a conservative attitude toward complex network products. Frequent surveys over the years, for example, indicated that 20% of dp managers were interested in buying local area networks, yet the percentage actually using a LAN remains 10%.

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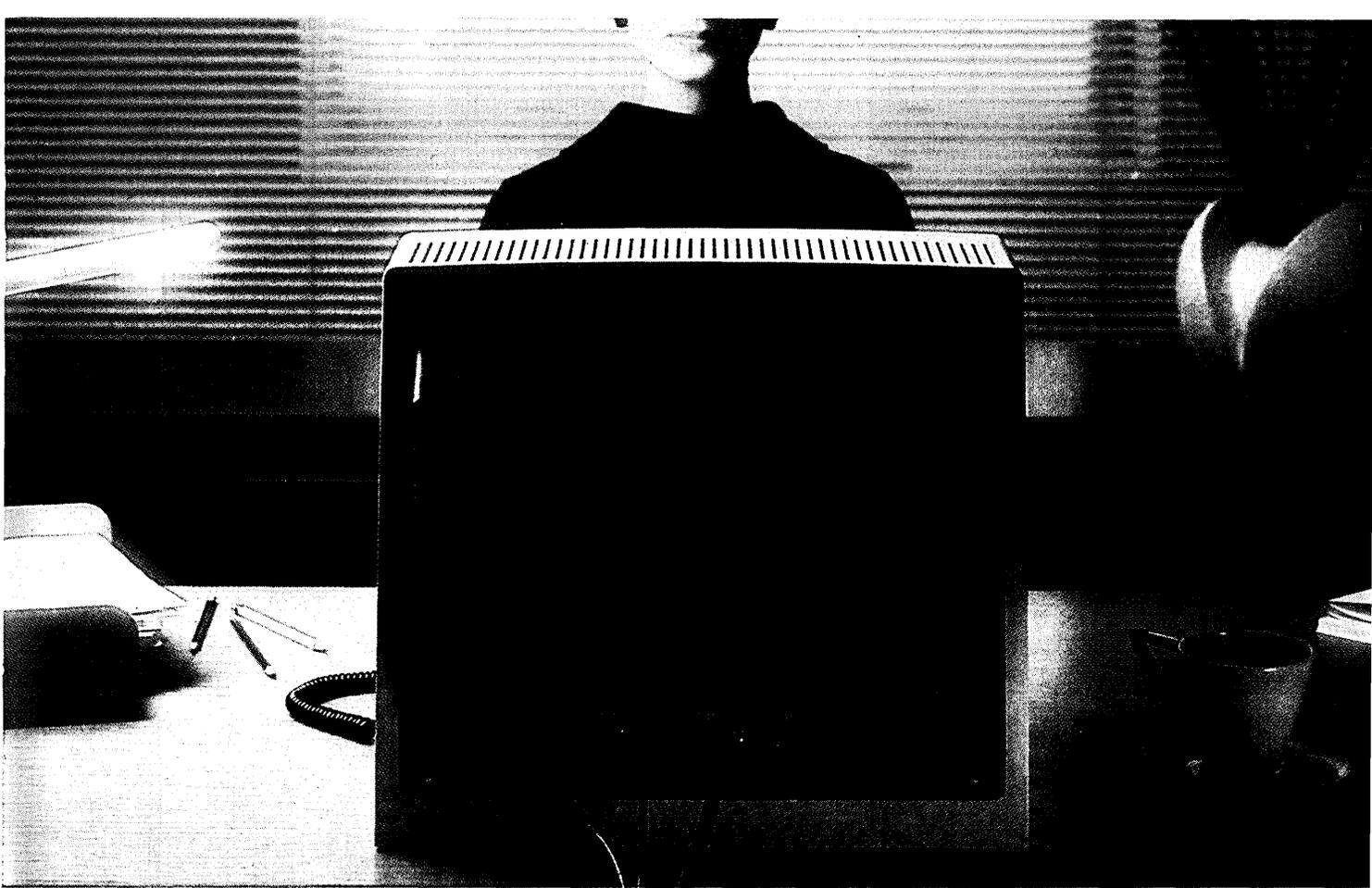
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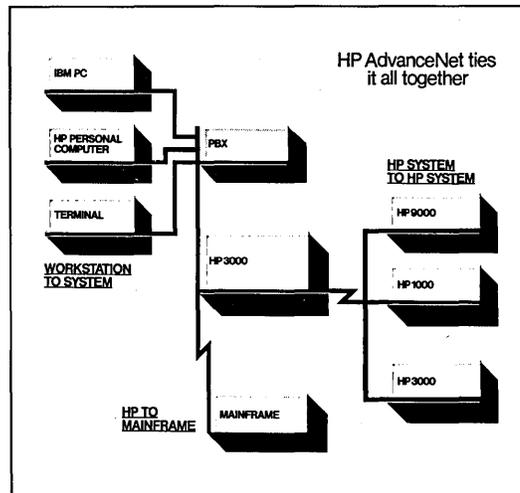
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NEWS IN PERSPECTIVE

Typically, a cautious attitude translates to intermediary steps to satisfy current needs while waiting for the market to mature.

As Bird of General Mills explains, "We have looked at a wide range of communication packages and found the area to be a very confusing one. We think many products are being sold today that on the face will provide micro-to-mainframe communication. But, when we look at them, we find there are a lot of problems and deficiencies, whether in terms of integrity or functionality.

"It is a very dynamic area and at this time, apart from one or two products that tend to be very expensive, is not one that enjoys either a high reputation or a good track record," Bird concludes.

The General Mills short-term solution is Passport from Datalex Co., San Francisco, and Kermit, designed at Columbia University and sold by Kermit Distribution, New York. They are typical of what dp departments are looking for in terms of function. According to Bird, Passport is "reasonably priced," provides

Only 22% of the respondents are using micro-to-mainframe products from the leading mainframe software suppliers.

an "acceptable level of user friendliness," and transfers spreadsheet files from micro-to-micro or to a mainframe. Kermit offers more potential for flexibility than Passport, boasting macro programming and other capabilities, he adds.

Next to functionality, cost is another big factor for dpers. Some packages General Mills looked at were \$40,000 for mainframe software and \$1,000 for each micro. "When you are looking at 50 entities, that's a big investment, relatively speaking, in an environment that is still very young and developing," says Bird. "We recognize that and want to secure products that provide the basic level of functionality, but don't incur the level of investment that indicates we are going to be with the product for a long time. We don't think that is going to be the situation. We think there are going to be significant developments along this area in the next one to two years and we don't want to sink a lot of money into this area at this point."

Dpers also point to overambitious and inflated advertising as reasons for postponing purchases. A common complaint of dp managers contacted by DATAMATION is that many products just don't perform as suppliers claim. Early announcement of products or product enhancements lengthen the time before corporations will purchase. Dpers feel the products aren't fully tested before they

are announced and the availability date is uncertain. If an MIS manager decides on a particular product and then the next version with enhancements is announced, he or she may wait until the enhanced version is available.

Approaches and experiences with suppliers vary considerably. On-line Software announced its Omni-Link micro-to-mainframe link in April 1983, to be delivered by December. The deadline was met.

On the other hand, Cullinet's In-

formation Database (IDB), which was announced in January 1984, was scheduled to complete beta testing at the end of January this year. That didn't stop the company from mailing hundreds of demonstration disks to magazines months before beta testing was completed, or from selling about 150 copies in 1984 at \$75,000 each. Goldengate, Cullinet's integrated pc package that can link to its IDB, was introduced in June, selling about 3,000 copies in 1984, claims Goldman.

Goldengate's reception is mixed.

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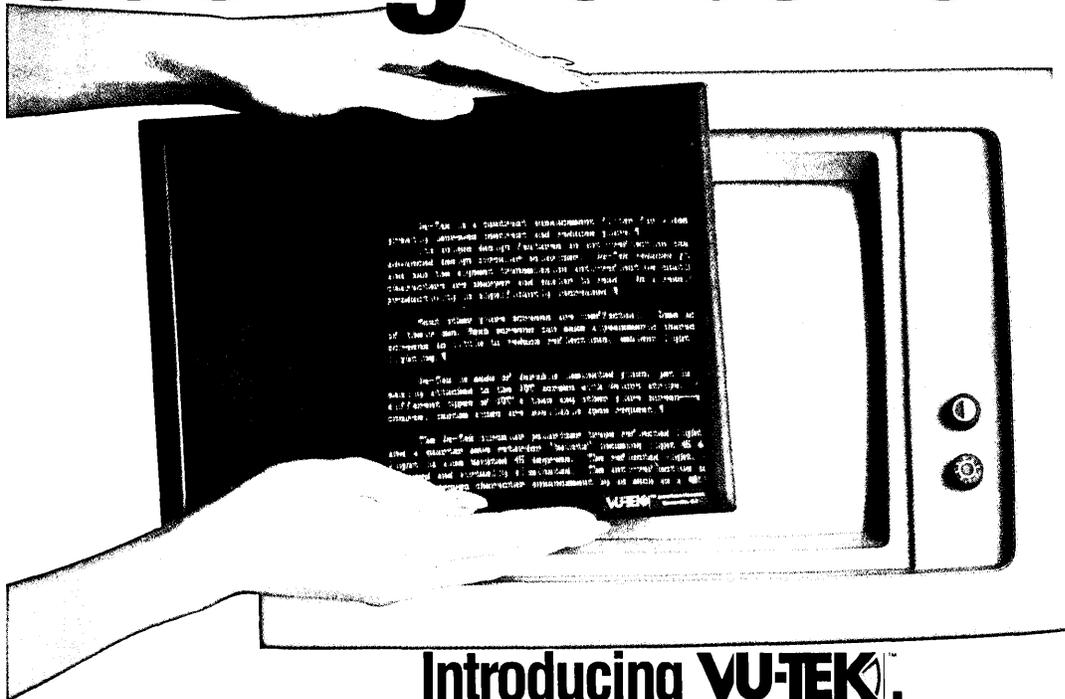
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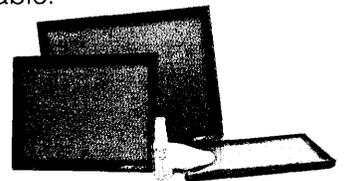
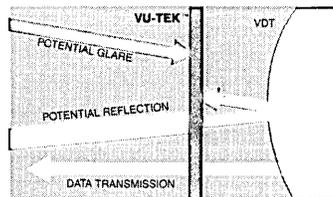
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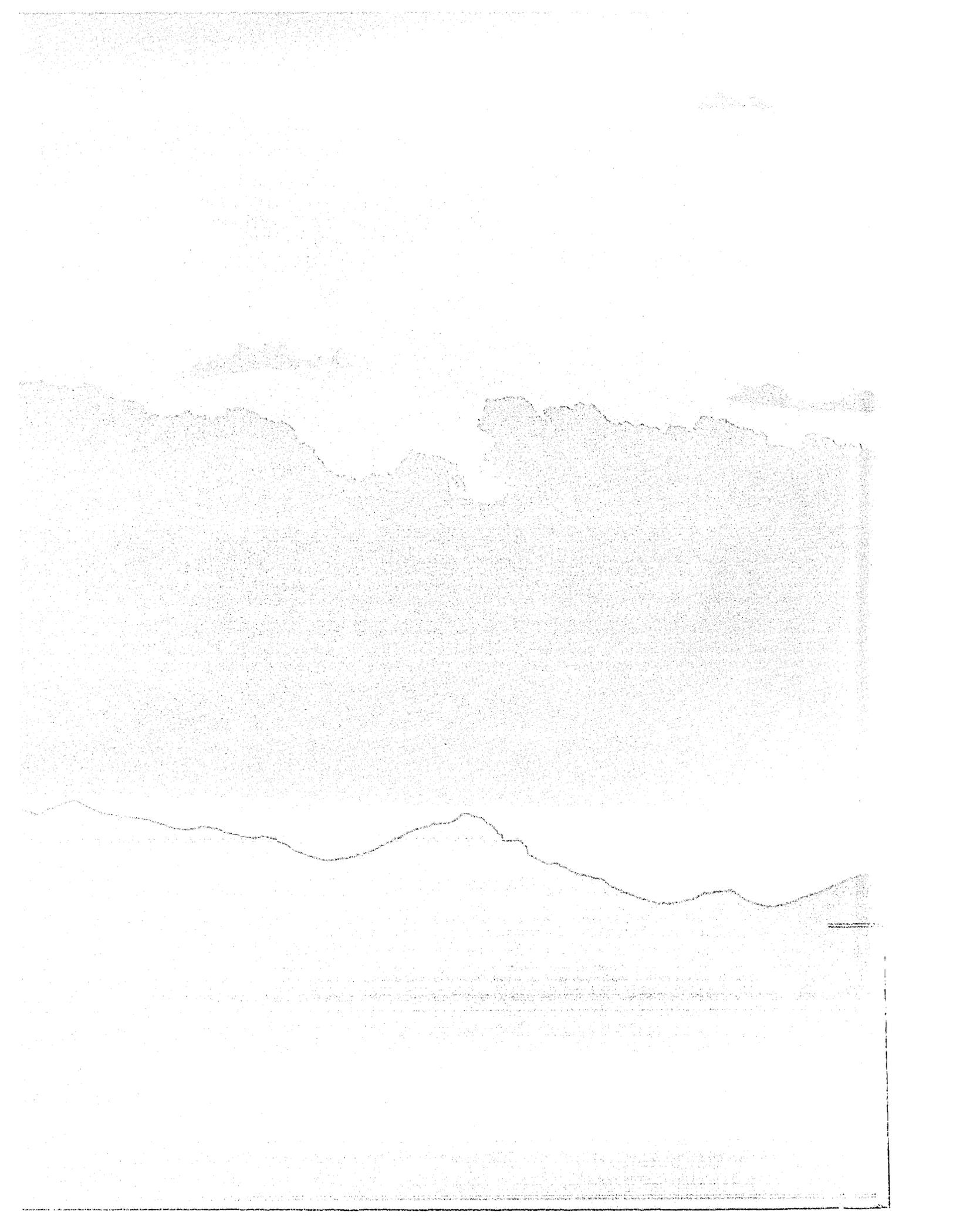
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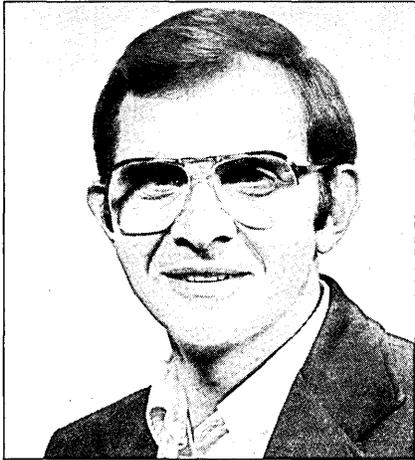
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NEWS IN PERSPECTIVE



PETTIT OF UNION CARBIDE says there are lots of limitations using the 3270 boards, such as the on type and size of file transfer.

"Relay has lots of nice little features incorporated into it; the on-line help and vendor support are excellent," he continues. "Its full-screen simulator allows a user to dial the mainframe over a regular asynchronous line and operate as a 3270 terminal. We also support it so heavily because it is the only package that we know of that will allow a file transfer between our CMS system and the pc that will do binary file transfer with error checking."

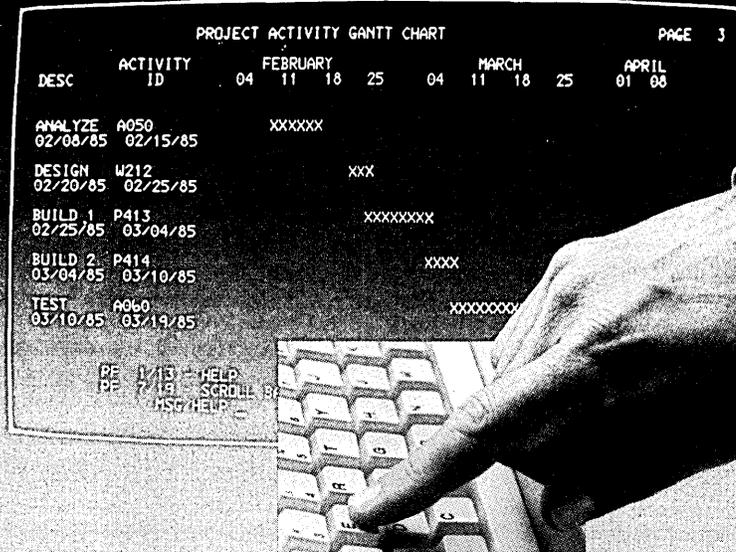
Union Carbide also uses Forte, IRMA, and Tempus emulator boards in its pcs; it recently dropped the Tempus emulator board package from Micro Tempus Inc., Montreal, due to inadequate support. The Forte board is slightly faster than IRMA, reports Pettit, and there are lots of limitations using the 3270 boards, such as the type and size of files. It is working around this by using Relay and the boards together.

Harvey Shlasky, manager of the management consulting department for the Big Eight accounting firm Deloitte, Haskins & Sells, Los Angeles, claims his experience using Relay and BLAST has been "fair to middling with pretty much the same problems."

The problem in making the connection between micros and mainframes isn't just hardware and software. "One problem is that the users don't define their requirements properly. They just kind of throw in a product to try it out without doing a thorough requirements definition before they actually start the effort," Shlasky comments. "The result is that they are typically frustrated."

The suppliers have their work cut out for them, with many eyes watching them. Will they dance or get cold feet, dooming dp managers and their pc end users to terminal emulation forever? ©

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LAST CHANCE FOR NT

Northern Telecom is poised for yet another stab at the OA market, but its prospects are dubious.

by Karen Gullo

Can Northern Telecom make a mark in the office automation market? The Ontario-based telecommunications company, which last year may have outsold AT&T in the U.S. PBX market, has thrown its hat yet again into the OA ring, this time with an integrated voice and data workstation connected to a shared resource host. Some analysts see the product as the company's last ditch effort to save its integrated office systems (IOS) division.

"Northern claims that with the new workstation it is keeping a promise it made to its customers to be an end-to-end supplier of data systems," says Kathy Healy, an analyst at Northern Business Information Inc., a New York-based market research firm. "I don't think they've done it. This is definitely an attempt to save the data systems division and its facilities."

On the surface, NT's introduction of the Data Voice System (DVS) last week represents the growing trend toward telecommunications companies entering the data processing business. NT joins a number of major vendors, including IBM/Rolm, InteCom/Wang, and AT&T, as well as several startup companies, in diving into the market for integrated voice data terminals (IVDTs).

But a closer look reveals a company in transition. NT has never been a strong player in the data systems market; its success stories are its central office switches and PBX systems, which together represent about 60% of NT's income. In fact, Northern Telecom has been one of the big winners in the aftermath of the AT&T divestiture. Between the business of sorting out the breakup mess and developing new products, AT&T couldn't move quickly enough to catch its Canadian rival. As a result, NT walked away with a large chunk of the market for switches bought by the regional Bell holding companies.

But the rosy picture isn't expected to last long, and that's where the new workstation steps in. While the outlook

for 1985 is "reasonably good," says Cliff Higerson, an analyst at L.F. Rothschild, Unterberg, Towbin in San Francisco, next year and beyond is less encouraging. "In the short term, the competition in PBXs and central office switches is going NT's way," he says. "But as AT&T and Rolm get their act together, 1986 will be more subjective." Stronger competition coupled with an anticipated plateau in sales of office switches could mean trouble, but NT hopes to fill the gap with its new data system.

While NT clearly wants to improve its showing in the OA market with the product, it also hopes that the product will boost its PBX sales. Consequently, as Northern Business Information points out, NT is broadening its market approach from being a provider of standalone systems to being an end-to-end system supplier. It has developed the product to enhance corporate networks in conjunction with the firm's PBX and central office product lines.

Dick Deischer, NT's manager of market development, explains, "The use of this workstation is analogous to what IBM is doing with its workstation systems. Its mainframe base will grow as a result of its PC sales. NT will extend the use of its central switching equipment through the use of our terminal workstations."

The product supports Northern's SL-1 PBXs as well as non-Northern Telecom systems. The \$38,000 DVS system includes five multifunction 128KB workstations, with integrated voice, data, text, and graphics capabilities and a microprocessor-based shared resource host that contains modules for processing power, storage, networking, and telephony capabilities. The five-terminal system will support another 10 voice-only users. The DVS supports data and voice transmission over twisted pair at 2.56Mbps and runs under the Unix or Concurrent DOS operating systems. Up to a dozen workstations can connect to the host via a local area network module. The workstation comes with the Q Office integrated software from Quadratron Systems Inc., Encino, Calif., and the Informix DBMS from Relational Database Systems Inc., Palo Alto. NT says that with additional modules, the system will support a maximum of 35 voice and data workstations and up to 100 voice-only users, at a per-user cost of \$4,000 to \$6,500. Workstations are priced at \$1,395. The company did not release module pricing.

Northern also enhanced its SL 1 and SL 100 PBXs to take advantage of the 2.56Mbps data rate and other features of the new office system.

Whether the company is equipped to stand up to the competition in the telephone-terminal market is questionable at

best. Terminal equipment contributed 11% of the firm's 1984 U.S. revenues of \$4.2 billion, which were up 28% over 1983. Analysts are predicting 1985 revenues of \$5.3 billion.

Yet NT's line of distributed data processing terminals and remote and batch terminals holds less than 1% of the terminal market in the U.S. The company's premier product line, the Displayphone family of IVDTs, was among the first on the market, but market response fell short of the company's expectations. Greg Carlstead, an analyst with Dataquest, a San Jose market research firm, explains, "Northern Telecom made two strategic blunders with the Displayphone. First, they marketed it to executives, who are not its primary users, and second, they gave it a small, chiclet keyboard. In addition, products of this sort had a slow start because it's difficult to measure their worth in the office automation arena."

NT has since enhanced the Displayphone and was the market leader in 1983, selling half of the 30,000 units sold. Last year, Carlstead estimates, probably 50,000 products were sold, with NT holding on to 35% to 40% of the market.

Still, the market response is tepid. Some Displayphone users say they'd like to have additional telephony capabilities. "I'd like to be able to conference the calls that come in on the two lines the terminal offers," says Ken Cooperstein, a vice

"Northern committed a strategic blunder by marketing the Displayphone to executives, who are not the primary users."

president at Citibank, New York, where over 100 Displayphones are in use. "As it is, I can call one person on one line and someone else on the other line, but I can't put all of us together. And there's no intercom function, which would be useful for me."

With plants in Minnetonka, Minn., and Nashville, the IOS division is one of NT's key operating arms in the U.S., but since its creation in 1982, the division's performance has been dubious. The division is an offshoot of the dismantled Electronic Office Systems, an operation that reported substantial losses in the early 1980s. Northern combined its successful SL PBX line with the terminal operations to form IOS, and thus took the sting out of the division's financial picture. But analysts say the data systems operation had losses in the area of \$100 million a year even after the two product line divisions were merged. NT reports that the merged division is now breaking even.

If the company's past performance with data systems can be used to forecast the likelihood of its ability to suc-

NEWS IN PERSPECTIVE

ceed with the DVS, the picture is not a pretty one. NT has failed twice to develop integrated end-to-end voice and data systems—once with the Office Communications System project, developed several years ago, and a second time in 1978 with the disastrous acquisitions of Sycor and Data 100 Corp., a pair of U.S. terminal makers. NT wrote down about \$180 million in obsolete inventories and suffered comparable operating losses.

"NT is not and never has been a major player in the office automation market," says Alan Fross, an analyst at Eastern Management Group, an industry consulting firm in New Jersey. "There's nothing wrong with their products; the problem is that they are a telecommunications company trying to sell data processing gear."

Many observers agree that if NT relies on its base of PBX customers as potential terminal customers, it may not work, since PBXs are most commonly purchased by telecommunications managers while terminals are most often purchased by dp managers. Users may be confused about which side—communications or dp—is the right place for IVDTs. Prospects who are not NT's PBX customers may perceive the firm only as a telecommunications company, and may thus be skeptical of its data systems.

"NT wants to be a total telecommunications supplier, so now it has to re-

If the company's past performance with data systems can be used to forecast the likelihood of its ability to succeed with the DVS, the picture is not a pretty one.

late to an MIS or dp person," Fross says. "It may not feel comfortable in that position and may not understand all the concerns of dp."

On the other hand, if IVDTs find a place in office automation—an issue hotly debated among analysts and vendors—some companies may look to their PBX vendors for data systems. "On the communications side, among its PBX customers, NT may do reasonably well," Higgerson of Rothschild says. "But as a stand-alone system, I think it will be more difficult for the company to sell a data product."

In addition to competition from as many as 20 IVDT manufacturers, NT's DVS will also be pitted against similarly configured systems with office automation software, from such industry heavyweights as Digital and Data General. NT appears to be undaunted, claiming the system's features, including windowing capabilities, voice and data applications, and particularly telecommunications ca-

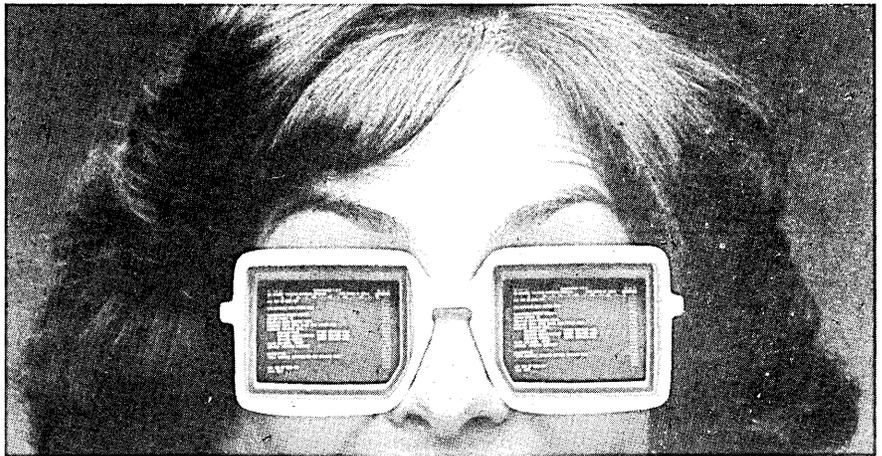
pabilities, will work in its favor.

"There is no similar terminal available for the price," says Gary Gull, director of marketing. "We're breaking new ground for this product, and we're at least two years ahead of AT&T and IBM."

That may be, but the terminal is still attached to a shared resource unit. NT is not saying what the extra costs will be for adding networking and analog line modules to support more users, but it appears that customers may pay a considerable price for the privilege of expanding

beyond the \$38,000 five-workstation system when compared to products which offer the same features.

While Eastern Management Group's Fross points out that the new workstation may not make or break the company, Northern's reputation as a supplier of data systems is clearly on the line. And if the firm cannot succeed this time in OA, the failure could drag NT's bread-and-butter products with it. And that is something Northern Telecom hopes to avoid at all costs. ©



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SOFTWARE

BEAN COUNTERS ATTACK!

An accountants’ arcane dispute erupts into a fight pitting software vendors against ADAPSO.

by David Stamps

A messy brouhaha has erupted in the software industry, with a wide variety of vendors pitted against their trade association, the Association of Data Processing Services Organizations. Recently proposed answers to decade-old questions about how software vendors should deduct the cost of research and development would, in the eyes of critics, increase costs and hinder the development of software, among other calamities. The issue splits the entire industry into two camps and affects anyone who designs, writes, or sells software.

The question bedeviling the industry is, simply put, whether the costs for developing software should be reported on a firm’s profit and loss statement sheet as an expense, or capitalized on the balance sheet as an asset. If vendors can capitalize their costs—spread them out over a period of time, like homeowners paying a mortgage—then their quarterly and annual earnings would be higher than if they took all the staff salary and computer time costs as expenses deductible that year. Indeed, securities analyst Sandra Krause at the Wall Street firm of Kidder Peabody recently noted that the estimated 1985 earnings of a dozen publicly held software companies would soar if the proposal were adopted: MSA, up 40%; Triad Systems, up 57%; Cullinet, up 30%.

Industry expectations are that the Financial Accounting Standards Board will soon open the question to public hearings or authorize a new draft that reflects a pro-expense position, which would be a 180° change from its position last year. Last summer FASB, which writes the rules accountants follow, began circulating to the software industry a draft proposal outlining the procedures by which companies could capitalize software R&D expenses. Since ADAPSO was largely responsible for the procapitalization stance of the draft and since the association presumably speaks for its members, nobody anticipated widespread opposition to the plan; approval by the FASB board was expected to be little more

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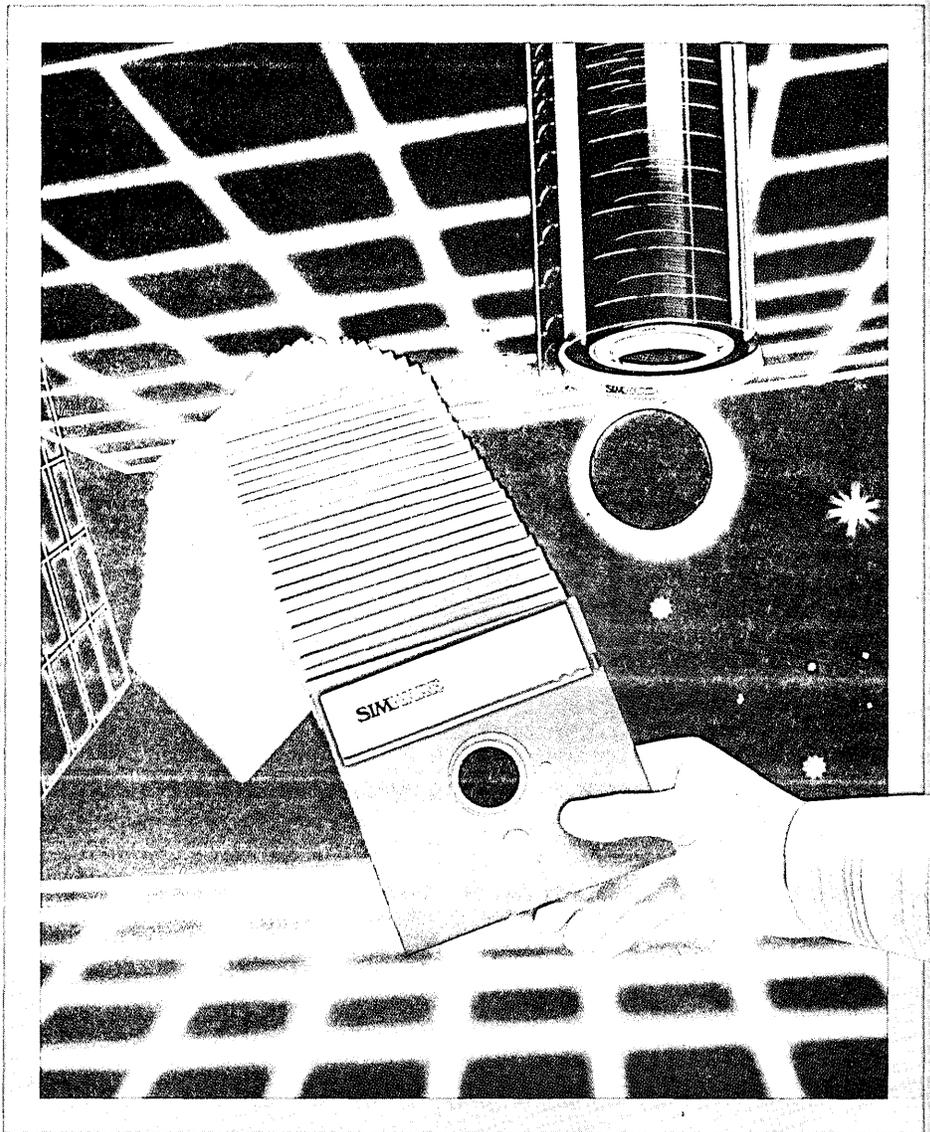
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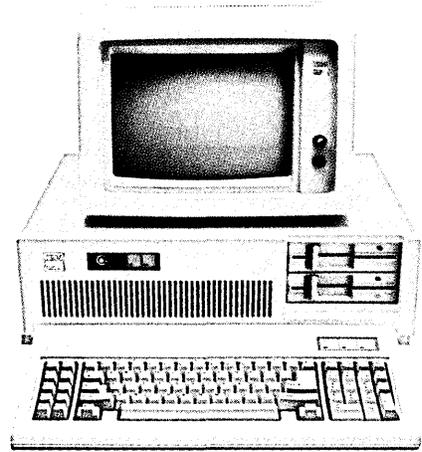
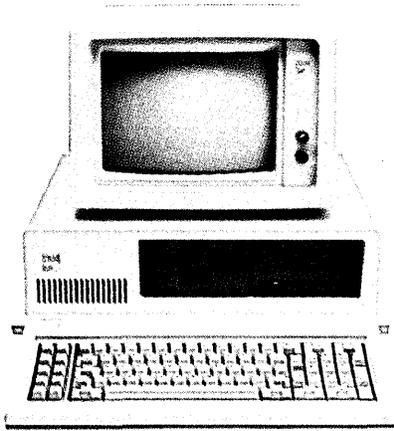
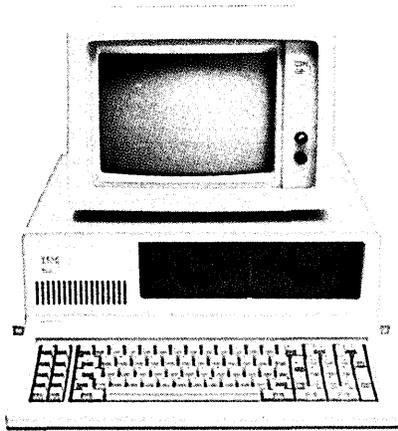
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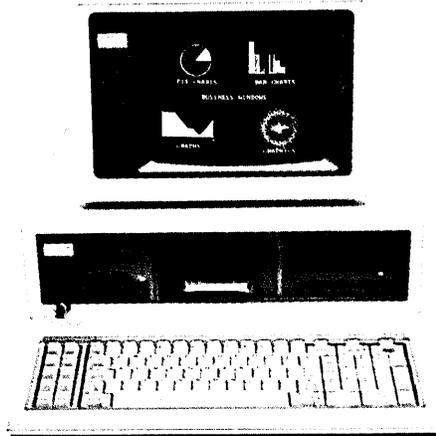
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than a formality. By December, however, 60% of the 170 responses FASB received opposed capitalization.

The FASB proposal last year that

"I think the FASB just plain got snookered by ADAPSO."

ignited the fire in the industry said that initial product R&D efforts would be expensed as incurred, including such things as product and program design. Coding, testing, and other production costs of a

product master could be capitalized.

How a company draws the line between when to expense something as R&D or when to capitalize the costs of a product would be determined by what the FASB proposal calls "the recoverability of costs test."

It's a four-question test with millions of dollars at stake: is the product technically feasible? Does a market for the product exist? Is it probable that the revenue from a product will exceed the capitalized production costs? And, final-

ly, does the company itself have the financial wherewithal and the management commitment to produce and market the product? Affirmative answers could make a company's financial statement appear far more robust than warranted.

Briefly stated—and at the risk of oversimplification—the philosophical debate hanging over the industry and the FASB is this: should the software industry be allowed, as many other industries are, to count chickens before they hatch by listing some product development costs as assets? Or should they list all development work as an expense, suffer low earnings, and wait until the day when the product finally hits the market as a whopping success?

The opponents to the capitalization question challenge the assumption that vendors can legitimately determine development costs and predict when a new product will actually be introduced and its actual market lifetime. Added paperwork and bureaucracy will stifle the industry, they add.

Traditionally, software companies have taken the conservative view. To paraphrase Aesop, they expensed all devel-

The philosophical debate is this: should the software industry be allowed, as many other industries are, to count chickens before they hatch by listing some product development costs as assets?

opment costs without waiting to see if the software eggs hatched. But a few firms, including IBM, have capitalized at least part of the costs of developing new software. Those who favor capitalization contend that the software industry is unfairly punishing itself by deducting expenses as they are incurred. All this is based on an interpretation of a 1974 rule from the FASB that has been debated ever since.

The argument from would-be capitalizers goes something like this: don't oil companies capitalize the expense of drilling oil wells? Don't recording companies capitalize the expense of producing the next greatest hits album? Even a chicken rancher counts his chicks prematurely when he goes to the local bank to negotiate a feed loan. By not capitalizing software, says the pro fraction, the industry is representing itself as being in a shakier position than it really is.

As part of the background to this issue, it could be noted that the FASB document didn't simply materialize one day because someone at FASB had finally figured out a solution to the capitalize-versus-expense question. In April of 1983, the Securities and Exchange Commission imposed a moratorium on capitalization, citing concern over what appeared to be a

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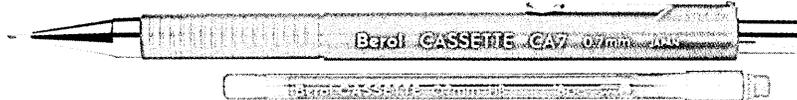
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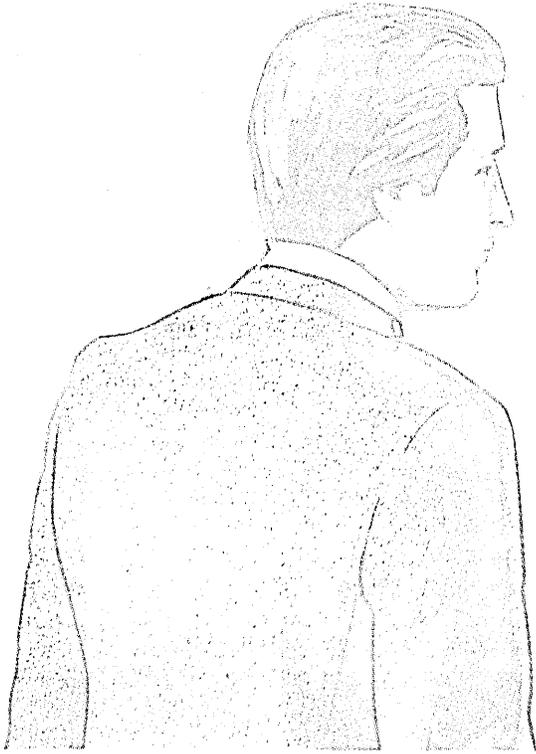
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growing discrepancy in the industry over cost accounting practices. A couple of recent publicized cases, in which companies had been forced to take write-offs on products that had been capitalized and then either did not appear or were delayed, may also have attracted the SEC's attention to the issue.

While SEC concern is a persuasive prod, it would be wrong to say that FASB jumped into the breach to hammer out a quick and dirty draft proposal at the SEC's behest. For nearly a decade, ever since FASB issued its infamous Statement No. 2, ADAPSO has been seeking a clarification on how R&D costs should be applied to software developments. Less than satisfied with a couple of minor addenda, ADAPSO continued its own efforts to develop a consistent software accounting procedure. In 1982, a joint committee from ADAPSO and the American Institute of Certified Public Accountants produced an issues statement that served as the basis for the FASB draft proposal.

Given the fact that ADAPSO supposedly speaks for its members, plus the long gestation during which it crafted its issues paper, it was reasonable to expect

Responses to the FASB draft were far from unanimous.

that response to the FASB proposal would be mostly supportive.

Responses to the FASB draft, however, were far from unanimous—at least not unanimously in favor. "Capitalization makes good sense if you could do it," says analyst Charles Taylor of the brokerage firm Prudential Bache, New York. "Unfortunately, what they're after is the Holy Grail of accounting—matching revenues and expenses for software in the period in which they occur."

Considering what preceded the FASB proposal, a surprising number of firms voiced loud objections to capitalization. One of the strongest protests came from Cullinet Software Inc., Westwood, MA.

"Our main objection is that the software development process cannot be defined as neatly as FASB tried to do in its exposure draft," says Richard Carli, Cullinet's director of finance. "At Cullinet, coding and testing is not part of a [separate] building phase; it's part of the overall design."

Software firms most frequently raised this objection to the FASB draft. Explains one developer, "Sometimes the real design work only begins when we install a working product at a customer site, and the customer says, 'I know it's what we said we wanted but what we really want is this,' and so you start all over."

The costs of complying with in-

creased capitalization would outweigh any possible benefits and could put heavy burdens on software companies, particularly smaller firms, according to Cullinet. Increased costs would come in three areas—implementing new cost accounting systems for development projects; higher fees to auditors and to market researchers for formal market studies; and increased taxes, assuming that the Inter-

While some complaints may sound specious, concern over the proposal was widespread.

nal Revenue Service will follow the FASB position and declare software assets to be taxable.

Cullinet also objected to the numerous judgment calls that capitalization would allow, "which is why we don't think this is good for the industry," Carli adds.

"For instance," he points out, "the current draft could allow one company to capitalize \$2 million and another to capitalize \$10 million on an identical product, as long as recoverability is likely. Essentially, that means a company is able to capitalize its inefficiencies as assets."

Capitalization just might change the climate of the software industry, contends Cullinet. "Right now we don't have stringent cost accounting in place," explains Sue Macdonald, Cullinet's manager of financial analyses. "There are a lot of free spirits in this industry. If you start pushing administrative responsibilities on programmers, you could hinder the development process. You could even drive programmers to less bureaucratic firms."

For the smaller software development firms, a focal point of interest of data processing managers and investors these days, the proposed capitalization rule would be particularly onerous. Actual reported quarterly and annual earnings could fluctuate wildly, depending upon the phase of the software product process a company is in during the reporting period.

For example, a company like ASK Computer Systems, Los Altos, Calif., whose only product is software, would have wide quarterly fluctuations. "Our R&D runs at about 8% of revenues," explains ASK's Bob Riopel. "On any given quarter, depending on the status of our projects, the shift between capitalized versus expensed costs could swing from 25% to 75%. That in turn could result in a 25% swing in earnings per share. That kind of earnings shift isn't going to make our customers feel real comfortable."

While some of the complaints may sound specious, concern over the proposal was widespread. Hewlett-Packard, in addition to the above points, raised an ob-

jection unique to its own position as a hardware and software vendor.

"It would create an artificial inconsistency between hardware and software development," says Rick Haller, HP financial reporting analyst. "An R&D manager might conceivably decide to focus on a software solution rather than a hardware solution if he thought capitalization would allow him to defer some costs and stay under budget. That's not the way R&D decisions should be made."

Objections from HP and Cullinet did not take FASB entirely by surprise. "Most of the major firms had already made their positions known," says Gregory Ray, financial manager of Union Carbide who is presently serving as an FASB project manager of computer software accounting as part of an industry fellowship. "We knew the big companies were split, that IBM and AT&T favor capitalization while HP, DEC, and Honeywell oppose it. We figured there might be some split in the software firms too, but that the majority would favor it. We were led by ADAPSO to believe that the industry was behind this."

The number of software companies that responded in opposition to the FASB draft last fall, however, took FASB quite by surprise.

"The response from the industry raises a flag that ADAPSO may not have had its finger on the pulse of the software industry," says Ray.

Others are more blunt. "I think FASB just plain got snookered by ADAPSO," says Riopel of ASK Computer Systems. "They came to the erroneous

"I'm not sure ADAPSO has always done a good job representing its members."

conclusion that ADAPSO was representing a wide range of firms. On this issue they weren't. In fact, most companies are opposed to capitalization."

James H. Wilkins, chief financial officer at bank software vendor Systematics Inc., Little Rock, Ark. and leader of a group of nine firms that filed a joint complaint, opines that except for the two firms that backed the FASB proposal—Management Science America and Informatics—no software firms are in favor of capitalization. "I'm not sure ADAPSO has always done a good job representing its members."

As to why ADAPSO so misjudged the industry sentiment on this particular issue, Wilkins offers a theory. ADAPSO did a survey in 1982 to determine what percentage of software R&D projects fail. It's findings, that once projects are out of the initial R&D phase the success rate is between 80% to 90%, are among the argu-

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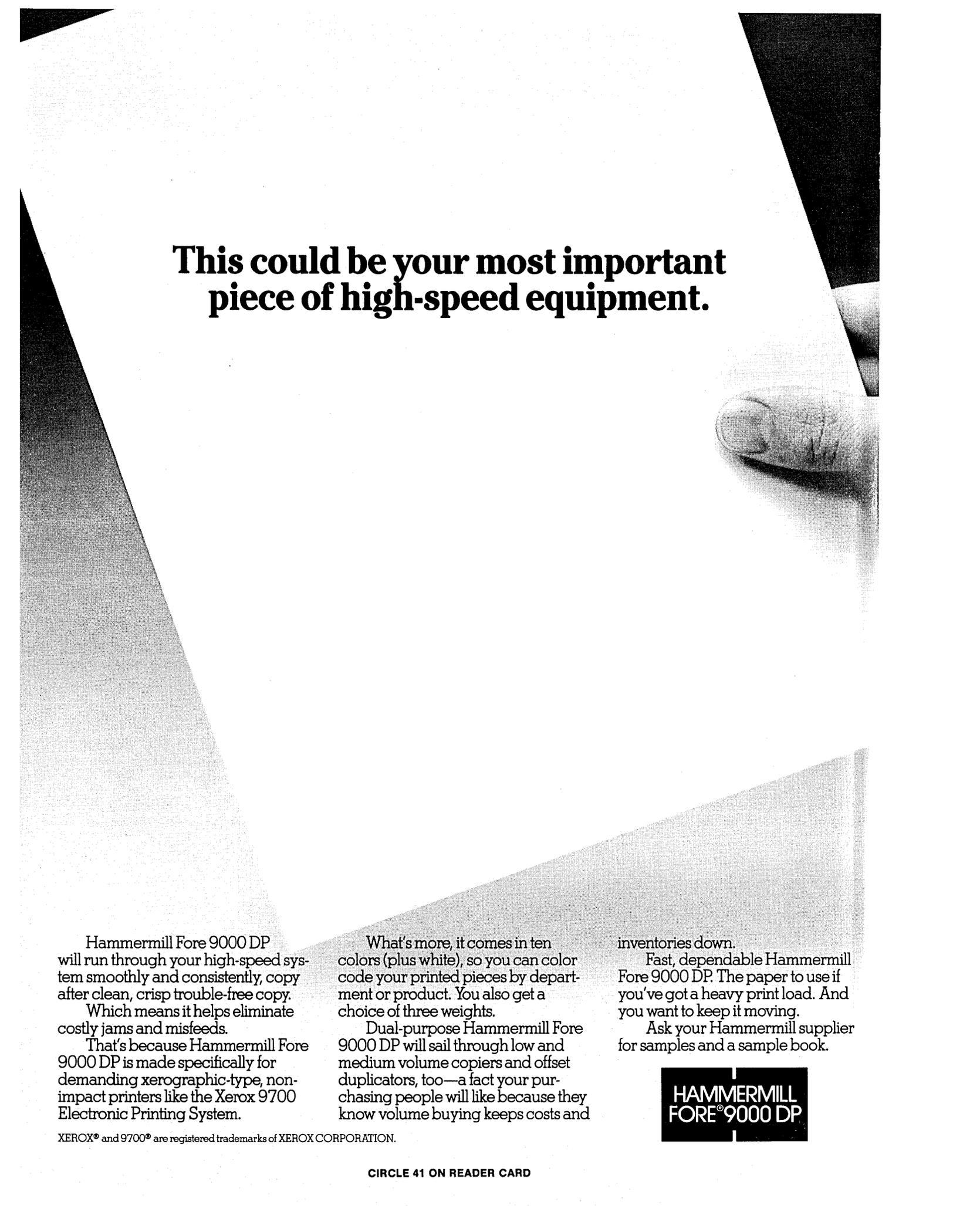
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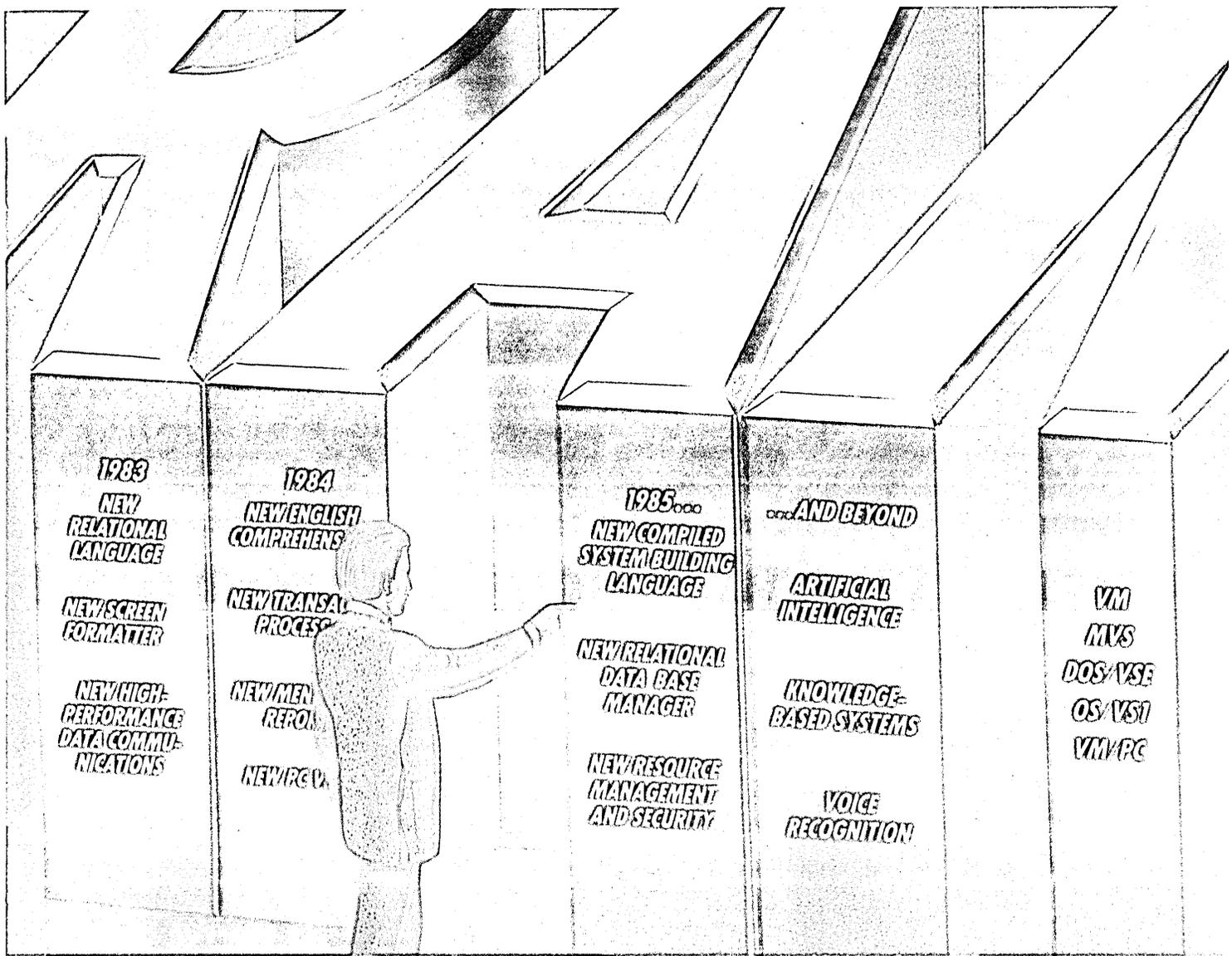
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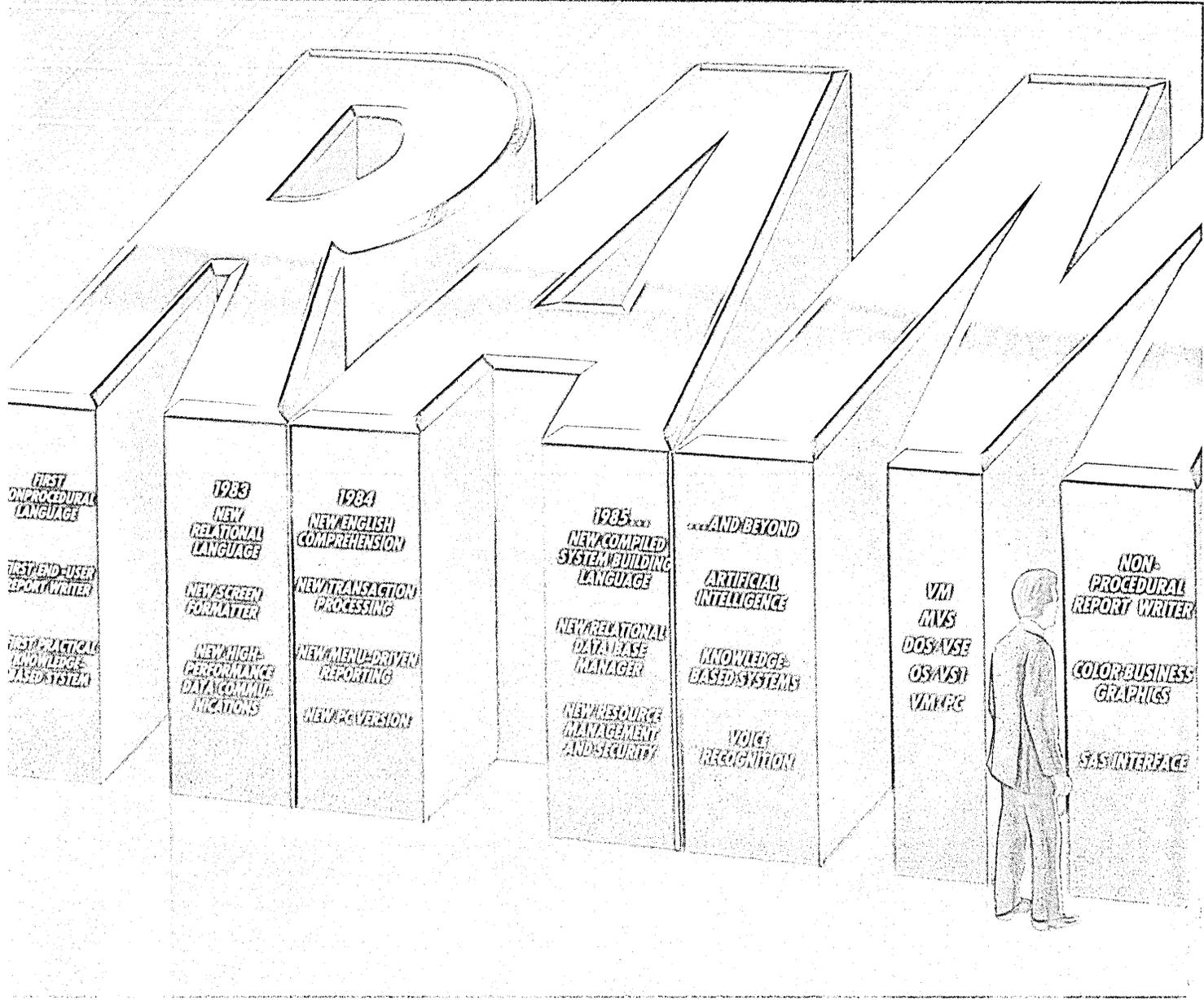
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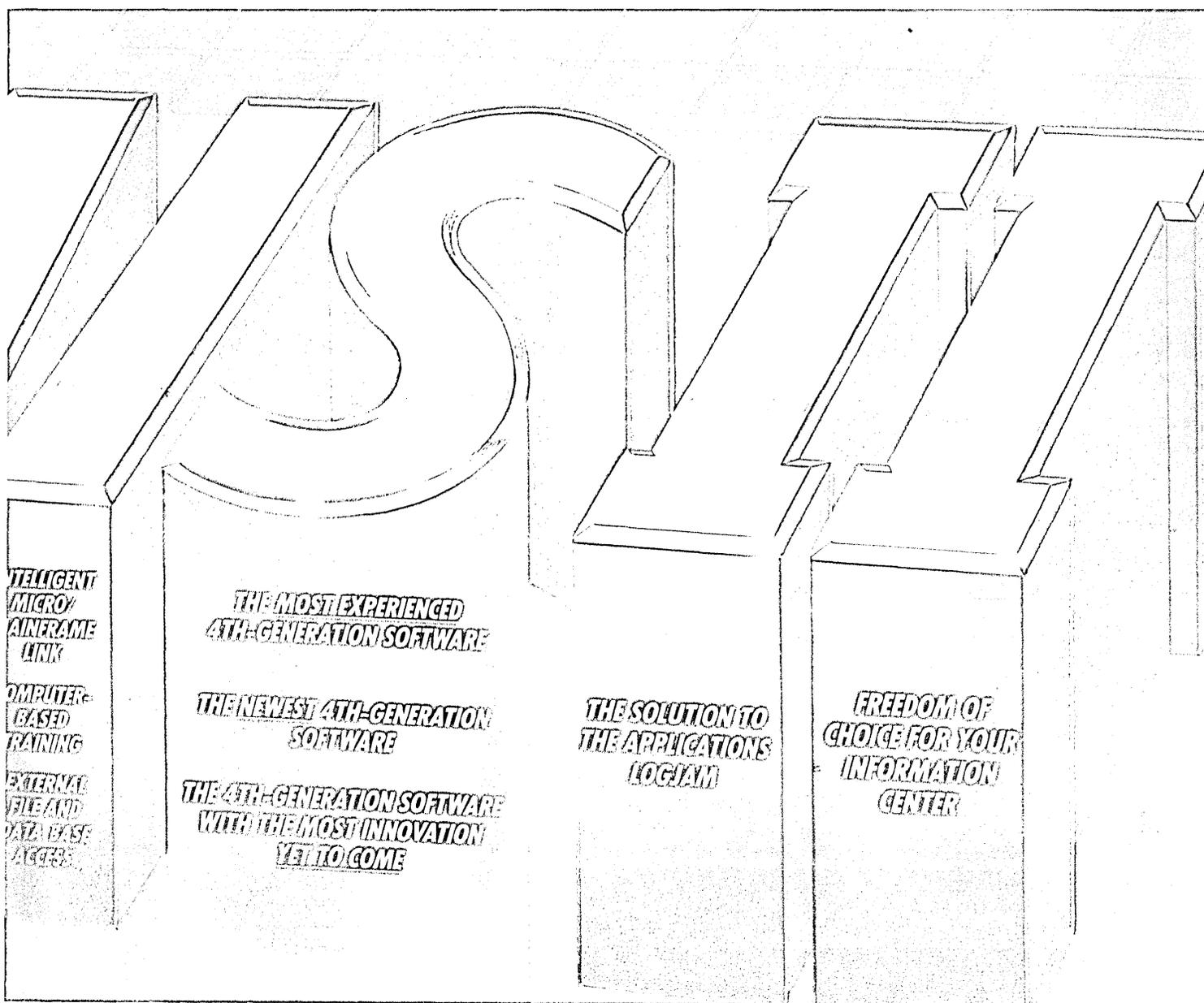
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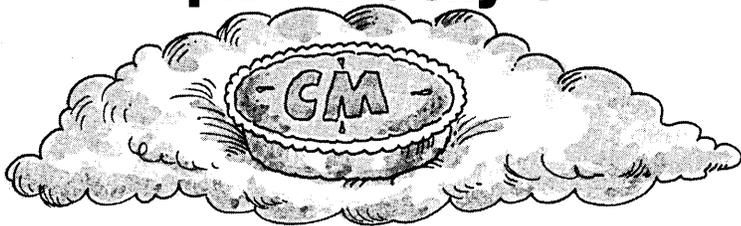
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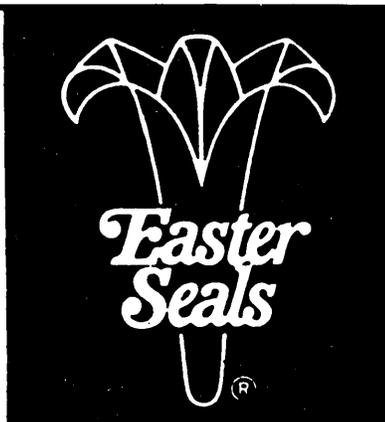
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ments ADAPSO cites as the rationale behind the cost recoverability test.

According to Wilkins, however, ADAPSO may have used "a self-fulfilling questionnaire. They asked point-blank how many projects fail. Who is going to answer that? The fact is, the success of software is a much iffier proposition than the FASB draft recognizes."

ADAPSO's director of research, Julie Johnston, discounts the notion that its survey was flawed or self-fulfilling. She also objects to the charge leveled by some, she says, that ADAPSO "tried to push capitalization down the throat of the industry."

"This has been a long process, almost 10 years now. No way did we 'push this through.'" To the contrary, she adds, the response from the industry arose due to the fact that Cullinet, which is not an ADAPSO member, launched "a very strong negative campaign."

"ADAPSO never really took a position on this," she says. "We didn't lobby for it. We know it's an issue where each company will have to make up its own

To the charge leveled by some that ADAPSO tried to push capitalization down the throat of the industry, the organization's director of research retorts, "No way did we push this through."

mind, and that not all will be for it. But had we known that Cullinet was going to launch a fear campaign, telling people that this would raise their taxes, we might have lobbied harder for it."

Bill Graves, president of MSA and a member of the ADAPSO/AICPA task force which drafted the original procapitalization paper, states, "The misconception here is that this is going to result in wholesale capitalization, and that that would create some credibility gap for the software industry. The fact is, the standards for capitalization are hard to meet and most small companies would not even be in a position to capitalize R&D expenses. What we are trying to do is create some standards so they will be in place when the industry grows into them."

Whether or not the industry would grow into them seems to be the question the opponents raise. And no matter which way the FASB goes, the dispute has damaged ADAPSO's relations with the industry. One more thing to blame on the bean counters. ©

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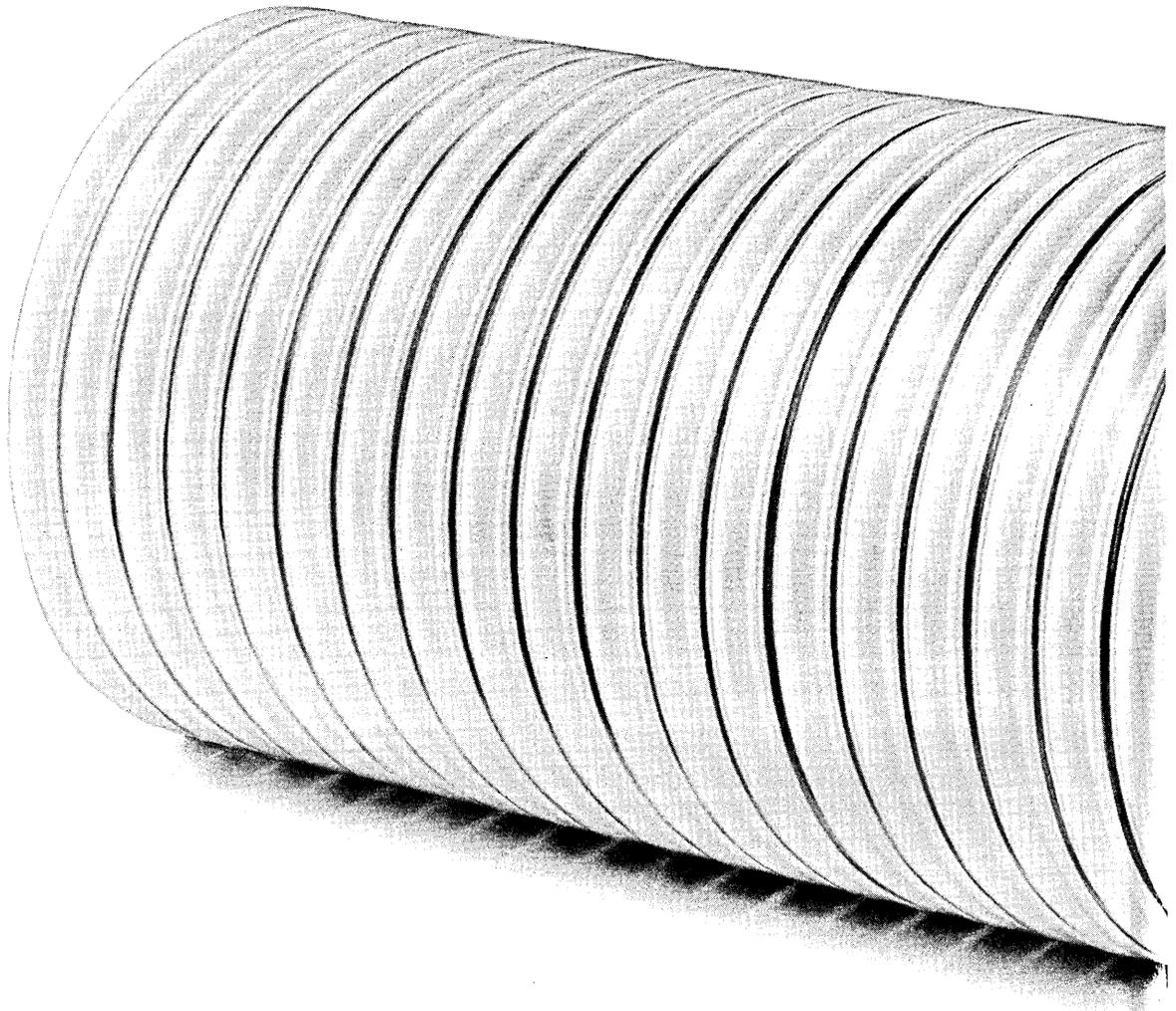
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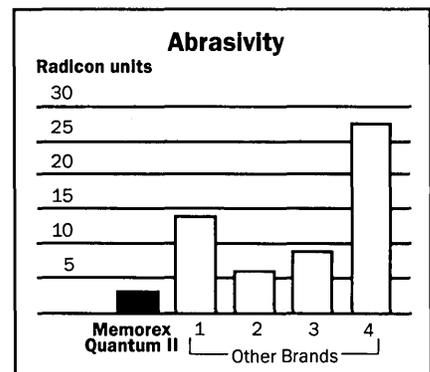
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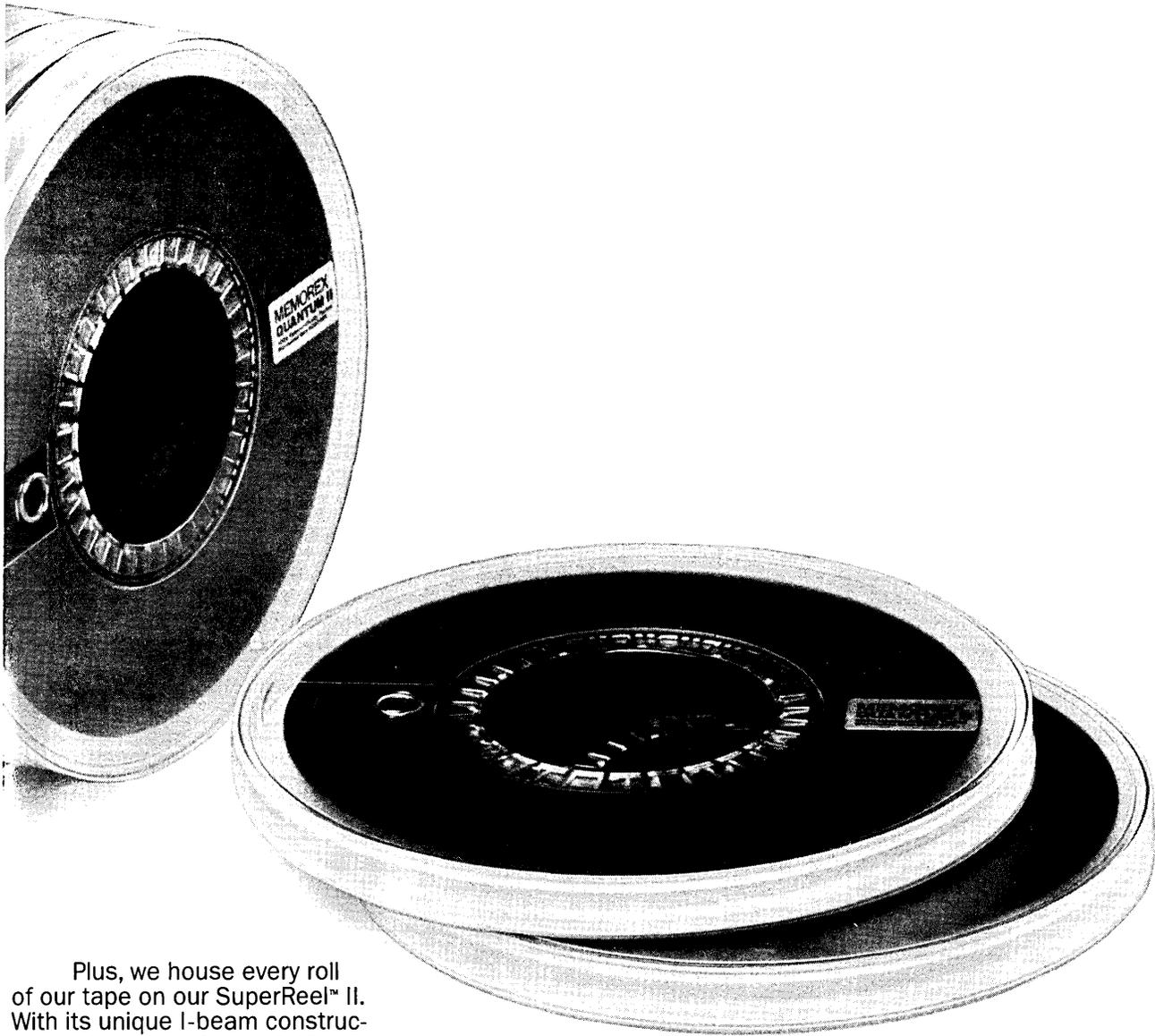
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NEWS IN PERSPECTIVE

BENCHMARKS

EASES CONTROLS: The Department of Commerce has implemented a new series of rules designed to eliminate controls on exports of many popular personal computer models, such as the Apple II series and the TRS-80. If you can buy them at the corner computer store, the theory goes, why try to stop them from entering Eastern Bloc countries? The regulations also free up all computers with processing data rates (PDRs) below 2Mbps and with memories that don't exceed 1.15Mb. Also free at last are embedded computers with PDRs below 28Mbps and incorporated computers—those that can be removed from a product without impairing its function—with rates below 5Mb, provided the products into which they are incorporated are not themselves subject to licensing. The rules comply with decisions made last summer by the 15 participating nations in the Paris-based Coordinating Committee for Multilateral Export Controls (CoCom), which was formed to regulate the flow of technology to Communist countries. In return for easing restrictions on some products, Commerce officially enslaved “sophisticated” or “sensitive” software by adding it to the Commodities Control List (CCL). The move means that West-West shipments of such software, including Ada, CAD/CAM, and artificial intelligence programs, will be subject to agency review. “They're written in Greek, and we're trying to figure out exactly what they mean,” says a government relations executive for a major mainframe company. “But it's clear they've added to the regulatory burden in a manner not called for by the CoCom agreement. Now they want to control software shipments to friendly countries. By adding it to the CCL, they've short-circuited the whole technical data process. It just isn't done this way.” It is now.

BUYS OXFORD: Continuing its push into the software industry, Martin Marietta Data Systems purchased Oxford Software Inc., a privately held firm that specializes in on-line application development products. The Oxford acquisition places MMDS among the five largest independent software vendors, the company said, although it would not disclose the value of the transaction. Oxford's UFO application development system is installed in 2,700 sites worldwide, according to Paul Grabscheid, director of marketing for the Information Technology division. The product complements the Mathematica RAMIS II query system, he added, since only about 10% of all UFO sites have RAMIS. Oxford, located in Hasbrouck Heights, N.J., becomes the fifth unit of

MMDS's Information Technology division, based in Greenbelt, Md. The other four units, formed during a reorganization last summer, are General Business Systems, which sells administrative and financial applications software; Manufacturing Systems, which sells manufacturing software; Merit Software, which sells micro-to-mainframe pc packages; and Mathematica, which sells end-user DBMS and query systems.

GIGAFLOPS: Trading claims of having the world's fastest engine, both Hitachi Ltd. and Fujitsu Ltd. have announced development of computers capable of performing more than 1 billion floating point operations per second (GFLOPS). Fujitsu's VP-400, which was tested by the National Aerospace Laboratory of the Science and Technology Agency in Japan, is more than twice as powerful as the company's previous high-end supercomputer, the VP-200, Fujitsu said. The VP-200 can perform 500 MFLOPS, while the low-end VP-100 can perform at half that speed. The company said it expected an order for the VP-400 later this year, but did not indicate from whom or when the machine would be delivered. Hitachi, meanwhile, announced its next-generation supercomputer program, whose goal is a 1TERA-FLOPS machine. Such a machine would be about 1,600 times faster than the current Hitachi top end, the 630 MFLOPS S-810-20. It also plans a 1 billion instructions per second general purpose processor. In the U.S., meanwhile, Control Data Corp. completed the spinout of its supercomputer operations to its ETA Systems Inc. affiliate. The Minneapolis mainframer shifted all sales and marketing functions to ETA, which is 90% owned by CDC. The shift affected about 50 people, who had the option of switching to ETA or to similar positions with CDC's Cyber 180 mainframe group. ETA was formed in mid-1983 as an R&D effort to develop and build succeeding generations of the Cyber 205 supercomputers.

REORGANIZES: International Business Machines Corp. further consolidated its booming personal computer business into the mainstream of the company by shifting all marketing of the PC family to the National Distribution Division. The Entry Systems Division lost its retail marketing arm in a move the company described as necessary because of its huge growth—estimated 1984 PC revenues of more than \$6 billion. Outsiders noted that the company has been embarrassed by reported malfunctions of the new PC AT model, and may have wanted to reduce the division's responsibilities in order to prevent future problems. Entry Systems president Philip Estridge claims that he

initiated the changes. Part of the reorganization involves fragmenting systems development into subsets like office systems, communications, and interfaces. The new organization also will help IBM accomplish its goal of distributing higher-end processors like the System/36 through retail and value-added reseller channels.

BOUNCING BACK? The fortunes of Franklin Computer Corp. are beginning to rise. The Pennsauken, N.J., manufacturer of Apple II-compatible pcs is planning to bring out its Ace 2000 micro this summer. The machine would use the new FDOS 2 operating system, which is about 96% compatible with the Apple II computers, according to president Morton E. David. The company has maintained a network of 300 dealers despite demanding cash in advance or on delivery for shipments.

POPPA TO STORAGETEK: Ryal R. Poppa is coming back to the computer industry, to what may be one of the most daunting posts in industrial history. The directors of bankrupt Storage Technology Corp., Louisville, Colo., named the former senior official of Pertec Computer and Mohawk Data Sciences as the new chairman and chief executive. The 51-year-old Poppa faces the formidable task of trying to save what was once a billion-dollar-a-year peripherals vendor but now is only a fraction of its former size: for the first nine months of 1984, STC lost \$86 million on sales of \$405 million. Banks and other creditors of the beleaguered company refused to extend more credit, forcing the Chapter 11 bankruptcy petition last October. Until recently chairman of a Minnesota industrial equipment company, BMC Industries Inc., Poppa replaces Jesse Aweida, who with his brother and other IBM researchers founded STC in 1969 and built it into a high-flying manufacturer of plug-compatible tape and disk peripherals for large IBM machines. The company also marketed a line of printers and other products on an oem basis. All went well until 1983, when the company became overextended due to unsuccessful ventures like a CMOS-based mainframe and an optical disk storage system. Shipping delays and malfunctions in a new IBM-compatible thin-film disk storage system also severely wounded the company (see “Probing Pcm Perils,” Jan. 15, p. 30). Poppa is expected to sell off profitable assets like the tape drive line, drop the optical disk business, further cut personnel ranks, and otherwise reduce expenses to improve the company's cash flow. Also expected is a crash effort to boost shipment rates for STC's 8380 line of thin-film disk storage devices that resemble IBM's top-of-the-line 3380s. ©

WORLD WATCH

BONN--The German Bundespost, often considered the world's strongest bastion of PTT power, is secretly preparing a plan to dismantle and decentralize its cumbersome operational structure. The bulky Bundespost, which is trying to get into step with the computer age, has asked a local consulting outfit to recommend the paths it should take on the road to reorganization.

PARIS--It looks like French firm Bull will be the first to bridge the gap between IBM's OSI and ISO's OSI. Slated for release next month, the gateway, code-named Janus, will link Bull's Distributed Systems Architecture and SNA via an OSI interface.

TOKYO--Hearings held this month by Japan's Ministry of Posts & Telecommunications give foreign vendors a token opportunity to mouth off about the island nation's interconnect standards. Sources view the MPT move as a superficial attempt to placate outsiders hoping for a shot at the lucrative local market. MPT, of course, may also want to smooth the ruffled feathers of the tough talking feds who are threatening retaliation against the Japanese on U.S. telecom turf.

LONDON--The Thatcher government's noninterventionist notions are likely to come under fire once again when a long-awaited government report on Britain's shortage of high-tech pros hits the streets. The controversial report could be a real hot potato, since it's expected to come out in favor of government funding to remedy the U.K.'s high-tech people problem.

STOCKHOLM--Swedish users may get a big break on maintenance fees if computer service bureau association SEBRO and insurance company Skandia come through on their promise to slash these charges by up to 50%. The Skandia policy would establish discount deals with third-party maintenance outfits.

NEW DELHI--Having relaxed its restrictive trade policies, the Indian government is looking for foreign collaborators in the mini, micro, and software sectors. Outsiders can now do business in the country as long as they link up with a local company.

REYKJAVIK, ICELAND--In one of the few places Big Blue could be frozen out of the market, local micro maker Atlantis is making it big with its PC clone. The machine could be a surefire hit in this far northern realm, since it can handle the complex Icelandic character set -- something IBM probably wouldn't be interested in tackling.

MOUNT EVEREST--While some corporate chiefs go in for the tame game of golf, others prefer more daring pursuits. Take for example Ralph Høybakk, president of Norwegian terminal maker Tandberg Data. Right now, the Viking-spirited Høybakk, along with nine other top climbers, is scaling his way up the southern face of Mount Everest. This could well be the peak of his career.

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Just as important, the 200 Series also features three levels of security to give you comprehensive control over user access.

Special password protection. Pre-established parameters that restrict access to authorized limits. Plus, the added protection of built-in automatic callback to users—*at their specific device*—for complete security.

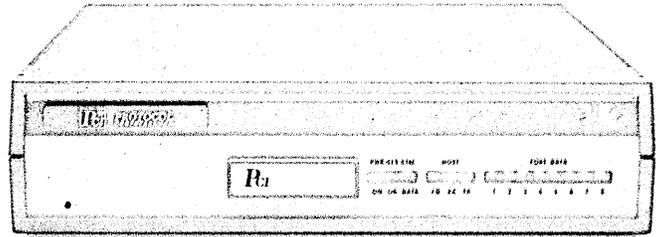
So now, if someone tries to gain mainframe access from an unauthorized device, they can't.

With the 200 Series, you can choose your users. And lock out intruders.

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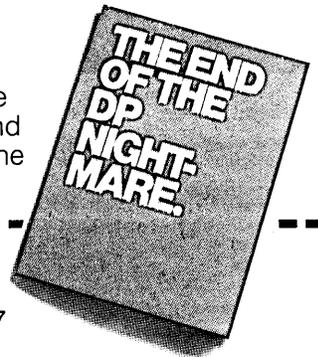
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NIGHTMARE.

CIRCLE 54 ON READER CARD

The rigor of mathematics is needed to cure the ills of current programming practice, say leading theorists.

BRIDGING THE SOFTWARE GAP

by John W. Verity

"Everybody expects to find errors in their software. They take it for granted. This should not be so. Software should be as reliable as other products."

So says Professor C.A.R. Hoare of Oxford University's Programming Research Group, a leading thinker in the science of programming.

"I'm concerned with the common acceptance of programming errors as a fact of life," he says. Professional architects in the building trade generally know early on whether their structures will be successful, Hoare points out, and there is no reason computer programmers shouldn't have similar confidence in what they build.

Structures. The word conjures up the term structured programming, which in various forms was to have solved the industry's software development problems long ago. The idea was to add precision to the development process, break it down into easily identifiable steps and processes, and make possible the construction of bigger and better programs than ever before. The December 1973 issue of *DATAMATION* was largely devoted to structured programming—a revolution, it was called. Guest editor Daniel D. McCracken called it a "major intellectual invention."

Now, more than 15 years after the term came into popular usage, there seem to be more structured methodologies, programming tools, and spotlit software gurus than ever before. Obviously, the software development problem remains unsolved.

It may be getting even worse. According to one group of observers, "Current software practices are a serious bottleneck in the industrial development of the U.S., and the perpetuation of these practices represents an even more serious trend in international industrial competition in the future. Software costs were less than 10% of hardware costs in 1955, were three times as great as hardware costs in 1975, and are projected to become nine times as great as hardware costs in 1985."

The relief of this bottleneck, says the group of industrialists, scientists, and teachers who prepared the COSERS (for computer science and engineering research

study) report for the National Science Foundation in 1981 under the title "What Can Be Automated?," is to be found in mathematics. From the rediscovery that "the mathematical method is indeed the most effective way to come to grips with complexity" has arisen the notion that "we should reshape our field of programming in such a way that the mathematicians' methods become equally applicable to our programming problems, for there are no other means," Professor Dr. Edsger W. Dijkstra of the Netherlands has written.

The COSERS report suggests that mathematically correct techniques of programming "will lead to such significant improvements in programming productivity and in software dependability that pure economics will force its adoption in the long run."

Hoare, Dijkstra, and other theorists, such as Professor David Gries of Cornell University, say there are indeed powerful mathematical methods available to help build computer programs. The problem is, these methods require new ways of thinking, new ways of analyzing problems, not just the application of another "methodology" or "programming tool."

"Previously you were just supposed to learn programming by watching. We believe there are more scientific methods that show principles and guidelines for developing correct programs," says Gries. "The difficulty is that these techniques require a reeducation of the programmer. Nobody wants to think how they program. It's much easier to look at a new tool than to learn how to think right."

Adds Hoare, "Major advances in reliability and quality can be made by people who are intelligently equipped and given an education of a fairly deep kind."

THE THREE WISE MEN SPEAK OUT

The three might be considered the three wise men of structured programming, for, they have continued to speak out in various forums—books, lectures, technical papers—about the necessity for "right thinking" about the programming task as opposed to the mindless application of the latest programming tool. Their message often falls on apparent-

ly deaf ears, as related by Dijkstra in his witty, privately published newsletter: " 'But that would require people to think!' [exclaimed a member of his audience]. It was as if I had made an indecent proposal."

(Dijkstra's *EWD* newsletter is something of a marvel in this word processed world: its handwritten pages are as punctilious as the thoughts they convey. See "Fruits of Misunderstanding" for a typical *EWD* essay.)

The most visible result of the structured programming boom launched 15 years ago was the flood of programming tools, many of which were promoted as solving the software development problem by having workers manipulate diagrams or fill in the the blanks on prewritten forms. Many of these tools have been oversold, say critics, and have not yet been shown to aid the writing of correct programs as much as helping managers organize the programming process in a seemingly scientific manner.

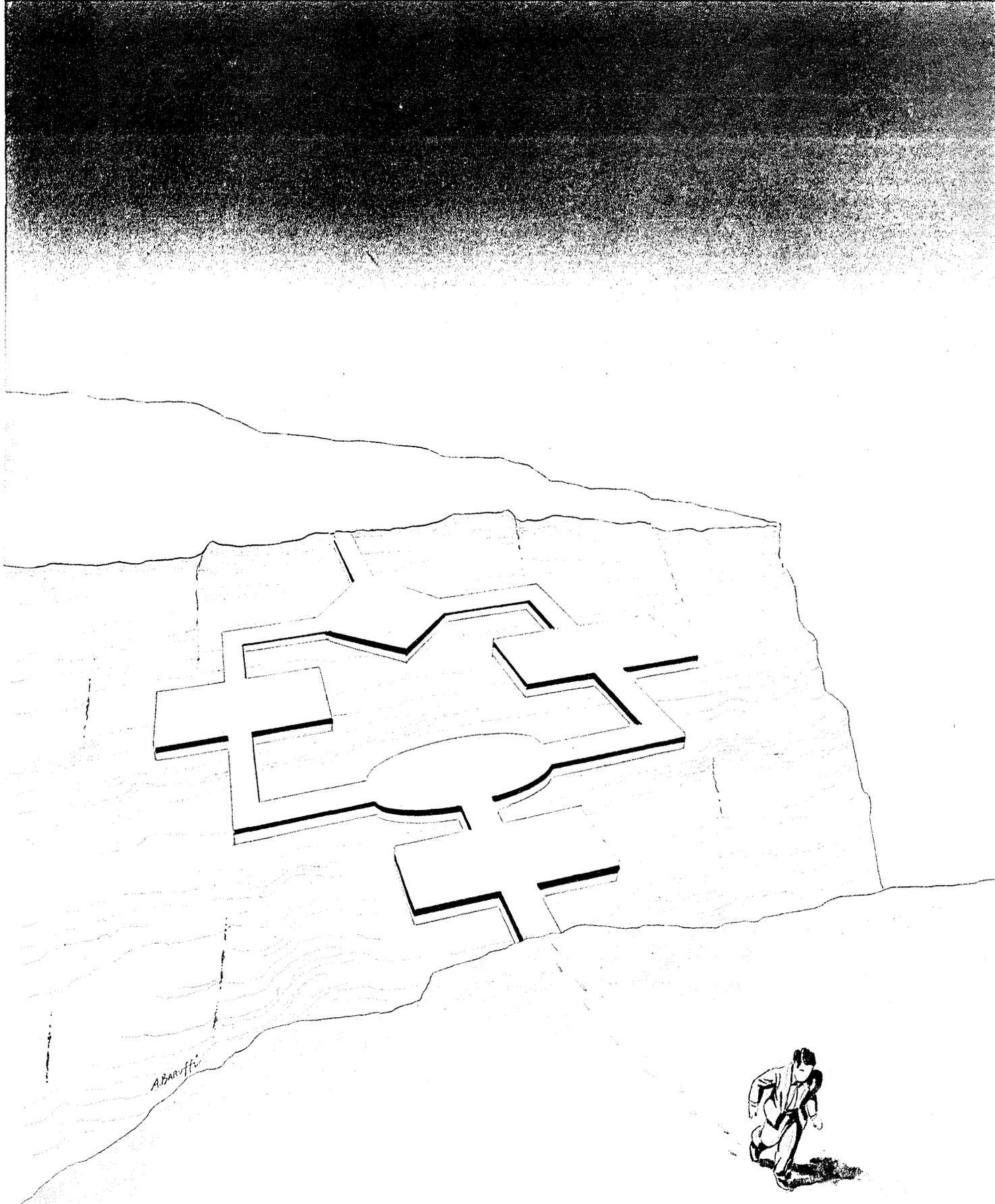
Says Hoare, "Some kinds of tools can be very valuable but the genuine improvement [in software development] will come only if the tools are used in an effective way. It's going to require a higher level of skill than people imagine. But the methods that lead to more reliable software can be taught in the usual manner, by proper, serious education. It requires an underpinning of theory and a larger amount of practice and examples."

The Oxford professor notes that many professional programmers build programs correctly "without knowing they're using mathematics."

But why this demand for programming tools, this desire for easy solutions to what must obviously be an intellectually complex task?

"People think software should be easy and cheap," says Ken Orr, a successful programming methodologist based in Topeka, Kans., and coauthor with E.Z. Systems of the tongue-in-cheek *One-Minute Methodologist*. "Tools are tangible. You can give courses to people, but if you show them a book, you can say 'This is a methodology.' That makes it official. If you build the methodology into a machine, that makes it even more tangible: 'That's our

ILLUSTRATION BY ANDREA BARUFFI



ABARFF

FRUITS OF MISUNDERSTANDING

Professor Dr. Edsger W. Dijkstra publishes his own newsletter, which is notable for its frankness, wit, and clarity, not to mention its being handwritten. Known by those on its limited distribution list as the EWD, the newsletter covers topics ranging from the theory of programming to Dijkstra's many travels through computerdom. The following essay comes from EWD-854, written May 19, 1983. It was published by the German magazine Elektronische Rechenanlagen in its twenty-fifth anniversary edition. Dijkstra is currently Schlumberger Centennial Professor of Computer Science at the University of Texas, Austin.

Some things, it seems, can only happen in the world of computing. The design of a new product is announced and the world is full of high expectations, but when the product is ready and people start to use it, it fails to meet in a most blatant manner its main objective. It is a failure and one would expect it to be recognized as such. Nothing of the sort: the original main objective is kindly forgotten and the vast majority believes the product to be a great success.

You may have another example in mind. I was referring to COBOL, whose main objective was to make the professional programmer superfluous and which is now the main vehicle for three out of four professional programmers. In the name of "ease of programming," "readability," "understandability," its verbosity was considered a virtue; in practice that same verbosity turned out to be one of its striking defects.

COBOL was not an isolated case. When in the 60s the promise of salvation by means of "higher-level" programming languages did not materialize, the slow response in batch processing was identified as the culprit that made efficient debugging impossible, and in the name of the fast response needed for debugging, "interactive programming" was introduced on a large scale. Its spread seems to have been totally unaffected by the fact that, in the meantime, controlled experiments had demonstrated that the beneficial effect of interactive debugging facilities on "programmer productivity" was at best marginal.

But all this was long ago and won't happen again, because in the meantime we have discovered

- that interactive programming failed only because the communication channel between "end user" and "workstation" was of too narrow a bandwidth: high-resolution color screens and voice communication will overcome that limitation;
- that PL/I failed because it did not cater to the needs of the "embedded programmer," and because it was insufficiently "portable" to be acceptable as a worldwide standard; these problems are now

solved by Ada;

- that the now generally admitted difficulty of rigorous programming is not so important after all, since it only applies to "programming-in-the-small"; in the "real world" the problems of "programming-in-the-large" are much more pressing and for those "software engineering" is developing "programming support environments" with enough "intelligence" and "expert knowledge."

The inventions of the slogans that will explain in 1990 why these three dreams turned into nightmares is left as an exercise for the reader.

The brutal fact is that a large part of the history of computing can be written in terms of multimillion-dollar projects that failed. That may hold for other disciplines as well, but what seems unique to computing is that in most cases the future failure was already obvious at the moment the project was conceived. It is a long history of castles in the air, the one after the other, and the phenomenon is so persistent that it needs an explanation.

The high failure rate could be explained by the assumption that the world of computing is largely populated by conscious quacks and deliberate frauds, but that is an explanation I reject because the underlying assumption is, first of all, too bitter to be healthy and second, wrong: by and large, the hopes are each time genuine. We obviously observe a widespread misunderstanding whose persistence is so remarkable that we cannot ignore it.

How do most people understand? We seem to order our impressions to our satisfaction. Today the trees in our garden are very restless; also the chimney is very noisy. But these observations are neither disquieting nor disturbing. I have my satisfactory way of coping with them: by booking them, as usual, under the heading windy I can almost ignore them. And the next time I am taken on a sailing trip and the ocean waves are very restless, it is fine with me: after all, what is the difference between waves of water and waves of foliage? There is no difference if it suits our purpose not to introduce it.

As we grow up we acquire our habits of thought and develop our metaphors (Did you notice that I described the trees as restless—that was unintentional!)—they are characteristic of how we order our impressions and of how we use language.

This scenario tries to capture the most common way in which we seem to cope with novelty: when faced with something new and unfamiliar we try to relate it to what we are familiar with. In the course of the process we invent the analogies that enable us to do so.

It is clear that this way of trying to understand does not work too well when we are faced with something so radically

new, so without precedent, that all analogies we can come up with are too weak and too shallow to be of great help. A radically new technology can create such circumstances, and the widespread misunderstanding about programming strongly suggests that this happened with the advent of the automatic computer. (Nuclear weapons could very well provide another example of discontinuity with which thinking in analogies cannot adequately cope.)

There is another way of approaching novelty, but it is practiced much more rarely. Apparently it does not come "naturally" since its application seems to require a lot of training. In the other way one does not try to relate something new to one's past experience—aware of the fact that that experience, largely collected by accident, could very well be inadequate. Instead, one approaches the novelty with a mind as blank as possible and tries to come to terms with it on account of its own internal consistency. My guess is that computing is such a novelty that only this second approach is viable, and that consequently we must try to free ourselves in this case from the habit of approaching the topic in terms of analogies.

To ease that process of liberation it might be illuminating to identify the most common metaphors and analogies.

I think anthropomorphism is the worst of all. I have now seen programs trying to do things, wanting to do things, believing things to be true, knowing things, etc. Don't be so naive as to believe that this use of language is harmless. It invites the programmer to identify himself with the execution of the program and almost forces upon him the use of operational semantics.

We should never try to come to grips with a huge set by looking at "enough" of its members, because that is so hopelessly ineffective. Ideally, the individual members disappear from the consideration and one deals with the definition of the set itself. In the case of understanding a program, we should not look at individual computations; ideally—i.e., for the sake of mental efficiency—we should deal with the program in its own right, temporarily ignoring that it also permits the interpretation of executable code. All this is well known—it is called the Axiomatic Method. The point to be made here is that the use of anthropomorphic terminology erects a barrier for its application. One of the fruits of anthropomorphism in computing is that the most effective way of developing programs and reasoning about them is rejected on such grounds as being counter-intuitive or too abstract, and that is very serious.

I skip the numerous confusions created by calling programming formal-

isms languages, except in a few examples. We have had the general who wrote, "Obviously, NATO is not interested in artificially simplified programming languages such as Pascal." It also gave birth to the idea that a "living" programming language is better than a "dead" one. Not so long ago a branch of a large industry had received from the central facility of the company a program it had asked for, but the program had been written in Pascal. The branch had an external software house translate it into FORTRAN "because Pascal was not maintained."

And now we have the fad of making all sorts of systems and their components "intelligent" or "smart." It often boils down to designing a woolly man-machine interface that makes the machines as unlike a computer as possible: the computer's greatest strength—the efficient embodiment of a formal system—has to be disguised at great cost. So much for anthropomorphism. (This morning I declined to write a popular article about the question "Can machines think?" I told the editor that I thought the question as ill-posed and uninteresting as the question "Can submarines swim?" But the editor, being a social scientist, was unmoved: he thought the latter a very interesting question too.)

Another analogy that did not work was pushed when the term software engineering was invented. The competent programmer's output can be viewed as that of an engineer: a nontrivial, reliable mechanism, but there the analogy stops.

In contrast to the traditional engineer's mechanism, made of physical components, a program is an abstract mechanism, so to speak, made from zeroes and ones alone. And this difference has profound consequences.

To begin with, a program is not subject to wear and tear, and requires no maintenance. Yet the term program maintenance established itself, only adding to the confusion.

Second, the mechanism being abstract, its production is subsumed in its design. In this respect a program is like a poem: you cannot write a poem without writing it. Yet people talk about programming as if it were a production process, and measure programmer productivity in terms of number of lines of code produced. In so doing they book that number on the wrong side of the ledger: we should always refer to the number of lines of code spent.

Third, in the case of a physical mechanism, higher quality, greater reliability, greater precision, etc., always induce higher cost. In the case of programs, the correlation is the other way round since unreliability and high cost stem from the same source, viz., unmastered complexity.

Finally, the engineer's standard design paradigm does not work. He designs a thing to the best of his abilities, makes a prototype, and tries to see whether it works satisfactorily. If not, he improves the design, and "repetatur." There are circumstances under which such iterative design is defensible; a necessary condition is, however, that the feedback loop can indeed be closed. And we know that with programs this is impossible, except with utterly trivial ones. For many a manager for whom iteration by means of prototypes is the only design paradigm, this impossibility is so disconcerting that they are unable to see it. But is it a miracle that so-called software engineering became a movement devoted to "how to program if you cannot?"

The precomputer object that offers the closest analogy to a well-designed piece of software is an equally well-designed mathematical theory. But also this analogy has its problems. It has a social problem: it is not very popular. Computing systems are sold to people who are expected to consider anything mathematical as the pinnacle of user unfriendliness. It has a more technical problem too.

The bulk of traditional mathematics is highly informal: formulas are not manipulated in their own right, they are all the time viewed as denoting something, as standing for something else. The bulk of traditional mathematics is characterized by a constant jumping back and forth between the formulas and their interpretation and the latter has to carry the burden of justifying the manipulations. The manipulations of the formulas are not justified by an appeal to explicitly stated rules but by the appeal to the interpretation in which the manipulations are "obviously" OK. By and large, the mathematicians form a much more informal lot than they are aware of.

Whether this informality is in general good or bad is neither here nor there. (There exists a type of mathematician with a puritan streak that feels guilty about it.) The point is that in most of computing this informality seems inappropriate when you wish to approach the topic mathematically. There are two reasons for this inappropriateness.

First, by its very nature, each computing system embodies a formal system of some sort. We can of course (try to) hide this fact by giving it so many complicated—and ill-documented—properties that in its capacity as a formal system it becomes an impossible one to use. Often this has happened by accident, sometimes this is done on purpose, the hope being that it becomes a suitable tool for informal use.

Second, the intrinsically discrete nature of symbol processing makes programming such a tricky job that again,

when we wish to approach the topic mathematically, the application of formal techniques becomes a necessity. For safety's sake the reasoning has to be carried out mostly by rule-governed manipulation of uninterpreted formulas: the intuitive justification of these manipulations becomes for combinatorial reasons too error prone.

There is a further aspect in which computing science, when regarded as a branch of mathematics, differs from most of the precomputer mathematics. Traditional mathematics has subdivided itself into many different branches, each with its own specific body of knowledge. (This to the extent that by now the complaint that mathematicians from different branches can no longer communicate with each other is a very common one.) As a branch of mathematics, computing science differs from the others in that the size of its body of relevant mathematical knowledge is relatively small.

There was a time when I blamed the topic's youth for that circumstance and felt that the building up of such a body of knowledge would be a worthy goal. It never acquired, however, the status of one of my explicitly stated purposes in life, and as time went by it just faded away. The relative irrelevance to the core of the topic of much specific knowledge is, in retrospect, quite understandable: it is a direct consequence of the fact that computers are truly general purpose equipment. Extending the body of knowledge faded away as a purpose, when developing the *quo modo* began to absorb much more of my attention than developing the *quod*.

If—as I am beginning to believe—the relatively modest role of knowledge is intrinsic to the topic, this will be reflected in our way of teaching the topic. Since all over the world the practice of mathematics is so tightly interwoven with its teaching, this last aspect in which computing science differs from most of the rest is felt very much.

Many computing scientists are hesitant to stress the mathematical nature of their topic for fear that this will be misunderstood as a plea for "more analysis, more statistics, more algebra and group theory" in the curricula, while what they meant was more rigor, more elegance, more hygiene, and more convincing logic.

And here we have the full scope of our difficulties. With yesterday's words we have to plan today for tomorrow, and the computing challenge being without precedent, the words are no good. If we don't coin new terms, we have to give new meanings to old words.

Regrettably, the world of computing seems better at coining new terms for old meanings (or without any meaning at all).

"We could then face a software gap more serious than the missile gap of some years ago."

methodology box,' you can say."

But, says Orr, just as industrial robots appear to be used best by those companies that have used manual labor best, programming tools will likely be best exploited by programming staffs that are trained properly to think for themselves. "People are always looking for panaceas, but there just aren't any," he says.

The scientific methods aren't being promoted as panaceas, either, the professors claim, but merely as a set of powerful tools for the programmer's kit. Of particular importance is being able to prove a program's correctness before any coding is begun. The proof itself, in whatever notation is used, must only grow linearly, not combinatorially, with the size of the program.

"There is an all-pervasive tendency, down to the hobbyist, to undertake tasks beyond what you can exercise intellectual control over. It's not realized until later [that the system is out of control]. Professionals are not yet able to know if they can deliver on time and at cost," Hoare adds.

He, Dijkstra, and Hoare plan to convene next June in Newport, R.I., to give a 10-day course on their scientific approach to constructing programs. The idea, says Dijkstra, is to "make the participants familiar with the patterns of formal reasoning by means of which one can demonstrate that a program meets its program specification." Moreover, he says, such an approach will provide "powerful heuristic guidance" that will help the programmer "in not getting lost in the complexities of [his] own making."

FORMAL, LOGICAL NOTATION

In other words, he explains, striving to prove a program's correctness formally, using the proper logical notation, can provide insight into its proper construction.

"One should arrange the program efficiently, giving it such a shape that one can argue effectively that it meets its functional specifications. This is far better than program testing," says Dijkstra, a mathematician whose famous criticisms of the GOTO statement in 1968 prompted the entire discussion of structured programming. Though he coined the term, Dijkstra has rarely used it himself and continues privately to rail against those quacks who claim to have discovered the latest Holy Grail of structured programming tools.

Most observers would agree that the term structured programming has lost meaning over the past decade. "People took it to mean what they wanted," comments Gries. He notes, too, that the term is

gerundial and refers mainly to the process of building programs, not to the resulting programs themselves. He notes, however, that research into the subject has centered on four closely related topics: programming methodology, program notation, program correctness, and program verification. Substantial improvements are possible in each category, he says, but getting industry to employ even what's known now will require radical changes in computer science education. Too many people, Gries notes, write software by watching others do it, but without any understanding of, say, the mathematical nature of a loop.

Industry's general ignorance of programming techniques that are firmly rooted in logic is beginning to show as what some refer to as a crisis in "programmer productivity." So seriously is the problem being taken in some circles that the Cold War rhetoric of national security is invoked: "If software practices continue to drift," notes the COSERS report chapter on software methodology, "in 20 years the U.S. will have a national inventory of unstructured, hard-to-maintain, impossible-to-replace programs written in FORTRAN and COBOL as the basis of its industrial and government activities. Conversely, the Soviets may very well have a set of well-structured, easily maintained and modifiable programs in more modern languages, because, in fact, they plan to leapfrog FORTRAN and COBOL. In this case the competitive process of selecting efficient industrial processes among feasible alternatives will be impaired in the U.S. but facilitated in the USSR. We could then face a software gap more serious than the missile gap of some years ago."

No doubt it is partly this fear that has prompted the Defense Department to set up a Software Engineering Institute, which it plans to be an "automated software factory" that will set new standards in the field. The center, which is to be located at Carnegie-Mellon University in Pittsburgh, will hire some 250 engineers who will study software development methods for their applicability to defense systems and then try to persuade private contractors to use them.

The Defense Department is also pushing hard its Ada programming language, which offers many structured programming features—perhaps too many, say some critics—including the notion of packages. Packaging is a way of building program modules whose interfaces are supposedly more straightforward than is possible in previous block structured languages such as Pascal and ALGOL. It is not clear what impact, if any, Ada will have on nor-

mal commercial data processing for it was originally developed for use in embedded systems.

The Newport course, sponsored by Teleprocessing Inc., Boston, will attempt to instill in those attending a new way of looking at the construction of programs. "We're trying to give people mental tools, not supplemental tools, such as debuggers and cross-reference tables," comments Gries.

HELPFUL TO COBOL USERS?

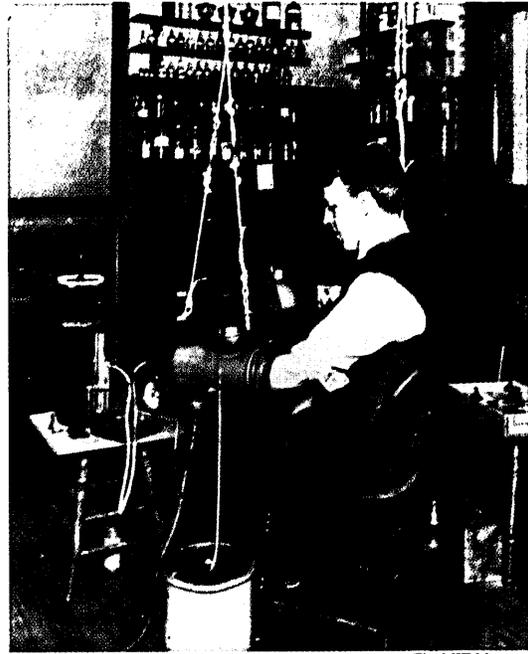
How much of this math-based technique will help the typical COBOL programmer is questionable, the course's organizers concede. ("COBOL is such a vast problem itself," says Hoare.) The new ideas will find most use from those steeped in more elegant languages such as Pascal and even the hotly debated Ada, and will be helpful primarily to those in industry that need to write systems software that must be compact, efficient, and maintainable. The power of the scientific programming method comes not from using a particular language, although that can certainly help in the final writing of a program, but from the prior use of a logical notation with which the structure of the program is proven correct. "[Structured programming] methodology tells us not to program *in* a programming language, but *into* it," notes Gries.

And, as Dijkstra pointed out in 1977 in a characteristically eloquent paper, "Programming: From Craft to Scientific Discipline," the "programming guild" currently numbers some 500,000 to 1 million persons, "for the majority of whom it is totally unrealistic to expect that they can still acquire a scientific attitude. For them the recent developments in programming poses [sic] a serious problem, and their existence presents a serious barrier to the more widespread adoption of the newer programming techniques."

Hoare two years ago urged "ambitious senior programmers of the present day to make the effort now to gain the necessary mastery of the [new programming methods] and so ensure that they will become in the future the effective chief programmers, technical managers, and technical directors of their companies and institutions."

The next few decades, he wrote in a paper entitled "Programming as an Engineering Profession," will be an awkward period because senior programming managers may not be as fully informed of the scientific programming methods as their junior subordinates who are acquiring the skills at university. ©

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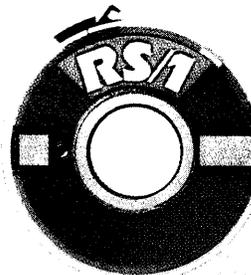
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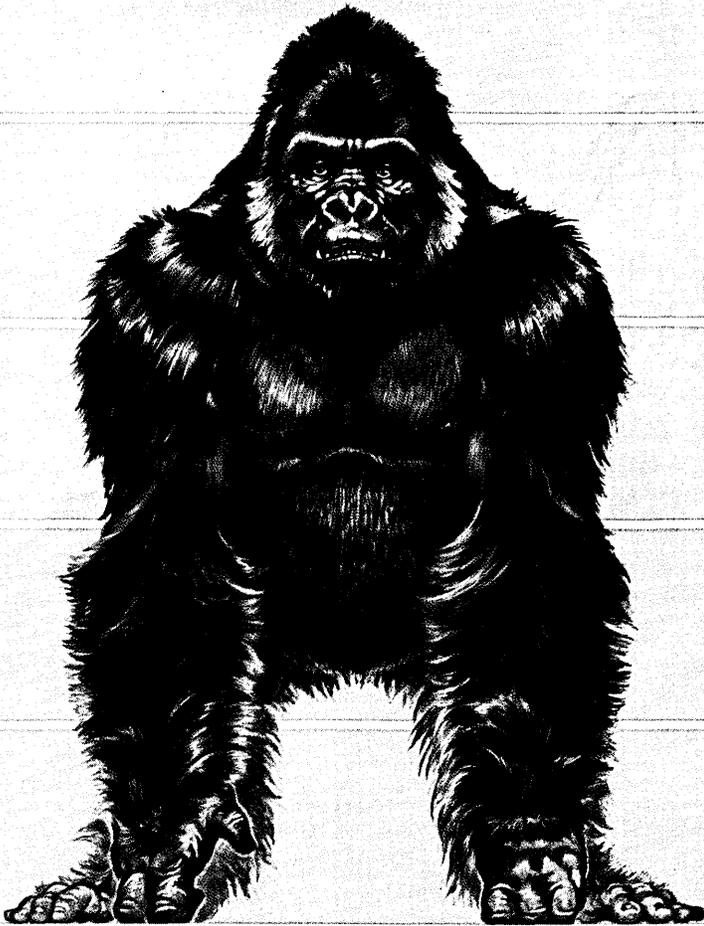
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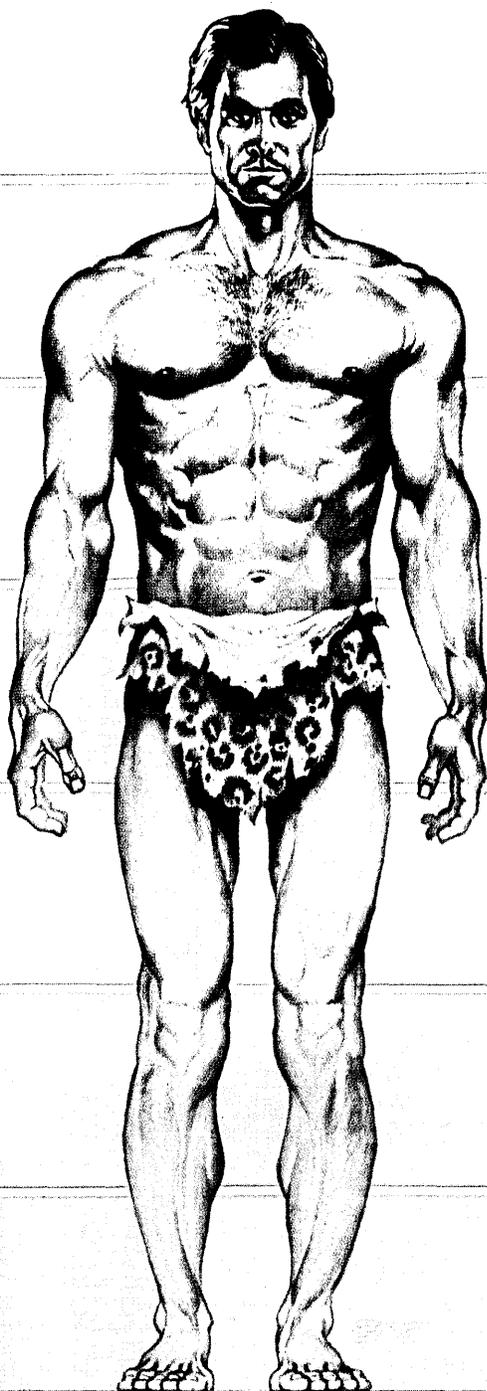


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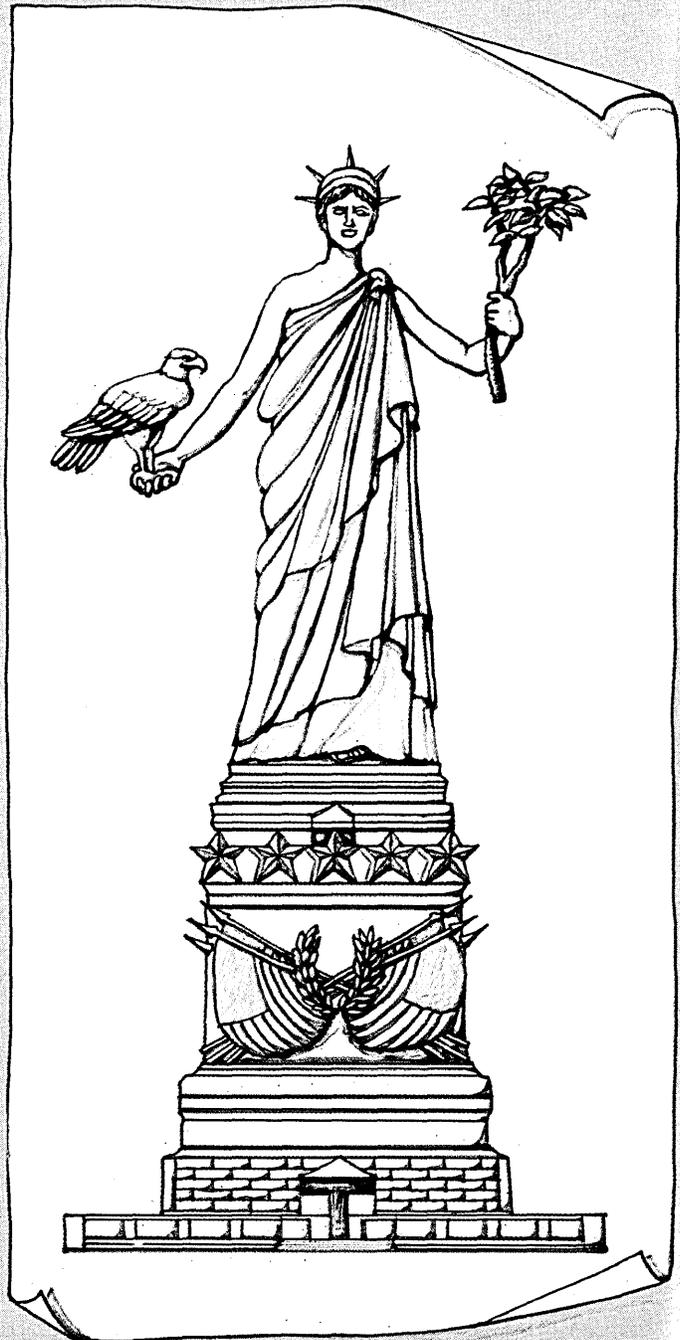
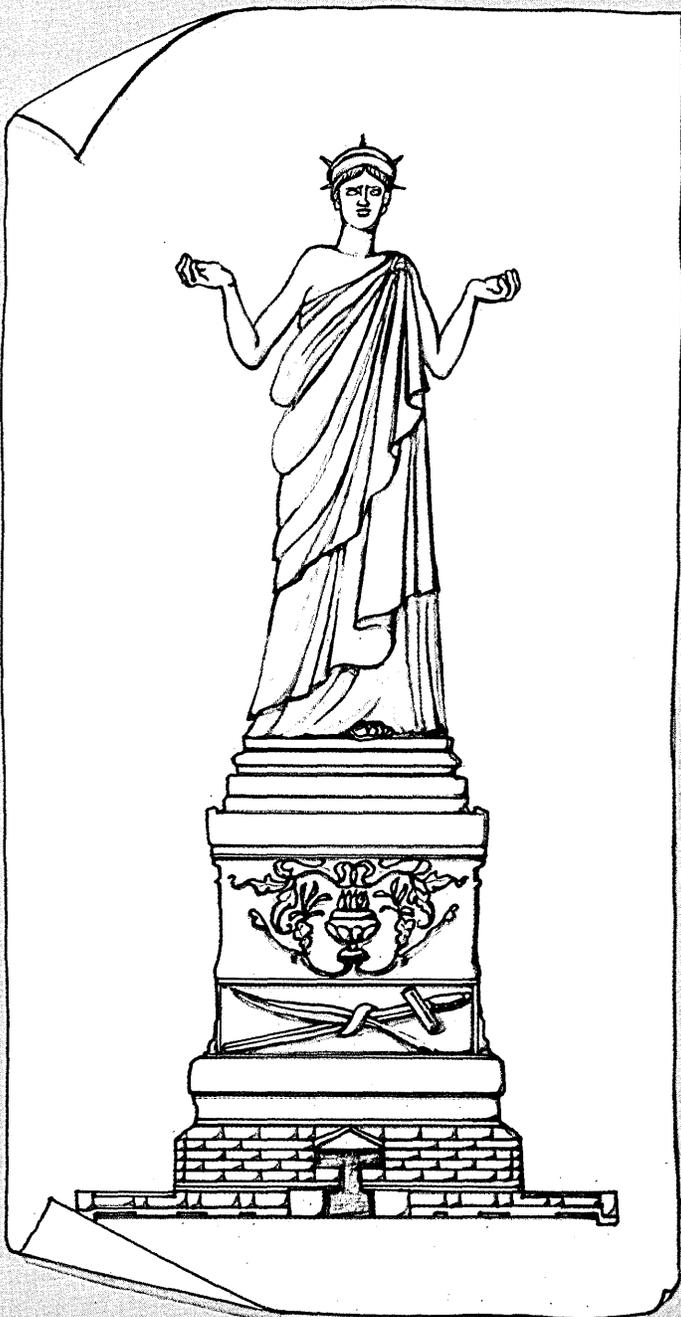
If at first you don't succeed, command-level languages give you the opportunity to try again.

by Ronald L. Cullum

This article is designed neither to praise nor to condemn command-level languages (variously called nonprocedural, fourth generation, or end-user languages). Instead, we will examine a series of successes and failures in order to summarize some lessons and guidelines for the future. These guidelines support a rapid development approach to system creation. Using such an approach can increase the potential of command-level languages.

We do not want to get into a debate about the exact definition of what is or is not a command-level language. Instead, we provide Fig. 1, which lists common products that fall within the general definition. To begin, let's look at some case studies.

ITERATIVE DEVELOPMENT



A large conglomerate. Here, operations were decentralized. At the small corporate headquarters group, a major data processing function was to extract summarized data from various subsidiaries, purify the data, make the data consistent among divisions, and prepare management action reports.

One of the challenges of the system was the variety of source input, such as printed reports, floppy diskettes, electronic mail, tapes, disks, and even punched cards. Although the desired output was quite simple (a few prespecified reports plus a decision support database), unique processing, grouping, validation, allocation, and reclassification had to be performed on more than 30 inputs.

Since the corporate staff already

had extensive experience with a command-level language, they decided to use that language in the new system. They began by developing the system for one subsidiary. After spending about 40 days on the project (including one rewrite), they converted the first subsidiary. Once it was converted, they wrote and converted systems for each of the remaining subsidiaries.

Development took about 10 months and required three people. If the system had been developed with a procedural language, the effort would have required about six work-years.

An insurance company. This specialized company decided to develop a claims processing system in a command-level language. Two factors influenced their decision: the expected productivity gains they

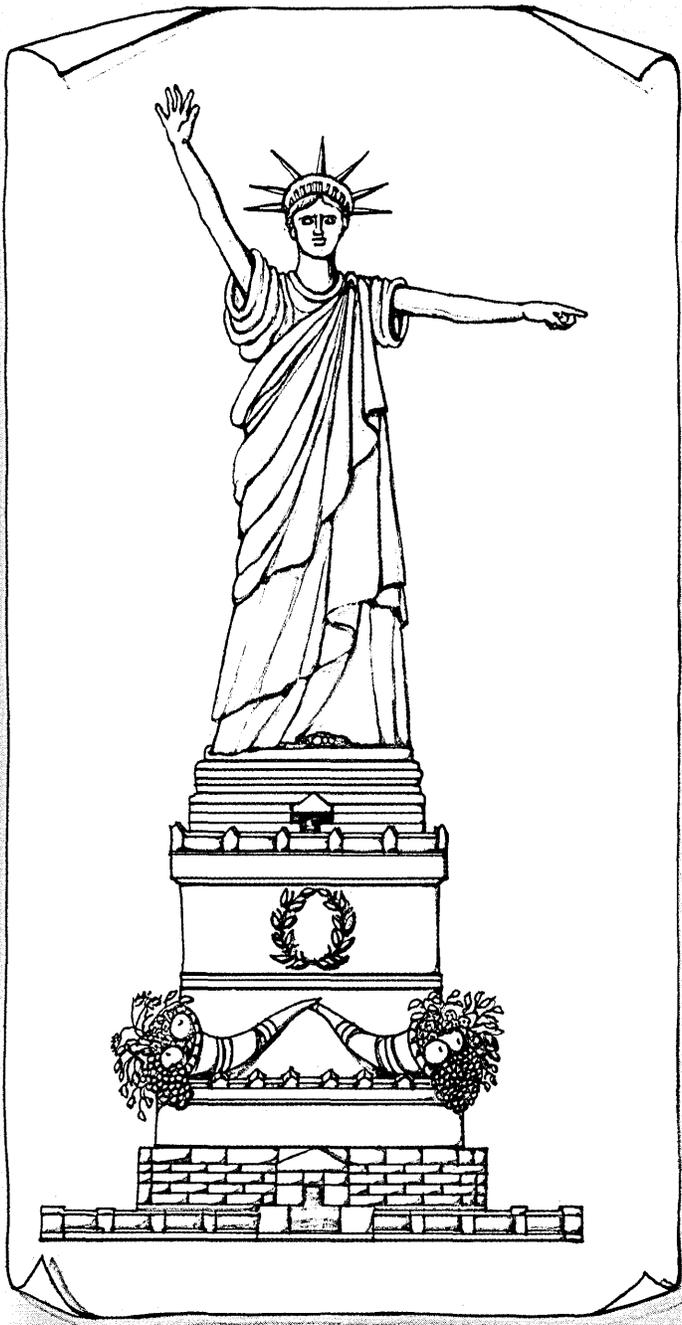
had heard about at public seminars and the simplicity of the policy and claims being processed. They felt that the latter factor limited their risk with the new tool.

A project team of three users and three data processing people spent two months defining the system requirements and designing the system. Another four months were required to implement the system. This project was accomplished in about one fourth the time required for a more traditional approach.

Users began to convert their existing policies and related claims to the new system. The system met all user requirements, simplified the user's work, and improved the quality of claims processing.

After about a quarter of the policies had been converted, the computer was at

ILLUSTRATION BY CYNTHIA STODDARD



When one undertakes a project without understanding the strengths and consequences of a tool, results can be disastrous.

FIG. 1

A SAMPLE OF COMMAND-LEVEL LANGUAGES

PRODUCT VENDOR	PRODUCT TYPE			TYPICAL USER		
	ENVIRON- MENT SHIELDING (1)	I/O RELATED (2)	DATA STRUC- TURED (3)	DP PROFES- SIONAL	DEDI- CATED USER	CASUAL USER
ADS/On-line Cullinet Software Inc.	X			X		
Cross System Product IBM		X		X		
dBase III Ashton-Tate			X			X
Express Management Decision Systems Inc.			X		X	
Focus Information Builders Inc.			X		X	
Lotus 1-2-3 Lotus Development Corp.			X			X
Mantis Cincom Systems Inc.	X			X		
Mapper 1100 Sperry Corp.			X	X		
UFO Oxford Software Corp.		X		X		

(1) Environment Shielding products provide a high-level interface to more complex low-level languages and databases.

(2) I/O Related products provide user logic before and/or after each I/O operation to databases or screens.

(3) Data Structured products build a language around a predefined structure of data (such as a two-dimensional spreadsheet).

capacity and a second computer was acquired. Four months later, this computer was also full. A request for an additional computer was prepared. Top management requested a detailed study to determine if another computer was really needed. They doubted this would be the last request for additional computers.

Specialists were employed to study the situation. The results were verified with the software and hardware vendors. The study found that adding new hardware would result in diminishing returns. It also concluded that even an infinite number of coupled machines would be unable to process the entire application.

The application was rewritten in a procedural language.

A software leasing company. One person manually controlled all the software leases. The main items to be tracked were the lease sites, the components leased at

each site, and the annual maintenance fees. Because of the relatively small size of the system (1,000 leases and 10 to 30 new leases each month), they decided to develop the system on a microcomputer using a nonprocedural language.

One analyst was assigned to work with the user. The analyst had used a product that they both felt could do the job, and together they implemented the lease control system in three weeks.

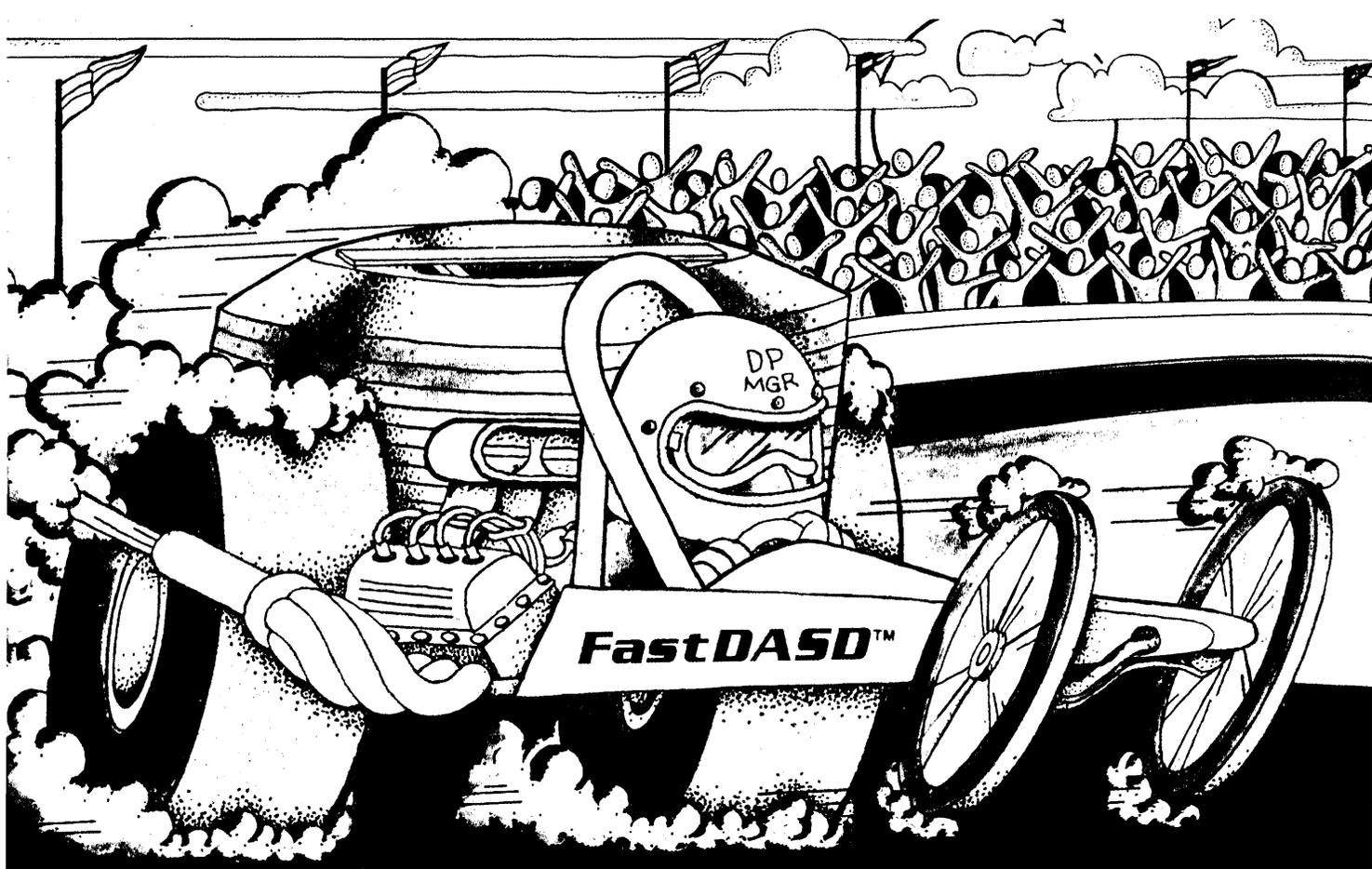
**SYSTEM
DIFFICULT
TO USE**

As the user began to work with the system, he discovered that there were more features he wanted to add to it. With two weeks of additional effort, these features were added. The system became more difficult to use. Many of its features fell into disuse and the quality of the data supporting these features slowly deteriorated.

A decision was made to rewrite the system using a different tool. The user and analyst spent two weeks analyzing the first system's problems, features that were not used, and features to be added. Another month was spent rewriting and converting the system.

The completed system provides not only basic lease management information, but a substantial amount of marketing information that was previously unavailable. The system is considered a great success.

A manufacturing company. User management recognized that it needed a new manufacturing and inventory control system. The current systems were outdated. The users asked their data processing department to develop a new system. After a brief study, dp proposed a manufacturing software package with a total price of more than \$1 million and an 18-month installation schedule.



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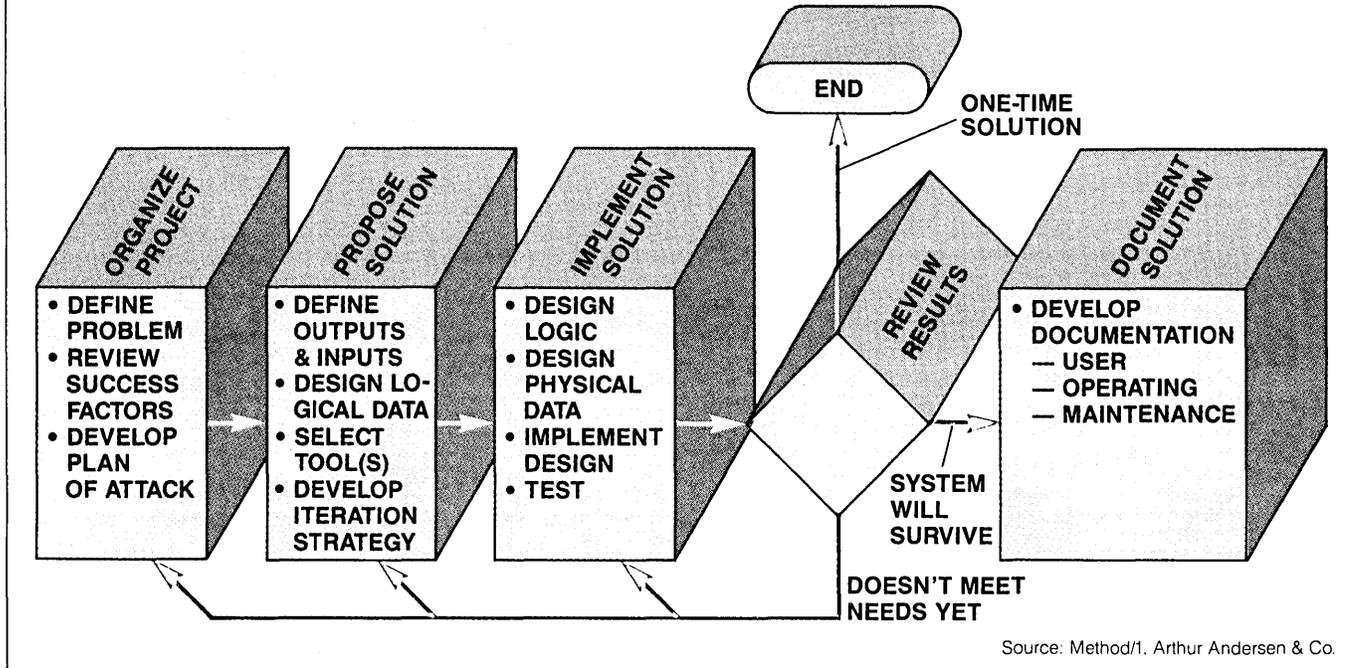
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It is best to delay documentation until the system meets the requirements and will assuredly survive.

FIG. 2

RAPID DEVELOPMENT METHODOLOGY



Source: Method/1. Arthur Andersen & Co.

The users balked. Since user management was familiar with data processing, they had heard about high-level generators and decided to implement the system themselves. Key users and business analysts were trained in the new tool. A dedicated computer was acquired. Eight months later, the new system was up and running. Users loved it—at first.

Then, the inventory began to grow and there were more and more out-of-stock situations. The internal auditors found a large inventory shrinkage due to outdated parts.

Management requested an analysis of the situation. They found that the users, unfamiliar with complex systems design and unaware of some of the advanced features of the language, had overlooked many validation and control functions. Invalid part numbers were being input. Several of the bills-of-material were wrong. Many exception processes were not included in the system and each user found his own way around the situation. The analysis resulted in a decision to rewrite the system.

The package originally proposed by data processing was implemented. This time, the cost was higher because an additional amount of data purification had to be performed on the files.

A distribution company. This company had a great need for new and constantly changing marketing information.

Due to the volatility of the requests and the data, they decided to use a high-level language. Two data processing people were assigned to serve as an information resource center for the marketing department.

Once this function was established in the marketing department, demand for information grew. Nearly all requests were satisfied in a timely manner. The center became very popular. While there were many one-time requests, often the same information was requested repeatedly.

The reputation of the information resource center spread. When another company felt it needed a similar function, it hired the two data processing people. There was no supporting documentation on the information resource programs. The marketing department was severely handicapped until new people could be trained to work with the existing programs or write new ones.

These examples highlight some common positive characteristics, which can be called success factors; they are present in successful projects and absent from the failures.

FACTORS FOR SUCCESS

My experience has shown that the absence of any of the following factors greatly increases the project's chances of failing. The absence of two or more almost certainly invites failure. I

have stated each success factor in the form of a question, which if answered affirmatively, indicates the presence of a success factor.

1. Is management willing to accomplish one small piece at a time?

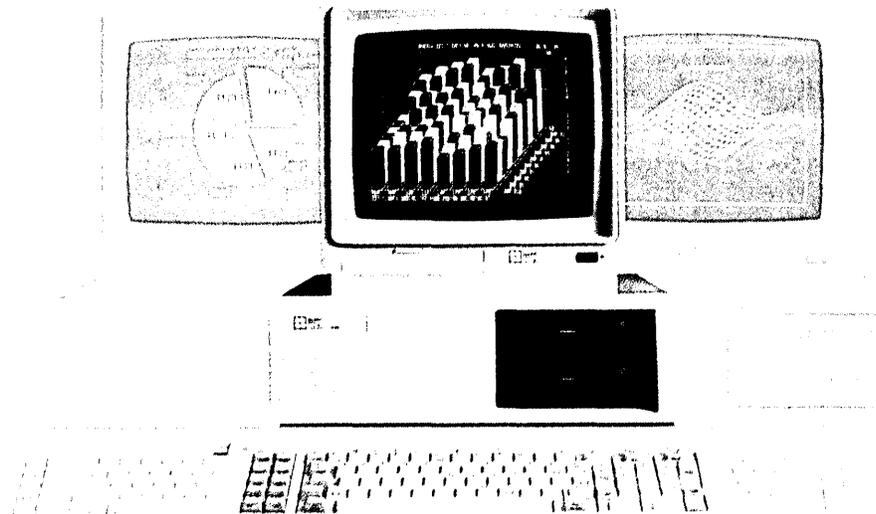
The conglomerate dealt with the subsidiaries individually, writing a procedure and converting them one at a time. They ensured that each program worked before they went on to the next one. Some programs had to be rewritten three times before the team completely understood the data they were receiving. The manufacturing company, however, tried to do everything at once and the sheer complexity of the system overwhelmed the designers.

In general, managers of successful rapid development projects tend to plant seed money in a project to see what comes up. If the initial investment (usually measured in workdays committed) pays off, further iterations or functions are added. Otherwise, the project is scrapped.

2. Is management willing to discard a system if it does not work?

A rapid development approach encourages change. Once users see a result, they often think of new requirements. The key is to minimize the cost of going from one version of the system to the next. In the software leasing company, we saw a system outgrow its original purpose. Based on the knowledge gained from the first version,

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DECIDEDLY BETTER

Command-level languages can be used successfully in different ways and in different environments.

the second version became very successful. In addition, it included many features that would not have been considered had the system been developed via the traditional life cycle, starting with extensive requirements definition and external design tasks.

In other situations, such as the insurance company, management had no choice but to discard the system. Of course, they would have preferred to know about the potential for discarding the system before investing a large part of one year's income.

3. Are the developers knowledgeable about the tool being used?

The information resource center at the distribution company shows the power of command-level languages when used by experts. Yet when one undertakes a project and does not understand the strengths and limitations of a tool, the consequences can be disastrous. At the manufacturing company, major control features were omitted from the system due to the limited experience of the developers. This error eventually caused the demise of the entire system.

4. Are adequate computer resources available?

The insurance company is an example of what can happen when computer performance is not considered. Command-level languages are not necessarily inefficient; they can be quite efficient for some operations. While they move the user (pro-

grammer) away from the actual computer instructions, however, they limit the casual user's ability to predict the performance impact of a command or a specific sequence of commands. We must always expect potential surprises in the performance area.

5. Is management aware of the tentative nature of estimated benefits?

At both the software and distribution companies, management committed resources without a fixed expectation of system benefits. Due to the power of command-level languages and the ease with which changes can be made, the scope of the project often expands beyond initial expectations. Also, because of the potential computer resource requirements, costs can spiral out of control. Management must be aware of this beforehand. The tool should not be discarded because it did not succeed the first time.

6. Do the developers understand the need for adequate documentation?

Documentation is undoubtedly a critical communications tool on large projects and for personnel who maintain systems that they did not develop. But what about other system situations? Documentation can take so long to develop that it can slow down the development of a critical decision support system. The distribution company demonstrated the results of inadequate written documentation.

KNOWING WHEN TO DOCUMENT

The key is to know when to document a system. In a rapid development environment, it is best to delay documentation until the system meets the requirements and will assuredly survive.

To find out if your task is suited to development using command-level languages, answer these six questions. For each negative answer, you receive no points; each positive answer merits two points; and each "not sure" answer wins you one point. If your score comes out to 12, your project stands a very good chance of success through use of command-level languages; a score of 11 means you stand a reasonable chance of success; 10 says there is some chance of success with careful attention to risk areas; and a score of less than 10 means you stand little chance of success using this approach.

Command-level languages can be used successfully in different ways and in different environments. When used by knowledgeable people, they can efficiently replace portions of a system that might otherwise be developed with procedural languages. When used as a prototyping tool during design activities, they can provide users with a much better understanding of how their system will operate.

This article concentrates on ways to use command-level languages to circumvent the traditional system's life cycle. If all of the success factors described are present, an alternative development life cycle can be used to develop high-quality systems in substantially less time. Because of the iterative nature of the life cycle, however, there is no guarantee that the cost of the system during its lifetime will decrease with the rapid development approach. Nonetheless, it can achieve significant benefits. The approach is summarized in Fig. 2.

This technique has proved successful with major system developments, and particularly with decision support systems and personal systems. Keep in mind, however, that it is not appropriate to all situations. ©

Ronald L. Cullum is a partner at Arthur Andersen & Co., Chicago. He has overall responsibility for the development and maintenance of the firm's systems development methodology, METHOD/1. From this vantage point, Cullum is able to consolidate the many experiences gathered from Arthur Andersen's consulting division. For the past four years, he has been actively involved with numerous clients who have developed systems using command-level languages.

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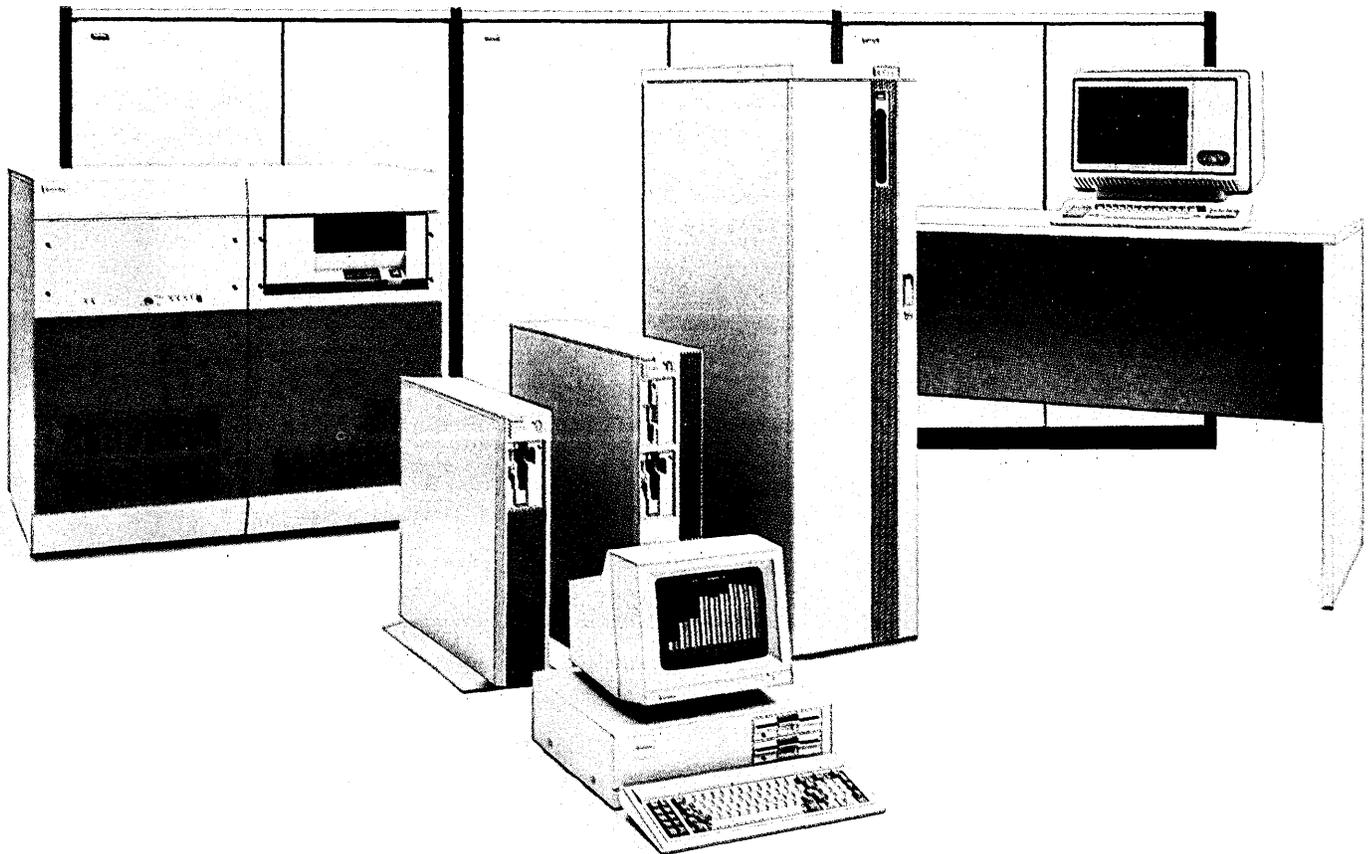
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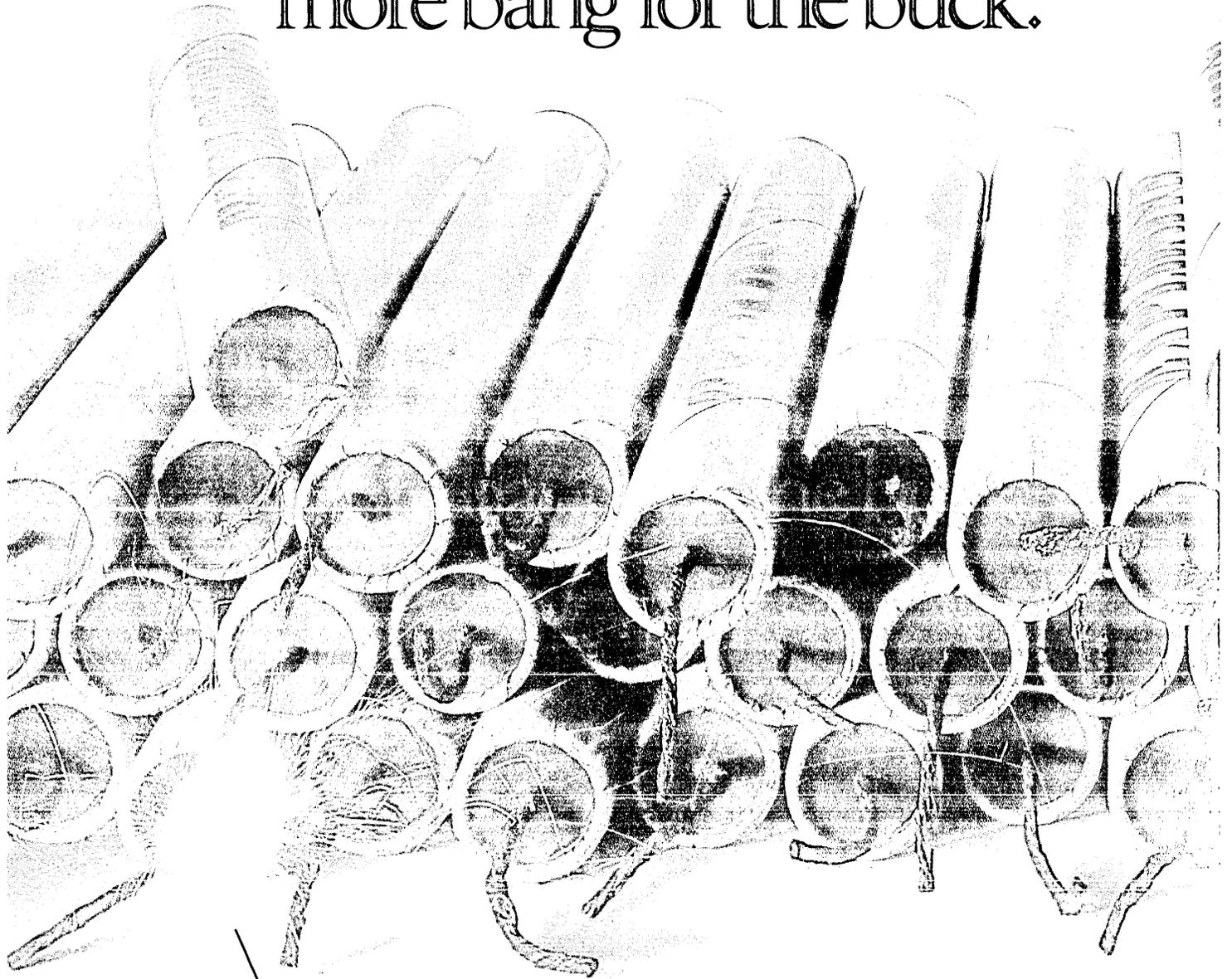
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A new technique helps managers justify projects and demonstrate improved productivity.

MEASURING APPLICATIONS DEVELOPMENT PERFORMANCE

by Steve Drummond

The function points technique measures an application by counting its external inquiries, inputs, and outputs, as well as master files and interfaces to other applications. It is technology independent and can be meaningful both inside and outside the applications development organization.

The managers of applications development at Hallmark Cards Inc., Kansas City, Mo., are continually challenged to demonstrate improved productivity and measure their contribution to the corporation as a whole. Schedule and budget performance show only part of the picture, while system failures and user change requests provide added visibility but a skewed picture.

At the corporate level, the effectiveness of a project is measured against that project's justification—which could be return on investment (ROI), improving control, or meeting the competition. Most organizations subject project proposals to a present value or payback analysis. We attempt to describe the value of intangibles in terms of dollars, and then we compute net present values twice: once with and once without the intangible benefits. In this fashion, the project's sensitivity to abstract benefits can be assessed. Automation of this process on the mainframe or personal computer is relatively simple and inexpensive, and readily provides applications development management with an early indication of a project's potential effectiveness.

Corporate management requires additional gauges of productivity, efficiency, and effectiveness, however. Over the last several years, the standard of lines of code (LOC) has been successfully applied as a yardstick in numerous organizations.

At Hallmark, two lines-of-code statistics are monitored: one in which a count of all lines in a system is recorded, the other

in which only verbs are tallied. Norms, established through experience, are set for new development and for maintenance projects, and permit evaluation of recent projects. One indication of the industry's acceptance of LOC rates as a productivity measure can be found when reviewing vendor software productivity tools. Often such packages are specifically promoted on the basis of enhancing the client's LOC rate.

Using lines of code to measure applications development performance has its shortcomings. Some staff use less code than their colleagues to produce equally workable program solutions, and lines-of-code measures can make them appear less productive when that may not be the case. Applications written in fourth generation languages are not easily compared with those coded in COBOL, nor can applications written in COBOL contrast with those written in PL/I. Multiple sets of statistics are needed. Management reporting for the department can of course be phrased as "so many lines of code implemented for the period" or "x lines of code were supported throughout the year," but it is difficult to relate the technical nature of a line of code to senior management.

Hallmark required another measure of the application development process. Two and a half years ago MIS management met with Alan Albrecht of IBM. Albrecht had pioneered a measure, function points, which addresses many of the shortcomings inherent in the LOC measure. Function points is used in some form at several major corporations, and it is gaining adherents. The function points measure is noted for its technology independence. This is accomplished by counting external functions (or user deliverables), a more precise method than the vague measure achieved by the internal counting of computer commands under the LOC scheme.

Function points specifically identifies these features of an application: exter-

nal inputs such as a customer address change transaction, external outputs such as a printed bill of material report, and external inquiries such as an order status query. Each item is assigned a level of complexity.

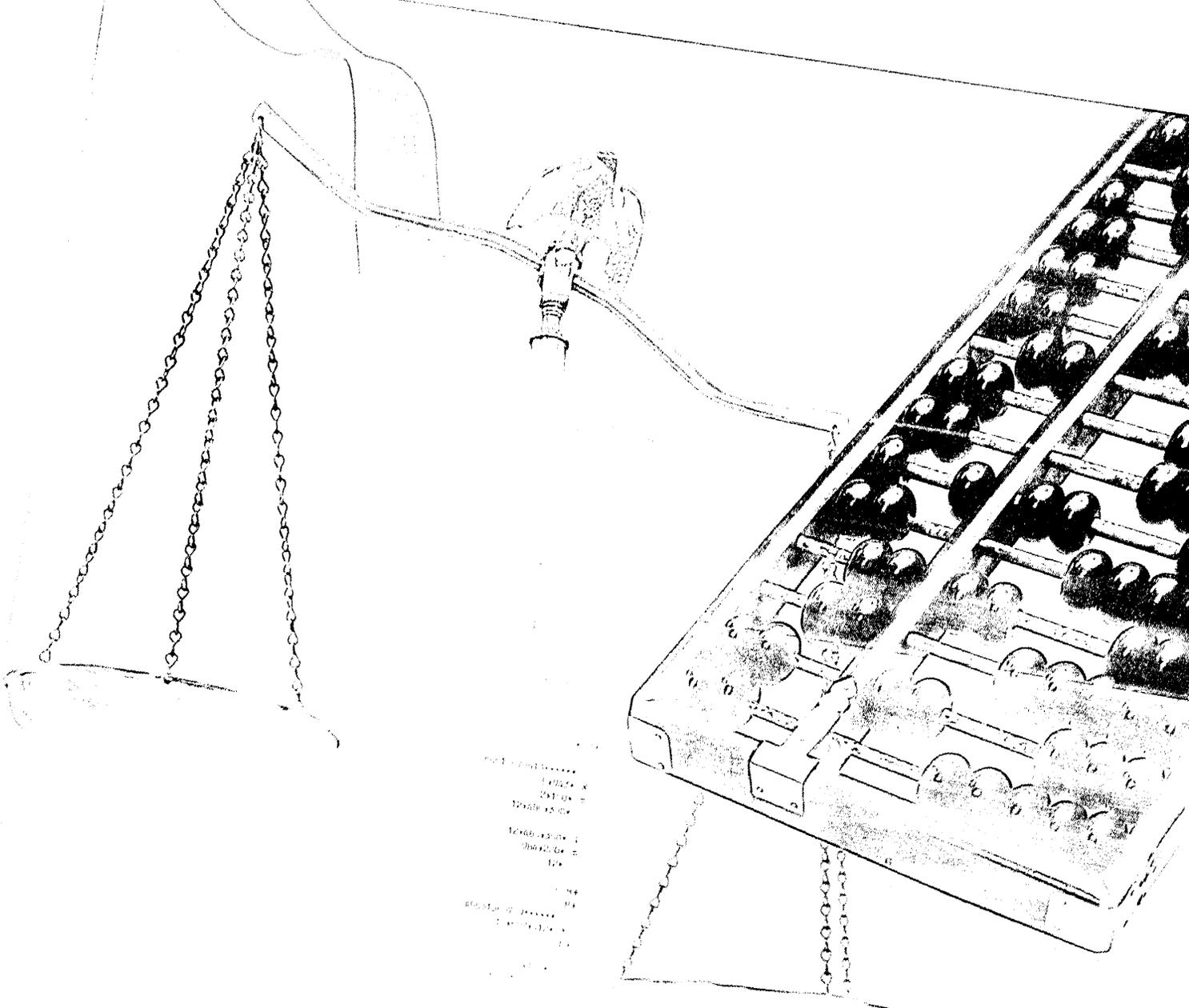
Also counted and assessed for complexity are master files and system-to-system interfaces. Once these information-providing elements have been individually classified, the overall application is considered. The impact of various innovation and technology factors such as transaction volume, real-time updating, telecommunications, or multisite installation is assessed. The sum of these factors that influence a project is then applied as a percentage against the subtotal of the previously counted deliverables, to arrive at the function points index for the application. Fig. 1 provides a simplified representation of the technique.

EXAMPLE OF THE TECHNIQUE

An example may help clarify the procedure. Consider a project control system to maintain project tasks, record programmers' time against project tasks, and prepare schedules. Our example (Fig. 2) will directly provide time and attendance information to the payroll system and will provide time expenditure data to the user-showback reporting system. Six on-line and batch input transactions update two master files. Six batch reports are produced; three on-line inquiries are provided. To simplify the example, all the function-providing elements of a specific form are assigned the same level of complexity, e.g., each input is considered to be of moderate complexity.

Note the graduated weight scale for each function-providing data form. Our six inputs, all assumed to be of moderate complexity, will produce when extended a function count of 18; our six complex outputs, a function count of 36; and so on, arriving at

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Function points addresses many of the shortcomings inherent in the LOC measure.

a grand total of 100 unadjusted function points.

The application is then considered as a whole. The influence on our project of such factors as on-line processing requirements, data volumes, and overall logic complexity were determined for our hypothetical application, and then summed. The equation to arrive at a function point index is set up such that the project-influencing factors (of which eight principal ones are identified here) adjust the result up or down within a range. When calculated, our example application produced a function points index of 96.

The function points indexes thus derived are not only language independent but also unaffected by programming style or experience.

As data continue to be collected on projects, comparisons become increasingly meaningful. Projects making use of productivity aids such as an interactive editor or an on-line debug facility can be contrasted with projects not employing such aids. Projects developed with a fourth generation language or using prototyping techniques can be compared to projects using procedural languages or traditional implementation techniques. Project scope and productivity can be evaluated by considering projects in different groups, for example, comparing those under 300 man-days with those over 300 man-days.

Function points provide the applications manager with a measurement strategy that has meaning outside of the department. The department-level count of functions delivered provides a measure of the output of the systems and programming staff, and is more easily explained to ranking management than lines of code. Here's why: the LOC measure is oriented more toward the needs of applications development as an efficiency measure; return on investment is directed more toward corporate level needs as an effectiveness measure; and function points falls somewhere between the two as a measure of both efficiency and effectiveness, providing acceptable meaning both within and without the department.

The function points methodology is relatively straightforward, requiring perhaps four to six man-weeks to implement. Four projects completed in late 1982 were chosen to participate in a trial counting. The counting was performed by the respective managers of the projects but coordinated by a single individual. In this way questions were centrally resolved and needed conventions identified and established. To achieve consistency, a recount of the pilot projects was made. Documentation was

FIG. 1

COMPONENTS OF THE FUNCTION POINTS INDEX

$$\begin{array}{rclclcl} \text{Identify project} & & \text{Weighted} & & \text{Total} & & \text{Additional} & & \text{Function} \\ \text{elements and} & \times & \text{factors} & = & \text{function} & \times & \text{influencing} & = & \text{points} \\ \text{assign complexity} & & & & \text{points} & & \text{factors} & & \text{index} \\ \text{level to each} & & & & & & & & \end{array}$$

FIG. 2

FUNCTION POINTS EXAMPLE

COMPLEXITY WEIGHT SCALE

FUNCTION-PROVIDING ELEMENT	SIMPLE	MODERATE	AVERAGE	COMPLEX	HIGHLY COMPLEX
Input	2	3	4	5	6
Output	3	4	5	6	7
Master File	5	7	10	13	15
Inquiry	2	3	4	5	6
Interface	4	5	7	9	10

COUNTS

	FUNCTIONS	WEIGHT	FUNCTION POINTS
6	External inputs (moderate complexity)	$\times 3$	= 18
6	External outputs (complex)	$\times 6$	= 36
2	Master files (average complexity)	$\times 10$	= 20
3	Inquiries (simple)	$\times 2$	= 6
2	System interfaces (highly complex)	$\times 10$	= 20
Total Unadjusted Function Points Count			100

PROJECT INFLUENCING FACTORS (RANGE 0-5)

Communication facilities	0
Distributed processing	0
On-line processing	3
Data volumes and performance objectives	2
Complex processing logic	5
Multiple sites	0
Conversion difficulty	2
System flexibility	4
Total	16

COMPUTATION

$$\begin{array}{rclclcl} 100 & & [.8 + (16 \times .01)] & & 96 \\ \text{Function Points} & \times & \text{Constant* Influence} & = & \text{Function Points Index} \end{array}$$

*The constant is developed from the difference between 1.00 (100%) and the sum of the midpoints for the influencing factors (20 in this case), such that an average influence would yield a function points index equal to the unadjusted function point count.

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As data continue to be collected on projects, comparisons become increasingly meaningful.

then prepared and used as a basis for staff training.

COMPUTING INDEX FOR PROJECT In actual practice, one to four hours are required to compute a function points index for a one man-year project. The index is prepared shortly after completion of the implementation phase. Consistency is best served when all function points index assignments are reviewed by one individual.

Unforeseen questions continue to arise: perhaps how to treat a novel multi-purpose screen design or a multiformat report. These issues are resolved and documented for future reference to ensure proper point assignments in the future. Periodically, the accumulated function points data can be analyzed to reveal productivity trends over time.

Function points statistics have been gathered at Hallmark for projects completed since mid-1982. The general rule applied is to develop a function points index for medium-scale and larger projects, i.e., those projects that require 75 or more man-days. Enhancement as well as new development projects are counted. Other project characteristics such as use of a fourth generation language, use of structured design techniques, and use of on-line development tools are recorded. As the statistical base is enlarged, comparisons of specific project attributes become increasingly meaningful.

Also documented are information center function counts. In addition to giving users consulting support for languages and file structures, the information center at Hallmark does programming of small independent systems and ad hoc user requests. The function counts for the ad hoc programming requests are used primarily in the tally of annual department output. Any comparisons of information center productivity with traditional applications' development must take into account the differences inherent in the two.

During 1983, Hallmark completed 31 projects for which a function points index was prepared. One of these projects utilized prototyping design techniques (Fig. 3, No. 30); another encompassed a purchased package (No. 31). While these two projects showed high function counts, demonstrating the relative productivity of the two implementation approaches, their inclusion in the overall project analysis visibly distorted the trend analysis. They were therefore excluded. The data for the remaining 29 projects are presented in Fig. 3; function point rates are plotted against man-days in Fig. 4.

The data points plotted are skewed and statistically inconclusive. The plotted

FIG. 3

1983 PROJECT DATA

PROJECT	M DAYS	FP	LOC	FP/ M DAY	LOC/ FP	LOC/ M DAY			
1. ETSE	74	67	N/A	.9	—	—			
2. AB	74	73	5,000	1.0	68	68			
3. APD	87	121	11,925	1.4	99	137			
4. 5AUR	108	111	9,830	1.0	89	91			
5. PSMR	110	55	6,928	.5	126	63			
6. UW	115	94	12,000	.8	128	104			
7. CT	120	59	9,379	.5	159	78			
8. CIRS PIIA	148	72	26,819	.5	372	181			
9. MPDR	148	144	17,738	1.0	123	120			
10. EDOPI	149	67	12,713	.4	190	85			
11. EDNPR3	165	87	35,280	.5	406	214			
12. SCR	194	320	25,638	1.6	80	132			
13. PPJ	219	86	10,300	.4	120	47			
14. MPFC	239	77	22,980	.3	298	96			
15. MIRSPII	273	108	35,500	.4	329	130			
16. CIRSIB4	283	148	26,933	.5	182	95			
17. OS	283	174	44,000	.6	253	155			
18. ECS	296	341	17,085	1.2	50	58			
19. EEI	305	684	19,250	2.2	28	63			
20. AGSMA	494	697	70,393	1.4	101	142			
21. AEDS	502	507	106,000	1.0	209	211			
22. COTS	522	170	35,474	.3	209	68			
23. IEM	582	314	49,521	.5	157	85			
24. MIRSPI	626	293	66,000	.5	225	105			
25. BR	855	434	64,178	.5	148	75			
26. ACOS	946	738	28,000	.8	38	29			
27. AUR	1,427	1,206	50,379	.8	42	35			
28. SSF	1,642	791	72,747	.5	92	44			
29. HCR	2,912	1,284	126,332	.4	98	43			
Included Projects Average				.8	158	98			
Information Center Projects (six months' composite count)				435	2,758	45,419	6.3	16	104
Projects Excluded									
30. AFRS	1,223	3,045	255,000	2.5	84	208			
31. LW	460	2,970	82,560	6.5	28	179			

trend line is a linear regression, and though interesting (for instance, Fig. 4 suggests that large projects tend to produce less function per man-day than small projects), it is not reliable for predicting the outcome of future projects. The model, which represents system rewrites, large enhancements to existing systems, and new development projects, exhibits a standard deviation near .5 of a function point per man-day.

The differences in the nature of these projects may not permit logical comparison. System rewrites copy many existing functions, while streamlining and

enhancing others; large enhancement projects may add little function but require extensive research to locate new code and test the system; new development is less confined by existing data processing solutions. • Though individual project points are varied in the scatter plots, a certain consistency is seen when the plots are viewed together.

On the whole, approximately four fifths (0.8) of a function point per man-day can be anticipated for a project. Only three 1983 projects reported function point deliveries at this rate. With such an established

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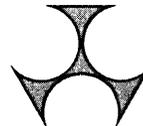
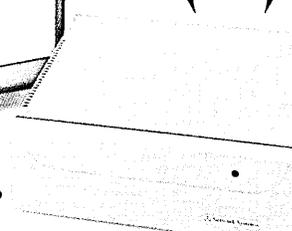
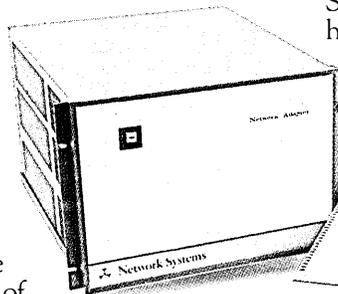
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It is significant that function points do not contradict what would have been speculated.

baseline, however, projects reporting substantial deviations can be probed for features that may have influenced productivity.

- Lines of code per function point vary dramatically. Since function points are language independent, no correlation of the two may be possible. However, projects with higher function counts required fewer lines of code per function point.

- Ad hoc information center projects were delivered at rates markedly more favorable than traditionally developed projects (6.3 vs. 0.8). This observation is more fully investigated below.

Some specific project observations were also made. As an example:

- The EEI project (No. 19) reused existing code and was very productive—2.2 function points per day—demonstrating the desirability of cloning existing code when possible.

- Adding a new data handling capability to an existing application can be costly in terms of function points delivered. Two examples of such projects are PPJ (No. 13) and MPFC (No. 14).

- Lack of staff experience (CICS, database, system design) may have contributed to a lower function point productivity on some projects such as the IEM (No. 23) project and the BR (No. 25) project.

Function point statistics from projects in the ad hoc information center described especially high productivity when contrasted with traditionally implemented projects. The information center group produced 6.3 function points per man-day (2,758 function points in 435 man-days), and traditional projects 0.8 function points per man-day (9,255 function points in 13,824 man-days).

PROJECTS LIMITED IN SCOPE

Typically, information center projects are limited in scope—reported man-days average less than three per project—and are specifically focused on producing an explicit function, i.e., an external output. This is in contrast with the implicit functions typically found in full-scale projects, e.g., date/schedule logic, order-selection logic—concepts that do not add directly to a function count.

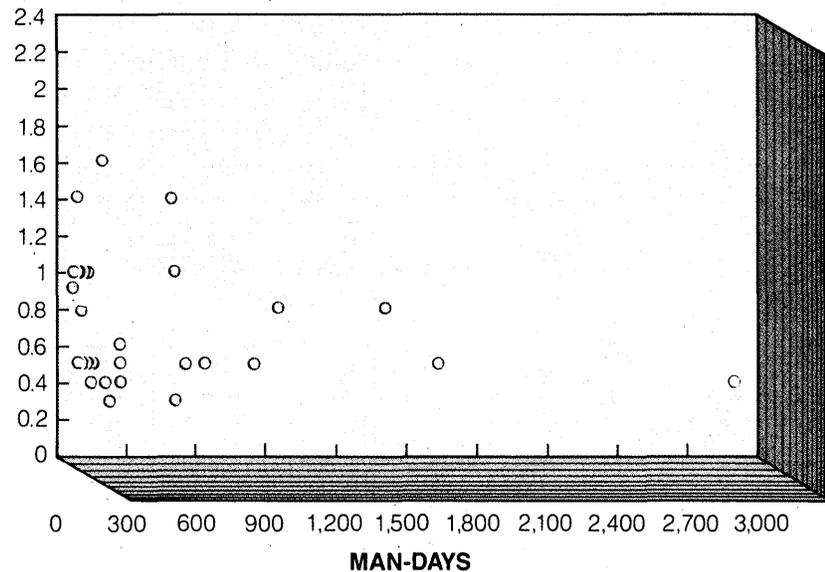
Other characteristics of the information center projects, however, apparently contribute to their high productivity:

- Needed data files have usually been previously designed, coded, and implemented.
- Projects are usually designed and implemented by one person working closely with one user.
- Coding is typically accomplished with a nonprocedural language.

FIG. 4

FUNCTION POINT RATE ANALYSIS HALLMARK-1983

FUNCTION POINT RATE PER MAN-DAY



Twenty-nine projects with Function Point Indexes ranging from 55 to 1,284 are plotted. Each project's function point rate per man-day is plotted against man-days expended. The trend line suggests that as projects get larger, function points delivered per man-day decreases, though the standard deviation is near .5. The lineal model depicts a smoothed range of about .8 of a function point per man-day to a low of .4 of a function point per man-day.

- Projects do not usually possess the intricacies of the larger, traditionally developed projects for which function counts were completed.

From a productivity standpoint, function points did not reveal any surprises: prototypes appear more productive than traditionally developed applications; purchased packages provide more function per man-day invested than do their in-house counterparts; less experienced staff often require more time to complete tasks; changes to existing systems require greater manpower for function delivered than new application development; large projects appear less productive than small projects; information center projects are more productive than conventionally implemented projects.

What is significant is that function points do not contradict what would have been speculated, lending credibility to this concept of measurement. Without this credibility, future productivity assessments would not be possible. Additional data, the centralized review process, and continued experience should provide us the confidence needed to expand our use of function points.

Other measures, will, of course, continue to be used. The corporate contribution and justification of an application must still rely on its tangible and intangible benefits as measured finally in dollars. Quality measures are more effective in terms of system failures and user requests for fixes. On-time and within-budget measures provide needed project status and expenditure information. Lines of code is a well-established measure, and thus can provide valuable transition information with which to validate new measures.

But for the applications development manager seeking to enhance both internal and external performance reporting, the function points technique represents a significant advance in measurement strategies. ©

Steve Drummond is productivity coordinator in Systems Development for Hallmark Cards Inc., Kansas City, Mo. He is responsible for the identification, implementation, and monitoring of productivity enhancing tools and techniques. In his 15 years at Hallmark, Drummond has worked as a programmer, analyst, and project manager.

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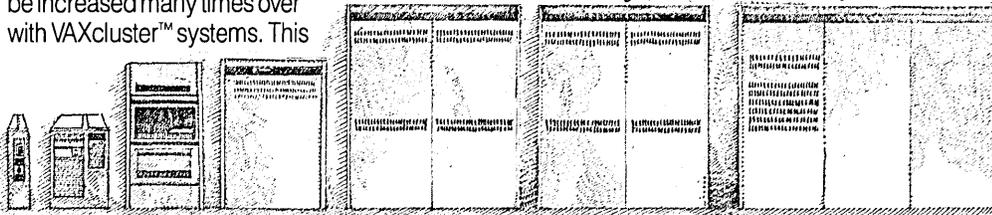
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by David Dee

Nora McKamey is a pc user in a large chemical company. After hearing her department was to receive an IBM PC, the first application that came to her mind was the budget. For years Nora had been repetitiously performing the laborious tasks required to produce and maintain her department budget. After receiving the computer she immediately signed up for a class in Lotus 1-2-3.

After class she began developing her application. Her development plan was obvious. She would duplicate her paper budget spreadsheet on 1-2-3's electronic spreadsheet. Nora immediately began entering her budget numbers into her PC, along with the titles and labels from the paper spreadsheet she had worked with for years. Instead of using a calculator to produce the totals and percentages, she coded formulas into the 1-2-3 spreadsheet. She honed her skills in 1-2-3 as she developed the application. When it was all finished she printed it out. It worked.

After printing, however, new opportunities became apparent. If she divided her single spreadsheet file into smaller files, it would be easier to print and she could have separate spreadsheets for the budget components most important to her department. She parceled her large spreadsheet into several smaller ones, while still maintaining the master format required by her company on a separate file. She devised a system of multiple file generations enabling her to maintain records of actual expenses.

She then realized she could add a whole subset of detailed entries to the major components of her budget that were now in separate files. In one case, she devised a journal to track subscription expenses as the invoices were processed.

The evolution of Nora McKamey's budget system continued until it was just

right for her needs. Her system enabled her to enter and maintain useful information that was previously not readily available, and it simplified her year-end budgeting process. Nora had developed a successful personal computing application. In doing so, however, she used methods that were often the antithesis of those used in traditional data processing.

Other organizations are attempting to standardize personal computing applications like Nora's by analyzing general requirements and developing standard models for all departments to use. This approach to personal computing conforms to the application development methods that are the foundation for traditional data processing.

Traditional application development methods have evolved during the past three decades in response to the cost, complexity, and widespread impact of data processing. The large investments required for data processing necessitated effective management; the complexity of data processing meant that numerous technical specialists had to be marshaled into producing meaningful end results; and the impact of a data processing system upon so many users and support personnel required the solicitation and incorporation of user requirements into the system design.

The system development methods that have evolved to meet these needs possess one common characteristic—they are all highly structured. The entire MIS environment is typified by structure and it's evident in the hierarchy of a project team, in the project schedule, the project budget, the system flowcharts, and in the program code itself. The reasons for structured methodologies are so obvious that they are never an issue in the traditional MIS environment (see Fig. 1).

Structured development methods are not unique to data processing. They are

essential to the design and production of skyscrapers, automobiles, hydroelectric plants, and the planning of a space mission. Structured methods are probably responsible for many of mankind's greatest achievements. Any complex project that involves a great deal of money and affects many people requires structured methodologies.

DESIGNED FOR LARGE PROJECTS

Simpler projects, such as the planning of a family vacation, the design of a filing system, the creation of a customer mailing program, or the building of a spreadsheet model are inappropriate for such methods. The need for structured methodology is related to the cost, complexity, and impact of the undertaking.

Personal computing in the corporate environment is evolving in response to the low cost, simplicity, and limited impact of personal computing applications. With complete systems now available for \$3,000, the personal computer ranks between the typewriter and the tabletop photocopier in cost. It is becoming simple enough for the average office worker to use, and for any single user the impact on the organization is no greater than that of the user himself.

When operating a pc, the user exercises total control over the computing environment. The user is the programmer, systems analyst, computer operator, and input clerk. He designs the applications, writes the code, boots the computer, mounts the disks, keyboards the data, tends the printer, and backs up the files. In the traditional dp environment, technical specialists would be required for each task.

The popularity of personal computing is based on the limited technical expertise required to use it. As personal computing becomes more sophisticated, computer literacy becomes increasingly unnecessary, just as engine literacy is no longer needed

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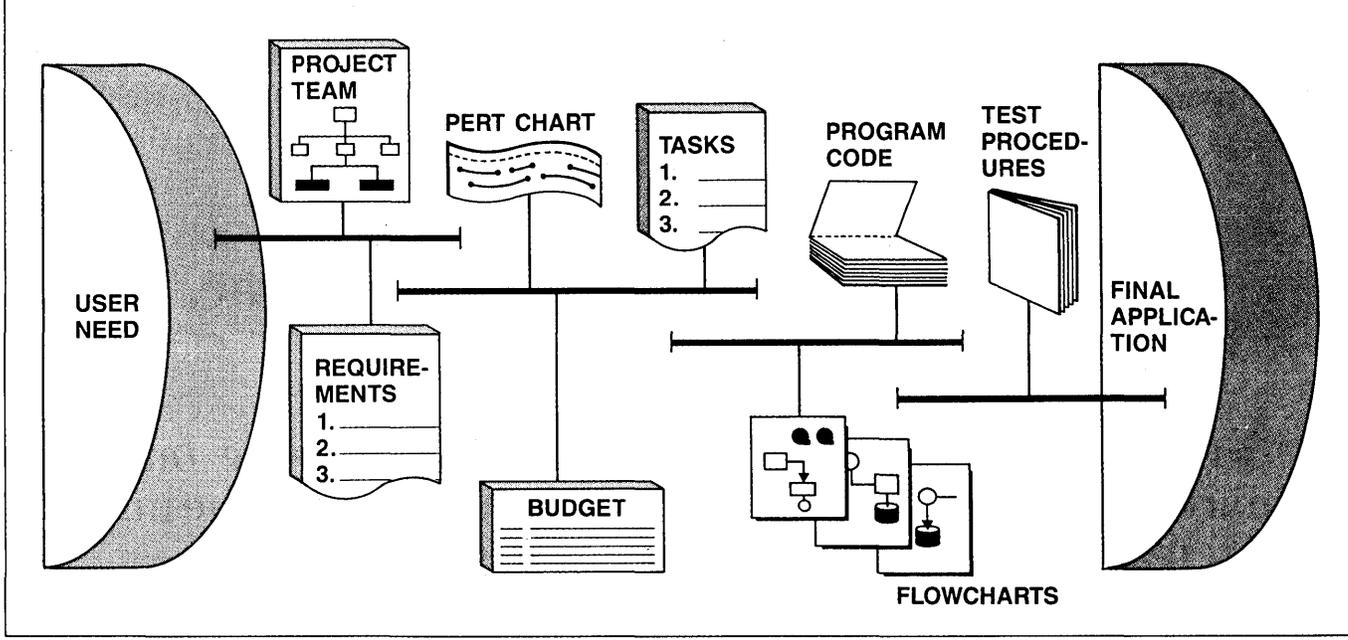
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*Taken from a research report prepared by Data Decisions and printed in PC Week, January 8, 1985 issue.

With a complete system available for \$3,000, the pc ranks behind the typewriter and tabletop photocopier in cost.

FIG. 1

TRADITIONAL APPLICATION DEVELOPMENT



to drive an automobile. The pc user wants to concentrate on the application, not the computer technology.

Pc users are application experts, not technical experts. They are intimately familiar with the requirements, dynamics, subtleties, and nuances of their own work. Personal computing brings the power of the computer into close proximity with the real-time work requirements of the user.

The abstract process of defining requirements for traditional applications, (long before there are any tangible results), cannot match this proximity. No amount of insight and perception on the part of a systems analyst will ever equal the first-hand understanding of the application expert. Even dp professionals trained from the ranks of end users quickly lose touch with the applications they once worked with every day. It is the pc users, the application experts, who are best equipped to computerize their own work.

Personal computing has evolved new tools for the computerization of work. Currently the most popular of these application tools are electronic spreadsheets, word processors, and data managers.

Personal computing can take place on all types and sizes of computing hardware. Dedicated word processors were the first personal computing devices widely used in business. Today's large multiterminal word processors, popularized by Wang, provide their users with a variety of

personal computing tools in addition to word processing. A terminal connected to a mainframe running Nomad, Focus, or some other fourth generation language can be used as a personal computing device. Minicomputers with office automation software can also be used for personal computing. The size and power of the computing device does not distinguish personal computing from traditional data processing. Personal computing takes place when the user freely applies computing resources to the work at hand.

In computerizing his own work, the PC user uses an application tool like Lotus 1-2-3 or Framework. The development of personal computing applications with such tools is a try and retry process. The user interacts with the developing system as it is being created.

The application starts with a concept, perhaps a mental procedure used to perform an administrative chore. The next step is to start up the computer, load an application tool, and code the procedure following the rules of the tool. The user then tries it out. If it doesn't work right the first time, the user adjusts the coding and tries again until it does work, often using real data for testing. Between trials the user may adjust or expand the original concept. To structure the development process by preparing requirements, plans, schedules, and deliverables is clearly not required (see Fig. 2).

MODEL OF PARAMOUNT VALUE

Application development using 1-2-3-type spreadsheet software involves the creation of a spreadsheet model containing formulas and labeling. The formulas correspond to the processing code of a traditional program while the labels correspond to the print program.

Sophisticated users may include input controls and even edit checks. The electronic spreadsheet is the preeminent interactive development tool because all phases of the system (input, processing, and output) are concurrently interactive.

Word processing software may be used to create applications that type routine correspondence or generate promotional mailings. Word processing applications require that parameters be set for formats, printing, and automatic text generation.

Application development using data management software, such as PFS File and Report or dBase III, involves the naming of fields and the creation of selection criteria, report formats, and input screens. The user then generates the input, usually from the keyboard, and prints the output. The initial application is modified until satisfactory results are achieved. Many pc users find data management tools, like dBase III, KnowledgeMan, and RBase, require the assistance of an expert.

If the expert approaches the appli-



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WHEN YOU'VE GOT TO BE RIGHT.



The process of developing applications for personal computing contrasts sharply with traditional methods.

cation in the traditional manner, with requirements definitions, project plans, and the like, the development effort becomes a structured process. The expert will assume control and the user will be placed in an advisory role. In this role, the user will attempt to convey his requirements to the expert who will code them into a customized system. The user will not interact with the new system (nor understand how it really works) until it is in final form. By that time, it's usually too late to make changes.

If the expert uses an interactive development method, however, he can enhance the pc user's development process by becoming an extension of the user's expertise, coding those parts the user cannot code, letting the user try it out, and recoding when necessary until the final product meets the user's needs. This expert has not taken control away from the user; he has merely enhanced the user's capabilities.

The process of developing applications for personal computing contrasts sharply with traditional methods. Some of these contrasts are highlighted in Fig. 3.

Planning, the cornerstone of traditional methods, can be counterproductive to pc users. It is an abstract process that assumes the outcome is difficult to change, and it requires a detailed prior knowledge of the development tools and understanding of a systems planning methodology. It necessitates assumptions, predictions, and time sequencing, which are obviated by the pc user's ability to see the consequences of his actions immediately.

As the pc user's ideas move from thought to reality, the results are immediate and tangible. Planning removes the spontaneity that often fosters the most innovative and best solutions.

Efficiency is a byword of traditional methods. The high cost of data processing resources necessitates continual attention to efficiency in the system development process. Cpus, disk drives, memory, and communication lines must be efficiently and fully used or the organization's money is wasted.

Efficiency is one of the last things a pc user thinks of in developing applications. The application expert has no time to worry about technical efficiency. Personal computers are often notoriously underused, sitting idle for hours. The declining cost of pc resources will contribute to increased inefficiency of their use. At the same time they will be increasingly available when needed. Pc users will determine the best balance between cost and availability—as is always done with similar priced resources such as typewriters and photocopiers.

FIG. 2

INTERACTIVE APPLICATION DEVELOPMENT

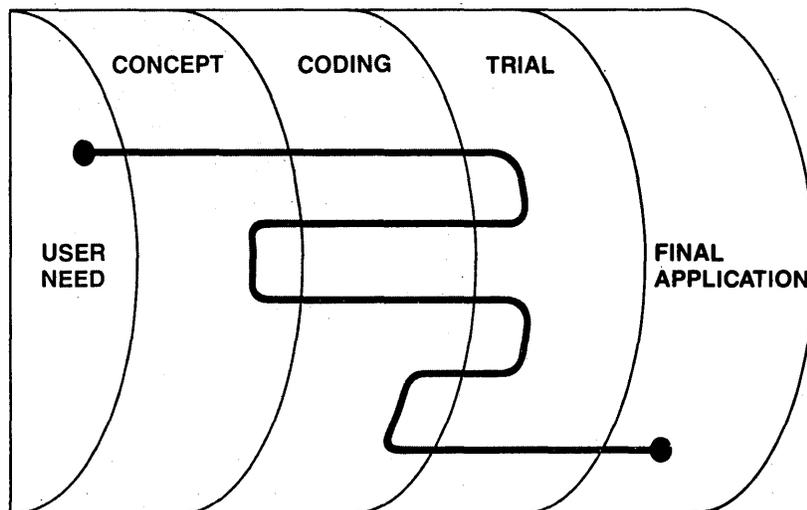


FIG. 3

MAJOR DIFFERENCES BETWEEN STRUCTURED AND INTERACTIVE DEVELOPMENT

STRUCTURED DEVELOPMENT	INTERACTIVE DEVELOPMENT
Planned	Spontaneous
Efficient	Inefficient
Compromising	Uncompromising
Certain	Quick
Dominated by technical experts	Dominated by application experts

Traditional systems are developed as a compromise between the competing demands of users and the economic scarcity of computing resources. The requirements-definition phase of traditional development projects is a prime example of such a compromise. The pc user can develop the application to suit his individual needs. Right or wrong, he's in full control.

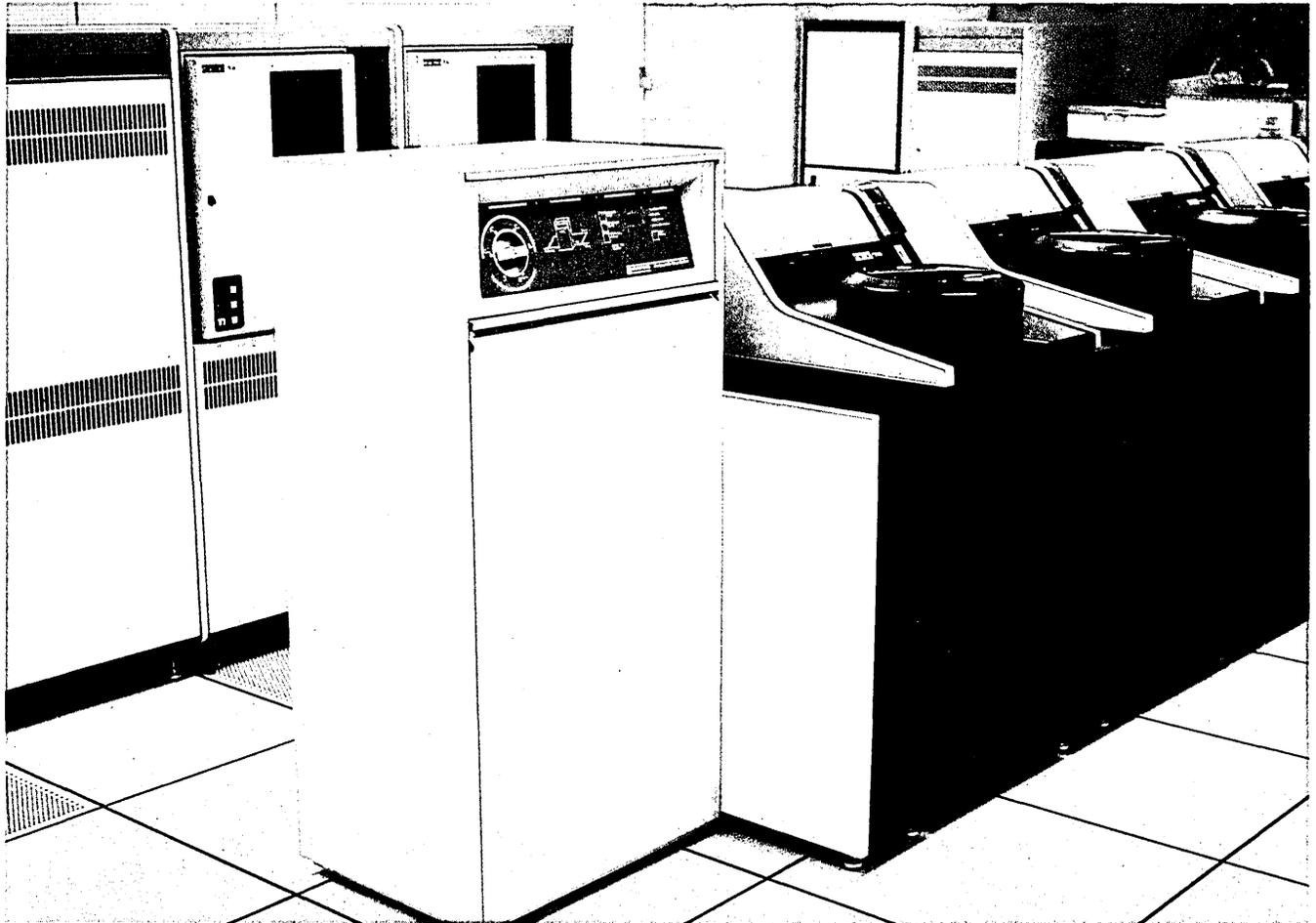
Traditional systems must be developed to work the first time. Every effort is made to avoid errors in the design and code. Elaborate testing procedures are intended to remove errors from the product before it is put to use. Nothing is left to chance.

The personal computer user's approach to development is often little more

than "try this and see if it works." If it doesn't work the pc user will learn something, perhaps even resort to the manual for some instant training. Users want quick results and can easily try again if the outcome is unsatisfactory. The try-again approach is unthinkable when hundreds of thousands of dollars have been invested on the first try. ©

David Dee is the director of Personal Computer Learning Systems (PCLS), San Francisco. PCLS develops end-user training for personal computing. His prior professional experience at various corporations includes manager of office automation, information systems manager, and manager of training.

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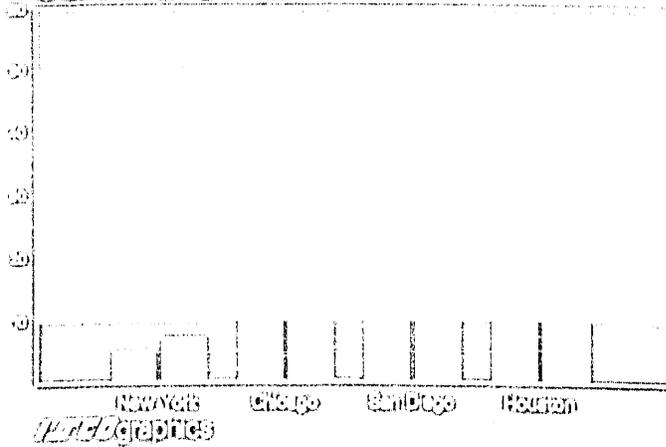
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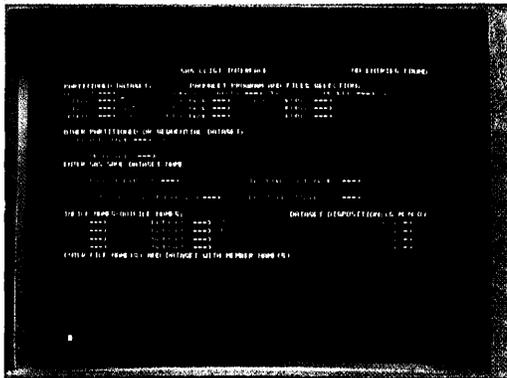


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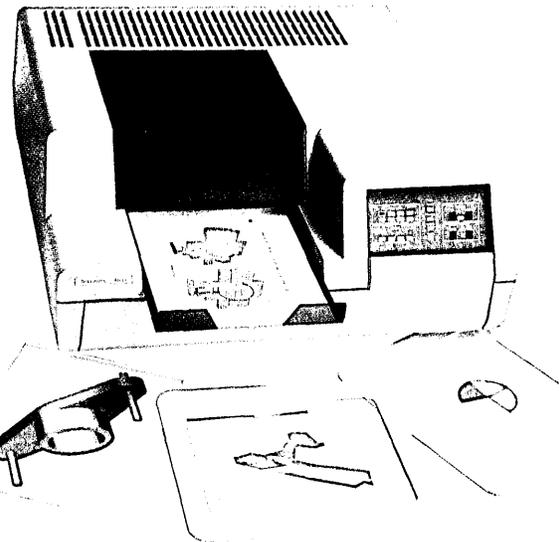
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DISOSS: THE TRUE PATH TO ENLIGHTENMENT

In the words of the Belgian latitudinarian, Pierre de la Microcode, "Sometimes the strangest things can lead to enlightenment." Thus it was with the Guru Baba Ghanoush.

Many years ago, the Guru Baba Ghanoush was wandering through the wasteland of Cupertino, greatly disquieted. He called out to the Lord for a sign, and the Lord spoke to him, saying, "See you the 8100s of the field. They toil not, neither do they perform much processing. Yet they are good in my sight."

And the Guru Baba Ghanoush went forth, and arrived at a mainframe, and there he lay down. And the Lord spoke to him out of a great Blueness, instructing him to strike the 8100 to see what was within. The Guru did as the Lord bade him, and lo! Therein was DISOSS.

"See thee DISOSS," spake the Lord. "Some of it is in the host and some of it is in the 8100, yet it is one, and its words go out to all manner of devices." The Guru Baba Ghanoush pondered DISOSS, and as he did, a great peace descended upon him. He saw a vast multitude of people who accessed DISOSS and heard its words, and he rose up and set forth to spread the word of DISOSS.

From that time forth, the Guru Baba Ghanoush has walked the face of the market, and preached the gospel of DISOSS. The people have hearkened unto him. Now the Guru invites men of all races, creeds, and operating systems to join with him in the wondrous peace of DISOSS. For DISOSS is bliss to the world, and only by contemplating it can a man attain Oneness with the market and know what is to come.

We begin, as the Guru teaches, with the parables of Baba Ghanoush.

The tale of the Texans. In ancient times, there was a mighty tribe that called themselves Texans. Their leader, Volume, was an ungodly man, and his works were an abomination unto the Lord and the Finance Department. The men of Texas coveted the market of Commodore, and lusted after it in their hearts. They asked counsel from a false guru, who did project. They

knelt at his feet and prayed, "Guru, we beseech thee, how many shipments shall be shipped, that Volume may know their number, and prosper from them?" And the guru consulted his false software, and made his projections, and prophesied, "Seven million shall be shipped, praise to the Model." And the men of Texas girded their loins and readied their capacity, and did laugh at their competitors, who had no mighty Volume to lead them.

But the Lord was wroth with the men of Texas, and caused the people to buy but one home computer each, and a great pestilence fell upon the tribe. Its name was Inventory, and it was sorely feared. But the men of Texas did not hearken to the Lord, and asked again of the false guru, "Guru, how many shipments shall be shipped?" And the false Guru replied, "A certain softness is developing in the market, which is not demonstrating the price-elasticity the Model spoke of. Let us say, 4 million units."

And the men of Texas did weep and rend their production targets, but the fiend Inventory would not be stayed. And the Lord did smite the men of Texas, unto the components and the components of components, and there was great weeping in the land, and gnashing of consultants.

Yet the men of Texas hardened their hearts unto the Lord, and went again unto the false guru, and did say, "Guru, what shall we do next?" And the false guru consulted his Model and said, "MS/DOS is the way to go. The market for MS/DOS desktops is growing at 400% annually. Also, portables look nice."

JESTING WHILE INVESTING

This man whored among the venture capitalists who jested as they invested, saying, "Verily, this is a surefire thing." And the man showed them the preachings of the false gurus, that did demonstrate 400% annual growth in personal

The curse of Osborne.

There was in the great lands of the West a man who hearkened not to the

word of the Lord. This man whored among the venture capitalists who jested as they invested, saying, "Verily, this is a surefire thing." But still the man hearkened not unto the Lord, and did summon his marketing managers and say unto them, "Heed not

computers, compounded annually through 2010. And they rejoiced, and built him a mighty plant, and did offer him much capital. But the Lord did not look with favor upon the man and did smite his cash flow with a great smiting, and the company did fold. And the venture capitalists cried a great cry, and summoned their attorneys, saying, "We hath been ripped off!" But the Lord smote them further, and their attorneys.

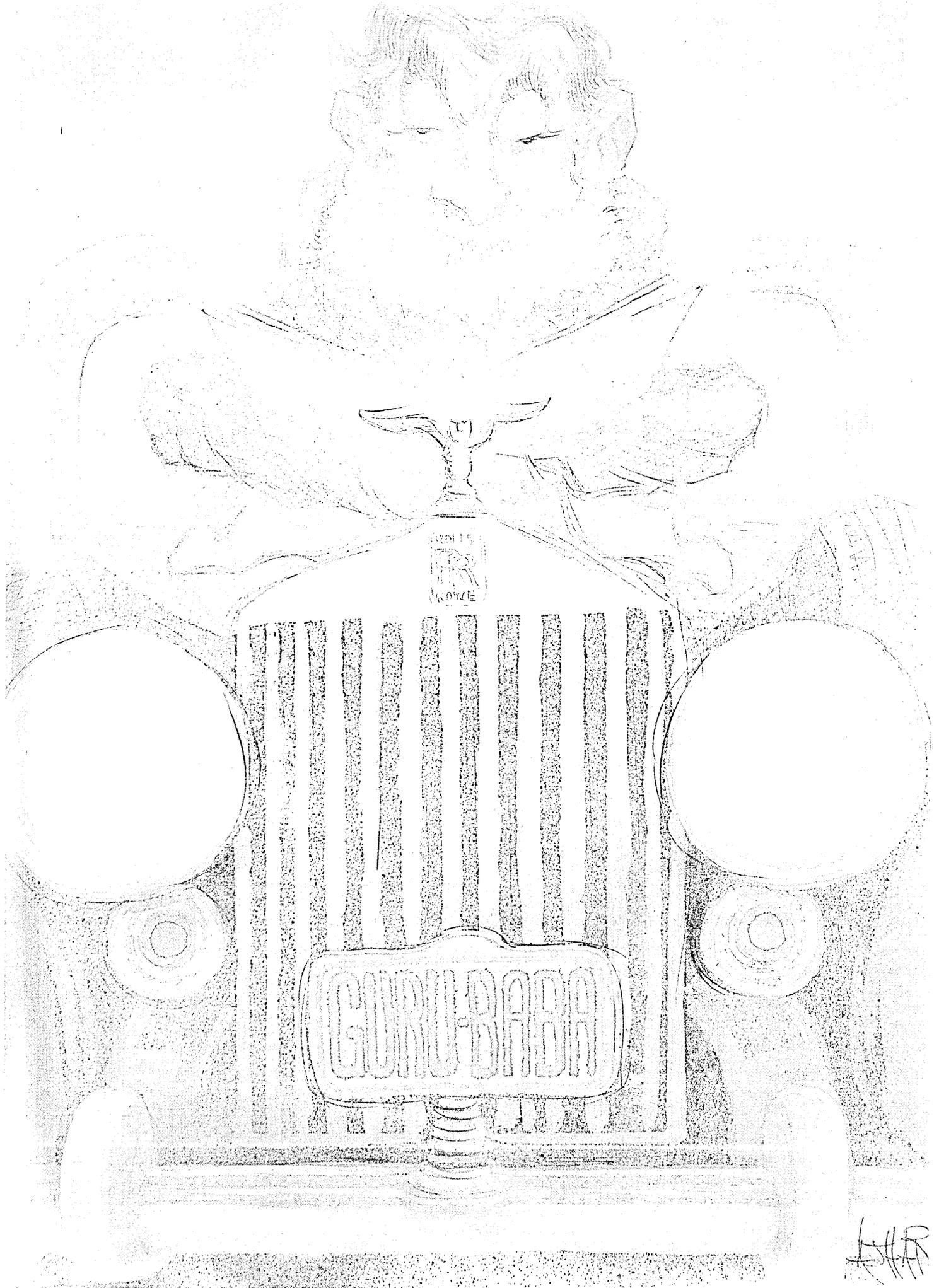
But the venture capitalists hardened their hearts against the Lord, and did invest in others who were like the man, and they did hearken unto the words of these men, and did say, "Lo, 400% is a big figure. We must invest, for verily, this is a surefire thing."

And the Lord did wonder why he bothered.

The tale of the peanut. There once was a man in the land of Boca, who did good in the sight of the Lord, and the Lord did cause him to prosper. His PCs did go forth and multiply, and were as stars in the heavens, yea, a great multitude, as grains of sand upon the seashore, or applications unto the Apple IIc. And the Lord did look, and it was good.

But the man waxed proud, and hardened his heart against the Lord. And the Lord spoke unto him, saying, "Don, the PC doth prosper, but perhaps it is time for a revamp." And the man laughed at the Lord, saying, "Verily, we have wrought a great multitude of PCs, and our DOS is worshiped in the land. *Business Week* hath said nice things about us, and none may stand against us. Our PC shall live forever, and its software shall be supported unto the fourth generation, and we shall make little PCs to exceed our most optimistic projections."

And the Lord was vexed with the man, who had grown so proud. And the Lord moved his spirit on the face of the media, and there was a great cry of "Peanut!" But still the man hearkened not unto the Lord, and did summon his marketing managers and say unto them, "Heed not



And the people cried, "Help us to understand the MIPS of the Great Trout, that we may align ourselves thereunto."

the cry of the people, but let your eyes be fixed upon the schedule."

But the Lord did smite the man, and the people did rise up and cry "Peanut," and there was a great leaking in the land. And the man did yield to the people, and did present the Peanut unto them, and did say, "Lo, behold the Peanut. It shall be unto you as the PC, and shall speak unto your tv sets." And the Lord did cause the people to look upon the Peanut, and the scales did fall from their eyes, and they saw not the man and his power. And they did say, "This thing?" And the people did cry out, "Chiclets!" and did demand to run their PC applications on the Peanut and lo, they would not run. And the Lord sent again the fiend Inventory, and he smote the dealers until there was a great weeping and gnashing of discounts.

But the man cried: "We shall enhance!" Whereupon the Lord raised a mighty horde of Macintoshes and Iics that ravaged the land, until the Peanut was an abomination to all the people.

Still the man rebelled against the Lord, and did make a portable, and the people did cry yet again, "This thing?" But the cry was not loud, and the Lord was

still, for he was fed up with the whole thing.

The tale of Gideon. There once was a man named Gideon, who walked in the ways of the Lord and knew the ways of the Source Code. One day there came emissaries of the people beyond the sea, and they said unto him, "Tell us the ways of XA, that we may know them and be compatible unto them. And help us to understand the MIPS of the Great Trout, that we may align ourselves thereunto." And Gideon was tempted, and did write scenarios unto them, and tell them the ways of XA.

GIDEON CONSORTED OVERSEAS

But the Lord was wroth with Gideon, for he did consort with the people from beyond the sea, whose mainframes were an abomination unto the Lord. And the Lord said to Gideon, "If thou do not lay off, it shall fall on thee from a great height."

But Gideon hardened his heart, and did speak again to the men from beyond the sea. And the Lord brought forth a great horde of mighty men of Enforcement, and did afflict the men from beyond the sea with many suits, yea unto civil suits and criminal suits. And Gideon hid his face

from the Lord, saying, "It was not me, Lord." But the Lord did say unto Gideon, "The Lord thy god is a jealous god, and thou hast been ripping him off." And he smote Gideon with the jawbone of an attorney, and there was a great settling in the land, and much wailing and gnashing of newsletters.

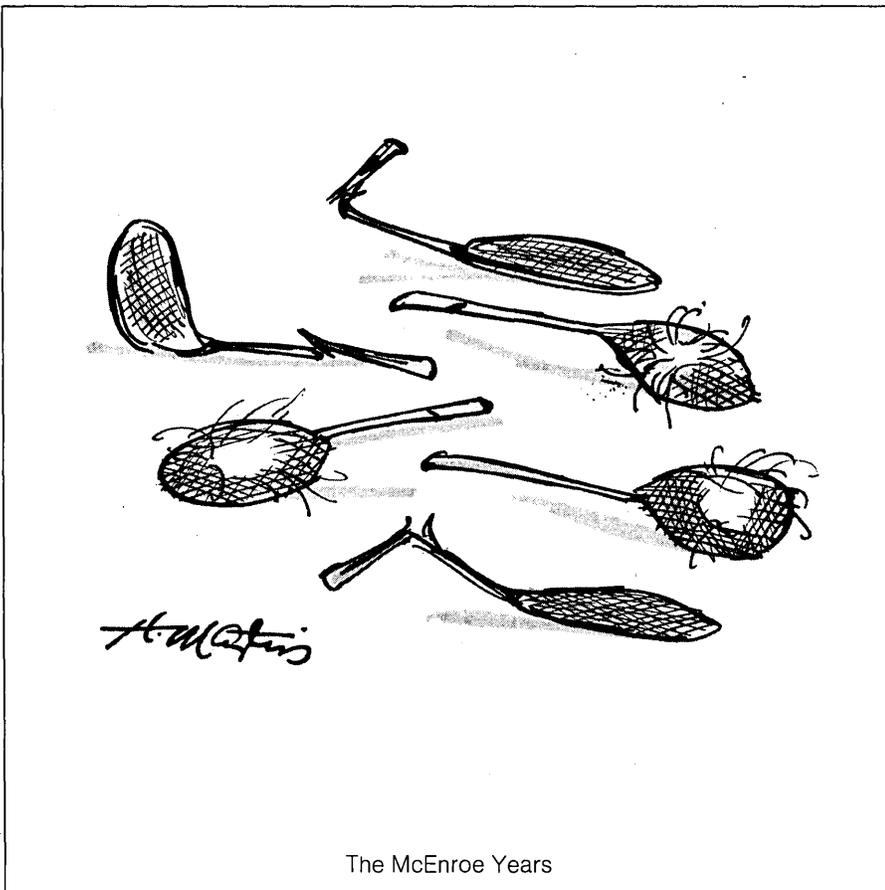
And thereafter Gideon walked in the ways of the Lord, and his voice was not heard in the land.

What lies ahead. Through DISOSS, and a correct knowledge of these Parables, it is given to the Guru Baba Ghanoush to know what lies ahead. He alone can voice the secret intent of IBM, and say what Unix shall do in the world. Because the signs are favorable, and our check has cleared, he offers here an inspired vision of the next seven quarters:

- IBM will announce MVS/XA for the PCjr, plus DISOSS/Recreational Support to allow users of 327X devices to access host-loaded Pac-Man, Zork, and other applications.
- Commenting on delays to the token ring LAN system, an IBM spokesman will confess that the company has really been spending all its R&D money on finding a cure for the common cold. In a Statement of Direction, IBM will announce its intention to implement a cure for the common cold over the next 100 to 150 years.
- A new trend will develop in the nation's largest corporations: not using personal computers. Nonuse of personal computers will quickly achieve a 400% annual growth rate.
- After a rash of bankruptcies among micro vendors, the government will announce a package of emergency measures, including the formation of a Micro Adjustment Administration to purchase surplus stocks, a forced 10-week shutdown of all microcomputer production, and quotas for generation of MS/DOS software. In a fireside chat, President Reagan will appeal for calm, and announce the formation of a new government agency to resettle unemployed workers as venture capitalists.

This is merely a glimpse of the Guru's wisdom. In fact, if there were as many database management systems as there are lines of code in IMS/VS, and as many DBMS again as there were lines of code in all the new DBMS, the total number of lines of code in all the DBMS would still be *less than the number of things that Guru Baba Ghanoush knows*. This is the power of DISOSS.

If you would like to know more, just send the Guru a stamped, self-addressed envelope, along with all your worldly possessions and a copy of your business plan. If you are worthy, he will get back to you. ©

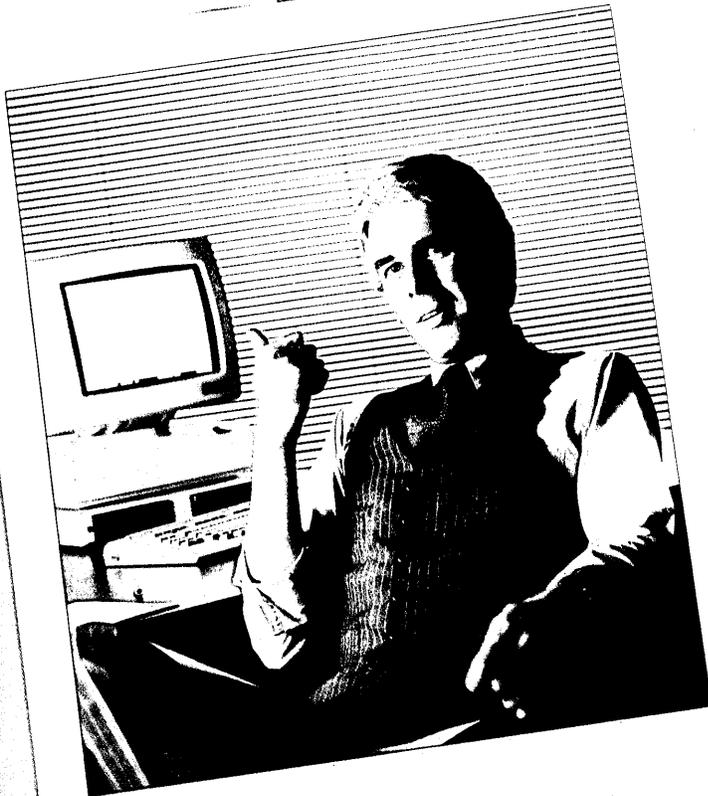


The McEnroe Years

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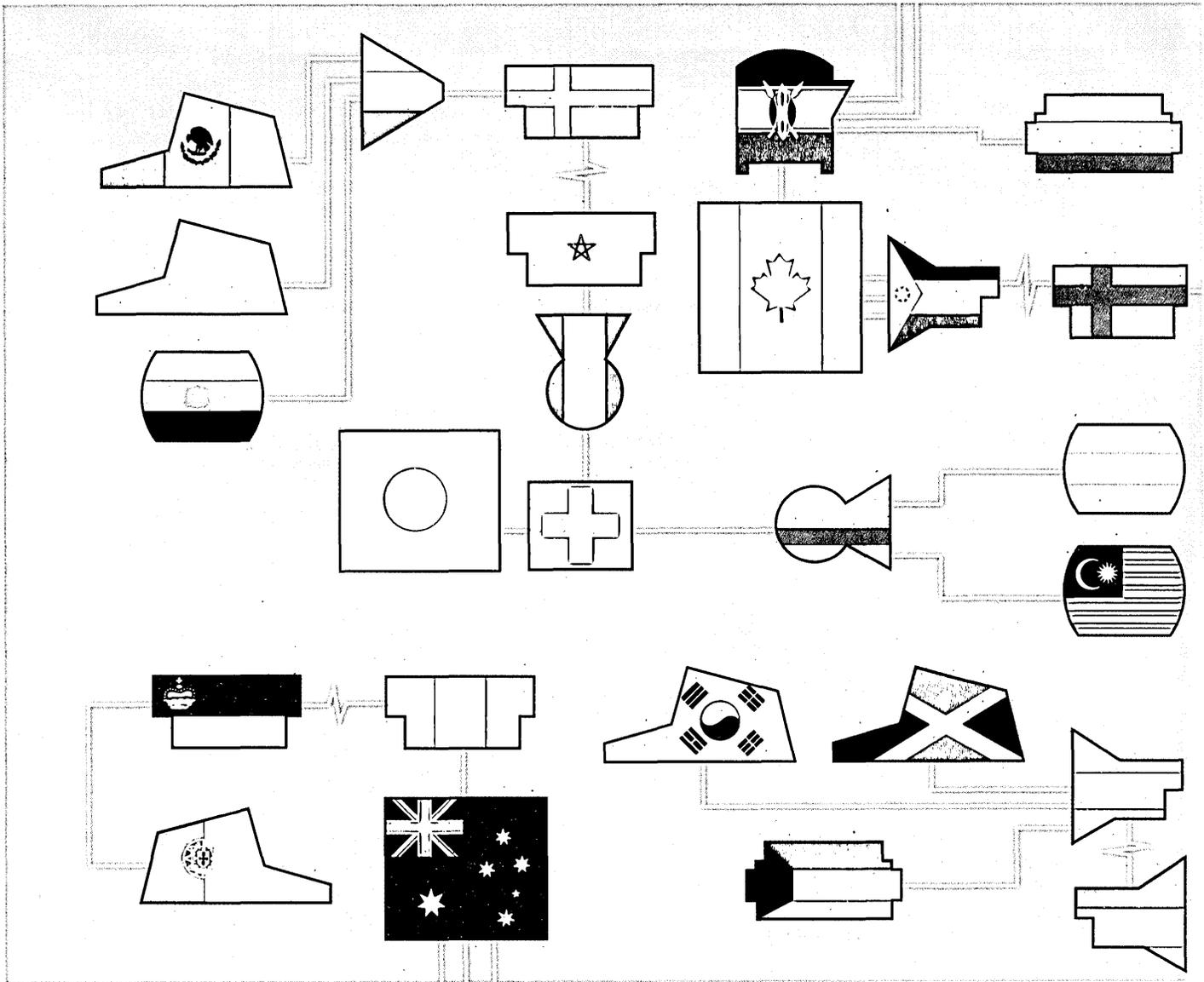
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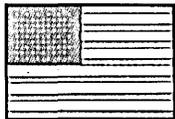
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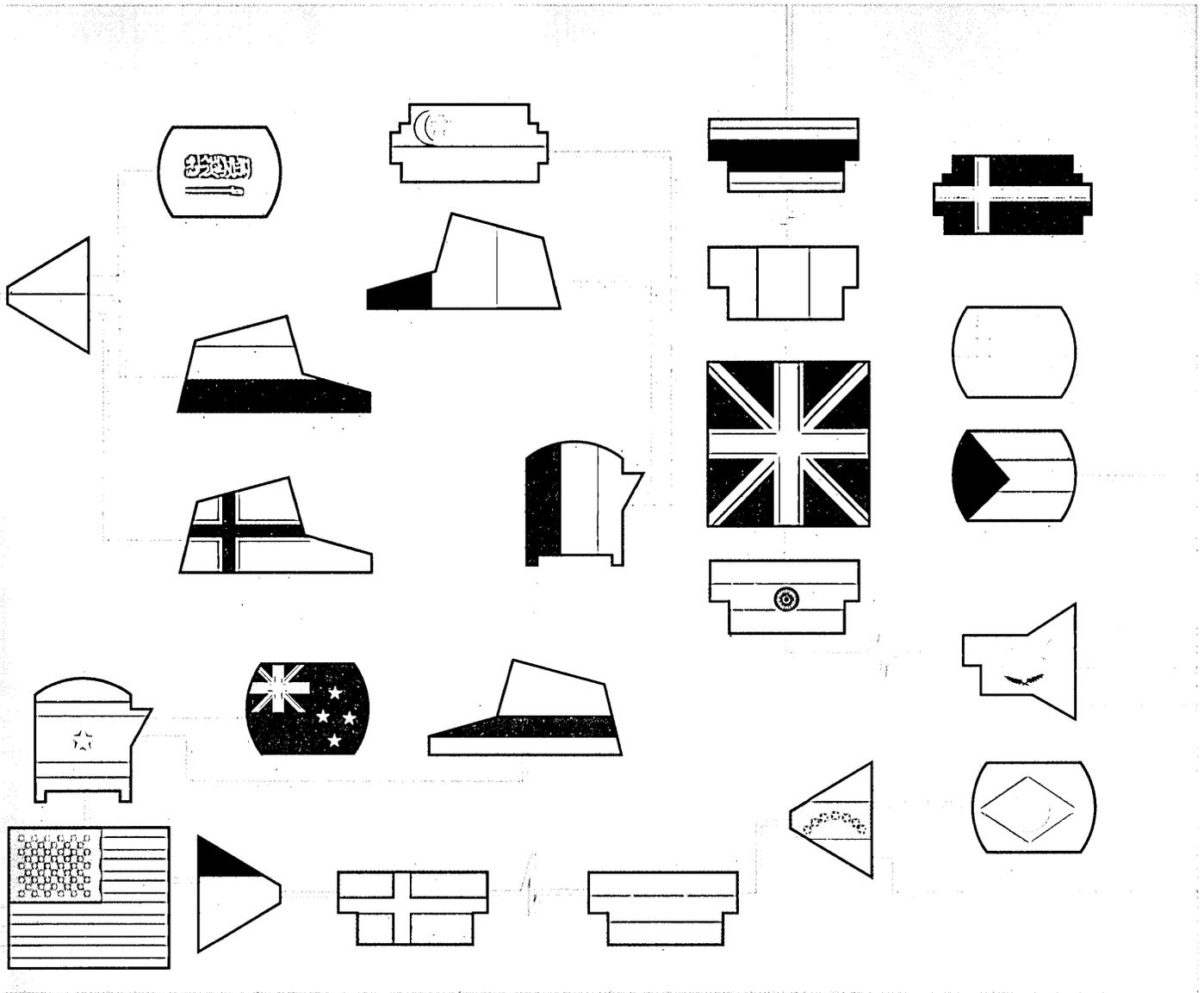
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CIRCLE 60 ON READER CARD

Last summer, TecNICA sent some U.S. dp people to Nicaragua. One of them explains what it was like to work there.

MESSAGE FROM MANAGUA

by Marcy Darnovsky

We arrived in Managua in August 1984, the middle of Nicaragua's hot and steamy season. Our group consisted of two economists and nine others from all corners of the computer world, from programmers to marketers, technical writers to engineers. We had come to Nicaragua to provide technical assistance to a variety of government and independent agencies: a kind of Computer Peace Corps, but in a country at war with guerillas funded by our own government.

We worked as volunteers and paid our own airfare from the U.S., but once we were in Nicaragua all our expenses were taken care of by our hosts at the Central Bank. The bank provided us with air conditioned accommodations at one of the few North American-style hotels in Managua, a comfortable place, but not so fancy that it didn't have cucarachas the size of frogs.

Our hosts also made a minibus and driver available to us whenever they could. This amenity eased our transition into a city where the buses are more crowded than cattle cars and the taxis are few, far between, and also overly full. Managua, a city of 750,000, has had no center since an earthquake 12 years ago destroyed the inner city. Ruins and empty lots still dominate what used to be downtown because, as popular history has it, President Somoza, then dictator of Nicaragua, channeled into his supporters' pockets much of the \$100 million of international aid sent to rebuild the city.

As we went about our work and wandered through the barrios and markets of Managua, we saw wealthy Spanish-style homes, middle-class neighborhoods, areas full of modest bungalows, and unpaved streets lined with rundown shacks that are nonetheless electrified. There are lots of poor people and a flourishing black market in Nicaragua—but in towns we visited, we saw no signs of malnutrition. The roads are always clogged with the overloaded buses and taxis, lots of private cars, and an occa-

sional horse-drawn cart. Billboards for banks and consumer goods stand next to political posters and slogans urging support for soldiers on the front. Independent vendors selling sodas, fruit drinks, sweets, and the country's three daily newspapers (including the opposition paper *La Prensa*) are everywhere.

TECNICA ORGANIZES TRIP

Our two-week trip was organized by TecNICA, a nonprofit, independent organization based in the San Francisco and Silicon Valley area. Since its inception in 1983 by three Bay Area people, TecNICA has coordinated the efforts of technical professionals who seek to express their disagreement with the Nicaragua policies of the Reagan administration by providing technical assistance.

Our weeks in Nicaragua were busy ones. We taught classes in database management, structured programming, and microcomputer repair. In an effort to help whip a potpourri of less-than-ideal computer systems into shape, we consulted with the Ministries of Health, Education, and Agriculture, the Central Bank, and the University of Central America. We also made recommendations to the government agency charged with coordinating the acquisition of government computers in Nicaragua. And we patched up some systems left by other well-meaning volunteers.

The August trip, one of TecNICA's first, was put together through word of mouth and a letter sent to a couple of hundred people on the mailing list of Computer Professionals for Social Responsibility, a national organization based in Palo Alto. As a result, almost all of us considered ourselves progressives of one variety or another. Michael Urmann, the 40-year-old economist who serves as TecNICA's coordinator, expressed a shared feeling when he said in an impromptu speech given at a demonstration of American citizens outside the United States Embassy in Managua, "We've spent so many years being forced to oppose things. This is a chance to

do something constructive."

All of us were and are unconditionally opposed to U.S. intervention and interference in Nicaragua. At the same time, we are painfully aware that a country that calls itself "revolutionary" has not necessarily realized its ideals. Certainly, Nicaragua is not paradise.

Our uneasiness about the Sandinistas stems not from President Reagan's claim that Nicaragua is a "totalitarian dungeon." According to a news story in *The New York Times*, such statements are so obviously untrue that they embarrass the leaders of Nicaraguan parties opposed to the Sandinistas. Nor do we believe that Nicaragua is shipping arms to the guerillas in El Salvador, since after three years of intensive CIA activity on Nicaragua's borders, not one shred of convincing evidence of these arms shipments has been produced.

Our criticisms of the Sandinista government are aimed at policies like press censorship and limitations on trade union activity. Yet many of us are sympathetic to the argument that these restrictions are understandable during a war like the one raging on Nicaragua's borders and in its countryside, and considering the CIA's efforts to sabotage the economy and the government. We discussed and debated these issues before, during, and after our trip to Nicaragua—as did, it seemed, almost everyone else in the country.

For most of the people drawn to TecNICA, the bottom line is twofold: curiosity about just what kind of society the Sandinistas are trying to build, and a desire to use our skills to help a poor third world country being unfairly attacked by our own government. As TecNICA member David Wald put it, "You see the victim of a bully being set upon, and the tendency of any decent citizen is to come to the aid of the victim."

As we started to get a picture of the computer situation in Nicaragua, we realized just how high the cards are stacked against its efforts to use computer technology. There is a fair amount of hardware in

The Nicaraguans are trying to use computers to help deliver social services, administer government agencies, and analyze the needs of the population.

the country, most of it IBM minicomputers and mainframes left over from the Somoza regime and micros donated since its overthrow by Canadian or Western European governments, organizations, and individuals. But Nicaragua suffers from a severe scarcity of both trained personnel and modern software.

There are few skilled technicians in Nicaragua because of the brain drain that followed the overthrow of Somoza. Large numbers of managers and professionals left the country in the first few years after the Sandinistas came to power in 1979, some because of opposition to the new government and others simply to avoid the consequences of an economy destabilized by years of civil war.

Software is hard to come by because of Nicaragua's dire shortage of foreign exchange. Everything imported, from hand lotion to light bulbs to printer ribbons, is unbelievably expensive. A bottle of shampoo, which like so many other goods cannot be manufactured in Nicaragua, costs 15% to 25% of an average worker's monthly salary. As for computer paper or diskettes, even the Central Bank has a hard time getting enough.

The dearth of hard currency is a symptom of the fragility of the Nicaraguan economy. Its economic problems, in some ways typical of third world countries, have been greatly exacerbated by the United States. Since the Sandinistas took power, the U.S. has cut off aid, limited imports of Nicaraguan goods, and blocked loans to Nicaragua from world lending institutions—moves that a Sandinista government official estimates have cost Nicaragua about \$550 million since President Reagan took office. In addition, the government claims it spends 25% of the national budget on the war with the contras, who receive funding, training, and support from the United States government and from private sources.

AMBITIOUS COMPUTER PROJECTS

Against this background, the Nicaraguans are trying to use computers to help plan the country's economy, deliver social services, administer government agencies, and analyze the needs of the population. They are undertaking ambitious projects in an environment that is both economically shaky and technologically deprived.

The closest we can get to being in their shoes is to imagine that it's 1977 or 1978. Pretend you're in charge of a medium-sized organization, and someone drops a 1984-model micro or supermicro in your lap. The bearer of this gift tells you it can

do amazing things for you and your outfit, and then walks away. You're on your own with the wonder machine.

Remember, it's a different world. None of your colleagues know how to use the thing—many of them have never seen a microcomputer before. There are no retail computer stores, no nontechnical computer magazines, no trade shows. There's hardly any commercial software around. You have a few programmers on your staff, but they work in RPG, the archaic forms-based language designed for System 3. You know the microcomputer offers huge advantages in efficiency, power, and quality, but you're not exactly sure just what it can do. And there's no one to ask.

Of course, the Nicaraguans know all about the trappings of the computer age. But they exist largely over the rainbow.

The Spanish language computer books we brought from Mexico City were treated as treasure. Most of the 40 students in the database management class that Erika Andersen and I taught were getting their first exposure to packaged DBMS; most students in Marc Wieder's computer repair workshop had never before laid eyes on the insides of a microcomputer. The appreciation our students showed for our efforts was overwhelming.

Considering the odds against success, there are quite a few computer applications up and running in Nicaragua. But there are also plenty of horror stories.

For example, the University of Central America (UCA), funded by the government and Jesuits, is the only school in Nicaragua that gives a degree in computer science. One hundred eighty-nine students are enrolled in the five-year program. But UCA has only one computer, a single-user IBM System/32 with a 5MB hard disk and 32K of RAM. This machine does double duty for administering the 5,000-student school and for teaching. As a result, 90% of the computer science students graduate without ever having touched a computer.

UCA leases this machine from IBM, the only mainframe or minicomputer company with an office and repair facilities in Nicaragua. The monthly payment, figured at the official exchange rate, is \$4,400. That's \$52,800 a year for equipment that is inadequate, inappropriate, and obsolete.

For UCA and many other Nicaraguan organizations, an IBM PC would make more sense and cost a whole lot less, but IBM doesn't sell or support micros in Nicaragua. Roberto Parrales, head of public relations at IBM Nicaragua, explained that although PCs might be preferable in some cases, they are sold only through dealers, and there are no dealers in Nicaragua.

IBM no longer even makes the System/32 or the System 23/Datamaster, another small computer that Nicaraguan agencies continue to lease from IBM. A spokeswoman at IBM's U.S. information office said that the IBM branch office in Nicaragua only markets products that are already installed in the country. It hasn't imported any equipment recently, she said, because Nicaraguan customers haven't been able to pay in dollars. She said IBM is still taking new orders and is collecting lease payments in cordobas, but no new IBM equipment is making it into the country. A customer there, she noted, could buy a PC, for instance, with dollars by ordering directly from the United States.

LITTLE INCENTIVE FOR IBM

If IBM is providing its Nicaraguan customers with something less than the best, it has little incentive to do otherwise. The lack of a repair infrastructure—there are no independent computer technicians in Nicaragua—and the absence of most other distributors make Nicaragua a captive market. But IBM is not nearly as interested in receiving cordobas as it would be dollars.

In fact, a Nicaraguan government official who did not wish to be identified speculated that IBM would just as soon close up shop in Nicaragua. According to this official, that's just what Burroughs did in 1977, during the war against Somoza, and now Nicaragua has three Burroughs mainframes gathering dust. The only reason IBM stays, he believes, is that pulling out and leaving Nicaragua without support for its 70 or so IBM computers would severely tarnish the company's reputation in the rest of Latin America.

Our advice to UCA was to get rid of their obsolete IBM system as soon as possible. UCA is fortunate in having a possible source of funds for new equipment that is independent of the strapped government coffers. As a Jesuit university, it finds sympathetic ears in the Jesuit community.

A few other computer companies have offices and repair facilities in Nicaragua, including Monroe, Radio Shack, and OSM, which makes IBM PC and XT look-alikes. But after consultation with the staff at the UCA computer center, we suggested that UCA might purchase two Unix-based supermicros, each with an 80MB hard disk and from four to eight terminals. The cost of these two computers would be about the same as one and a half years of renting the IBM, while giving UCA at least eight times as many terminals and 30 times the memory capacity. The Unix programming environment seemed appropriate for a university,



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since it supports languages currently in-use in Nicaragua, such as FORTRAN and BASIC, as well as more modern structured languages like Pascal and C that could serve as the basis for future development.

Nicaraguans can't just go shopping for the best available configurations, however. Though the U.S. Commerce Department has not put any unusual restrictions on computer exports to Nicaragua, the overwhelming sentiment is that it is dangerous to depend on the U.S. for vital goods and parts.

\$1,000 TO FIX CHIP IN APPLE

IBM isn't Nicaragua's only computer problem. The scarcity of repair technicians means that breakdowns the size of molehills grow into mountains. When a 50 cent chip in an Apple at an agricultural research institute went bad, for example, there was no one around to fix it. The Apple was shipped to Costa Rica, where the repair took six months—and cost \$1,000.

Donations and volunteers—including those from TecNICA, of course—can also be a source of difficulty. Good intentions notwithstanding, free help is often worth what you pay for it, or less.

At the Ministry of Education (MED), for example, payroll checks for 40,000 teachers are now at least a month behind because of a donated computer system inadequate to the application. After receiving several Commodores as a gift from the Canadian government, MED scrapped its manual payroll system, transferring the personnel who ran it to other departments. But the Canadians who had installed the hardware and software had given MED very little training in their use, and apparently very little thought to the task at hand.

By the time the typical startup problems were taken care of—first power surges, then the need to add new data fields—the data has exceeded the machine's disk capacity and the program was revealing bugs. MED would have been happy to go back to its manual system, but couldn't retrieve its personnel.

At the same ministry, TecNICA volunteer Greg Williamson spent four days deciphering a thousand lines of code that had been written by the Canadians for a nutritional and anthropometric study of schoolchildren. The program, written in Commodore BASIC, was undocumented, used cryptic variable and file names, and included almost no comments, save a few in French.

The Ministry of the Interior, which is responsible for technical and economic analysis of the agricultural sector, has also

received computers as gifts. It is successfully using several donated Apple IIs and KayPros, though here, too, a lack of training made the transition difficult. The ministry has ambitious plans nonetheless to set up a computer network connecting its central research office in Managua with seven field stations around the country—despite the fact that right now six of the seven field offices don't even have telephone lines.

The Ministry of Health is another success story, though we winced when we heard that a programmer there wrote a database system from scratch in BASIC rather than buy a commercial DBMS for a few hundred dollars. The system is serving the ministry's current purposes—maintaining a database on drugs and medical supplies in the country—but it's difficult to modify or add new queries to its repertoire.

The Nicaraguan government, which is painfully aware of the snags involved in harnessing the benefits of computer technology, has set up an agency charged with coordinating the acquisition and maintenance of computers. The National Office of Informatics (DNI) has been working on software development, arranging training in computer repair, and grappling with the questions of standardization.

The benefits of selecting a few hardware models and a couple of standard operating systems are persuasive. At the moment, DNI is leaning toward a deal with a Spanish government-owned company called Secoinsa. DNI is most interested in the Secoinsa 20, a multi-user Z80-based system running the OASIS operating system. The availability of software for OASIS is somewhat limited, but the company has promised to support concurrent CP/M by late 1984. While CP/M wouldn't be the system of choice in the U.S., DNI has the possibility of an American economic boycott to consider, along with the fact that Spain is one of the few countries still providing Nicaragua with substantial aid.

In such a highly politicized situation, it isn't surprising that DNI is interested in political issues as well as technical ones. The agency addresses some of the questions that are near and dear to the hearts of many TecNICA members: appropriate technology, the centralization of information, the creation of technical elites, the wisdom of knowing when not to computerize.

We had feared we would find the Sandinistas in the grip of a love affair with high technology like the one that has so many Americans in thrall. A few in the TecNICA group remain wary even after our trip. Moshe Adler, an assistant professor of economics at the University of California at Davis, worries about creating a class of

technicians with a hunger for gadgets that a poor country like Nicaragua will never be able to satisfy. Adler also questions whether a country with unpaved streets and shortages of medicines should be spending any money on computers.

But most of us came away feeling encouraged. The existence of a government agency that asks the right questions is a good sign. So is the hand-lettered poster that hangs in the classroom of the Central Bank's skills center: "To become a technician is not a credential for acquiring privileges, but a social responsibility."

The majority of the computer technicians with whom we worked are not Sandinistas. They are largely middle class, which means they have benefited the least from the Sandinista revolution. Yet they retain positions of power and responsibility in the Sandinista government, and they are going about their jobs with competence and enthusiasm. Most of the projects they are computerizing, from nutrition studies to analyses of agricultural production, seem to be chosen to enhance economic development and the delivery of social services to the greatest number of Nicaraguans.

Since our return from Nicaragua, we've found that TecNICA's activities appeal to a wide range of Americans. We've been deluged with calls from computer technicians; statisticians, economists, bankers, machinists, and other technical professionals. A recent ad for TecNICA in the *San Francisco Chronicle's* classified section drew over 60 responses, including one from a banker who said, "I've worked in this field for 20 years but I feel as if I've never made a meaningful contribution."

In technical work, as in the rest of their efforts, the Nicaraguan people are undertaking a social experiment on a grand scale. The Somoza dictatorship was overthrown through the combined efforts of peasants, workers, and the middle class. Whether they are successful in building a society as egalitarian and humane as the one they envision, and what role the Sandinista leadership will play in this reconstruction, remain to be seen. Our hope is that Nicaraguans will be allowed to pursue their experiment, wherever it might lead, in their own way. ©

Marcy Darnovsky is a free-lance writer living in the San Francisco Bay Area. She is a member of the Community Memory Project, a Berkeley, Calif.-based nonprofit organization, which is developing a public-access, community-controlled computerized message system. She spent a month working and traveling in Nicaragua last summer.

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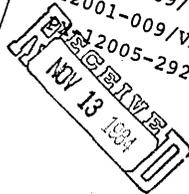
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CIRCLE 63 ON READER CARD

Ohio State University charts a course toward centralized management of a decentralized computer operation.

A NEW VOYAGE FOR COLUMBUS

by Paula J. Stevenson

How can a large organization with one main computer center and many smaller, separate sites create an environment that offers both central support and local autonomy? Such a method of system management would allow the advantages of ownership and control by the individual departments or projects, while the staff at each computer facility enjoys the benefits of being associated with the main center. The following story tells how Ohio State University, Columbus, successfully expanded its computing from one centralized center to include a number of separate departmentally owned facilities, each with one or more computers.

The history of computing at Ohio State University is one of explosive growth. It became obvious very early that obtaining and operating a large-scale computer was a costly venture. Cost-effectiveness meant careful selection of a large computer and the establishment of a university-wide computer center. Funding was furnished centrally from university operating funds. From a few pieces of card-handling equipment and two part-time employees in 1947, the computer center regularly upgraded its equipment and expanded its staff to the current Amdahl 470 V/8, DECSys 20/60, IBM 4341 computers, and over 100 full-time staffers. With each move to a faster, more expensive computer with more capabilities came an even larger jump in the number of users and the scope of applications. The ever increasing load made it difficult during periods of the center's growth for students and researchers alike to obtain access to the equipment. Larger computers with more capabilities were always needed, but funding usually lagged behind need because replacement costs were so high.

Things began to change in the early 1970s, however. The availability of affordable, highly reliable minicomputers started to reverse the trend away from one large, centralized computer facility with auxiliary stations connected to the main computer, to a more decentralized system. Departments and research projects began to invest in their own mid-sized computer systems, operated entirely by their own staff. A

cent estimate of the separately owned university minicomputers put their number at around 100, and the count is constantly increasing. At the same time, the load on the computer center's mainframes also continues to increase. Even with all of these other computers, the central computer facility continues to handle the majority of instructional and research computing for OSU.

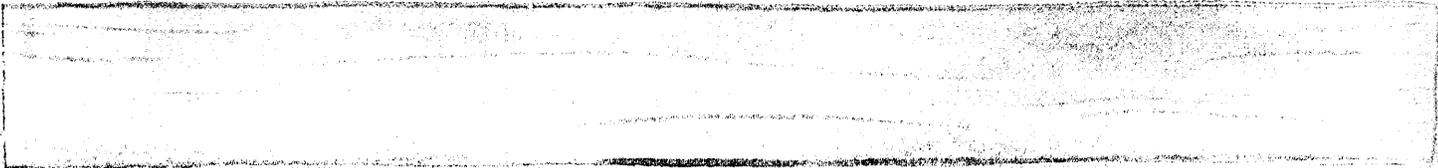
Local ownership and management of these individual minicomputers had a number of immediate advantages over the large computer center. A department had control over who used its facility and what it was used for. All associated personnel were on site and accessible. A sense of individual ownership vs. university-wide ownership tended to promote an atmosphere of sustained interest by departmental faculty and administration in the well-being of their own lab. Innovation and a sense of excitement prevailed. Funds were regularly sought for equipment upgrades.

ANALOGY WITH HOME OWNERSHIP

An analogy exists in the concept of home ownership compared with housing rental. A home owner takes pride in his home because it is his, and works to upgrade it and keep it looking nice. On the other hand, a renter simply uses his apartment and moves on, rarely making improvements because the property belongs to someone else. Obviously, the parallel is that if separate, departmentally owned computers are affordable, in some cases individual ownership is desirable.

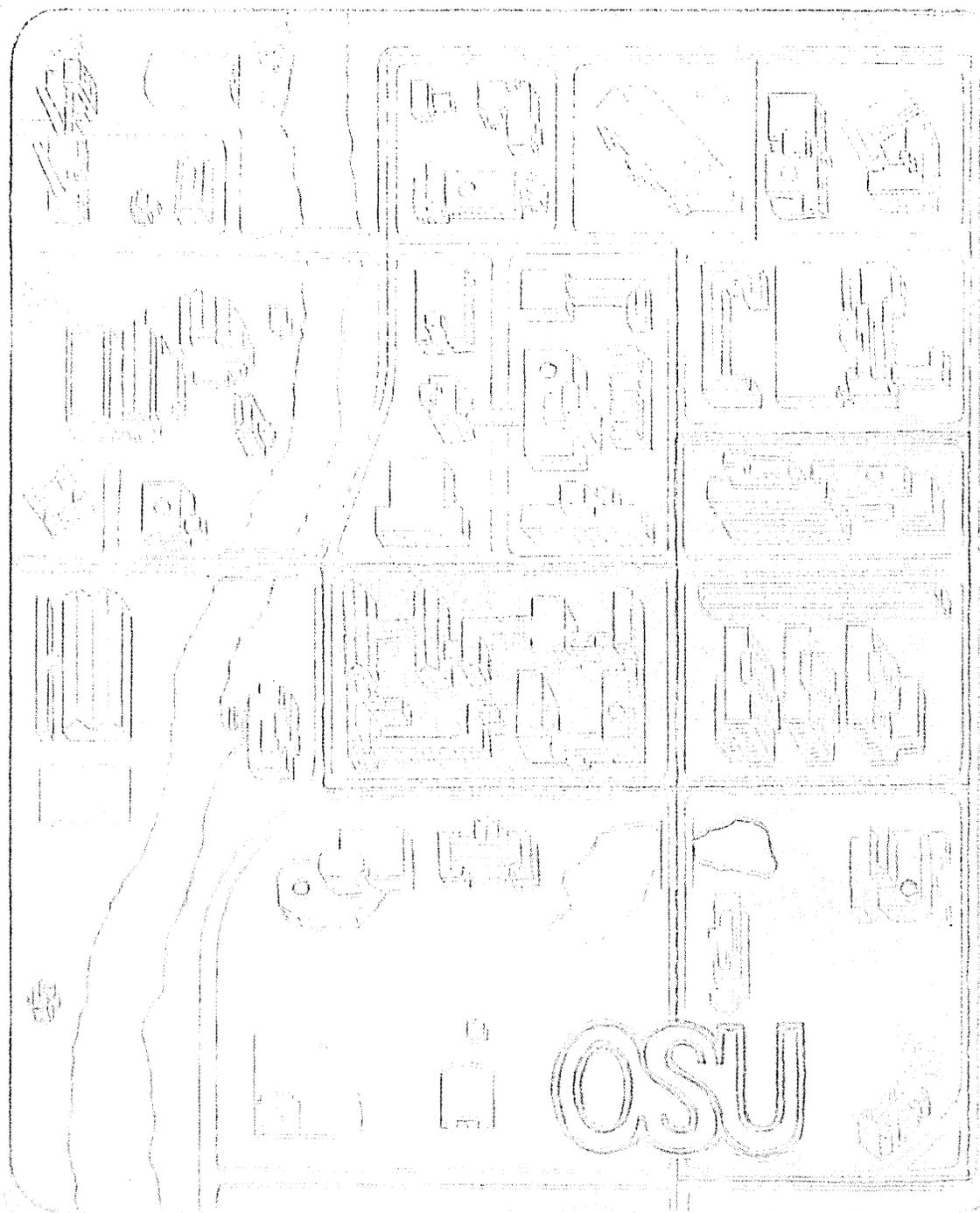
Over a period of time, some problems in ownership by individual departments emerged. The university administration would allocate one-time funds to purchase equipment for a computer site. Obtaining continuous funding for staff, equipment maintenance, supplies, and so forth was more difficult. Departments were often in a poor position to estimate the ongoing costs; budget overruns were frequent. Individual sites tended to become isolated; communication about problems with other small, similar sites was difficult. It was impossible for one individual to keep abreast of new technical developments and equipment was often underutilized.



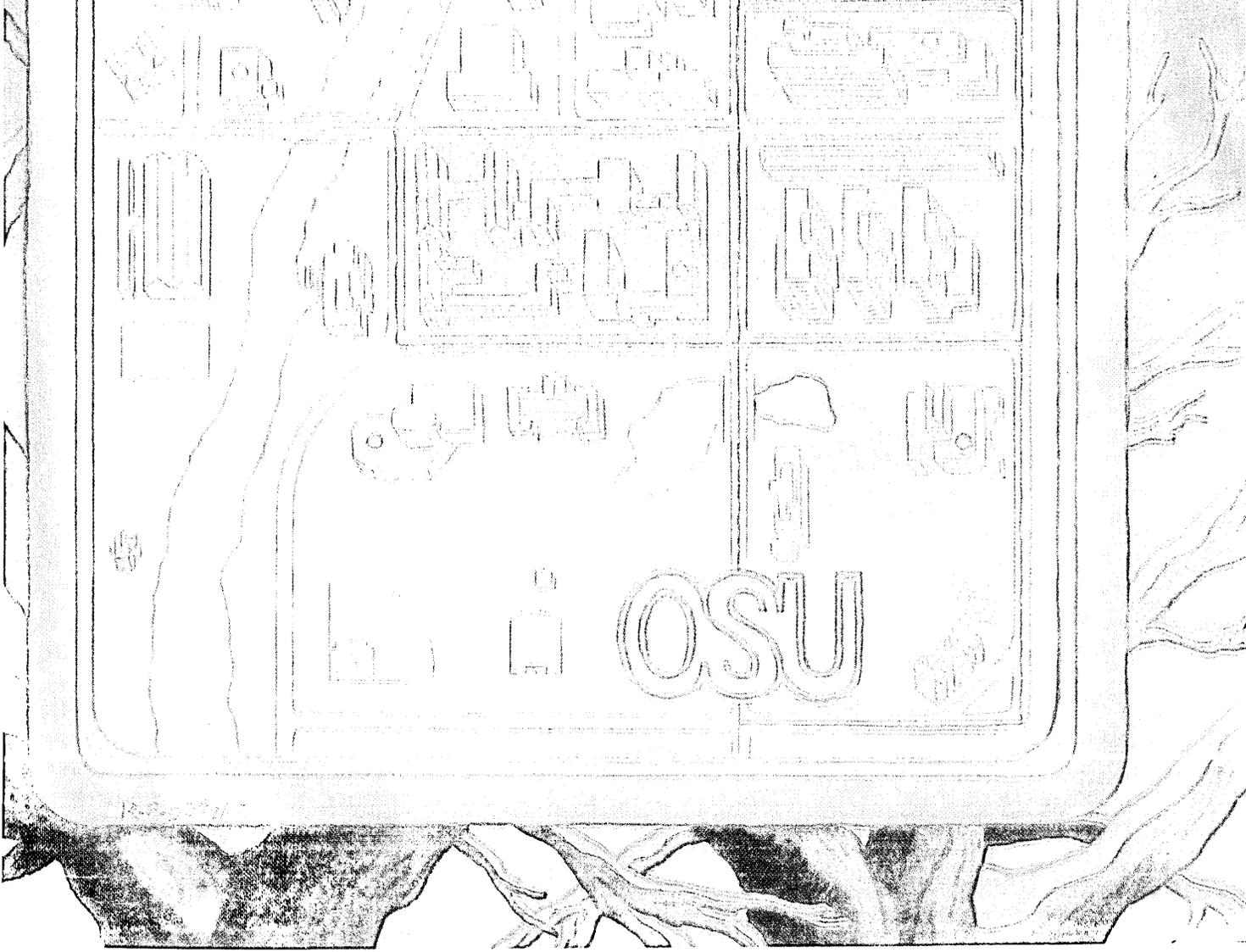


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OSU



When department conflicts resulted in an expensive new computer being unplugged, the college asked the computer center for help.

To further complicate matters, department electronic specialists sometimes altered the equipment—personalizing it by patching together a hodgepodge of equipment to fit specialized needs—only to discover that this meant no vendor would maintain the system. When that specialist left, the next person was often unfamiliar with the idiosyncrasies of the alterations, which caused even more trouble. Equipment selection of peripherals such as disk drives, printers, interfaces, special cables, and cabinets was sometimes haphazard. The lowest-priced equipment was purchased from miscellaneous vendors without a view toward long-term maintenance and compatibility. Occasional power struggles ensued over which group should have primary access to the computer. Operating staff who were hired, promoted, and supervised by the department were sometimes influenced to show favoritism in granting account privileges.

An example of these problems was typified to an extreme in the case of a particular departmental facility. Problems such as those mentioned above had resulted in a new, very expensive computer simply being unplugged and left idle! At that point, the college contacted the computer center in desperation to request assistance in reviving the site. A senior staff person was assigned to coordinate the effort to get the site running. This situation led to a solution that evolved into a new model for efficient system management of numerous sites within a large organization.

The computer center hired a site manager. The self-customized software and hardware on the computer were removed, a maintenance program was begun, standardized software and hardware were installed, and equitable accounts were set up. The computer center continued to oversee

the day-to-day management of the facility. The college administration was pleased with the efforts of the computer center and subsequently asked the center to assume management of several other departmental minicomputing facilities that were experiencing operating problems.

The college furnished operating funds in accordance with a mutually agreed upon annual budget to the computer center, which hired the on-site staff, purchased the supplies, and arranged and paid for maintenance costs. Each facility retained its individual character and purpose. A faculty computer committee at each facility set policy and insured that overall control remained within the department. Later, the computer center was approached by other colleges and projects about managing their computer facilities.

A case history of another computer facility provides a good example of uniform, well-intentioned self-management by a department. A faculty member obtained permission and funds to start up a computer site. He ordered the computer, procured some donated off-brand peripheral equipment, and installed everything himself. He and a graduate student custom-built some communications devices to serve as interfaces to the equipment. Unfortunately, equipment failure was frequent and prolonged. The faculty member devoted much of his time to the computer, and as a direct result did not achieve tenure and had to leave the university. Air conditioning and security were inadequate, causing more problems. There was a great deal of departmental infighting over who should be able to use the facility.

In July 1983, management of this computer site was turned over to the computer center. The substandard and mismatched equipment was replaced. Other

departments were brought in to share and more fully use the existing resources. It soon became apparent that this was an appropriate union: the department could enjoy all the benefits of having its own facility to use as it pleased while leaving all of the operating problems to the computer center.

CENTER FORMS NEW DIVISION

As a result, a new division was formed within the computer center, called facilities management. A small central support staff was hired to coordinate budgets and funding, place supply orders, maintain records, handle the division's accounting, and perform other administrative support collectively for all the managed sites. The entire function of this new division was to manage computer facilities for other departments, and the sponsoring unit determined the level of service to be provided by the computer center. At the discretion of the sponsoring unit, the computer center's facilities management service took responsibility for all staffing, security, supply orders, air conditioning, scheduling of the labs for classes, wiring, phones, equipment maintenance and repair, inventory, and insurance.

One problem that had to be overcome, which still partially exists in the university as a whole, was an individual department's fear of losing control of its facility, that it would become another site belonging to the computer center. After all, the department purchased its own computer to separate from the computer center, and to rely on and control its own resources instead of depend upon university-wide resources. As word got around that it worked to have management assistance from the computer center, more departments have been willing to consider this option.

The site employees interact regularly with employees of other, similar facilities-managed sites. These other employees function daily as a sort of ad hoc support team; they serve as mutual resource persons for the continual problems that arise, and they fill in for each other during illness, vacation, or resignation. As employees of the computer center, they are exposed to much of the latest information in hardware, software, and data communications developments as a matter of course.

Specialization is possible within the computer center itself because of its relatively large size; facilities management personnel have easy access to these specialists. Another primary advantage of employees being paid through the computer center rather than through the individual departments is that they don't need to be involved



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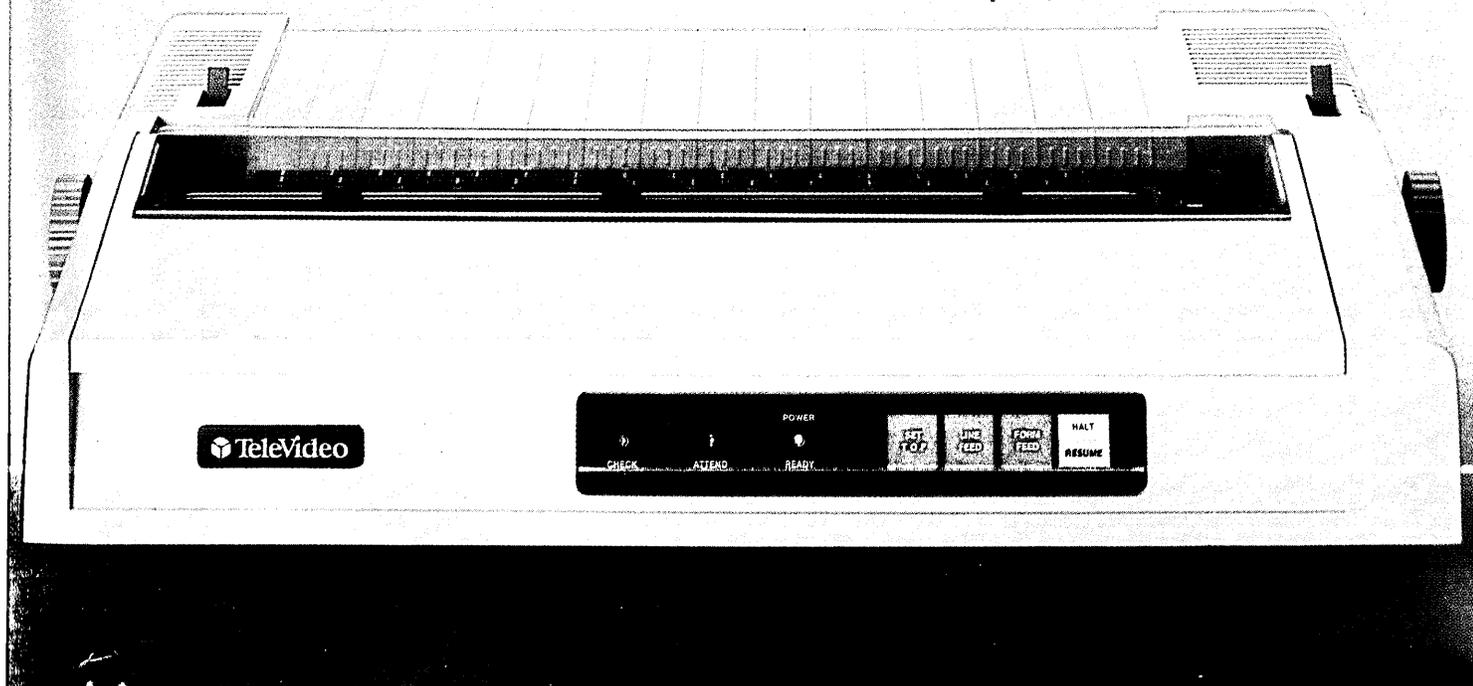
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CIRCLE 64 ON READER CARD



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One problem that had to be overcome: departments' fears of losing control of their facilities.

in departmental politics regarding use of the facility. Instead, they can function impartially, balancing the needs of all approved users and abiding by departmental policies.

In this management combination, similar computer systems in different departments make use of the same software programs to perform some common functions, such as setting up and maintaining user accounts. Programming efforts can be easily coordinated, shared, and duplicated as needed to minimize costly individual program development. In 1984, facilities management site programmers coordinated their efforts extensively; this freed up a great deal of time to pursue exciting programming projects involving university-industry cooperation.

A disk-sharing project was developed in conjunction with System Industries, San Jose, and a database management product was developed with the Tominy Corp. of Cincinnati. In exchange, the companies contributed expensive hardware and more than ample operating funds.

Other exciting opportunities arise

with personal computers, which, like mini-computers a decade ago, have come down in price, become more affordable, and are now entering the university environment in large numbers.

PLAN, MANAGE MICROLABS

Facilities management has also been involved in helping to plan and manage the new microcomputer teaching laboratories. Four of these microlabs are now operational; an additional eight sites are planned for 1985. A typical laboratory/classroom consists of 20 microcomputers. The sponsoring unit provides space for the lab and sometimes initial funds for equipment and hardware. Startup equipment cost is low, and the sponsoring unit receives priority scheduling of the lab. Other departments can share open work-time hours in the lab, which lowers costs and improves resource use. A low hourly fee is charged to rent the entire microlab. This allows equipment use at the highest possible levels.

Most of the facilities management sites have been networked to other univer-

sity computer systems. Software standards were set up to ease the transition to networking and allow users to move easily between individual computers. This is an important new trend, and eventually, we envision interconnecting all OSU computer systems for communication and resource sharing, while retaining the organizational advantages to keeping the management of computer systems in one place. Long-term costs are reduced by sharing knowledge of the best equipment purchases for the least cost, by combining supply and maintenance orders to receive substantial bulk discounts, and by pooling programming efforts, as mentioned previously. The trend, however, appears to be toward a network of smaller, interconnected computers, rather than ever larger supercomputers. ©

Paula J. Stevenson is the administrative assistant for the Facilities Management Division of the Instruction and Research Computer Center, Ohio State University, Columbus, Ohio. In her spare time, she studies electrical engineering, also at Ohio State.

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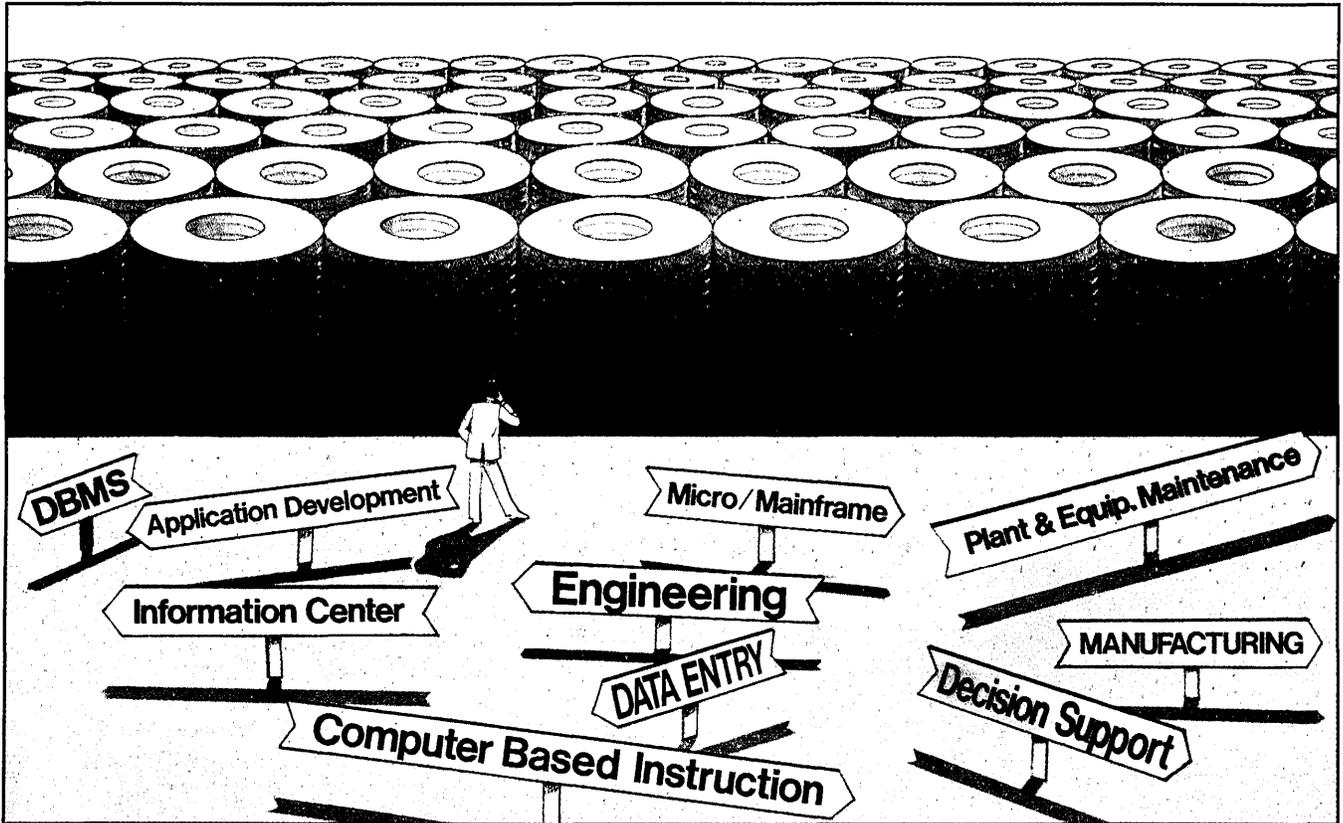
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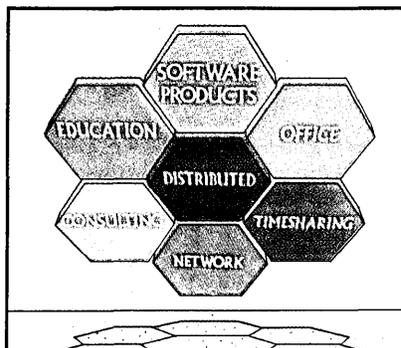


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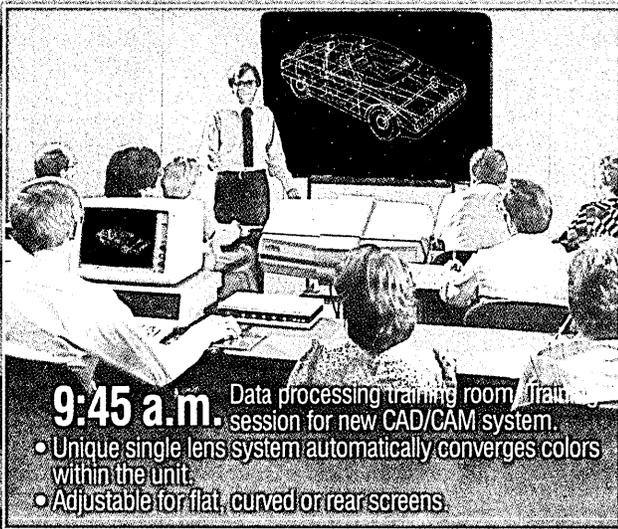
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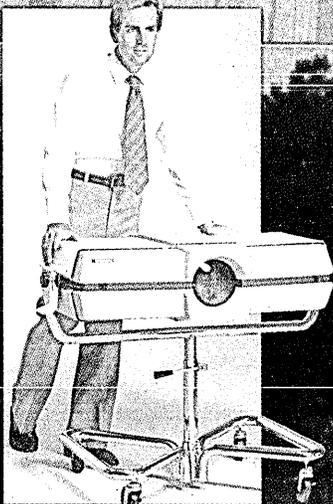
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CIRCLE 66 ON READER CARD

HARDWARE

OFF-LINE

Will 1985 be remembered as the year of the blue-collar pc? It's likely, as more micros show up outside the cloistered cubicles of middle management, and on factory floors. Industrial applications are being supported by several large and small vendors. Digital Equipment Corp.'s PDP-11 is still the backbone of many controller applications. It has become commonplace for companies to link minis and micros on the factory floor with the corporate mainframes to keep better control over the production process. This year will see more products specifically targeted for this market; early samples include the OMTI 5500 and OMTI 5700 IBM XT-compatible peripheral controllers from Scientific Micro Systems of Mountain View, Calif. This vendor also manufactures DEC-compatible minis for use on the factory floor.

And as IBM eases the supply shortage of its AT, expect that product also to show up on the factory floor. IBM recently inked a deal with Micro-MRP of Foster City, Calif., a small startup that sells an inventory control and planning software package for the AT, as well as for the PC and XT. IBM will offer this manufacturing resource planning system through its own distribution channels as it attempts to expand and diversify the PC AT market. IBM has also introduced an industrial graphics printer designed to operate on the factory floor. The product comes out of the PC capital of the world, IBM's Entry Systems Division in Boca Raton, Fla., and offers complete XT and AT software compatibility.

According to the Yankee Group, the research firm in Boston, many new industrial local area networks (ILANS) will be announced for manufacturing applications this year. Most will be joint efforts by factory automation and local

network vendors; for example, General Electric is expected to team with Ungermann-Bass, and Allen-Bradley is reportedly working with Concord Data Systems toward product introductions in the future. The Yankee Group sees ILANS as "one of the fastest growing and most important technologies in the burgeoning factory automation business."

At the top of everyone's list of ILANS, of course, is the General Motors MAP (Manufacturing Automation Protocol). Through sheer force of will and size, GM has managed to bring several competitors together to build an open network for the factory. MAP, however, is not a fully specified system and will not be available until at least 1987.

The growth in networks may also signal a growth in sales of other factory automation tools. As the manufacturing becomes more continuous, the industrial companies are facing complex management problems as separate operations find they need coordinated information. Tools in the automated factory must be tied together by networks to reap the full benefits of automation. Most vendors of "intelligent" equipment for the factory will offer interfaces to GM's MAP, but other networks will also be used.

Part of Apple Computer's 1985 Mac-Office strategy is the ability to link Macintosh pcs with one another in networks, as well as to mainframes. An early supporter of Apple's networking drive is Zilog, whose System 8000 can provide mass storage facilities and network gateways for the Mac. The Exxon subsidiary, based in Campbell, Calif., is pushing the 8000 as a disk server with from 52 to 673MB of capacity. Macs link to the 8000 via the AppleTalk network. With a little help from its friends, Apple clearly is trying to make quiet inroads into corporate accounts.

REPLACES 9950

The Prime 9955 is designed to replace the vendor's model 9950. Like its predecessor, it has a 32-bit cpu with a five-stage pipeline architecture. The main difference between the two units is that the 9955 has a multiplier array processor with Motorola macro cells and its performance has been quadrupled, according to the vendor.

It has a 64KB cache and a 1Kb branch cache. The unit has a soft error recovery feature that will reload from main memory data lost due to a parity error occurring in the cache, branch cache, or in the buffer. It runs under the vendor's new release of its proprietary operating system, Primos 19.4, which includes hooks into Unix, though Unix is not currently supported.

According to the vendor, this product is designed for use as a general-purpose computer as well as for CAD/CAM/CAE applications. It has up to 16MB of main memory and can support 256 terminals, 16 disk drives, and 8 tape drives. It is a 4MIPS machine that is rated at more than 4,000 single-user Whetstones and 3,200 double-precision Whetstones, the vendor says.

A system with a 350MB disk drive and 4MB of main memory sells for \$351,000. An in-cabinet kit to upgrade a 9950 to a 9955 costs \$45,000. PRIME COMPUTER INC., Natick, Mass.

FOR DATA CIRCLE 301 ON READER CARD

DATA SWITCH

The CommXchange DS01 data switch allows connection of large groups of terminals to single or multiple-host computer networks through keyboard commands. It supports 180 terminal-to-computer port connections or 360 lines. Expansion units can be added for an additional 480 connections or 960 lines.

According to the vendor, the unit is compatible with virtually any type of computer or asynchronous terminal and performance is not affected as the number of users is increased. The basic system in-

HARDWARE

cludes a central unit, power supply, and central board set. It can be configured with complete redundancy. The backplane is fully redundant as a standard feature, and redundant central boards, expansion bus boards, and power supplies can be added as options. It also has battery backup.

A supervisory control board, located within the central unit, provides menu-driven software for step-by-step instructions on routing terminal lines to designated computers. System parameters can be changed on-site and new lines can be added and existing lines reconfigured while the switch is operating.

A terminal can select any of 45 types of destinations by using eight-character symbolic names or specific line numbers. Destinations can be single or multiple groups of computer ports, dial-out modems, printers, or personal computers. Access privilege lists are configured into the system to keep users from connecting to unauthorized destinations. The network log records unauthorized attempts and password protection is also available.

Automatic backup switching is provided for high system availability. In case of computer failure or service, all incoming calls can be automatically switched to a preassigned backup computer by the unit. It has a throughput rate

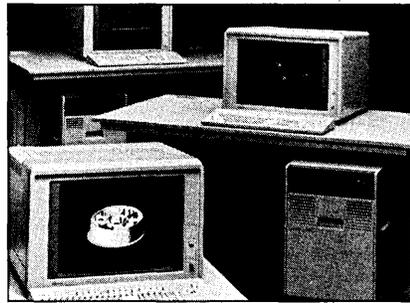
of 9,600bps and all lines can run continuously at this speed with no degradation, the vendor says. Bandwidth rating is 6.336Mbps. List price for a system consisting of the central system, redundant power supplies, and redundant central board sets is \$15,000. EMULEX CORP., Costa Mesa, Calif.

FOR DATA CIRCLE 302 ON READER CARD

UNIX-LIKE OS

The Datapoint 3200 is a 32-bit computer with a Unix-like operating system called UNOS. The system supports a relational database management system, RM/COBOL, C, and Databus development languages. It will be marketed as a standalone system and as an additional resource on the vendor's ARC intelligent local area network.

The system incorporates two Motorola 68000 microprocessors. One 68000



with 4KB cache memory performs all application processing at a 12.5MHz clock rate. The other 68000 is dedicated to I/O operations. An entry-level system consists of 1MB of memory, 32MB disk storage with 1MB of diskette storage, 4KB cache memory, and four serial ports. Initially, two models will be available with options including up to 8MB of memory, three types of terminals, three types of printers, and a 2780/3780 communications adapter. It supports up to 28 terminals.

The system interfaces with the ARC network via the Intelligent Network Executive-32 (INX-32), an optional internal card, and accompanying software. The UNOS operating system provides file management facilities including multitasking, device-independent I/O, I/O redirection, dynamic file allocation, and hierarchical directory structure. The base system is priced at \$15,500. UNOS costs \$1,000. The INX-32 adapter with software sells for \$2,500. DATAPOINT CORP., San Antonio.

FOR DATA CIRCLE 303 ON READER CARD

PORTABLE MICRO

Pro-Lite is a briefcase-size personal computer. It is targeted for what the vendor calls "highly mobile professionals such as salespeople, insurance agents, auditors, and consultants."

Depending on the industry application, data can take the form of inventory status reports, marketing data, order/shipment status, or customer reports and presentations. It is compatible with the vendor's TI personal computer.

The computer features a 12-inch liquid crystal display that shows 80 columns by 25 lines. The screen can display either graphics or characters. An external color or monochrome monitor is offered as an option.

With up to 768KB of RAM, the product can accommodate some of the more memory-intensive integrated software packages. The entry-level configuration of the micro includes 256KB of RAM. It has a 16-bit 80088 microprocessor, with an 80087 numeric coprocessor available as an option.

The 10.5-pound unit has a single 3.5-inch floppy disk drive. Diskette storage capacity is 720KB. Through an expansion box that attaches to the back of the product, either a second disk drive or a battery pack (or both) can be added. In addition, an internal 300-baud modem is available as an option. The modem plugs into one of the two internal option slots. The remaining option slot can accommodate one of the following: an RS232C interface, external monitor, or programmable software modules for application-specific needs. An external parallel port for connecting a printer comes with the

HARDWARE SPOTLIGHT

THWARTS PIRACY ATTEMPTS

Access Keys is an access management and user authentication system, primarily designed to eliminate unauthorized access to computer systems, networks, and programs. It works in conjunction with computer resident protection routines.

When held to the screen of a computer system that is protected, the handheld device reads information that has been generated by the matching protection routines. The proper password is determined by the Access Key using the information that was read from the screen. The password, which is different for each use of the computer, is displayed on the key itself, and works only for that access of the computer. When typed into the system and accepted by the protection

routines, the correct password permits user access. The product can also be used to protect individual software programs.

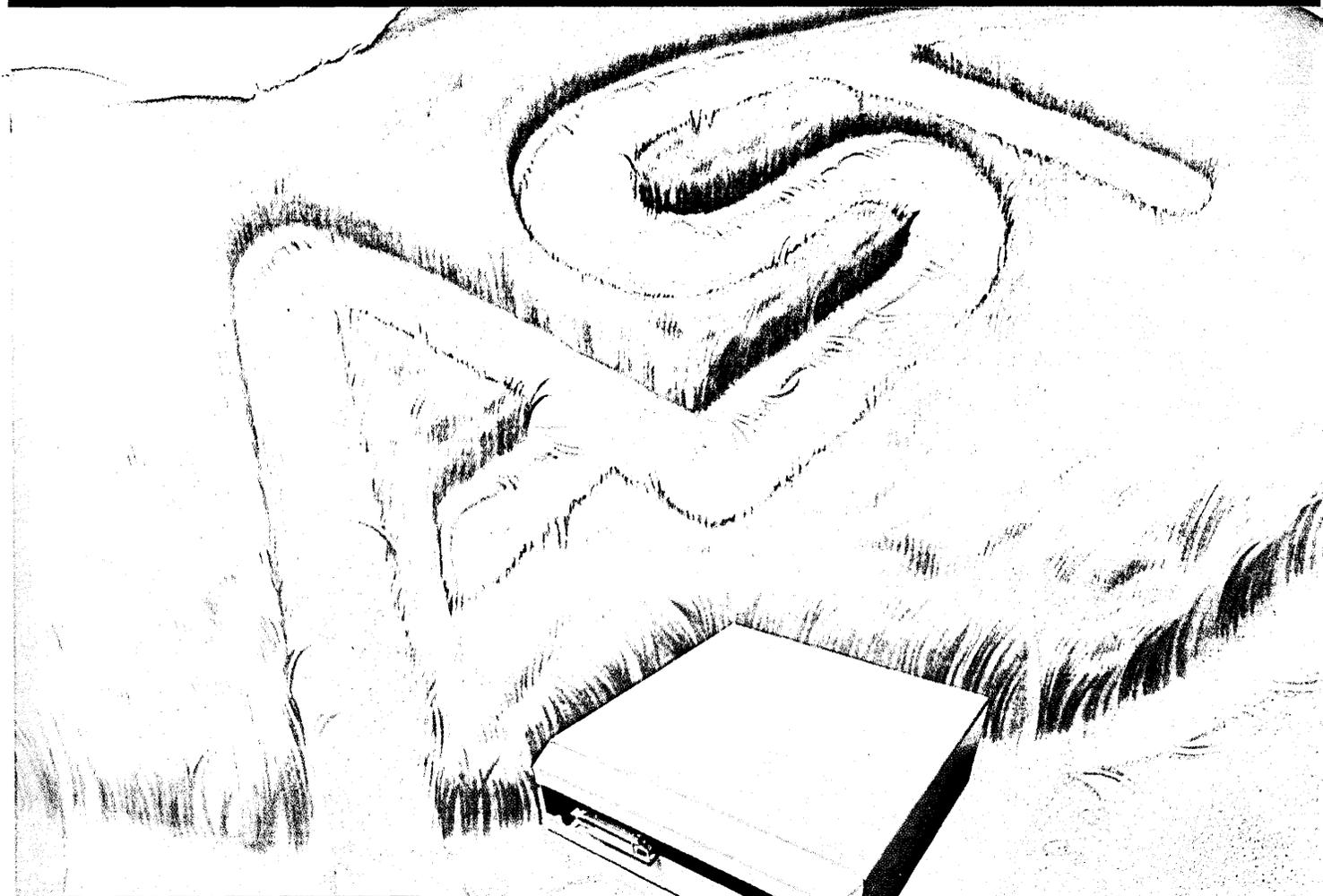
With this system, the password changes with each attempted use of the computer. The only way to determine the valid password for that particular use of the computer or data is by possessing the matching Access Key. The password the unit generates is created in part from a computer-generated random number that cannot be predicted, and in part from the Access Key resident data that is even more difficult to determine, the vendor says. Also, access is not limited to computers or databases, and a specific time period of use can also be assigned by the MIS department.

Each Access Key contains optical sensors, a custom integrated circuit, a five-year battery, a six-character alpha/numeric LCD, an internal clock, and counter components. An access management starter kit for a dp environment costs \$15,000 and includes 50 blank keys, key programming equipment, and software source listings of algorithms. A starter kit for micro software developers is available for \$6,000. GORDIAN SYSTEMS INC., Palo Alto.

FOR DATA CIRCLE 300 ON READER CARD



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And with an average access time of 30 milliseconds and direct disk to tape data transfer at 5Mb per minute, this 67Mb disk subsystem with 60Mb streaming tape cartridge backup is the choice for performance too. Easy to use, Colossus is perfect for your large data base, multi-user and local area network applications and will also backup the IBM internal drive when installed in an AT or XT.

Advanced Architecture. Colossus uses state-of-the-art SCSI (Small Computer Systems Interface) architecture. A high performance bus, Colossus' SCSI design provides extensive operational error identification and recovery,

automatic disk media defect management, intelligent peripheral controllers to off-load housekeeping from your PC's CPU and a self-test at power-on. So problems are diagnosed before faulty operation occurs, operational errors are recovered and data errors associated with bad disk track maintenance are eliminated.

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For ease of use, Colossus' tape

backup allows streaming image or file-by-file tape backup operations with a choice of menu or command driven software operations. Industry standard tape format means media is transportable for access on other systems too.

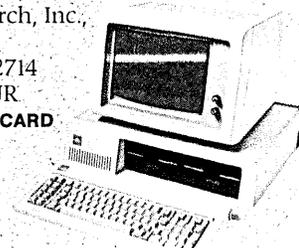
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CIRCLE 67 ON READER CARD

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HARDWARE

basic unit as standard. The keyboard has 79 full-sized keys. It includes 12 programmable function keys and an embedded numeric keypad.

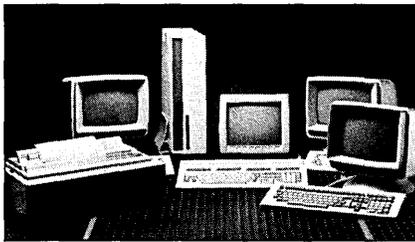
With 256KB RAM and one diskette drive the Pro-Lite sells for \$3,000. TEXAS INSTRUMENTS INC., Data Systems Group, Dallas.

FOR DATA CIRCLE 304 ON READER CARD

UNIX MICRO

The PE 7350A is a supermicro computer system targeted at oems and vars using Unix software. The 68000-based processor features the UniPlus port of Unix System III.

Up to five users are supported by the system, which offers memory sizes from 512KB to 3MB, a choice of a 15MB or



28MB fixed disk, a floppy diskette, optional monochrome or color graphics, and an optional IEEE-488 bus.

Software for the product includes a variety of UniPlus applications packages. In addition to C, programming languages include FORTRAN-77, BASIC-Plus, RM/COBOL, and SIBOL. Communications facilities are available for interacting with other Unix systems through the standard interprocessor Unix facilities cu, uucp, and uux.

The vendor provides an optional OS/32 interface package for interacting with the company's proprietary real-time operating system. It will also support Ethernet. In quantities of 100, a complete system sells for \$5,100, and the processor alone costs \$3,900. PERKIN-ELMER, Data Systems Group, Oceanport, N.J.

FOR DATA CIRCLE 305 ON READER CARD

PC GRAPHICS ADAPTER

Palette Master is a high-resolution color graphics board for the IBM Personal Computer. It can display 256,000 different colors, 256 at a time.

The product provides the ability to display photograph-like images stored in computer memory. It has 64KB of memory on the adapter, which permits a complete single image to be displayed and stored. Other images can be moved from disk storage to the display in less than one second, the vendor says.

The device supports existing software that works with the IBM PC color graphics adapter. It displays images 320 dots wide by 200 dots high. According to

the vendor, the photographic-like images are achieved because of the 256 colors available at a time and the fact that the human eye forms a complete image with the large number of colors.

The graphics adapter will also allow users to send photo-like images through modems. This product was co-designed by Quadram and Comsell. The Palette Master retails for \$700. QUADRAM CORP. and COMSELL INC., Atlanta.

FOR DATA CIRCLE 306 ON READER CARD

UNIX SUPERMICRO

The P/15 is a 32-bit supermicrocomputer designed for the one- to eight-user environment. It is targeted for the var/oem marketplace and is compatible with the vendor's other Unix-based products.

It utilizes two MC68010 microprocessors, a memory capacity of up to 2MB, and eight full-duplex serial ports for terminals or other peripherals. According to the vendor, the product is specifically geared for the small-user market where high performance is also required.

The unit is packaged to fit in a very limited space. It is 25 inches high and weighs under 75 pounds. The computer is totally self-contained, allowing for up to 54MB of disk storage in two Winchester disks, plus a single 5¼-inch floppy disk. It uses 115 vac power and runs under the Unix operating system. The cpu job processor with a 10MHz clock operates with no wait states through a shared map with 8MB of address space. It supports the IEEE proposed standards for floating point arithmetic. Utilizing current 256KB RAM devices, the unit is available with up to 1 million 16-bit words. Prices for the P/15 start at \$11,000. PLEXUS COMPUTERS INC., San Jose.

FOR DATA CIRCLE 308 ON READER CARD

WORKSTATIONS

The Dynamite 654X line of personal workstations is designed to complement the vendor's NonStop line of systems by letting users gain access to host computer data for on-line or standalone processing. It is aimed at users who require the ability to process their corporate database and manipulate that information with personal decision-support tools.

The workstations include IBM 3270 emulation plus the local processing capability of a standalone personal computer. Dynamite is based on the 16-bit 8086 microprocessor, and for local processing runs under MS/DOS. According to the vendor, it can run most software written for the IBM PC. The line consists of two models, each with a dual-mode, 12-inch green phosphor display screen that supports both text and graphics, and either two 360KB floppy disk drives or one floppy disk drive and one 10MB Winches-

ter disk drive. Both models include MS/DOS and GW-BASIC. Main memory can be expanded to 640KB.

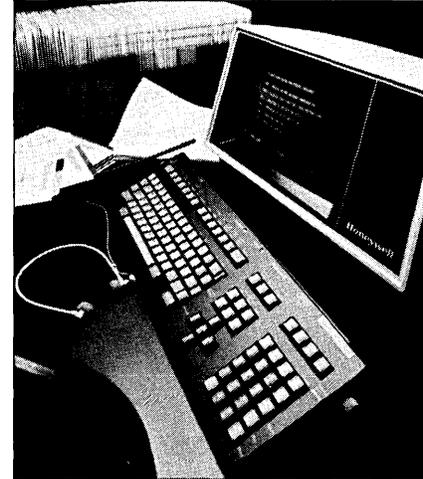
The keyboard contains the full set of the vendor's 653X terminal function keys as well as 10 function keys that duplicate IBM PC function keys. Two communication ports are provided for local or remote connection to a host processor and connection to a local printer or additional I/O device. The main port provides half- or full-duplex asynchronous transmission at speeds up to 19.2Kbps. Bit-mapped graphics in three resolutions are optional.

The 6541 with two floppy disk drives and 256KB RAM sells for \$3,000. The 6546 with one floppy and a 10MB hard disk costs \$4,000. TANDEM COMPUTERS INC., Cupertino, Calif.

FOR DATA CIRCLE 310 ON READER CARD

MANAGES MEDICAL RECORDS

TRACTS (Transcription Recording and Chart Tracking System) is a medical rec-

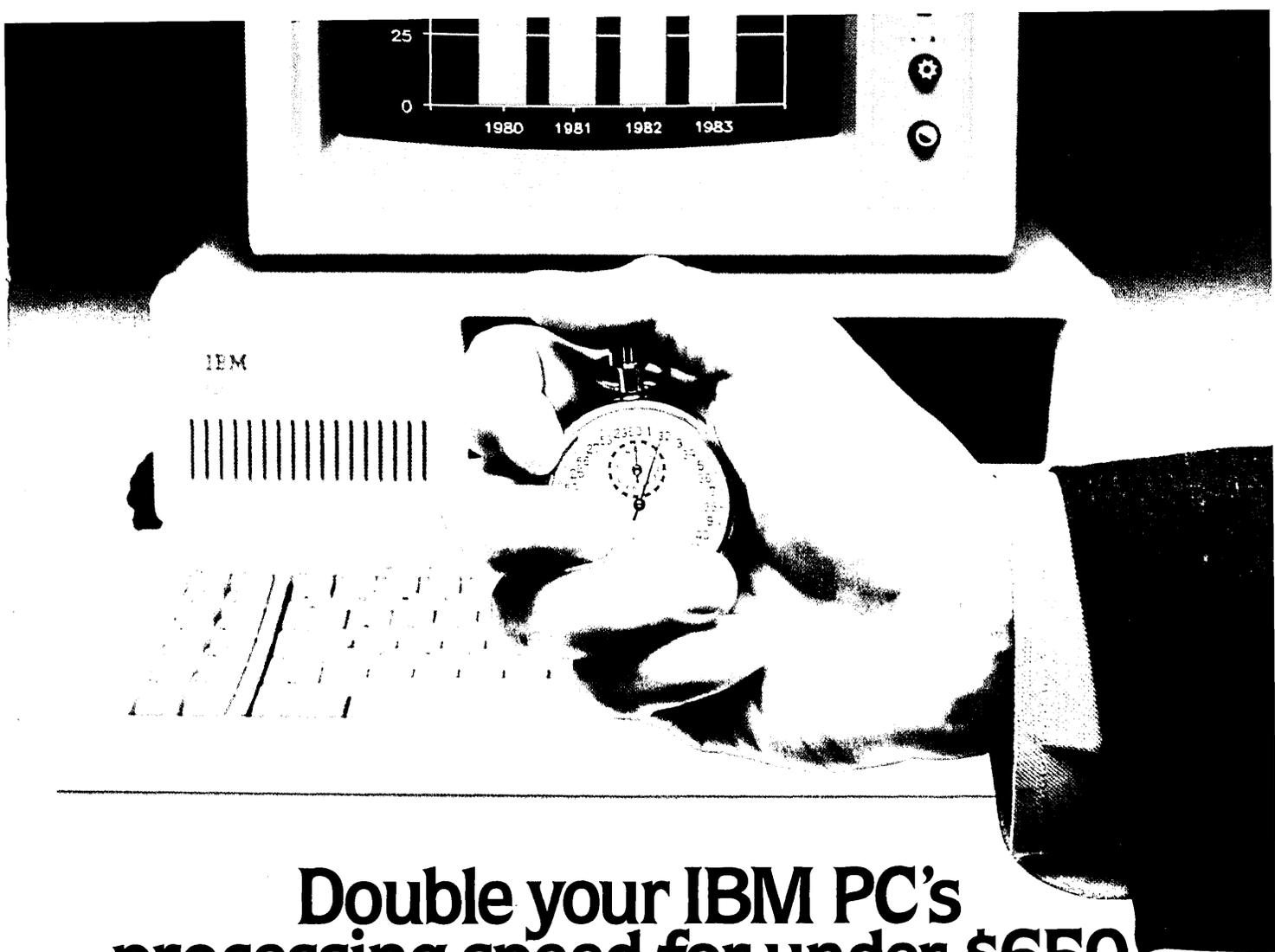


ord management system for hospitals. The mini-based system documents health services rendered by the hospital.

Hardware for TRACTS is the vendor's DPS 6 line of computers operating under GCOS. The medical record software automates transcription, record analysis, record tracking, abstract production, and report generation. Options for the system include a database management system, transaction processing packages, and high-level language support. A variety of communication software is available to support the exchange of data between the TRACTS system and hospital billing, statistical, and admissions computers. The price for a 250-bed hospital configuration, including the DPS 6/45, four workstations, a printer, 1MB memory, and two 20MB disk drives is \$62,000. Prices range from \$35,000 to 200,000. HONEYWELL INC., Minneapolis.

FOR DATA CIRCLE 311 ON READER CARD

—Robert J. Crutchfield



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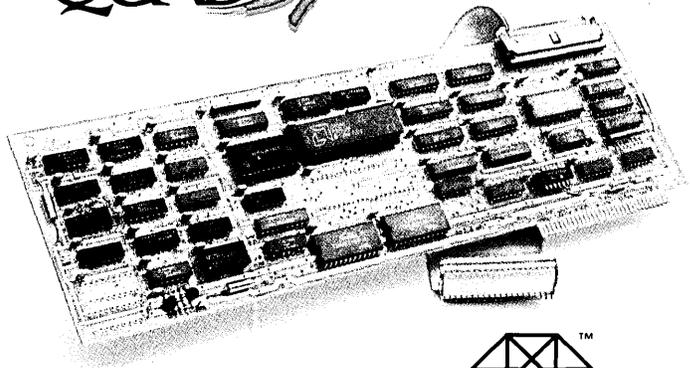
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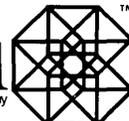
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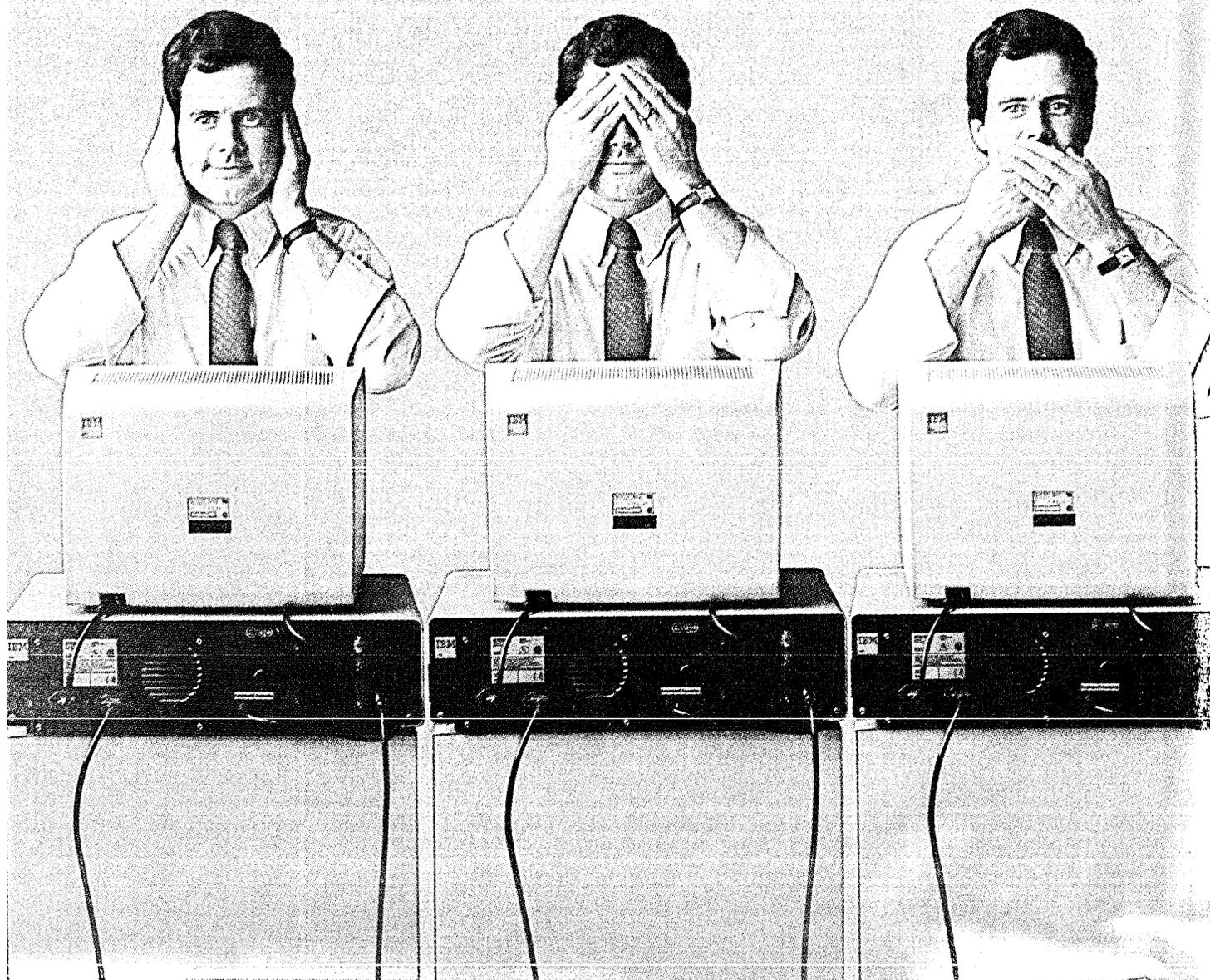


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CIRCLE 68 ON READER CARD

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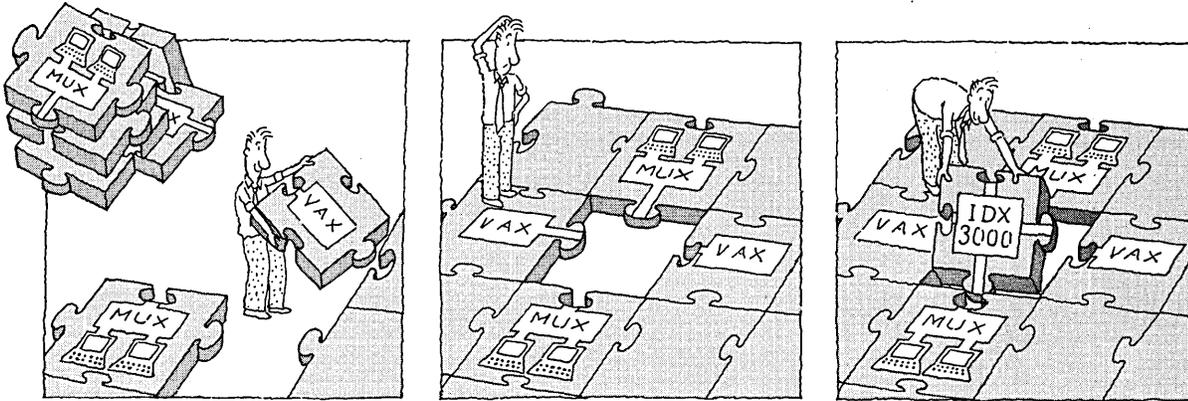


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SOFTWARE AND SERVICES

UPDATES

Governor James Blanchard of Michigan is leading a trade mission to Australia this month in an attempt to entice people from the land down under to move to his state. Blanchard, a Democrat, is not looking for the tired, the poor, or the huddled masses yearning to be free, but for businesspeople who want to relocate their companies to Michigan. He is attempting to diversify the state's industrial base away from the automobile and other heavy industries on which it has relied for several decades. Computer industry vendors rank high on his list of the kind of companies he would like to see move to the state, long a symbol of this country's smokestack industries.

Michigan already has netted one resettled Australian firm, Attache Software Inc., which specializes in accounting software. Attache was founded in Australia in 1978 and moved to Ann Arbor last year. Attache president Gary Blom is the man most responsible for helping Blanchard put together the U.S. contingent for the Australian road show. The delegation will include venture capitalists, bankers, Commerce Department representatives, and Michigan state government officials. Blom says Michigan will offer financial help to Australian companies relocating there. One of the reasons he chose to move his company to Ann Arbor, he adds, is the strong presence there of other software firms, such as Comshare and EDS.

Few data entry clerks would call their jobs the most interesting work they could imagine. So, because of the makeup of the job, companies are challenged to find creative ways to motivate these clerks. Educational Computer Applications Inc., Arleta, Calif., is one company that accepts this challenge when training data

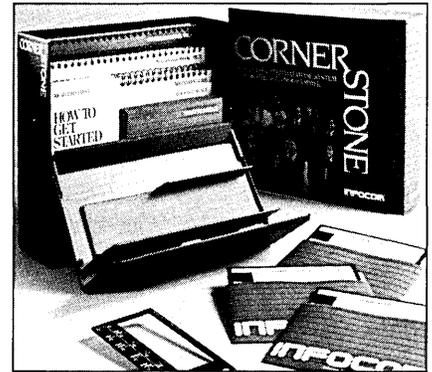
entry clerks for client companies. ECA president David Lichtman says that managers in these firms should worry less about the operators' technical competence and more about their propensity for boredom.

So how does management fight ennui among what Lichtman calls "knowledge foundry workers"? How can people be stimulated to perform necessary but mundane tasks? One solution is to wire these employees for sound. One ECA client allows employees who meet their quotas to listen with headphones to personal radios and tape players while they tap away at the terminals. According to Lichtman, since that policy was introduced at the client's Los Angeles office, productivity among the data entry clerks has shown a measurable improvement. In addition to the privilege of listening to music while working, Lichtman says, the headphones serve as a status symbol -- a way for all the employees to see who is up to par and who is not. Lichtman says he took a straw poll of clerks in the office, and found that over two thirds of them had the devices strapped to their heads.

Microsoft Corp. is establishing telephone support for its software products via customer pcs. The new technical assistance program is called a Direct Information Access Line (DIAL), and is designed to benefit hardware manufacturers, independent software suppliers, peripherals manufacturers, and corporate end users. The system is a means of processing and administering technical assistance requests, allowing users to report problems or request information from the Bellevue, Wash.-based company through a pc and telecom link. Microsoft says its goal is to have an answer for the user within 24 hours. Most of Microsoft's products will be supported by the service.

DATABASE

Cornerstone is a full-featured relational database designed for the nonprogrammer. It helps managers, small business owners, and professionals with their data management problems. According to the



vendor, the software overcomes many problems users encounter when generating reports from a database. Its interactive report writer is not a separate product, but a fully integrated part of the system that can draw information from any file or combination of files. Also, the structure of the database can be modified at any time. Reports can be generated by arranging information on the screen until it is formatted the way the user wants it. It also lets users add notes and comments to the files whenever they want. Notes can be as short as a few words or as long as several pages, and can be searched for specific words. The help system is context-dependent. The help messages correspond to the portion of the program the user is in and tells her what she can do and where to can go next in the program. Another support feature is the options key. It shows users what can be typed next, regardless of whether it's a command, the name of a file, or an item in the database.

The product comes with a screen-based tutorial and a handbook written for nontechnical users. It also comes with a sample database application that includes a Rolodex, mailing label, and client track-

SOFTWARE AND SERVICES

ing system that can be modified by the user. The software runs on the IBM PC, PC XT, PC AT, and compatibles. It can be used in conjunction with other spreadsheets and word processing packages, as well as IBM's TopView windowing software. Cornerstone retails for \$500. INFOCOM INC., Cambridge, Mass.

FOR DATA CIRCLE 326 ON READER CARD

MAINFRAME LINK

This version of Softerm communications software links the Apple IIc to any mainframe computer, the vendor says. It will enable Apple IIc users to access information services, bulletin boards, electronic mail systems, and other computer installations.

The software includes keyboard macros, built-in phone book for automatic dialing, and simultaneous capture to print or disk. The file transfer capabilities provide automatic execution using command files, support for protocols such as XMODEM, and the vendor's own Softrans protocol, which comes with an adaptable source program for host computers.

The product is available in two versions compatible with the Apple IIc and IIe systems with 128KB RAM. Softerm 1 provides basic tty terminal emulation and is suited for accessing information services and bulletin boards. Softerm 2 has all the features of Softerm 1 plus exact emulations of 24 crt terminals used by companies to access corporate mainframes. According to the vendor, Softerm 2 provides terminal emulations and all

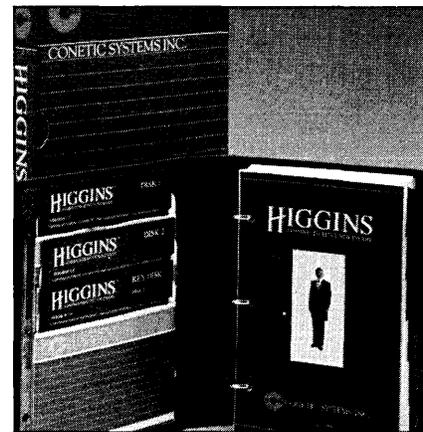
keyboard functions. The keypad plugs directly into the mouse port, and there are no boards to install. The vendor also provides a free 24-hour on-line update service and bulletin board system. Program updates and enhancements including new terminal emulations are available from the service. Softerm 1 sells for \$135 and Softerm 2 retails for \$200. SOFTRONICS INC., Memphis.

FOR DATA CIRCLE 327 ON READER CARD

DESK ORGANIZER

Higgins is an interactive "administrative assistant." Built on a database, the product allows complete interaction among all its administrative tasks. It takes care of such things as time management, personal filing, expense reporting, telephone directory, autodialer and routing, notepad, project task lists with prioritization, calculator, tickler and reminders, automatic timer for tracking meeting length or phone conversation duration, electronic memos, and telephone messaging "pink slips."

The product is also interactive with other PC/DOS-based programs that run on an IBM PC XT, PC AT, or compatible micro. It can index other program files, letters, and spreadsheets under key words and full-length names. Besides working as a standalone product, it was also designed to be a multi-user product. Its initial release supports many local area networks including 3Com Net and Novell's NetWare. The LAN version includes a phone messaging system and electronic memos



providing users in the offices with a common link.

The integration level of the software enables users to input information into the system only once. The product will automatically place it on a "to do" list, file it in a directory, or associate it with an expense. The software supports macros that can execute sequences of commands with a single keystroke. It allows users to set up macros that can make the software commands work in a way to suit their management style. The single-user version costs \$400. The multi-user version sells for \$150 per user in the local area network. CONETIC SYSTEMS INC., San Leandro, Calif.

FOR DATA CIRCLE 328 ON READER CARD

MICRO MRP

MAX The Production Manager is a full manufacturing resource planning (MRP) system consisting of six modules, and providing bill of materials control, inventory control, master scheduling, materials requirement planning, purchasing control, and shop floor control.

The software is designed to run on the IBM PC, PC XT, and PC AT. According to the vendor, availability of the product on the PC AT will allow the software to be used in a multi-user environment with better response time to the user and better database storage than available on the PC or PC XT. On the PC AT, the software provides total production and inventory control to several users at once who can query the MAX simultaneously. MAX costs \$20,000. MICRO MRP, INC., Foster City, Calif.

FOR DATA CIRCLE 329 ON READER CARD

DATA ENTRY SYSTEM

KeyPlus is a high-speed, on-line data entry system for IBM and IBM-compatible mainframe computers. The system operates directly with VTAM (Virtual Terminal Access Method) to provide an immediate link to the computer without being slowed by interaction with teleprocessing or batch systems. According to the ven-

SOFTWARE SPOTLIGHT

ELIMINATES IMS/V S GENS

Delta IMS allows IMS installations to configure on-line IMS/V S environments without IMS "gens," (the system by which the software is installed at a user's site and customized to a user's purposes). Databases, application programs, transactions, and VTAM terminals can be added or modified using the product. According to the vendor, not only is no IMSGEN required, but also the IMS cold start to put the new "gen" into effect is eliminated. Instead, changes are made from a TSO terminal while IMS continues running. When terminals are added, IMS security maintenance is not necessary; the security characteristics of a terminal currently in the system can be copied. The product also provides a dynamic change facility.

Some features of the software include the ability to add and rename IMS logical terminals and VTAM terminals associated with them. It also eliminates the batch IMSGEN and supports all releases of IMS, including 1.3 running with any release of the MVS operating system. The software is totally interactive. Full-screen

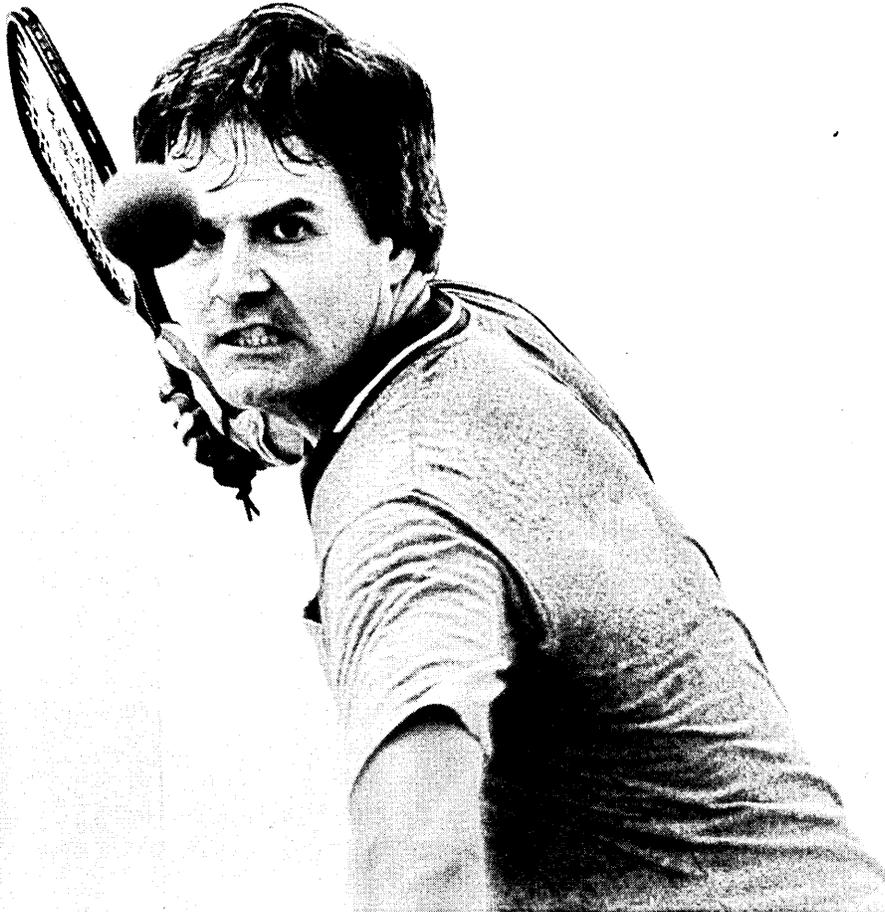
panels prompt users for information that formerly had to be typed as System/370 macro statements. Errors are detected and corrected on-line. Also, there is an on-line help facility.

A single TSO terminal can be used as a central control point for all the user's IMS systems, not just those running on the same cpu as the TSO session. The communications are handled with a standard VTAM LU-LU session. It allows users to issue IMS commands to all IMS systems under its control and to see the output of those commands. It supplements the IMS command set with commands to reload ACBS and DMBS. Access to all Delta IMS services may be limited to authorized personnel with the product's built-in security facilities.

Delta IMS has an introductory price of \$18,000 for a perpetual lease or \$900 a month for the monthly lease program. The price will increase to \$25,000 for a perpetual lease and \$1,250 for a monthly lease. Multisystem discounts are available. BMC SOFTWARE, Houston.

FOR DATA CIRCLE 325 ON READER CARD

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CIRCLE 71 ON READER CARD

SOFTWARE AND SERVICES

dor, this approach to on-line data entry eliminates slow response time at the terminal, adding that this system has a fast response time. Editing and logic functions can detect errors and prompt the operator for corrections during the input session.

It also provides backup and recovery facilities, which safeguard against inadvertent erasure of viable data. No coding or compiling is ever required to use the system, allowing users without programming experience to develop new interactive data entry applications. Existing batch programs can be brought on-line using the system to develop front-end screens. Message broadcasting, operating statistics, and system security are also provided. KeyPlus is priced at \$29,500 for the DOS/VS(E) version and \$36,500 for the VS1-MVS version. The price includes two days of training, interactive facility, retrieve facility, logic facility options, and complete documentation. THE BRIDGE INC., Milbrae, Calif.

FOR DATA CIRCLE 330 ON READER CARD

ENHANCED WORDSTAR

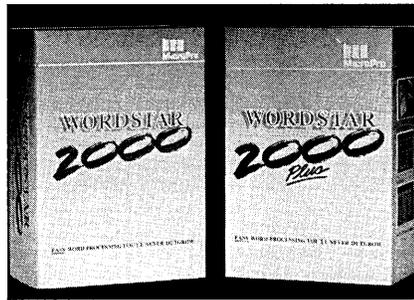
WordStar 2000 and WordStar 2000 Plus are software packages that combine word processing capabilities such as telecommunications, on-screen windows, a mailing list database, and on-line spelling correction, with a simplified user interface. Mnemonic commands let users operate the program without using a lot of syntax. For example, "C" stands for copy and "P" means print. User-definable function keys store special or frequently used commands.

The vendor evaluated feedback from many WordStar users and studied reports from labs specializing in the human-computer relationship to develop the simplified command set.

Help assistance is indexed to the section of the program in use. It features screen windows for simultaneous editing of up to three documents and for incorporating output from spreadsheet programs. Users can create customized form letters with a mail merge function or fill in forms or envelopes with a typewriter mode.

Other features include a five-function calculator, automatic paragraph reformat, pagination, and dictionary-based hyphenation. A keystroke glossary has frequently used text or chains of commands, and a sort function helps users organize lists. There is on-screen boldfacing and underlining, proportional spacing, and a utility to convert files between the original WordStar and WordStar 2000 formats. Both products will be translated into several European languages as well as kanji for the Japanese market. A version for the U.K., called The English WordStar 2000 is also introduced.

An introduction to the software's



capabilities and interactive, on-screen tutorials are included, as is an alphabetical reference guide and a keyboard overlay for function keys. WordStar 2000 Plus has the additional features of telecommunication capability, mailing list database, and an indexing system. Both products operate under PC/DOS, and take advantage of operating environments such as IBM TopView. WordStar 2000 costs \$500.

WordStar 2000 Plus sells for \$600. Existing users can upgrade to WordStar 2000 for \$250 and 2000 Plus for \$350. MICROPRO INTERNATIONAL CORP., San Rafael, Calif.

FOR DATA CIRCLE 331 ON READER CARD

TAPE LOADED

If the Softbridge Financial Planner were on diskettes, it would take more than 20 of them to load the entire program, according to the vendor. So this microcomputer software package loads from a tape. The product is a completely integrated package for personal financial planners. It analyzes financial information, creates customized client plans, and manages the planner's practice. Using the proprietary technology of the vendor's "integrator," the system combines extensive financial practices and procedures with Multimate word processing, the Informix database, and Lotus 1-2-3. The entire system can be modified by the planner through another proprietary technology the vendor calls the customizer. The vendor says this product enables the computer novice to prepare a complex analysis and financial plan without having to learn a separate set of commands for the individual software packages included with the product. The vendor says it has worked with many practicing financial planners to develop the system.

The content is divided into two areas, financial planning and practice management. The financial planning segment includes schedules and forms for gathering data, analyzing a client's financial position, and preparing complete financial plans. The practice management segment features a centralized database for summarizing actions taken and for performing cross-client searching, sorting, and screening. A support and maintenance program for the software is also

available. It runs on the IBM PC or PC compatibles. The vendor offers the software alone for \$4,500; software and a streaming tape drive for \$5,500; software, hard disk, and streaming tape drive for \$7,000; and a personal computer with software and tape drive for \$11,000. SOFTBRIDGE MICROSYSTEMS CORP., Cambridge, Mass.
FOR DATA CIRCLE 332 ON READER CARD

BANK SALES

SalesStar is a software package that ensures bank salespeople of having the latest product and customer information to market the products and services offered by the bank. In addition, the vendor says the product increases the productivity of branch personnel by speeding up new account opening, automating calculations, and improving personnel efficiency.

SalesStar applications modules consist of customer profiles, checking, savings, loans, and investments. The customer profile module initiates an inquiry to the host mainframe to retrieve up-to-date information regarding the customer and that customer's current account relationship with the bank. Within each module is a menu of the bank's financial products. While each of the products offered in the checking module have similarities, each of the specific products may be tailored to a particular market segment such as NOW accounts or money market checking. Using a menu approach, the salesperson may select one or more products to present to the customer. In addition, the salesperson has the option of allowing the system to select the particular product within the module that best suits the customer's needs. For any product a customer may be interested in, a screen or screens will detail information regarding the particular product selected. The customer can be given a printout of this information summarizing all the terms and conditions of the service.

Throughout the process, the salesperson is prompted by the software application to enter the appropriate data. All entries are validated automatically by the system. The transaction to be sent to the mainframe can be transmitted immediately or stored locally in a batch mode for transmission during off-peak hours.

According to the vendor, the product is tailored to fit the bank's sales strategies. Implemented through Bunker Ramo's ADTRAN application package, it can be customized, maintained, and expanded using ADTRAN's transaction generator. SalesStar and ADTRAN operate on the vendor's Aladdin microcomputer system. Prices for SalesStar modules start at \$800. BUNKER RAMO INFORMATION SYSTEMS, Trumbull, Conn.

FOR DATA CIRCLE 333 ON READER CARD
—Robert J. Crutchfield



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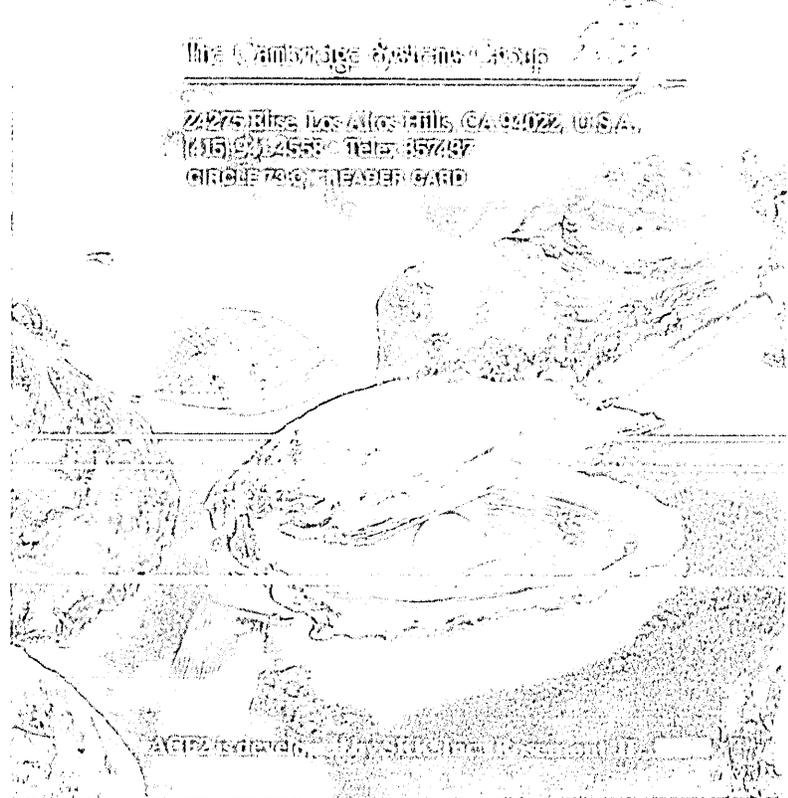
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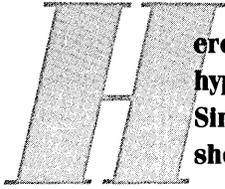
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ON THE JOB

BRANCHING OUT INTO THE HOME

Last issue we took a look at some of the legal and personal issues related to telecommuting. Electronic Services Unlimited (ESU), a consulting firm specializing in telecommuting, has completed a report, *Telecommuting: Demographics, Profiles and Projections*, based on three recent surveys on the subject.

The central ideas explored in the survey are the displacing of office em-

ployees into locations other than the conventional central office and the use of telecommunications to transfer their work, and the increasing use of telecommunications technology among people whose primary place of employment is the home, i.e., the self-employed. The report states that by the end of 1985, there will be around 7.2 million jobs that could be performed via telework, and that by 1990, as many as 10 million to 15 million telecommuters may be doing all or part of

their work either at home or in satellite offices.

ESU bases its report on the findings of the following surveys:

- a survey on computer-based work at home, carried out by Charles McClintock at Cornell University and presented in May 1984 to the American Association for the Advancement of Science;
- a survey on telework conducted by Robert Kraut of Bell Communications Research and presented in June 1984 to a

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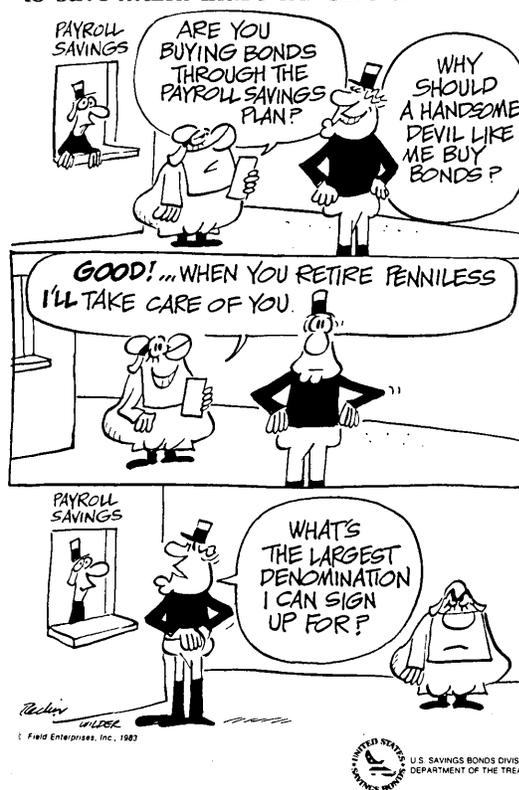
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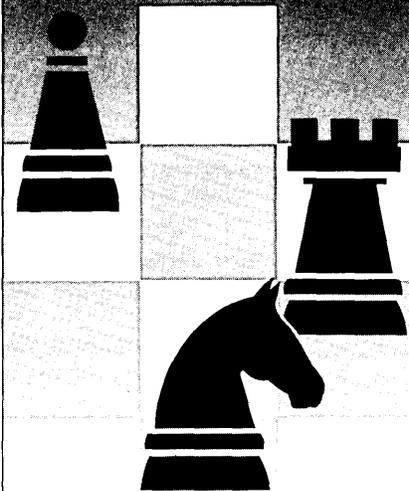
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conference on the technology and the transformation of white-collar work;

- a survey of nontelecommuters carried out by Carole Smith and presented during the summer of 1984 as a thesis to the faculty of the School of Systems and Logistics of the Air Force Institute of Technology.

ESU also built a database of interviews with telecommuters and telecommuting program managers at various organizations around the country, focusing more on the organizational view than

upon individuals.

Basically, the report suggests that the average telecommuter is a male, 30 years of age or older (no older than mid-forties), who is well educated, and either married or living with someone, and that information workers predominate. Self-employed telecommuters presently outnumber those who are company employed by about five to one.

As for work quality, company supervisors and individual teleworkers all agreed it improved in the home, as did

work quantity.

The majority of survey respondents who telecommuted agreed that supervision improves with telecommuting, while among nontelecommuters doubts were high that telecommuters could be successfully supervised.

One issue raised in the Jan. 1 On the Job was the fact that some people were concerned about the likelihood of career advancement while working at home and out of sight. The Cornell research found teleworkers believe their promotion chances are improved by doing telework. The exception was in the military, where a high degree of visibility is considered essential for advancement, and where telework was more constrained than among civilians. The Pratt research found career advancement to be a "a nonissue among clerical workers, an issue of uncertain importance among male professionals and managers, and a critical issue to female professionals/managers, who believed they had to be seen to be considered for promotions." ESU found some companies that seemed to be bending over backward to keep telecommuters aware of all current job opportunities.

Distractions at home don't seem to be much of a problem, either. At first, conflicts over use of time and space may increase, but outright distractions aren't a major complaint. In fact, teleworkers report that distractions at the office typically were worse than those at home.

The report identifies 25 different jobs in the table listing the "Prime Telecommuting Occupations Ranked by Weighted Proportion of Work That Could be Done Remotely." Those occupations are travel agent, architect, writer, word processor, salesperson, data entry clerk, insurance agent, securities agent, real estate agent, computer systems analyst, bookkeeper, accountant, computer programmer, engineer, lawyer, counselor (vocational/educational), purchasing agent, accounting clerk, personnel/labor relations, secretary, clerical support, computer operator, marketing manager, bank officer/finance, and miscellaneous managers. It then discusses each job category and how much and what part of the job can be done via telework. Of course, individual peculiarities need to be assessed on a case-by-case basis.

ESU then outlines the number of people employed in each state in each of these professions.

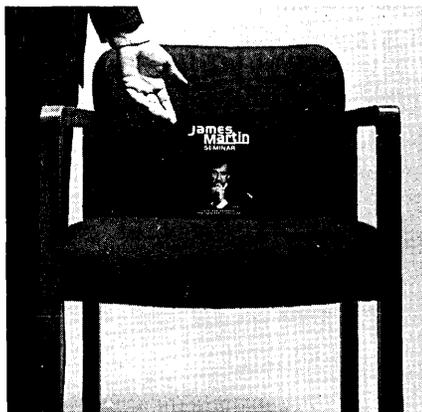
If you're interested in a copy of ESU's report, contact Marcia Kelly, president of Electronic Services Unlimited, 142 W. 24 St., New York, NY 10011, (212) 206-8272. But don't be surprised if she's out telecommuting.

—Lauren D'Attilo

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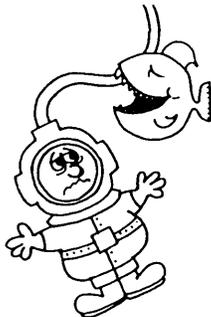
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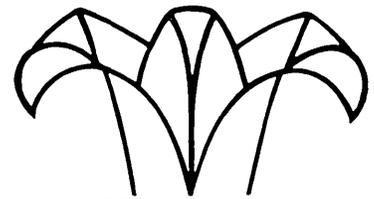
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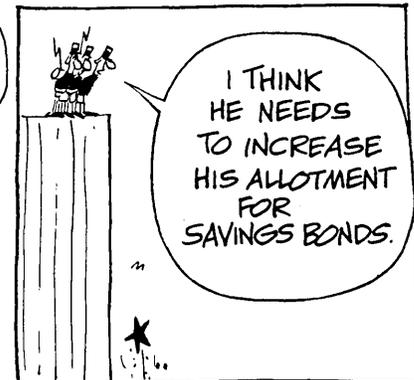
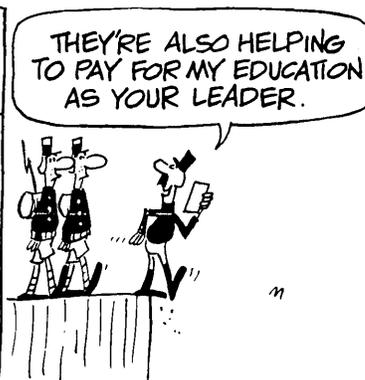
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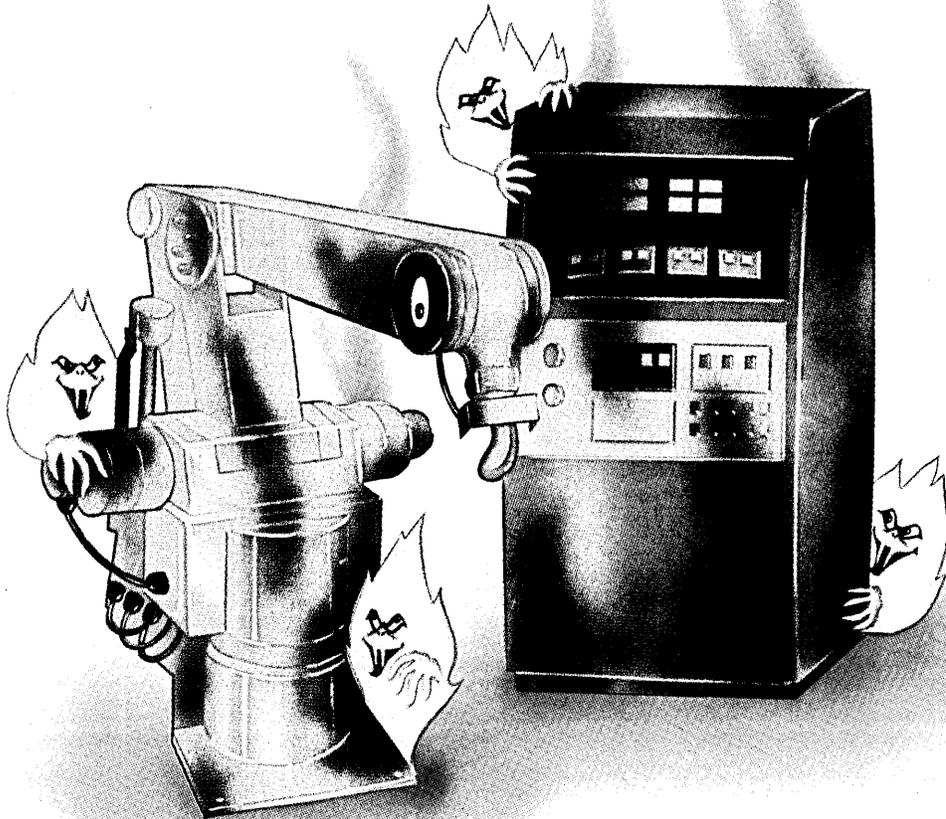
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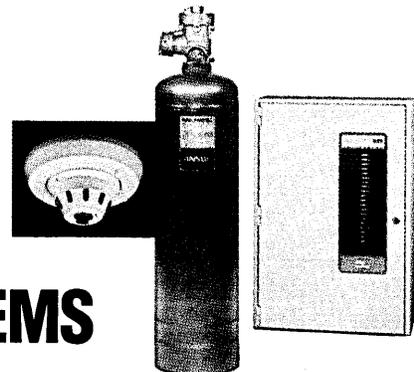
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READERS' FORUM

THE TROUBLE WITH STANDARDS

There are two contradictory impulses in human beings. One is the tendency to categorize, systematize, and regulate. The other is the tendency to innovate, improvise, and rebel. People in whom the former is dominant tend to become librarians, scholars, and prison guards. People in whom the latter is dominant tend to become artists, scientists, and beach bums.

While those at either extreme sometimes despise or fear each other, most people would acknowledge that both tendencies are necessary to any productive endeavor. Discipline without creativity leads to stagnation. Creativity without discipline leads to chaos.

The struggle between these opposing tendencies is present in the data processing department just as in all other aspects of life. On the one hand are the proponents of methodologies, standards, and conventions. On the other hand are those who believe, "If it feels good, code it."

Nevertheless, there is a built-in bias toward regulation. When people operate without rules or conventions, problems are bound to arise, and the natural response from management is to impose some rules to resolve the problems. After all, isn't that one of the functions of management, to direct employees in the performance of their duties? When the system is working well the new rules will resolve the problem; when the system is working poorly management will at least have the feeling that it is doing something.

On the other hand, when employees are working under a set of rules, there are also bound to be problems that can be related to those rules. But the response is not generally to repeal the rules that led to the difficulty, but rather to modify them or even to create more rules. At its worst, this can lead to a never-ending spiral.

Several possible reasons for this imbalance come to mind. The disadvantages of having a rule tend to be intangible: inconvenience, stifling of productive creativity, frustrated employees. But the advantages of having a rule are concrete: if a certain rule

is imposed, a particular problem is not likely to recur.

Another reason may be the politics of the situation. People rarely feel personally offended when someone says, "We had this problem because of confusion over how the job is to be done. Now let's establish some procedures so we can do it right." Even if someone does not like the imposition of the standard, the offense is not personal. It is quite different to say to someone, "That procedure you devised doesn't work. The best thing we can do with it is throw it in the trash."

A third factor may lie in an employee's perception of his role. For example, if a manager is not directing the activities of his subordinates, what is he needed for?

One company I worked for established a department whose sole responsibility was to develop standards and procedures for the programming staff to follow. Perhaps you can imagine the result: they continually issued a stream of new rules. If they ever stopped issuing new rules, they would no longer have a *raison-d'être*, and the company might decide to fire the lot of them.

When a new standard is being considered, there are two fundamental questions to be resolved. Many people seem to jump immediately to the second one: what is the best, most effective standard that could be imposed to resolve this situation? The first question should have been: can we reasonably expect this problem to be solved by imposing a new standard? Any proposed rule must be evaluated on a dual basis: "Is it better than any other rule we can think of?" And "Is it better than nothing?"

The epitome of standardization in the data processing department is the methodology. Many dp departments, especially those in large corporations, have purchased methodologies from outside consultants and conduct extensive in-house training in their application. Or the the company may have devoted a great deal of time and money to developing one on its own. My personal experience has been that many methodologies start out by promising to resolve basic design issues and end up by becoming a set of naming conventions; but let us look at both ends of the spectrum.

At one end are detailed rules relating specifically to program coding. Let me take one example of this: naming conventions. While I have not done any historical studies on the question, I would guess that such conventions began being implemented when system users started accidentally destroying each other's files by using the same name. (Just think, how many times has the average programmer used the name "TEST1"?) Or

READERS' FORUM

perhaps someone decided that it would be convenient if he could quickly discern some essential piece of information about a program by simply looking at its name, such as which system it belonged to. Naming conventions that require the first few letters of a program name to identify the owning system readily handle this sort of problem.

But much more elaborate systems have been devised. One company I worked for had a program-naming convention that went like this:

- Position 1 C for CICS programs (an IBM data communications system)
I for IMS (a db/dc)
N for other
- 2 B for batch
I for interactive
- 3 C for COBOL
P for PL/1
A for assembler
- 4-7 sequence number (within first three)
- 8 P for production
T for test

Thus programs had names like NBC1027P or IIAOO31P. One could argue with the usefulness of the information in this particular case, but while the details differ, the same general approach can be seen in many such schemes. People will try to cram information into a name by making each letter meaningful. This forces them to come up with a standard list of attributes of the named entity, such as what language a program is in or how frequently a job is to be run. Since it is highly unlikely that such a list of standardized attributes will be unique, they then tack on a sequence number to prevent duplication. (There are those who seem to delight in assigning numbers to everything, from departments to people to simple questions, like "Enter 1 for yes, 2 for no.")

But do we really care that a certain program is our 1,027th batch COBOL program? What we really want to know is, what does it do? It is extremely unlikely that we could invent a scheme that would enable someone to look at a six- or eight-character name and immediately deduce what every single line of the program must look like, but surely we can provide more information than NBC1027P.

An example of good naming convention that I have seen went something like this:

- Position 1 one-letter code for division of dp
- 2-4 abbreviation for major system
- 5-8 describes specific function of program
(with a list of recommended abbreviations)

Thus, if you write a program to produce overdue notices, you might call it IACROVDU, for Internal system, Accounts Receivable, OverDUE. You are likely to remember this name, and be able to quickly find the program, for months or even years. You would be lucky to remember NBC1027P when you came back to work after a three-day weekend. Perhaps more important, if the person who wrote the program has moved on to a better-paying job in Hawaii and you are now faced with finding the overdue notices program, you might have a hard time finding NBC1027P, especially if the author filed all documentation under "N". But under the more descriptive system, you would surely know that it was part of the accounts receivable system, and even if you didn't have a list of the system abbreviations you could probably make some reasonable guesses. It would then be just a matter of listing the programs that began with the appropriate letters and scanning through them for likely possibilities.

By the way, one of the divisions of dp in the company that established that standard refused to make up three-letter abbreviations for its systems; it insisted on using three-digit sequence numbers instead.

At the other end of the scale, most methodologies have a

top level that states general design principles. Those that I have come in contact with all began by setting forth steps in the development of a system. While the details vary, they generally state something of this nature:

1. Determine user requirements
2. General design
3. Detail design
4. Code
5. Test
6. Implement

They usually emphasize that the steps must be performed in sequence; for example, we should not begin designing the system until we know what the user's requirements are, and we should not begin coding a particular program until we know what other programs in the system will be and what they will do.

There is a sense in which this all sounds very rational and organized. After all, how can we begin writing a program until we know exactly what the user wants it to do? (It would be terrible to spend months developing an accounts payable system on the basis of a quick conversation with the user, only to discover that it was a slip of the tongue, and he meant he wanted a payroll system.) Some have gone so far as to advocate that one should write the user's manual before beginning any coding.

But there is an opposite danger here. The very nature of the earlier steps is that they ignore many details in pursuit of an overview. What if one of those details we glossed over happens to render a significant portion of our design invalid? I once knew an analyst who spent a good deal of time developing design plans for a system, only to discover that one of the data items he needed was not even stored on the computer (and no one was prepared to enter it). A gross oversight? Of course, but precisely the kind of error human beings make. In reality the steps are almost never followed rigidly. More detailed work leads to discovery of errors and revision of the original design. When we're at our best, detail work may also lead to simplifications of the original design, or the discovery that whiz-bang new features can be added with little extra work.

Likewise, it borders on the absurd to separate "Code" from "Test." No programmer in his right mind is going to write dozens of programs and thousands of lines of code before testing anything. In all but the most trivial programs, the result of testing is that errors are found, which must then be corrected through more coding, which must then be further tested, and so on. Systems development is and must remain more of an iterative process than a linear one.

I have found that programmers can often develop a system with almost no preliminary work. Sketch out a basic approach (perhaps just in one's head for straightforward systems), decide on the necessary data structures, and begin coding. You will often make mistakes and have to rewrite portions of the programs, but you would have made mistakes anyway. By beginning coding quickly, errors in the design are discovered quickly. If the programs are written in the order in which data passes through them, then you will always have sample data available from previous programs and you will know that your assumptions regarding input are valid. Of course, as a project gets larger and more people become involved, the communications, planning, and paperwork must increase. I'm not saying that we shouldn't do preliminary planning, but rather that in some organizations the tendency is to do too much planning. I once heard a consultant say that the more time you spend planning, the less time you will have to spend implementing. This may be true, but if two days of planning will save one day of implementation, you'll have a net loss.

Most damaging to dp's reputation has been the insistence that the user fully and explicitly state his requirements before seeing any results. Who would tolerate such a demand in his personal purchasing? Imagine if you went into a store to buy a

SCIENCE / SCOPE

A future generation of infrared "eyes" for space surveillance systems will be far more capable as the result of technology advances at Hughes Aircraft Company. These systems will be able to see distant targets in space, in the air, or on the ground—and relay data instantly to ground stations. Advances are being made in focal plane design, signal processing architecture, and in the design of a unique sensor with very steady telescoping optics. By building modularity and programmability into the new technologies, researchers are making it possible for systems to use tailored combinations from a single family of hardware and software. For its advances, Hughes received an Award for Technical Achievement from the Strategic Technology Office of the Defense Advanced Research Projects Agency. This effort was sponsored by DARPA and monitored by the U.S. Air Force Space Technology Center.

A series of semicustom, high-performance HCMOS gate arrays, featuring flip-flop toggle rates of 75 MHz, has been introduced by Hughes. The new Quad Logic® arrays use a basic four-gate equivalent cell arranged as two 2-input and two 3-input gates. This architecture minimizes the number of gates needed to implement macro functions and ensures efficient interconnection and routing. High-density circuit layout and high performance are achieved through the use of double-layer metal interconnections and 3-micron processing technology. Electrical channel lengths are under 2 microns. Arrays vary in complexity from 2,000 to 8,000 gates.

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READERS' FORUM

suit, and instead of finding racks of clothing available for inspection, there was just a clerk behind a counter who insisted that you tell him the exact size, style, color, and material that you wanted, refused to show you any samples, perhaps condescending to take some measurements, and then disappeared into the back room and came back some time later with one suit and demanded payment.

You might occasionally be satisfied with the result, if you had come in knowing exactly what you wanted or if the clerk had good taste, but more often the suit wouldn't fit or would look terrible on you. Yet that is what the dp department expects from users. (In fact in our example it might be even more extreme. Sometimes the customer has never bought a suit before and isn't even quite sure how many legs the pants should have.) Of course it makes our job much easier to know all the requirements up front, but then it's easier for the clerk if he doesn't have to wait around while you try different suits on and see how they look.

Systems design has often been compared to carpentry. Let me embrace that analogy for a moment. Imagine that you offered a skilled carpenter a generalized but detailed list of instructions on how to build a set of cabinets. (Note that I am not talking about a design here, but a set of instructions on how to implement a design, perhaps including how to develop the design in the first place.) Would he perceive this as a way to improve his productivity and professionalism? I sincerely doubt it. If he was at all willing to learn, he would be eager to hear of new ideas and techniques you had developed. He would probably always be interested in acquiring new and better tools. But if you were in a position to force him to follow your instructions to the letter, he would probably grumble and complain a great deal. He wouldn't want to be required to make exhaustive measurements to determine how long the nails should be, when he can tell from a quick glance and long experience that they should be three quarters of an inch; nor would he want to wade through instructions on how to install hinges for a cabinet that isn't supposed to have any doors.

Who would appreciate such a set of instructions? Perhaps several carpenters working together on a project would decide that having a standard set of procedures could ease problems in communication or working at cross-purposes. But they would probably prefer to make up loose guidelines that they could agree to among themselves as they became necessary.

No, the person who would really appreciate your instructions is the novice who has not yet learned the trade. He would want (or at least he would accept) a great deal of picayune detail on the way to getting the job done. As he became more skilled, he would learn when steps could be skipped or combined. He would learn when the order of the steps must be followed explicitly, when an alternative order could be advantageous, and when the order was irrelevant and subject to the convenience of the moment. As he became more experienced, he would use your instructions only as a reminder, to refer to now and then to make sure he wasn't forgetting something. Eventually, he would learn to do the job without reference to any instructions at all, though he might keep them for a while in case a situation came up that he hadn't handled before.

The same conditions apply to data processing. The person who needs a methodology is not the skilled professional, but the student. Let's get methodologies out of the corporations and into the schools where they belong!

—Mark Johansen
Xenia, Ohio

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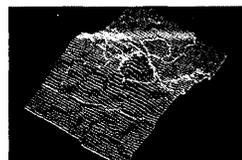
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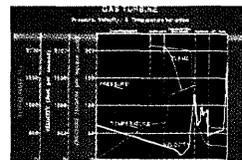
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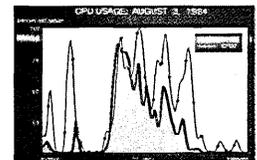
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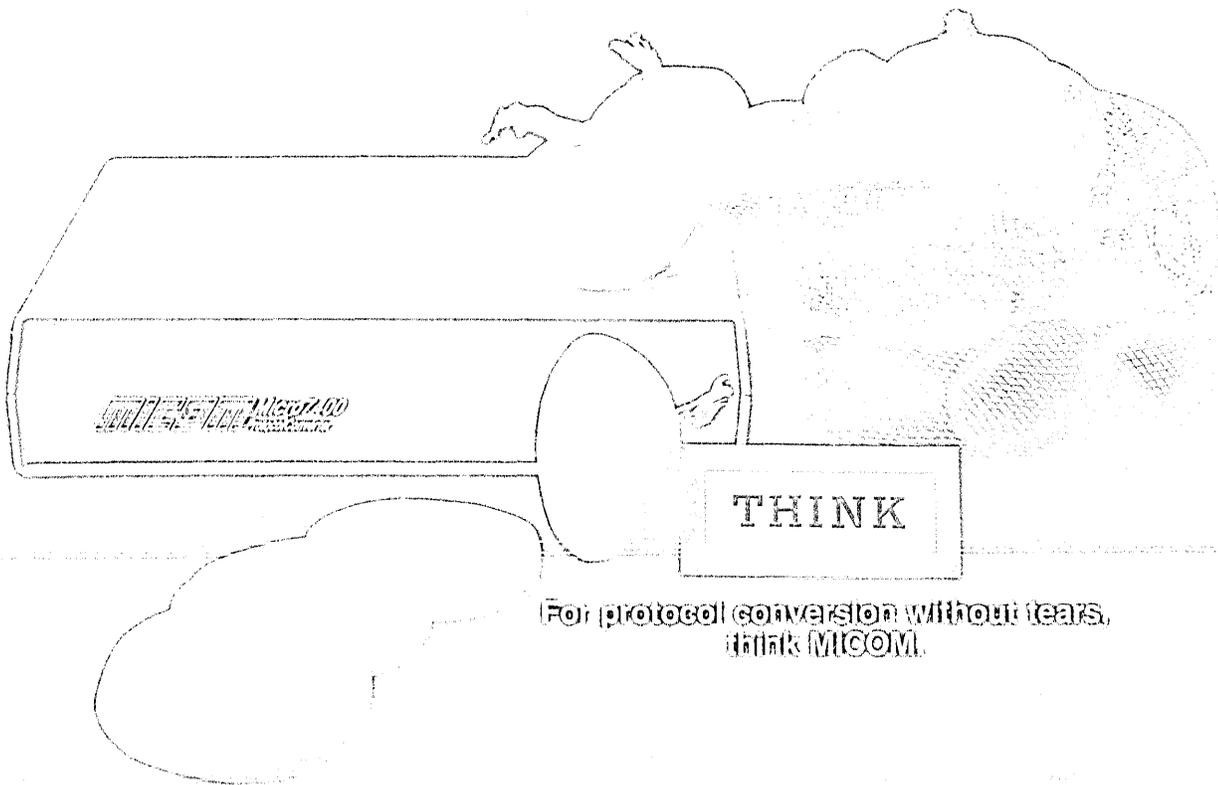
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