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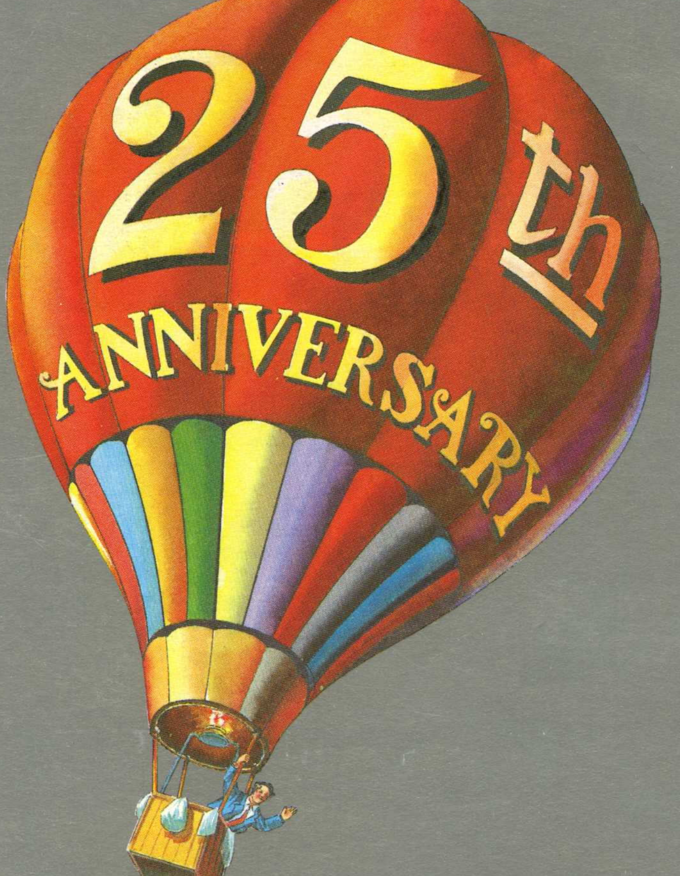

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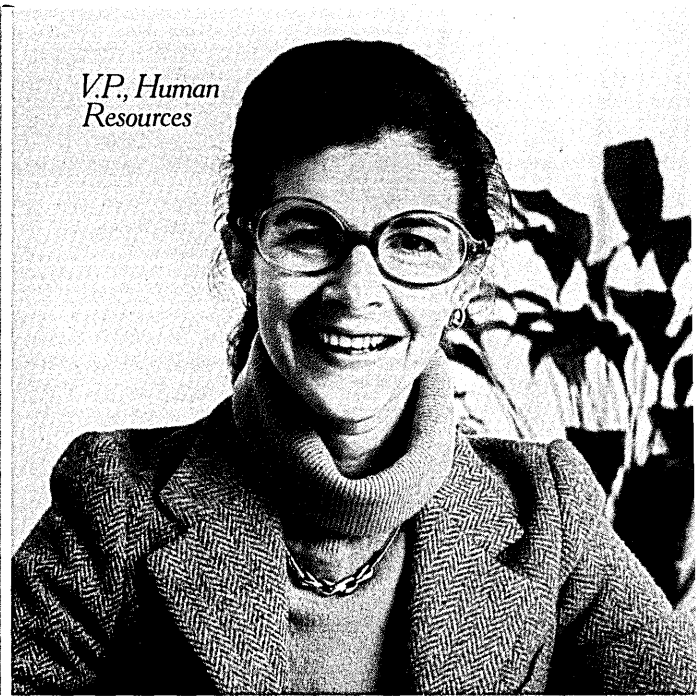
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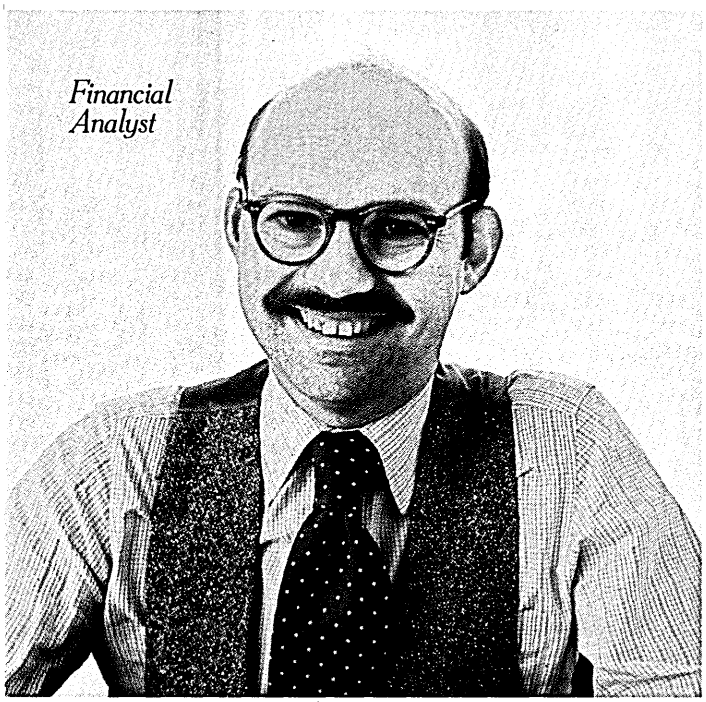
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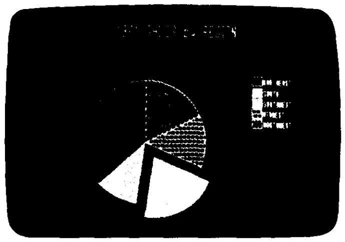

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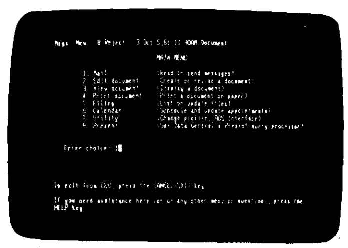

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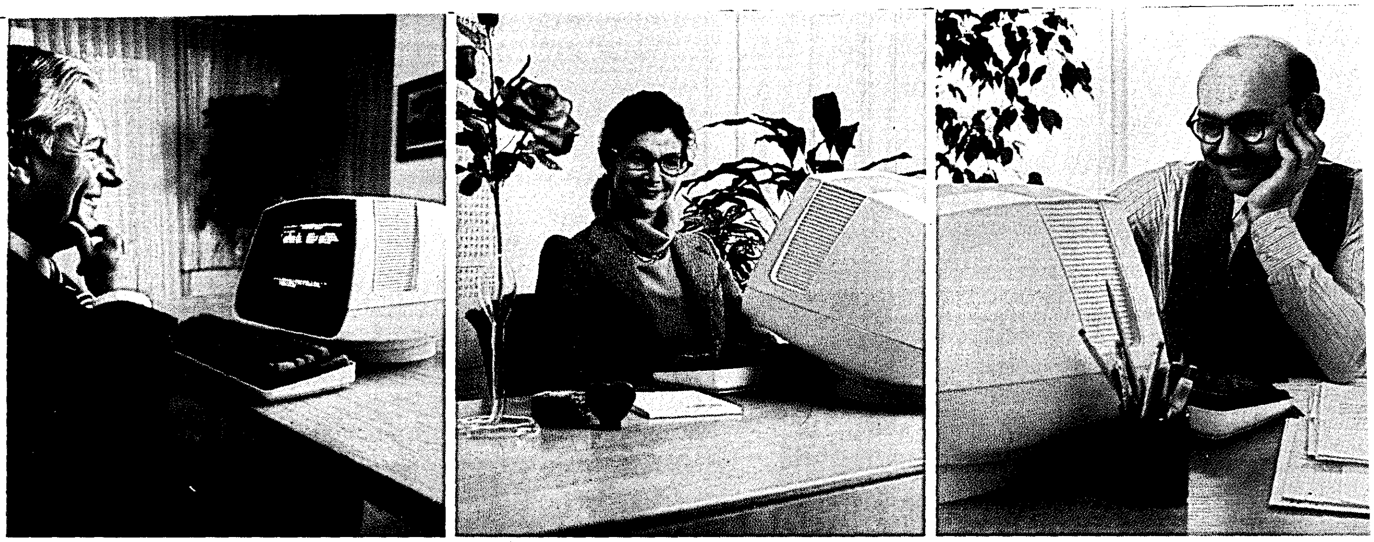

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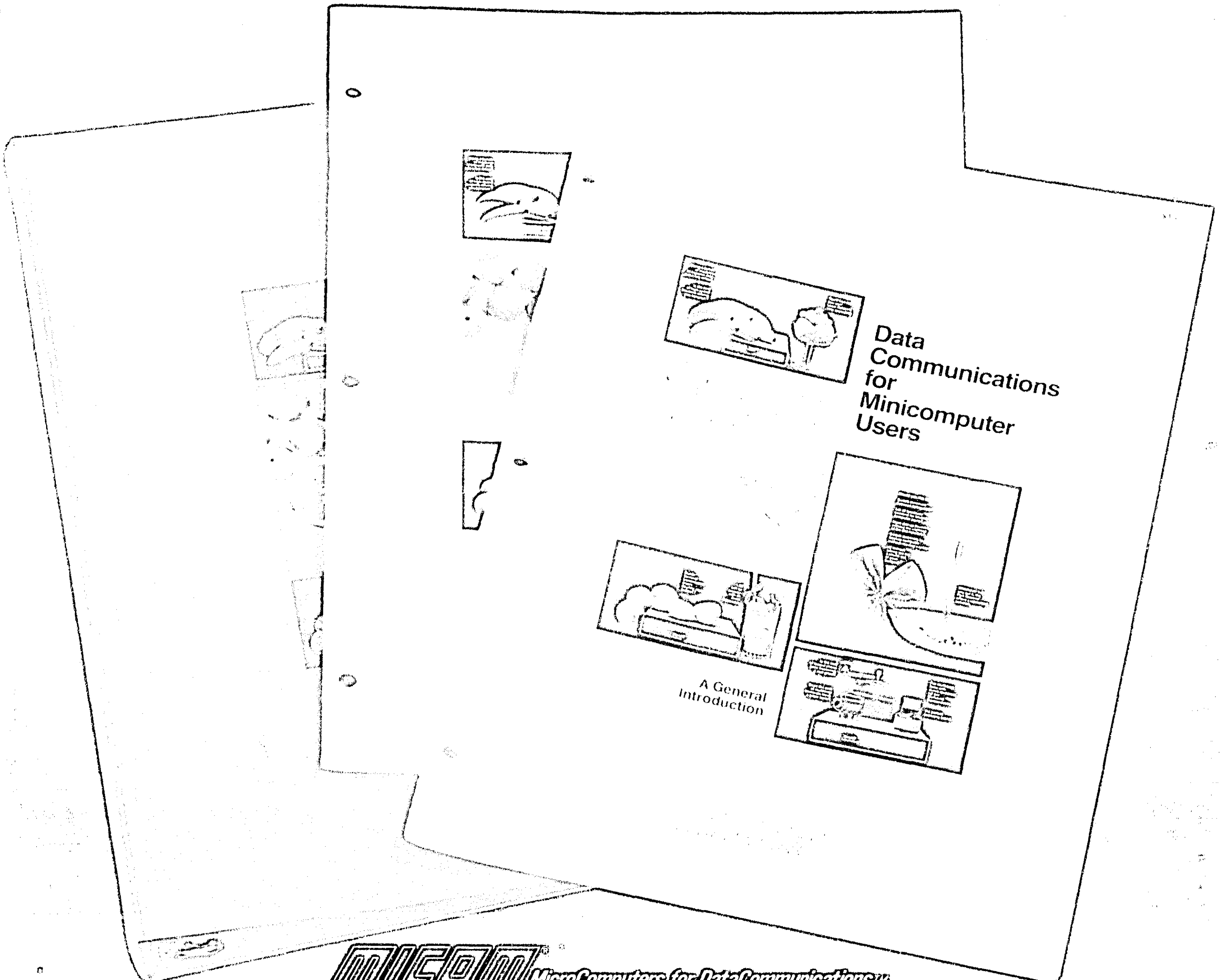

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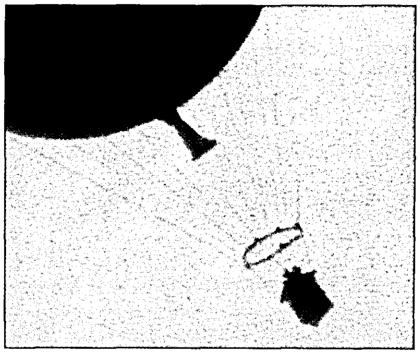

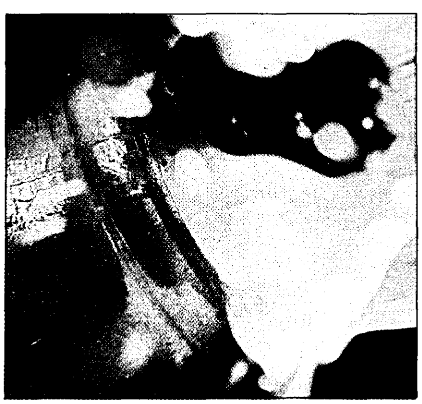

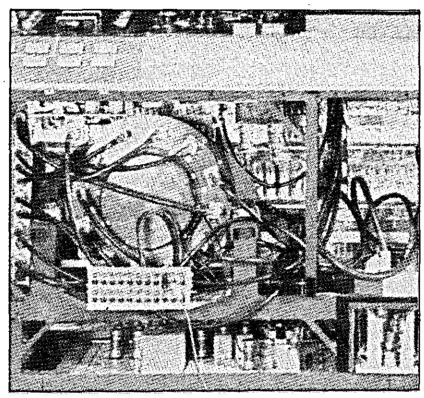

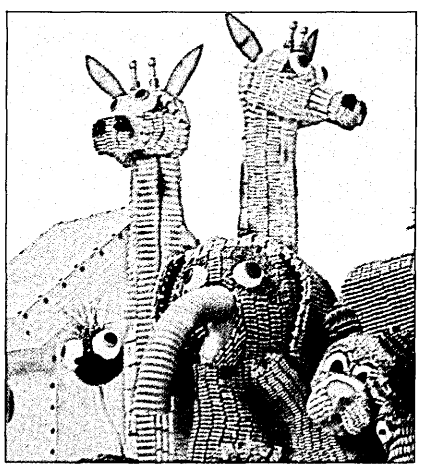

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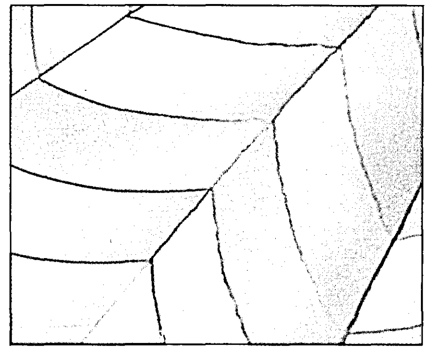

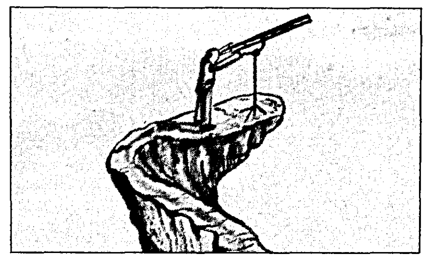

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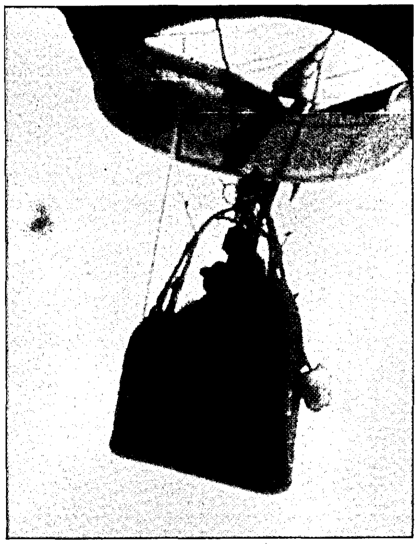

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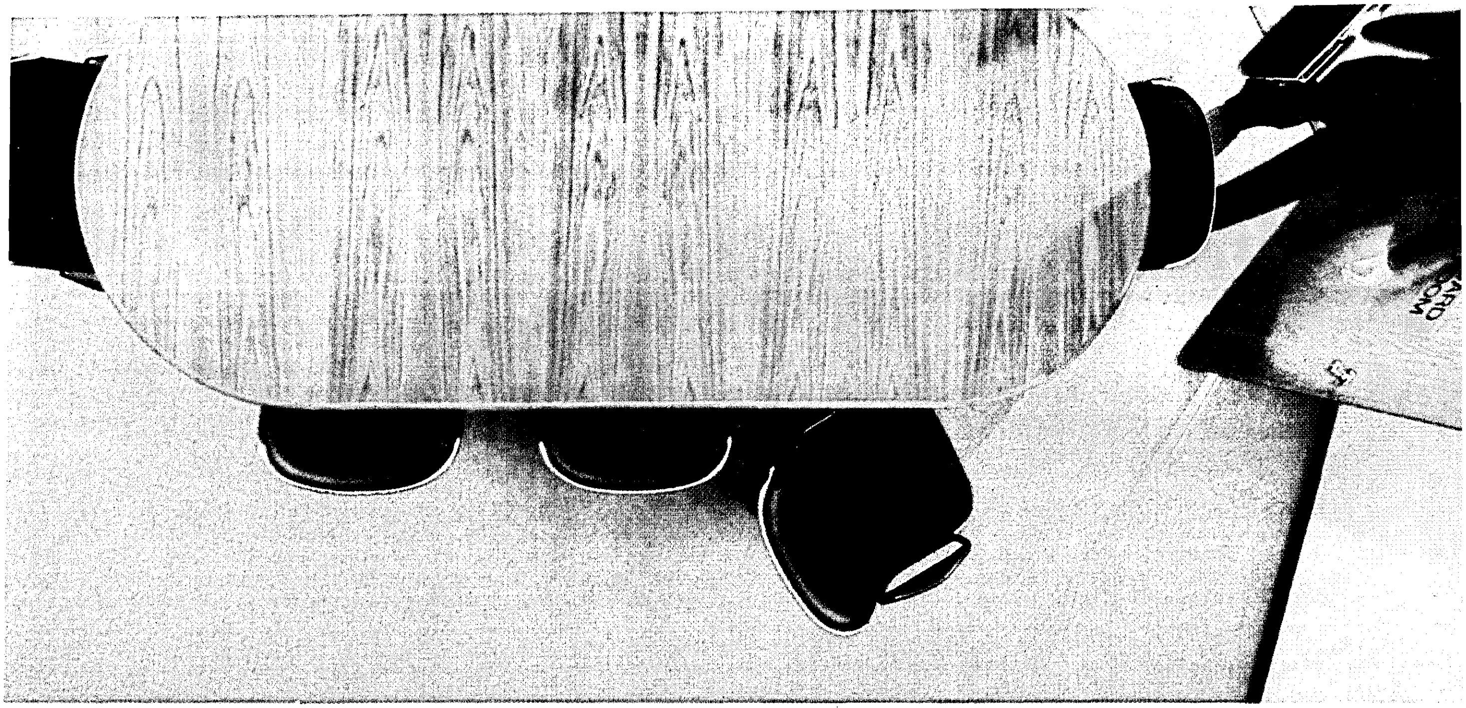

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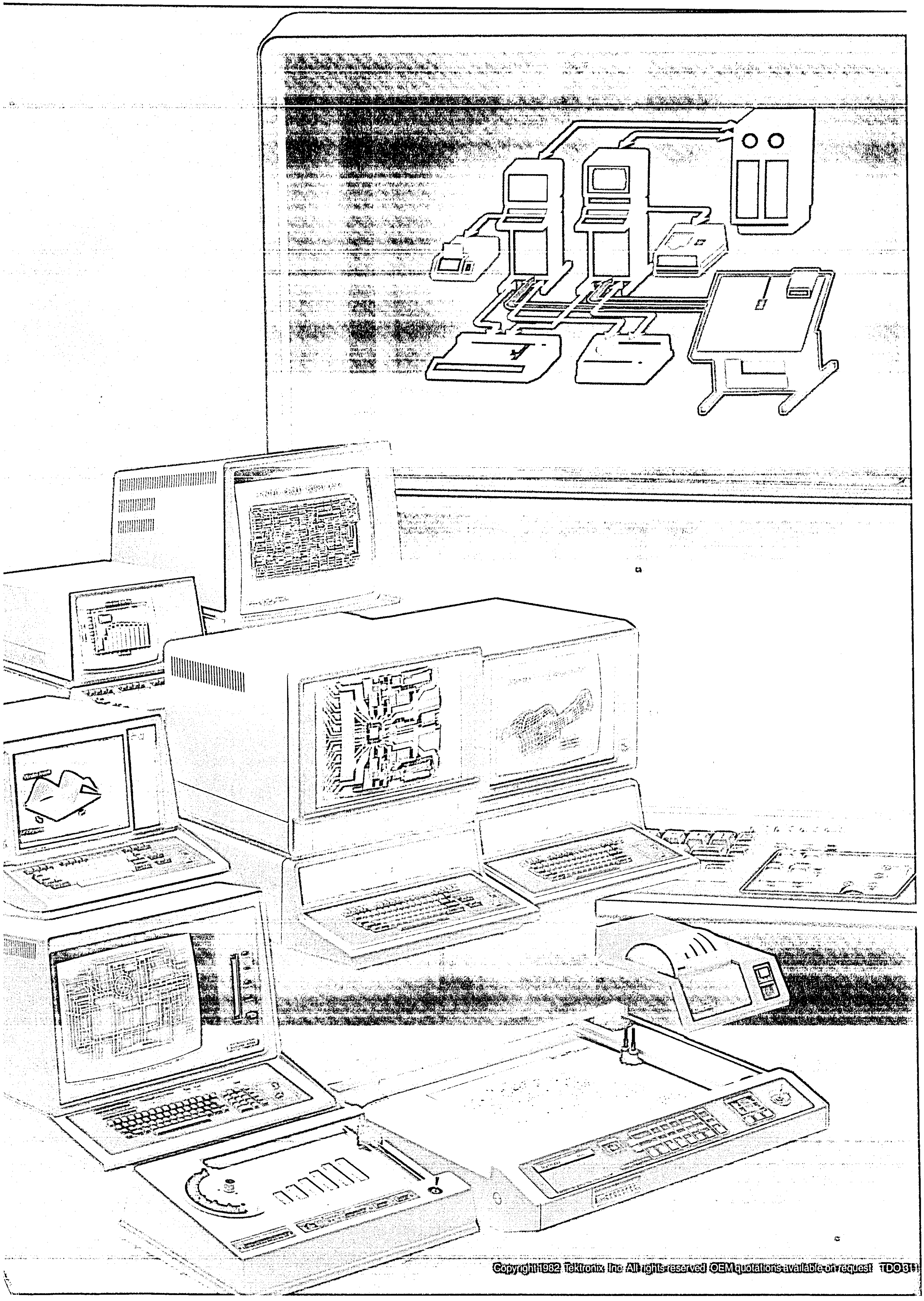

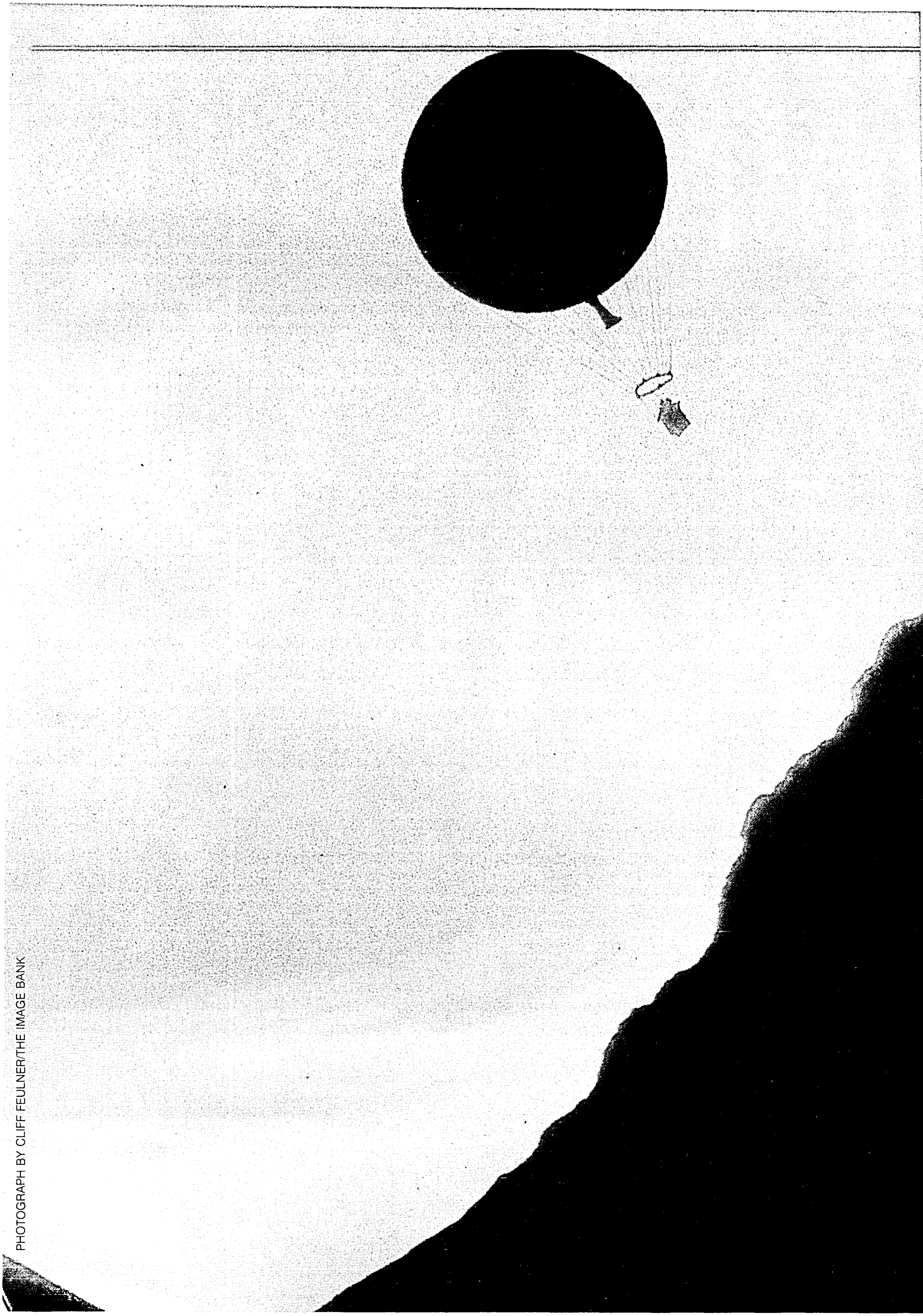

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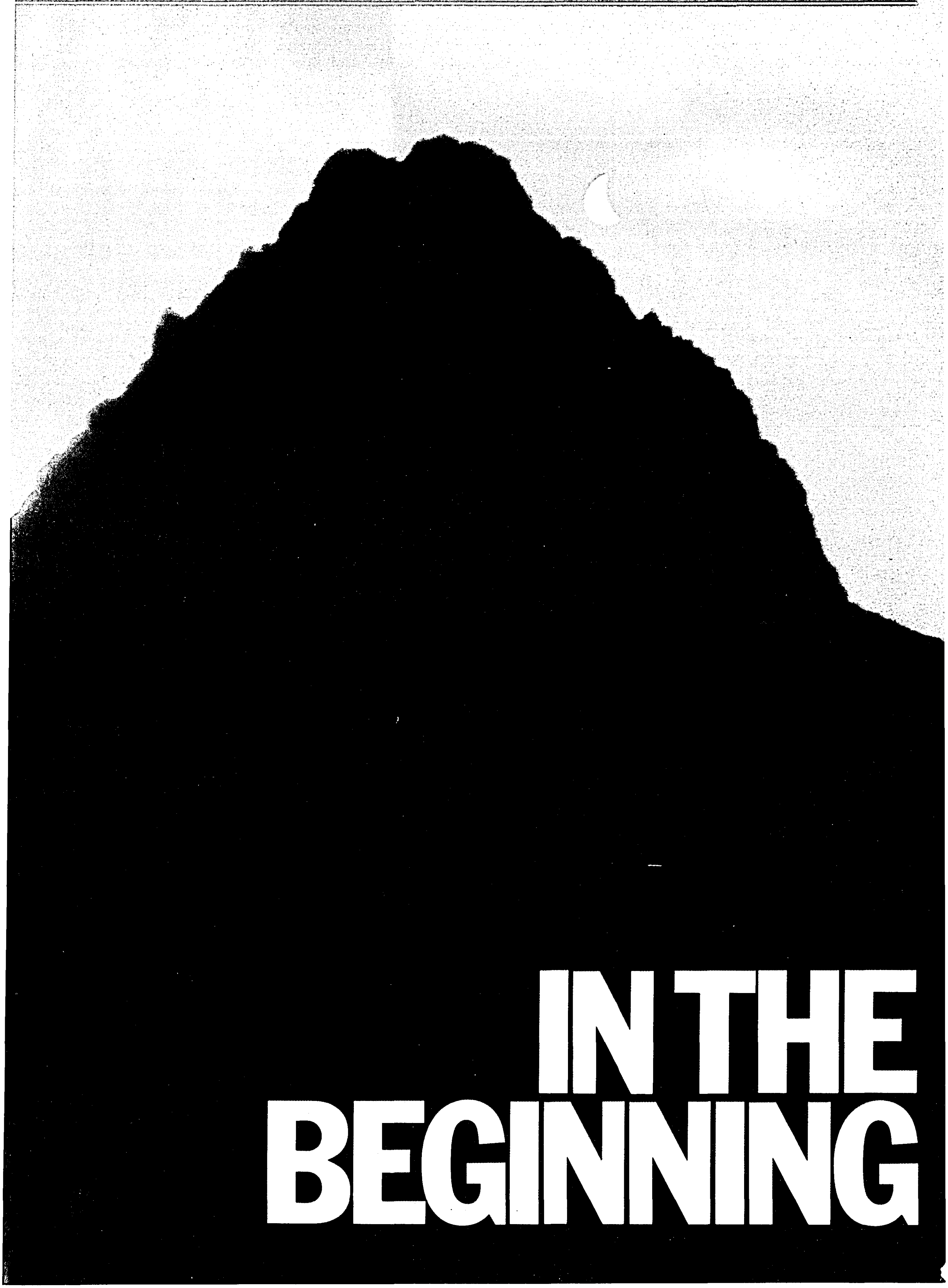


IN THE BEGINNING

John V. Atanasoff, creator of the automatic digital computer, did it his own way.

THE INDEPENDENT INVENTOR

by W. David Gardner

Perhaps no one in the press has studied and scrutinized the computer industry as closely as W. David Gardner. An insightful investigative reporter, Gardner made an art out of industry watching during his seven-year stint as a DATAMATION editor. The following excerpted chapter from his forthcoming book describes the work of John V. Atanasoff, one of the dp industry's more controversial pioneers.

In 1937 a young associate professor at Iowa State University turned his attention towards an IBM tabulating machine then located in the Mathematics Department at the college.

The professor, Dr. John V. Atanasoff, was frustrated. He was also stubborn—in fact so stubborn that some who knew him thought him downright bullheaded. Like theoretical physicists and mathematicians at U.S. colleges at that time, Atanasoff needed a new and improved calculating instrument to assist him and his students as they pushed into new research territory, where their problems required the use of linear operational equations including partial differential systems and integral equations. "We needed practical solutions for practical purposes," Atanasoff said. "The most powerful computing means that I had available was the IBM tabulator. I guess it was the power of the machine that caused me to turn in that direction for help.

"I conceived of the possibility of using the IBM tabulator in these calculations. At first I did not succeed very well by supplying data to the machine in a normal way, and so I decided to build a piece of auxiliary apparatus that could be connected by plug-ins to the IBM tabulators."

Atanasoff reconfigured the tabulating system without telling IBM what he was doing, but an IBM serviceman eventually discovered that he was modifying the machine, a practice forbidden by the company that dominated the tabulating machine market. Offended by this crime of IBM crimes, the serviceman reported the matter to his superiors at IBM and they fired off a warning to Atanasoff, telling him to stop tinkering with the IBM-leased machine. Atanasoff ceased working with the tabulating machine, but by this time he realized that it didn't have enough processing power to satisfy his requirements.

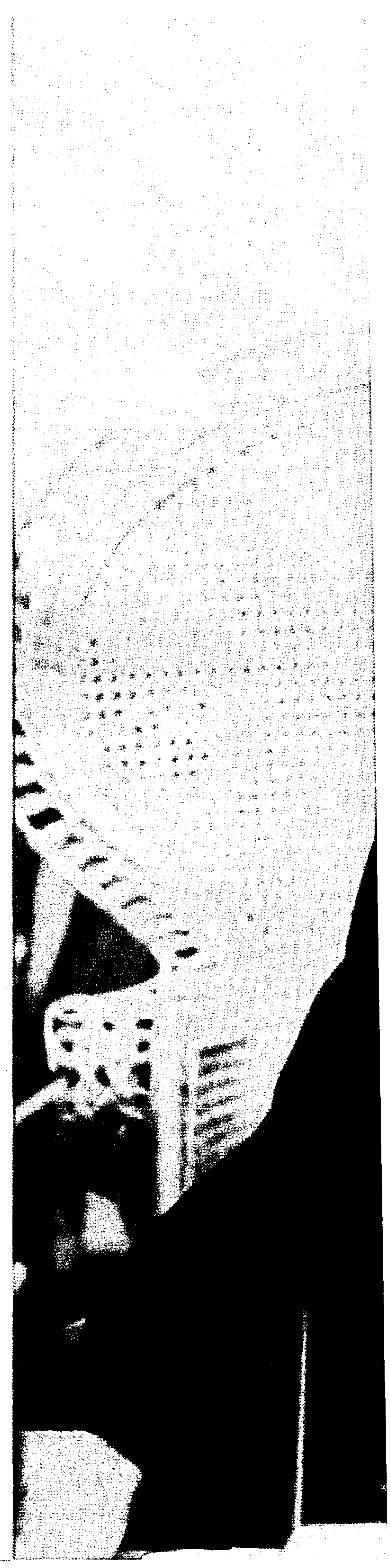
Nevertheless, the underlying challenge remained and Atanasoff and his students pushed even harder for a more powerful computing device. Atanasoff, often wrestling with this problem until 3 a.m. or 4 a.m. in his campus laboratory, began to cast about for another solution.

After an early dinner one particular night in the winter of 1937-1938, Atanasoff was anguishing in his laboratory about his failure to design a better computing device. "Tormented," he did what many a frustrated man has done before him—he went out for a drink of whiskey. But the nearest bar was 200 miles away in Illinois. (In those days Iowa was a dry state.)

Atanasoff jumped into his Ford V-8 and headed off in the bitter cold in the direction of Illinois. After a few hours of 80 mph driving, Atanasoff crossed the Mississippi River near Rock Island, Ill. He stopped at the first honky-tonk and went inside. "I had a very heavy coat, hung it up, and sat down and ordered a drink," Atanasoff remembers. "And as the delivery of the drink was made, I realized that I was no longer so nervous and my thoughts turned again to computing machines.

"Now I don't know why my mind worked then when it had not worked previously, but things seemed to be good and cool and quiet . . . During this evening in the tavern, I generated within my mind the possibility of regenerative memory . . . During the same evening, I gained an initial concept of what is called today the 'logic circuits.' "

If the automatic electronic digital computer has its precise moment of conception then that moment occurred in a honky-tonk in Illinois when John Atanasoff sat down to have a few drinks. There would prove to be many ironies and controversies surrounding Atanasoff's work that began in the Illinois honky-tonk, and not the least of them was the fact that one day IBM, which equated whiskey with the bubonic plague,



PHOTOGRAPHS BY CARL HOWARD

The young Atanasoff was very American—a sort of science prodigy Huck Finn.

would ride to the top of the heap of the world's industrial powers, peddling a machine that had been conceived in a barroom, its inventor's mind finally jolted into its most creative mode by a few belts of whiskey.

Back at the Iowa State campus, Atanasoff spent the next several months polishing the design of his computer during his spare time. In 1939 he was confident enough to approach college officials with a detailed proposal seeking funds to produce "the most powerful computing machine in existence." It was a swaggering proposal and yet to carry out the plan Atanasoff requested only $650.

The request was approved and the $650 grant must go down as the greatest bargain of the 20th century in view of the results that followed. With the grant, Atanasoff put aside $450 to hire a promising Iowa State electrical engineering graduate student named Clifford Berry. The remaining $200 was earmarked for materials. With that, the Atanasoff-Berry Computer—the ABC, as it came to be called—began to be assembled.

By the fall of 1939 the two men were able to produce an operating breadboard prototype model of the machine to demonstrate the soundness of Atanasoff's principle. Then they began building a working model. Atanasoff felt his machine incorporated four unique concepts—serial calculation, regenerative memory, logic circuits, and the digital electronic approach to calculating. For the logic circuitry, Atanasoff used vacuum tubes, commonly used in radios at that time. To keep memory continuously refreshed, Atanasoff used capacitors for the automatic jogging or regeneration of memory.

THE DIGITAL APPROACH

Atanasoff's mother, a teacher, played an indirect role in his choice of the digital approach for calculation. It was she who gave her young son a book that explained ways to calculate numbers to bases other than the common 10 digits used in the decimal system. When Atanasoff hit upon the idea of using base two numbers for digital computing—zeros and ones, essentially—he felt that somehow somewhere in his mind the book his mother gave him helped bring forth the idea. (In September of 1981 Atanasoff threw a big party for his mother on her 100th birthday. She was lively and active and, although she had failing eyesight, she was still able to do her algebra in her head. She is living with her son at his home near Frederick, Md.)

Atanasoff knew that there was nothing sacred about the decimal base 10 numbers other than their universal popularity and use because arithmetic systems trace their origins to the common habit of people counting on their 10 fingers.

His thinking on the logic structure and architecture of computing machines was years ahead of its time. But he was years advanced on the practical side, too: while the lords of the calculating and tabulating field in industry and academia would remain convinced for years that electronic components were unreliable, Atanasoff challenged that rigid gospel from the start. Thus, the importance of Atanasoff's work was in his unique blend of mathematician and theoretical physicist on his abstract side and laboratory and machine shop handyman on his practical side.

His conclusion that electronic components were reliable for what he had in mind was not easily arrived at. "I was very worried about the reliability of vacuum tubes—until I got them on the test bench," he recalls. Atanasoff's exhaustive testing revealed that vacuum tubes did indeed have reliability problems, but that the mechanical components of the time were equally unreliable. To Atanasoff that meant vacuum tubes would be just as reliable as the old relays used in the huge electromechanical calculating machines then lighting the way in mathematical calculation.

SHUNS THE LIMELIGHT

But who is this man who achieved so much and yet who shunned the limelight both among the public and among his scientific peers? Atanasoff has remained creative and cantankerous his entire life, even after mild strokes laid him low for a time. Sometimes he has bordered on the neurotic in his resistance to letting other people do things for him or in his resistance to doing things the way other people did them.

As a child, Atanasoff was precocious. He made up his mind to be a theoretical physicist when he was 13, picking a basic science whose broad range and physical structure appealed to his interest in the more concrete aspects of the physical world. While Atanasoff now notes with pride his American and Bulgarian peasant ancestry, he was then very American and very normal—a sort of science prodigy Huck Finn.

Atanasoff was born in upstate New York, but moved to Florida when his father, an engineer, got a job there. The young Atanasoff grew up in rural racist Florida. He remembers the night rides of the Ku Klux Klan, Catholics being ridden out of town on rails, and the lynchings that were not uncommon in Polk County in those days. In one frightening childhood incident, Atanasoff, returning home after playing sandlot baseball, saw the body of a black man swinging from a bridge—the victim of a lynching.

He received an engineering degree from the University of Florida in 1925 and moved on to Iowa State College for his master's degree in mathematics, then on to the University of Wisconsin, where he completed his studies for his doctorate in mathematics. His modus operandi was cast at an early age and then remained set. "I worked at computing machines the way I tried to solve any problem," Atanasoff said. "I fill myself with the subject until I exhaust everything about it. And then I worry and worry until I'm tormented. Sooner or later I get an idea."

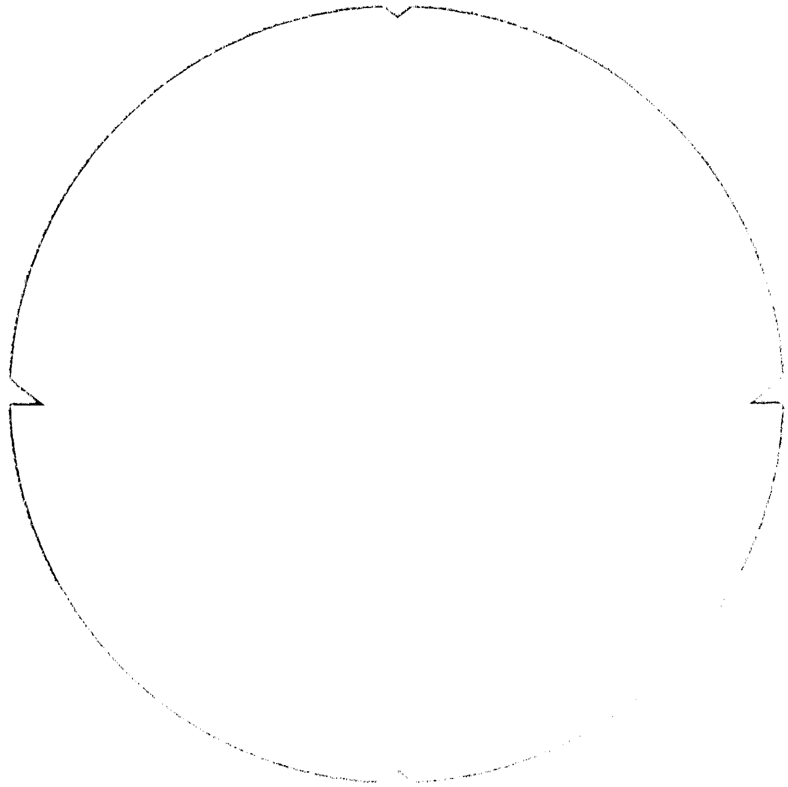
As a youngster, Atanasoff liked to read encyclopedias, and as he was working his way through the Encyclopedia Britannica he discovered the work of Charles Babbage, the great English mathematician who began devising mechanical computational devices in 1812. In his work, Babbage prophesied electronic digital computers more than a century before the components to make electronic digital computers had even been conceived. In that sense, Babbage would be the ghostly incubus in the paternity of the computer.

At first Babbage set out to build a device that he called the Difference Engine, which would perform a limited set of operations to calculate simple polynomials. Babbage envisioned a device capable of "eating its own tail," in which initial calculated results would affect other results, thereby enabling the machine to actually change the instructions it received.

But before he could complete the Difference Engine, Babbage began planning a more ambitious device he called the Analytical Engine, which, in principle at least, would solve any arithmetic problem by stringing together numerous arithmetic operations. The Analytical Engine was to have a memory capacity of a thousand 50-digit numbers, with its own auxiliary library of logarithm tables. In the design, Babbage borrowed the punched card concept from the Jacquard loom, where instructions are punched in cards. The information represented by the holes was read by feeler wires brushing over the cards.

The Analytical Engine became an obsession with Babbage, who labored on it for nearly 40 years. He produced thousands of superb mechanical drawings that detailed a machine requiring more than two tons of brass, steel, and pewter components. But Babbage never did complete construction of the machine, and, in the end, it was the mathematician's own imagination and inability to stop designing and start constructing that did him in. Babbage produced so many new improvements and enhancements that the design itself was never settled down and the Analytical Engine remained an ever-moving project. In this sense, too, Babbage was the father of modern computer designers, most of whom are plagued with a similar reluctance to stop designing and start building.

Atanasoff is open in crediting Babbage for his contribution to the development of the electronic computer. "Everything has



Years later the work of Atanasoff and Berry would come to fascinate the great patent attorneys of the land.

been around for a long time, you know," said Atanasoff, speaking specifically of Babbage's work. "Nobody really invents anything. We all lean on the work of others."

A DYNAMIC PROCESS

When Atanasoff was working to complete his computing machine, he also found, like Babbage before him and like all computer designers thereafter, that computer designing is a dynamic process. Computer designers become emotionally attached to their computer progeny and have difficulty allowing them out of their laboratories without just another improvement or two.

In that context, Atanasoff struggled with his computer. In 1941 he was applying for more funds and the Research Corp., a New York-based agency that dispensed money to college projects it deemed worthy, soon approved another grant for more than $5,000. By 1942 the most important element of Atanasoff's computer—the arithmetic unit—was successfully tested and Atanasoff felt that the key part of his computer project had been completed.

The machine never went into actual productive use. There were several reasons, not the least of which was the fact that there was a world war under way and important defense projects were simply not being worked on in Iowa. Also, the government effort needed top scientists like Atanasoff at the leading scientific centers that were gearing up for the war effort and not for what was thought at the time to be the relatively unimportant job of making electronic computing machines.

Unfortunately for Atanasoff and his computing machine, Ames, Iowa, just wasn't a major crossroads of technology development. Cambridge, Princeton, Philadelphia, and Palo Alto were on the high technology circuit, but few of the great scientists—the ones with the patronage clout to take a project out from under the dark mushroom of obscurity and push it into the limelight—ever visited Ames. Many of them had never even heard of the place.

The influential scientists who came to observe Atanasoff's machine or who listened to him talk about it were unimpressed. Samuel Caldwell, an MIT professor prominent in the analog and electromechanical calculating field, came to visit Atanasoff at Iowa a few times, but Caldwell wouldn't budge from his attachment to the Bush Differential Analyzer that he helped build at MIT under the guidance of Vannevar Bush. As science advisor to President Franklin Roosevelt, Bush was the most influential scientist in America.

Likewise, help was not forthcoming from prominent mathematician Warren Weaver, who had been chairman of the Mathematics Department at the University of Wisconsin when Atanasoff completed his doctoral work there. Weaver had gone on to the Rockefeller Foundation, which was actively funding advanced calculating machine projects at the time. Weaver was committed to a project at Eastman Kodak that proved to be unsuccessful. And, when Atanasoff went to Harvard to talk about his invention, the idea of automatic digital electronic computing fell on the deaf ears of Harvard's great computing pioneer, Howard Aiken, who, like Caldwell and Bush, was wed to the behemoth, slow electromechanical devices of their own construction.

"Sam Caldwell got attached to the Bush Analyzer and you couldn't shake him from that," said Atanasoff, describing his frustration. "And Aiken just didn't want to hear about anything that wasn't his." (Those three giants of U.S. computing—Aiken, Bush, and Caldwell—stuck to their rusty guns for years: they were openly unenthusiastic about the University of Pennsylvania's ENIAC computer that had been designed by J. Presper Eckert and John Mauchly.)

In due time, as the war effort grew, Atanasoff went off to Washington to the Naval Ordnance Laboratory and became chief of the Acoustics Division there. Later he headed the Navy's Fuze explosives program, and after that, he became chief scientist of the U.S. Army Field Forces. Decades later, when the importance of computers had become established, Atanasoff himself had second thoughts about dropping his computing work. "I wasn't possessed with the idea that I had invented the first computer," he said. "If I had known the things I had in my machine I would have kept going on it."

As for Clifford Berry, he went on to get his doctorate and eventually became a leading expert in mass spectrography. He retained his interest in computing on the side, however, and years later he popped up in a moonlighting role at IBM's research laboratories in Yorktown Heights, N.Y., helping an IBM scientist design an analog computer.

Atanasoff had an easier time inventing and building his computer than he had trying to patent and market it. In 1940 an IBM engineer inspected Atanasoff's computer in Iowa and sent off a report to his superiors. Atanasoff journeyed to IBM headquarters in New York to pitch his invention to the man who examined new and useful tabulating and computing equipment developments.

VIRTUAL MONOPOLY IN FIELD

In a letter written in 1940, Atanasoff outlined his frustrations in dealing with IBM, which he said held a "virtual monopoly in this field" of tabulating equipment. Atanasoff balked at signing a contract with the tabulating titan that he felt had him "by the neck."

In dealing with IBM and its weak competitor, Remington Rand, Atanasoff shared the dilemma encountered by other lone inventors when they deal with high technology corporations dominant in their respective industries. Usually before an independent invention will even be examined, a corporation requires the inventor to sign away basic rights to the invention to the corporation. If a corporation decides it wants to acquire an inventor's patent, the inventor is then paid.

Speaking for lone inventors everywhere, a frustrated Atanasoff wrote in 1940: "I wish that there could be arranged some

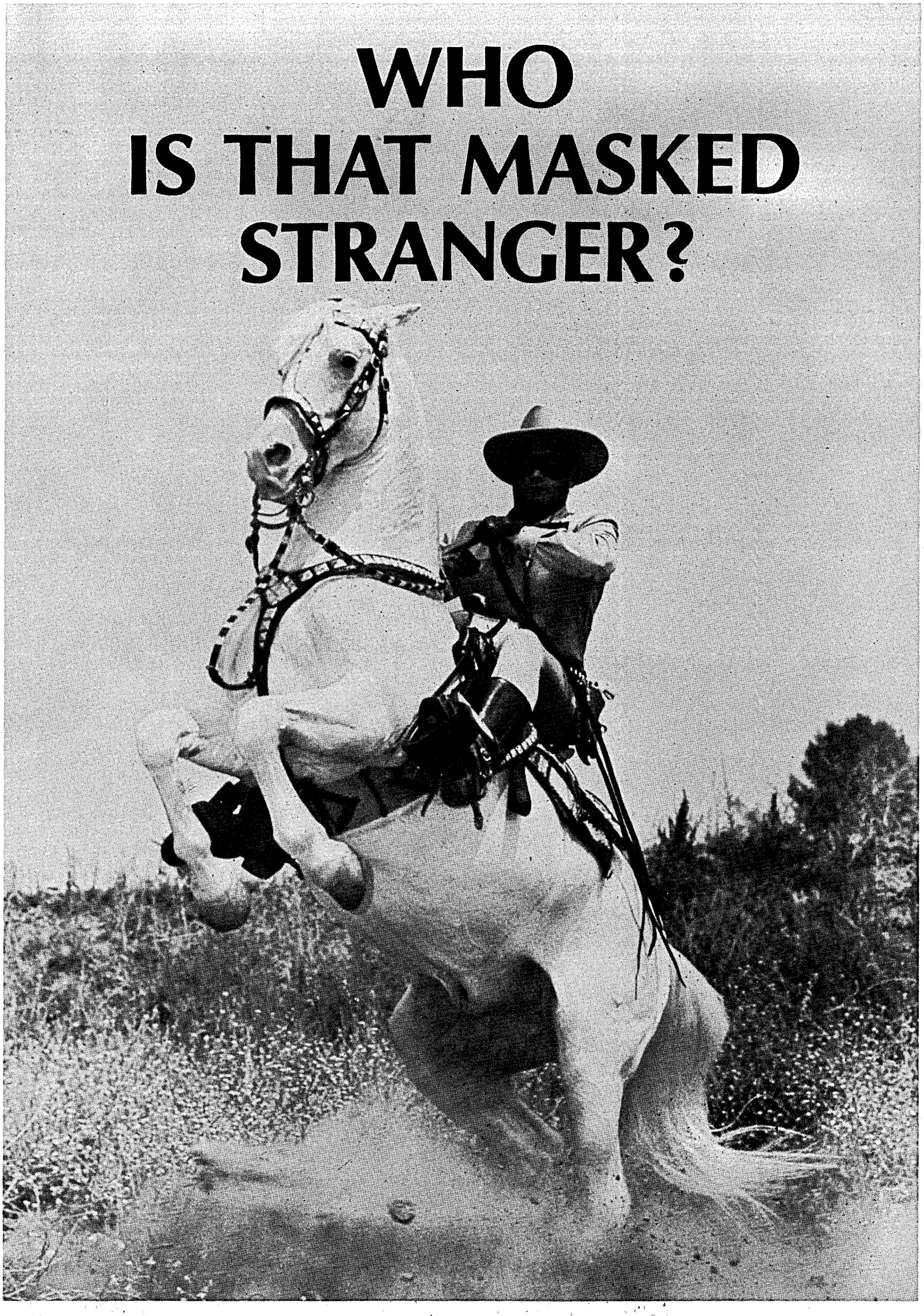
JUST A LITTLE GIZMO?

While John Atanasoff's pioneering work in computing at Iowa State University was ingenious in and of itself, its greatest legacy was its impact—conscious or unconscious—upon the later brilliant work of J. Presper Eckert and John W. Mauchly, who invented the ENIAC computer at the University of Pennsylvania. That Mauchly closely examined Atanasoff's work and was stimulated by it there is no doubt, as extensive Atanasoff-Mauchly correspondence has revealed. But years later Mauchly derisively referred to Atanasoff's ABC computer as just a "little gizmo." Mauchly went to his grave in 1980 insisting that he never learned anything of value from Atanasoff, and Mauchly's heirs have been vociferous in maintaining that stance since his death.

There is abundant evidence, however, that Mauchly took a keen interest in the ABC machine. In letters written in 1940 and 1941, he sought access to Atanasoff's work, downplaying his own efforts. Herman Goldstine and others close to Mauchly in the early days of the ENIAC project recalled Mauchly's excitement over his meetings with Antanasoff. In 1953 Mauchly's associate, Presper Eckert, even published a scientific paper that noted that "Atanasoff in Iowa" had developed what was "probably the first example of what might generally be termed regenerative memory."

The debate over the degree of Atanasoff's influence on Mauchly—and Mauchly's subsequent influence on the ENIAC—will no doubt rage forever. This is almost irrelevant since the work of the ENIAC team—sometimes against great resistance and often against monumental indifference—was nothing short of courageous. ENIAC was the world's first productive electronic computer and it spawned the computer phenomenon that has swept the world.

—W.D.G.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IS THAT MASKED
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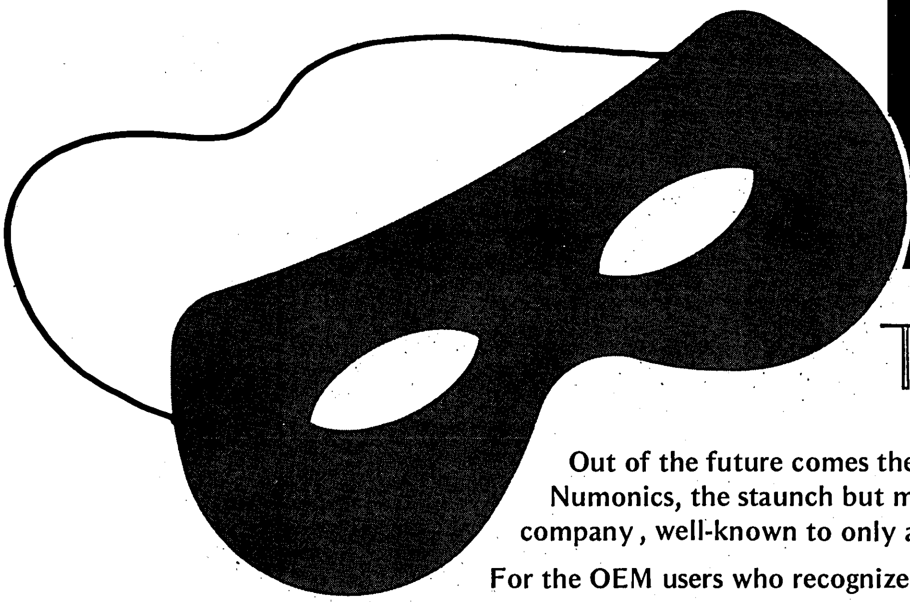

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John Mauchly described Atanasoff as "a sort of minor Thomas Jefferson."

more satisfactory ground for those who develop new ideas to meet prospective purchasers of these ideas since, after all, the value of such a meeting is not all on one side."

Atanasoff wouldn't sign a contract with IBM, but the firm wasn't much interested either. Atanasoff remembers receiving a letter, a classic in view of what happened in computing, from an IBM man who didn't expect the company would ever have much use for electronic digital computers. At the same time, Atanasoff was attempting to interest the Remington Rand Company in his work, and he discovered what that firm lacked in the way of business machines market share, it made up for in consistency. At Remington Rand it was the same story as it was at IBM—if he wouldn't sign a contract they wouldn't look at his invention. Atanasoff wrote to a Remington Rand vice president and complained that if he signed the company contract, "this procedure would furnish your company with all of my information without any corresponding obligation on your part and would perhaps enable you to resuscitate some old investigation and file an application on it, making my application the junior in the resulting interference."

He was once asked whether he thought IBM and Remington Rand were deliberately stringing him along on the patent issue. Was it a sinister conspiracy? "No," answered Atanasoff, "I just believe they were too damned dumb to know what was happening. They didn't know what was revolving around them. They thought they had the world by the tail and I guess they did."

Atanasoff then turned his attention to filing his own patent. He and his associate, Clifford Berry, visited the U.S. Patent Office in Washington, where they spent a few days digging through the mountain of patents, looking for any possible prior art. They found none they felt would threaten their work.

Then Atanasoff found a new obstacle. He needed the cooperation and assistance of Iowa State officials and lawyers, and while no one there opposed his idea of filing a patent, they were so ineffective that a patent was never filed. Atanasoff never expected to receive much material gain from his computer work in those days of conception before there was any gleam of the gigantic industry that would spring up in the wake of his work. "I would have received half the money Iowa State received from the sale of the patent rights," said Atanasoff.

Years later the work of Atanasoff and Berry would come to haunt and fascinate the great patent attorneys of the land. As huge high technology corporations collided over the emerging multibillion-dollar computer industry, the neglected work of the two lone inventors of Iowa became increasingly significant. The patents of later much-publicized and heavily funded computer projects could be declared invalid by the testimony of these two pioneers. The work of Atanasoff and Berry had to be knocked down in order for other later computer development efforts to be considered valid.

The irony of the situation was supreme: powerful interests in the emerging computer industry would spend vast amounts of money attempting to discredit the work that had once been offered so cheaply and turned down so nonchalantly. While Atanasoff never made a nickel from his early computer efforts, many attorneys lived handsomely litigating his work.

In the 1950s and 1960s, corporate patent attorneys began to focus on Atanasoff and Berry. Could they back up their Iowa work? Could the two scientists support claims that they were inventors of the computer? The interest in Atanasoff and Berry intensified in proportion to the growth of the industry.

But on a single day in 1963 all efforts to discredit Atanasoff became suddenly easier. Clifford Berry, the one person who could best corroborate Atanasoff's work, died.

Berry had led a varied existence following his Iowa days. After he obtained his doctorate, he moved to California, where he became a successful scientist in an engineering consulting company, but to some he seemed troubled.

BERRY'S STRANGE DEATH

It was a strange death. Berry was found in bed in his apartment on Long Island, N.Y., where he had just moved from California. His hands were at his side, the covers tucked in neatly under his neck, a plastic dry cleaning bag over his head. The coroner's report found there was a relatively high level of alcohol in Berry's blood—an indication that he had been drinking. The official verdict was suicide.

Berry's wife and Atanasoff, however, would not accept the suicide verdict. Atanasoff came to Long Island from his home in the Washington area and checked into Berry's death. He soon learned there had been no suicide note and that Berry had been enthusiastic about his new job and new life in the East.

The people closest to Berry at the time, his landlords, who had enjoyed his company at a recent family affair, found Berry to be a "friendly, congenial, delightful man"—in short, an unlikely candidate for suicide. There was one strange thing, however. Berry's landlord remembered that "He kept saying 'they' were trying to pick his brains." And who might be trying to "pick his brains" and what did "they" want? Berry had never said. Did "they" exist only in Berry's mind? Was there a possibility of foul play or was Berry just another suicide who had taken one drink too many? The answers died with Berry.

Atanasoff was now on his own in the patent cases. Computer firms increasingly began to take a new interest in Atanasoff, who found that he was eagerly courted by lawyers trying to get at his records and copy them. He was cordial to them, but he kept his records to himself and a certain suspense built up over the years as to what documentation, if any, Atanasoff had. With Berry gone, if Atanasoff hadn't kept good records, it would have been his word against the others'.

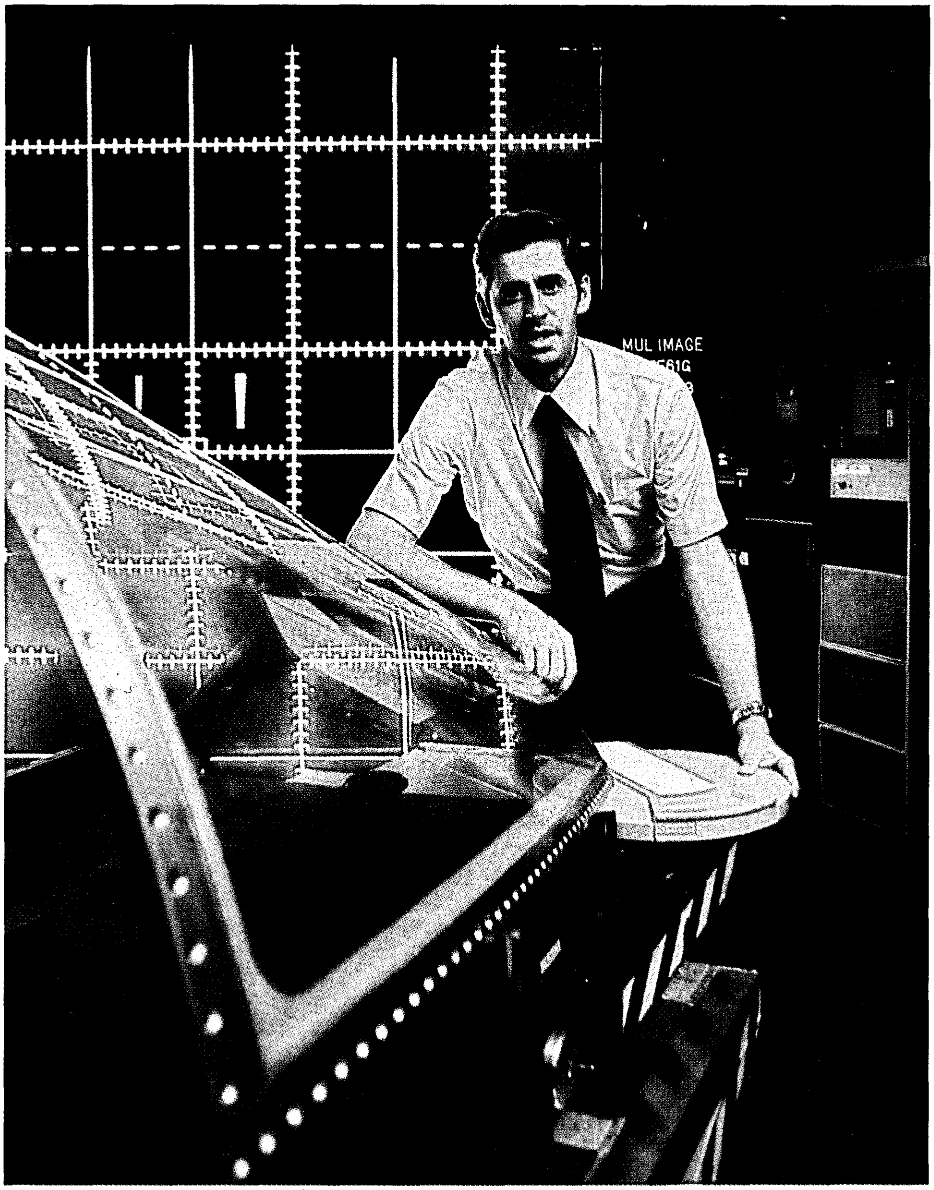
Atanasoff understood the drama of the situation perfectly. "Who would keep papers and letters and notes for 40 years?" Atanasoff asked rhetorically decades later. He answered the question himself: "Why, Atanasoff would."

Indeed he would. In bitter litigation between computer firms Honeywell and Sperry Univac that also involved IBM, AT&T, and scores of smaller companies, Atanasoff poured a cascade of scientific papers, letters, photographs, notes, diagrams, and memoranda into the public record. For a time, it seemed like a circus act, as if the man had never thrown away anything in his whole life. In addition, Atanasoff's memory was sharp and precise during the trial in U.S. Federal District Court in Minnesota.

The trial droned on and on in the early 1970s, becoming a massive and, for some, a treacherous whirlpool that caught just about everyone who had been involved in the early days of the computer industry. More than 30,000 exhibits were introduced. Finally, Judge Earl R. Larson made several sweeping rulings about the computer industry and its origins—the most startling decision being that John Atanasoff was indeed the inventor of the automatic electronic digital computer. The judge had heard testimony directly opposing Atanasoff but he said that he believed Atanasoff's side of the story.

The ruling came so many years after Atanasoff's work in the '30s that it was more of a moral victory than a new legal landmark. Statutes of limitation governing any possible irregularities had expired as had the patents on early computer design work, much of which had been accomplished years after Atanasoff's work. Judge Larson's decision was criticized by some who argued that federal judges didn't have a divine right to rule on what had or had not happened in the history of the computer industry.

While North America and Western Europe have been slow to recognize Atanasoff's work, he has long been a hero of science in his father's native Bulgaria. The Communist Eastern Bloc countries became mesmerized by superior American computer technology at the end of World War II.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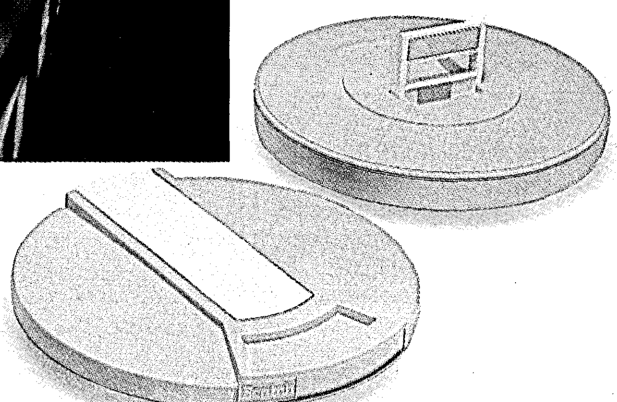

The Bulgarian Parliament honored Atanasoff as the inventor of the computer.

In their intensive studies of U.S. computer technology, Bulgarian scientists turned up the name of a Bulgarian-American scientist who they thought might have been the inventor of the computer. The scientist was, of course, John Atanasoff, and the Bulgarians tracked him down on a visit to the U.S.

Their discovery of Atanasoff's work had a great impact in Bulgaria, where the embargoed and vastly superior U.S. computer technology has always had an aura of forbidden and delicious fruit—an aura that permeates other Communist Bloc nations as well. In 1970, the Bulgarian scientists invited Atanasoff to Sofia, where he was acclaimed by Bulgaria's Academy of Science and awarded the Order of Cyril and Methodius, First Class, the nation's highest scientific achievement award. The Bulgarian Parliament also honored him as the inventor of the computer. At the time, Atanasoff's work was still unknown in his own country.

Toward the end of the war, Atanasoff drifted away from computers, but he retained his headstrong way of getting things done. It was an old friend and occasional adversary, John Mauchly, who perhaps best described Atanasoff as "a sort of minor Thomas Jefferson." He settled in the Washington area for good during the war. At his home near Frederick, Md., Atanasoff grew his own grapes and bottled his own wine; large storage freezers at his home contained the vegetables he grew in his experimental garden; and his futuristic concrete home contained several clever innovations he dreamed up, including an easily opened 800-pound rotating front door, and an energy-efficient heating conservation system that recirculated hot air from the top of the house to the bottom via jet. Atanasoff even did much of his own labor in his laboratory and home workshops, and recent callers at the Atanasoff home were likely to find the septuagenarian busy welding some new contraption in his garage.

For more than a decade, Atanasoff's most furious—and frustrating—work was in developing a new universal alphabet. While Atanasoff worked at the project unflaggingly, frustration set in when he found the world showed little interest in his alphabetic work. Determined as always—even bullheaded—he has made provision for this work to be preserved when he dies because he feels that sooner or later the world will come around to his way of thinking on the subject, just as it has on computing machines.

Atanasoff's independent thinking was such that when he started up his own firm a few years after World War II, he refused to use lawyers to incorporate the company or accountants to set up the books. Instead, he set aside three weeks to study corporate law and three days to study accounting.

His defense projects company was a roaring success, logging annual sales of $750,000 by the time he sold it to Aerojet-General in the mid-'50s. With the sale of the business, Atanasoff was financially secure forever. Attorneys handling the deal were surprised to find that his legal work was so neat and precise. Later, one of the attorneys called Atanasoff seeking advice on how to form a corporation.

Just recently, Atanasoff gave up the ghost on his alphabet work. Nearly 80 years old now, he has bought a personal computer for its word processing capability to help him write a scientific paper on his early computing work. He has been teaching himself programming from books, learning assembly language and BASIC. "You know," he said not long ago, "in assembly language every now and then I find something I did more than 40 years ago." ✻.

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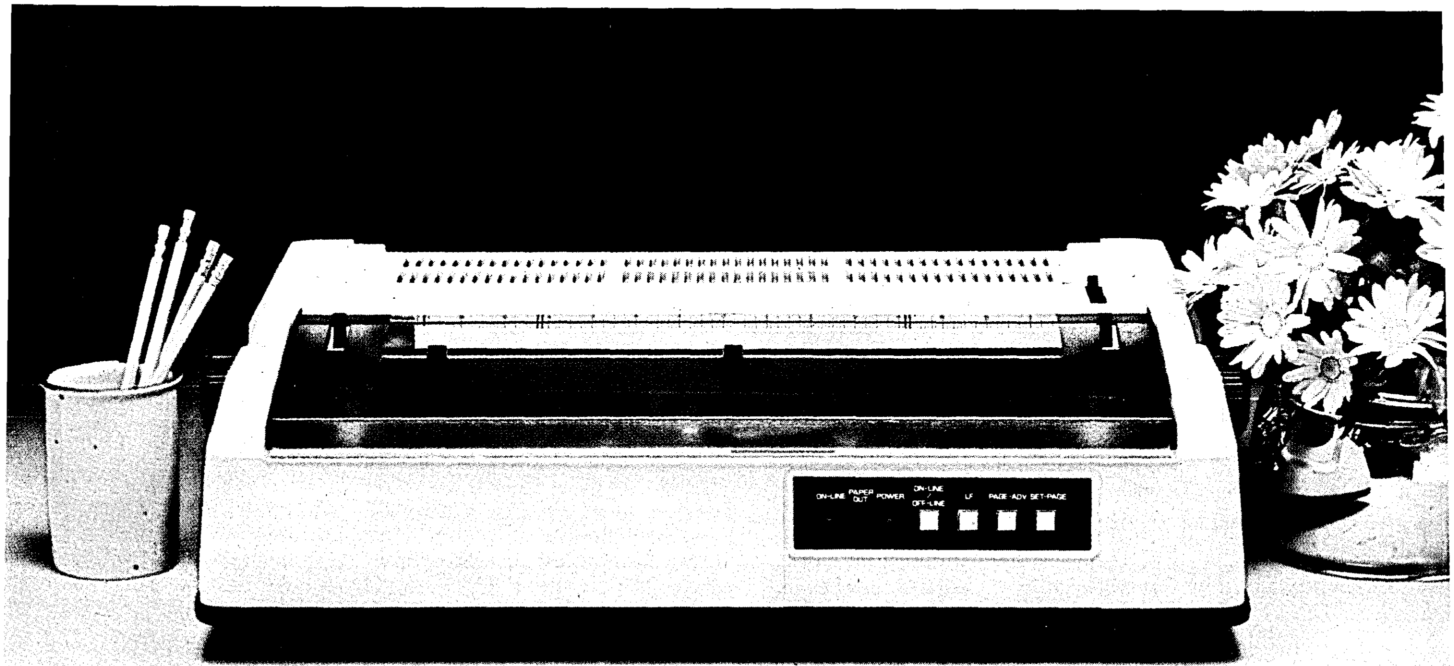

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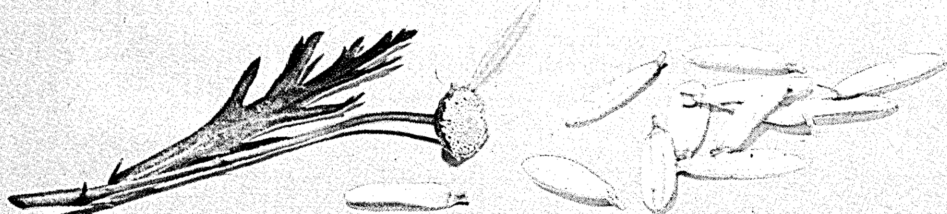

HOW DO I LOVE YOU? LET ME COUNT THE WAYS.

DATAMATION remembers some of the pioneering people whose visions became our reality.

THANKS FOR THE MEMORIES

With our concern over bits, bytes, and microcode, it's sometimes easy to forget that computers, however they may be personified, are machines that are designed, built, and operated by people. We sometimes forget that the computer industry is not just a collection of factories and offices, not just an anchor for stocks and bonds and convertible debentures. Rather, it is the complex embodiment of dreams, of hope, of sweat, of ingenuity, of perseverance, and of cooperation. It is also the showcase for human faults, for some great accomplishments may have sprung as much from greed and ambition as from generosity or acceptance.

In this commemorative issue of DATAMATION *it seems appropriate and necessary to remember a few of the people who helped shape the computer industry—people whose visions became our reality, whose insights became our understanding. Unfortunately, editorial constraints limit the number of people we can profile. Nevertheless, the people presented here have among them the gifts our industry requires and often rewards.*

Some of these personalities have indeed been rewarded with riches; the computer industry has made many millionaires. Others have achieved immortality in the realm of scholarship; the computer industry has many important thinkers.

For many of the pioneers, the contributions they made were reward enough. They didn't ask for fame or glory when they did their work. This more pragmatic point of view results from the fact that many of the key contributors to the computer industry were, and still are, scientists, engineers, and mathematicians. They lent the industry their skills.

They have shown that there are no rules for achievements, no personality types that fit or don't fit. Indeed, some of these people are quite colorful and outgoing, others plain and even reclusive; some are brilliant, others merely bright; some are daring, others conservative; some temperamental, others calm. But all of them are exciting. Each pioneer saw the future and gave it substance.

ILLUSTRATIONS BY GERRY GERSTEN

While most of the computer industry is tripping over itself trying to build smaller and smaller computers, two companies—Cray Research and Control Data—are still dedicated to number-crunching behemoths. The man behind supercomputers at both companies is **Seymour Cray**. Creating very fast scientific computers is his passion.

It's hard to describe just how fast the Cray computers are. Oh, you can put a number on it, like the 250 million floating point operations a Cray-1 can do in a second when it's running full tilt. But a better way to think of Cray's machines might be this: nobody has ever designed more superspeed scientific computers than Cray, and dozens of people have tried. It is Cray who gave America supremacy in these systems. If others at CDC or elsewhere have built machines of comparable capacity—and a few have—they knew it was the Cray machines that they had to beat.

Unlike his computers, Seymour Cray is neither fast nor flashy. He has a well-deserved reputation for reclusion. He seems to like nothing better than dreaming up better (read faster) computers in silence and often when there is nobody else around. Given the chance, Cray will show up at work in the late afternoon and stay well into the night. Describing his plans for a research lab, Cray projected "a strictly superquiet think tank where we are supposed to develop this colossal computer. Each room will be fully insulated from the others; I just can't think when it's noisy."

Seymour Cray

It should come as no surprise that Cray lives his life in a rural place, Chippewa Falls, Wis. But it's more than quiet he's after. "It was 1962 and the time of the Cuban missile crisis," he recalls, speaking of his move from the CDC facilities in Minneapolis. "I wanted to get out of the big city because I thought I might get my head blown off there." And getting back to the Falls is, for Cray, going home: he was born there.

Cray was with Bill Norris at CDC right from the start. In the early 1960s, after their 1604, the first solid-state commercial computer, was sold, Cray said he wanted to go to Wisconsin and start his own little company. Norris would hear nothing of it. Instead, CDC built a factory and a lab for Cray in Chippewa Falls. It was there that Cray built his better-known machines, including the 6600.

But by 1972, Cray was really fed up with life in a big company. "I wanted to back off," he said at the time. CDC was changing from a supercomputer company into its present form, which emphasizes services and peripherals at least as much as large computers. And Cray's budget was being cut to make room.

"My objectives are more limited than CDC's board's," he said. "My interest lies in large computers." With that, Cray set up a company near his home and CDC's factory. Half a million dollars came out of his own pocket, a quarter million was kicked in by 18 CDC execs, and another investor chipped in $100,000. Cray Research was born.

In 1976, the company went public to

Kilpatrick ended up in a tussle with Big Blue as rough as an Oklahoma cattle drive.

so much acclaim that even though it had not shipped one computer and was $2.4 million in the hole, its shares, 600,000 of them priced at $16.50 each, immediately sold out. By 1980, the company's revenues were up to $60.7 million on sales of Cray-1 machines. Cray was back in big business. So in November 1981 he stepped down, so he could build...the Cray-2. As an independent contractor to Cray, he's back in the lab a lot.

You just get the feeling his lab will grow into another supercomputer company and Cray, like Daniel Boone, will again seek elbow room.

While some of those smart Oklahoma boys made millions in pipelines, there's only one who made his fortune in just plain lines: **Lester L. Kilpatrick**. He founded California Computer Products (Calcomp), a spin-off of the West Coast aerospace industry that made a business of getting computers to draw a straight line.

Kilpatrick's a down-home sort of guy whose simple style belies one of the most complex relationships with IBM any outsider in the computer business ever had. He helped the high and mighty company put its computers to work for architects, engineers, and even clothing manufacturers who needed pictures, not numbers. He also ended up in a tussle with Big Blue that was as rough as any Oklahoma cattle drive and as hard to sort out as a Sooner drilling deal.

These days, Kilpatrick is head of Newport Securities, an Orange County, Calif., company that helps local companies find financing. He and his son give advice, round up capital, and generally inform the world about business doings in the region. Their success is the result of education, persistence, and Kilpatrick's hard-won wisdom. How he grew wise and mellow is a story.

The story starts when Kilpatrick decided his 1948 electrical engineering degree from Texas Tech was more important to his career than his MIT master's. Somehow Kilpatrick knew his future would be tied to the future of the computer business. When North American Aviation developed the first airborne digital computer under Kilpatrick's inspired direction, however, the industry might not have realized that its future would indeed be tied to his. But it soon found out.

About 10 years after leaving MIT, Kilpatrick saw that the drawing board was a weak link in the chain connecting engineering and industrial production. Although digital computers could run off the numbers describing the shape of a wing or the underground pressures in an oil field, nobody had built a machine that could draw pictures with draftsmanlike detail. These pictures had to be repeatable, have great accuracy, and, most importantly, justify the cost of a machine. They also had to be drawn quickly using any computer running any language (which at the time generally meant FORTRAN). The machine had to stand up in the field. And it had to be built at a profit so there would be money around to make even better machines.

In the days before CAD/CAM and Pac-Man, computer graphics was a kind of laboratory curiosity. But once Calcomp got into business, the electronic plotter acquired legitimacy in engineering, much the same way IBM's efforts made the electronic accounting system a regular part of business.

Calcomp's first nine-month revenues of about $29,000 rocketed to nearly $3 million annually by mid-1963. Four years later, the company was cooking at a rate of over $11 million and telling its shareholders about something called computer aided design. During the next five years, Calcomp grew to dominate the plotter market; its products were being used to design everything from the tops of Mercedes cars to the bottoms of bikinis.

Meanwhile, the company had taken the pcm plunge, jumping to the forefront in a game played against one of the biggest buyers of its plotters—IBM. Calcomp had become the largest supplier of plug-compatible disks in the world. Total revenues passed $80 million in 1973.

That was the year Calcomp sued IBM. It would prove to be a very serious error for Kilpatrick. But Telex had won in court—before the appeals process, anyway—and Calcomp saw the world much the way Telex did. The pcm shepherds were doing battle with the IBM cowpunchers.

These days, Kilpatrick is philosophical about his star-crossed battle with the Armonk army. The effort of the fight—more, perhaps, than Calcomp's lack of success in the courts—led to irresistible pressures that resulted in Kilpatrick's 1977 resignation from Calcomp. "Let us say," he ventures, "that a lot of my banking friends didn't agree with me."

What do you do after you work with Admiral Hyman Rickover developing the first computer programs used to design nuclear power plants? If you're **Ruth M. Davis**, you figure it's a start of sorts, and go on to do a few more things. In Davis's case, those few more things include getting the world to accept a data encryption standard, putting Uncle Sam in a pivotal position in robotics, and implementing medical literature retrieval systems and a satellite hookup to link the sick in remote Alaska with doctors in the outside world. And that's hardly all.

Ruth Davis is one of the most amazing organizers in the world. That the computer industry got the fruits of her work is basically good luck. Davis started out not as an organizer, but as a mathematician. With a bachelor's, master's, and doctorate in math (summa cum laude all the way), she might have ended up as a professor. But the computer industry caught her attention.

Ruth M. Davis

Today, Davis, who is 54, limits her academic urges to memberships on the boards of overseers for mathematics at Harvard and Dartmouth. She also does an occasional stint as a lecturer on campuses with sufficiently tempting atmospheres, and serves in a top advisory post at the University of Pittsburgh.

This doesn't mean that Davis has a typical academic personality. She is one of the most down-to-earth people you'll ever meet, but she's strictly business.

When the National Bureau of Standards needed someone to direct its Institute of Computer Sciences and Technology, Davis was tapped. If you had visited her in those days, you might have been forced to give up any preconceptions about the civil service. Things were hopping all the time. Things got done.

When Ruth Davis left NBS, she temporarily left the front lines of computing applications to serve in the Defense Department. The posts she held were arguably the most sensitive ever held by a mathematician, a computer expert, or a woman. Her two major accomplishments were organizing development in ultrafast integrated circuits and directing research into particle-beam weapons.

Along the way, she's picked up so many honors and citations that her résumé could confuse your average DBM system. Davis currently has a Washington company, Py-

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CIRCLE 21 ON READER CARD

Eckert and Mauchly built their dream machine under a $400,000 Army contract.

matuning Group, that allows her to help prestigious clients with big questions—the kind you might pose to a think tank full of experts if they were as smart as she is.

President Reagan's plan to reduce taxes while a budget deficit exists will increase the government deficit and raise the pressures to increase the money supply. This will fuel inflation without providing supply-side incentives for increased production. Human intuition and mental models have failed to cope with the problems that result from complex social dynamics, and fundamental forces will eventually cause our exponential growth to stop. There are orderly processes at work in the creation of human judgment and intuition that frequently lead people to wrong decisions when faced with complex and highly interactive systems.

Who says? **Jay W. Forrester**, that's who.

For the past 20 years or so, Forrester's been using computers to model and analyze human social systems. With his colleagues, he has created the discipline known today as system dynamics, which involves using computer simulations to examine the forces underlying inflation, unemployment, energy, foreign exchange rates, human mobility, and tax policies—the various names we give to social and economic factors in our lives and to the daily functions of our institutions.

Forrester also invented magnetic core memory, formally known as the random-access, coincident-current magnetic storage device. It works, like almost everything else Forrester studies, when events that by themselves would cause no change coincide, producing a new state. While at MIT's Digital Computer Lab, he was also responsible for the design and construction of one of the early high-speed computers, the Whirlwind I.

But the work that absorbed Forrester the most was his use of computer models to analyze social systems. This began in the late 1950s, when Forrester was a professor of management at MIT's Sloan School. There, Forrester applied his understanding of computers to problems that had never been rigorously formalized. Out of this work came several books and innumerable studies by others.

Industrial Dynamics in 1961 presented a new philosophy and method of business analysis. In 1968, his *Principles of Systems* was published, a year later *Urban Dynamics*, and in 1971, *World Dynamics*. This last volume dealt with a global model of economics and resource utilization. The model covers interrelationships among population, food production, capital investment, natural resources, pollution, and even quality of life. The model indicates that people have failed to cope, and that there are limits to growth that must be recognized and dealt with.

Building from this base, *Limits to Growth*, also known as the Club of Rome report, led to worldwide interest in energy conservation and ecology. Such was the power of a computer model.

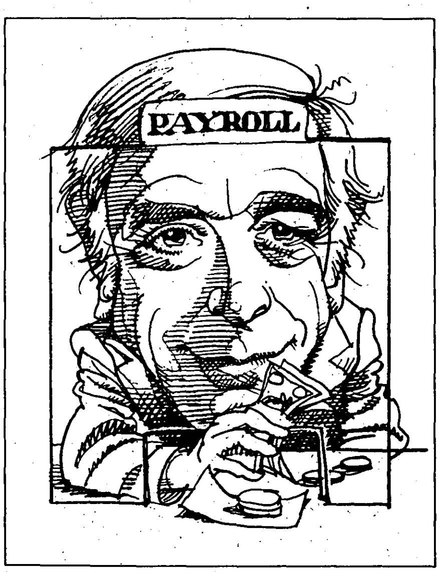
Today at 64, he's still at it, hoping to extend human understanding with the aid of computers, hoping that the problems he predicts will be solved.

"Big company life was not for me," **Frank R. Lautenberg** says, reflecting on his youth, when he used his degree from Columbia University's Business School to win a job at Prudential. Today, he seems to have changed his mind about big company life: the company he cofounded in 1953 at the age of 29, Automatic Data Processing Inc., has netted $50 million on revenues of about $560 million.

Lautenberg, who is 58, is still at ADP, and he seems to have adjusted well. "There's as much ahead at ADP as there is behind it," he observes. "So, I'll be there, exploring new markets." He'll be there, that is, if he doesn't end up in the U.S. Senate—a move he's hoping to make.

Lautenberg launched ADP with two partners, some Underwood bookkeeping machines, and the idea that he might make a living if he could save businesses time, money, and hassle by helping them do their books. Then, in 1961, the IBM 1401 came along and ADP set up bread-and-butter applications, like payroll. That worked pretty well, if you figure that making ADP one of the biggest independent computer services companies in the world is a measurement of success. But, as good as Lautenberg is, he was never able to figure out how to do that and avoid that big company life.

There are some people who might say that Lautenberg really hasn't spent the time to study this contradiction. He might have, if he hadn't served as a commissioner of the Port Authority of New York and New Jersey, as a trustee of the National United Jewish Appeal, as a past president of ADAPSO, as an advisor to Columbia University, or as an overseer of the New Jersey Symphony Orchestra, or a founder of a tumor research center. These are jobs that definitely get in the way of thinking small.



Frank R. Lautenberg

Just how does a man who couldn't stand the heat, got out of the kitchen, and ended up with the McDonald's of computing explain his peculiar circumstances? "I guess I've always been an entrepreneurial type," he says.

The first large-scale general purpose electronic digital computer was a war machine that never served a single day of wartime duty. Its name was ENIAC, and although it was built to be used in World War II, by the time ENIAC was up and running the war was long over.

ENIAC's designers and builders were two of the computer industry's foremost pioneers—**J. Presper Eckert Jr.** and **John W. Mauchly.** Mauchly died in 1980 after a prolonged illness; Eckert, who is 63, is still alive and well.

The famous team of Eckert and Mauchly first met at the University of Pennsylvania's Moore School. Eckert, who was 22 at the time, was a lab instructor in a government-paid defense course in electronics in which the 34-year-old Mauchly was enrolled.

During the early part of World War II, Eckert had his first brush with digital electronics, a field that also sparked the interest of Mauchly. Two years after the famous duo met in class, they began work on their first computer, forming a blend of talents that would last for many years.

Eckert and Mauchly built their dream machine under a $400,000 Army contract. Work on the vacuum tube computer got under way in April 1943. Three years and 200,000 man-hours later, ENIAC was ready. It was a monster, weighing 30 tons and covering 1,500 square feet of floor space. Inside its cabinets, ENIAC was a complex maze of more than 18,000 vacuum tubes, 500,000 soldered joints, 700,000 resistors, 10,000 capacitors, and 6,000 switches. Fast as it was at computing, ENIAC was slowed down by its patchcord board, used for changing programs.

While the ENIAC was certainly slow by today's standards, it was just as certainly a success. First installed in 1947 at Aberdeen Proving Grounds, where it was used for weather forecasting, wind tunnel design, and cosmic ray study, the marvel machine also recomputed ballistics tables—the time-consuming task it had originally been built to

Shockley, who shared the 1956 Nobel prize, founded one of the first Silicon Valley companies.

handle. ENIAC was run through its paces for the next 10 years.

After ENIAC, Eckert and Mauchly began work on a computer that would digitally store programs as well as data. The new machine would be the EDVAC—the Electronic Discrete Variable Automatic Computer—and its development would be helped along by the brilliant mathematician John von Neumann.

In late 1946 the computer crusaders left the Moore School over some patent disputes and formed a partnership, Electronic Control Co. They began work on still another computer, the UNIVAC. Money problems drove them to take on yet another computer project, this time building the BINAC for Northrop Aircraft. Completed in 1949, the BINAC was the first operational stored-program electronic digital computer that used mag tapes rather than punch cards.

Still plagued by money troubles, the two men sold their company to Remington Rand in February 1950. The next year they finished UNIVAC I, the first commercially produced digital computer. While one UNIVAC I toiled over the 1950 U.S. Census, a second UNIVAC I tabulated the election of President Dwight D. Eisenhower, projecting his victory over Adlai Stevenson 45 minutes after the polls closed.

In 1955, Remington Rand merged with Sperry Corp. and Eckert stayed with Sperry's Univac division. His last computers were the Livermore Automatic Research Computer (LARC), which was the first computer to feature multiprogramming and multiprocessing, and the UNIVAC III.

Today, Eckert says, "I don't do that much inventing anymore." In 1962 he observed, "What puzzles me is that there wasn't anything in the ENIAC in the way of components that wasn't available 10 or 15 years earlier. The real question is, 'Why wasn't it done sooner?' "

At the beginning of the last decade, IBM was seriously affected by a different kind of competition. A number of brash companies had begun to manufacture disks, tapes, and memories that plugged into large IBM systems and that were, for all practical purposes, equivalent to IBM's own gear. In their wake came finance companies, intent on renting systems that could run IBM software at cheaper rates than IBM and still pull in a profit. They seized on the compatible products as a way to market IBM-type systems to a large, growing, and well-heeled base of users who had big money tied up in software for IBM's computers.

IBM seemed to view these companies as pirates to be defeated in the marketplace. The plug-compatible makers seemed to believe that the rules of war should be technical and economic, that the company that builds

Dan McGurk

the box with the best combination of price and performance ought to get the business. Big money was at stake, and everyone was playing for keeps. The pcms wanted to win business from IBM, but they also wanted the battle for hearts, minds, and budgets of the users to be fought by what they felt were the Queensbury rules: the American antitrust laws. Lawyers rushed in where salesmen feared to tread and the U.S. government joined the legal donnybrook.

Enter **Dan McGurk**. He pointed out that IBM had driven its competitors to desperation and then told them to get out and walk. He argued, successfully, that IBM's adversaries had a great deal in common even if they fought each other for specific pieces of the business pie.

The pcms and their financial allies needed a general, and McGurk—eighth in his 1949 class at West Point, a Rhodes Scholar, and one of Max Palevsky's wonder boys at wonder company Scientific Data Systems—was the commander they needed. First in California and later in Washington, the organization McGurk pulled together, the Computer Industry Association, rallied the technology troops against Big Blue. McGurk woke up the pcms to the reality of public opinion by getting the ear of the press (calling his organization CIA helped) and the attention of the Feds.

It was possible to get Dan McGurk out of California, but not to get California out of McGurk. That urge for newness that characterizes the West Coast mentality led to some unrest once McGurk had gotten CIA under way. Venture capitalism, his sometimes avocation, sometimes vocation, just didn't seem to have the right allure after the CIA startup. Politics would be next, and for the charismatic McGurk this meant bringing his business acumen to Washington, where the White House Office of Management and Budget, under Jerry Ford, needed a hard driver to serve as associate director. The inauguration of Jimmy Carter ended McGurk's stint in Washington.

Bidding for a return trip to the Capital City in 1978, McGurk had hoped to run for the House out of the same district that elected Barry Goldwater Jr., who had considered a race for the Senate. Things turned out differently; when Goldwater again ran for the House, McGurk, always a good sport, managed his campaign.

It's doubtful that the computer industry has seen the last of Dan McGurk, who is 56 years old. But right now computerdom isn't calling for the kind of "White Knight" leadership that is McGurk's specialty. We may have to wait for one of those pivotal moments to once again see him at his best.

William Shockley, who shared in the 1956 Nobel prize for inventing the transistor, is one of the seminal figures of modern technology. He is the father not only of solid-state electronics, but the founder of the first Silicon Valley company. Had he withdrawn from public life 10 years ago, he would undoubtedly be revered as one of America's great contributors to the modern world. But in recent years, Shockley has gotten a great deal of adverse publicity for his ideas about eugenics and his participation in a California sperm bank that seems to be dedicated to the idea of breeding geniuses.

Despite such seemingly nonsensical notions, Shockley is a smart physicist, and the real immortality he has won comes from his work at Bell Labs and what followed from that.

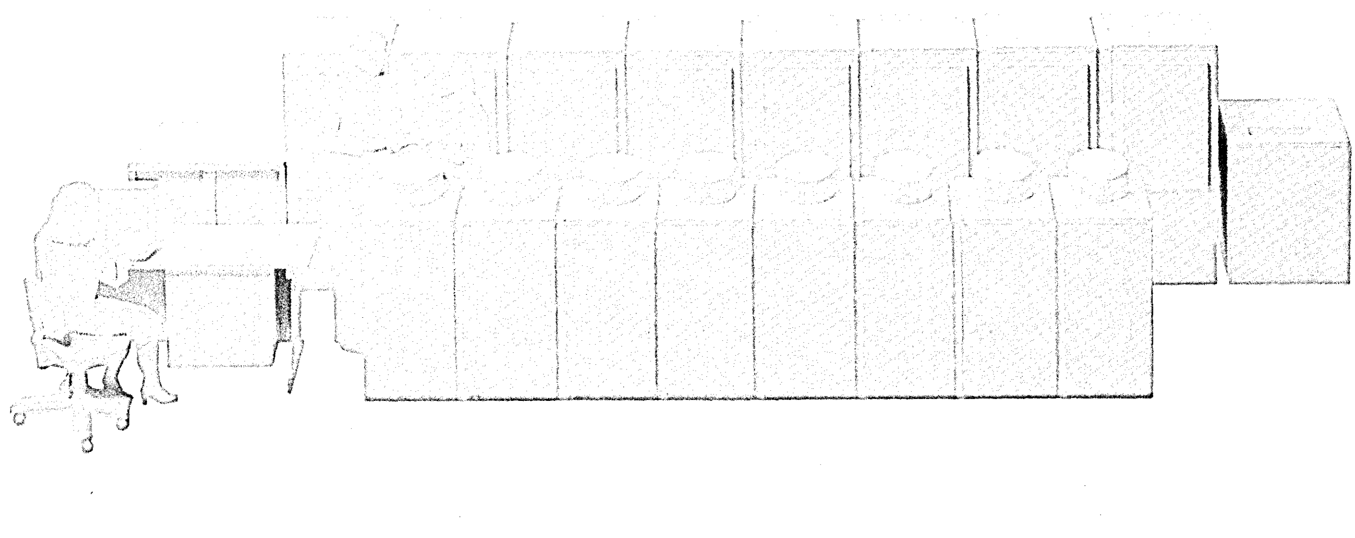
In 1936, after earning a PhD from MIT in physics with a thesis dealing with the behavior of electronics in certain crystals, Shockley entered Bell Labs. At first, he did research on vacuum tubes, the electron valves of the day. He then moved on to work with semiconductors, which he believed could be made to exhibit the same effect. (Field-effect transistors do indeed act a bit like tubes; earlier current-controlled transistors behave in a comparable but distinct way.)

Shockley embedded a copper grid in an oxide and used it in an attempt to control the flow of electricity through the base device. Things didn't quite work out at first, however. In the midst of all this work, World War II broke out, during which time Shockley was in the hands of the Navy. After the war, work on the transistor resumed, and the first breakthrough came when the team Shockley led realized that certain surface effects were preventing the prototype transistor

CIRCLE 23 ON READER CARD ▶

When you need
enormous volumes of information,
from hundreds of sources,
in a variety of formats,
from anywhere in the world,
there are only a
handful of computer systems
that can do the job.

When you
need it without fail,
there is only one.



The Tandem NonStop™ Network

Components fail. But that doesn't necessarily have to mean downtime. With a NonStop network from Tandem, you're assured of completely reliable system operation—right through a component failure that would shut other systems down. The result is that you get the right information to the right people at the right time. Across the street or around the world. Without fail.

The network is based on the continuous processing capabilities of Tandem NonStop computer systems—a fault-tolerant environment in which a malfunction or component failure will not inhibit or interrupt system operation.

With a Tandem system, you can access information from anywhere in the network, in different formats (text, data and images), integrate all the information in a form that meets your specific requirements, and distribute the finished product at the appropriate times to any number of recipients at any number of locations. Those receiving the communication can 1) interactively add or delete information; 2) forward it to other individuals or send it back to the originator; 3) print it out; or 4) store it for future reference. Or any combination.

And in a Tandem network, all the advantages of NonStop system availability become NonStop network availability. If a line failure occurs, our advanced networking software transmits the message over the optimum alternative path— transparently to the user, of course. But the result is always the same: your information gets through. Without fail.

DEVELOPING THE INFORMATION

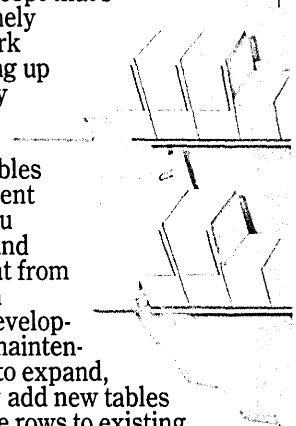
As the nature of doing business on a large scale becomes ever more complex, so does the nature of the information behind it. Not only is this information in many different formats, it is typically widely dispersed throughout an organization. With most systems, that means throughput problems for those users in remote locations who need only occasional access to it.

Not so with Tandem.

The wonders of a distributed, relational database.

Unlike other approaches to distributed processing in which each location functions as an independent database, Tandem treats the network as one single database with multiple files distributed geographically. Programs will run with files from anywhere in the system, whether you have a single two-processor system or a 255-system network. And with no user intervention or special programming required.

The key is the relational organization of the database—an extremely flexible design concept that's also extremely easy to work with. Setting up files merely involves creating or filling in tables with pertinent data. So you save time and money right from the start on program development and maintenance. And to expand, you merely add new tables or add more rows to existing ones—without rewriting or modifying your applications programs. This lets you concentrate on the application at hand, not on system organization.



MOVING THE INFORMATION

Most business information systems are configured for the purpose of automating the tasks normally associated with office work: writing, printing, filing and distributing information within a local area.

But communicating this information in a timely, reliable manner outside that area is another problem entirely. If you don't know beforehand precisely which locations are to be included in your network, you'll pay a stiff penalty in reprogramming and restructuring costs when you want to add nodes or change them around.

That's where the Tandem difference is so important.

Rings. Strings. Stars. Or any combination.

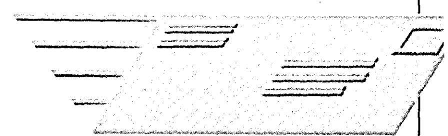
The Tandem system was designed from the start to be a single, flexible network. No matter what the configuration. Or how many times you change it. A simple two-processor system at one physical location may be thought of as a network, just as a 255-system configuration spread across the globe is a network. The very same network, at that. This concept of a *total* information/communications system results in significant time- and cost-saving benefits for the system designer. And ultimately, for the user.

Plenty of room to grow.

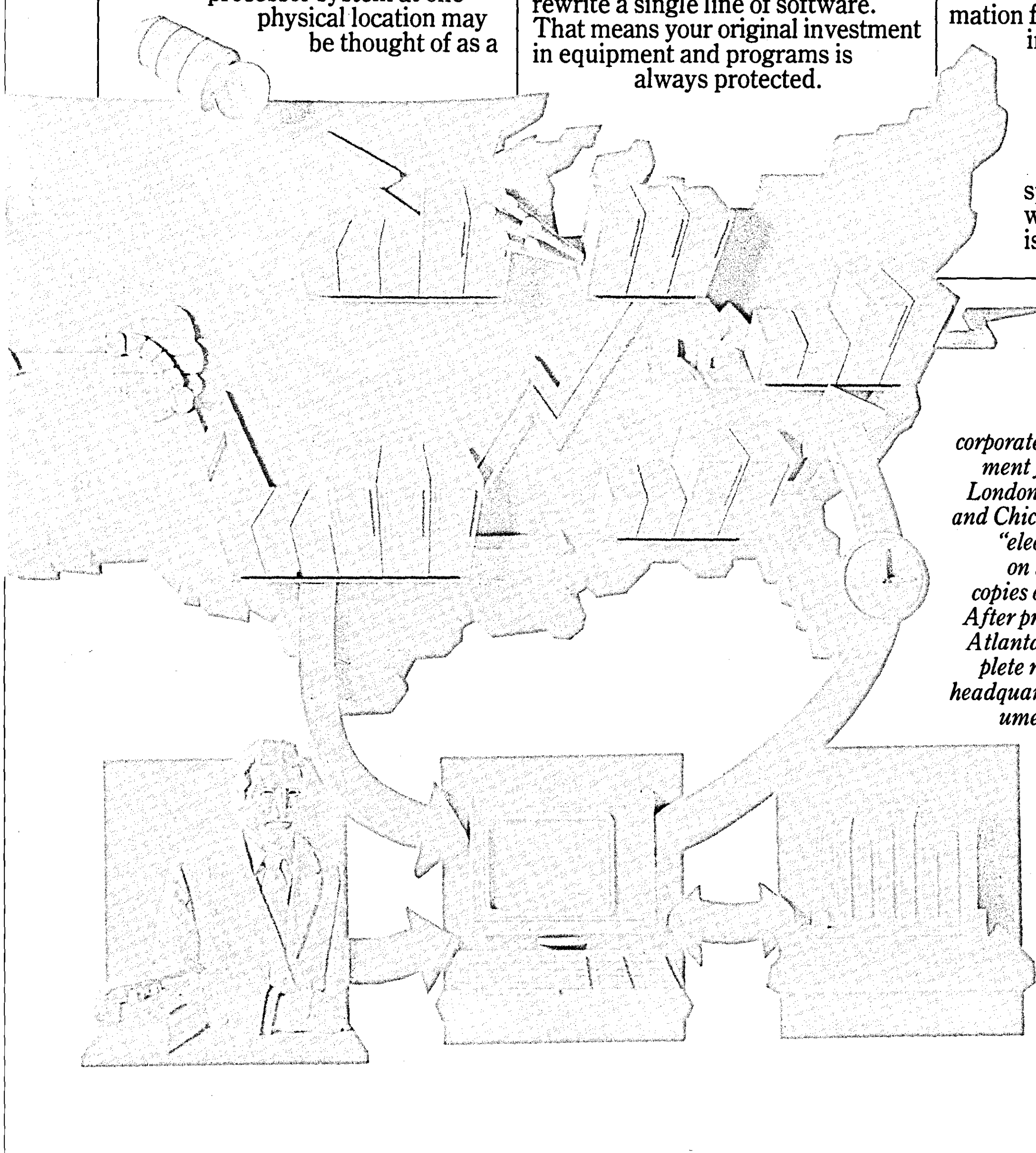
System expansion is easy and economical. Thanks to the network's modular construction, moving up to larger configurations is simply a matter of adding hardware, piece by piece, as requirements dictate. You start only with what you need, and add processors, peripherals and communications facilities in low-cost increments. And without having to rewrite a single line of software. That means your original investment in equipment and programs is always protected.

The right information to the right people at the right time.

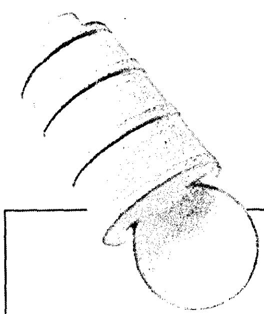
The Tandem NonStop network integrates all devices into a single virtual system. This provides a framework for information handling that is independent of both content and



time. Each user can send, query, receive, store, secure, forward and distribute information at his or her own terminal. Including information from the database and images from a facsimile machine, and the user's own ad hoc memos. The system assures that the information will reach its destination at the user-specified time. And that's what effective communication is all about.



On a Tandem network terminal in the Dallas office, a sales representative accesses the corporate database to draft a quote document for presentation to a customer in London. Meanwhile, the San Francisco and Chicago offices respond to a separate "electronic memo" by sending charts on the customer's sales activity and copies of faxed news stories and photos. After product inventory figures from the Atlanta warehouse are added, the complete report is transmitted to corporate headquarters in New York, where the document is reviewed and a cover letter drafted. Finally, with a few simple keystrokes, the entire package is sent in seconds to the London sales office, with copies to New York and Dallas for storage on file. Thus, the full resources of the system are put to work for effective corporate information management.



higher dependability. Tandem supplies all other ground components, including controllers, RF modems and complete computer/communication interface modules, all of which were designed with solid state technology for outstanding reliability. And, since Tandem maintains the entire system, you always have only one number to call for the answer to any question.

Putting it all together.

With a full range of communications capabilities and the enormous capacities of a global system, the Tandem NonStop™ network is uniquely suited to the complete information requirements of multi-divisional, multi-national corporations. And most especially for any business or institution that needs to get the right information to the right people at the right time. Without fail.

THE TANDEM EVOLUTION

A single system.

A single hardware architecture.

A single operating system.

A single database.

A single operating environment.

A single network architecture.

A single application environment.

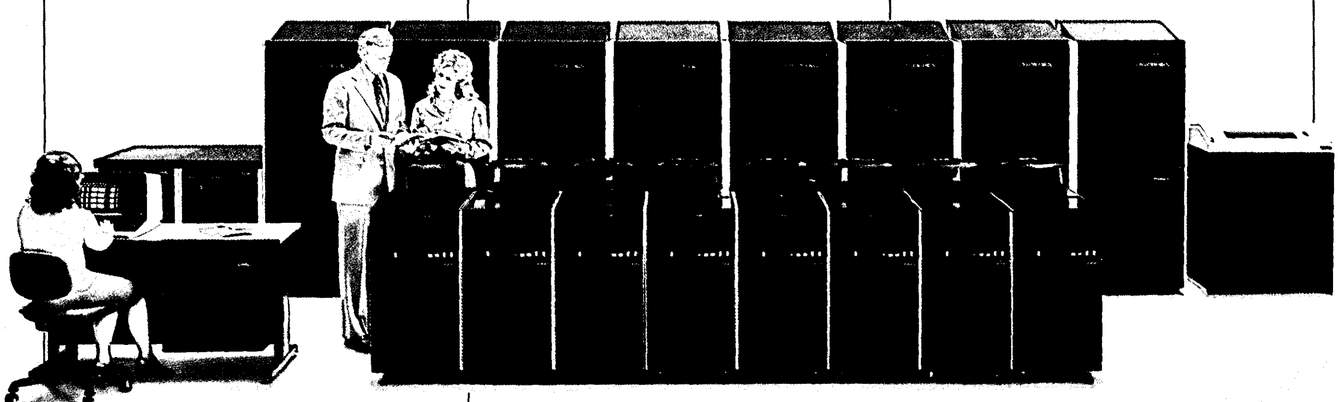
The Tandem Evolution—our original design concept, still big enough to contain the past, handle the present and include the future.

The Tandem Evolution—an evolution in products and strategy that integrates information and communications in a single virtual NonStop system. A system with the flexibility to adapt as time, markets or economic considerations change. A reliable network that links people, equipment and data independent of location, application, form of data, method of transmission, number of users or types of equipment. An evolution that from beginning to end protects your investment in information resources.

The Tandem Evolution—a consistency in philosophy that's designed to give users the optimum in computer performance right now. While providing a continuing, flexible framework for enhanced performance tomorrow.

Tandem provides local sales and service support in the major computer markets throughout the free world. Plus fourteen software education centers in the U.S., Canada and Europe offering professional technical training courses for your programmers and analysts. With this kind of support behind each new capability, applications can be implemented on-line quickly, easily and economically.

If you'd like more information, call your local Tandem sales office listed on the back cover. Or contact Tandem Computers Incorporated, 19333 Vallco Parkway, Cupertino, California 95014. Toll Free 800-538-3114 or (408) 725-6000 in California.



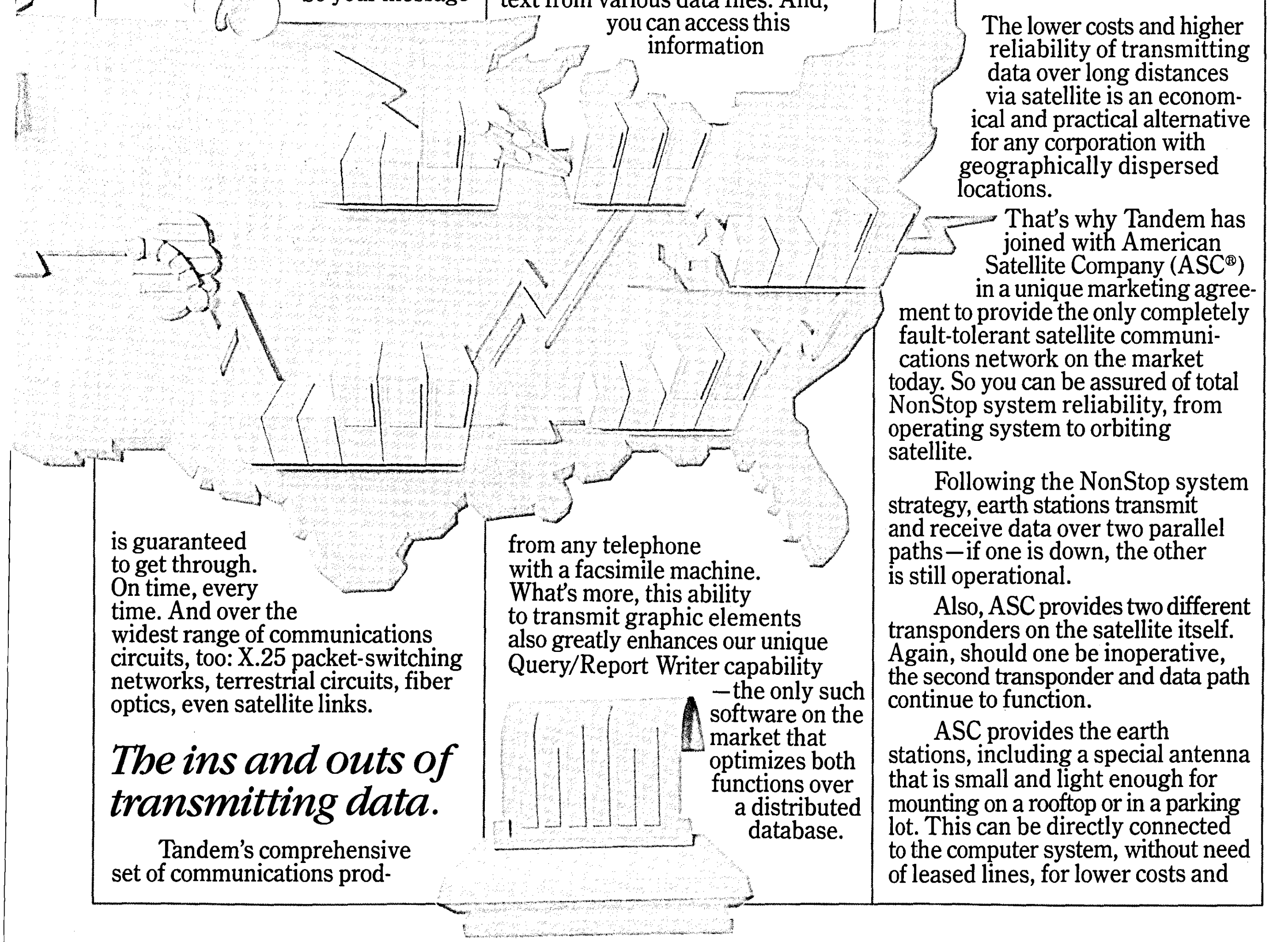
The system shown is a sixteen processor system. It can function independently or as the local node of a 255-system network, more than 4,000 processors, providing direct and immediate access to information sources anywhere in the world.

When you need it without fail, there is only one.

TANDEM

THIS NETWORK WORKS

Tandem processors complement each other, working together to increase power, performance and throughput for a lower total cost per transaction. Adding NonStop fault-tolerant operation to advanced networking capabilities, the Tandem system virtually eliminates the risk of network failure. At the same time, it protects the database from damage caused by electronic malfunctions. And when a component does fail, the system can be serviced —parts removed and replaced— while continuing to process transactions. So your message



is guaranteed to get through. On time, every time. And over the widest range of communications circuits, too: X.25 packet-switching networks, terrestrial circuits, fiber optics, even satellite links.

The ins and outs of transmitting data.

Tandem's comprehensive set of communications products protects your investment in other mainframe, mini, and peripheral products. The Tandem system supports BISYNC, ASYNC, SDLC and HDLC basic communications protocols. There are also a variety of software packages that allow a network of Tandem systems to be linked to other mainframes or networks (including SNA) for the support of interactive processing and remote batch processing.

In addition, the Tandem system can be interfaced to a wide range of terminal products such as text processors, ATMs, cash registers, badge readers, optical scanners and shop floor terminals.

Words and images.

Tandem's special facsimile software lets you store and forward facsimile reproduction of charts, graphs and diagrams to accompany text from various data files. And, you can access this information from any telephone with a facsimile machine. What's more, this ability to transmit graphic elements also greatly enhances our unique Query/Report Writer capability —the only such software on the market that optimizes both functions over a distributed database.

The speed of light.

Using state-of-the-art optical technology, our high-speed fiber optics extension provides the means to link Tandem processors up to a distance of 1000 meters between individual systems.

In effect, you can link up to 224 processors within your headquarters or plant, giving you an extremely fast and efficient system that provides enormous processing capability. And of course, you can interconnect this system into your network for expanded information-sharing capabilities.

The sky's the limit.

The lower costs and higher reliability of transmitting data over long distances via satellite is an economical and practical alternative for any corporation with geographically dispersed locations.

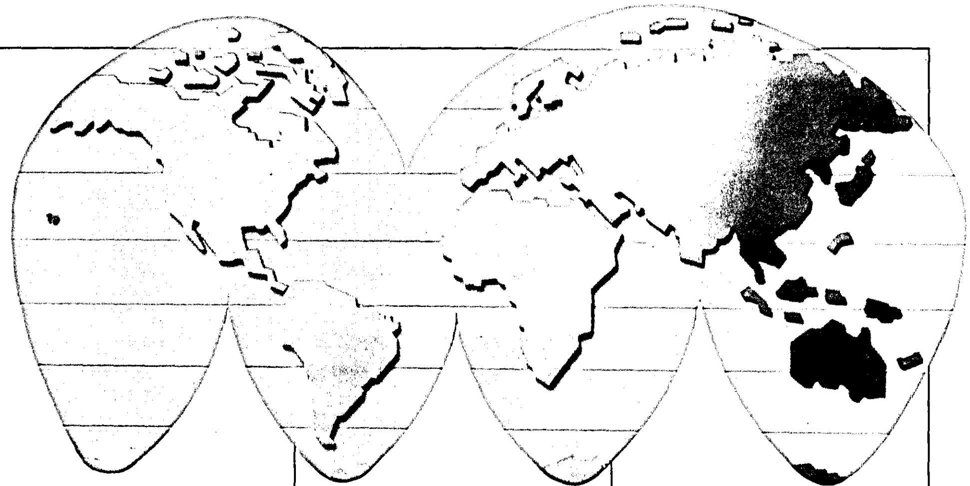
That's why Tandem has joined with American Satellite Company (ASC®) in a unique marketing agreement to provide the only completely fault-tolerant satellite communications network on the market today. So you can be assured of total NonStop system reliability, from operating system to orbiting satellite.

Following the NonStop system strategy, earth stations transmit and receive data over two parallel paths—if one is down, the other is still operational.

Also, ASC provides two different transponders on the satellite itself. Again, should one be inoperative, the second transponder and data path continue to function.

ASC provides the earth stations, including a special antenna that is small and light enough for mounting on a rooftop or in a parking lot. This can be directly connected to the computer system, without need of leased lines, for lower costs and

For information on any of Tandem's computer products, contact the sales office nearest you.



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TANDEM

The least appreciated thing Gene Amdahl did was to make IBM sweat.

from working. In November 1947, the Bell team tried attaching electrodes to the surface of some germanium and using a stronger electric field to produce changes in conductivity of the material. By December, the first point-contact device—gold spikes were the electrodes—was a reality.

The invention was made public in June 1948; the world hardly seemed to notice. The vacuum tube was king, and it continued to reign. Shockley went on to develop the modern junction transistor, and after that others added the integrated circuit in its many forms as well as the many other semiconductor devices that have largely made the vacuum tube a thing of the past.

Within 10 years, there was a vast difference in electronics. Transistors were a real business; 30 million had been made and prices had fallen from about $20 a pop to $1.50. During that decade Shockley had gone west to take a job at Beckman Instruments, where he set up the company's semiconductor lab. The lab grew into a subsidiary, and was sold to Clevite Corp. and later to ITT. It was in that setting that Shockley's employees, including Robert Noyce, saw the way the world was going and left to start Fairchild Semiconductor, and, subsequently, many of the other companies that populate the high technology region of Northern California.

At 72, Shockley continues to pursue his varied scientific interests. His ideas, his inventions, and his view of the relationships between phenomena are recorded in notebooks. Within those notebooks may be ideas that are as great as those that gave us the transistor.

"What made me set up Scientific Data Systems? Stupidity, I guess. I had no idea of the magnitude of what I was getting into."

If **Max Palevsky** started SDS because he was stupid, he must have gotten smart pretty fast. Seven years after the company first got rolling, it was snatched up by Xerox Corp. for a hair under an incredibly cool $1 billion. Most entrepreneurs would like to be as stupid as Max.

Actually, everyone knows Palevsky is a pretty savvy guy. And some people know that he really doesn't describe his coup as the amazing job it certainly was. In the early 1960s, he says, "it was not so common to be an entrepreneur in the computer field. It was very small. The complexity of the task was great. But so were the people I worked with."

From today's perspective, the SDS phenomenon might look like an overnight wonder, but Palevsky began in the computer business right at the beginning, in the 1950s, when desktop computers were only science fiction. Armed with a good education (in math and philosophy) and experience as an electronics officer in World War II, Palevsky took a job at Bendix Corp.'s computer division in 1952.

After four years, he left to help found Packard Bell Computer, where he was vice president and general manager. That lasted another four years.

But his "stupid" move, the one that changed the computer business, came in 1961. With financial help from venturists Davis & Rock, he started SDS. Palevsky was the chairman. And the products were computers that may be viewed as descendants of the IBM 7090 line abandoned with the announcement of the 360: fast scientific computers that could be efficiently turned into timesharing systems. Boy, did those sell!

The company became XDS, but the SDS moniker held some romance, and in 1977, a new company using that name was set up by Jack Mitchell, one of the old SDS crew. Xerox had abandoned the SDS name completely in 1975, when it took an $84 million write-off and got out of computers.

Xerox still likes high technology, but today the company is a comparatively cautious investor in its own research. When Xerox jumped in with both feet in the late 1960s, making Palevsky the copier company's largest individual shareholder and taking SDS out of a business that, in retrospect, was at its peak, it freed Palevsky from a life that he may well have been tiring of. Since those days, the SDS founder has pursued a variety of other interests.

"I don't have one ruling passion," he says. "It was wonderful running SDS, but I worked 18 hours a day. Frankly, success helps a great deal. It makes one less driven. Now, I do what I can. What I can't, I don't."

Max Palevsky

Among the things he can do is publish *democracy*, a quarterly that favors left-liberal thought. It may go the way of his SDS. Why? "The left has run out of ideas," said the 58-year-old Palevsky. "That's why we have Reagan now."

Palevsky's more visible pursuits are eminently visible; they are movies. *Islands in the Stream* is one, *Fun with Dick and Jane* and *Marjoe* are others. In addition to producing these movies, he also put money into *Rolling Stone* and the now defunct *Wet* magazine. Palevsky is also playing a big part in the effort to give southern California a modern art museum, slated to be ready in time for the next Olympic games.

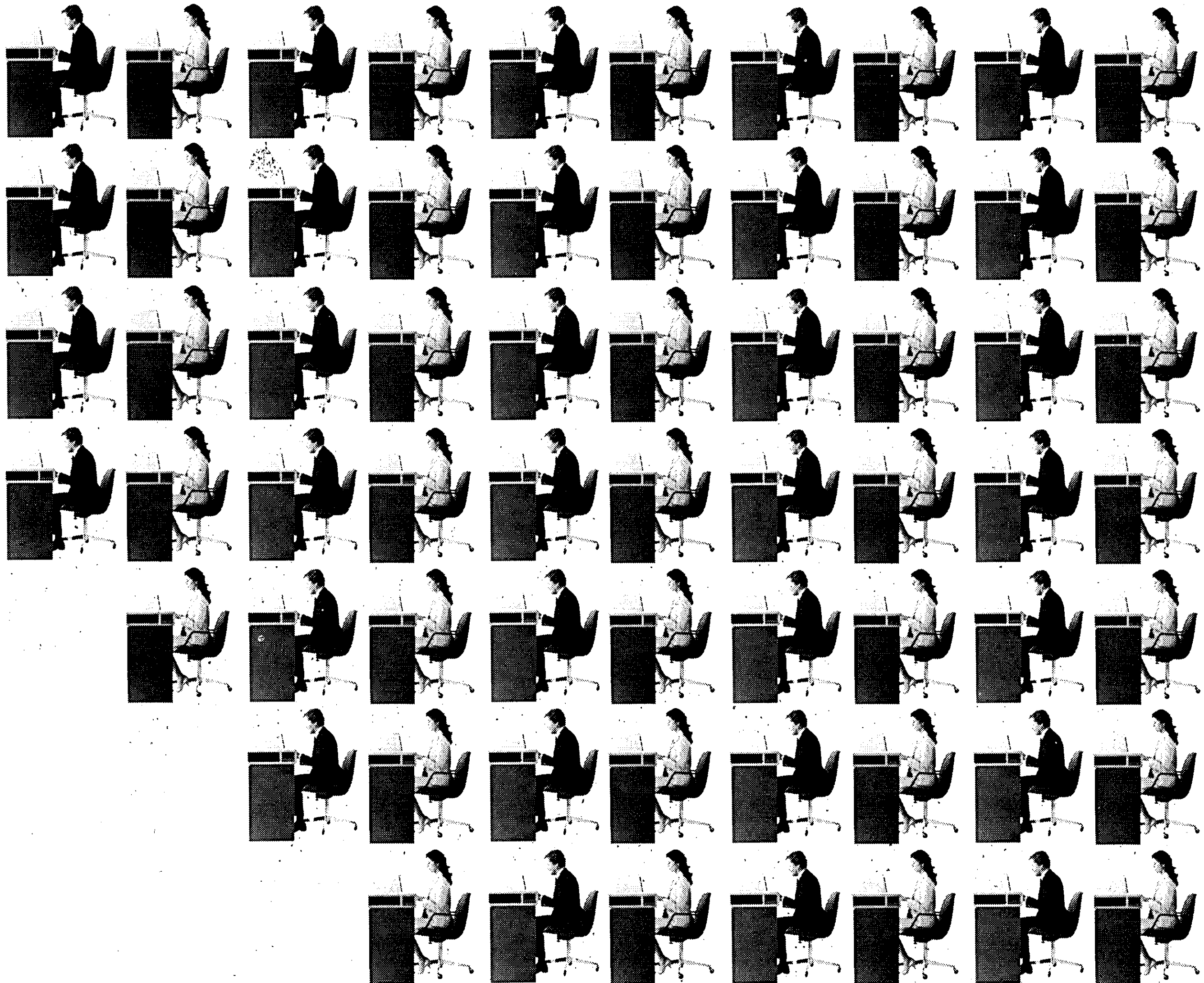
Can a lone scientist be the secret ingredient in a huge computer company's offerings? Ask **Gene M. Amdahl**, who took IBM through its early systems as chief designer of the 704, brought the company into the solid-state era with his 7030, and created a revolution in computing as manager of architecture on the System/360.

The 360 series did more for the user than any of Amdahl's earlier work. It enabled companies to preserve, to a large degree, their investments in software as their system loading grew by providing a compatible migration path. It allowed companies to acquire and master one system and use it effectively for both business and scientific data processing. It fostered the development of what are now perceived to be the first modern operating systems oriented toward disk storage. It severed some of the ties that linked peripherals and mainframes so that users could make progress and not junk everything they owned at once. And finally, the 360 led to the maturation of a user community that could share experience across a vast panorama of company sizes and applications.

Can all this be attributed to one man? Of course not. But the computers that brought this all about (and their manufacturer, IBM) owe a great deal to Amdahl's genius in designing an architecture that is still the visible basis for IBM's current mainframes.

Then there's Amdahl Corp., founded in 1970, after Amdahl wound up a stint as an IBM Fellow, after he had been head of IBM's Advanced Computing Systems Lab, and after he decided that he could build a much better mousetrap.

As most everyone knows, Amdahl Corp. built a 370-compatible line of processors. The machines were cheaper, smaller, faster, cooler, and, a lot of people say, more reliable than IBM's own gear. They sold, too, after some initial hesitancy on the part of customers, giving Amdahl Corp. a decent slice of IBM's pie.



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CIRCLE 24 ON READER CARD

Hewlett and Packard's first plant was in a Palo Alto garage. Initial capital: $538.

Then, in 1980, Amdahl got itchy. Amdahl Corp. had become a big company, with all the attendant complications. Amdahl remained the inquisitive scientist, also with attendant complications. The upshot: Trilogy Ltd., a research and development organization that will, if things go as planned, build computers that leapfrog, but also compete, with IBM products derivative of Amdahl's work in the 1960s and Amdahl Corp.'s wares derivative of Amdahl's work in the 1970s.

Not bad for a farm boy from Flandreau, S. Dak. But what makes the 59-year-old Amdahl so important is not just his work on computer design, although his ideas by themselves are more than enough to make him one of the industry immortals. What is perhaps the most widely felt and least appreciated thing Amdahl did was to make IBM sweat.

Until Amdahl Corp. got its first 470 running, IBM's only direct competitors were peripherals makers. Nobody had the nerve to compete head-to-head with the giant in the big mainframe business. IBM owed its overwhelming leverage to the fact that it could basically price mainframes the way it pleased within very broad limits. It also had the luxury of being able to worry about a next generation pretty much at its discretion, pushing technology as it saw fit. In short, IBM was in the driver's seat, largely by virtue of its success in what may have been the biggest gamble in American corporate history: the development of the 360 line. After that, IBM seemed to be mainly interested in consolidation—at least it looked that way from the outside.

But when Amdahl got his computers to market, a tad late but with demonstrable advantages over IBM's offerings, IBM had to fight back. The end result has been a remarkable decline in the price of computation, to say nothing of an improvement in user morale, because customers know that if IBM slacks off again . . . whammo! Gene Amdahl or somebody with his kind of guts will jump into the race.

"Tom Watson was a fascinating man. He followed the rule that money was all. He believed money brought hapiness and wisdom, that money brought wiser decisions . . . He was a cross between a pirate, Jerry Falwell, and Bernie Baruch." Thus spake **William Rogers** when asked about his contribution to the computer scene, the book, *Think: A Biography of the Watsons and IBM*.

Rogers considers *Think* to be his "main work," and it has been immensely successful, with over 125,000 copies printed in eight languages since its first publication in 1969. *Think* is still the definitive unauthorized history of IBM, although Rogers says it is now outdated.

William Rogers

Think was written without any official cooperation from IBM, and this is probably why it has been so enthusiastically received. Rogers' irreverent style—he names a chapter dealing with Tom Watson's personality and fame "Our Father in Heaven"—made *Think* a book to read behind closed doors, particularly if you worked for IBM.

Rogers had made his mark as an independent-minded writer with his 1962 work, *Rockefeller's Follies*, which he describes as a "slight, mildly critical book about Nelson Rockefeller and the free ride the family estate got from the taxpayers of Mt. Pleasant, N.Y., where I then lived."

Rockefeller's Follies brought Rogers some recognition as a writer after many inauspicious years with various newspapers. It also won Rogers a reputation as a writer unafraid of controversy. After the book was published, Rogers says, he was driven out of town by a "sudden and murderously punitive doubling of my property taxes."

With *Think*, some of the heat came directly from IBM even before the book was published. "Wallace McDowell, IBM vice president at Endicott, N.Y., visited me early one morning in the autumn of 1967 after reading a newspaper item that reported my involvement with a book on Watson, and told me that the company felt one biography of Mr. Watson and IBM was enough," Rogers wrote in the book's acknowledgment. "He was referring to the book authorized by the company (*Lengthening Shadow*) . . . Mr. McDowell said he thought it only fair to warn me that, at some point in the research and writing project, I would need the help of the company and that it would not be forthcoming."

So, without IBM's official help, and with a great deal of unofficial help from many IBM employees and former employees, Rogers put together a thought-provoking and influential book.

Now in his late 60s, Rogers describes himself as "jaded." He leads a reclusive life in Maryland and watches the U.S. with fear and loathing. "People read Harold Robbins novels today," he says, while complaining that he no longer has a good forum for his work. "Today's climate is deeply depressed. With that . . . Reagan, there is a degeneration of values. People are compulsive and greedy. I'm not sure I can make any contributions anymore."

Despite such misgivings, Rogers is now working for Network News, an independent news bureau in Washington.

William Hewlett and **David Packard** are the dynamic duo of the computer and electronics business. Together they built from scratch a company that means high quality, high-technology products.

The two first crossed paths while undergraduates at Stanford University. They became friends, and later, in 1938, when Packard returned West after a two-year stint as an engineer with General Electric in Schenectady, N.Y., they decided to go into the electronics business together. Their first plant was the now-legendary garage behind a house Packard rented in Palo Alto. Their initial capital was $538. Total product line: the Model 200A audio oscillator, an electronic instrument used to test sound equipment.

The Model 200A was first shown at a meeting of the Institute of Radio Engineers (now the IEEE) in the fall of 1938. Shortly after, the two young engineers embarked on a modest advertising campaign: they mailed about 25 letters to some hot prospects. Sure enough, orders started coming in, a few of them prepaid. Then, a sales agent in Los Angeles put Hewlett and Packard together with Walt Disney Studios. Could the two engineers modify their oscillator to cover a different frequency range? Could two young, ambitious engineers do a little extra work for one of the biggest and most famous movie studios? Is the sky blue?

In a short time, the Model 200B audio oscillator was in production and being used to make the animated Disney film "Fantasia." Hewlett and Packard had themselves a business, and in 1939 they made it official. The Hewlett-Packard Co. was born.

After a year, they moved their work to a small building and began hiring their first sales reps. Among the young company's early objectives: keep the business on a pay-as-you-go basis, do not run a "hire 'em, fire

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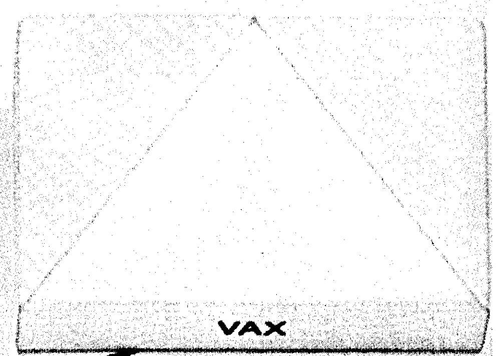

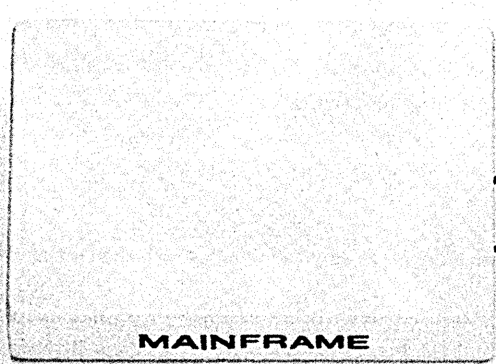

By now, everyone understands the need for standard communications protocols. Without them, an electronic Tower of Babel would surely ensue. But there have to be different standards for different networks. A local-area network is different from a wide-area network. A public network is different from a private one.

No single universal standard has emerged. Nor is one likely to. There are simply too many diverse networking environments, each fulfilling specific, mutually exclusive needs.

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Digital offers the X.25 protocol for use with public packet-switched networks such as Datapac (Canada), Transpac (France), and PSS (U.K.).

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Hierarchical networks.

Even though we prefer to implement more flexible distributed networks, we are amply equipped to support SNA and related mainframe-oriented protocols such as Batch BISYNC, Interactive BISYNC, and HASP.

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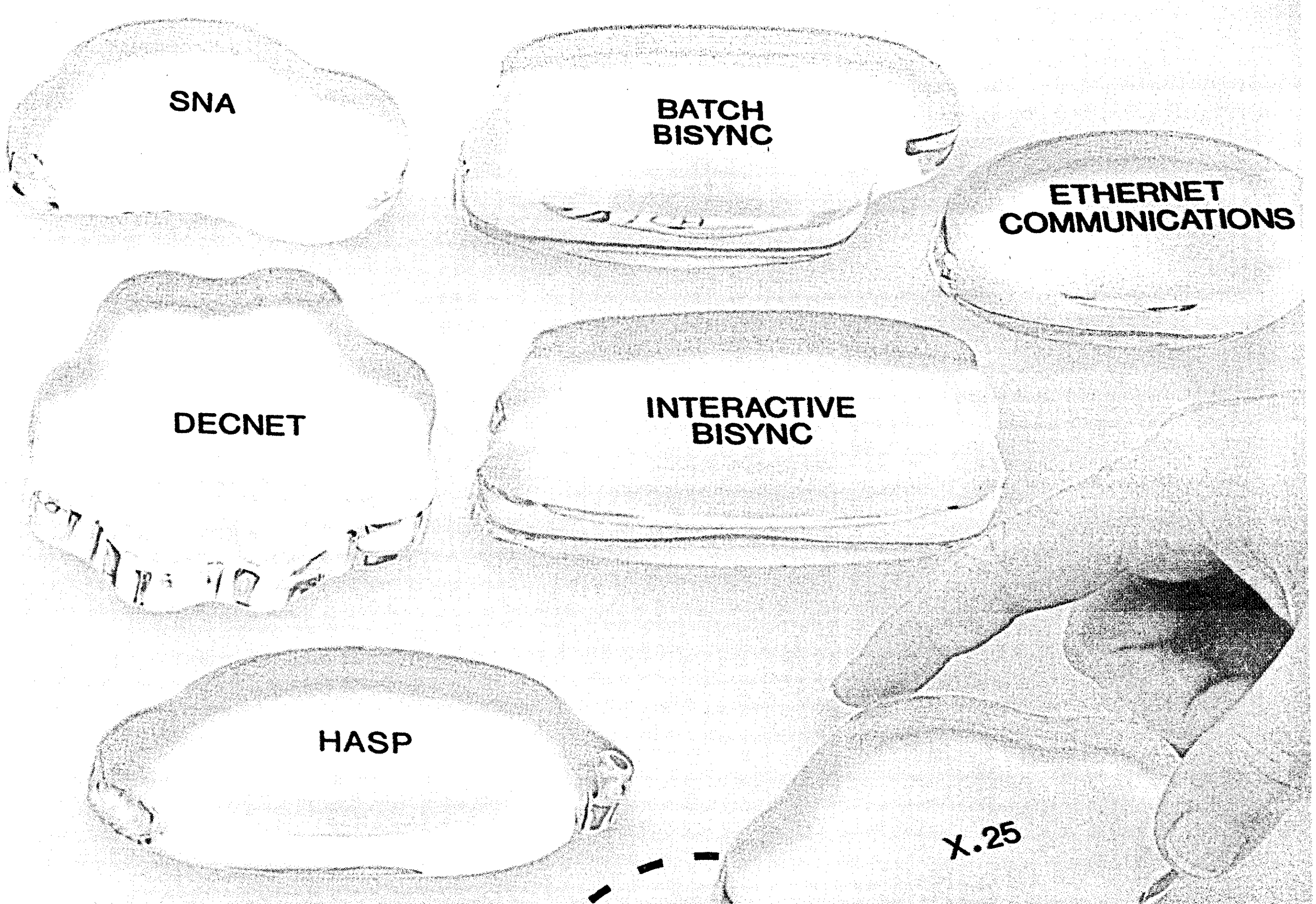

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We have listed a few of the many standards we are currently supporting. There are more.

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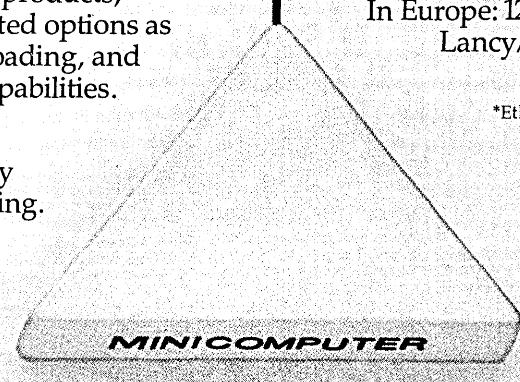


digital

We change the way the world thinks.

Kemeny believes everything will be invented sooner or later. All you have to do is wait.

'em'' operation, and concentrate on making a contribution—that means new products.

Today, of course, the company has grown, but the philosophy remains the same. HP does business around the world, business that in 1980 was worth more than $3 billion. The company that started in a tiny Palo Alto garage now makes more than 4,000 different products and has nearly 60,000 employees.

For two men who have dedicated themselves to making high quality electronics gear, both Hewlett and Packard spend a lot of time around nature. They're serious outdoorsmen; they're even partners in a cattle ranch.

In 1977, Hewlett resigned as HP's president; a year later he resigned as chief executive officer. Although no longer active in the company's daily affairs, the 69-year-old Hewlett does remain active as chairman of the HP executive committee and as a company director.

Packard, who is 70, served as Assistant Secretary of Defense under Nixon during the Vietnam War. He is currently chairman of the HP board. But he has recently started to think of himself as semiretired and is inactive in the company's everyday affairs.

We asked Packard what he thinks he'll be doing 10 years from now. He answered, ''I'll be trying to get out of the day-to-day business; I don't expect to be active here.'' Where he does expect to be active is with the soon-to-open Monterey Bay Aquarium, a project of Packard's family foundation.

Jack S. Kilby is the man behind the chip, an inventor par excellence with over 30 patents to his name. Among them is the silicon integrated circuit, which Kilby showed to his employer, Texas Instruments, back in September 1958.

Kilby worked hard to gain this high degree of self-confidence, starting as he did in 1947 by working for the only electronics company that would even offer him a job.

That company was the Centralab Div. of Globe-Union Inc., in Milwaukee. The division was selling components for radio and television, and one of their biggest concerns was trying to lower the cost of these components.

Kilby's first boss, we're told, was patient, and taught young Kilby how to break a complex problem into manageable pieces. It seemed to work for Kilby: he developed a technique of adjusting certain electronic circuits by sandblasting them. Kilby began to realize that he was a natural innovator.

In 1952, Bell Labs began to spread the word on the transistor that its scientists had developed. The company said it would sell licenses and set up a 10-day seminar to explain transistors. Centralab sent Kilby, and later put him in charge of a small project to make germanium alloy transistors. The project fascinated Kilby, who realized that the potential transistor market was huge. Nonetheless, Centralab was unwilling to invest much money. So he began to look around for a new job.

By this time Kilby had really begun to show his stuff. Plenty of companies were eager to have him on board. Kilby chose Texas Instruments. In the late '50s TI was a small company, but it had had a few dramatic successes, including the manufacture of the first silicon transistor.

Kilby was assigned to work on TI's Micro-Module project. The idea was to interconnect electrical components by making them all the same size and shape, stacking them vertically, and then running wires up and down the stack. Although Kilby's intuition told him it would be better to lay out the components horizontally, he developed the Micro-Module the way TI wanted him to. His prototype worked. But it was twice as expensive to build as had been expected.

Kilby then set to work doing what he had learned at Centralab—cutting costs. He realized this time that the answer lay in silicon, not germanium. TI was then one of the few companies that had invested heavily in expensive manufacturing equipment for silicon components. So why not make all of a circuit's components from silicon?, Kilby wondered.

With Kilby's notes and sketches, the company gave it a try. When all was said and done, TI spent about $100,000 to design and build a silicon IC. It worked. The company had a finished product in September 1958, applied for a patent in February 1959, and showed its invention to a skeptical world.

Jack S. Kilby

The rest is the history of the TI empire.

Kilby's other inventions included an early handheld electronic calculator and a solar energy collection and conversion system using silicon, electrolysis, and fuel cells.

''Everything will be invented sooner or later,'' declares the modest 58-year-old Kilby. ''All you have to do is wait. I helped accelerate some trends.''

Today the BASIC programming language is so widely used on personal computers that it's hard to imagine micros without it.

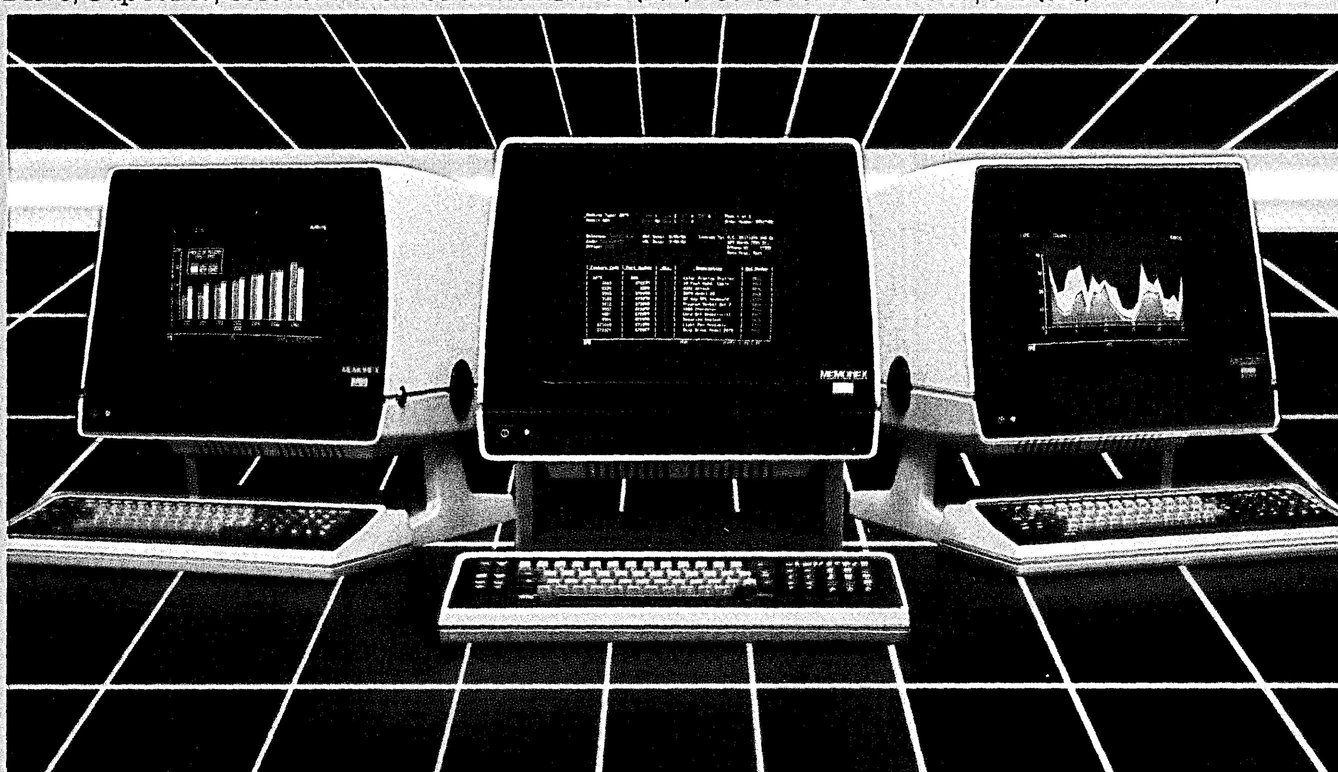
Yet B.B. (before BASIC) was not long ago. Neither was the concept of timesharing, now firmly embedded in the minds of computer people. BASIC and timesharing—two ubiquitous properties of computers—were both developed and popularized by one man. **John G. Kemeny** is the visionary genius who brought us to the land of instant computer gratification.

Genius? What else can you honestly call someone who is a distinguished mathematician, philosopher, and teacher, someone who has successfully led careers as a university president, professor, scientific researcher, author, and government commission chairman. Someone who has been granted honorary degrees from 12 of America's most prestigious universities (not to mention the BA and PhD he paid for).

Born in Budapest, Hungary, in 1926, Kemeny came to America as a teenager, learned English, and went on to study mathematics at Princeton University. His undergraduate days were interrupted by World War II, during which he was assigned by the U.S. Army to serve as a mathematician for the Manhattan Project, America's effort to build the first atomic bomb. After the war, Kemeny returned to Princeton to serve as Albert Einstein's research assistant. Then, with doctorate in hand, Kemeny taught math at Princeton and Dartmouth College, where he was to make some of his most important contributions to computerdom.

In 1963, under Dr. Kemeny's leadership, Dartmouth made an introductory computer course a regular part of its liberal arts program. The college's pioneering work was, in part, the result of Kemeny's realization that batch processing systems were slow and cumbersome, and that somebody had to do something about it. ''The thought of several hundred students juggling their academic schedules so that they might come each day to the computation center to receive the latest computer output and then waiting several weeks for their first program to work correctly was an educational nightmare,'' he wrote in his 1972 book *Man and the Computer* (one of 13 books which Kemeny either wrote or helped write).

So a team comprising two faculty



Announcing the smartest terminal-based system in the DDP business

Osborne was simply around at the right time with the pocket calculator.

members and a group of undergraduate research assistants developed a prototype on-line timesharing system. It started running in 1964. The system was subsequently marketed by General Electric as the Mark II Time-Sharing System. Along with it came BASIC.

Kemeny and Thomas Kurtz developed BASIC as a teaching language. In Kemeny's words, BASIC, "although artificial, is so designed that it can be easily learned by a human being." Today, BASIC's role in the world of computers is unassailable. BASIC was clearly an idea whose time had come . . . and shows no sign of passing.

Call her Captain Hopper. Call her, as she has called herself, slightly ancient. Call her the discoverer of the first computer bug (a real moth). Call her one of the pioneers. Call her anything you want, but take a minute to remember that if you're using a computer in business, she's made your job immeasurably easier. Capt. **Grace Murray Hopper** is the progenitor of COBOL.

"Nobody believed it could be done," she remembers of her first efforts to get backing for a business compiler that would be largely system independent. "It was all so obvious. Why start from scratch with every single program you write? Develop one that would do a lot of the basic work over and over again for you."

And that's how COBOL got started.

Grace Hopper got started in 1906. She's hoping to be around to celebrate New Year's Eve on Dec. 31, 1999. "I have two reasons," she says. "The first is that the party will be one to end all New Year's Eve parties. The second is that I'll want to point back to the early days of the computer and say to all the doubters, 'See, we told you the computer could do that.' "

Grace Hopper is a grand old gal, a Navy career officer as tough as any captain ever was. The military runs in her blood: her antecedents include a minuteman and a Civil War captain and admiral. Getting from binnacles to binaries is her own doing.

Hopper has been in the computer business since 1943, when the Navy sent her to Harvard to work with the Mark I. In 1946, she joined the Harvard faculty and worked on the Navy's Mark II and Mark III. It was the Mark II that bears the distinction of containing the first computer bug. It was the summer of 1945, as Captain Hopper tells it, and the Mark II was still under construction. Something was inexplicably wrong with the monster machine. A little poking around inside the hulk's innards revealed a moth, which had somehow gotten stuck in the circuitry.

In 1949, Hopper went with the Eckert-Mauchly Computer Corp., which was building UNIVAC I. She stayed there through its merger into Remington and then into

Grace Murray Hopper

Sperry. She didn't retire from the company until December 1971. "I seem to do an awful lot of retiring," she says today, "but I don't think I will ever be able to really retire."

Hopper has published more than 50 papers, stood watch on the first (and many subsequent) meetings of Codasyl, and served on the ANSI X3.4 committee. The list goes on.

Some of what she's seen keeps Hopper hopping, and it sometimes makes her hopping mad. "It's costing this country $450 million a year because we're not using a standard high-level computer language," she has complained. At another time, she told the industry she has tried to lead through stormy seas, "I'm going to shoot somebody for opposing change because 'we've always done it the old way' someday. In the computer industry, with changes coming as fast as they do—and they're coming all the time—you just can't afford to have people saying that."

But most of the time, Capt. Grace Murray Hopper isn't really mad at all. She just likes to make people think. Her famous counterclockwise clock—it runs backwards—symbolizes her attitude. When people first see it, they're confused. After a moment, they realize it does indeed tell the time, just in a different way. Its message, and Hopper's, is that there is more than one way to solve a problem.

Tom Osborne's best years may still be before him. In his past is the development of the handheld scientific calculator and similar machines made by Hewlett-Packard. In his future is software research that's hush-hush.

Osborne's earlier work is anything but secret, but he feels that it is a misunderstood success nonetheless. "With the pocket calculator, I guess you would have to say I simply was around at the right time. It was a commercial success, but people don't understand that the inventor is selling techniques, not a product. People and companies buy ideas, not things."

As you might guess from these remarks, his latest work involves the exploration of ideas and techniques, not products. In other words, he is at work on some software, about which he won't say much.

"What I'm working on is now secret. It has to do with a programming language that is like formal language grammar. To get where you want to go, you need a program that is completely specific.

"For example," he says, "a month is a poor measure of time; it is an approximate measure. When most people think of a telephone number, they leave out the dash between the three-number prefix and the other four digits."

To a person, it might make no difference, but to a computer it means either an error or an assumption, which might not be the assumption the user intended.

"It would be nice to know if your program has fundamental conceptual errors. I police programs for errors with such vigor that it would make most people cry. It is very difficult to write a consistent program. But once that is done, it is very easy to solve problems."

The problems of problem solving are what the mystery language (or anti-mystery language) is all about. Somehow, you suspect that there's something afoot that will change the way people use computers, just as Osborne's earlier invention changed the way people did engineering, to say nothing of the way it wrecked the slide-rule business.

John Backus is one of the reasons the computer industry moves so fast. During the 1950s he headed the group of IBM engineers that developed the FORTRAN programming language and the first compiler for the IBM 704. Today, he is working on programming languages that he believes could replace conventional programming languages, including his own FORTRAN.

Remarkable as that might be, Backus has already established himself as one of the industry's movers and shakers. In addition to his pioneering leadership on the FORTRAN front, Backus introduced the notation for describing the syntax of Algol 60, which has since been adopted for many other languages. It's called BNF, Backus Normal Form.

Backus set off on the right foot, with a BS and MA from Columbia and a knack for finding the right place to work—in this instance IBM. There weren't too many programmers in 1950, but Backus was among the sparse ranks during his first three trailblazing years in the industry. In 1952 he

Heizer and his company have been one of the computer industry's sugar daddies.

John Backus

headed the group that produced the Speedcoding system for the IBM 701. The next year it was the FORTRAN project on the 704, a system Backus helped design and program.

During the 1960s Backus shifted to the Watson Research Center in Yorktown Heights, N.Y. At Yorktown, he participated in designing Algol, refining his notation for computer language syntax.

Today, Backus at 58 is an IBM Fellow, meaning he is pretty much free to pick his own projects. This has enabled him to advance his mathematical theories of programming. Although his current work has not been made public, hints of Backus's interests might be inferred from papers he published in 1978 and 1981.

His 1978 paper calls for nothing less than a complete rethinking of computer languages. "Programming languages appear to be in trouble," he writes, later adding that "conventional languages create unnecessary confusion in the way we think about programs." Backus suggests that the framework of current programming languages is so flawed that "programming systems are growing weak as they increase in size like some tumor."

So far, Backus hasn't told us exactly what he thinks can be done about the situation, a well-known source of frustration to systems programmers. But don't give up yet. John Backus is still prowling the IBM labs.

E.F. (Ned) Heizer Jr. and his company, Heizer Corp., have been one of the computer industry's sugar daddies. Heizer is in the business of developing other businesses. Business has been good, including important investments in Amdahl Corp., Paradyne, NCR, and other less well-known companies.

After kicking around in various capacities with such big leaguers as Allstate Insurance, Booz-Allen & Hamilton, Kidder Peabody, and Arthur Andersen, Heizer started his own business in September 1969. (Along the way, Heizer also earned his CPA and became a member of the Illinois Bar.)

Between 1969 and 1975, Heizer Corp. invested resources in 32 different companies. Some were young and promising; others were oldies that appeared to be in short-term straits. Heizer Corp. not only helped these companies raise cash, it also worked closely with the firms' boards, management, customers, suppliers, lenders, investors, and others. In some cases, it helped find and recruit company officials.

Today Heizer Corp. is the largest independent company engaged in corporate development activities in the U.S. Its goal is simply to make money on its investments. In May 1981, the 51-year-old Heizer took his company public. By the end of the year, stock analysts were hastily telling their clients to buy up Heizer stock, which they felt was seriously underpriced. As one financial writer put it, "Heizer provides a means to participate in the expected rapid growth of [Amdahl, Paradyne, and Computer Consoles] technology stocks at a discount from their current market prices, with the remaining holdings thrown in for free."

Taken together, Heizer Corp.'s holdings in Amdahl, Paradyne, and Computer Consoles makes up about 70% of its total value. Amdahl Corp. was perhaps Heizer's coup. Heizer Corp. now holds some 19% of Amdahl's outstanding common stock. Together with Fujitsu Ltd. (which owns about 29% of Amdahl's outstanding common stock), it virtually runs things at Amdahl. And why not? Heizer was the man who first put Amdahl and Fujitsu together.

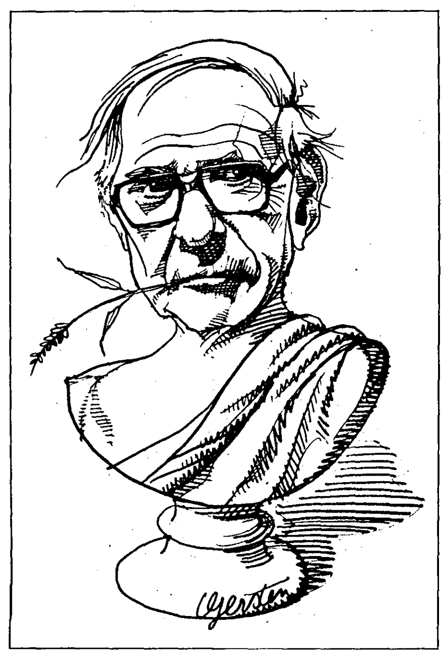
What can you say about the only man who can claim to have whipped IBM in a big court battle? Well for one thing, you can't quite say he won in court. The CDC-IBM antitrust suit, stemming from IBM's announcement of big systems to compete with CDC's that were never built, ended in an out-of-court settlement. **William C. Norris**'s company got IBM's service bureau, IBM got CDC's computerized index of IBM's files destroyed, and Norris got another scalp on his belt.

It's easy to speculate about what might have been, had the case gone to completion in the courts. Would the industry be the same? Would U.S. vs. IBM have come out differently? One thing that's not speculative is what Norris did do: he built one of the most high-powered and innovative companies in the industry; he nurtured talent like Seymour Cray. He told the world computers were good for education, and he put his money where his mouth was, building the Plato system, the most complex and powerful computer aided educational system ever conceived.

Much of what Norris has done is controversial. The whole world wants CDC scientific systems for their research. Norris has sold them, not only to the key research facilities of the West, but also to the Soviets and others. This, in a world of shifting political judgment, has not been easy. But the role of challenger is one that Norris seems to play well, and the role of winner, much more often than not, is another. He's called Bill by friends, but Will might be more appropriate.

While the 76-year-old Norris shuns public events, he has put his thoughts down in a series of monographs for others to read, think about, and try to understand. Understanding the man is not easy, for he is a mixture of the simple and the complex that defies explanation. He says technological exchanges are good for mankind, and as a result of his efforts, he has brought about many exchanges among the scientists of the world's quarrelsome countries. He has implemented programs to help the inner cities more visibly and more thoroughly than anyone else in the computer business. And yet his love of the rural life was not ignored: he's also played a big part in programs to help the small farmer, and not only with the weather forecasts that could not be done without CDC's computers.

So Norris is an enigma. Is he just out for computer sales? Does he make the world a better place? Does the Nebraska farm boy who built an empire really intend to do all the things he says? So far, Norris has. He's tough, determined, and, after a lifetime of fighting for what he wants, he's still at it.



William C. Norris

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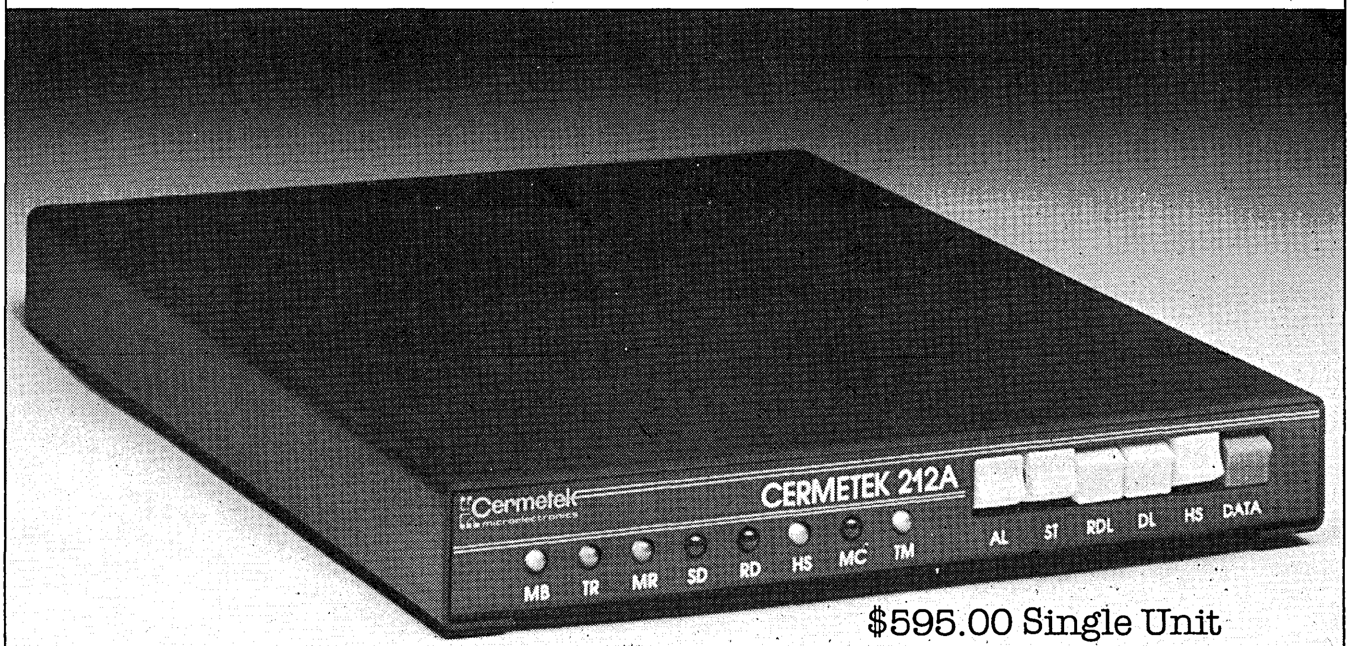

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IN THE BEGINNING

DATAMATION celebrates a decade with a champagne cruise down an international memory lane.

DEJA VU ON A DECADE

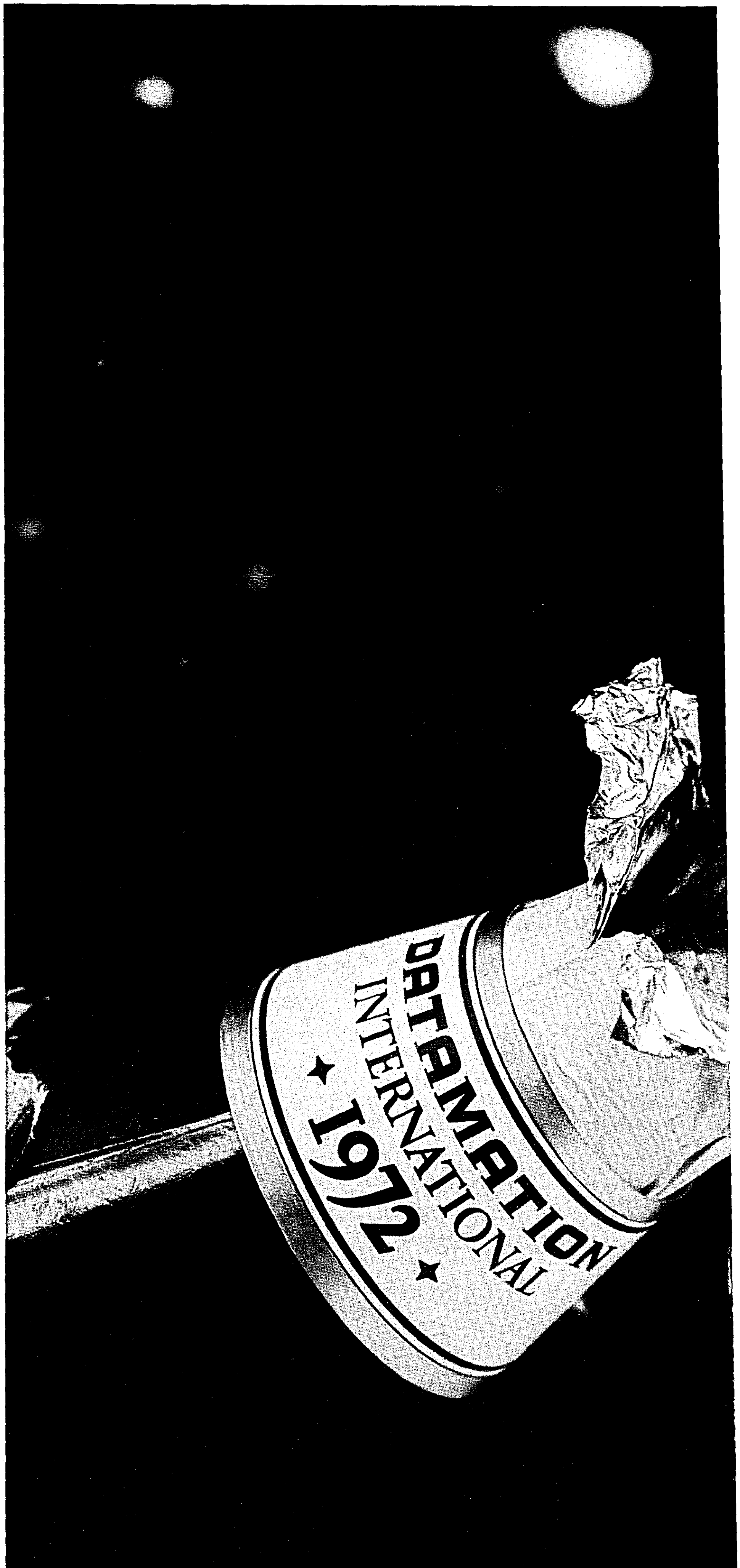
by Angeline Pantages
Contributing Editor

Fifteen years after its founding, DATAMATION launched its international edition, which was 10 years old last April. To celebrate this milestone, we asked our first international editor to take a look at the past decade that has brought so many dramatic changes to the world of computing.

The year was 1972. The computer industry was going through its first economic disaster, one that claimed countless companies and dashed the hopes of many aspiring millionaires. The energy crisis was just starting to warm up. The world's dominant force, IBM, was into the fourth year of antitrust suits, the second year of a new generation of computers, and the first year of unbundling in Europe. The endless battles between the world's major computer powers—the dwarfs against IBM, the Europeans and the Japanese against the U.S.—had begun.

It was indeed a time of turmoil. It was an era in which the telecommunications monopolies fought their own terrible obsolescence and the computer vendors that threatened their domain. It was a time when developed and developing nations determined that "information is power" and technological independence is vital, these concerns being manifested in the transborder data flow debates and in a rise in protectionism through tariff and nontariff barriers.

For IBM, it was a decade of market skirmishes with scrappy competitors. It was also a decade of financial success for the mighty multinational. Back in 1972, IBM was one of the few profitable mainframers in the world. Would-be rival RCA had abruptly departed the computer scene, leaving Siemens and Hitachi, licensees of the Spectra series, high and dry. GE had sold its computer operations to Honeywell, including its GE-Bull interests in France.



PHOTOGRAPH BY STEVE COOPER

The European computer powers suffered severely from mainframe myopia in the '70s.

ICL, dubbed a "lame, wingless duck" by an unkind British wag, was in a slump and preparing to call in American troops to help get its late, late New Range on the road. The French government's Plan Calcul was beginning its second round of funding for its brainchild, Compagnie Internationale pour l'Informatique, and there were rumblings of "cooperation" among Siemens, CII, and, perhaps, the ever-cautious Philips.

In Japan, the Ministry of International Trade and Industry (MITI) had offered a $100 million carrot to the six national mainframe manufacturers: Hitachi, Fujitsu, Nippon Electric (NEC), Toshiba, Mitsubishi, and Oki. All they had to do was split up into three groups for joint development work on mainframes.

Who would have conceived that in fewer than 10 years the Japanese could have gone so far so fast? Who would have guessed that Fujitsu would capture the number one spot from IBM in Japan, and NEC and Hitachi would be hot on IBM's heels . . . that such companies as National Advanced Systems, ICL, Siemens, BASF, and Olivetti would all be hawking Hitachi and Fujitsu plug-compatible computers . . . or that the Japanese would snatch the lead from the Americans in 16K and 64K memory markets?

Likewise, virtually no one would have believed that ICL and Siemens would still be independent and in trouble by 1982 . . . that Cii-HB would finally face nationalization . . . and that one of the most promising information technology powers in Europe would be called LM Ericsson Telephone Co.

The world did indeed expect more from Japan Inc. than it did from Europe. Nevertheless, it still came as a surprise that the European Economic Community in 1980 would still be saying: "If Europe wishes to improve or even preserve its economic power in the world it must urgently equip itself with a powerful data processing industry" (Simone Veil, European Parliament president).

JAPAN'S SUCCESS STRATEGY

What happened? While they had their fits and starts, the Japanese pursued an all-encompassing, long-term strategy. They poured enormous sums into mainframe development, but they also financially fed such waves of the future as small systems, personal computers, office equipment, semiconductors, and robotics. They were ardent students of U.S. technologies and markets and ready partners in new ventures, such as Fujitsu's linkups with Amdahl and TRW, and Hitachi's hookup with National Advanced Systems.

Japan has subsidized exports and it has used a variety of finely tuned, highly effective protectionistic policies for each of its infant subindustries. Liberalization of computer trade, presumably instituted in the early '70s, has been more facade than fact.

This total strategy, coupled with the heralded Japanese methods of organization and business, have accounted for the nation's success at home and its growing power around the globe.

In sharp contrast, Europe could not get its act together in the '70s. Nationalistic interests ruled, despite the plaintive efforts of the EEC to encourage cooperation. The computer powers—the U.K., France, and West Germany—suffered severely from mainframe myopia, to the detriment of high-growth subindustries. Their pride and funds were concentrated on a head-on attack on IBM in the general purpose computer market.

This is why the EEC is squawking today about a potential $4 billion European peripherals deficit by the end of the '80s. It also explains why many European firms must oem their microprocessors, semiconductors, office systems, and plug-compatible products from the U.S., Japan, and even Israel.

In recent years, the Europeans have tried to reverse this situation through new or revitalized national programs such as the U.K.'s INMOS. European firms have also gone for joint ventures and made a stab at new cooperation in "telematics." If there was indeed a way to successfully fight IBM in the 1970s, it might have been through mergers. Europe and Cii-HB's Jean-Pierre Brulé certainly tried.

Most people know the story of Unidata, the ill-fated consortium that folded less than four years after it was formed (1972 to 1973) by CII, Siemens, and Philips. Some people say the venture failed because of its organizational structure, a loose confederation managed by committee. In fact, the "committee" was never given a chance to work.

In 1975 Honeywell Bull offered France a better deal—namely, merger with CII and majority interest for the French. It was a small price for Honeywell to pay, considering the government aid and guaranteed procurements the Cii-HB combine would receive. With scarcely a word to CII, evidenced by the abrupt departure of president Michel Barré, the merger was announced in 1975. Jilted again, Siemens went back to its independent ways. Philips wisely departed the mainframe market to concentrate on small systems and terminals. And ICL, which had refused to join Unidata, jibed, "I told you so."

The nationalistic interests that created Cii-HB ultimately led to the undoing of its architect, company leader Jean-Pierre Brulé. Brulé was a model of stability, forward business planning, and corporate social responsibility. He laid down "The Iron Law of the EDP Market," demonstrating that at least 12% of the world computer market was mandatory for a company's profitable survival. Brulé believed mergers were required to achieve this, but his prime targets, ICL and Siemens, would have none of it or France. Cii-HB is now in the hands of the French government and Brulé and his dream are gone.

In taking over control of Cii-HB, the government paid Honeywell $150 million, slashing the U.S. company's stake in the French firm from 47% to 19%. The remaining shares are held by Compagnie des Machines Bull. Saint Gobain's 51% interest in CMB will be handed over to the French government. This diversified glass and construction conglomerate, which was nationalized at the beginning of the year, acquired a 20% interest in Olivetti in 1980 and formed a joint semiconductor venture with National Semiconductor—a relationship that could ultimately include NAS computers.

Across the channel from France, the U.K. thought its days of subsidizing ICL were finally over in 1979. But ICL hit a slump again in 1981, forcing a massive capital transfusion by a reluctant Thatcher government. The ICL story has been a soap opera for more than 10 years. Tune in on any given year and the story line is familiar: new management is coming in to reorganize. Is ICL going to abandon its large systems users to pursue a career in small systems, telecommunications, and office automation? Will ICL ever find happiness in the U.S. market? What operating system will be victorious—VME/K, VME/B, or George 3?

ICL has nonetheless had some excellent successes on world markets and produced some fine technology, such as the 2903 and its successors and the DAP array processor. Its acquisition of the Singer international base of small systems and terminals has also been profitable and valuable.

The problem is that the British mainframer has never been able to move forward with continuity. It has perennially suffered confusion over its direction, management problems, and the uncontrollable urge to publicly backstab departing executives.

When Geoff Cross and his American cohorts came in from Univac to get ICL's New Range going in 1972, there was a replay of the American Revolution. When the dust finally cleared with Cross's departure in 1977, it seemed ICL was financially and technologically on its way. The short-term financial success, however, masked long-range troubles, and the new managing director, Chris Wilson, was unable to achieve the stability he had hoped for.

ICL IN DEEP TROUBLE

In 1981 ICL was in deep trouble. The government came in with a $200 million subsidy, and in the process replaced Wilson with financial man Robb Wilmot of Texas Instruments. Observ-

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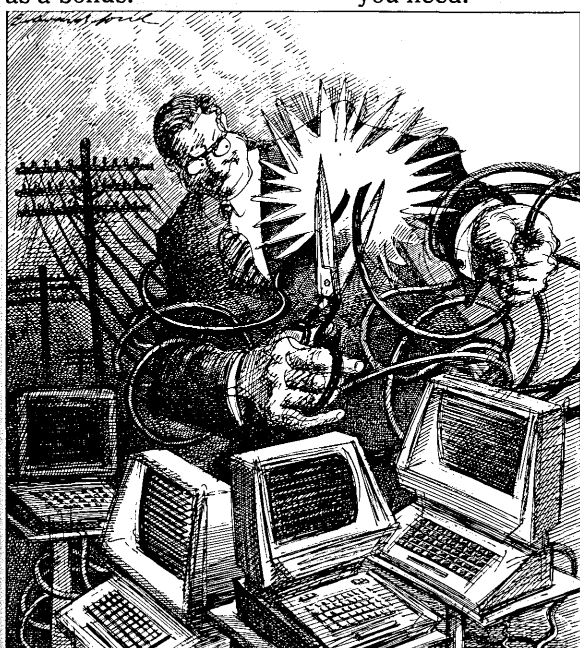

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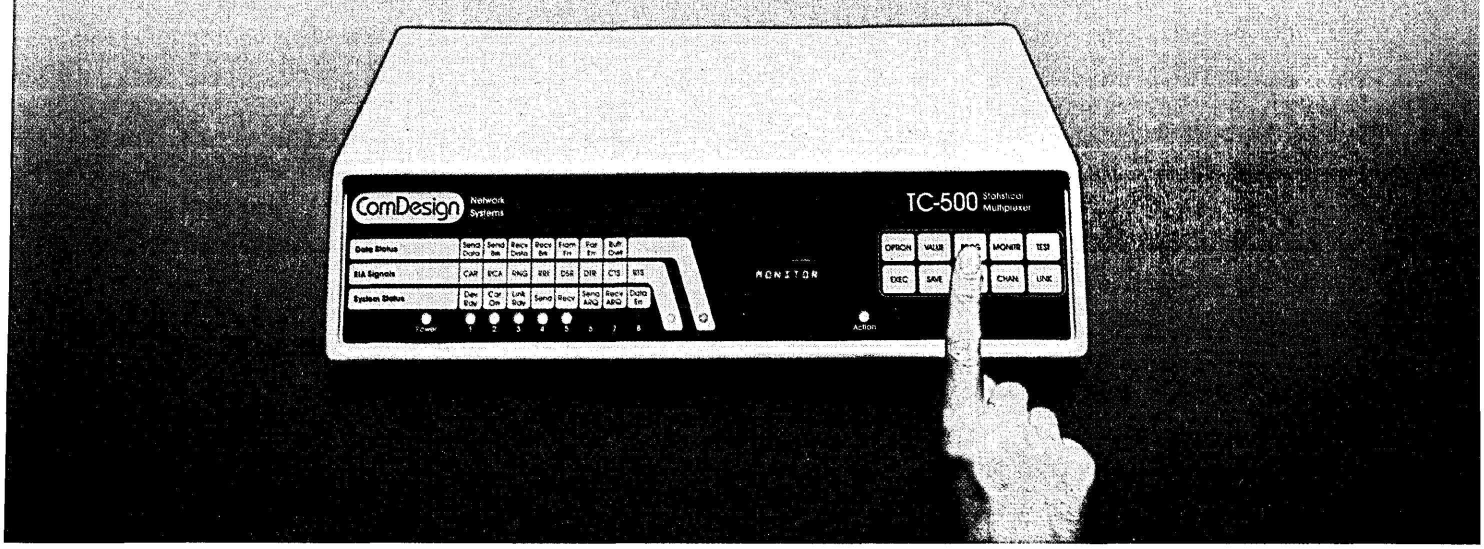


THE POWER OF THE PTTS

During the last decade, the domains of the national telecommunications monopolies (PTTs) were threatened by technological changes—changes that made them and their raison d'être obsolete. With hobnail boots, the PTTs raced to modernize their aging networks and capture new markets through innovations like viewdata/videotex, facsimile, and teletex services. Combining forces, they united to develop such intercountry networks as Euronet and the Nordic Data Network.

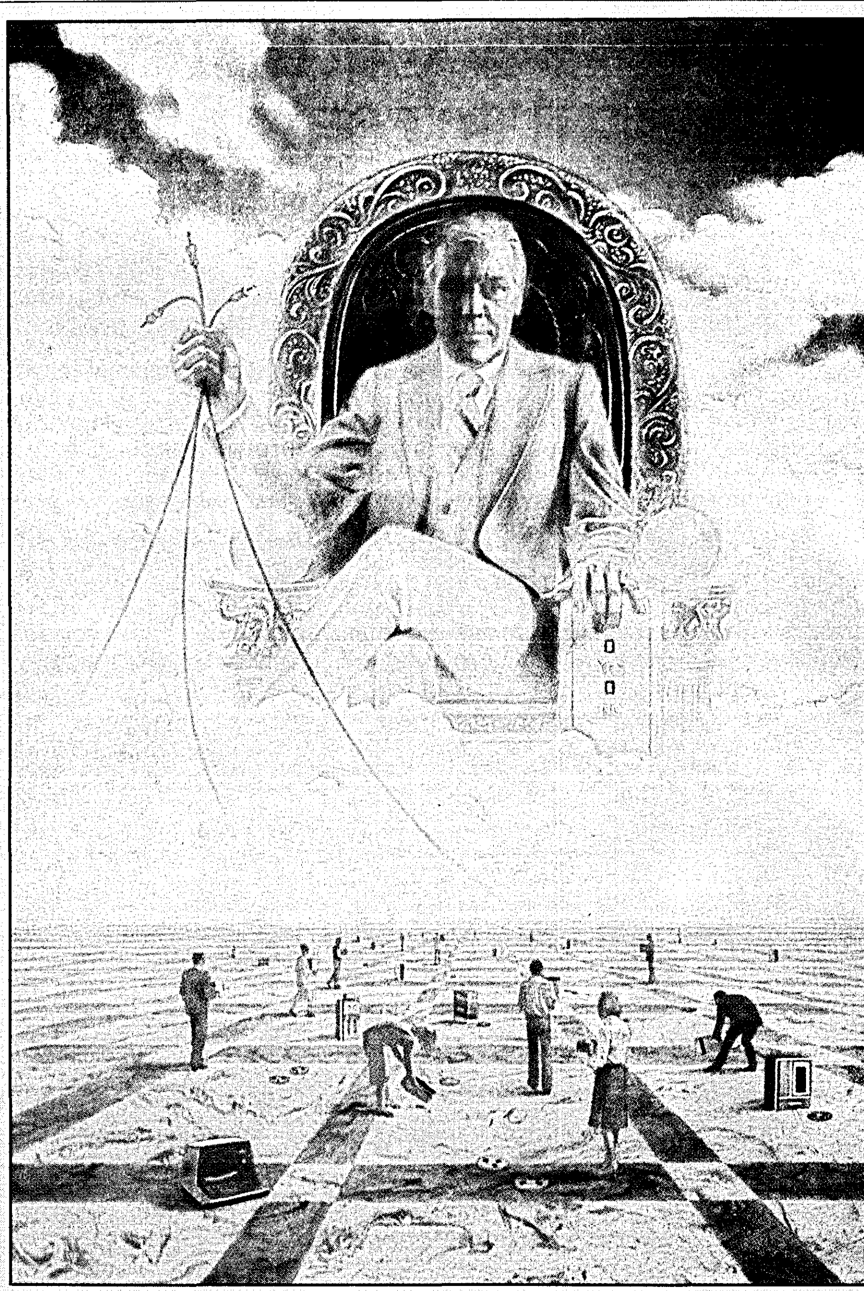
While updating their image, the PTTs also liberalized some of their interconnection policies, allowing the Tymshares and Telenets to forge connections across the ocean. The free enterprise spirit was strongest in Great Britain, where the telecom authority relinquished monopoly control over equipment attachments.

What the PTTs clearly did not give up was their ability to wield power—whether fairly or unfairly. Even IBM was no match for their might in the battle to establish X.25 as the standard protocol for packet switching.

IBM was a threat to the PTTs in more than one way. One danger point was reached when IBM announced its Satellite Business Systems operation. Indeed, France's famous Nora report warned the PTTs that the U.S. multinational would tread on their turf with its skyborne SBS scheme. To get the upper hand, the French exhorted the PTTs to take control of satellite services.

And that's exactly what the PTTs are planning to do through their European satellite venture, which was officially launched in January 1981. (More recently, British Telecom also linked up with SBS to provide such transatlantic datacom services as high-speed fax and electronic mail.) The European satellite business services to and from user antennas are scheduled to start next year—two years after the takeoff of SBS services in the States. Expected to be available in most of the EEC countries, the satellite service will cost users in those countries dearly.

This will be nothing new to most users, who are all too aware of the PTTs' inflated charges. In the absence of fast, reliable public lines, many users in the '70s developed, at great expense, their own private leased networks. The PTTs, anxious to protect the market for their aborning public services, retaliated by hiking the leased line rates to unconscionable levels.



SWIFT, the international banking network that started up seven years ago, was hit with rate increases of up to 150%. SWIFT complained to the EEC to no avail. Unlike SWIFT, other operations, such as the Associated Press photo wire service, were unable to absorb the costs and folded as a result of the PTT rate rise.

The PTTs' preposterous prices led one international network operator to confidently declare: "I could make a pile of money running data transmission services at one third the rates the PTTs charge. Their rates are an absolute rip-off."

—A.P.

ers see hope with Wilmot, who is busy streamlining the company while expanding its market horizons. (Since 1970, ICL has slimmed down from 38,000 to 22,000, the latter including the 10% layoffs instituted by Wilmot.)

Meanwhile, the British firm, which has shunned IBM compatibility in the past, finally heeded experts who see real revenue growth in mainframes coming from following the pcm path. Taking the pcm plunge, ICL turned to Fujitsu and is now marketing its large-scale systems.

Siemens is also using Fujitsu's wares, which have reportedly helped the company penetrate IBM sites. Siemens has always been a baffling company. Although it has done well in gross revenues over the years, garnering a healthy 21% of the West German market, it has never reported profits for its dp operations. It has also never made a serious thrust into many world markets.

The giant company's absence from the American arena has in fact puzzled industry watchers. Its deal with Xerox earlier this year does nothing to enhance its U.S. presence. What it does do is give Xerox additional marketing muscle in Europe, while expanding Siemen's range of office automation offerings. Like ICL, Siemens has reorganized many times in hopes of finding new solutions. And its current overhaul, launched last year, has been the most horrendous, with

While IBM was winning its antitrust suits in the U.S., it was facing legal hassles worldwide.

massive layoffs, management shuffling, and a radical restructuring. Dp has always been tangled operationally with the rest of Siemens, and the new reorganization is even more of a jumble.

While Siemens and ICL have somehow managed to survive, other less fortunate firms have cashed in their chips. The 1970s saw the departure of several companies from the mainframe market—Philips, Japan's Oki, Denmark's Regnecentralen, and Sweden's Datasaab.

Sperry Univac acquired Datasaab's computer operations in 1975, completing the buy in 1980 . . . and for Datasaab, it was a blessing in disguise. The firm, which did indeed have some very successful small systems and terminal lines despite its lack of profits, was taken over by LM Ericsson early last year. The large Swedish telecommunications firm has already folded Datasaab, along with its other operations, into a $650 million subsidiary, Ericsson Information Systems. It also boasts of a master plan for attacking the "integrated information systems" market worldwide: distributed processing, office automation, and communications systems.

There were several success and "return from the dead" stories during the 1970s as well. Italy's Olivetti made the excruciating transition from electromechnical to electronic office and small systems products in the '70s and has reentered the mainframe realm. Two years ago the company formed Olivetti Computers to market Hitachi and IPL PCMs. Guided by financial wizard Carlo De Benedetti, it has expanded its product lines, stepped up its acquisition of shares in many U.S. companies, and taken on shareholder Saint Gobain—a connection that could someday result in closer Cii-HB-Olivetti ties.

Another company that managed to overcome the odds was Nixdorf Computer. The indefatigable German firm proved that small is beautiful in systems and that a European company could find happiness in the U.S. marketplace. Still other success stories can be told about Norway's Norsk Data, which can take credit for advanced minicomputer systems, and the U.K.'s diversified dp/telecom concerns, GEC and Plessey.

A list of the victorious vendors would be incomplete without CISI and Cap Gemini Sogeti, two of Europe's superstar services companies. Pulling in annual revenues of around $200 million, these two French firms are now on the acquisition trail.

Meanwhile, IBM has also been building its profits. But everything was not blue skies for Big Blue. While the fearless firm was winning all its antitrust suits in the U.S., it was facing legal hassles worldwide. The EEC, after about eight years of investigating this "dominant concern" (and spurred by the ill-fated Telex and government suits), finally filed its charges against IBM in December 1980. Today, the EEC claims it is adamant in pursuing its case.

IBM also suffered some legal defeats in Europe. Its national companies, desperate to nip the plug-compatible peripheral movement in the bud, refused to maintain processors that had pcm memory. Cases protesting this practice were filed in two countries and won. In subsequent years, IBM was forced to resort to the time-honored tactic of pressure to hold the pcm peripheral and mainframe vendors in abeyance.

In addition to warring with vendors, IBM also had to fight the policies of nations in the Third World. During the '70s, the multinational was facing trouble in such developing nations as India, Nigeria, and Indonesia, all of which had challenged IBM's policy of 100% ownership of its national companies. Unable to reach a compromise in one nation, India, IBM packed its bags and left.

During the '70s, developing countries, along with the rest of the world, began to confront one of the hotter issues of the information age—transborder dataflow. This was the era when nations began to think that unfettered data flow across borders could become a serious problem, affecting their sovereignty, defense, and economic interests. Louis Joinet of the French Ministry of Justice put it simply when he said, "Information is power."

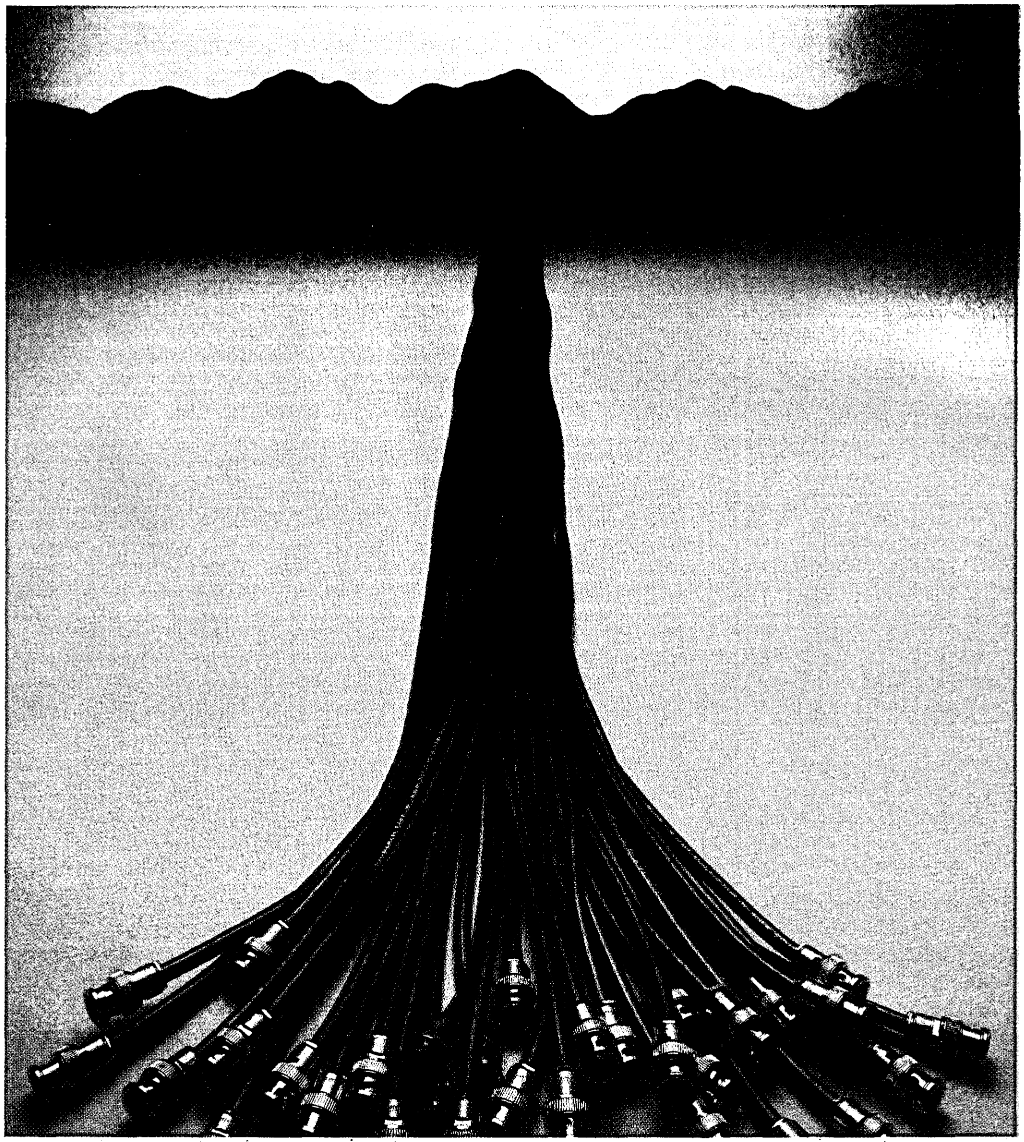
This issue had its origins in the Swedish data law of 1973. Europe's first privacy law was aimed at protecting individuals from misuse of data collected, stored, and transmitted. Using the Swedish model, many nations moved to propose their own laws, and the Council of Europe began an effort to rationalize those laws through a convention.

In the mid-'70s, the council's efforts were suddenly interpreted as a threat to the free flow of information between countries that had data laws and those that did not. Sleeping giants like the U.S. were nudged awake by multinational and computer companies fearful of the implications. Lacking its own information policy and confused about the European initiatives, the U.S. joined other countries in a countermove designed to develop less binding guidelines under the auspices of the Organization for Economic Cooperation and Development (OECD). When all the dust had cleared, in 1980, both a convention and OECD guidelines had been approved. Only time will tell if nations will handle this new legal regime evenhandedly or as a nontariff barrier to mainly serve economic interests.

In 1992 DATAMATION will no doubt do another déjà vu of the decade. During that decade, the company and country battles for automation markets will probably continue unabated. It is also likely that higher orders of concern will be further crystalized, hopefully for the good: technology's implications for nations, for unemployment, for the well-being of the individual. Such concern is vital because as a wise Dutchman declared, "Without revolutionary thinking and action on these issues, we may face revolution."

International editor from 1972 to 1979, Angeline Pantages is currently editor of the *Cerberus Report*, an in-depth publication on the computer services industry.

CARTOON BY TOM STRATTON



Now you can add 31 IBM 3270 devices without adding 29 miles of cable.

Our new CMX Cable Multiplexer takes up to 32 inputs from an IBM 3274 Controller, combines them into a single signal, in a single cable, for demultiplexing up to 1500 meters away. With no performance degradation. So using an existing cable, you could add as many as 31 new terminals without pulling any new cable at all: at 1500 meters each, that's 29 miles of cable you don't need to find room for, install or manage.

Installation is easy, using existing RG-62A/U coaxial cable and BNC connectors. It's especially easy when you consider the alternative—pulling miles of new cable through already-crowded ducts.

Up to four cables can be run from the CMX, so you can support 3278, 3279 and 3287 devices on different floors, or in different directions, from one unit.

The CMX Cable Multiplexer system is available in 32-port, 24-port, 16-port and 8-port models. It is completely transparent to IBM user software and terminal operation and meets all type A interface and cabling specifications.

Another solution to your local communication problems from Ungermann-Bass, the Net/One™ company.

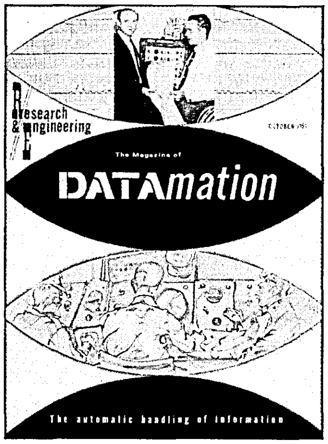
Please call the regional office nearest you for more information about the new CMX system: Santa Clara, CA, (408) 496-6464; Burlington, MA, (617) 273-5858; St. Louis, MO, (314) 434-1024; Dallas, TX, (214) 385-7090; Los Angeles, CA, (714) 553-1771.

Ungermann-Bass

CIRCLE 37 ON READER CARD

You must remember this . . .

AS TIME GOES BY



DATAMATION is 25!

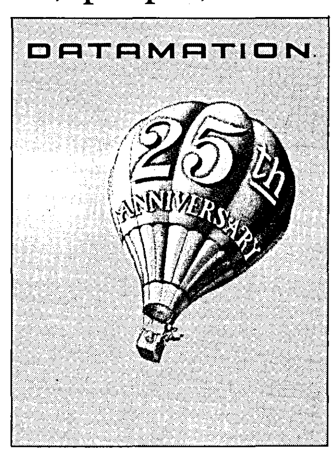
For a quarter of a century, DATAMATION's pages have reflected the ups and downs of companies, people, techniques, and trends in the most dynamic, changeable industry this world has ever seen.

Looking backward, we see now how often we got excited about a development that never happened or missed an event that redirected a generation. Ah well! It's equally rewarding to look back and see how often we were right.

DATAMATION is not an official journal of record trying to set in concrete, for all time, every forward-going step. A magazine is created by editors. Sometimes we've been right; other times we've been wrong.

We present here the DATAMATION 25-year time line, an ambitious, exhausting, memory-rousing, exciting, sentimental, and sometimes "sorry we did it" stroll through our family album. It is not, we warn academics and corporate PR departments alike, exhaustive. Family albums don't always show Uncle Jim's warts.

What our time line represents is a 300-issue trek through the mists of the '50s, memories of the '60s, and miasma of the '70s. The '80s are still pretty clear and don't require a lot of head scratching. Some of the memories are pretty funny. Some are purely sentimental. We remember with affection the passing of some industry pioneers, companies long gone, machines that have been scrapped, and even a programming language or two. We salute the arrival of companies, machines, people, and programs that had important implications for all of us.



For those who lived this entire time with us, congratulations and felicitations. You, too, are approaching middle age. For those who joined along the way, welcome. For those who believe the world began with VisiCalc and BASIC on a microcomputer, forgive the reminiscences of your elders. For all of you, everywhere, look at our time line and remember that the words encompass excitement, hope, frustration, and—sometimes—triumph. Happy 25th anniversary!

'57

INDUSTRY

Arthur D. Little study predicts total future computer purchase value: $2.4 billion (if technology remains as is, that is).

Control Data Corp. is formed by ex-Univac executive William Norris.

Digital Equipment Corp. is founded by MIT's Kenneth Olsen.

Fairchild Semiconductors Corp. is established by Fairchild Camera.

First UNIVAC II goes to John Hancock Mutual Life Insurance.

Harvard's Mark II, the Aiken Relay Calculator, is retired from the Naval Proving Ground in Dahlgren, Va.

IBM announces that 1956 revenues hit $700 million.

Underwood Corp. withdraws from the computer business.

Dr. John von Neumann, computer pioneer, dies at 53.

Burroughs's 1956 acquisition, ElectroData, is beginning to talk of building machines to process high-level language statements and hiring public relations specialists like Robert B. Forest and William J. Rolph.

Two thousand attend Western Joint Computer Conference.

System Development Division of Rand Corp. becomes an independent company, SDC.

TECHNOLOGY

Late Friday afternoon, April 20, at Westinghouse-Bettis, the first live user-written FORTRAN program runs. Run one produces a missing comma diagnostic. Run two is successful.

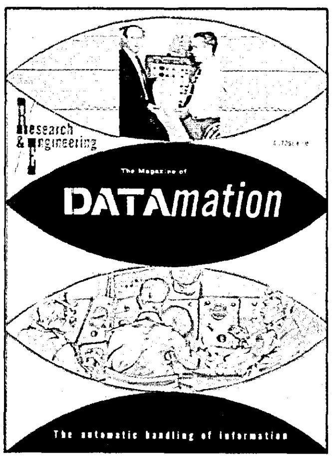
IBM 610 Auto-Point Computer, with built-in floating point, is announced, which makes little sense to scientific users whose 704s have been merrily cranking away for two years.

RCA announces germanium junctions but continues to emphasize tube production, leading ultimately to nowhere.

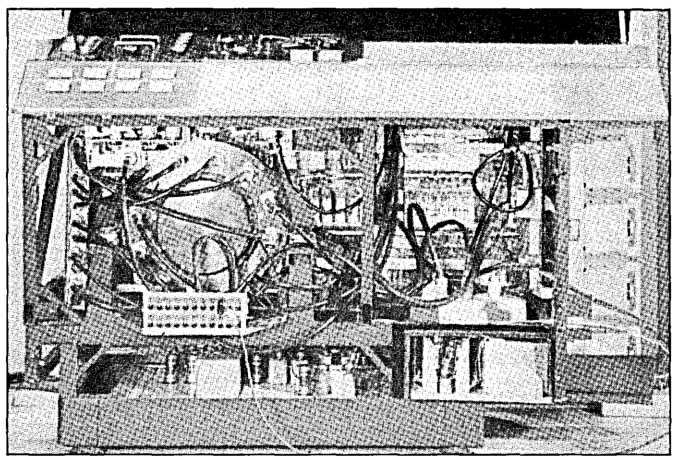
The U.K.'s Mercury is the first large-scale scientific computer from outside the U.S.

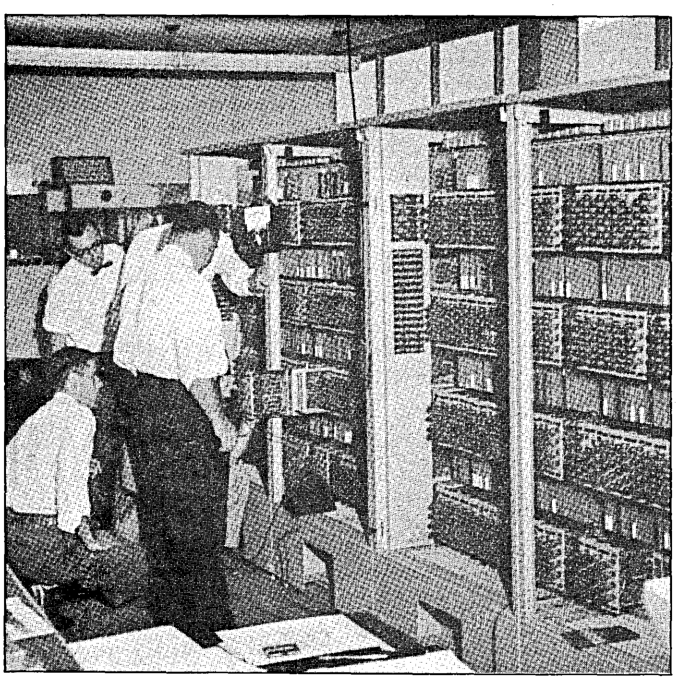
R. Gordon Gould makes notes that will lead to future patent on laser.

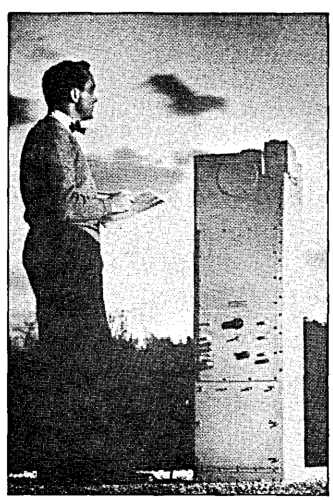
New languages published or in development include FLOW-MATIC, COBOL predecessor, for business; IPL-V, first language for list processing; and COMIT, string handling and pattern matching language.



In 1957, Datatron claimed to have the first medium-priced ($325,000 to $600,000) digital computer system with full magnetic core memory (below).







Computers are engineered for compactness. Above, modules are plugged into the subframe, and subframes are interconnected with cables. Magnet "memory" drum provides large storage capacity (800 words) and allows several programs to be stored.

Designed by Dr. James G. Baker, president of Spica, Inc., the auroral patrol spectrograph (left) photographically records the spectra of auroras and airglow.

'58

IBM signs a cross-licensing agreement with RCA and agrees to work with Texas Instruments on transistor development.

Air Force on-line real-time air defense system, SAGE, opens first center, McGuire AFB (New Jersey).

Japan's Ministry of International Trade and Industry begins subsidies of computer industry.

Philco creates a new computer division.

Packard Bell Computer Corp. is formed, led by ex-Bendix exec Max Palevsky, to build small computers.

Bendix Computer Division, formed in '52, produces 100th G-15 computer.

Federal Reserve Board sues ALWAC Corp. for nondelivery of ALWAC-80.

Dp manager salaries average $1,150 a month, senior programmers $750. SDC's trainees get $325.

Institute for Advanced Study in Princeton, N.J., closes Computer Project, brainchild of von Neumann, Burke, and Goldstine.

Forty-ton Datamatic 1000 (Honeywell) is in operation at Blue Cross/Blue Shield in Detroit.

Germany has 97 computers, worth DM 26 million, installed.

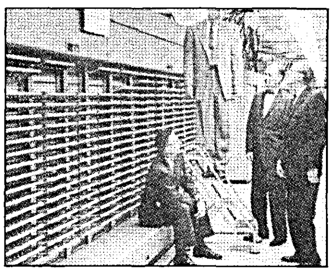
New products announced include Stromberg-Carlson 5000, a 4680 lpm printer using Charactron tube; Calcomp 650 X-Y recorder (drum plotter); Honeywell Datamatic 1000 computer—40 tons; Teletype Model 28; IBM 7070, fully transistorized but slow, shortly to be replaced by 7074; Bell Dictaphone, 600 bps announced but very quietly; RCA's first commercial computer, the 501; and Sylvania's truck-mounted mobile binary digital computer MOBIDIC.

First deliveries are made of IBM RAMAC and 608, Control Data 1604, RemRand Univac 1105, (Bureau of Census), and Philco Transac S-2000.

The first NCR computer, the 304, is ordered.

Dr. William Shockley announces the transistor diode.

Texas Instruments develops the first integrated circuit—the TI oscillator.



"Automation is coming as rapidly to the office and to the credit department as to the production end of business. It may not come upon us all of a sudden, but we cannot presently ignore it with the mistaken thought that it is 15 or 20 years hence." *Financial Management's Edwin Moran*

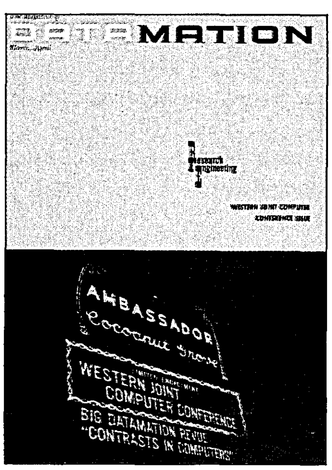
INDUSTRY LEGEND: The SAGE Computer (top).

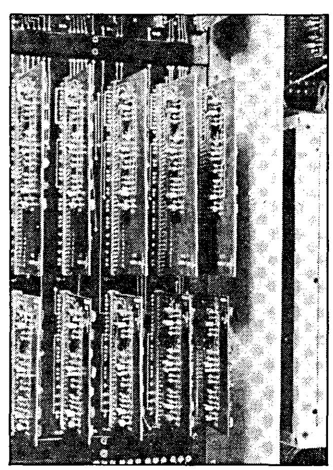
While hubbies toil at the WJCC, which attracted 1,800 attendees, wives (left) get set for spending spree on Rodeo Drive in Los Angeles.

© DATAMATION

The NCR 304's 2K word memory and associated circuitry (below).

"It's not office problems that's creating all the interest, chief! . . . They're having it estimate the size of their Christmas bonus! . . ."





'59

General Electric installs ERMA demand deposit accounting system—the project that pushed it into the computer business—at the Bank of America.

Computer Sciences Corp. is formed by Fletcher Jones, Roy Nutt, and Robert Patrick.

International Computers and Tabulators is formed through merger of British Tabulating Machine Co. and Power-Samas.

In this era of educational gifts and discounts, IBM has donated 50 model 650s to universities.

Automatic Data Processing celebrates 10 years of payroll processing; future software leader Applied Data Research formed.

The International Federation of Information Processing Societies is formed at first International Conference on Information Processing in Paris.

Committee on Data System Languages meets to establish a common business language, leading to COBOL.

First large-scale computer disaster is at the Pentagon, where fire sweeps facilities.

Hitachi, Nippon Electric, and Oki Electric unveil computer entries in Japan.

CEIR, claiming to be "the largest independent commercial computing service," plans five new large-scale centers.

New products announced include Honeywell 800 computer featuring hardware multiprogramming; Autonetics Recomp II with hardware floating point; IBM 1401 computer and 1403 chain printer—1,000 1401 orders rumored the first month and every month thereafter for five years; Digital Equipment Corp. Programmable Data Processor, PDP-1; Control Data 1604 adapter for IBM peripherals; and IBM's 729 III tape drive at 556 bpi.

APT, first generally successful problem-oriented language, is demonstrated by Doug Ross at MIT, signaling the beginning of CAD/CAM.

COBOL is in development.

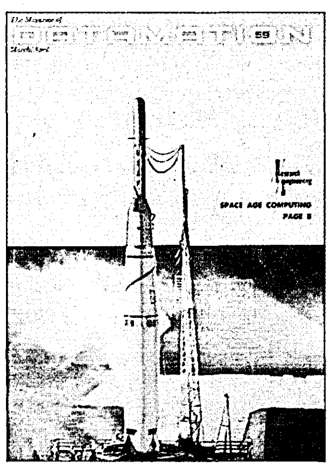
LISP language for list processing goes into use.

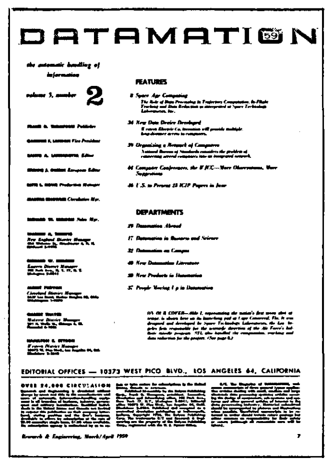
Leo Asaki, later to be with IBM Japan, develops the tunnel diode for which he will win a Nobel prize, but his technology will not mature into available commercial product.

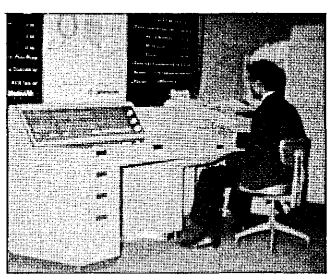
The first IBM 7090s are delivered, to Sylvania.

The Univac SS-80 aims at compatibility with IBM 650 and 1401 markets.

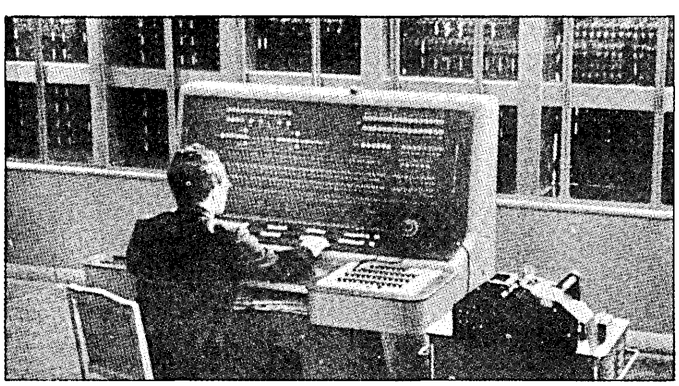
"Perhaps no group attending any conference ever so boldly faced so many challenging problems with so great a chance of success and with [such] a potential influence on society as a whole as do members of this conference." *Director, Computation Laboratory at Harvard University Howard H. Aiken speaking at the first International Conference on Information Processing in Paris, June 1959.*



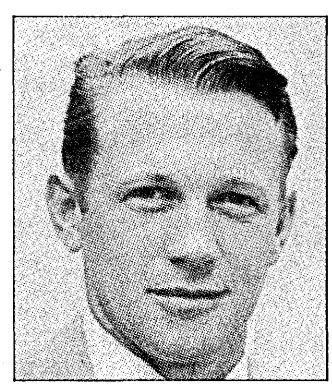




Hitachi's HIPAC 101 (center) could store 1,024 long words (39 bits).



Chinese sources reveal that Communist China is experimenting with the production of her first large-scale computer (left).



Arthur G. Anderson (right) became acting manager of Basic Science at IBM's Research Laboratory in San Jose, Calif.

'60

CBS's IBM 7090 projects Nixon as winner; NBC's RCA 501 picks Kennedy at the outset.

Two services companies born: McDonnell Automation Center and Computer Applications Inc. One survives.

General Mills enters the field.

Lockheed designs real-time manufacturing system.

Management Assistance Inc. formed to sell used tab equipment.

Pennsylvania State Correctional Institution begins computer training for inmates.

International Standards Organization forms Technical Committee 97: Digital Computers and Data Processing Machines.

Royal McBee installs 400th LGP-30 small computer.

FCC rules any business is eligible for microwave authorization.

New products announced include Ramo-Wooldridge RW-400 "polymorphic cpu" with matrix switch; IBM 7080 system; Univac III with COBOL; IBM "supercomputer" STRETCH; GE's first cpu, the 210, and first general purpose cpu, the 225 (sometimes known as a 704 cut in half); RemRand Univac 1107, with thin film memory; Bendix G-20 medium-scale computer; and Collins Kineplex, first high-speed data transfer, datacom box.

RCA (Howard Bromberg) and Univac (Grace Hopper) demonstrate COBOL compatibility, swapping programs between the 501 and Univac II—a successful experiment never repeated.

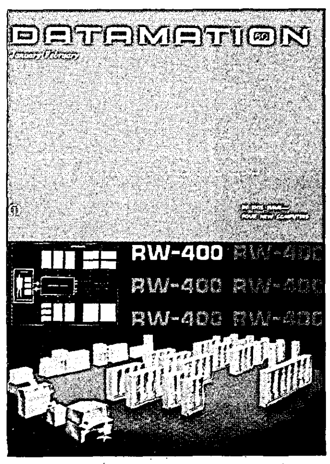
RemRand Univac delivers LARC to AEC Lawrence Radiation Laboratories; LARC is first with general purpose registers and timeshared bus.

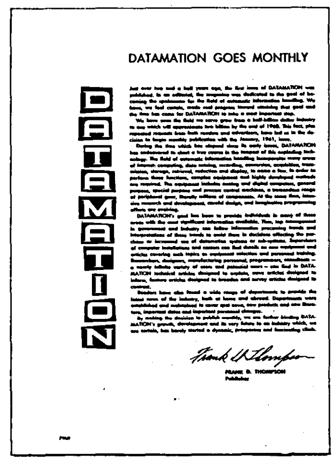
ALGOL 60, which inspires much future theoretical work in programming languages, is published. The document, only eight pages in length, popularizes the use of BNF for language descriptions.

JOVIAL, an Algol 58 derivative, becomes first high-level language used for real-time, command, and control computers. Designed in four months, the first subset is delivered in early 1960, a full compiler a year later.

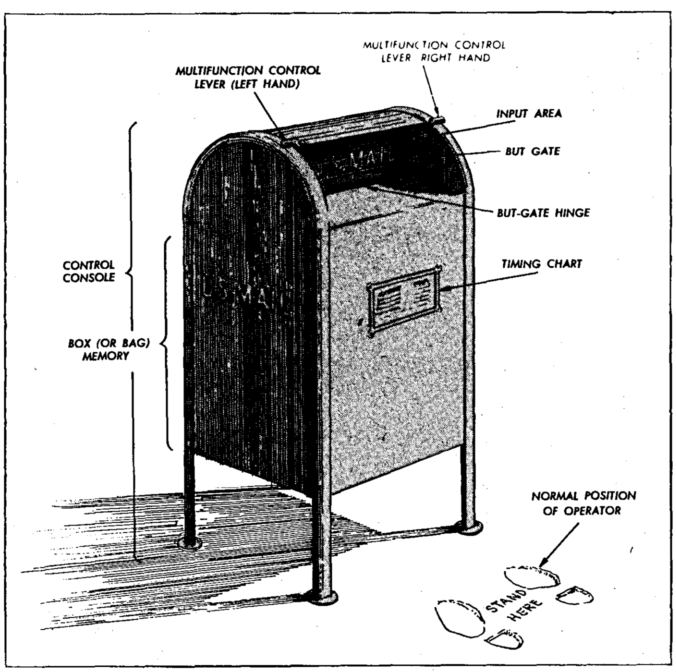
"The impact of large computers has been felt in the missile industry more than any other area in our life. In a decade, computers have developed from a curiosity and convenience in space vehicle design to an integral, indispensible element of our work."

Director, Marshall Space Flight Center
Dr. Wernher von Braun




DATAMATION GOES MONTHLY

DATAMATION



THE RW-400—A NEW POLYMORPHIC DATA SYSTEM, designed by Ramo-Wooldridge to provide a practical solution to those information processing problems now inadequately handled by conventional computer designs (above).

The early days of electronic mail?

'61

DATAMATION goes monthly.

IBM's first supercomputer, STRETCH, is withdrawn.

DATAMATION's market share guess: IBM—81.2%; Remington Rand—6.6%; RCA—3.1%; the rest split among NCR, Burroughs, Philco, CDC, Bendix, Honeywell, GE, Autonetics, Royal McBee, Packard Bell, Monroe, and ALWAC.

Scientific Data Systems formed by Max Palevsky.

Memorex formed to make magnetic tape products.

New groups: Association of Data Processing Service Organizations, European Computer Manufacturers Assn., American Federation of Information Processing Societies (née National Computer Committee), and Business Equipment Manufacturers Assn. (née Office Equipment Manufacturers Institute).

Rental value of equipment worldwide is $750 million; $2.7 billion expected in '65.

Data Processing Financial and General, computer leasing pioneer, formed.

More than 60,000 full-time programmers and operators now employed.

United Airlines runs first of new generation reservation systems, Telregister "Instamatic."

New products announced include Burroughs B5000: microprogrammed interpreters, stack architecture, paging, Polish notation, and dual processors (IBM looks skeptical); Ferranti Atlas: ROM, multiprogramming, compiler-compiler (IBM looks more skeptical); IBM 1301 disk for 7000 series; IBM Walnut information retrieval project: 1 million documents in five seconds using film strips (when it worked); IBM 7040 and 7044; IBM Hypertype system; Farrington optical page reader, a first (300 cps); and transistor-coupled transistor logic, TTL forerunner, from Pacific Semiconductors Inc.

Theodore Maiman, Hughes Aircraft, develops first working gas laser.

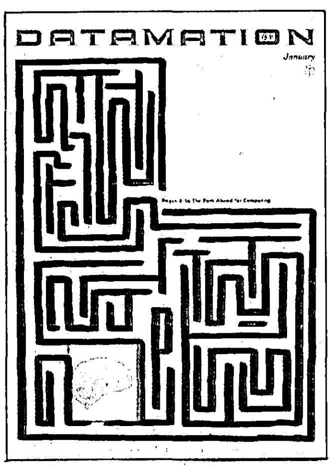
First use of a computer to help design another computer—Nike-Zeus project at Bell Laboratories.

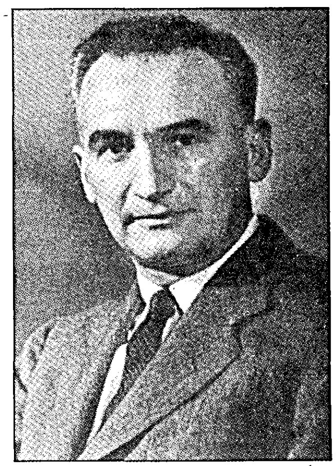
IBM STRETCH is operational at Los Alamos, the first computer to use instruction look-ahead.

First UNIVAC III delivered.

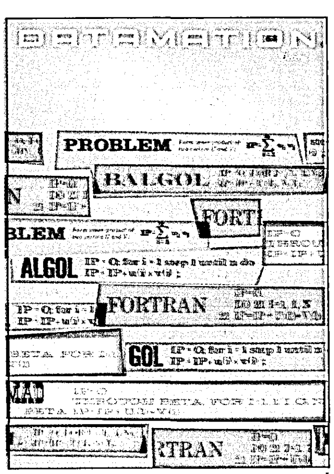
Bell Telephone Laboratories device reads hand-printed numbers.

IBM project "Moonlight" in Kingston results in first viable direct coupling of two large-scale mainframes, 704(x)/709(x).





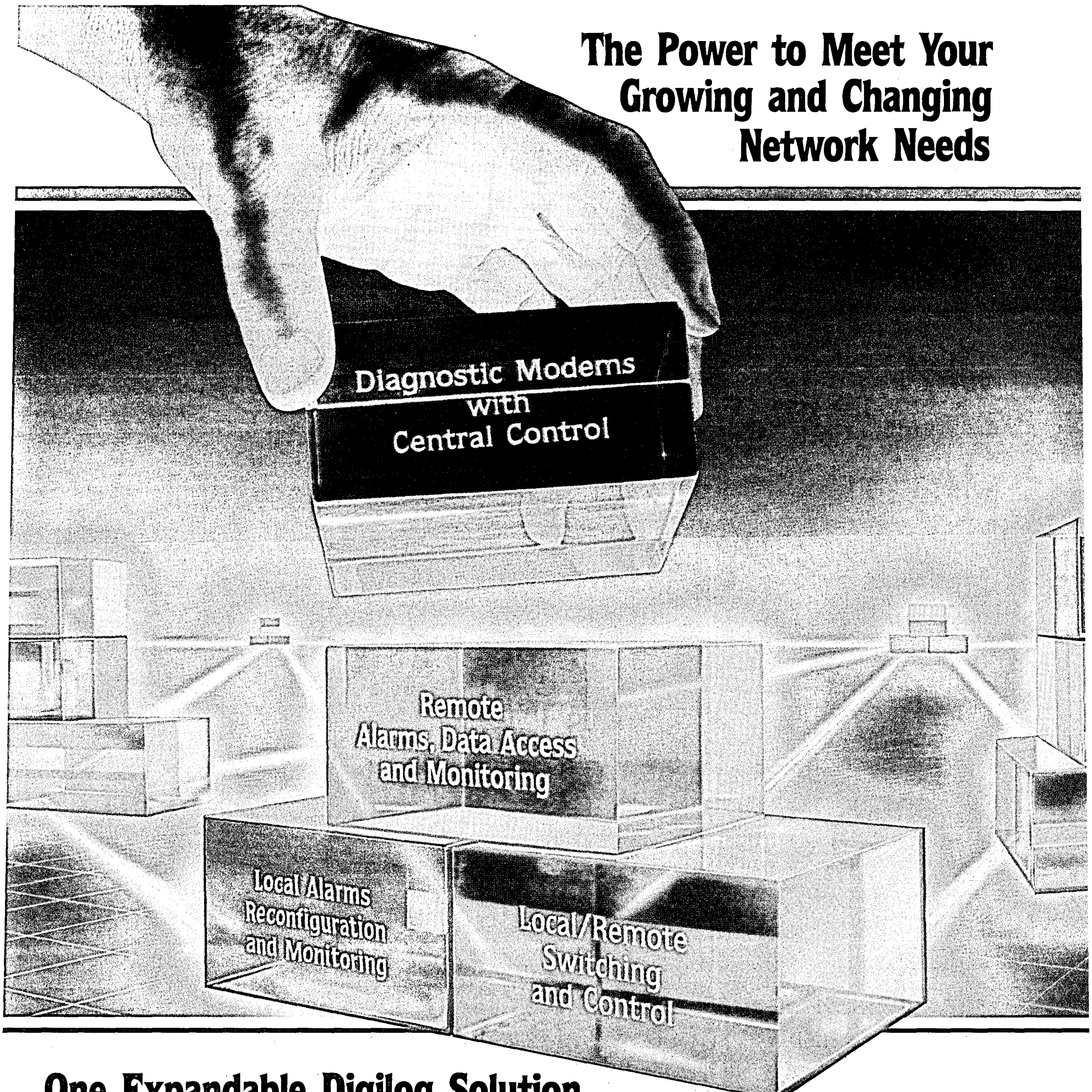
IBM president Thomas J. Watson, Jr. (left) and Thompson Ramo Wooldridge's executive vice president Dr. Simon Ramo were keynote speakers at the WJCC.



"Since the war a combination of factors, but mainly the union squeeze on labor costs, has brought us to the point where the Europeans are taking a lot of this business away from us. . . . The Europeans have continued to increase the productivity per worker. The solution to our problem is to tackle the cause rather than try to smash the machines. We ought to make an attempt in this country to again increase productivity to the point where we are competitive with the rest of the world."

Herbert Bright

The Power to Meet Your Growing and Changing Network Needs



One Expandable Digilog Solution for Tech Control, Network Control and Network Management

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NETWORK CONTROL DIVISION

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CIRCLE 39 ON READER CARD

'62

Top management shake-ups at RCA, Philco, RemRand, Bendix, Packard Bell, Ramo Wooldridge, and Royal McBee.

General Mills and Royal McBee drop out of dp business.

New companies: Electronic Data Systems, Recognition Equipment Inc., Boothe Leasing Corp.

An estimated 114 consulting firms are formed in early '62.

Western Joint Computer Conference draws 3,500 to San Francisco.

Social Security Network links 600 offices.

National Machine Accountants Association gives first programmer certification exams.

IEEE says this is the computer industry's first $1 billion year. Over 10,000 cpus are said to be installed worldwide, 9,337 in the U.S.

Rand, led by Paul Baran, does first work on packet switching.

New products announced include IBM 7094; Scientific Data Systems 910, 920, 930 with first nonmilitary use of silicon transistors; ITT 7300ADX message switch; Collins C-8000 data switcher; and Philco 212, "fastest commercially available hardware."

The first CDC 6600 is delivered to Livermore (256K words core), runs "faster than any other computer." A year later, T.J. Watson will wonder why CDC can build "the world's most powerful computer" with 34 people "including the janitor" and IBM can't.

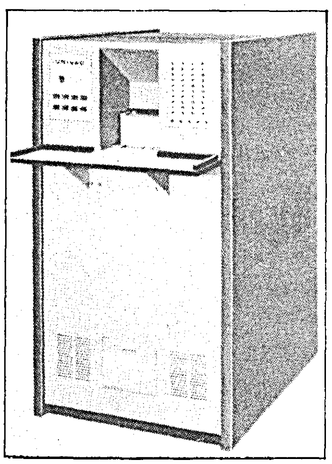
IBM voice response unit developed at San Jose handles 16 words.

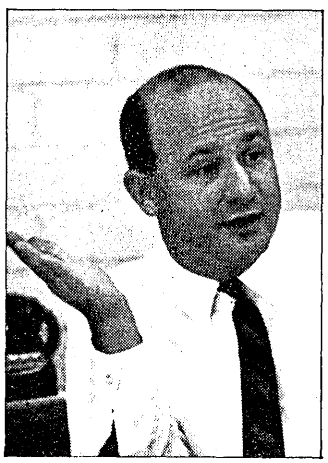
Bell Labs develops coherent infrared gallium-arsenide laser.

IBM tests subnanosecond diode using heterojunctions.

The word "kludge" is coined—an ill-assorted collection of poorly matching parts forming a distressing whole.

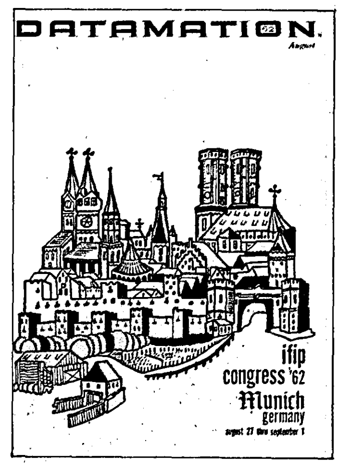
FORTRAN IV preliminary specifications are developed.





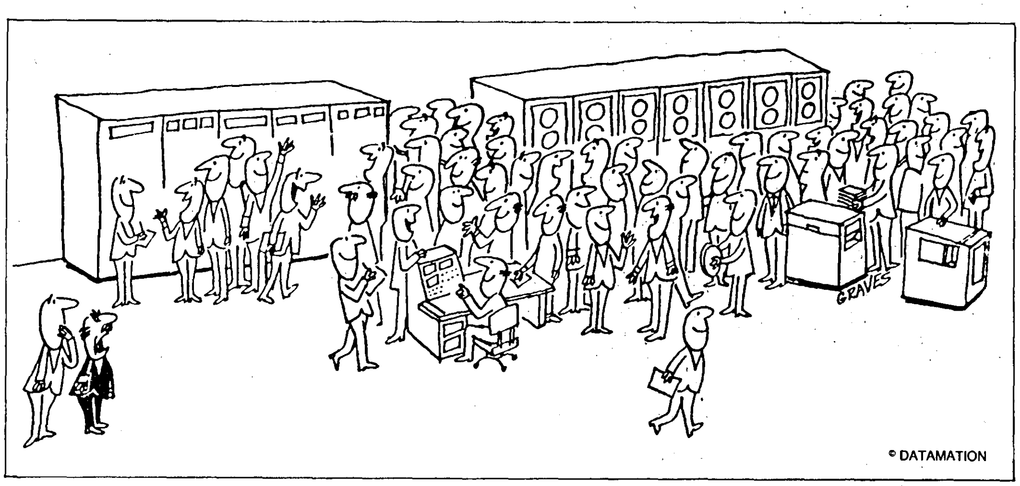
Remington Rand Univac's 5440 optical scanning punch (left) could read and punch cards at the rate of 9,000 per hour.

President of Scientific Data Systems, Inc. Max Palevsky (center).



"An awareness of Soviet computing technology is vastly limited in this country by the Russians' obvious timidity in broadcasting details of their specific scientific attainments and certainly their problem areas."

DATAMATION editor Harold Bergstein



". . . .and to think I bought this system to replace six bookkeepers!"

RELIEVE YOUR COMPUTER OVERLOAD WITHOUT OVERLOADING YOUR BUDGET.

Large-scale scientific and engineering codes can overload even the most powerful general-purpose computer system. Applications such as structural analysis and reservoir simulation can cause a demand for CPU resources that cannot be met during peak hours. Scheduling those jobs to run on a late shift causes overnight job turnaround that reduces the productivity of your expensive engineering talent. And yet, if you increase your computer resources by upgrading with another general-purpose computer, you may overload your budget.

Floating Point Systems has the solution.

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The FPS-164 is designed for high-speed cost-effective processing of engineering and scientific calculations. Attach the FPS-164 to your IBM or VAX™ system, and you can offload numerically-intensive computations for faster, more cost-effective solutions, while freeing your host computer for other jobs.

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Built-in reliability and a world of service.

Such features as error-correcting memory, internal diagnostic system with diagnostic microprocessor are engineered into the FPS-164.

Product reliability is backed by customer support that includes service facilities at key locations throughout the world, remote diagnostics, comprehensive documentation, installation, training, and other services.

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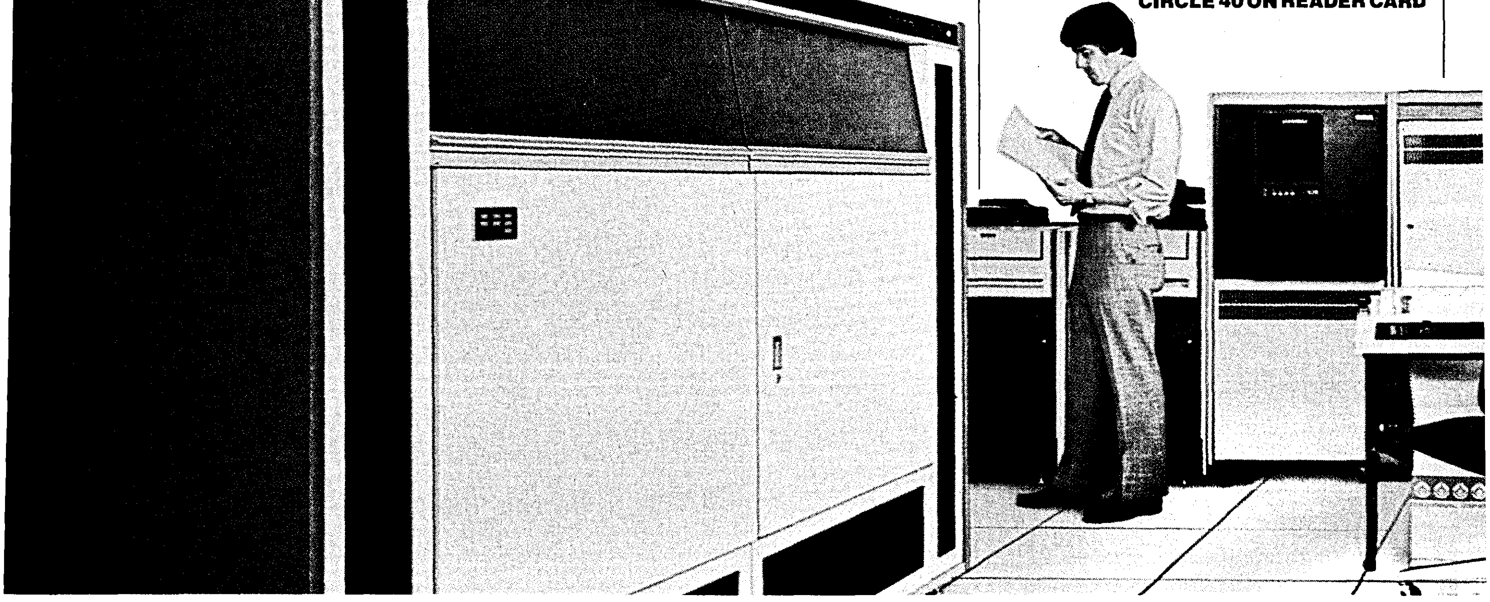
CIRCLE 40 ON READER CARD

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OFFICEPOWER™ is the multifunctional computing system that bridges those islands to bring office management and staff closer together than ever before. OFFICEPOWER increases productivity by enhancing communications and rescuing your organization from endless hours wasted on routine functions and paperwork.

With the mere touch of a button, you can harness the awesome power of OFFICEPOWER to perform a wide array of time and money saving duties. In addition to complete, full feature word processing capabilities, OFFICEPOWER gives you the power to:

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- Create budgets, conduct financial analysis and forecast using large electronic spread sheets
- Automatically check several users' calendars to schedule meetings convenient for all
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- Perform more productively by reducing time spent on routine functions and paperwork

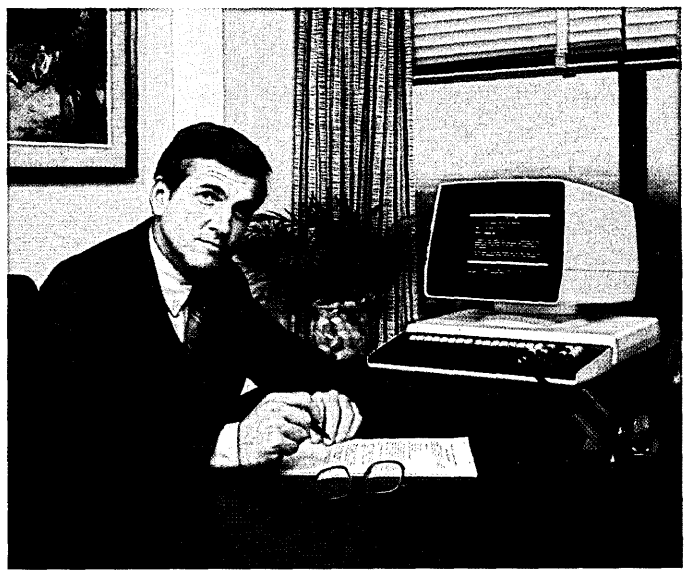
OFFICEPOWER runs under the UNIX* system, today's premier operating system for mini- and micro-computers. Versatile UNIX adapts to any change in hardware requirements with no change in efficiency, assuring that your system will never be obsolete.

OFFICEPOWER is a product of CCI, designers of PerpetualProcessing™, an exclusive concept which ensures that your system will virtually never fail. CCI has installed over $135 million worth of these "never fail" systems with another $60 million worth on order, for major telephone companies in 250 locations. **In early 1983, OFFICEPOWER will be available as a PerpetualProcessing system.**

OFFICEPOWER is fully expandable to meet tomorrow's growing needs. Add to your system as required, with configurations ranging from a few to hundreds of terminals. Before your needs become major problems, send an S.O.S. to OFFICEPOWER and we'll provide the solutions.

For more information, return the coupon below or call (716) 248-8200 today. And let OFFICEPOWER help you survive these troubled waters.

*UNIX is a Trademark of Bell Laboratories



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D

CCI
COMPUTER CONSOLES INCORPORATED®

CIRCLE 41 ON READER CARD

'63

American Airlines' SABRE system begins operation.

CDC buys Bendix Computer Division for $10 million.

North American Aviation's Autonetics Division and ALWAC leave the computer business.

ADAPSO attacks "giveaway" dp services from banks, the first of its endless confrontations with bank competition.

ASCII becomes an official standard.

Computer Sciences announces Remotran, the first remote on-line services for the general public.

First UNIVAC I retired to the Smithsonian; RCA BIZMAC sold for $6,000.

University Computing Co. formed. CEIR posts losses. CSC spends $200,000 decorating its new offices.

UCLA "computer utility" for 89 schools goes operational at Western Data Processing Center.

Univac wins $37 million Air Force Base Level Supply contract.

Insurance goes on-line as Metropolitan and The Travelers dole out network contracts.

One thousand school districts and 400 colleges are using dp.

Leasing firm Levin-Townsend is formed.

New products announced include Honeywell 200 with Liberator program for conversion from IBM 1401; Computer Control Corp.'s DDP-24 communications processor; GE Datanet 30 communications processor; GE 625/635, first third-generation cpus; GECOS operating system, multiprogramming, paging, timesharing/batch/RJE simultaneously (IBM still looks skeptical); and Radiation Inc. 31,250 lpm matrix printer.

RemRand Univac 1107, first FORTRAN IV compiler.

MIT Radiation Laboratories has H-1800 running nine programs simultaneously.

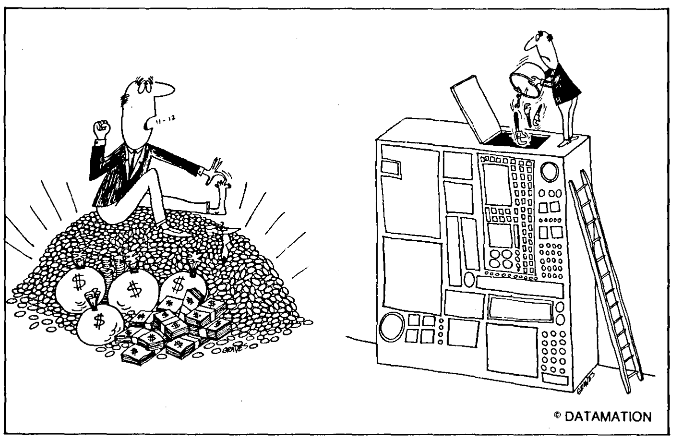
Atlas at Manchester University communicates over 10,000 miles to Melbourne University in Australia.

The first B5000 is shipped to United Airlines (with MCP operating system.)

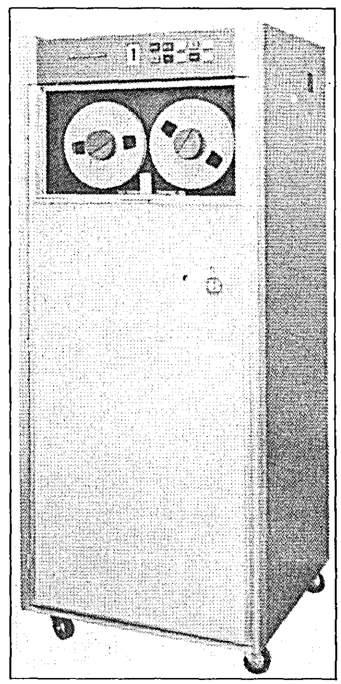
MIT starts second version of Project MAC (Machine-Aided Cognition/Multiple Access Computer) using double memory IBM 7090.

Tunnel diode memory is added to STRETCH, a first and last.

At General Motors, the first computer aided designed auto part—a 1965 Cadillac trunk lid—is produced, after five-plus years of research.



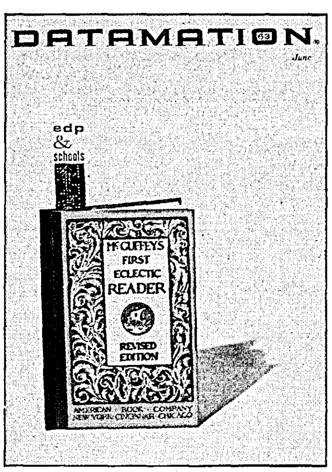
The programmer . . .
. . . as seen by management
. . . as seen by the field engineer

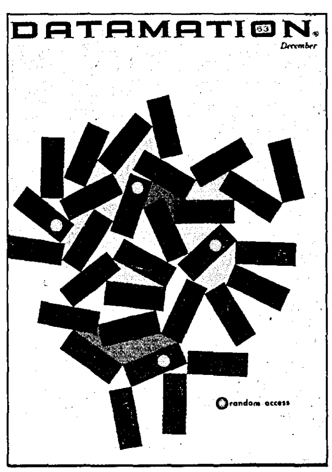


"The main official attention the computer industry receives is a threat to employment. Computing is not automation but the two names have become synonymous."

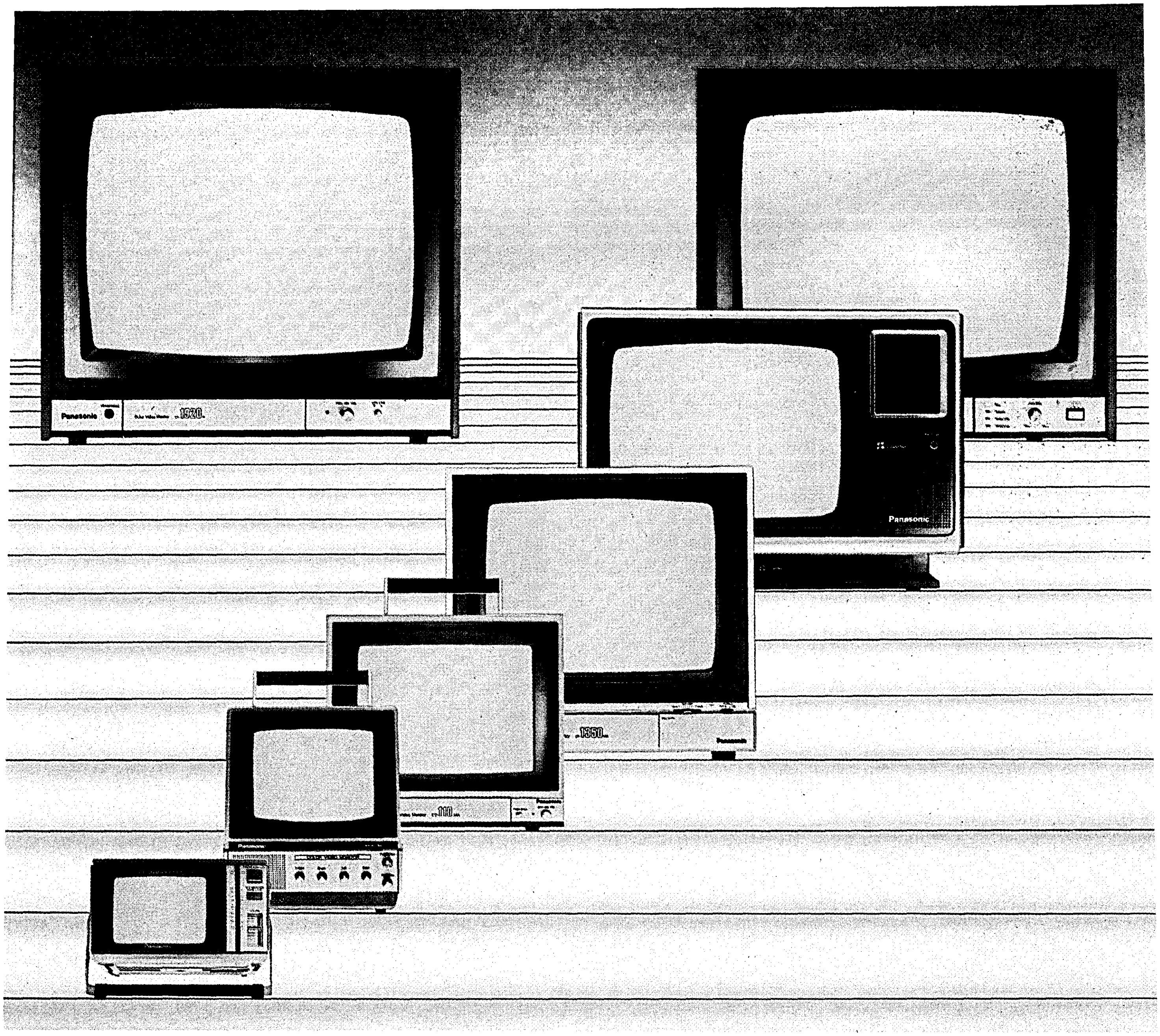
Chairman of the governing board, American Federation of Information Processing Services, Willis Ware

The Burroughs BC 422 mag tape unit (above) featured dual tape speeds of 90 ips and 120 ips.





Computer Sciences Corp. president Fletcher Jones (far left).



Panasonic color monitors.
Just the right specifications for your applications.

Whether you're editing videotape, monitoring a live broadcast, logging commercials or creating computerized graphics, Panasonic has just the right color monitor for your needs. From 5 inches to 19 inches (all screen sizes measured diagonally) at prices that start as low as $385.*

All Panasonic color monitors have our in-line black matrix Quintrix II™ picture tube so you'll get natural colors as well as excellent resolution for a vivid, well-defined image. All models include 8-pin connectors, video inputs and outputs, and audio loop-through for easy system adaptability.

Our 5″ CT-500V monitor/receiver and 7″ CT-700M monitor are naturals for ENG because they work on AC and DC power sources. There are three 10″ models that are small and light enough to fit on a desk.

And for a slightly larger Panasonic picture, choose from our three 13″ models. There's the CT-1320M monitor and CT-1320V monitor/receiver ideal for educational, industrial, medical and scientific applications. As well as the CT-1350MG with NTSC composite and red, green and blue video inputs ideal for studio use and computer applications.

Or choose from our two 19″ models. The CT-1920M features a comb filter for increased resolution and reduced color noise. And for PAL, SECAM and NTSC formats, there's the versatile CT-2000M.

So when you're looking for a color monitor with performance, features and versatility, Panasonic gives you what you're looking for.

*Manufacturer's suggested price.

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Company________________
Address________________
City________________
State________ Zip________
Phone (____)________________

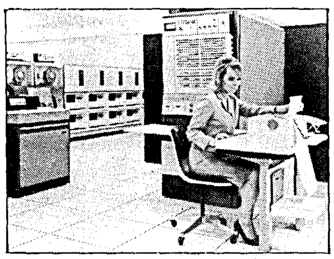
D-9-82

CIRCLE 42 ON READER CARD

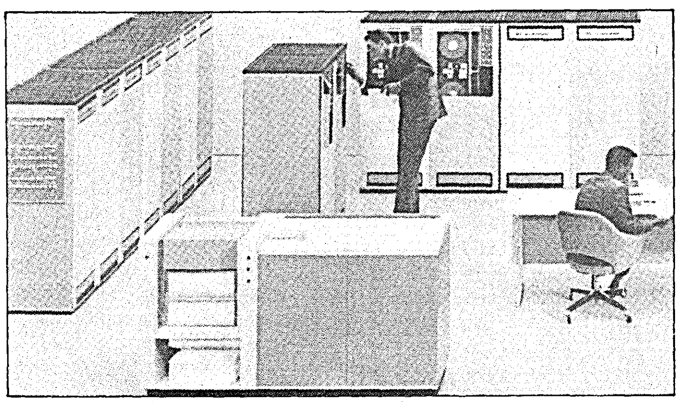
'64

Forty-five new machines are announced.
GE snatches prestigious time-sharing contracts away from IBM: Project Mac, Bell Labs, and Northrup.
Industry claims Honeywell 200 inroads into IBM 1401 base causes IBM to announce System/360 a year early.
IBM OS/360 is not protected, and will go into public domain.
RCA Spectra family is first of the "nearly compatibles."
CDC considers IBM 360/91 a "fighting machine" to compete against CDC 6600.
GE acquires Compagnie Machines Bull (over French public protests) and Olivetti computer operations in Italy.
Raytheon acquires Packard Bell computer operation.
George Cogar leaves Univac to form Mohawk Data Sciences to sell key-to-tape units.
IBM announces Quiktran time-sharing service, raising Consent Decree issues.
Japan moves to number two spot with 2,000 computers.
GE timesharing service begins.
Sperry Univac receives patent on ENIAC (filed in 1947).
DOD's AUTODIN is the world's largest digital data network.

New products announced include IBM System/360 family: OS/360, compatibility, 32-bit word, 8-bit byte, 2260 crt terminal, 2311 disk drive, EBCDIC, emulation, 9-track tape, Solid Logic Technology (hybrid); IBM 360/90 supercomputer series; GE 400 models; RCA Spectra 70 family; IBM near-compatibility, first systems with monolithic integrated circuits; CDC 6800; Burroughs (reintroduces) big D851 for airlines and military uses only; Burroughs 5500, hardware realization of B5000 software concepts; Univac 1108; RCA RACE mag card memory; Xerox LDX facsimile transmitter; Honeywell 2200 medium-scale computer; DEC PDP-8 at under $20,000 (impossible!); and IBM Magnetic Tape Selectric Typewriter (MT/ST), marking beginning of widespread use of word processing.
Dartmouth College (Kemeny and Kurtz) develops a timesharing system and new, simple language, BASIC.
JOSS conversational timesharing service begins on Rand's JOHNNIAC.
NPL, later PL/I, announced by joint IBM-SHARE 3x3 committee.
FORMAC, a problem-oriented formula manipulator, is delivered by IBM.

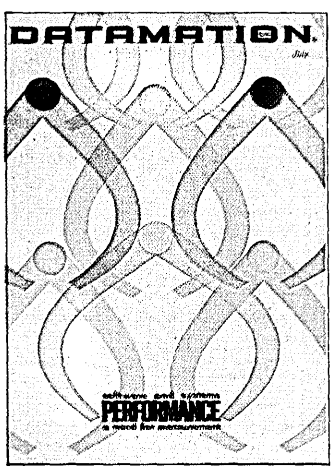


"The giant dropped the other shoe last month . . . And we'd guess that the last 360 announcement is not in . . . . The competition may feel that with the dropping of the other shoe their target is out in the open and clearly defined . . . but it's an awfully tough target."
Datamation editor Robert B. Forest



The new IBM 360/65 (top).

RCA responds to the 360 with the Spectra 70 series (center).



A SHORT HISTORY OF COMPUTER PROGRAMMING TO DATE

There once was a group of ambitious young men
Who thought to extend their inadequate ken,
And so they embarked on a perilous scheme
To learn to converse with a "Thinking Machine."

And so, they began from a logical start
From first rudiments, and they learned them by heart.
And soon they discovered, thru practice and pain
That they could converse with this monstrous Brain.

And lo! what a wonder, and what a surprise!
It answered their questions and told them no lies,
Except now and then when a bit went astray,
But this wasn't often and caused no dismay.

This happy relation went on for a time
And all went quite well and their life was sublime,
But then some insidious merchant of fear
Came forward and planted a bug in their ear.

Why must we descend to the level of dolts
To learn to communicate with mere nuts and bolts?
For men of our mettle and men of our mien
Should not have to kowtow to any machine.

Let's build us a program that knows how we think,
To act as a buffer, provide us a link.
And so they gave birth to this grand novel plan
And even decided to call it FORTRAN.

And in a short time there emerged from the group
A program devised to eliminate stoop,
But many did scurry, and many did flee
From the need to comply to this conformity.

The first was erratic, too crude, and too new.
More rules were developed, and like Topsy it grew.
And as it developed and used more of core
They all started stopping a little bit more.

A missed punctuation became a great crime,
And each compilation took more and more time.
A horrible nightmare to try troubleshoot,
Just keep recompiling, for who gives a hoot?

Where once stood a proud and unconquerable soul
There now stands a coder without core control,
A victim of FORTRAN and all that it means—
This new greedy monster controls the machines.

F.S. Ingrassia

'65

"The smart money for the short run is on GE and RCA," said DATAMATION.

CDC buys Librascope division of General Precision.

New timesharing services abound: ITT, Pillsbury, Keydata, Medinet, Tymshare Associates, and Comshare.

U.S. refusal to let CDC 6600 go to France for nuclear research stiffens French resolve to become self-reliant in dp.

Brooks Bill becomes law, establishing standard procedures for government dp procurement and control.

IBM, Univac sign cross-licensing agreement.

DEC ships 7,000th PDP-8, crosses $15 million revenues.

NCR ships 1,000th computer.

New York Stock Exchange Ticker-Quotation Computer System is operational.

Randolph Computer Corp. formed.

Between 1965 and 1969, more than 4,000 companies are reportedly established in dp, laser, communications, integrated circuits, and automatic control businesses.

New products announced include Burroughs large-scale 8500 system—which is never delivered; Mohawk Data Sciences key-to-tape units; GE 115 from Olivetti; IBM 1130 small scientific system; NCR 500; and IBM 360/67 timesharing system.

DEC delivers first PDP-8s.

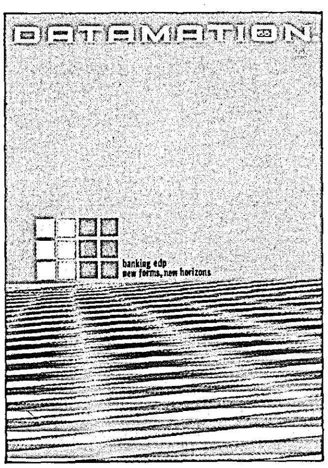
Carnegie Tech experiments with "portable" Teletype Model 33 (100 lbs.).

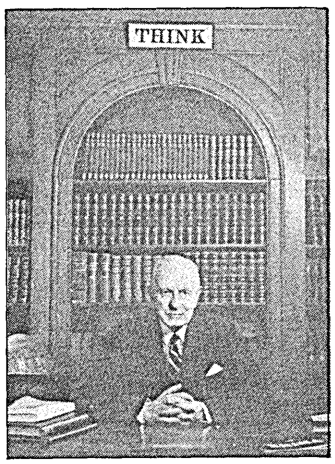
ARPA contracts with University of Illinois for parallel processing computer, ILLIAC IV.

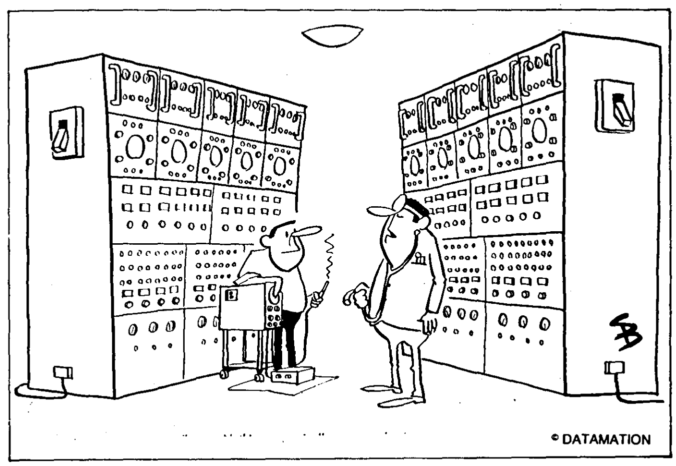
Early Bird satellite tests conducted for voice, data, facsimile; IBM, Associated Press, Pan Am, and RCA participate.

First IBM System/360s delivered in June with a minimum of software, consisting of an assembler, a linking loader, and IBM's best wishes.

ADR's Autoflow (automatic programming documentor) installations begin—first internationally marketed package.







". . . Nothing organically wrong, they're just incompatible."

Thomas J. Watson Sr. (above, center) headed IBM for 42 years, retired in 1956. The company that he molded is a reflection of his beliefs from research to sales.

DATAMATRON

Gung ho, automation!
And dinner gets cold
While daddy's debugging
And mommie grows old

Alone with our offspring
And memories proficient
Of times when by-hand
Was considered sufficient.

I too have a memory
With stored information
On years of togetherness
Pre-automation.

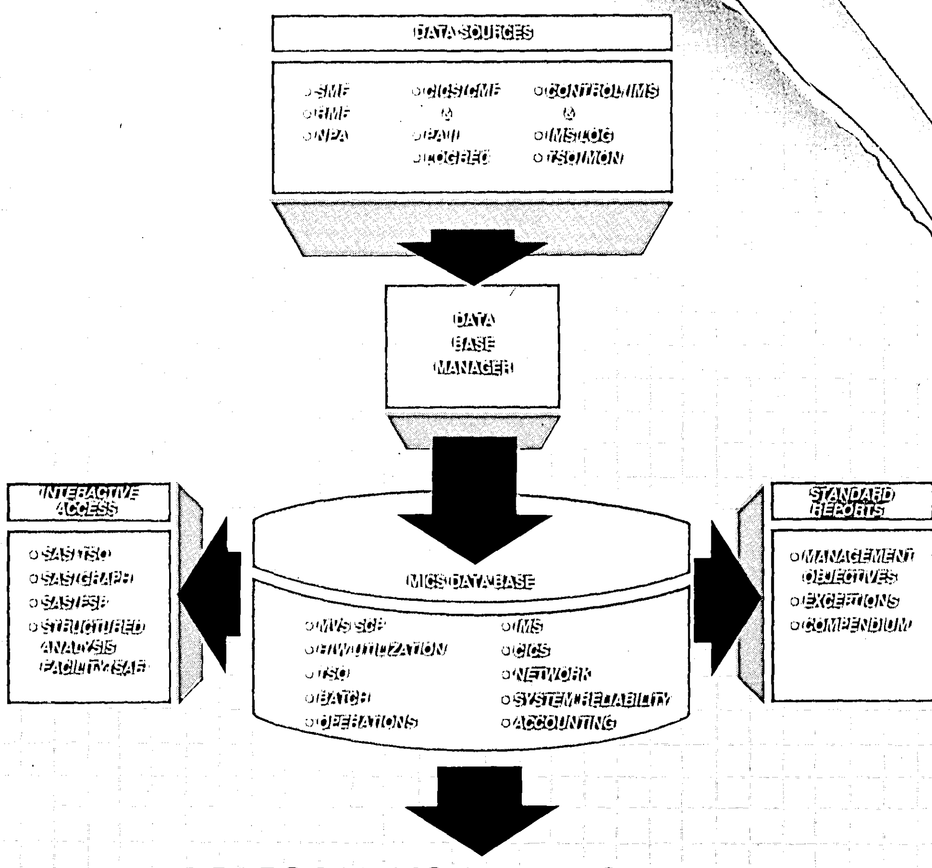
A girl from the office,
I'd know how to fight
But that's not where daddy
Is spending the night.

I've lost and I know it.
He thinks that it's fun.
Hey, how do you poison
A 1401?

Lou Ellen Davis

"In discussing the social impact of computers and automation, people often ask, 'How many are out of a job because of automation?' But the interplay between automation, technological change, cost, and demand very crucially affects the answer to the question. There can be no controlled experiment in which all other factors are kept constant while automation is introduced. So, we don't really know, and can't know." *Paul Armer*

SLA
MVS



- **PERFORMANCE MANAGEMENT**
- **CRISES REPORTING**
- **CAPACITY PLANNING**
- **INSTALLATION ACCOUNTING**

’66

United Airlines chooses Univac for advanced $39 million “everything” system (that will not work).

TWA chooses Burroughs for its $25 million version (that won’t work either).

Justice Department begins informal investigation of IBM.

FCC announces computer/communications inquiry.

GE’s dp losses put at over $400 million.

Honeywell buys Computer Control Corp., the pioneer minicomputer manufacturer.

Mini maker Interdata founded.

Hewlett-Packard enters the general purpose computer business.

Separate pricing of software begins...at SDS.

SITA launches first international message switching network for its 175 member airlines.

First automated credit bureau, Credit Data Corp., goes on the air.

Federal government reports 2,623 computers in use, 1,967 of them in the Defense Department.

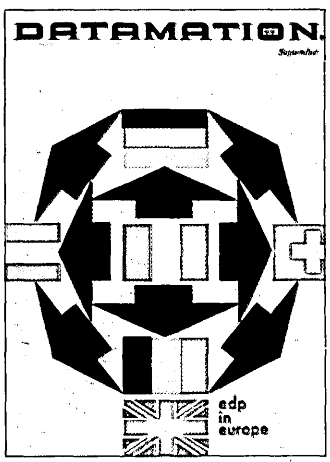
DuPont solicits bids for IBM-compatible tape drives, Telex wins, and the pcm industry is born.

New products announced include Univac 1108 II (tightly coupled multiprocessor); PDP-8S for under $10,000; SDS Sigma 7 and 2; Burroughs 2500, 3500 (works) and 6500 (never works); Honeywell DDP-516, first 16-bit compact mini; IBM 4pi military computer; BB&N commercial version of Mort Bernstein’s Rand tablet; Standard Computer introduces general purpose emulator, user microprogrammable; Univac EXEC 8 operating system for 1108 (announced just as EXEC 2 begins to run smoothly); DEC PDP-10 timesharing system; and Xerox telecopier-facsimile transceiver.

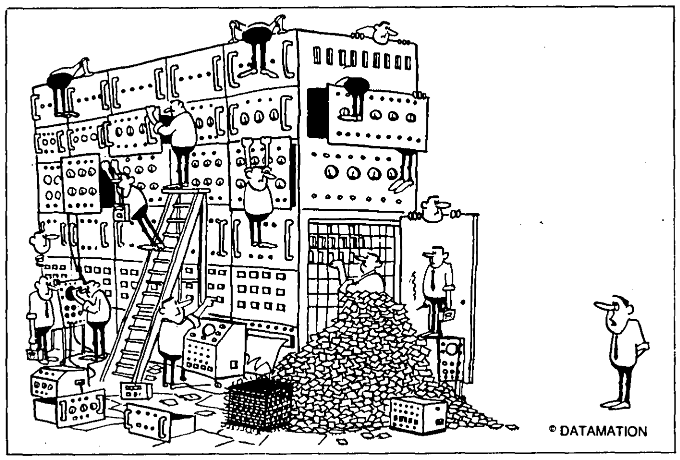
Livermore Radiation Laboratory Octopus network goes on the air with 48 Teletype terminals.

Rixon runs 4500 bps transmissions across Atlantic with Sebit modems.

Installations begin for Alltax (now an MSA package) tax preparation package.

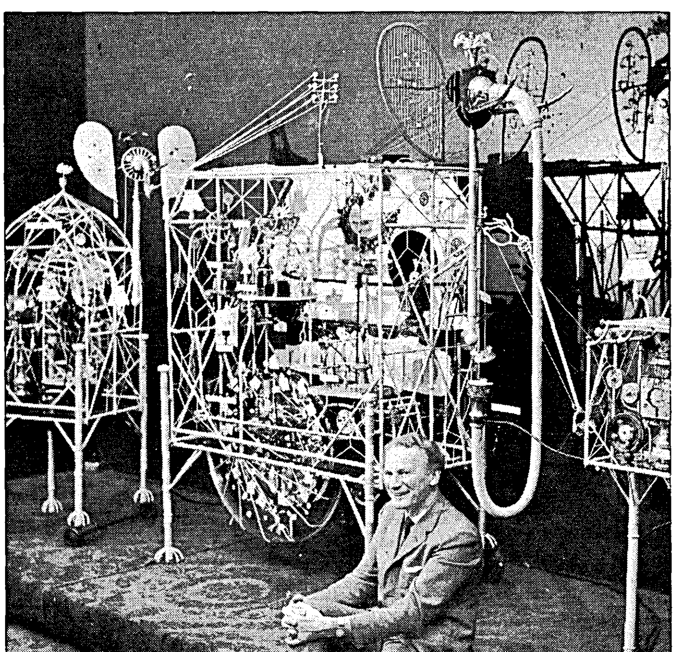


“Trouble?”



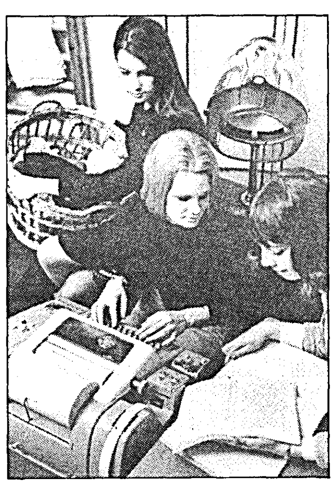
Honeywell’s Forget-Me-Not Computer (below), designed by English cartoonist Rowland Emett, was a big success at the Business Equipment Exposition.

Radcliffe coeds in dorm (below, right) go on-line with help of Harvard Computing Center.



“Timesharing is like wife-sharing—you can’t really make it work unless you have abnormal tastes.”

Unidentified government official



NEC's NEW ADVANCED PERSONAL COMPUTER GIVES CHARLIE THE BLUES.

If you're a businessman shopping for a personal computer, take a look at NEC. Our APC™ Advanced Personal Computer has better price/performance than any personal computer on the market.

It's a totally solutions-oriented system, supporting both CP/M-86™ and MS-DOS,™ developed to solve business problems in the simplest, most cost-effective way possible.

Our business software has been optimized to take advantage of the APC's unique hardware features. That makes system operation faster and easier.

Our software includes a full set of general accounting packages, word processing, mailing list management, business planning, database management, and communications. And we're readying many more.

We back our software with a unique unconditional guarantee. It will work or you get your money back.

Our APC comes with more information storage capacity than any system in its price range.

Our high-resolution color graphics run circles, arcs and lines around everybody else. The APC's screen images—lines, characters, pictures—are unprecedented in their clarity.

See for yourself how much better we are. The solutions-oriented Advanced Personal Computer from NEC. Return the coupon to NEC Information Systems, Inc., 5 Militia Drive, Lexington, MA 02173.

CP/M-86 is a trademark of Digital Research, Inc.
MS-DOS is a trademark of Microsoft, Inc.
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CIRCLE 46 ON READER CARD

'67

IBM stops taking 360/91 orders.

Computer Lessors Association is formed, visits Justice Department to complain of IBM's practices.

Charge card era gets boost as California Bank Card Association Master Charge system goes live.

First software package distributor, Computer Resources Corp., is formed by Robert Head.

Bunker-Ramo installs 10,000th Telequote III stock quote unit.

ADAPSO commences endless court battles over sale of dp services by banks.

IBM temporarily wins Air Force Phase II award . . . Honeywell protests.

Burroughs wins University of Illinois contract for ILLIAC IV parallel processing computer.

Reservations systems proliferate: CSC's Computicket, Ticketron, and Ticket Reservation Systems. Only Ticketron survives.

Control Data buys 10 companies, including perennially ailing CEIR.

Viatron Computer Systems formed to market $39 a month terminal.

French begin Plan Calcul for computer industry support.

Braniff is first with reservation crts.

Industry loss: Sam Alexander, 57, government adp leader.

New products announced include RCA Spectra 70/46, Informatics Mark IV information retrieval system; Interdata Model 16-bit mini; IBM 2780; Hewlett-Packard 2115A and 2116A; Teletype Model 37; and Tymshare Audio Magnetic Data Transceiver (first acoustic coupler).

RCA shows cryogenic memory cells.

IBM-Houston's (Tom Simpson) Houston Automatic Spooling Program (HASP) opens door to general use of remote reader/printer terminals.

IBM releases OS/MVT operating system and long-delayed, reduced function TSS system.

IBM delivers 360/91 to Goddard Space Flight Center, and trillion-bit photo memory (electron beam and film chips) to Lawrence Radiation Labs.

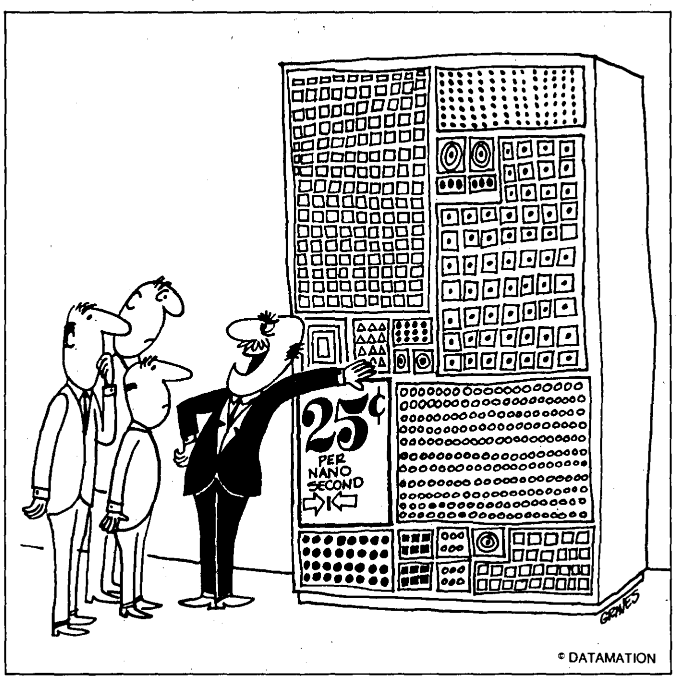
Bell Labs experiments with laser communications.

Fairchild delivers first ROMs (16 × 4 bit).

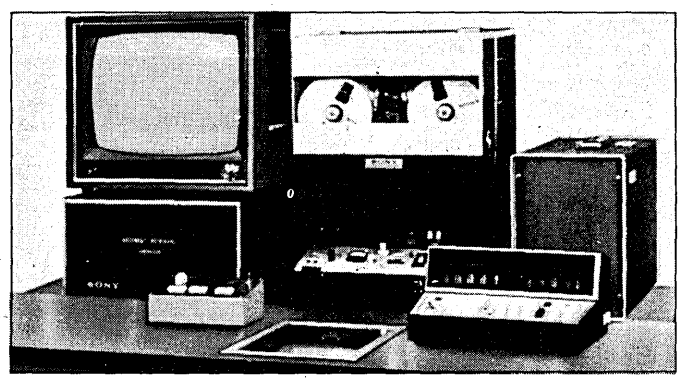
U.S. American Standards Institute accepts OCR (A) standard.

APL/360 released, the implementation of Ken Iverson's conceptual approach to defining a language for describing systems.

Publication of *The Art of Computer Programming* by Don Knuth.



"The accounting department helped us design our new timesharing system."

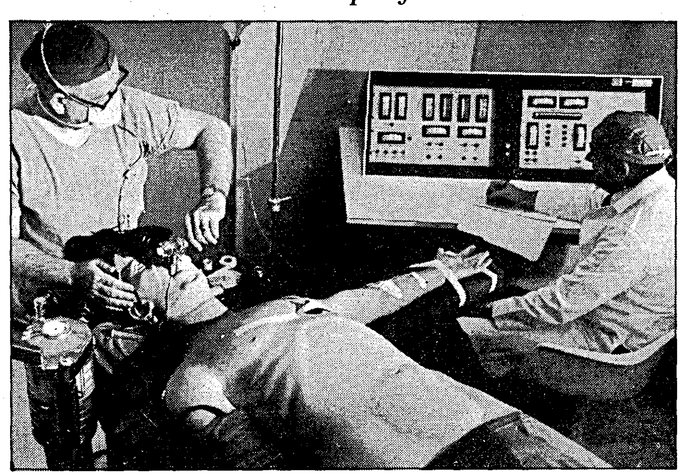


"Like war is too big to be left to the generals, so programming language design and implementation is too important to be left to one manufacturer."

360/65 user at University College of London professor Paul Samet

Sony's $20,000 Video Tape Document Retrieval System (above, right) stored copies of 8½ by 11 inch documents.

Anesthesiologists (right) practice on Sim One, a computer-controlled patient simulator.



’68

Trying to head off antitrust action, IBM: announces plans to unbundle in 1969; transfers time-sharing services to Service Bureau Corp; hires Nicholas Katzenbach as legal insurance.

Control Data buys 12 companies, including Commercial Credit Corp., and files antitrust suit against IBM and its "fighting" machines.

DEC departees form upstart mini-maker, Data General.

Phase II of Air Force Phase II contract: Burroughs with $60 million bid supplants IBM with $114 million bid.

Fund American sets up SSI Computer Corp. leasing firm, which becomes Itel Corp.

FCC renders Carterphone decision, allowing foreign attachments and interconnection to phone lines. AT&T counters with unpopular foreign attachment tariff.

International Computers Ltd., British hope, is formed by merger of ICT and English Electric.

U.S. COBOL standard officially approved.

Announcements of "nationwide network" plans escalate: ITT Data Centers, McCall Information Services, Fedder Data Centers, IBM Call/360, and CSC.

New products announced included CDC 7600 supercomputer (performs 20-25 MOPS); NCR Century Series, models 100, 200, and 400, featuring thin film rod memory; IBM 360/25 with writable control store, error correction, and specialized processors; IBM 360/85, with cache memory and bipolar circuits; General Automation SPC-8 for under $5,000 and SPC-12; Data General's first computer, NOVA, with braided core ROM and 32K memory; Precision Instruments laser tape memory, 13MB per square inch; and Viatron System 21 terminal, first to promise LSI.

AT&T offers wideband service, to 50 Kbps.

Univac EXEC 8 is installed after much user blood is spilled.

AT&T Picturephone II trials are held at Westinghouse.

GE develops bar codes.

First software patent #3,380,029 goes to Marty Goetz of Applied Data Research for a sort.

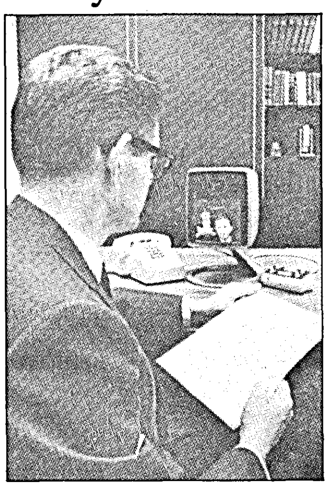
Pascal language is proposed by Prof. Niklaus Wirth.

Edsger Dijkstra writes his famous "GOTO considered harmful" letter.

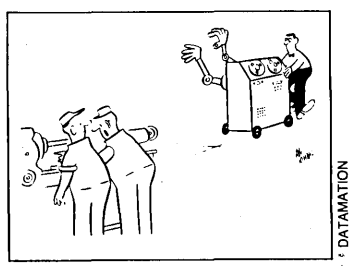
In April, IBM announces two new software packages: CICS, a teleprocessing monitor, and IMS, a database management system.

"Even if we accept the stirring notion that there can be well-designed, off-the-shelf, useful plug-me-in packages, it's painfully clear that some work has to be done to make this wonderful dream a less-than-nightmarish reality."

DATAMATION editor Robert B. Forest



Bell Labs developed picturephone Model II (left) for possible premiere in early 1970s.



"All these specifications done by computer! Next thing, they'll have computers to set up these machines!"

Control Data Corp.'s Seymour Cray (right) receives the W.W. McDowell Award at the SJCC.

I was born and raised around Poughkeepsie,
A programmer is what I had to be;
But IBM and its programming team
Have turned me into a debugging machine.

Running all my jobs under MVT.
Where a job can run and never be found,
And all you see is disks goin' round;
And when you get your output the results are nil:
If the JCL don't get you then the systems will.

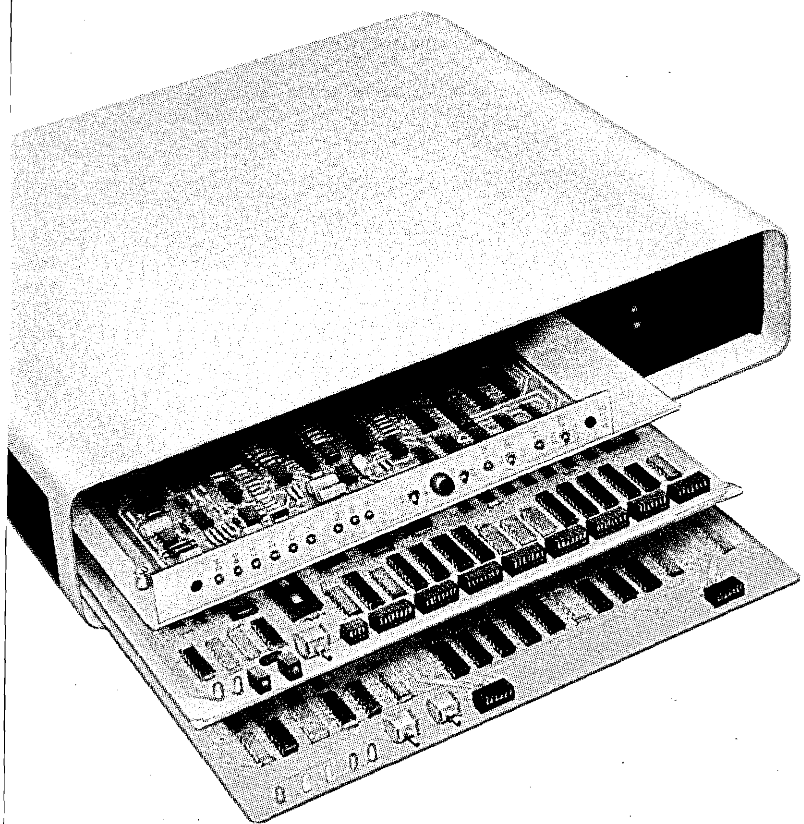
Jack P. Gelb

"Packaged programs are not new. . . . What is new today, however, is the increasingly important role that packaged programs are playing for many computer users, and the consequent rise of a whole new subfield of computer technology."

President, Software Resources Corp. and DATAMATION contributing editor Robert V. Head at the American Management Assn. EDP Conference

Minicomputer users:

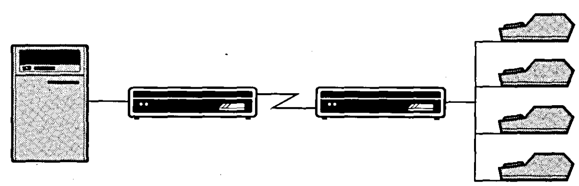
Timeplex offers a one-stop system solution for communicating with multiple remote terminals. Economically.



Asynchronous statistical multiplexer

Synchronous statistical multiplexer

High speed modem



The Timeplex E/SERIES is a complete data concentrator system designed to economically link clusters of remote terminals to your minicomputer.

E/SERIES: Cuts communications costs. Suddenly, saving communications costs by linking several terminals to one shared telephone line becomes easy.

Unlike the competition, the Timeplex E/SERIES simplifies the challenge of point-to-point communications by incorporating three functions in a single compact unit. One system offers you a statistical multiplexer supporting 4 to 16 asynchronous channels, *plus* an optional statistical multiplexer for an additional synchronous channel, *plus* an optional integral high speed modem.

E/SERIES: Puts it all together. Putting three functionally distinct modules in one enclosure eliminates external communications units and bulky, expensive cables. And, a minicomputer interface option further reduces costs. The result: System planning and installation is extremely simple. Reliability is enhanced. Costs are dramatically reduced.

Free step-by-step Guide. This easy-to-understand booklet contains all the facts on how to remote your terminals, simply *and* economically. Just write or call Timeplex for your free copy.

For the name of the E/SERIES stocking distributor nearest you, call 201-368-0736.

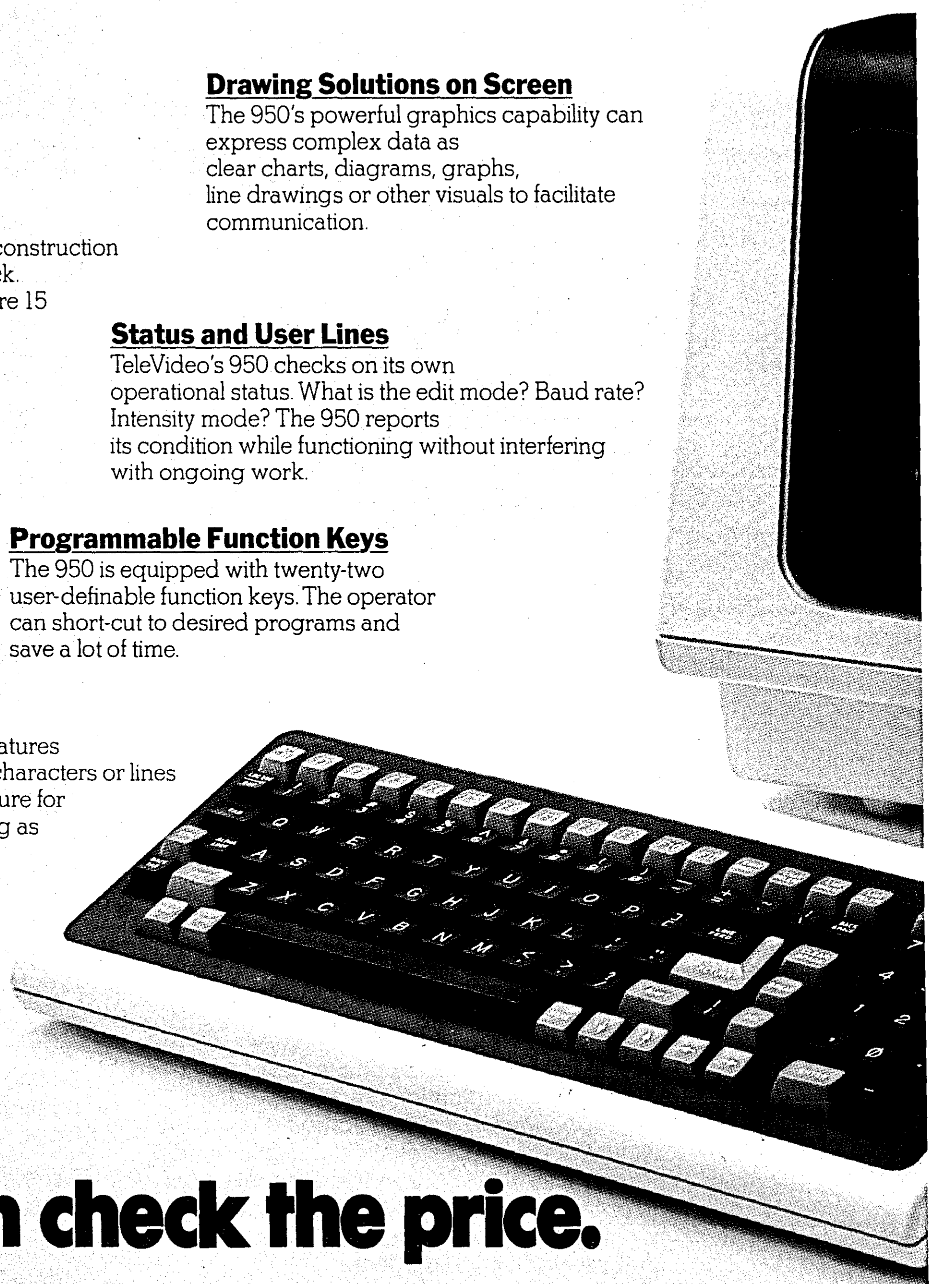
Timeplex, Inc./One Communications Plaza/ Rochelle Park, N.J. 07662.

Timeplex

The technology leader in data communications

CIRCLE 51 ON READER CARD

Before you buy any the features of



Drawing Solutions on Screen
The 950's powerful graphics capability can express complex data as clear charts, diagrams, graphs, line drawings or other visuals to facilitate communication.

Mean Time to Repair
Our simple design, quality components and modular construction make service easy and quick. Our average MTTR is a mere 15 minutes.

Status and User Lines
TeleVideo's 950 checks on its own operational status. What is the edit mode? Baud rate? Intensity mode? The 950 reports its condition while functioning without interfering with ongoing work.

Programmable Function Keys
The 950 is equipped with twenty-two user-definable function keys. The operator can short-cut to desired programs and save a lot of time.

Editing
TeleVideo's sophisticated editing features let you insert or delete characters or lines with a wraparound feature for maintaining data as long as you need it on screen.

Ergonomic Keyboard
The 950's detachable keyboard is made for operator comfort. Work close to the screen, or place it on your lap. You decide what is more comfortable and productive.

And then check the price.

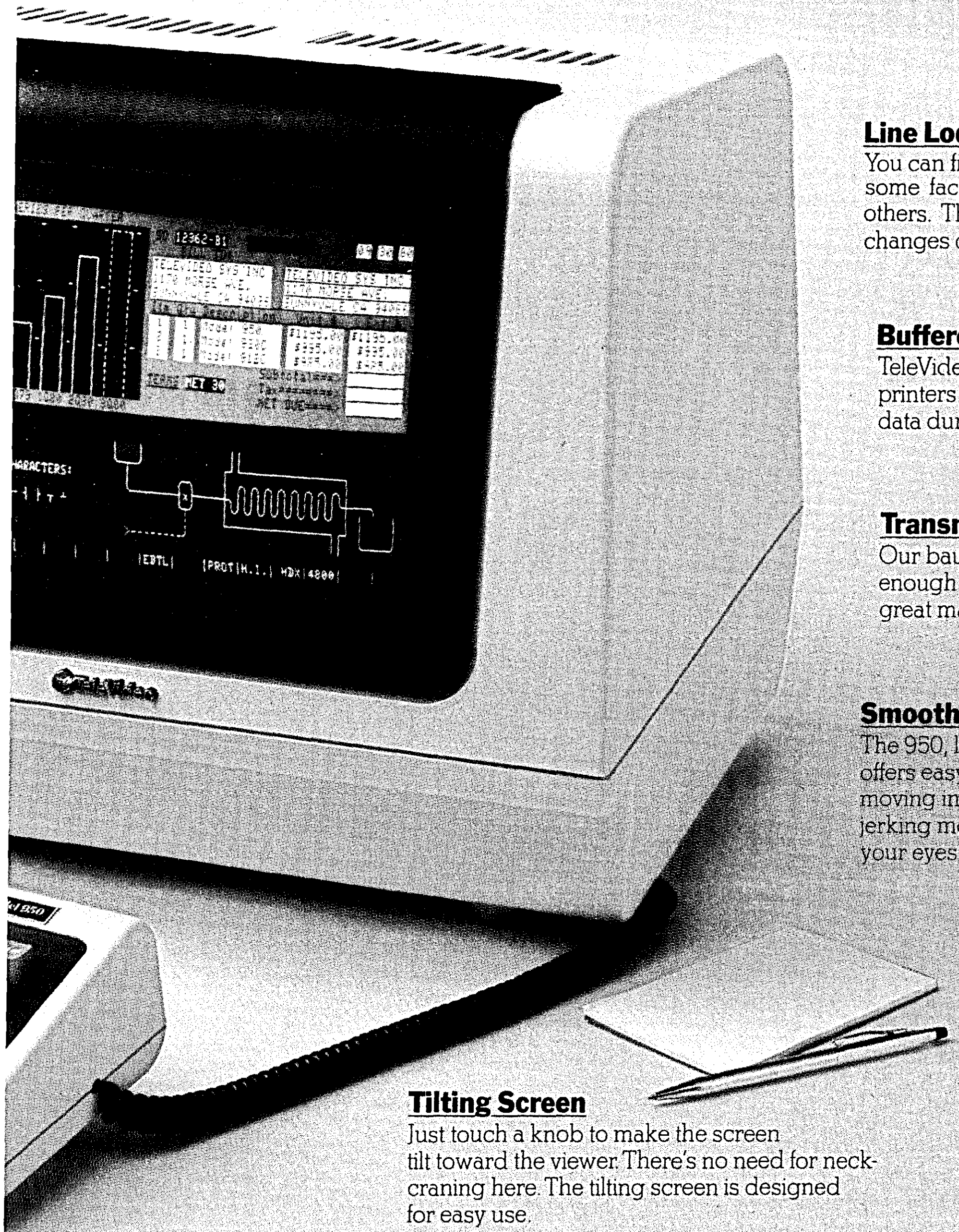
TeleVideo's 950 offers the features you'd expect in terminals costing much more than ours. And most of these features are also offered in our 925, at even a lower price. Both terminals are built with TeleVideo reliability, both engineered for high performance.

Whichever you choose, you can be assured of the same high quality and reliability, as well as nationwide service by General|Electric's Instrumentation and Communication Equipment Centers.

And TeleVideo builds to sales projections, and does not keep you waiting for delivery. That means if you order 200 TeleVideo terminals

California/Santa Ana 714-557-6095; Sunnyvale 408-745-7760; Georgia/Atlanta 404-255-9338; Texas/Dallas 214-980-9978; Illinois/Chicago Area 312-351-9350,

smart terminal, check TeleVideo's 950.



Line Lock
You can frequently reserve data by freezing some facts on screen while changing others. This feature eliminates inadvertent changes of field.

Buffered Print Port
TeleVideo's 950 can be used with printers of various speeds, so you won't lose data during slower peripheral cycles.

Transmission Speed
Our baud range is 50B to 19.2Kb, broad enough to accept data for the great majority of applications.

Smooth Scrolling
The 950, like all TeleVideo terminals, offers easy reading of fast-moving information, without those jerking movements that strain your eyes.

Self-testing
Remote troubleshooting feature determines if a service call is really needed, or if the operator can handle the problem. That saves time and money.

Tilting Screen
Just touch a knob to make the screen tilt toward the viewer. There's no need for neck-craning here. The tilting screen is designed for easy use.

today, we can ship them tomorrow.

To learn more about the 950, the 925 and the other terminals that have made TeleVideo the industry leader, complete this coupon, or call: 800-538-8725 (In California, 408-745-7760).

®TeleVideo Systems, Inc.

TeleVideo Systems, Inc.
Attn: Terminal Division
Dept. 209B
1170 Morse Avenue, Sunnyvale, CA 94086

I would like more information about TeleVideo's 950 and 925 terminals.

NAME____________________
COMPANY____________ TITLE________
ADDRESS__________________
CITY________ STATE______ ZIP______
PHONE #__________________

Suggested retail price for TeleVideo's 950, $1195; TeleVideo's 925, $995, excluding applicable state and local taxes — Continental U.S.A., Alaska and Hawaii.

Massachusetts/Boston 617-668-6891; New York/New Jersey 201-267-8805; United Kingdom/Woking, Surrey 44-9905-6464.

CIRCLE 52 ON READER CARD

'69

Justice Department, DPF&G, and Applied Data Research file antitrust suits against IBM.

GE convenes Shangri-La, a think-in to develop all-or-nothing master plan for its future product line.

Xerox acquires SDS for nearly $1 billion, 90 times earnings. "By 1975, the price won't matter," says Xerox.

UCC unveils plans for Datran—nationwide, non-AT&T, digital communications net.

Nearly 1,000 commercial banks are offering computer services.

U.S. Court of Customs and Patent Appeals rules on Prater and Wei: a computer program can change a general purpose computer into a patentable special purpose machine.

Control Data inaugurates Cybernet network.

Presidential Task Force on Communications Policy concludes that regulation of the data processing industry is unnecessary.

Computervision and Applicon, CAD/CAM leaders, are founded.

Industry losses: Ascher Opler, 52, "wise man in residence" at IBM Watson Labs, DATAMATION, and the industry in general; John Haanstra, GE executive thought to be key to computer future there.

New products announced include Honeywell 316 mini; IBM System/3 small business system with FLC technology (Funny Little Card with 96 columns, to Herb Grosch's outraged screams); and Computer Transmission optran infrared data transceiver.

Bell Laboratories demonstrates bubble memory, stopped dead by semiconductor economics.

IBM talks of 360/195 and delivers 360/91 to Oak Ridge National Laboratory.

Westinghouse electron beam recording reaches 4 million devices per square inch; "could make a whole computer on a chip" but didn't.

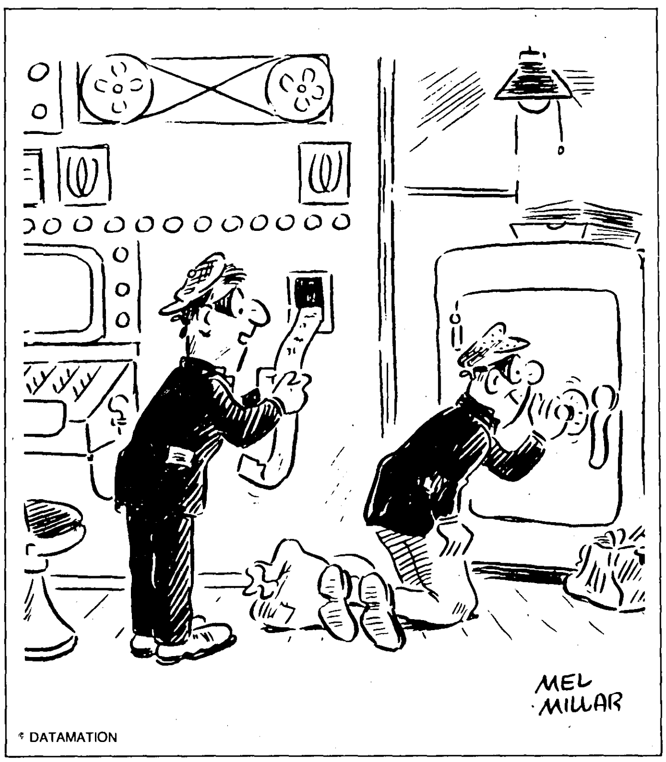
MIT Multics t-s system is up.

Advanced Research Projects Agency ARPANET computer-computer network goes live.

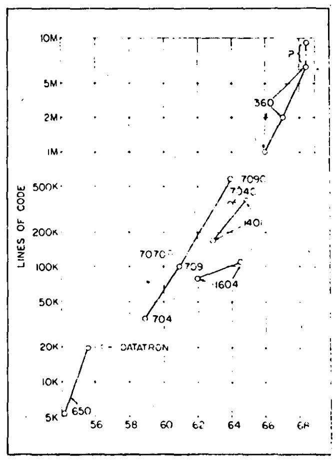
Richie and Thompson, in a tiny, top-floor room at Bell Labs, invent a useful operating system for themselves, dubbed Unix.

First installations of Cincom's TOTAL DBMS; ADR's Librarian source program management package; Pansophic Panvalet library management package; and University of Waterloo WATFIV (FORTRAN compiler).

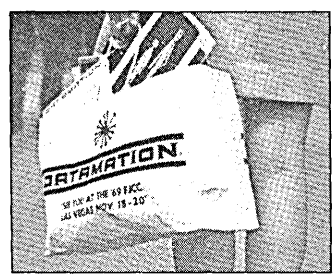
Publication of *Think* by William Rodgers.



"36 right, 17 left . . ."



GROWTH IN SOFTWARE REQUIREMENTS LINES OF CODE



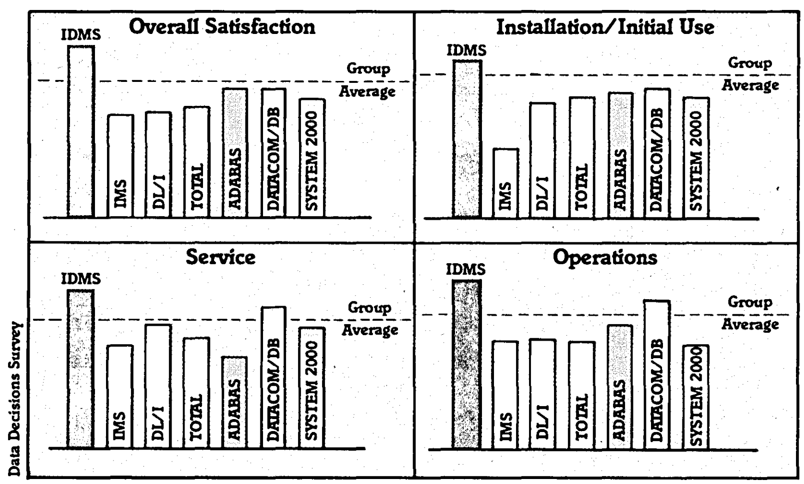
SJCC attendee (above) loads up on literature.

"I think the time has come to legislate the computer so that a man can have access to his credit data to correct errors. The national databank is out of the question for at least a few years, but there are plenty of local databanks in existence and there must be due process to control them. Safeguards against system judgments are necessary now."

Professor of public law and government at Columbia University
Alan F. Westin

Enough said.

Data Decisions' 1981 survey shows Cullinane's Integrated Database Management System (IDMS) to be the number one choice among DBMS users. Once again, IDMS has achieved higher ratings than any competitive product in the categories of reliability, ease of installation and use, quality of technical support and overall satisfaction. Additionally, a recent Datapro Research survey shows IDMS to be #1 in more categories than any competing database management system.



What does this mean? It means that IDMS continues to live up to our promises of high performance and ease of use. That the quality of our documentation and training remains unsurpassed. And that our customer service is faster and more thorough than any other supplier's. Who says so? The most impeccable source available — the industry's DBMS users.

Find out more about the database management system that's consistently at the top of the charts. Attend a free seminar in your area. For more details, just fill out and mail the coupon.

☐ Please send me an IDMS seminar schedule.
☐ Please send me more information about IDMS.

Name ______________________ Title ______________________

Company ______________________

Address ______________________

City ____________ State ____________ Zip ________ Telephone ( ) ____________

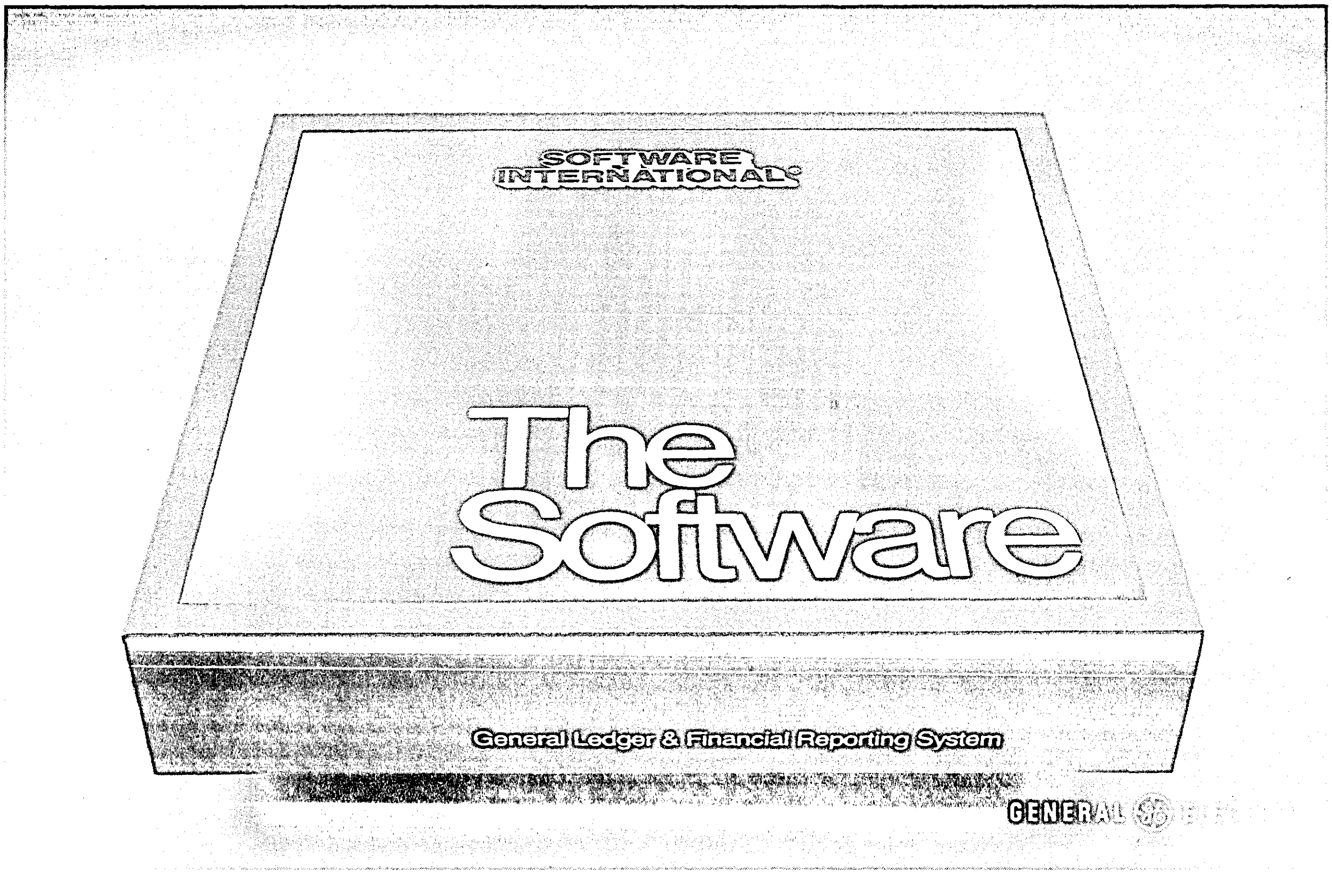
My computer is ______________________

Mail to: Rosalie Cope, Cullinane Database Systems, Inc.
400 Blue Hill Drive, Westwood, MA 02090
Phone (617) 329-7700

C Database Systems

Database: Cullinane

CIRCLE 53 ON READER CARD



No other General Ledger provides as much easy-to-use reporting power. Some systems have as many as three different report writers. But with our powerful Variable Report Writer and simple English instructions, users can generate almost any report, any time, in the format best suited to meet their needs.

Even better, users can have access to current, on-line information at virtually any time and at virtually any summary level.

The Software International General Ledger can be installed quickly. Many users report that within a few short months, they are closing their books faster, producing reports in hours instead of days, and generating more relevant information for business decisions.

Because no business operates solely from a General Ledger, our system interfaces with our top-quality Accounts Payable, Accounts Receivable, Fixed Asset, and Payroll/ Personnel packages to form a comprehensive financial database.

Best of all, THE SOFTWARE gives you something extra: *Confidence.* Confidence in first-class, thorough training and documentation. Confidence in continual product enhancements and stringent quality control. And confidence in our customer support because of the high caliber of our people. As part of General Electric Information Services Company, we are a member of a worldwide family of computer and business professionals.

More account-ability is the most important reason why more than 4,000 users worldwide selected our General Ledger over the competition.

Call or write today. You'll see that THE SOFTWARE delivers confidence you can account on.

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Australia, Brazil, Colombia, France, Guam, Hong Kong, Israel, Italy, Malaysia, Mexico, Netherlands, Norway, Saudi Arabia, Singapore, South Africa, Sweden, United Kingdom

CIRCLE 54 ON READER CARD

'70

DATAMATION goes twice monthly, causing industry collapse.

J.C. Penney unplugs GE's big retailing system, TRADAR, damaging GE computer fortunes.

For financial considerations, ADR and DPF&G end IBM suits.

Two of the big three in computer services fade: Computer Applications Inc. liquidates and Computer Usage shrinks.

United Airlines ousts Univac, TWA sues Burroughs for misrepresentation and breach of contract. IBM picks up the pieces.

CSS Inc. and Interactive Data Corp. are survivors in the rubble of 360/67-based timesharing firms.

Militants attack computer centers. At University of Wisconsin Mathematics Research Center toll is one human, four machines.

IBM enters photocopying field; Xerox sues for patent infringement.

Fujitsu enters U.S. briefly through Automation Sciences.

Japan blocks entry and transpacific offerings of U.S. network services firms.

Gene Amdahl forms Amdahl Corp. to make IBM plug-compatible mainframes.

Third-party maintenance firm, Comma Corp., is formed.

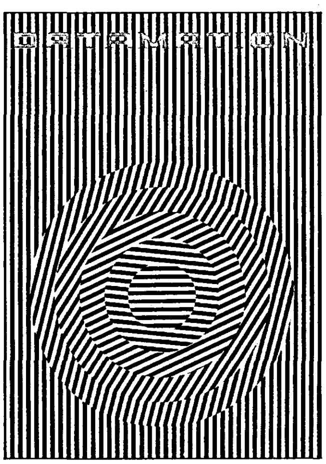
New products announced include IBM's new family, System/370, models 145, 155, 165; 3330 disk drives, cache memory; RCA models 2, 3, 6, and 7 with guaranteed conversion from 360s, and virtual storage; DEC PDP-11 with Unibus; Evans & Sutherland 3-D graphics systems, LDS-1; Sperry Univac top-end 1110 (potential users miss the imperfections that make this system weakest of all the 1100s); Data General Supernova SC, first all-monolithic memory computer; Xerox Sigma 9; Datapoint 2200; Fairchild 200 nsec memory at under 10¢ per bit; Advanced Memory Systems solid-state disk; Intel 1K ROM chip; Cambridge Magnetic Domain Memory; Corning terminal with photochromic glass store, the world's most expensive Teletype-compatible terminal and a classic "solution in search of a problem to solve"; and Bunker Ramo LSI computer for military (4½ lbs.).

IBM repackages 2314 disk drives, creates 2319 and a hatful of lawsuits.

Xerox introduces dial-up on-line maintenance for cpus.

ADR receives patent for Autoflow.

MRI begins installing System 2000 DBMS.



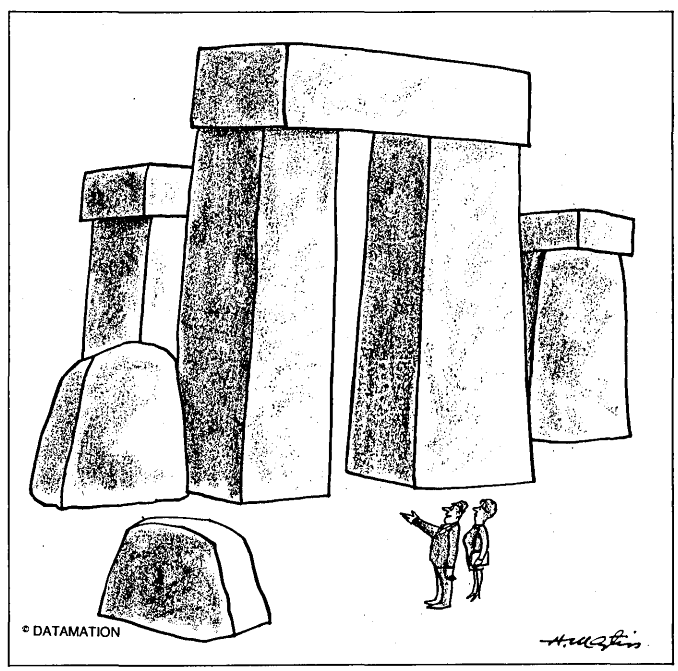
DATAMATION award-winning cover (above, left) featuring security of information.

Humorist Art Buchwald (above, right) lambastes and lampoons everybody at the FJCC luncheon.

"You can start small, stay small, and die small...Or you can start big, get big, and die big."

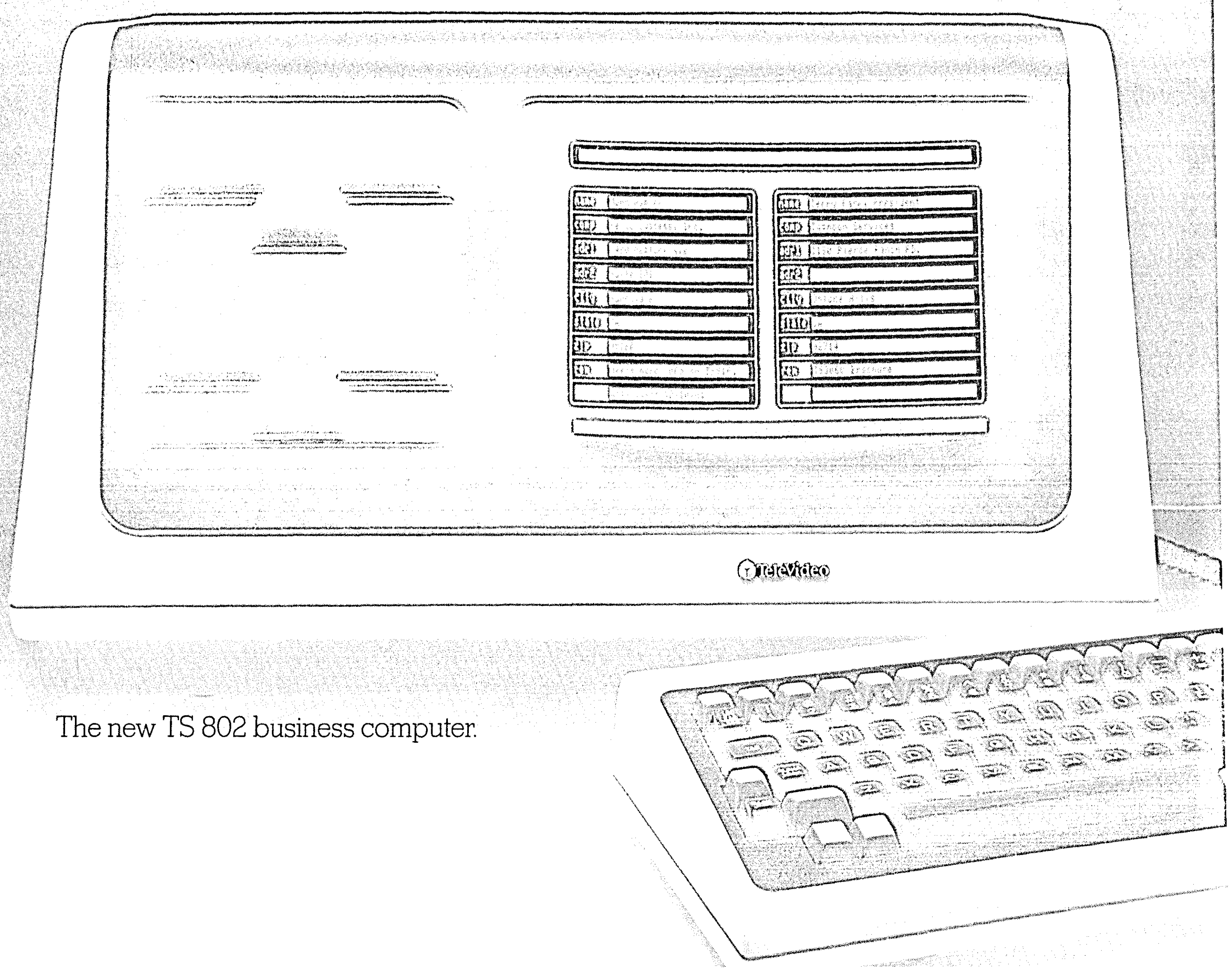
Former president of Viatron Computer Systems Corp. Dr. Edward M. Bennett

"This, Margaret, was the System/360 Model 195 of its day."



TO BECOME THE LEADER IN TERMINALS, TELEVIDEO HAD TO GIVE YOU MORE.

WE'RE STILL GIVING YOU MORE WITH OUR NEW SMALL BUSINESS COMPUTERS.



The new TS 802 business computer.

In three short years, TeleVideo became the number one independent supplier of CRT terminals in a very competitive marketplace.

We did it by designing and building terminals with more performance, reliability, features and functions than the competition.

But at a lower price.

Now TeleVideo has entered the even more competitive microcomputer marketplace. And we intend to repeat that success with the same basic philosophy:

By providing big system performance and features. And TeleSolutions—a hardware/software package that includes word processing and financial planning software programs.

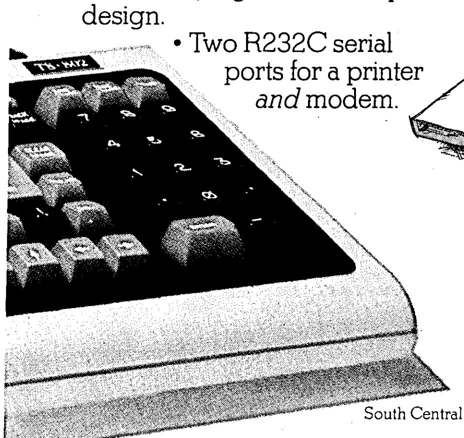
For a price lower than many of the low performance personal computers.

TELEVIDEO'S TS 802 AND TS 802H. THE COMPUTERS THAT GIVE YOU MORE.

The TS 802 is TeleVideo's lowest priced computer.

Yet it gives you many more of the important features found only in larger computers costing much more.

- Like modular design for easier maintenance.
- High speed Z80A microprocessor with 64K bytes of RAM main memory—enough memory to handle most business applications.
- The CP/M operating system, which is included at no additional cost to give you access to more microcomputer software programs than any other operating system.
- An upward growth path through a unique multiple processor, building block architecture.
- Dual 5¼ inch double density diskettes with a million bytes of unformatted storage capacity.
- A high resolution, non-glare video screen with detached keyboard—just two examples of our innovative, ergonomic computer design.
- Two R232C serial ports for a printer *and* modem.
- And a high speed port for plug-in expansion to a larger multi-user, multi-tasking TeleVideo computer system.
- But suppose you need more storage. TeleVideo's next model up, the TS 802H, gives you all the same features of the TS 802. But instead of two floppy diskettes, it uses one floppy diskette and a 5¼-inch Winchester hard disk to give you 9.6 million bytes of unformatted storage capacity—nearly 10 times the storage for only twice the price of the TS 802.



COMPUTERS THAT GROW AS YOUR NEEDS GROW.

The TS 802 and TS 802H are more than just single-user, stand alone computers.

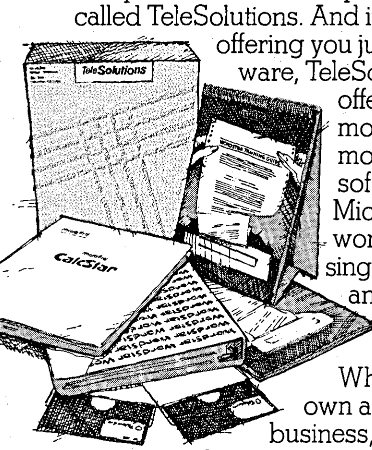
When it's time to expand, simply plug them into TeleVideo's more powerful TS 806 or TS 816 multi-user, multi-tasking systems. The TS 802s then become intelligent, fast response satellite stations.

And because each has its own CPU, there's none of the degradation of throughput and contention for a single CPU that slows down the typical shared system. Each user maintains full processing capability in a shared file environment.

With TeleVideo, there's no obsolescence. Because of the unique multi-CPU architecture and TeleVideo's multi-tasking software, the TS 802s do not have to be replaced as your data processing needs grow.

TELESOLUTIONS. THE SOFTWARE PACKAGE THAT GIVES YOU MORE.

Instead of offering you just a business microcomputer, TeleVideo is offering a computer and software package called TeleSolutions. And instead of offering you just any software, TeleSolutions™ offers you the most popular, most versatile software: MicroPro's® word processing WordStar™ and business planning CalcStar™. Whether you own a small business, manage a department in a company, or are your organization's DP manager, the combination of TeleVideo computers with WordStar and CalcStar gives you the quality text editing and financial planning help you'll need. If you do require more software, our CP/M operating system allows you to choose from the widest variety of microprocessor software.



When you buy either the TS 802 at $3,495* or TS 802H at $5,995,* TeleVideo includes WordStar and CalcStar for a special price of $500—a savings of nearly $300.

WORLDWIDE SERVICE.

TeleVideo's small business computers are serviced by TRW's nationwide service network, and by distributors around the world.

THE BETTER BUSINESS SOLUTION? PROVE IT TO YOURSELF.

Before you begin evaluating business computers make a list of what you'd like one to do for you. Then bring that list to one of TeleVideo's computer dealers throughout the world. Sit down at a TeleVideo® computer. Study the TeleSolutions Package. Even try another computer. Compare the features, the functions, and the performance.

And compare the price.

We don't think you'll find a better business solution than TeleVideo and TeleSolutions.

For details and the address of your local distributor call toll free 800-538-1780. And in California call 415-745-7760.

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TeleVideo Systems, Inc.
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Sunnyvale, CA 94086

Please send details on TeleVideo computers and TeleSolutions to:

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COMPANY__________
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PHONE # (_____)__________

*Prices are suggested retail excluding applicable state and local taxes—Continental U.S.A., Alaska and Hawaii.

Northeast Region 617/369-9370; Eastern Region 212/308-0705; Southeast Region 404/447-1231; Midwest Region 312/969-0112; South Central Region 214/258-6776; Northwest Region 408/745-7760; Southwest Region 714/752-9488; European Sales (Holland) 31-075-28-7461

’71

IBM hits Financially Troubled Memorex (henceforth, FTM on Wall Street) with trade secrets suits.

Viatron Computer Systems announces $40 million tax-loss carry forward, files for bankruptcy.

RCA abruptly announces withdrawal from computer business. Univac purchases customer base for $70 million.

Discovery phase in IBM antitrust cases begins with an IBM questionnaire to 2,700 companies.

Honeywell wins the controversial Worldwide Military Command and Control System contract for $51.3 million.

Greyhound Computer Corp. files suit against IBM.

Government plans COBOL validation center at National Bureau of Standards.

T.J. Watson Jr. steps down at IBM; T. Vincent Learson briefly reigns.

Another mini maker, Prime Computer, spins out of Honeywell and other Route 128 companies.

After at least 2,000 man-years, IBM drops work on timesharing TSS/360 software.

ENIAC's 25th birthday is celebrated.

New products announced include Honeywell HIS 6000 series with "advanced business unit," commercial attached processor; IBM 3270 crt terminal with light pen; Interdata Model 1 mini; Control Data Cyber 70; Hewlett-Packard HP 3000, 2100; Intel 4004, 4-bit microprocessor (looking remarkably like Vic Poor's original ideas—at Datapoint); and Goodyear's STARAN, content addressable memory.

First 370 delivered, a 155 to Zayres department store in Boston.

IBM releases TSO operating system, too little, too late.

RCA develops first full-scale all-optical memory, for NASA.

Unicon laser memory is tested (with dubious results) at NASA Ames.

The first Sigma 9 is installed two years after SDS disappears.

Datapoint delivers 2200 business processor with built-in microprocessors.

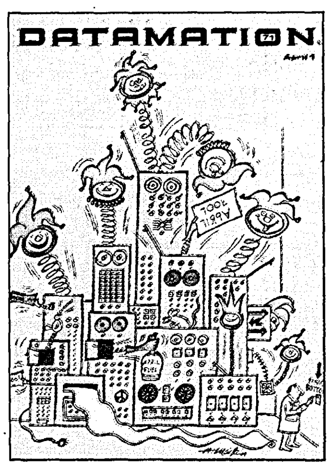
MCI begins service after eight years of fighting AT&T.

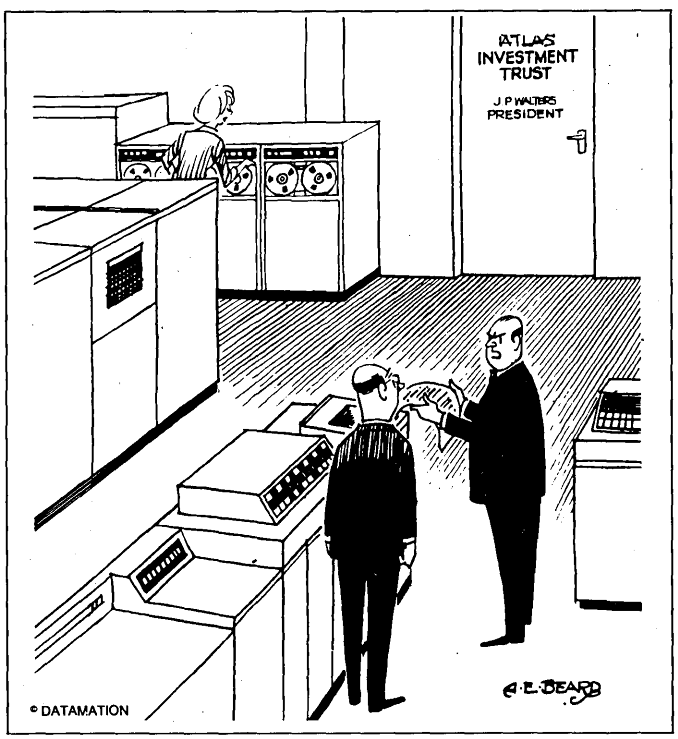
“The man in the street is nervous. He has seen the same problems that appeared at the start of the computer era repeated with every new application. He has seen that computers can turn out garbage faster than a human being ever dreamed of doing.”

DATAMATION contributing editor Daniel McCracken

New IBM president, Frank T. Carey (above, right).

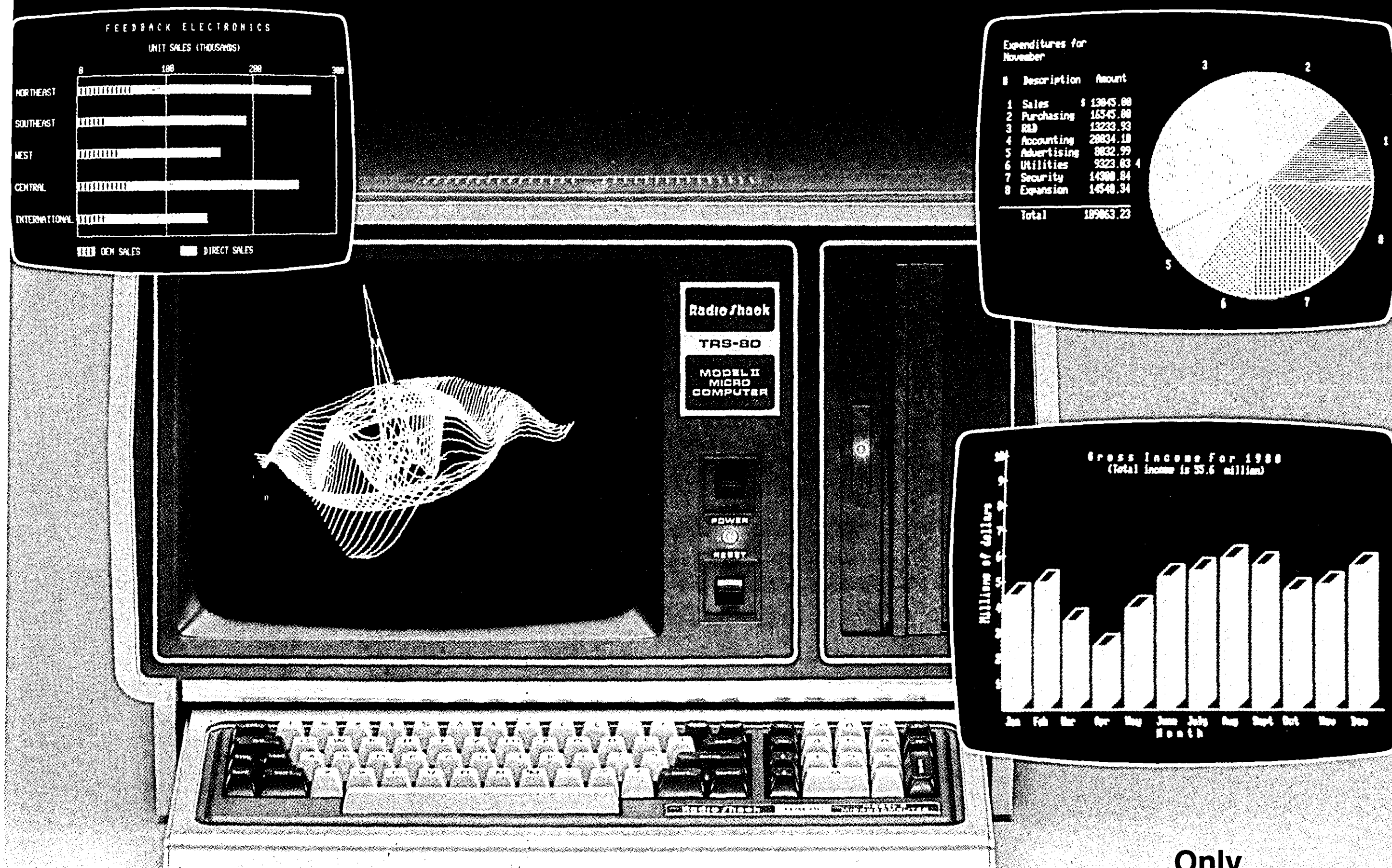
New IBM chairman of the board and chief executive officer T. Vincent Learson (above, left).





“I'd have more confidence in its impartiality if it didn't keep recommending computer stocks.”

Radio Shack Introduces Hi-Res Graphics for the TRS-80® Model II



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In addition, there's a library of assembly language subroutines that makes the Graphics Option even handier for those who are familiar with COBOL, FORTRAN or Assembler.

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CIRCLE 56 ON READER CARD

'72

DATAMATION goes monthly.

Philips, Siemens, and CII announce plans to create a European computer venture, finalized as Unidata in '73.

Japan develops plans for the "Information Society of the '80s."

At SJCC, AFIPS bans one of its own publications, *Government Regulation of the Computer Industry*.

Greyhound case against IBM temporarily dismissed but Telex and Levin file suits.

On-line theft of computer program leads to civil and criminal convictions for University Computing employee.

IBM announces plan to spend $40 million on data security.

Seymour Cray leaves CDC to form Cray Associates.

Itel sues to stop IBM from withdrawing maintenance on cpus with add-on memory...and wins (instant replay in France and Germany in 1973).

Two industry leaders die: young CSC multimillionaire Fletcher Jones, and Honeywell computer chief (from 1955 to 1967) Walter Finke.

Computer Industry Association is formed, expanding beyond peripheral makers as members.

New products announced include B1700 with hardware language processors and bit-addressable memories; HP-35 handheld calculator for $395; IBM 158 and 168, plus DAT box for 155 and 165, new memories with 1K bit chips, virtual memory; Intel 8008 full 8-bit microprocessor; Diablo daisywheel printer; Microdata dual-cpu mini; Prime 200 mini; Intel 2K 1702, first erasable PROM; Bell Dataphone 4800; ICC 2400 bps dial-up modem; First automated voice recognition supermarket checkout system, from Threshold Technology; and Informatics Production IV, integrated manufacturing system.

First deliveries of IBM 3270 terminals begin.

Domain tip, bubble-like (DOTRAM) memories become commercially available, but not for long.

Rockwell delivers first operational bubble memory.

Installations begin for Software ag's DBMS, ADABAS; Whitlow Syncsort sort/merge package.

Jean Sammet's count of high-level languages crosses the 200 mark.

Publication of *Psychology of Computer Programming* by Gerald Weinberg.

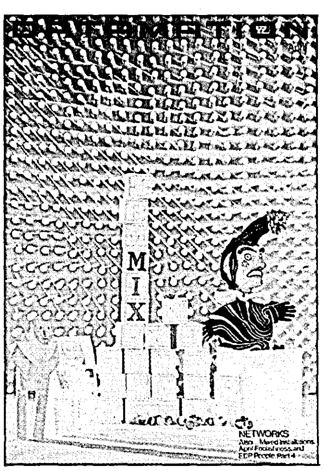
"The database management systems [DBMS] has captured the imagination and sometimes the fantasy of many influential figures in the data processing world. With a blinding, sensuous flash, DBMS concepts have caught us up in fascination while sometimes obscuring the real, practical issues of data processing."

Assistant vice president and manager of the advanced systems group, Banker's Trust Co., Albert C. Patterson

James M. Morris (above) named DATAMATION publisher.

"I'm stirring up a little trouble for AT&T. Care to add anything?"

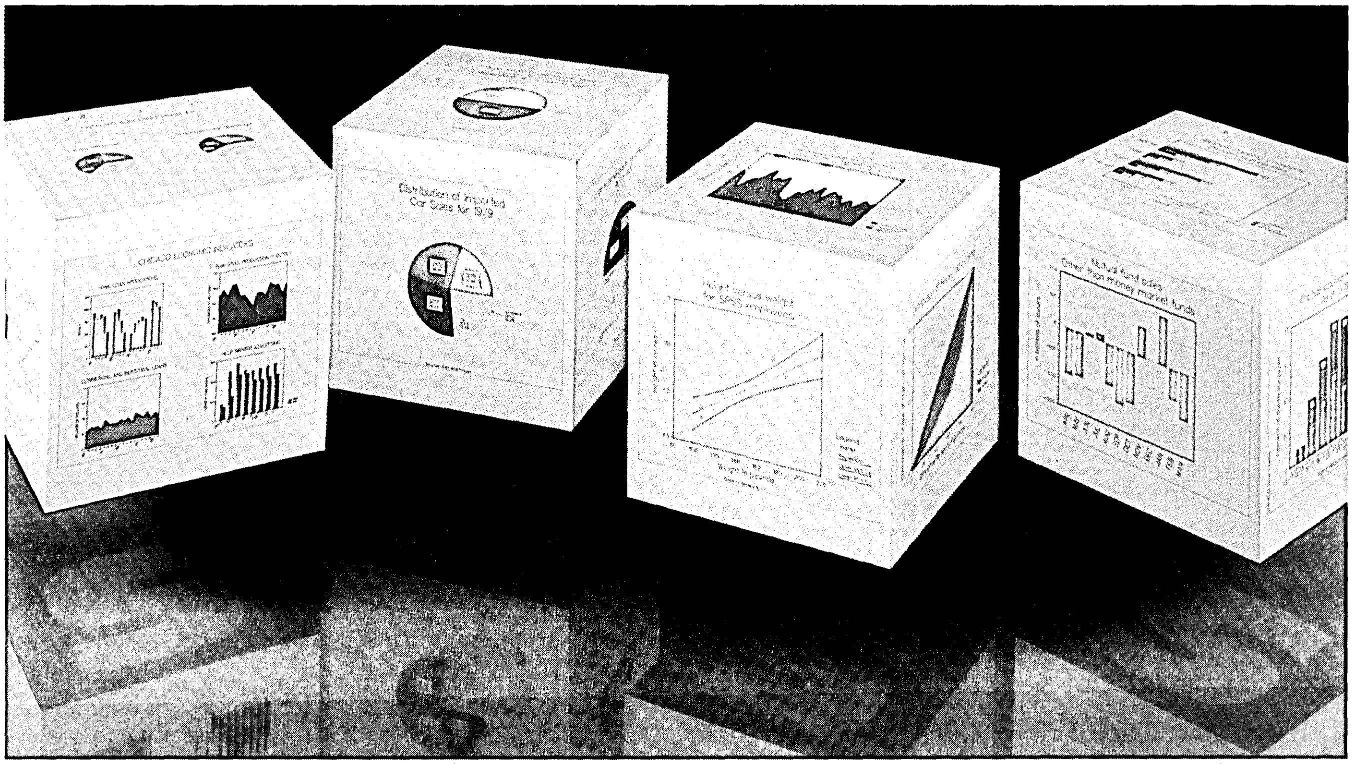
© DATAMATION



RCA's L. Edwin Donegan Jr. (below) applied IBM methods without IBM resources.

Budding city planners (below) get hands-on help at Shelters for Mankind conference.

GRAPHICS MADE SIMPLE



Now the world's leading producer of computer software for data analysis—SPSS® Inc. —and the world's leading producer of graphics software —ISSCO®—have developed the most useful graphics package you can find—at any price. It's SPSS Graphics: the state of the art in versatility, range of options, simplicity, and "artistry".

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Take control over form and content.
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CIRCLE 57 ON READER CARD

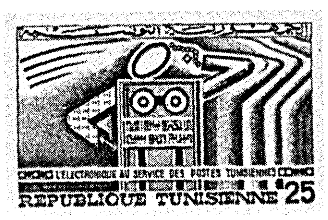
'73

- Settling with IBM, CDC gets Service Bureau Corp., contracts, legal fees in return for destroying its case index and data.
- IBM loses round one in Telex case, though judge fines Telex for trade secret theft. Decision later reversed.
- Computer used in Equity Funding Life Insurance scandal.
- Atanasoff named inventor of electronic digital computer.
- Nixdorf buys Victor Comptometer Computer Division.
- Telenet Communications Corp. is formed
- Sweden passes data protection law, sparking transborder data-flow issue.
- EEC begins "informal" investigation of IBM.
- Pitney Bowes-Alpex point-of-sale company succumbs.
- Moscow exhibits 360-like RIAD.
- AT&T invades dp turf with Dataspeed 40 crt terminal.
- Supermarket industry adopts Universal Product Code.
- CalComp, Transamerica, Hudson General, Memorex, and Marshall Industries file suits against IBM.
- IPL Systems is formed.
- Industry loss: Dr. Howard Aiken, designer of the Automatic Sequence Control Calculator, Mark I, at Harvard.

- New products announced include IBM 3420 magnetic tape drive; Computer Automation Naked Mini/LSI powerful one-card mini; HP 2100S with user-programmable ROM; Xerox page printer, one page per second; Microdata Reality mini with English programming; National Semiconductor six-digit calculator for for Christmas, $39.95; Teledyne microcomputer, 16 bits, 25 grams; Conrac TTY PLUS, first for under $1,000; Intel 8080 chip; and Vadic VA3400, first full duplex dial-up modem.
- IBM Zurich Research Laboratory has Josephson Junction working.
- ILLIAC IV parallel processor passes tests at NASA Ames.
- GE makes Multics timesharing system commercially available.
- Carnegie Mellon Multi-Mini-Processor (MMP) is operational with 16 PDP-11s.
- Dartmouth TSS becomes commercially available.
- First Hitachi 8800 (with 4 cpus) goes to Tokyo University.
- Cullinane's IDMS database management package installations begin.

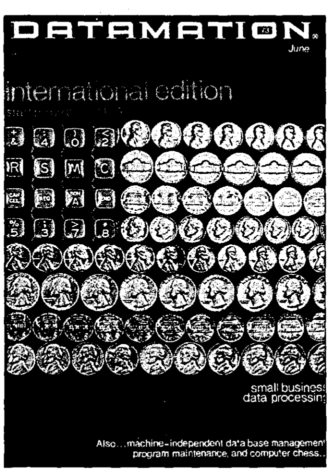
"That defendants, and each of them, so carelessly, negligently, and wantonly designed, constructed, and manufactured said data processing equipment that said equipment could be used for any business for the purpose of defrauding the public."

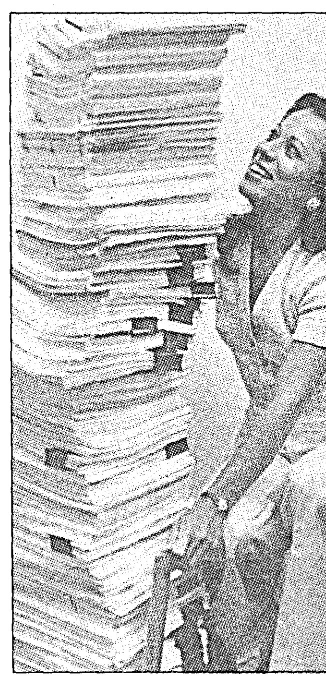
Lawsuit filed against Equity Funding, IBM, and several thousand unknown defendants.



Memorex president Laurence L. Spitters (above, right).

Sky-high stack of documents produced in IBM-Telex suit (below, right).





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CIRCLE 58 ON READER CARD

'74

Four antitrust suits filed against AT&T: Justice Department, MCI, Jarvic Co., and Milgo-ICC.

IBM proposes to buy 55% of CML to enter domestic satellite business.

Privacy Act of 1974 is passed, providing protection against government database misuse.

MCI wins battle for local loops on an "equitable basis" from AT&T.

IBM and detectives break international spy ring suspected of peddling IBM trade secrets.

More "big system" blues, as CDC writes down $30 million after losing Union Bank contract in Switzerland.

Dp managers' salaries average $477 a week.

Hinky Dinky and First Federal Savings & Loan Association start pilot to offer bank services via terminal in supermarkets.

Chase Manhattan and Equitable Life offer EFT system for California policyholders.

Dr. Toshio Ikeda, responsible for Fujitsu computer success, dies.

Perkin-Elmer acquires Interdata.

NCR wins $60 million POS contract from J.C. Penney.

Tandem founded.

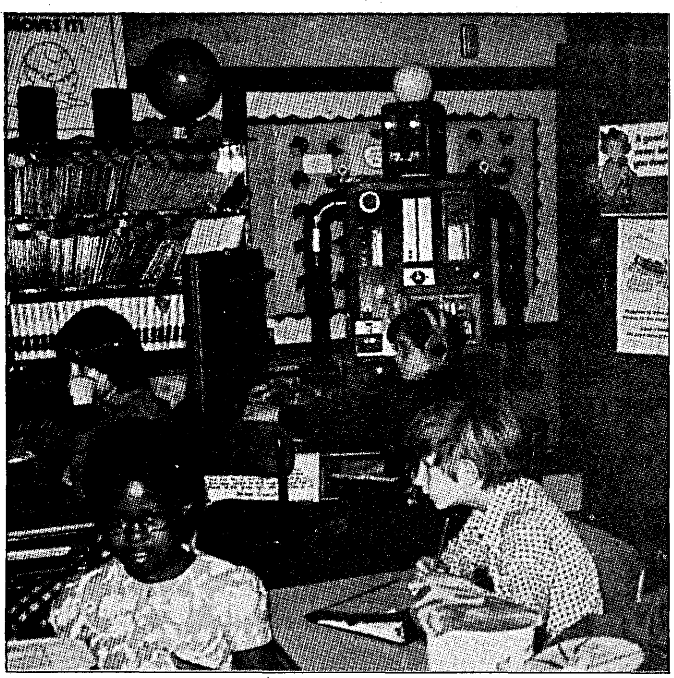
New products announced include Amdahl's first IBM "plug-compatible" processor, 470/V6; General Automation LSI-12/16 mini, using silicon-on-sapphire technology (unsuccessful); Motorola 8-bit 6800 micro; CDC Cyber 170; ICL New Range, the 2900 series, including the 2950 and 2960; National Semiconductor 16-bit micro on one chip, a first; DG Eclipse, with 200 nsec bipolar cache; IBM 3850 cartridge mass store (to 472 billion bytes)—generally known as the beer cans in the honeycomb; Intelligent System Corp. color crt; and Intel PL/M, first high-level language specifically for micros.

IBM Advanced Function for Communications (AFC) becomes generally available.

CDC's STAR array processor is in final checkout, a state from which it barely emerged.

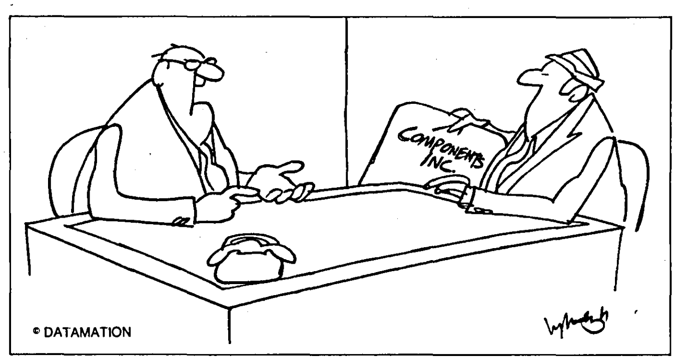
Several vendors are supplying 4K MOS RAM, the first to pass core in price/performance.

Datran (all digital network) is working in Texas.



"The Justice Department already has indicated that IBM should be broken up into a discrete number of 'competitive, balanced, broad line computer companies.'"

New York bureau manager for DATAMATION
Angeline Pantages



"That's a great innovation- . . .microprocessors so small they're invisible. . .unless, of course, you're putting me on."

Robot (above, left) helps teach students in P.S. 106, in New York.

ICL chief Geoffrey R. Cross (far left) moves the U.K. firm into profitability, temporarily.

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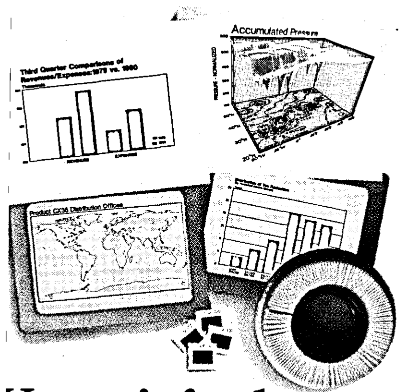

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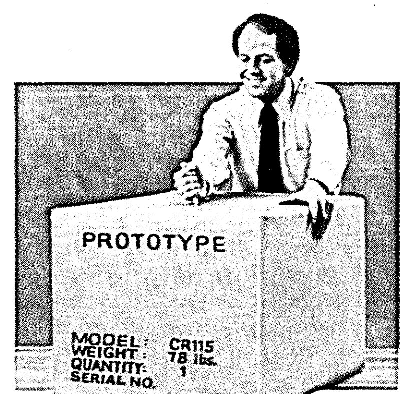

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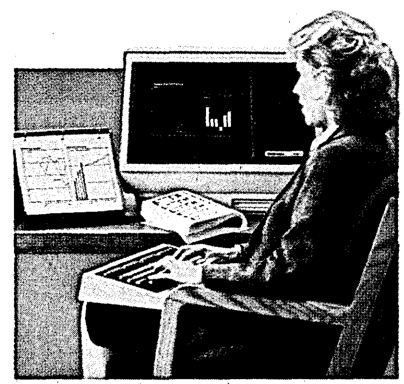

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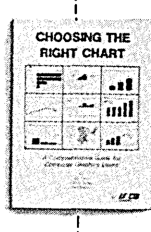

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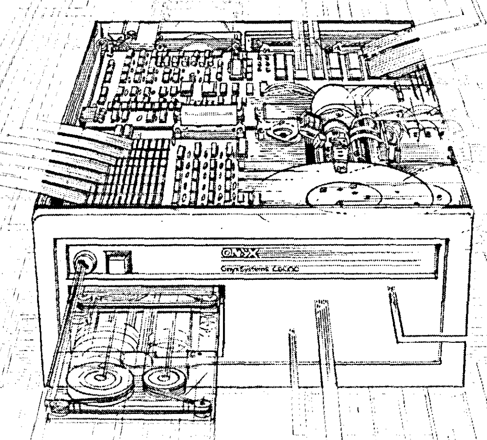
CIRCLE 59 ON READER CARD

* ISSCO has over 100,000 individual users in over 1000 installations worldwide, running on a variety of hardware from IBM, DEC, CDC, Cray, Burroughs, Honeywell, Perkin-Elmer and Univac to Prime.

How do you create a microcomputer to match the power of the UNIX™ operating system?



Imagine. You are perfecting a revolutionary operating system. In about two years, it will be the system of choice for 16-bit microcomputers.

It will be called the UNIX operating system.

But the breakthrough features of this operating system are going to make stringent demands on the computer.

The microcomputer developed specifically for the UNIX operating system more than two years before its commercial distribution is called ONYX.™

ONYX will live up to every demand and expectation.

To achieve the ultimate flexibility, simplicity, efficiency and productivity, the UNIX operating system will incorporate a file system of highly uniform sets and sub-sets of directories, arranged in a tree-like hierarchical structure.

And flexible directory and file protection modes, allowing all combinations of *"read," "write,"* and *"execute"* access, independently for each file or directory, or for a group of users.

But these advantages will require intensive disk access, and superior memory management. In simple language, disk access must be as fast as possible, and the disk must have an unusual capacity to maintain complex file systems on-line at all times.

Floppy disks with their low capacities and high access times won't do.

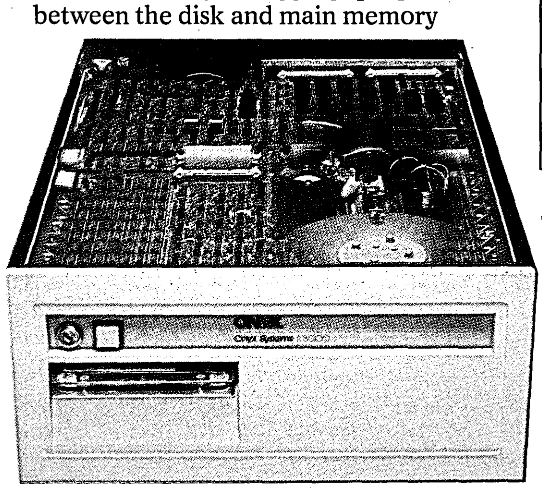
Winchester disk drives that utilize slow-moving stepper motor head positioning devices won't do.

ONYX's IMI Winchester disk storage system, with its servo-driven voice coil head positioning, is more than twice as fast!

So, obviously the ONYX C8002 *will* do.

And, as developed, the ONYX C8002 features expandable memory up to 1 Mbyte, and disk storage up to 160 Mbytes on-line. Its cartridge tape backup offers cyclical redundancy checking on every backup. Both the Winchester disk storage system and the cartridge tape backup are *internal.*

In the UNIX operating system environment, the disk becomes an extension of main memory. *"Swapping"* programs between the disk and main memory



increases the number of operations th can run concurrently. ONYX's memor management system utilizes *"scatter"* instead of *"contiguous"* allocation, and the more efficient swapping minimize demand on the disk channel. That's wh ONYX assures a highly efficient environment for the UNIX operating syste

Now it's 1982. The UNIX system's pr eminence among 16-bit operating systems is established. And ONYX is the only company that has significant production experience with UNIX system

ONYX has installed over 1500 UNIX systems.

Today there are a lot of systems being developed to operate UNIX (an *"look-alike"*) operating systems. But there are many reasons why you shoul consider ONYX and the UNIX operating system as inseparable.

System III available now for immediate delivery.

Phone this special number: (408) 946-6330 Ext. 251. Ask about these System III enhancements, including:

- Multi-key index sequential files under RM COBOL;
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- Enhanced printer handling capability;
- SCCS to maintain edit histories in text management applications.

**UNIX is a trademark of Bell Laboratories.*

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ONYX UNIX

OPERATING SYSTEM

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'75

Xerox quits mainframe business, admits SDS was a mistake.

Singer, first in electronic retailing, abandons Business Machine Division. TRW takes over North American base, ICL absorbs international.

Justice Department vs. IBM trial off to a "contentious" start.

IBM temporarily loses to customer Catamore Enterprises in fraud, negligence case; jury decision later overturned.

Honeywell Bull and CII agree to merge, spelling doom for Unidata.

Honeywell smashes own used computer market by levying heavy charges on old software for second users of its medium-scale computers. Users snarl and convert to IBM.

Beleaguered Telex gives up appeals in IBM suit.

Exemplifying growing third world desire for dp resource control, Brazil begins efforts to create and protect a small computer industry.

Aetna Life & Casualty joins IBM and Comsat in what will become Satellite Business Systems.

New products announced include IBM System/32; DEC PDP-11/70; IBM 3800 laser electrophotographic printer; Cray-1: 64-bit vector computer, 50 nsec bipolar memory, five times speed of CDC 7600; National CSS NOMAD database management system (relational); IBM first personal, portable computer, the 5100; Harris Slash 7 Supermini; Imsai 108 Intelligent Disk System; Intel 16K CCD chip, a technology that did not make it; Threshold Technology voice input system for numerical control programming; and Burroughs BDLC.

First Amdahl system, 470/V6, goes to NASA's Goddard Space Flight Institute in New York.

Bell T4M link between Newark and New York City begins (274 Mbps on coaxial cable).

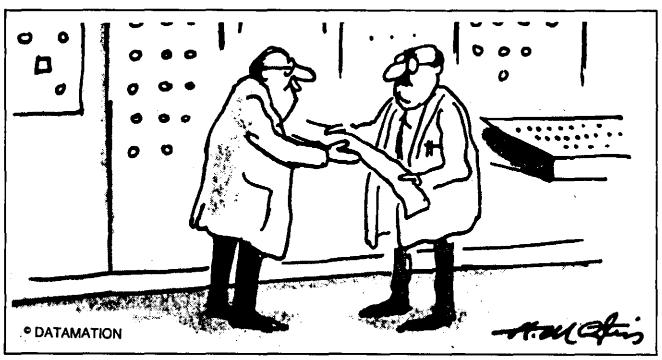
French Cyclades packet-switched Network goes live.

Digital Research begins delivery of CP/M microcomputer operating system.

Boole & Babbage performance measurement system, CUE, is first installed.

Publication of *The Mythical Man-Month* by Fred Brooks.

French demonstrators protesting the potential merger of Cii with Yankee-tainted Honeywell-Bull.



"Do you realize that without computers it would be impossible to assess the impact of computers on our society?"

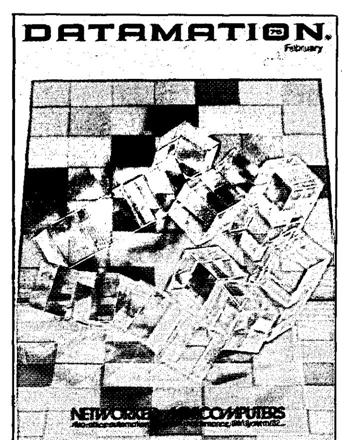
GENERATION GAP

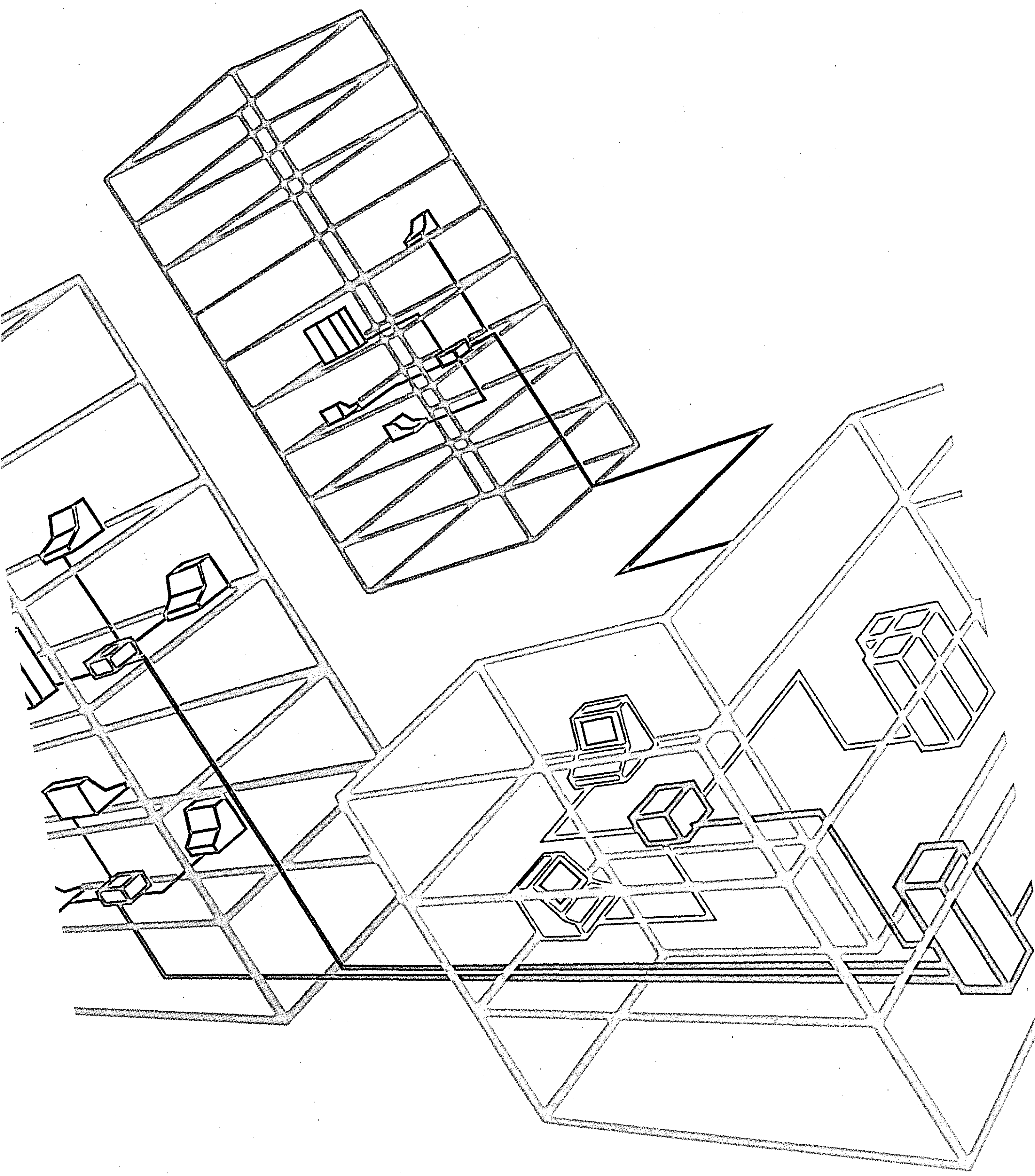
For I dipt into the future, far as human eye could see,
Saw multitudinous computers of generations yet to be;
Heard the wailing, moaning, muttering of users all nonplussed,
And the cry of corporate officers faced again with going bust.
Heard the salesmen speak throughput, and controllers mention dough,
And the engineer-designers saying this way we must go.
All the dusty equipment standing here upon the shelf
Reminds us constantly that history will repeat itself.

Jackson Granholm

"It's easy to get the impression that the battles [IBM antitrust] are being fought on Olympus . . . and have very little to do with dp users . . . The continuing results of regulatory and antitrust processes are going to dictate the technology available to you as users and what the marketplace is going to look like."

F. Sherwood Lewis, Sanders Associates





'76

The Bell Bill, the Consumer Communications Reform Act of 1976, is drafted.

Three more antitrust suits filed against AT&T, including a last gasp one from Datran. Wyly Corp. (née UCC), unable to find a buyer, closes Datran's doors.

IBM slashes 370 prices to counter add-on memory moves.

DATAMATION's first Top 50 shows the 10 leaders are IBM, Burroughs, Honeywell, Sperry Rand, CDC, NCR, DEC, Memorex, Hewlett-Packard, and TRW.

SWIFT, international interbank transfer network, begins operation, serving 300 banks in 15 countries.

West Europe's installed base is $22 million worth, with IBM general purpose market share put at 52.6%, followed by Cii-HB at nearly 13%, ICL at 10%, and Univac at 7%.

Japan has put more than $135 million in subsidies into its dp industry yearly since 1972, according to IBM's John Opel.

IBM users are averaging more than 1% of dp budgets for software products for the first time.

Wang Labs takes giant step toward eventual billion-dollar status by delivering word processors.

New products announced include HIS Level 6 minicomputers; DEC system 20, 64-user timesharing system; IBM Attached Processor System for 168s; NCR Criterion series, firmware-based; Shugart 5¼-in. floppy disk; IBM 370/138 and 148 models; IBM Series 1 (Peachtree) with 4KB chips, first minicomputer entry for IBM; Itel Advanced Systems (AS) based on National Semiconductor and ultimately Hitachi processors; and Univac 90/80 with emitter-coupled logic (ECL).

STAR 100 is operational at Lawrence Livermore (four times CDC 7600).

IBM breaks OS into "selectable units," presaging priced OS.

Los Alamos has Cray-1 for testing.

British Post Office tests Viewdata (Prestel).

Dataphone Switched Digital Service is offered, 56Kbps.

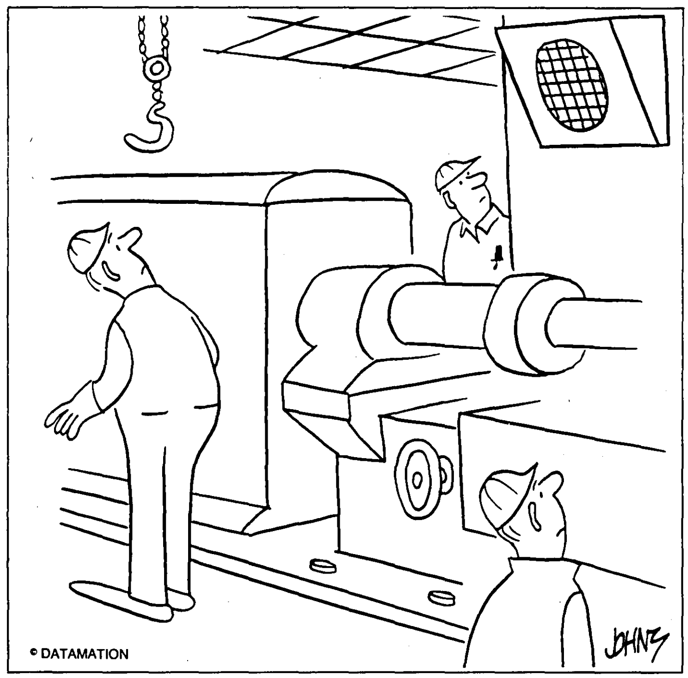
Canada's Datapac packet network is up.

Wang delivers 10/20/30 word processors.

Publication of *Computer Power and Human Reasoning* by Joseph Weizenbaum.

"[I can] take the simplest antitrust case . . . and protract it for the defense almost to infinity."

Cravath Swaine attorney assigned to the IBM defense Bruce Bromley

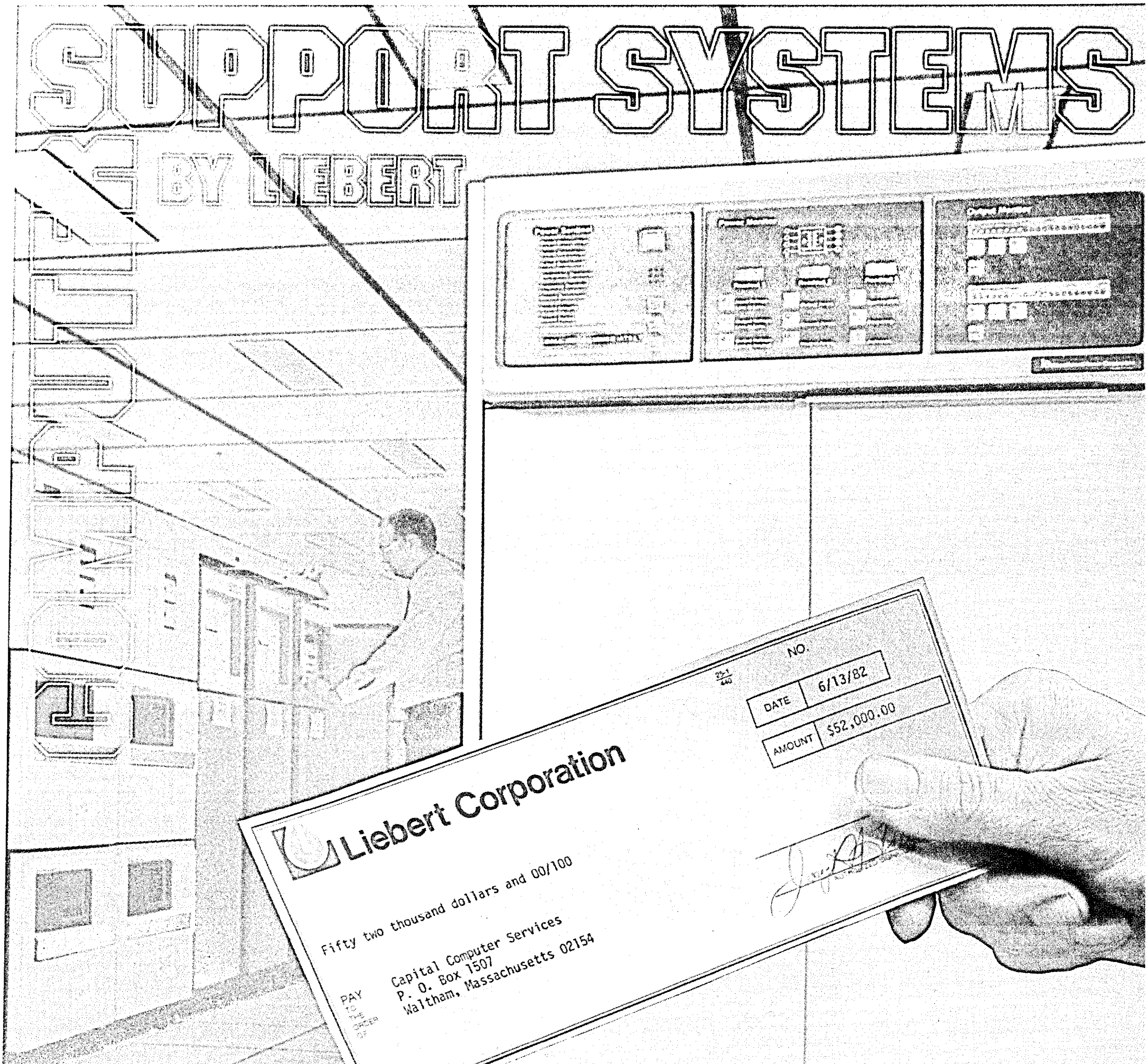


Rep. Jack Brooks (below), author of Brooks Act, is concerned about the apparently growing percentage of sole source procurements by federal agencies since his bill was enacted 10 years ago.

"Rumors that this plant is going to complete automation are ridiculous and completely unfounded. . .completely unfounded. . .completely unfounded. . ."

"I am not here to protect the profits of AT&T or to undermine the Justice Department. I am here for one reason and one reason only and that is because it appears . . . inevitable that over the long run, the FCC's policies will hurt service and add to its cost for the vast majority of our customers."

AT&T board chairman John D. deButts



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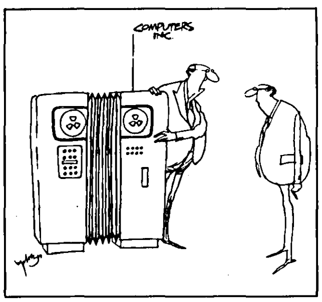
D9

'77

IBM antitrust: directed verdict for IBM in CalComp case.
X.25 becomes standard packet network communications protocol.
Hobby computer market born with MITS Inc.'s Altair 8800.
Itel begins marketing Hitachi large-scale computers.
FCC authorizes SBS entry to satellite business, finalized in '80.
Hartz Mountain vice president is indicted for taking kickbacks in computer supplies purchases.
IBM announces 3033.
France, protecting local industry, refuses to allow DEC to build a plant there.
Sperry Univac takes over Varian Data Machines.
Pcm Magnuson forms to compete with IBM medium-scale computers.
U.K.'s Racal buys Milgo.
IBM antitrust: Memorex trial begins, ends with directed verdict for IBM.
Copyright law passed, deferring computer program issue.
IBM, unable to reach compromise over ownership, withdraws.

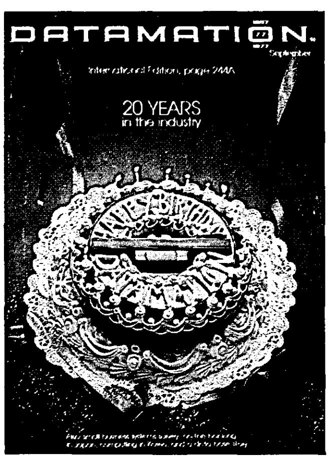
New products announced include IBM 3033, 370/168 replacement, with System Extensions; Amdahl V/5 and V/7; Univac 1100/80; Apple II personal computer; Commodore PET personal computer (Personal Electronic Transactor); Radio Shack TRS-80 personal computer; Datapoint ARC Attached Resource Computer network; Tandem NonStop, with redundant-processor and dual redundant communication paths (first commercial failsafe computer); DEC VAX-11/780 32-bit supermini; TI "Silent 765" portable terminal with up to 80K bubble memory; Applicon Inc. ink jet color plotter; Burroughs Scientific Processor (16 ALU array processor), later withdrawn; Micom Micro800, first micro-based stat multiplexor for mini; and BB&N Terminal Interface Processor (from ARPANET).
IBM San Jose has developed laser liquid crystal display.
Illinois Bell runs the first fiber optic links between two offices.
AT&T promises Bell Data Network in 1978.



© DATAMATION

"...How big of a system do you want?"

"When the smoke clears and the computer-as-big-toy craze subsides, there will be left a distinct trend—hobby, home, personal, small business applications—and that will be followed by the use of desktop computers for distributed computing in large businesses."
Professor of computer science at California State University, Northridge Fred Gruenberger



Citibank (above) goes on-line with workstations

Head honcho Heinz Nixdorf (below) keys in on his new data telephone, the simplest terminal of them all, he says.

A quiet moment of relaxation (right) at the Hannover Fair.

'78

IBM antitrust: Memorex trial begins, ends with directed verdict for IBM.

Copyright law passed, deferring computer program issue.

IBM, unable to reach compromise over ownership, withdraws from India.

Siemens signs to market Fujitsu's large machines in Europe.

GAO produces 200th report since 1965 on problems in acquisition and management of government computers.

National Telecommunications and Information Administration set up under the DOC.

Services companies begin offering hardware, as NCSS with Two-Pi and ADP with Microdata.

British Post Office begins live test of its creation, Viewdata (Prestel).

Announcements of TRS-80, Apple II, and Commodore PET signal start of personal computer market.

Computer consultant Stanley Rifkin uses wire transfer scheme to steal $10.7 million from Security Pacific National Bank.

Tandy Corp. breaks into Top 50, and Itel into Top 10.

ITT buys Courier Terminal Systems.

New products announced include IBM System/38 with 64KB memory chips and first built-in relational database management system; IBM 8100 (Orbit) for distributed processing; IBM 5110 desktop computer with diskette; Micropolis floppy with 1.89MB on 5¼-in. disk; CDC Cyber 203 obsoletes STAR (ECL, 100 MOPS); and Xerox color copier.

Xerox briefly unveils XTEN, with cellular radio.

AT&T unveils Advanced Communications System plan, for 1979 startup (never happened).

Texas Instruments ships 2MB bubble memory to Air Force.

Lawrence Livermore proposes first large-scale MIMD processor, for Navy.

Magnuson M/80 pcm computers begin deliveries.

"We have forecast the connection of approximately 137,000 customer terminals and computers to the ACS (Advanced Information Systems/Net 1) network by 1983, out of a total of 3.6 million terminals and computers estimated to be then in use."

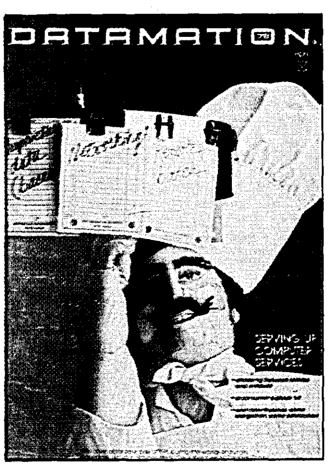
Spokesperson for AT&T

IBM VS. THE PCMS

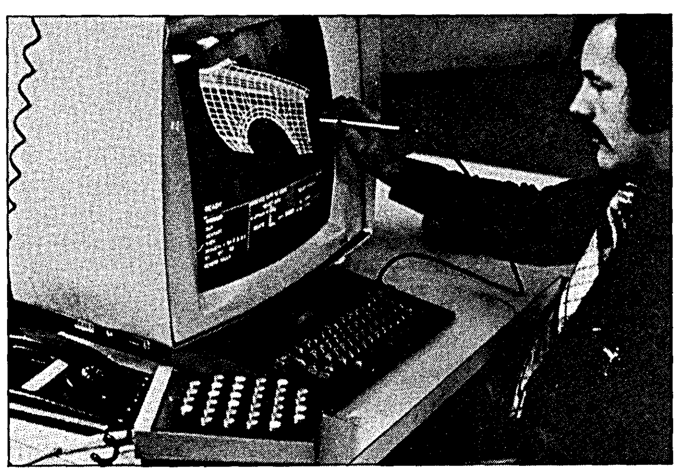
IBM	Amdahl Corp.	Itel Corp.	Control Data
138			480-1
148		AS/4	480-2
158-1		AS/5-1	
158-3		AS/5-3	
3031		AS/5, 7031	
168-3	470V/5	AS/6	
3032	470V/6-11		
3033	470V/7		

Changes within a year are expected in this lineup, which shows the comparative power of software-compatible processors without consideration for price. But price changes can also be expected soon.

The brothers Amdahl and friend Klatu (below).



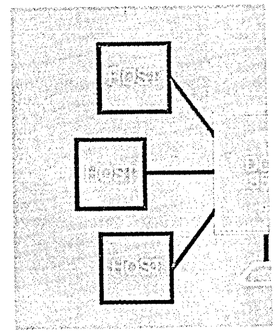
Computer aided design and manufacturing at work (below) at General Motors.

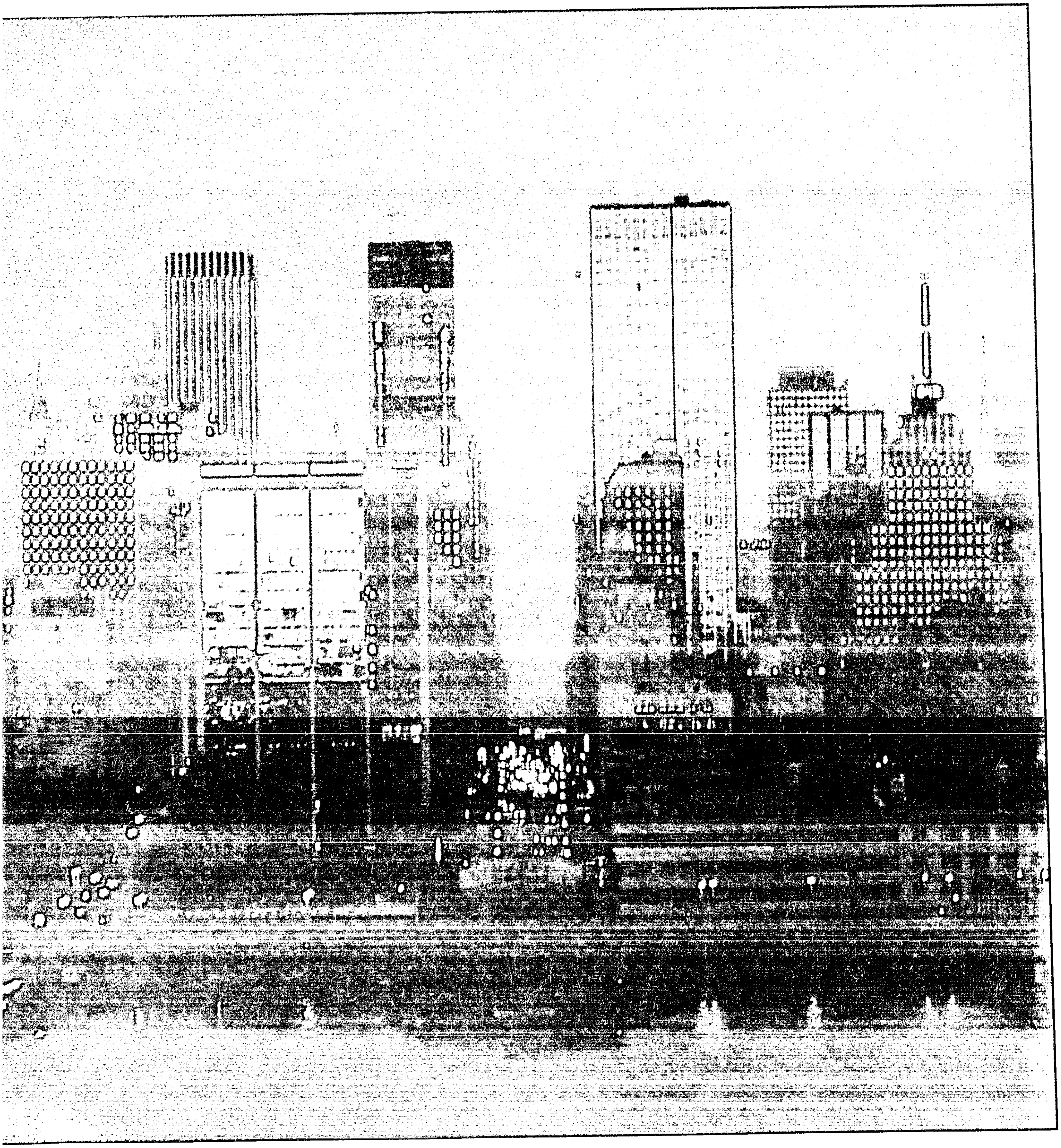


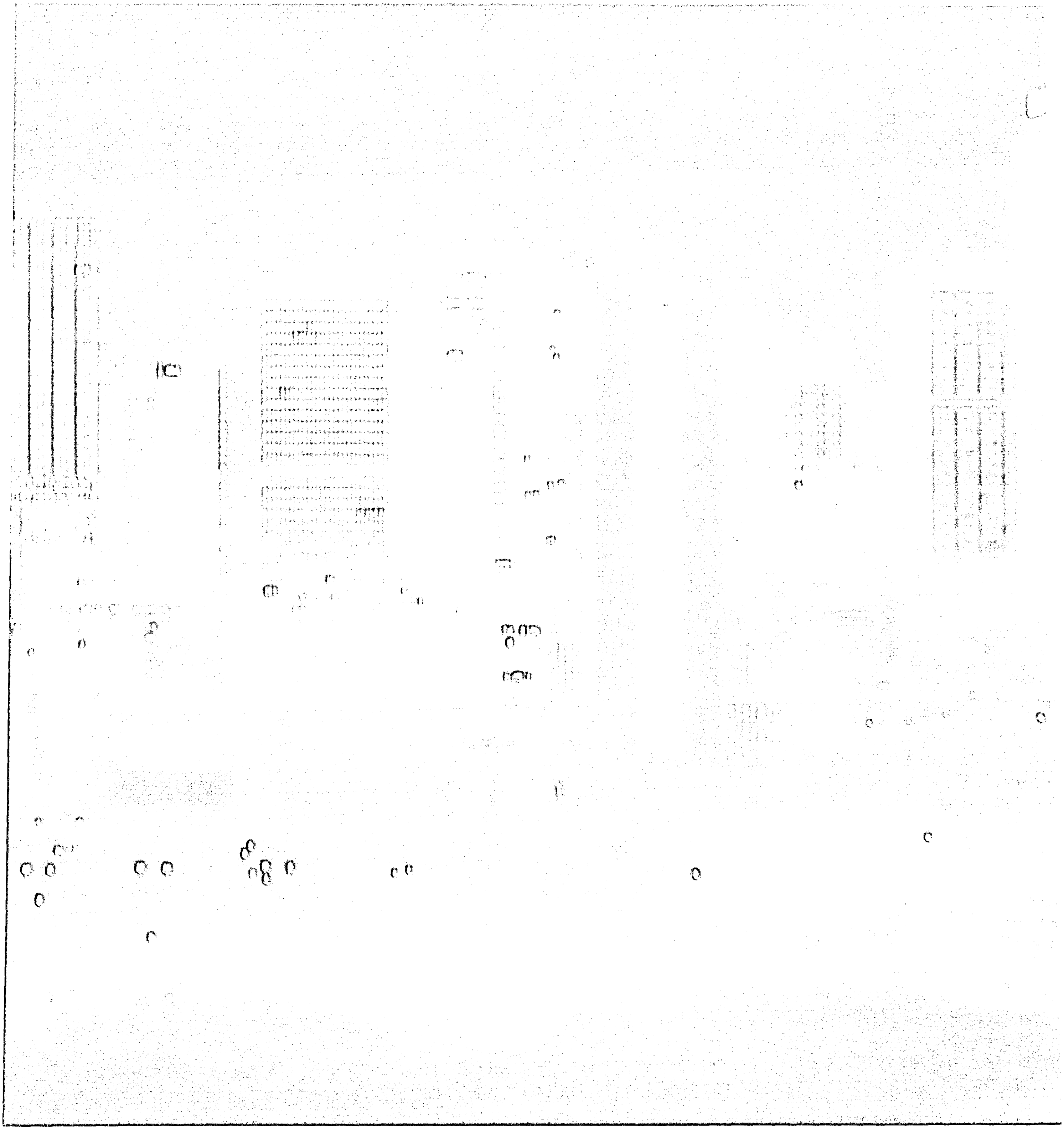
OUR BIG INVENTION FOR BIG BUSINESS:

CA. We're the ones who oneered the development f a master network proces- or with host selection—a ystem especially helpful to rger companies with many erminals accessing several omputers. With our 355 laster Network Processor, osts are reduced because nnecessary equipment is eliminated. Any terminal user can tie in with any host computer in the network—resulting in greater flexibility and increased capacity. And all DCA systems are designed with plug-compatible modular hardware, allowing systems to be easily upgraded as networks expand.

But that's just part of the story. Since the beginning, we've been the innovators in solving communications problems systematically. We were the first to make it possible to cost-effectively interface with X.25 standard protocols. This offers you low-cost access to public data networks and to host computers which support







'79

IBM 4300 computer announcement torpedoes leasing companies and residual insurer Lloyds of London. Itel, 4300 victim, unloads pcm computer operations to National Semiconductor.

IBM revenues pass $20 billion mark.

One hundred thousand TRS-80s shipped to date.

IBM announces first move toward new marketing philosophies—a volume discount on the Series/1.

First auditor certificates issued by EDP Auditors Assn.

CalComp sells off pcm business.

Dun & Bradstreet buys National CSS.

NCR buys communications expert Comten.

Federal government approves I/O interface standard. Burroughs, CDC, Honeywell, and Univac fail in suit to halt it.

IBM has first earnings decline for the first time since 1951.

DEC, 22 years old, crosses $2 billion mark.

CDC renews supercomputer emphasis with Cyber 203.

Intel buys MRI, gaining software/DBMS capability.

Olivetti and BASF agree to market Hitachi systems in Europe.

New products announced include IBM 4331 and 4341 (E series), replacing 138, 148 with dramatic price/performance improvements, includes Extended Control Program Support; IBM 1750 PABX ("Rosebud")—Europe only; Sperry Univac 1100/60 with multimicro architecture using 10K ECL and "phantom branch" instruction; HIS' Distributed Processing System for the '80s—DPS 8; Perkin-Elmer (née Interdata) 3220 32-bit computer; IBM 6670 Information Distributor system, with copier, printer, and communications; Intel 8089 I/O chip (like 360 channel); Zilog Z80 Pascal; Intel IMB bubble chip; Plessey laser data recorder (35MHz rate); Vector Instruction Set for HP1000F—first for a mini; and IBM 256K CCD chip.

Xerox introduces Ethernet: packets, collision detection, baseband.

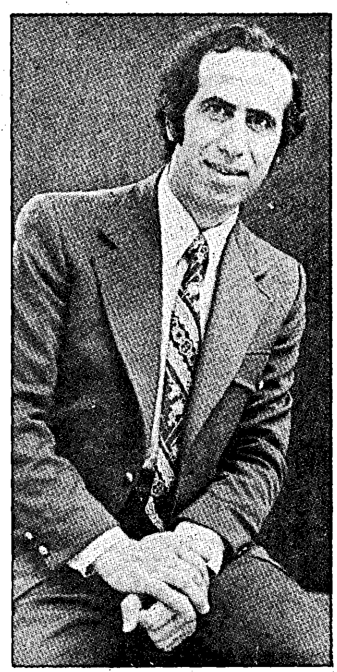
IBM drives bubbles to 3.3Mbpi.

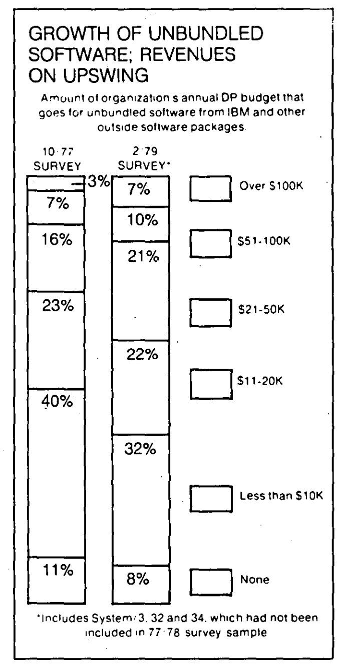
DOD accepts Cii Honeywell-Bull design for Ada, a language for embedded computers in weapons systems.

ITA Translation Systems for English to French, German to Spanish reduces translation time by 50%.

"Our world is rapidly becoming reduced to binary exchanges between data processing managers, with all hope of human personality being lost in the transmissions. . . . I disagree with the desire to eliminate all extraneous personal conversation that prefaces and suffixes an exchange of necessary information. Are we all going to reduce ourselves to faceless robots?"

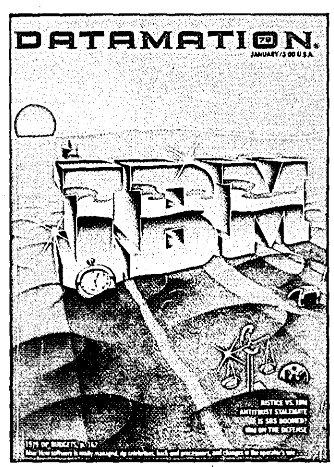
Bishop Graphics national sales manager Jerrold Asher



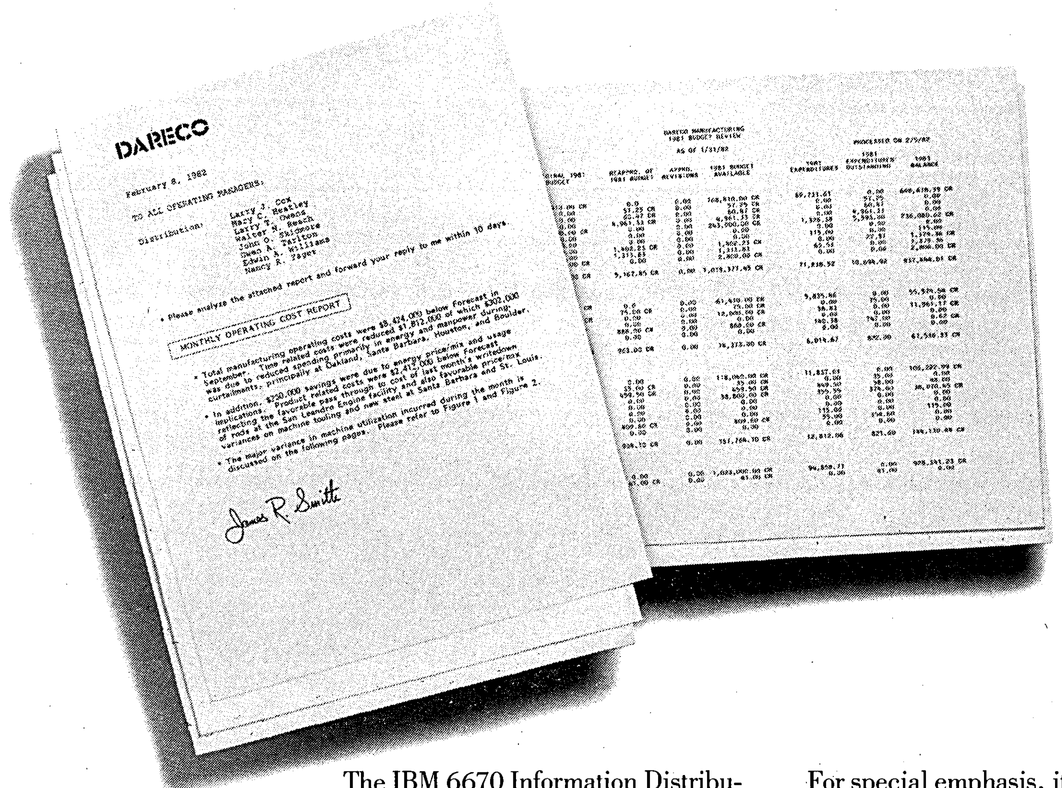


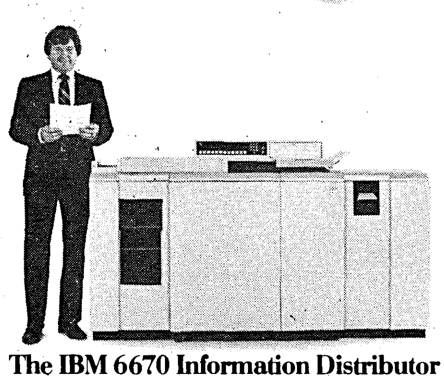
Storage Technology Corp. chairman and president Jesse I. Aweida (above): "We can afford to cut our prices when IBM does."

Former New York Stock Exchange president Robert C. Hall (left) named president and chief executive officer of Satellite Business Systems.



Your report can get across the country faster than it can get to your mailbox.





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CIRCLE 71 ON READER CARD

'80

Dr. John Mauchly, coinventor of ENIAC, dies.

EEC issues statement of objections to certain IBM practices.

FCC Computer Inquiry II has "deregulate" conclusion for all but basic transmission services.

Wyly and AT&T settle out of court; Wyly gets $50 million.

After delays and sieve-like leaks, IBM H series debuts with 3081.

Swedes raise national vulnerability issue, caused by centralized systems and reliance on foreign vendors.

TRW-Fujitsu Co. formed to market retail, financial, and small business systems.

MCI awarded $1.8 billion in damages in suit against AT&T.

Burroughs completes SDC acquisition, Triumph Adler buys Pertec.

Gene Amdahl forms Acsys (later Trilogy) Corp. to build line of pcm computers.

Between '78 and '80, more than a dozen dp installations in Europe are damaged by saboteurs.

French government uses conglomerate Saint Gobain to increase its share of Compagnie des Machines Bull (an owner of Cii-HB). Gobain also buys into Olivetti.

New products announced include IBM 3081 (H series), its most powerful computer but predictably in $3 million range—where top of line has been since 704 intro; Floating Point Systems 64-bit pipeline attached processor; DG Eclipse 32-bit computer (Eagle has landed); Displaywriter, IBM's premier entry into the word processing field; Ungerman-Bass Net/One local area network—broadband, co-ax, 4Mbps; Data Disc thin film disk, 3200 bpi; Xerox 5700 page printer: touch screen, mag card I/O; CDC Cyber 205, world's fastest at 800 MIPS; DEC VAX-11/750; Sharp pocket computer with BASIC; Intecom integrated voice and data switch; Cipher Microstreamer tape.

IBM has 5,000 circuit bipolar chip (equivalent of 370/138).

IBM announces support of X.25 standard.

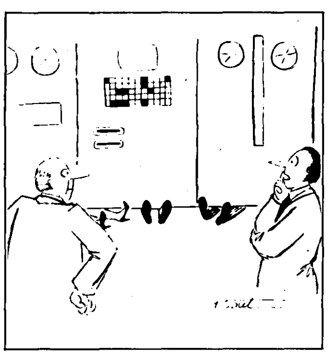
AT&T receives approval for New York-to-Washington, D.C. fiber optic link.

Bell experiments with Viewdata-like system in Coral Gables, Fla.

GTE Telenet introduces Telemail.

"The dp manager must seize the initiative in order to avoid being boxed into a technical corner. Convergence means that dp has become a small part of the total information service. The dp manager should get out and instigate new projects such as word processing. In order to do this, he must cease acting as a technician, stop talking and writing incomprehensible jargon, and identify with corporate needs rather than sectarian interests."

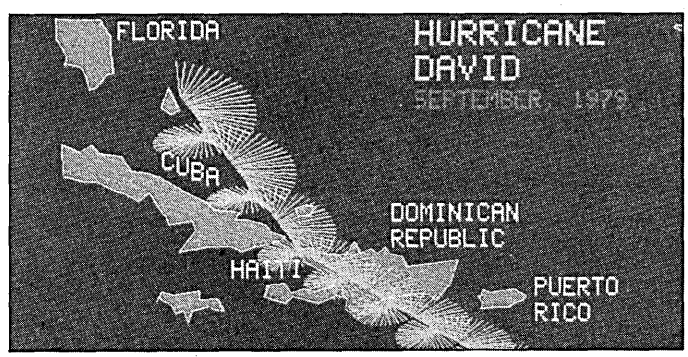
Director of BIS Applied Systems Ltd. Ron Yearsly

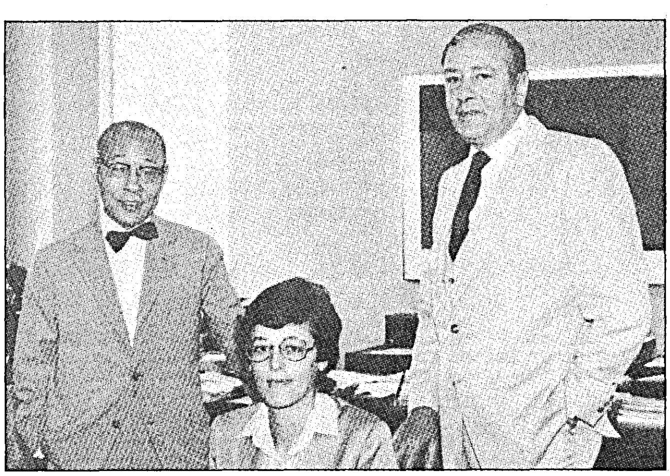


"It's one thing to replace three employees with this machine, but shouldn't you at least have fired them first?"

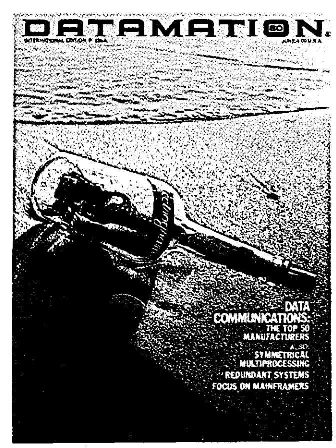
© DATAMATION

Blowing in the wind: Xiphias Corp. blows its own horn with its dynamic tv graphic of Hurricane David (right).





The Wang Institute of Graduate Studies is born (left): Dr. An Wang, Dr. Caroline Wardle, and Dr. Ugo Gagliardi.



'81

Supreme Court rules that machine processes implemented in software are patentable.

National Mediation Board rules analysts and programmers at Western Airlines belong to the clerical office craft and class.

Burroughs buys Memorex.

Siemens' troubles again bring massive reorganization.

Council of Europe convention and OECD guidelines for data protection adopted.

Foreign incursions into U.S. increase, as France's CAP/Gemini/Sogeti and CISI buy services companies.

Sweden's LM Ericsson buys Datasaab and forms $650 million office automation contender.

French socialists begin nationalization plans for industry. Honeywell reduces its Cii-HB stake to 19%.

IBM finally announces its Personal Computer.

Itel Corp. goes into Chapter 11.

Four-Phase buys Two-Pi, then sells out to Motorola.

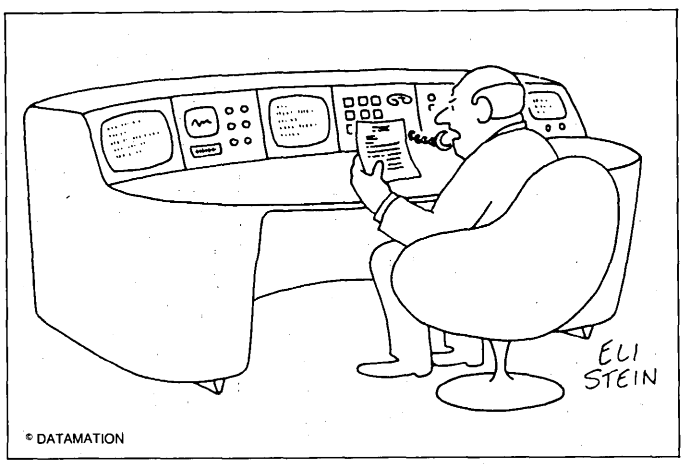
ICL's new managing director Robb Wilmot begins massive salvage operation by inking deals with Fujitsu, Mitel, and Convergent Technologies.

New products announced include Xerox STAR 8010 office control system; IBM 3081K; liquid-cooled, 13 MIPS, standalone channels; Philips digital optical recording 64-disk system, Megadoc (64 x 2,500 pages); Xerox "Worm" (which did not eat the Apple) micro-based personal computer; Fujitsu has 10-20 times Cray-1 with GaAS logic at -200°C; Datapoint ISX Info Switch Exchange for voice and data; Panasonic one-chip speech synthesizer; Intel iAPX 32-bit processor on three chips (a first available); LSI ADM 3A dumb terminal at $595 (a new low); Burroughs 7900 system; Wang's Wangnet; Convergent Technologies distributed intelligent computers sold by Burroughs, NCR, ICL, and Thomson-CSF; and IBM SQL DBMS—relational, based on System R.

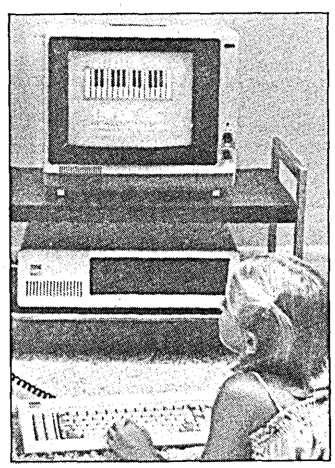
Seymour Cray discusses Cray-2 technology with immersed cpus.

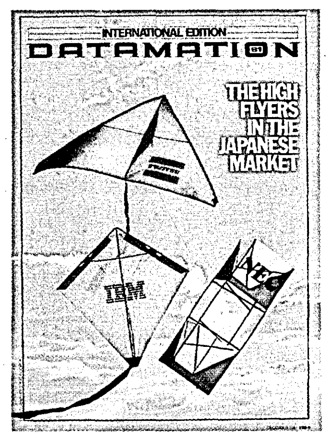
Sixteen-user Hawk 32 micro-based system for under $10,000 (COBOL, file manager, Pascal).

Publication of Soul of a New Machine by Tracy Kidder.

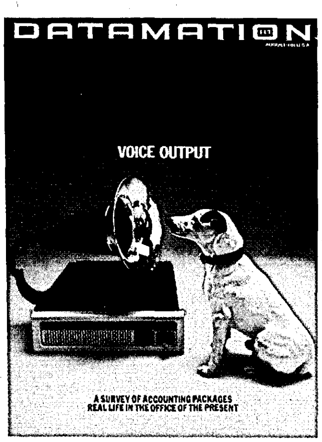


"Miss Farber, would you please tell me what this piece of paper is doing on my desk?"





For work or play, IBM announces its new personal computer (above, center).



"In 1952, seven bright Harvard B. School students wrote a report on 'The Giant Brain,' predicting that one day it would handle business and office routines . . . . The report was promptly forgotten except by their teacher, 'General' Doriot . . . . A pair of MIT engineers approached Doriot with an idea. Doriot liked what he saw and for $70,000 his venture capital enterprise, American Research and Development, picked up 78% ownership in the startup company, called Digital Equipment Corp. (DEC) . . . . Twenty years later, DEC grew like Topsy, its stockholders got rich, Massachusetts got jobs (and its taxes). The marketplace got better products because of the competition. And in the end, Professor Doriot's students at the Harvard Business School got their Giant Brain for handling office and business routines."

W. David Gardner

'82

Justice and IBM settle. Judge Edelstein vows to keep case going.

Justice and AT&T settle. AT&T gives up local operating companies but keeps Long Lines, Bell Labs, Western Electric.

Congressman Wirth drops long-awaited new communications legislation to replace 1934 Act.

AT&T announces birth of American Bell and promises to be competitive.

IBM continues to increase aggressive marketing with such new devices as quantity discounts, mail order sales, use of distributors, agreements with retailers, and competitive pricing.

Burroughs shows signs of life after dismal period.

STC woos and then jilts Magnuson leaving the pcm in deep trouble.

IBM enters robotics business using personal computer for code generation.

Datapoint, once Wall Street's darling, stumbles and reels.

Amdahl delays new systems.

FBI agents grab multiple employees of Hitachi and Mitsubishi on charges of attempting to obtain stolen IBM documents.

Happy Silver Anniversary to DEC, CDC, DATAMATION.

New products announced include DEC's low- and high-end microcomputers; IBM's three models of new 3083, all of which are smaller than 3081 (to add to the confusion); and Univac 1100/90 and 91 high-end systems.

Last of bubble memory producers drops out.

IBM reduces size of 64K dynamic RAM.

"On the surface, AT&T appeared to give away the store, but a second, more studied look indicates that they really gained the store. In fact, you might ask if AT&T lost any power at all."
Arthur D. Little exec Frederic G. Withington

"The dismissal of the IBM suit was a non-event. It simply shows that the government didn't have a case, never did have a case. It was a terrible waste of time, of management attention and energy, and of the taxpayers' money. The only result is that IBM will get even more aggressive."
President of Dorn Computer Consultants, Inc. Philip H. Dorn

"The contrast is striking; the government here has pursued antitrust litigation against IBM, while the government in Japan has actively assisted that nation's computer industry."
President of Data General Edson de Castro

Contributing to the time-line project were:
Martha Dorn, a free-lance writer based in New York City; Philip H. Dorn, president of Dorn Computer Consultants, Inc. and a DATAMATION contributing editor; Mac McLaughlin, director of Marketing Communications at Micom Systems, Inc., and former DATAMATION articles editor; Angeline Pantages, editor of the *Cerberus Report* and former international editor of DATAMATION; Linda Runyan, international editor of DATAMATION.

The authors gratefully acknowledge the assistance of Edith Myers and Sandy Lanzarotta in helping them obtain some of the more obscure issues of DATAMATION. Special thanks to Cynthia Stoddard for designing the time line.

New Marketing Concept

VAX Vouchers™

Guaranteed 43% return on investment.

It's a flood. It began in 1978 and has been rising ever since.

The flood is software packages for the VAX computer family. There are a few good values among them—but watch out. There are also a lot of duds, especially among data-base management software.

You may already have one of these DBMS's installed on your VAX computer. If you do, you're familiar with some of their many problems: poor documentation, slow execution times, and limited data-base functionality. Above all, you also see user-level features that remind you of the early days of interactive computing.

The cause of these problems is easily explained. Soon after DEC announced the VAX, several companies noticed a great opportunity and rushed to market with their DBMS software. Some of them quickly converted their products to the VAX from other hardware. A few others took their academic research projects and tried to make them viable commercial products. If only good data-base software could be created so easily!

We took a fresh approach. Our years of experience in commercial data-base systems taught us what we and other companies had done well and had done poorly. VAX users in the 1980's, we reasoned, deserved and wanted better than the software flaws of the 1970's. So we decided to design and implement a completely new data-base system. We hired a large team of experienced software designers and documentation writers. And we spent three solid years designing and documenting our software from the ground up.

In 1982, you will see the results of our work—a DBMS for the 1980's. Whether you're a research scientist, a corporation executive, or a novice, you can immediately use our DBMS productively from your terminal. Even in the middle of a command, you can access our online documentation without opening our users manual. If you're a programmer, you can also use our DBMS from any language that supports the VAX/VMS procedure-calling standard —languages such as FORTRAN, COBOL, MACRO, BASIC, and PASCAL. And we have not sacrificed performance for usability. We exploited the unique architecture of the VAX to give you the fast execution times and throughput that will not appear in other software for years to come.

YOU PAY FOR THE ADVERTISING

Display advertising is not cheap. Just telephone the advertising department of this publication to find out the cost of an advertisement this size. Yet advertising space is only a fraction of the cost of an elaborate promotional campaign. Include glossy literature, a large, expense-account sales force, trade show promotions, and the like and the costs quickly become staggering. Unfortunately, you pay for all of this when you buy a heavily-promoted product.

We want to avoid these expenses, and we will pass on most of our savings to you.

OUR UNIQUE OFFER

If you own a VAX computer, or if you have one on order, send us the coupon below. This puts you on our exclusive and confidential mailing list. We will keep you posted on the progress of our software development and testing. Then three weeks before we formally announce and release our DBMS, we will send you the announcement with our descriptive literature.

But that's not all. In exchange for your coupon, we will send you a voucher worth $12,000 towards the purchase of our software. That's right—$12,000! The voucherless, without exception, will pay $40,000 for our DBMS software. With a voucher, you will spend only $28,000 for software worth at least $40,000—a respectable return on investment of 43% in these inflationary times.

When we release our DBMS, you will have at least six weeks to test it, at no charge, on your VAX computer. Compare and benchmark its speed and flexibility against other software that you already have or are considering for purchase. Decide risk-free whether indeed it is worth its $40,000 price, let alone your low price with your voucher.

The voucher comes with your company's name on it and it is not transferable. Therefore, the information that you list on the coupon must be accurate and complete. The voucher expires two months after we formally release our software, so you will have to act promptly when we notify you of the release date.

Of course, we may still spend some money to market our software to those of you who do not respond to our voucher offer. But by that time, we hope to have quite a large mailing list as a result of this advertisement, so we will have to advertise very little.

We have chosen to remain anonymous until we release our DBMS. Otherwise your many telephone inquiries would seriously distract us from our development work. We also want to test our marketing concept and prove that VAX owners are value-conscious in their software selection. Despite our anonymity, we can assure you that we are a respected company with substantial assets and an excellent reputation for software expertise and customer service.

The DBMS software for the 1980's is almost here. Participate risk-free in its exciting release. Send in your coupon with no obligation, today.

VAX Voucher Coupon

D-9-82

Please send me my $12,000 VAX Voucher and put me on your mailing list. This places me under no obligation to test or purchase your DBMS software. You will not give or sell my name to anyone; you will use it only to inform me about your DBMS release. No salesman will call me unless I request otherwise.

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Title ______________________

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Country ______________________

Telephone ______________________

☐ Operating system (circle one): VMS, UNIX, other.

☐ We have installed ____ VAX 11/780's, ____ VAX 11/750's, and ____ VAX 11/730's.

☐ We have on order ____ VAX 11/780's, ____ VAX 11/750's, and ____ VAX 11/730's.

☐ I have none installed and none on order, so I am not eligible to receive a VAX Voucher, but please put me on your mailing list anyway. My hardware is ________

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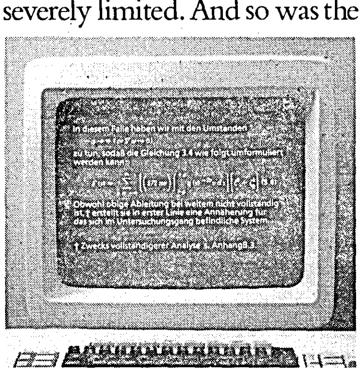
Diablo announces the first 400 character daisy wheel printer. Because the world isn't as simple as ABC.

Until now, if a business needed a printer with a wide range of scientific or multilingual characters, the choices were severely limited. And so was the print quality. Not to mention that prices were high and reliability low.



But now Diablo introduces the 630 ECS* printer. The first 400 character daisy wheel printer in the world. For technical, legal, or multilingual business applications, no other printer comes close. It's the best alternative to twin daisy wheels and multi-pass matrix systems.

Only the Diablo 630 ECS gives you true extended character set applications on one print wheel. Printing at 33 cps average English text, the durable new print wheels developed by Diablo do more than just increase character count. They provide real compatibility between the system screen and the page.

What the host shows, Diablo prints. Without changing wheels. Even if it's $F(\tau) \approx \eta(\tau)\,\epsilon^{-2\upsilon}\upsilon\, d \rightarrow \infty$ (*or* $\nabla\omega \rightarrow 0$), for scientific applications. Or a combination 10 or 12 pitch or *italic type* for legal applications.

International business languages frequently call for hundreds of characters. Now, companies who use Teletex or any West European language can rely on a Diablo printer to do the work. And to do it without changing the print wheel.

The new 630 ECS printer is based upon the regular Diablo 630 which has an MTTR of less than 30 minutes and an MTBF of more than 4000 hours. And, except for the carriage, has common spares.

If you would like to know more about the Diablo 630 ECS, write to: Diablo Systems, P. O. Box 5003, Hayward, California 94545.

We believe it will shortly become the standard of the industry. It's as simple as that.

Diablo Systems
A Xerox Company

* Extended Character Set

Type shown not actual size.

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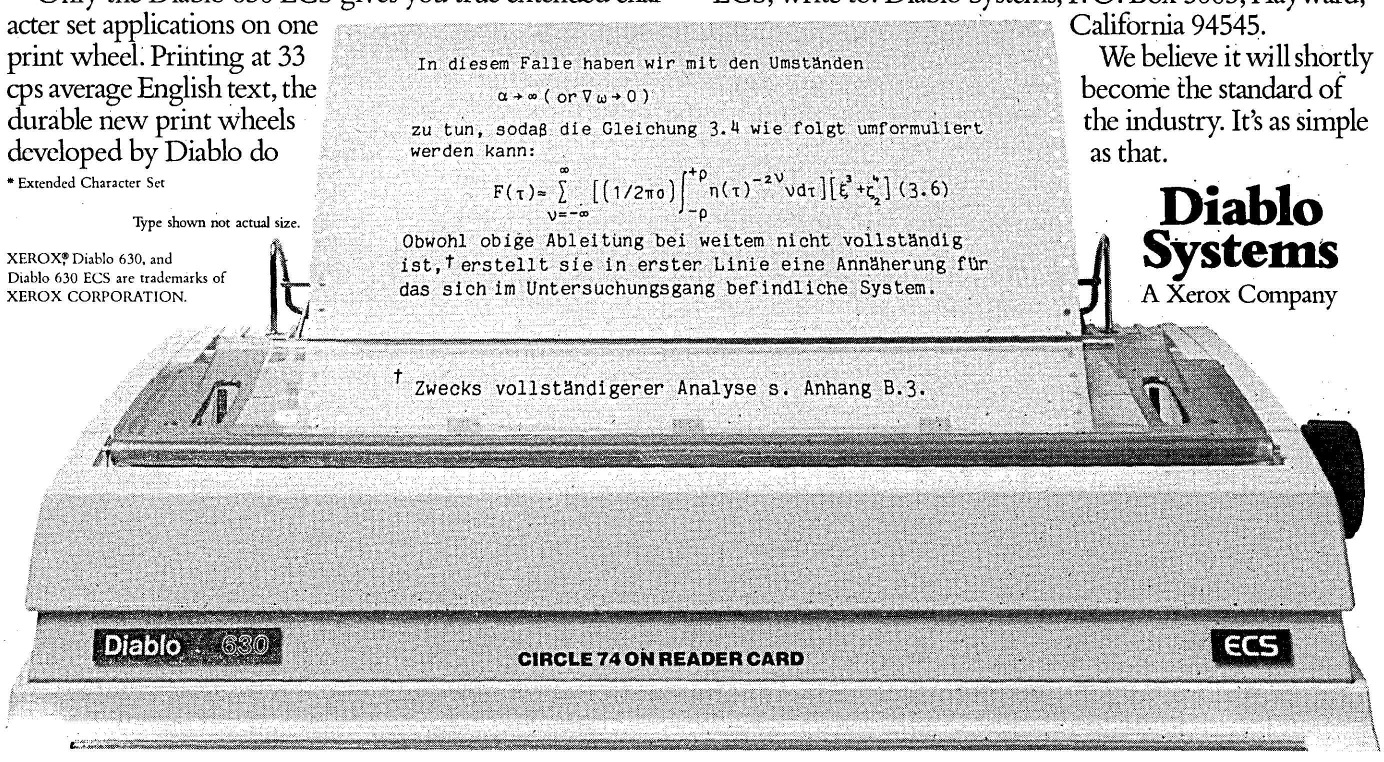


CIRCLE 74 ON READER CARD

Some were dream machines, some were unrecognized breakthroughs, but they all were . . .

PRODUCTS OF THEIR TIMES

by Michael Cashman

Tens of thousands of new products were brought to the attention of DATAMATION readers over the years. Thousands were described, as one of the better-read sections in the magazine struggled to keep users abreast of developments. In some cases DATAMATION took a position, always attempting to make it perfectly clear that we were all part of an industry as potentially revolutionary as the industrial revolution.

An exact chronological listing of all these countless products would be impossible. So instead, we asked Michael Cashman, DATAMATION's talented new products editor from 1970 to 1977, to trace some of the more interesting product developments that took place over the past two and one-half decades. Included in his product potpourri are some eye-openers, some firsts and lasts, some winners, some losers, and even some DATAMATION bloopers. So join us on our tongue-in-cheek trip down memory lane, but be forewarned: as with all reminiscences, your laughter could easily give way to tears.

SOME FIRSTS AND LASTS

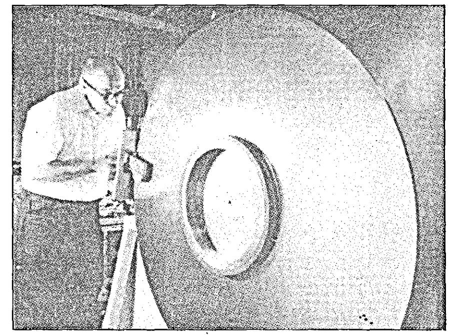
DATAMATION editor Charles Kluge and his subordinates had to move fast back in September and October of 1957. A missile tracking camera from Flight Research, the Multidata MOD, seemed like a natural then. To our knowledge, it's still the only missile tracking camera DATAMATION has ever run. In that issue, IBM's Dr. Cuthbert C. Hurd was pointing out that computers would play a significant role during the forthcoming Vanguard satellite project. But on Oct. 4, 1957, it became painfully clear that we would be tracking another country's satellite first.

Other new products—some of the earliest ever described in the magazine from the last pre-Sputnik, pre-Space Age issue included: the Codetyper EBC3, a "miniature computer" that didn't require a trained operator to broadcast code at up to 75 words per minute in an emergency—say when the Russians hit the beaches. Then there was the Telemeter Magnetics "coincident-current magnetic core storage unit that can be used as a temporary store, buffer, or delay time unit in data processing, computing, and automation systems. Known as the Type 1092-BQ-S Buffer Storage Unit, each of the 1,092 [sic] characters has a capacity of eight binary digits in length."

Then there was the S-100 from BJ Electronics, Borg-Warner Corp. A "digital processing and recording system . . . capable of sampling inputs from one of 100 Vibroton digital transducers at rates up to 100 per second. Measurement input is delivered as directly digital information, either sequentially or upon demand." (Did we say that?) Other products in those earliest pages included an oscillogram reading device, transistorized subcarrier oscillators, an integrated air computer test set, a unity ratiometer, Philco's TRANSAC C-1100 airborne computer (Philco was big in computers in those days . . . really), a voltage to digital converter, a wideband DC amplifier, and an integrating amplifier. And you say you're afraid you won't be able to make yourself understood in one of today's computer shops?

With minicomputers everywhere now, one can't help but wonder when the term first showed up in the pages of DATAMATION. Around January 1967 is a good guess since we ran a headline announcing something called a "mini-computer" (the model 449). Described as a "12-pound, 4K 24-bit word, overcoat-pocket-sized computer with integral keyboard, display, and batteries that could elongate to nine inches," this wonder of wonders was previewed by that reknowned manufacturer of small computers, Control Data Corp.

Hope you laid in a lot of "card patcher" when it was introduced in the spring of 1967. It sure was an easy way to cover errors in punched cards, according to its developer. It dried in a minute, and if you had covered a nonerror-error, you could punch right back through card patcher without fouling the keypunch. It's true, it was beginning to look like a "batch is forever world, but even so . . ."



METAL MONSTER: General Precision's prototype 48-in.-diameter disks spun onto the market in 1963.

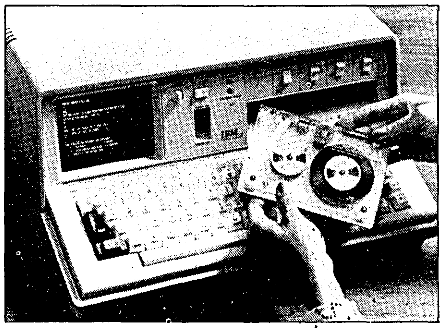
DO YOU REMEMBER?

Remember Electronic Brain Enterprises Inc., a Salt Lake City manufacturer? We do, at least in our pages. In January of 1958 this fearless firm announced the Minilog, a desk-sized computer that used plug-in components to solve any mathematical problem up to simultaneous differential equations. Other products in that issue that were a little more abiding included the IBM 305 RAMAC (Random Access Method of Accounting and Control) unit and Potter Instruments' model 306 tape drive that operated at four speeds up to 150ips.

Do you remember when General Electric was in the industry? If you read the May/June 1958 copy, you doubtless recall its switching transistors, a line of four new "PNP medium-speed switching transistors having less than a 20% change in hFE and Ico after 4,000 hours storage at 100° C." Sounds like something that would be useful today.

So does high tolerance, and that's what Barker and Williamson Inc. of Bristol, Pa., was hawking in 1958. High-tolerance toroids, we hoped, would be of interest to manufacturers of memory devices, chokes, filters, transformers, and other components utilizing toroids, especially this "new line of specials, wound on high permeability cores. Sizes range from ⅞ inch to 3 inch OD with frequencies from 1,000 cycles to 200 kc."

We didn't think much of the Winchester disk drive when it was introduced in 1973.



LEANING TOWARD THE LOW END: IBM's 5100 came with a leather-look carrying bag back in 1975.

Hope they were useful.

Scratching your head over in-line resistance decades? Digitran Co. of Pasadena unveiled the model 7317 fast-setting incremental resistance decade that "uses only five resistors to obtain 10 levels of resistance." The company was probably angry over losing the Rose Bowl game that year to Minnesota, 21 to 3.

The product editor in June of 1963 was enamored with General Precision's prototype desk offering, "said to be an associative memory system utilizing six 48-inch diameter disks . . . 153 megabits, 900 rpm, transfer rate of 350,000 cps." There are those in the industry today who feel disks this powerful were developed in conjunction with metal suppliers simply because lead was so inexpensive.

RIGHTS AND WRONGS

We'll be honest. We didn't think much of IBM's Winchester disk drive, introduced to our readers in May of 1973. We judged it to be a needlessly expensive solution to the problem of storing massive data files. It didn't seem to make much sense to package multiple logic sets into the disk packs and reduce the disk drive to a motor. It didn't make sense unless you remembered that IBM was in a firefight with the plug-compatible manufacturers. Nevertheless, this design would result in very expensive packs lying around unused, with the users paying too much of the bill for whatever IBM wanted to do to counter the inroads of the pcmers.

"We" (I) were wrong here, because there had indeed been something wrong with the disk storage technology used in previous designs. Disks crashed too often, mostly at the worst possible time. The first Winchester was a quantum improvement in reliability. Usually when we were technically out of bounds, IBM would tell us so, but in this case, a good midcourse correction in disk storage technology, a strong enough case for the improvement in data reliability that would help users get their jobs done, wasn't made.

We liked IBM's 5100, carried in the November 1975 issue, and so did competitors and analysts. It was the first time IBM called me up and said it would bring its latest computer to my house for evaluation. We knew it would happen someday, but IBM (not Apple, not MITS, et al) was the first to do it.

IBM knew the 5100 was a new machine for new markets. It was interesting, wowed technical types with its power supply design, contained APL and BASIC interpreters, a small crt, and as much memory as the original 360/30. It was bread-box size and we thought it would be a fantastic success. It wasn't.

While DATAMATION was wrong about the 5100, it was right about RCA's Spectra series. In the Nov. 1, 1970 issue we wrote: "RCA gambled and lost . . . right after the 370 series announcement [RCA] reintroduced the Spectra because it was lulled into thinking IBM was just reintroducing the 360. Now look at the shape [RCA is] in. For the next half decade [it] is going to be selling a 360 against a 370. . . ."

Well, editor Richard McLaughlin was mostly right, but it didn't last a half-decade more. McLaughlin was promptly flown East and called on RCA's not-so-magic carpet to defend those remarks, but it was all too painfully true. The 370/145 announcement from IBM pulled out all the stops technologically, and it was a stopper.

"The [PDP-11] may one day be the most common of minicomputers." Hasn't that statement, first made in January 1970, worn well! Indeed, variations and elaborations of this basic machine are still powering systems that weren't even envisioned when the PDP-11 was introduced. For many years, this computer held the record for the greatest number of responses for a product described in DATAMATION.

WHERE ARE THESE WARES WHEN WE NEED THEM?

It was going to be curtains for the U.S. (probably Iron type, definitely ill-fitting) if plans for the Laser Computer (pronounced "leisure computer") fell into the wrong hands, according to its developer, Frank Marchuk. In the July 1, 1971 issue Marchuk was promising to unveil a 10 trillion bit, 20 nsec machine, the CG-100, of which 178 had been sold.

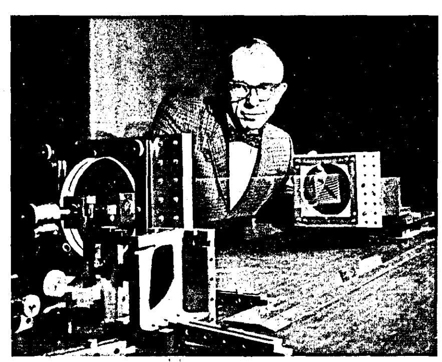
A DATAMATION editor eventually saw what was purported to be one—a collection of large modules displayed behind crimson "theater entrance" cords. Sitting on a non-raised floor, the CG-100 didn't need cabling to connect the modules together—they could just relate to each other.

The world wouldn't be the way it is today if Marchuk's machine had worked. Those weren't Marchuk's words. Rather, they were the words of California Institute of Technology students and professors, who pointed out that some details of the CG-100 were in clear violation of the Heisenberg Principle. A "talk" given at Cal Tech ground to a halt as people who had not only heard of the Heisenberg Principle but were familiar with it explained the fundamental physics problem in the CG-100. It seemed that even Marchuk's lasers couldn't pin down the exact location of densely stored holographic data without confounding this and other laws, some of which had been proven by another guy who used to give talks in that very same Cal Tech auditorium—one Albert Einstein. At least Frank left 'em laughing.

The laser computer wasn't the only course not taken by the computing industry. It didn't jump on the i-85 bandwagon either. Introduced as a general purpose computer by General Intellitronics of Yonkers, N.Y., in the March 1963 issue, the $13,500 machine seemed reasonable enough. Perhaps it was the 3K of 19-bit-word memory.

We'd also like to know what became of Bell Lab's Optical Delay Lines, touted in the June 1965 issue. When last heard from, Bell Lab's publicity department was showing us that Donald Herriott and Harry Schulte were hot on the trail of something that would use mirrors to fold a two-mile long laser into 10 feet and provide 10,000 bits of storage that would be retrievable 10 microseconds later. Faster delay lines always seemed like a good idea to us.

Maybe we wouldn't be in the computing pickle we're in if we had taken the fluidic computer fork in the road as urged by Air Force Maj. John Humphries Jr. in the March 1967 issue. After playing around with fluidic flip-flops, jets, and orifices—not to mention the Coanda Effect and taxpayer money—his conclusion was that, all things considered, "fluidic computers have a definite place in the ever-expanding array of data processing techniques." An industrial market of $250 million was foreseen by some in 1970.



RESEARCH REDUX: Bell Labs was experimenting with using optical delay lines for computer storage back in 1965.

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The extraordinary success of the MDS *Series 21* product line is based on one very simple factor: if you can justify installing one of our systems to automate even a single distributed processing function like data entry, you'll be delighted with what the future holds in store.

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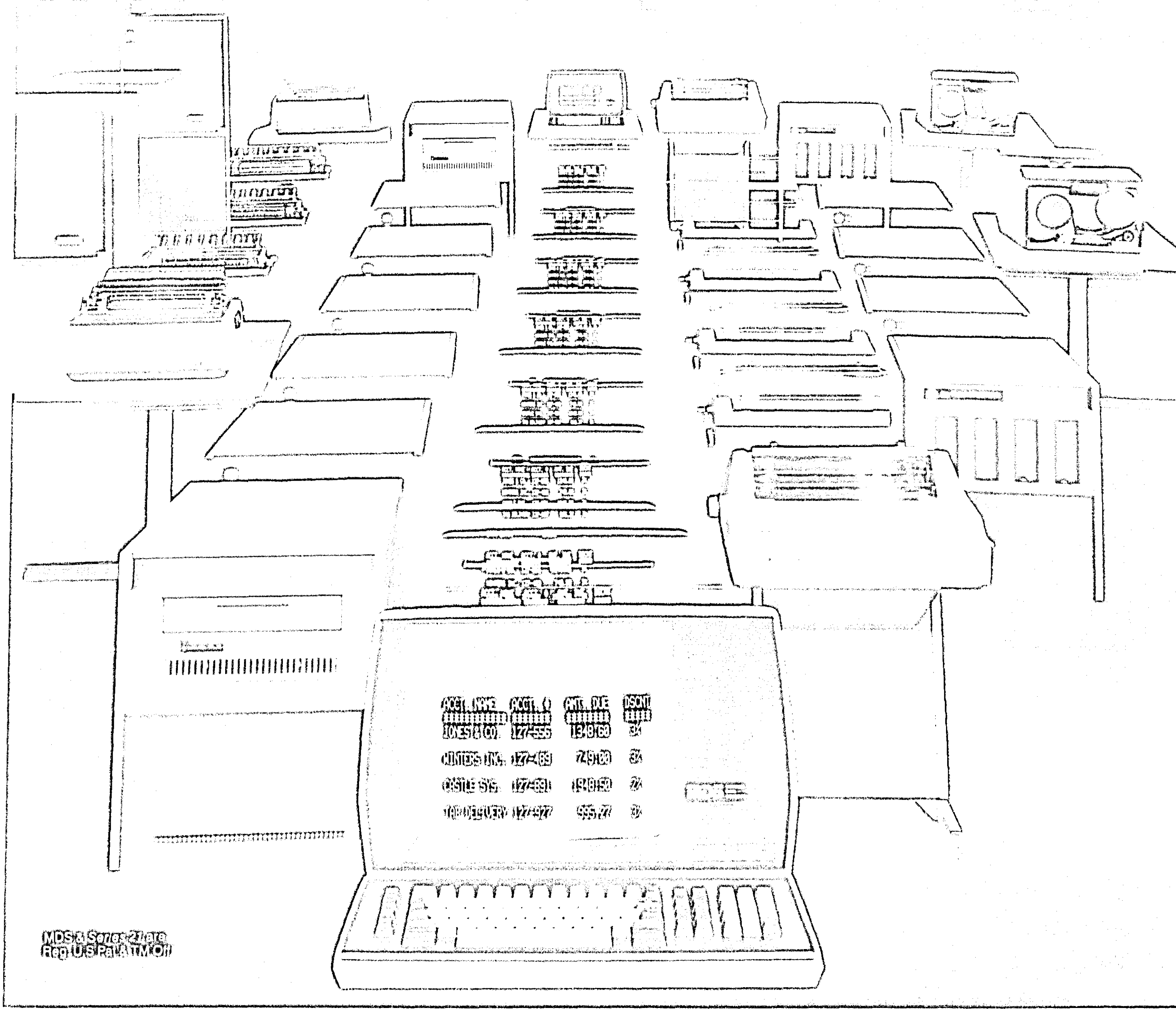
MOHAWK DATA SCIENCES

Building on the Theory of Productivity.

A system should improve [illegible]



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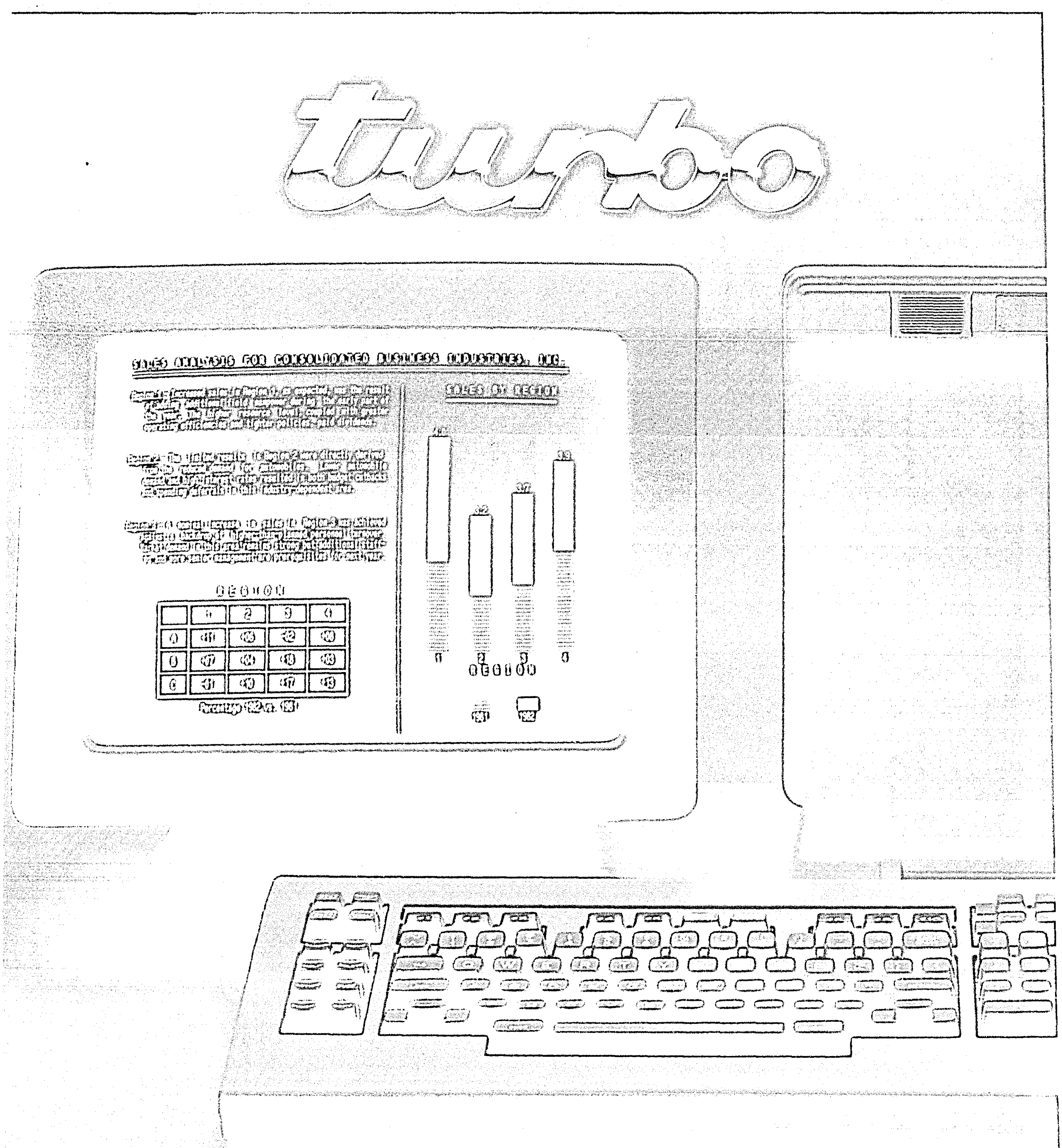
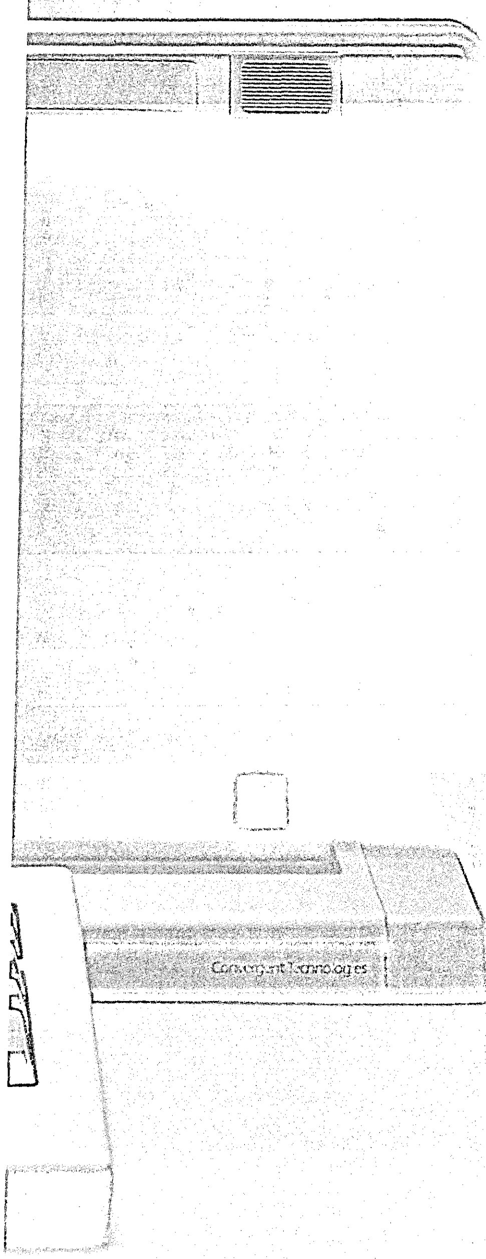

turbo
SALES ANALYSIS FOR CONSOLIDATED BUSINESS INDUSTRIES, INC.
SALES BY REGION
REGION
Percentage 1982 vs. 1981
REGION
1981
1982

PERFORMANCE. 0% MORE DOLLARS.



INTRODUCING THE CONVERGENT TURBO WORKSTATION.

The original Convergent IWS workstation literally defined the hardware and software standards of the Electronic Office. Its powerful 16-bit distributed intelligence architecture, built-in clustering capability, and state-of-the-art software made it an instant success with OEM's.

Then our AWS workstation line made most of the same advantages available in a significantly smaller package, at a dramatically reduced price.

Now meet the AWS Turbo Workstation. The same compact packaging. The same low price. *With over four times the processing speed.*

The world's first high-performance mini on a desktop.

The Turbo takes advantage of new IC and memory technology to provide true minicomputer capabilities —*including mass storage*— in a package hardly bigger than a terminal. The slim lectern contains a 16-bit, 8 MHz processor plus optional 630 kB minifloppies and/or Winchester disks up to 16 MB.

Add a printer and Convergent software, and you've got a superb word processor. Other software options let you do spreadsheet modeling, handle standard communications protocols (3270, 2780, 3780, X.25), and use an advanced electronic mail system. The powerful multitasking operating system supports applications in COBOL, FORTRAN, BASIC, Pascal, and assembler, with complete portability between stand-alone and clustered systems.

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The new Turbo Workstation offers a sensational price/performance package. But it also offers some things that nothing remotely like it can match:

— A fast-growing community of Convergent users approaching thousands of installed systems.
— A software development environment tailor-made for OEM's.
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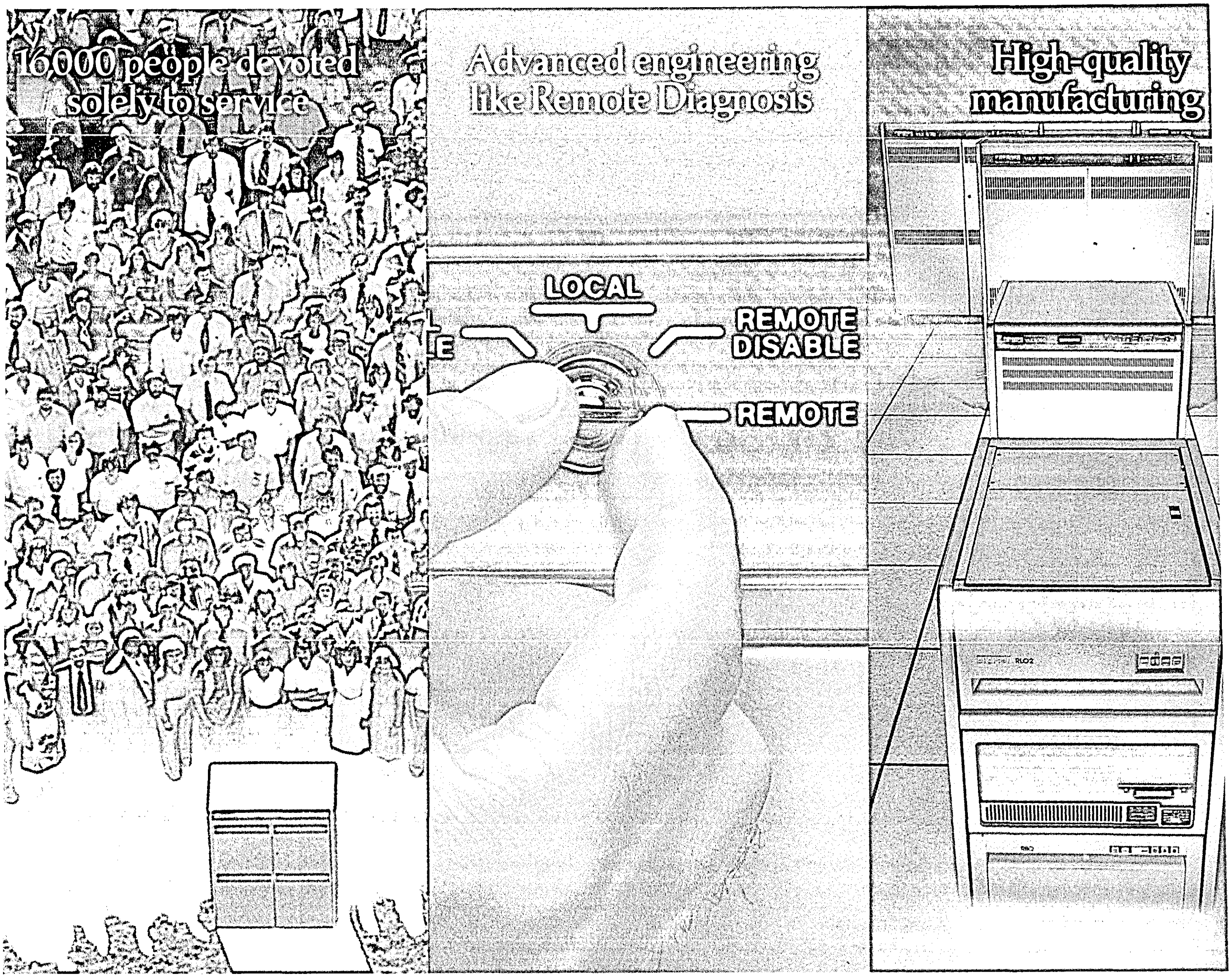

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digital

Data Disc came close to announcing something that looked like a floppy disk back in December of 1963.

AHEAD OF THEIR TIME

One of the first standout products introduced in our products department (January 1958) was the S-C 5000 electronic printer from Stromberg-Carlson of Rochester, N.Y. It operated both on- and off-line, and a 7-inch Charactron Shaped Beam Tube generated one million characters a minute. It printed a set of 64 characters at 4,680 lpm. What was more, "the new unit will print on rolls of paper, or on sheets cut to the desired size by an electronically controlled cutter. Because the unit's printer can be used with any kind of paper, the S-C 5000 prints on all grades of stock, from thin tissue to punched cards." Wow!

How long has the Selectric typewriter been around? Our readers were introduced to it in May of 1963 when it cost $1,350. The design has aged well. Twelve years later IBM even offered Athabascan language (Navajo and Apache) golf balls for it.

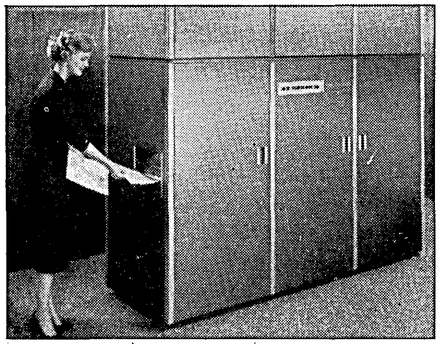
January of 1959 saw the introduction of the model 220 edp system from Burroughs' ElectroData Division. ElectroData equipment was highly thought of back then, and the 220 was probably a good enough system, but its best component appeared to be its line printer that operated at 1,500 lpm. That's still fast even today.

Data Disc sure came close to announcing something that looked like a floppy disk back in December of 1963. The system featured interchangeable 12-inch disks with two megabits of capacity, 150 msec access, and 30 seconds to change the medium. But the price was $9,500. Compare that to the minifloppy (in both price and performance) available for personal computers. Technology rushes on.

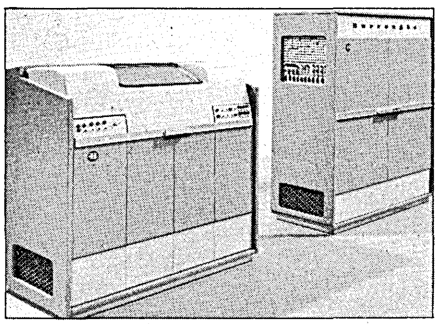
March of 1965 saw the introduction of the IBM 1130, an end-user supported computer (minicomputer?) from IBM that users came to love. Perhaps the most interesting aspect of this machine was that it came to the attention of some folks in sleepy San Diego at Digital Scientific Corp. DSC had developed the META 4 (one of our very favorite product names), a truly microprogrammable minicomputer that eventually mimicked more machines than any other system. When IBM pulled the plug on the 1130, DSC rushed in and emulated them faster than IBM had run them. IBM didn't seem to care much at the time, but DSC showed it could be done. IBM would later come to care when the RCAs, Amdahls, and Itels came along.

Things were really popping in the small-scale field during the mid-60s. The PDP-8 was out from DEC, and the industry was about to change dramatically as users and systems integrators found new and ubiquitous uses for these machines.

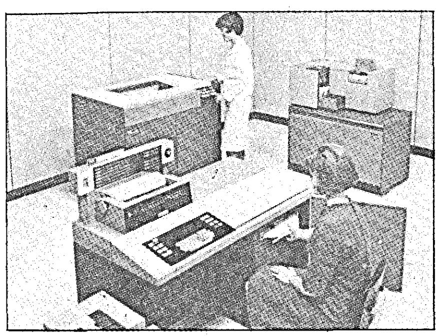
The first robot that appeared in DATAMATION's pages was in October 1967. The robot was from the company that is still thought of as the world leader in robot production—Unimation.



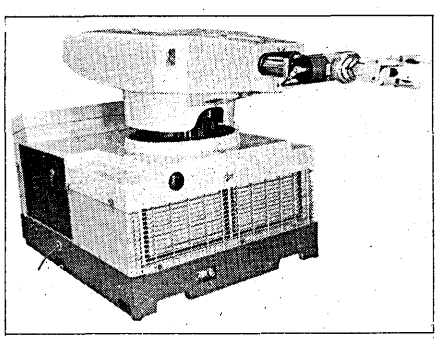
STANDOUT PRODUCT: The Stromberg-Carlson S-C 5000 printer could generate 1 million characters a minute when introduced in 1958.



PRINTER PRIDE: Burroughs could be proud of its 220 system printer that operated at 1,500 1pm in 1959.



IBM WINNER: Users came to love the 1130 that Big Blue brought onto the market in 1965.



ROBOTS REVISITED: The first robot to appear in DATAMATION's pages was from the ubiquitous Unimation.

HAS THIS BEEN DONE?

We have seen some things over the years that people in the know tell us are difficult to do today. They seemed like useful capabilities, and we'd simply like to know whether these accomplishments, or virtual accomplishments, have been firmly accomplished yet.

It was a sweltery New York afternoon in July of 1964 at the World's Fair in Flushing Meadow where an IBM booth awed spectators with the computer's ability to translate foreign languages. One crt in the booth showed lines of Russian Cyrillic writing being fed to a computer. Another crt showed flowing English text coming out.

Can we really do this? If we can, we are happy to report that we are ahead of the Russians in at least one category. Here's the proof. A sign recently seen aboard a Russian ship showing emergency procedures read: "HELP SAVERING APPARATA IN EMERGINGS BEHOLD MANY WHISTLES! ASSOCIATE THE STRINGING APPARATA ABOUT THE BOSOMS AND MEET BEHIND. FLEE THEN TO THE INDIFFERENT LIFESAVERING SHIPPEN OBEDIENCING THE INSTRUCTS OF THE VESSEL CHEF."

Another capability that we may have once had, and that seems to have been lost, is weather forecasting. Though we are unable to predict even the severity of typhoons or other local disturbances today, an IBM 704 was installed at the Japanese Meterological Agency in Tokyo, according to our January/February 1959 issue.

Someone was telling us that "a 704 has been used by the U.S. Weather Bureau at Suitland, Md., to predict weather conditions for the northern hemisphere." This capability must be enormously more advanced by now.

How is the Extendable Computer System Simulator doing these days? If your installation is still running Simscript II, there may be some good news here. This NASA-funded package, reported in our Dec. 1, 1979 issue, was available through the Rand Corp. It purported to simulate computer configuration performance to ascertain whether adding memory or additional peripherals would improve performance.

Where is Longitudinal Redundancy Check Inc.'s impact printer with "unlimited" character capability (but at 120 cps) for $700? Did any oem products ever come out of Riverton, Wyo.? Check the rumor in the June 15, 1971 DATAMATION.

Hope all you Gleipner programmers were able to find other jobs. For those few who don't remember Gleipner, this high-level language was named for "a shackle or fetter made by a dwarf for Norse gods to

Best Software Glitch award: To the letter writing package that sent a missive to Mr. Intl B. Mac Hines.

constrain a wolf who had broken the strongest of chains." The original Gleipner "was soft and smooth as silk, yet strong and tough, and was made from the noise of a cat's footfall, the beard of a woman, the roots of a mountain, the nerves of a bear, a fish's breath, and the spittle of a bird." Seemed like the only reasonable programming language for the ILLIAC IV (Aug. 1, 1971).

Calling all Ovonic Memories! You "promised" you would show a 3330-like disk drive in March of 1972 that would provide 10 times the storage of the IBM product. This was supposed to be made possible by coating the 4440's disk with amorphous glasslike "Ovonic" material.

Large files did become de rigueur, so Grumman Data Systems, if you intend to install those MASS-TAPE trillion-bit memories you were thinking of showing at the Fall Joint Computer Conference in Las Vegas back in November of 1971, we have a hunch the time will never be better than today.

Does anyone know when the bubble burst for bubble memories?

In September of 1973 we noted that Memorex had decided not to market tape reels with psychedelic designs on them. We were disappointed: we thought it was good that a company in such deep financial trouble was somehow able to keep its head above . . . above . . . wow, man!

The industry showed all the signs of taking itself too seriously in November of that year, when Reality was announced by Microdata. The machine seemed to be a clear breakthrough in the man(sic)/machine interface, enabling noncomputer-oriented personnel easy access to the system.

So, in the April 1974 issue, we countered with the Marks 2, a machine that not only was difficult to access, but openly defied it. This machine combined many of the buzzwords of the time, including pipeline architectures and bubble memories, and featured "unusually deep" two-bit bites (which came to be known as fangs). No garlic around the machine, please. At least J.A. Hage at Western Electric liked it, and introduced the first independent software package for the machine, MORBID.

SIGN OF THE TIMES: Do you remember when the going rate for a house was $17K? (1966).

SPECIAL AWARDS

DATAMATION is fond of giving informal awards. So to celebrate our silver anniversary, we decided to hand out some special plaudits in the product realm.

- GREATEST NUMBER OF INQUIRIES FOR A NEW PRODUCT—To the Hewlett-Packard 35 handheld calculator. The first of the very smart calculators, the HP 35's performance compared favorably to the ENIAC.
- SMALLEST IMPACT FOR MOST (INVISIBLE) INK—Tie: CDC STAR and ILLIAC IV.
- BEST SOFTWARE GLITCH—To the virtually intelligent letter writing package that missived IBM once with a letter addressed to Mr. Intl B. Mac Hines.
- HUNGRIEST SALESPERSON—To the NCR salesman who sold the point-of-sale terminal to the Hasegawa General Store at the end of the narrow 900-curve road in Hana, Maui, Hawaii, back about 1975.
- MOST CREATIVE PR DEPARTMENT—To National Semiconductor for announcing the Write-Only Memory back in the mid-'70s. Most of the media thought they were kidding, but not every editor.
- MOST COOPERATIVE PR DEPARTMENT—Tie: IBM and Hewlett-Packard.
- MOST UNCOOPERATIVE PR DEPARTMENT—To Texas Instruments, which responded to our list of fundamental questions on the Advanced Scientific Computer with a terse: "It looks like you want to build one." ❋

HOW DO YOU STOP POWER DISTURBANCES FROM CAUSING COMPUTER CONFUSION?

Answer: With a Topaz Power Conditioner.

Ordinary AC power often confuses computers. Transient electrical impulses (noise) can be misread by a computer, causing untraceable data entry. Common voltage fluctuations can cause memory losses, system malfunctions and even hardware damage.

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Don't let power disturbances baffle your computer. Protect it with a Topaz microcomputer-controlled Power Conditioner. All models are available for immediate shipment.

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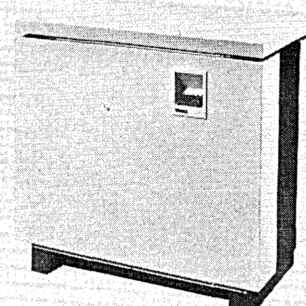
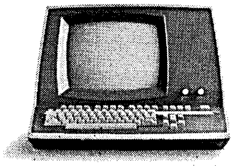


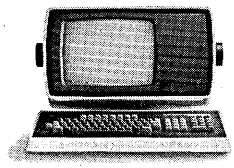
TOPAZ

SOLUTIONS TO POWER PROBLEMS™

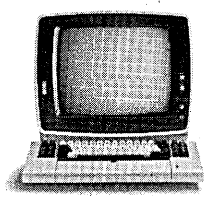
CIRCLE 80 ON READER CARD



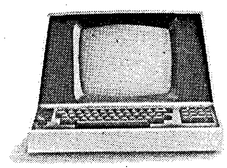
WORD PROCESSING SYSTEM



DISTRIBUTED DATA PROCESSING

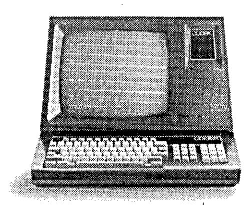


ONLINE INQUIRY SYSTEM



DATA ENTRY SYSTEM

$25,000



ditto

$5,417

Our new CDX-268 Series distributed processing system combines those applications that once called for separate terminals into one cost efficient system. So when you need to perform extra functions, you don't have to buy extra terminals.

The CDX-268 Series from Codex. One system for multiple applications. One system that lets you put together a totally integrated network for optimum efficiency and lower cost. For more information call 1-800-821-7700, ext. 893.

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MOTOROLA INC.
Information Systems Group

See us at TCA, San Diego, September 21-24.

Codex Corporation, 20 Cabot Blvd., Mansfield, MA 02048/Tel: (617) 364-2000/Telex 92-2443/Codex Intelligent Systems Operation, Tempe, AZ Tel: (602) 994-6580/Codex Europe S.A., Brussels, Belgium Tel: (02) 762.23.51/Codex (U.K.) Ltd., Croydon, England Tel: 01-680-8507/Codex Deutschland, Darmstadt-Griesheim, W. Germany Tel: (6155)-3055/Codex Far East, Tokyo, Japan Tel: (03) 355-0432/ESE Ltd., Toronto, Canada Tel: (416) 749-2271/Offices and distributors in major cities throughout the world. Member of IDCMA.

All prices estimated on cost per user. CDX-268 four-user System includes 128K memory, 2 MB storage, 120 cps printer, communications interface, all software. Price subject to change without notice.
UNIX™ is a trademark of Bell Laboratories.

CIRCLE 81 ON READER CARD

Rummaging through the issues in our attic.

THE OLD CLOTHES OF ADVERTISING

by Deborah Sojka

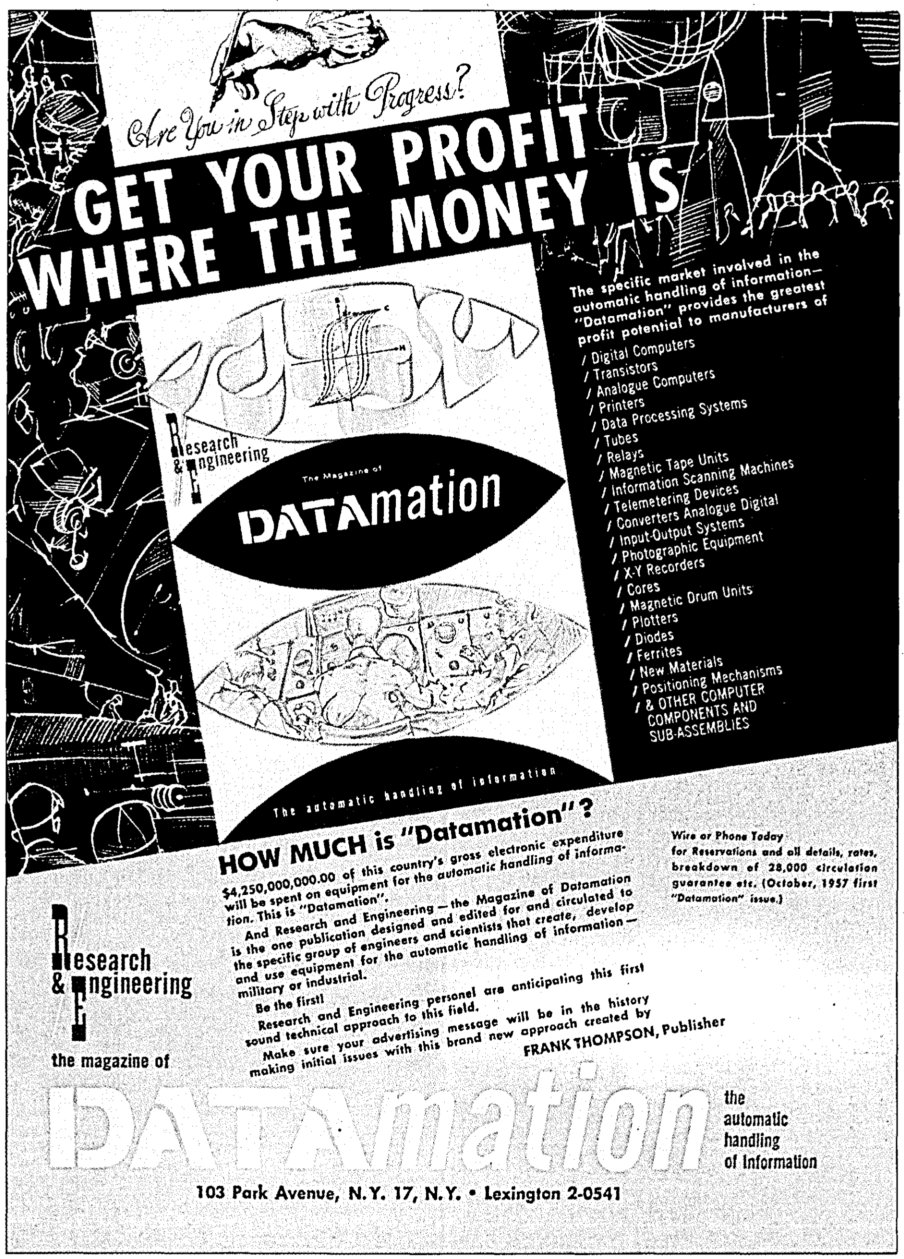
"The clothes make the man." If that's true, then logically advertising should make the company. When you go into an attic, however, and pull out a 15-year-old outfit, it can look quite foolish compared with current fashions. While hemlines and styles may come back into vogue (witness the rebirth of the mini skirt), old advertisements never do. Once they've served their purpose, old advertisements are filed away, thrown out, or put on plaques for nostalgia's sake. But, almost always, they're good for a chuckle or two.

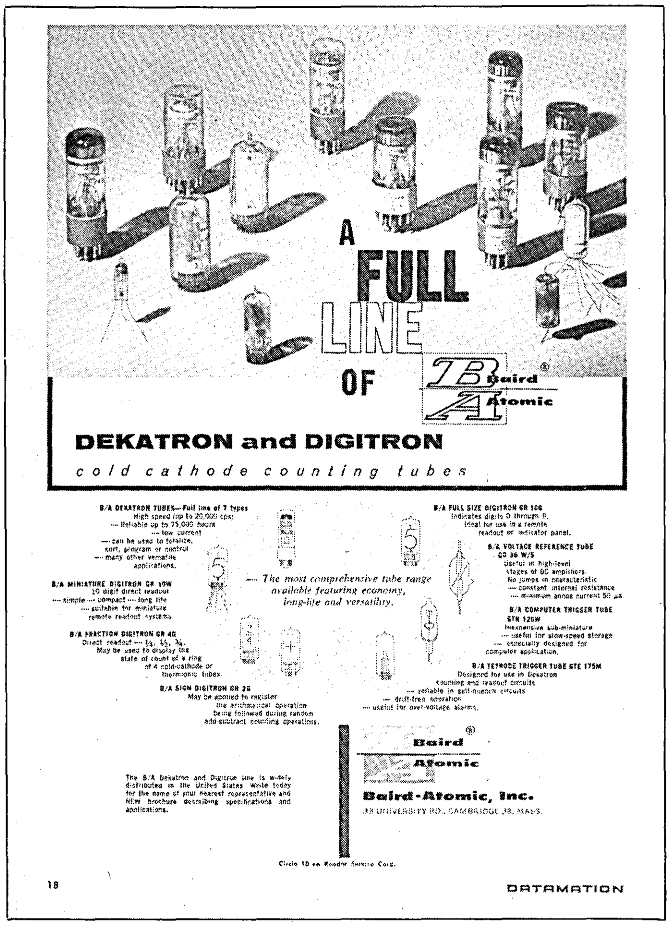
DATAMATION recently dug deep into its advertising attic and emerged with a collection of ads ranging in age from one to 25 years. None of them, of course, represent the companies' offerings today—after all, this is a historical look at advertising.

Unfortunately, while trying to obtain permission to reprint these ads, we encountered some particularly sensitive companies and issues. We were denied permission to reprint Entrex Inc.'s ad (July 15, 1970), which read, "We taught our data entry system to speak a new language: Dumb Blond. If a girl can type, she can enter data on our system. If she can read, she can verify it on the display. To her, it's a typewriter and a nifty little tv screen. (She can be the dumbest blond you can find.)"

And, because Microdata no longer uses nude female models to accent its microprogramming handbooks, we were not allowed to run its ad (November 1972) that proclaimed, "The second edition of our microprogramming handbook is more revealing than the first." We also got turned down when asking to reprint a Xerox Data Systems ad (December 1969) that said, "The same old management that put SDS out of business now runs Xerox Data Systems."

Most companies, however, were as amused as we were to rummage around in the attic and chuckle over yesterday's fashions. Read on, and see if you agree.





A FULL LINE OF Baird Atomic

DEKATRON and DIGITRON

cold cathode counting tubes

B/A DEKATRON TUBES—Full line of 7 types
High speed (up to 20,000 cps)
— Reliable up to 75,000 hours
— low current
— can be used to totalize, sort, program or control
— many other versatile applications.

B/A MINIATURE DIGITRON GR 10W
10 digit direct readout
— simple — compact — long life
— suitable for miniature remote readout systems.

B/A FRACTION DIGITRON GR 4G
Direct readout — ¼, ½, ¾.
May be used to display the state of count of a ring of 4 cold-cathode or thermionic tubes.

B/A SIGN DIGITRON GR 2G
May be applied to register the arithmetical operation being followed during random add-subtract counting operations.

— The most comprehensive tube range available featuring economy, long-life and versatility.

B/A FULL SIZE DIGITRON GR 10G
Indicates digits 0 through 9.
Ideal for use in a remote readout or indicator panel.

B/A VOLTAGE REFERENCE TUBE GD 36 W/S
Useful in high-level stages of DC amplifiers.
No jumps in characteristic
— constant internal resistance
— minimum anode current 50 μA.

B/A COMPUTER TRIGGER TUBE STK 125W
Inexpensive sub-miniature
— useful for slow-speed storage
— especially designed for computer application.

B/A TETRODE TRIGGER TUBE STE 175M
Designed for use in Dekatron counting and readout circuits
— reliable in self-quench circuits
— drift-free operation
— useful for over-voltage alarms.

The B/A Dekatron and Digitron line is widely distributed in the United States. Write today for the name of your nearest representative and NEW brochure describing specifications and applications.

Baird Atomic®

Baird-Atomic, Inc.
33 UNIVERSITY RD., CAMBRIDGE 38, MASS.

Circle 10 on Reader Service Card.

18 DATAMATION

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Now you can have...

SOLID STATE ULTRA RELIABLE

Digital Tape Transports

with HIGH PERFORMANCE MILITARY QUALITY and *Modern Styling*

Data Stor Model 59 tape transports incorporate the highly reliable features of military tape transport systems developed by the Cook Electric Company for the Atlas, Titan, Polaris and other missile programs. These features include exclusive use of solid state circuitry for all control and read/write electronics, proportional reel drive servo systems, and tension error sensing by synchro transmitters. Field adjustments are eliminated by building tolerances into a single rugged tape deck casting.

TAPE SPEEDS TO 150 IPS • LESS THAN 3 MS STOP/START • REWIND SPEEDS TO 400 IPS NO PROGRAMMING RESTRICTIONS • OPERATES FROM CONTROL PULSES OR LEVELS OF EITHER POLARITY • FRONT PANEL ACCESS • CHOICE OF NARTB, IBM, OR SPECIAL REELS • CONDUCTIVE LEADER, LIGHT TRANSMISSIVE, OR LIGHT REFLECTIVE END OF TAPE SENSORS • METAL FACED READ/WRITE MAGNETIC HEADS • AVAILABLE AS HIGH SPEED PHOTOELECTRIC READER.

Experienced recording systems engineers are invited to apply for existing employment opportunities.

A DIVISION OF Cook Electric Company

Designers and makers of ground and airborne magnetic recording systems, photoelectric readers and computer peripheral equipments.

ADDRESS YOUR INQUIRIES TO
8100 MONTICELLO AVENUE SKOKIE, ILLINOIS

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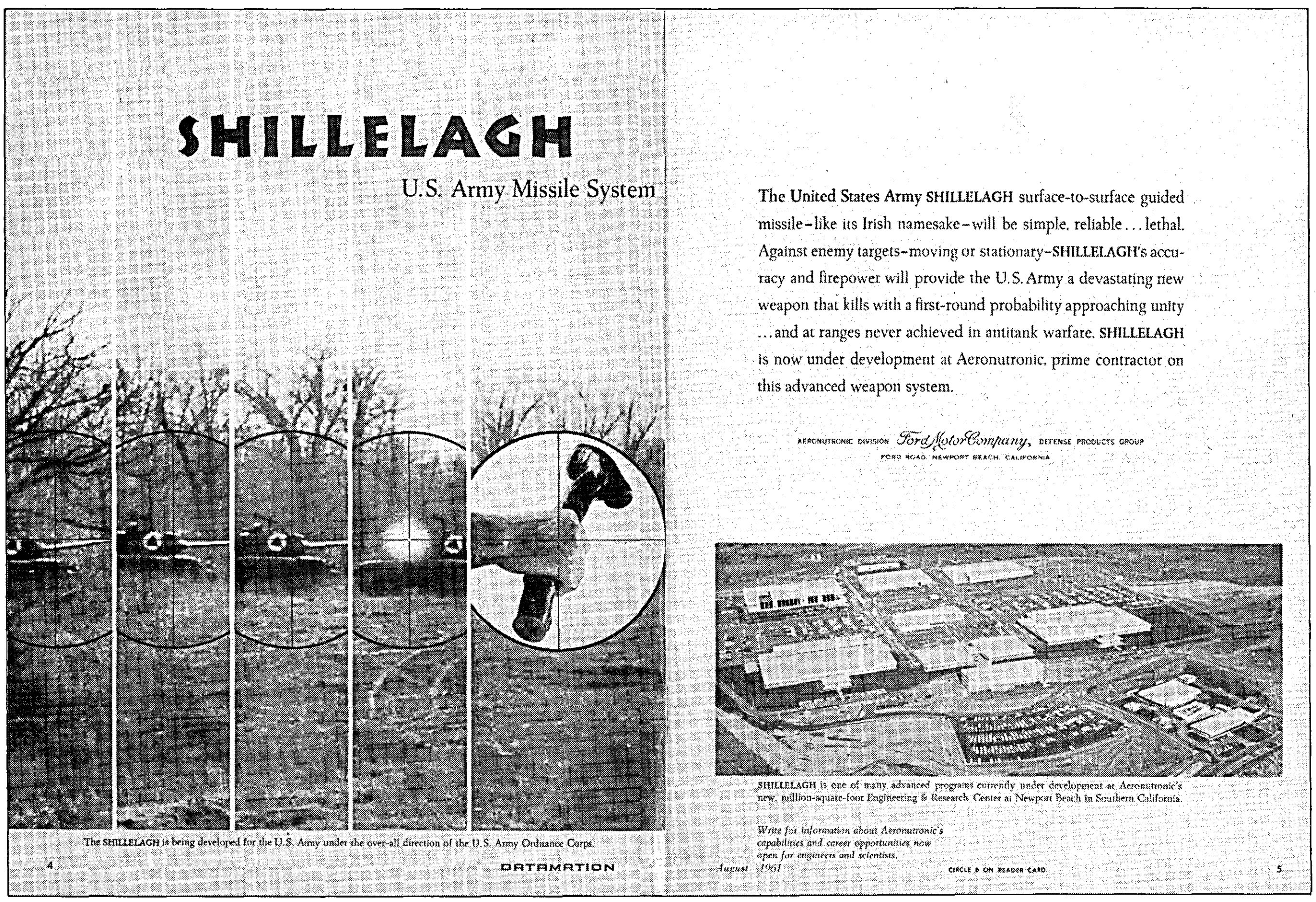


SHILLELAGH

U.S. Army Missile System

The SHILLELAGH is being developed for the U.S. Army under the over-all direction of the U.S. Army Ordnance Corps.

4 DATAMATION

The United States Army SHILLELAGH surface-to-surface guided missile–like its Irish namesake–will be simple, reliable... lethal. Against enemy targets–moving or stationary–SHILLELAGH's accuracy and firepower will provide the U.S. Army a devastating new weapon that kills with a first-round probability approaching unity ...and at ranges never achieved in antitank warfare. SHILLELAGH is now under development at Aeronutronic, prime contractor on this advanced weapon system.

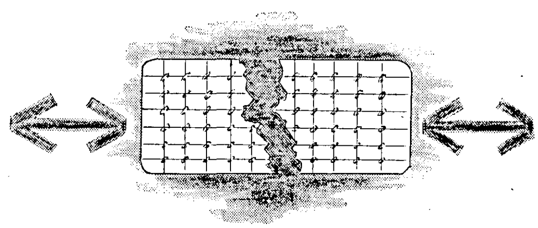
AERONUTRONIC DIVISION *Ford Motor Company,* DEFENSE PRODUCTS GROUP
FORD ROAD, NEWPORT BEACH, CALIFORNIA

SHILLELAGH is one of many advanced programs currently under development at Aeronutronic's new, million-square-foot Engineering & Research Center at Newport Beach in Southern California.

Write for information about Aeronutronic's capabilities and career opportunities now open for engineers and scientists.

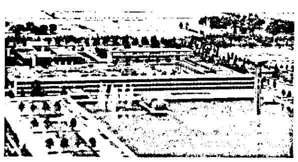
August 1961 CIRCLE 6 ON READER CARD 5

OPPORTUNITIES AT THE OUTER EDGE OF COMPUTER SCIENCE...



SCHIZO-PROGRAMMING*

***SCHIZO-PROGRAMMING.** *This is a symbolic representation of an experimental, split-memory multi-programming technique now being investigated. One portion of the machine memory will be used for continuous scientific computations. The other, for real-time data handling problems that put random instantaneous computational demands on the computer. For this unusual problem mix, intricate programming systems are being analyzed and prepared for the efficient space-sharing of the IBM 7090 magnetic core memory and time-sharing of its central processing unit.*



Home of the General Motors Research Laboratories consists of these eight buildings making up part of the 330-acre GM Technical Center. This modern campus of technology is located in suburban Warren, 13 miles north of downtown Detroit and within easy driving distance of top Michigan and Canadian recreational areas.

The latest computers can carry on many operations simultaneously—with part of their memory units completely unaware of what another part is doing. This demands a new level of sophistication for programming systems.

Here at the General Motors Research Laboratories, the development of such advanced programming techniques is part of a long-term effort aimed at extending the sensor, problem-solving, and motor capabilities of computers. If you are interested in projects at the outer edges of computer science—where you are free to discover and can do your most constructive work—investigate the many opportunities in our growing computer staff.

Immediate non-routine assignments, many at the senior level, are now open in these areas: **PROGRAMMING SYSTEMS ... PATTERN AND CHARACTER RECOGNITION ... NUMERICAL ANALYSIS ... PROBLEM-ORIENTED LANGUAGES ...** and **NUMERICAL CONTROL.**

For those qualified in any of these areas, we invite you to . . .

Discuss the unusual growth opportunities at GM Research with management members of our computer staff while attending the **WESTERN JOINT COMPUTER CONFERENCE** in Los Angeles, May 9, 10, and 11. Call Mr. D. E. Hart, Head of the Digital Computations Department, at DU 7-5134 Tuesday through Thursday to arrange a convenient appointment or . . .

Send us a brief résumé today. Write:

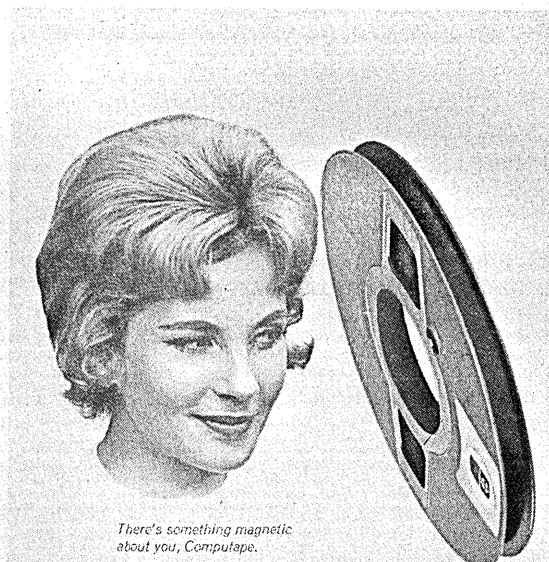
Mr. J. B. Sparhawk, Personnel Staff

General Motors Research Laboratories

WARREN, MICHIGAN

CIRCLE 79 ON READER CARD

April 1961 89



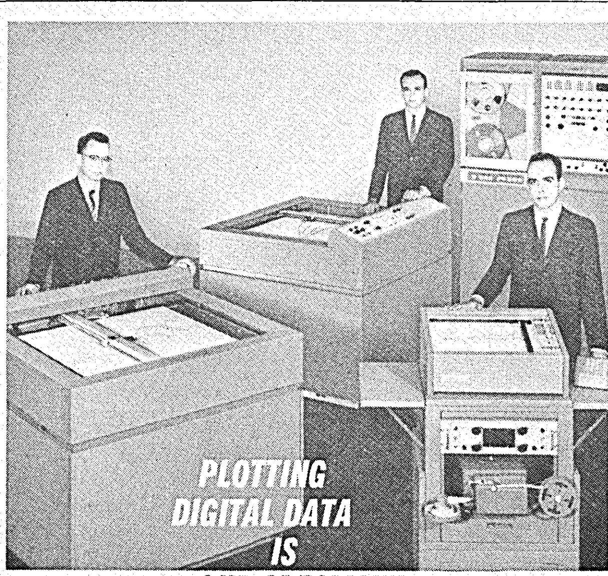
My special oxide coating, Penelope. It's revolutionary. Specially designed for high density, high resolution data recording. Helps me guarantee 556 or 800 bits per inch with no dropouts for severest computer applications.

P. S. Computape doesn't really talk, of course. But in a computer, Computape *reliability* will deliver its own message. New COMPUTAPE, the premium quality computer and instrumentation tape, is the product of the only company devoted exclusively to the manufacture of quality tapes for data processing and instrumentation. *Investigate new Computape today. Better still, immediately.*

COMPUTRON INC.
122 Calvary Street, Waltham, Massachusetts

CIRCLE 31 ON READER CARD

82 DATAMATION



OUR SPECIALTY

Since 1952, EAI plotting equipment has been applied to a steadily lengthening list of data reduction applications—from simple, manual point plotting to high-speed magnetic tape input contour plotting. Again and again, the flexibility, speed and extreme accuracies of EAI plotters have dictated their selection over competing instruments. ◻ EAI standard plotters include 11"x17", 30"x30", and 45"x60" boards. Operation can be either off-line from punched cards, punched tape and magnetic tape, or on-line with various computers. Output modes include point, line, symbol, and contour plotting. Plotting speeds up to 4500 line segments per minute can be provided. Reliability is assured by solid-state circuitry and superior mechanical design. ◻ You can draw upon EAI's wide application and design knowledge by describing your requirements. Write for information, detailing your needs, today.

EAI ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

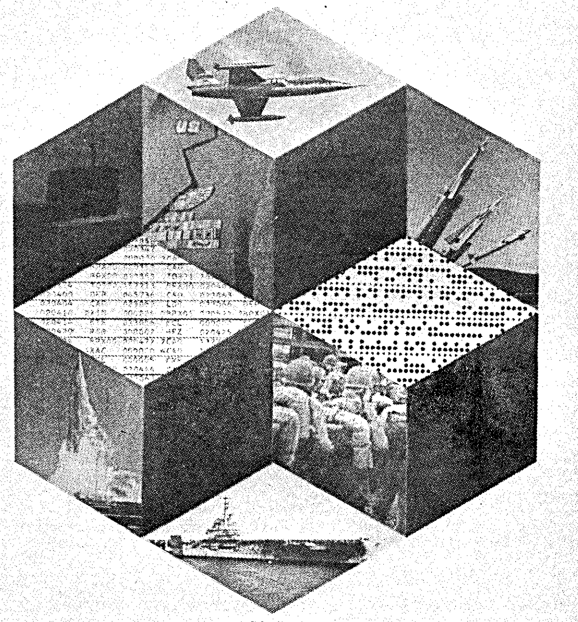
CIRCLE 8 ON READER CARD

December 1962 7

Decision-Making: Deploy or not?...When and where?

The costly, complex weapons systems of today make such a decision far more difficult than in the past. World-wide forces and events are frequently involved. The time for decision has been compressed, the information on which it must be based has been multiplied in volume, variables, interrelationships. This new era of decision-making has led commanders and governmental leaders to make use of man-machine systems which provide information processing assistance. SDC's staff of scientists, engineers and computer programmers have been developing these huge systems for more than eight years. They help develop the system itself, not the hardware within the system. Specifically, they analyze system requirements, synthesize the system, instruct computers which are the core of the system, train the system, evaluate the system, adapt it to the changing needs of its users. And in so doing, they consider the interaction and effect of men, doctrine, tradition, training; of organizations, chains-of-command and chains-of-succession; of communications, traffic centers, command posts, computers and displays. Computer programmers, human factors scientists, operations research scientists and systems-oriented engineers interested in joining this rapidly expanding field and working in a close interdisciplinary effort are invited to write Mr. A. E. Granville, Jr., SDC, 2401 Colorado Ave., Santa Monica, California. Positions are open at SDC facilities in Santa Monica; Washington, D. C.; Lexington, Massachusetts; Paramus, New Jersey; and Dayton, Ohio. "An equal opportunity employer."

SDC
System Development Corporation
Systems that help men make decisions and exercise control



CIRCLE 87 ON READER CARD

82 DATAMATION

PERQ now comes with FORTRAN, Unix and IBM 3780 Compatibility.

The Processor per Person Machine. Now, more useful than ever.
PERQ® has the processing power and storage capacity to handle virtually any task. *Without* time sharing. And now Three Rivers has made PERQ more versatile than ever. Because now it accepts FORTRAN 77. And the latest Unix operating systems. And it's even IBM 3780 compatible.
Which means even more processing power.
Add these new features to what PERQ already offers. A 32 bit virtual address system. 512K-1MB memory. 24MB of hard disk storage. RS-232 & IEEE-488 interfaces. With a 10MBs Ethernet* local network option. And it's micro-programmable with our optional writable control store.
And even more power at the keyboard.
Along with the new capabilities, the compact, detachable, dependable PERQ keyboard accesses a high performance software package. And it includes a user-friendly operating system, a super pascal compiler system, a what-you-see-is-what-you-get text editor and plenty more.
And even more power with our already very effective display.
Crisp, proportionally spaced, black and white text in a variety of fonts. Together with high resolution graphics. Our display image is also super responsive, receiving data at about 60 mega bits-per-second. And interacting through a cursor positioning tablet that's standard equipment.
All of which gives our customers the optimum in high performance workstations.
In applications ranging from publishing to CAD/CAM to research. And others we haven't even thought of. After all, flexibility is one of the main advantages of a complete, high performance single-user machine like this one.

PERQ. The ultimate in distributed computing.

Three Rivers Computer

Three Rivers Computer Corporation
720 Gross Street
Pittsburgh, Pennsylvania 15224
412/621-6250

CIRCLE 82 ON READER CARD

PERQ is a trademark of Three Rivers Computer Corp.
*Ethernet is a trademark of Xerox Corp.

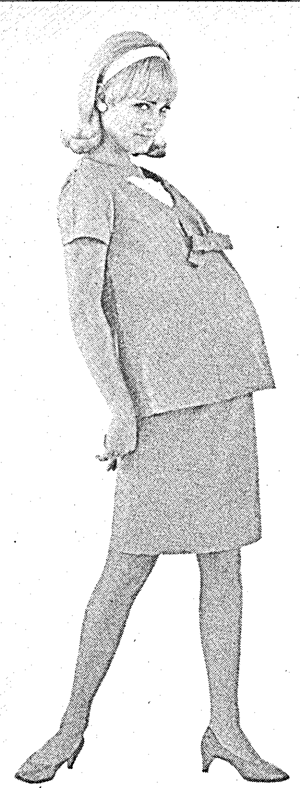
Someday man will hang his hat on the moon

It may not be the hat pictured here. But it will be close. For man's ancient dream of journeying to the moon is steadily nearing reality.

Bellcomm is busy planning this journey, evaluating systems needed for manned space flight there and back. If qualified, you might like to join the vanguard creating this exciting expedition. There are rewarding openings in the fields of physics, chemistry, engineering, psychology, mathematics, flight mechanics, computing and programming, propulsion, aerodynamics and aeronautical engineering.

Bellcomm welcomes your résumé. Send it to Mr. W. W. Braunwarth, Personnel Director, Bellcomm, Inc., Room 1118T, 1100 17th St., N. W., Washington 6, D. C. Bellcomm, newest company of the Bell System, is an equal opportunity employer.

BELLCOMM, INC.
A Bell Telephone System Company



Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't take maternity leave. Or suffer from morning sickness. Or complain of being tired all the time. But it *can* read. And gobble data at the rate of 2400 typewritten (or hand printed) characters a second. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

Our machine reads upper and lower case characters in intermixed, standard type fonts. It can handle intermixed sizes and weights of paper, including carbon-backed sheets.

An ordinary computer program tells our reader what to do . . . to add, subtract, edit, check or verify as it reads. Lets you forget format restrictions, leading and trailing zeros, skipped fields, and fixed record lengths. And our reader won't obsolete any of your present hardware because it speaks the same output language as your computer.

Our Electronic Retina Computing Reader can replace all—or almost all—of your keypunch operators. At least that's what it is doing for American Airlines.

If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.

RECOGNITION EQUIPMENT Incorporated

U. S. Headquarters: Dallas, Texas 214-637-2210 Offices in principal U. S. cities, subsidiaries in Frankfurt, London, Milan, Paris and Stockholm

CIRCLE 4 ON READER CARD

February 1967

DISTRIBUTED PROCESSING NETWORKS

Another in a series of messages on advanced technologies from Honeywell Information Systems.

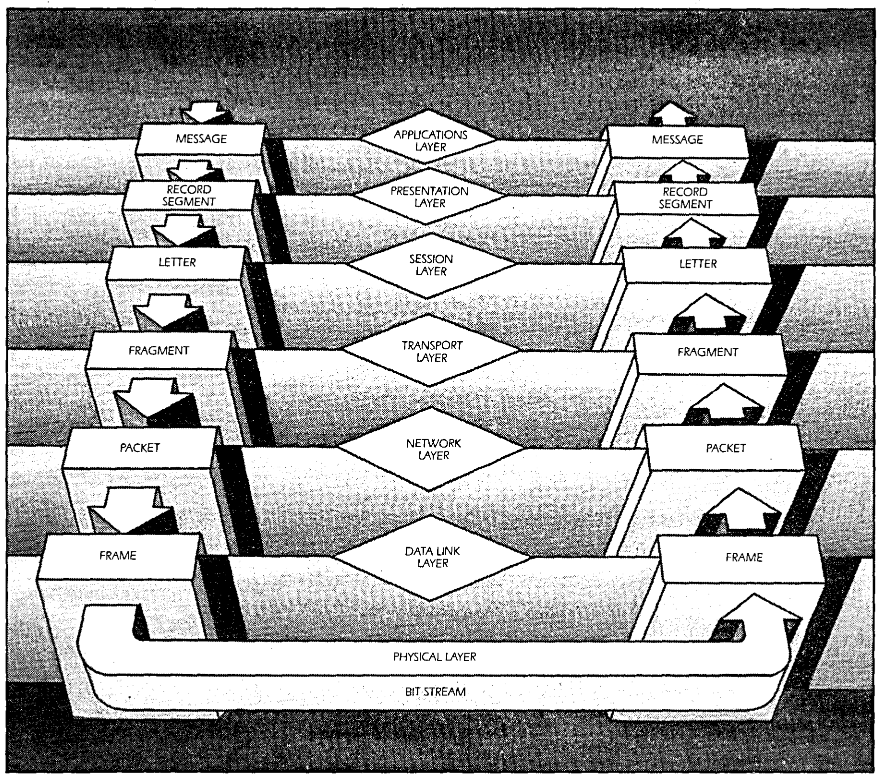
Many data processing professionals are being faced with demands for networks capable of moving increasing amounts of data among more and more locations. Up to now, application-dependent network structures—with their inherent risk of major conversions—offered the most readily available response. Honeywell's Distributed Systems Architecture (DSA), however, provides a more practical alternative. An application-independent networking structure, it fully supports public, value-added, private and international nets.

World-Class Networking Today
Honeywell's DSA establishes standards for data movement and application cooperation in compliance with the International Standards Organization's (ISO) open systems reference model. The architecture, which is not dependent on specific technology or techniques, keeps applications and communication processes separate. Thus DSA is transparent to the end user. DSA creates a cooperative, flexible environment within which the user can build and phase in a communications system that can handle current applications and grow to meet new domestic and international demands.

DSA Structure
DSA's flexible set of rules, protocols, and interfaces allows users to configure and implement data processing systems and networks to help meet the needs of geographically dispersed organizations. Introduced in 1980, DSA consists of a seven layer architecture divided into three groups. The implementation of the first four layers in the Communications Management group controls physical exchanges across the network. The next two layers, the Message Management group, format messages so that the communicating entities can understand each other. They also contain the dialog mechanism that permits communicating activities to synchronize their actions, and the presentation control services which provide application independence from data format, character codes, and terminal handling conventions. The seventh layer, Applications, defines the logical rules to which computer applications conform when communicating. Finally, each layer of DSA also provides network administration and control data to enable overall network control of the distributed system.

Network Support
Because DSA conforms to the ISO open systems model, it's certified as providing native support for the CCITT international X.25 packet-switched and X.21 circuit-switched network protocols. These protocols are being implemented in a growing list of public data networks around the world as well as in value-added and private networks. DSA products support such X.25 based networks as TELENET and TYMNET (United States), DATAPAC (Canada), DATEX-P (Germany, Austria), DDX-P (Japan), DN 1 (The Netherlands), EURONET (European Economic Community), PSS (United Kingdom), EDWP (Switzerland), and TRANSPAC (France). Also supported is the X.21-based NORDIC Net (Scandinavia, Finland). DSA uses High-level Data Link Control (HDLC), also an ISO standard, for data communications between intelligent devices in private networks. Users can configure hierarchical, peer-coupled and hybrid network topologies.

Product Implementation
DSA already enables medium-scale and large-scale host computers and mini-computers to operate in a variety of network configurations. Specialized network processors can be utilized for front-end processing, remote concentration and switching, in addition to communications control and administrative functions. The implementation includes such distributed processing applications as file transfer, remote job entry, terminal concentration and two-level transaction processing as well as office automation applications, including document distribution and host storage, and printing of documents. In addition, DSA administration permits monitoring, control, and maintenance of the network from one or more control sites.

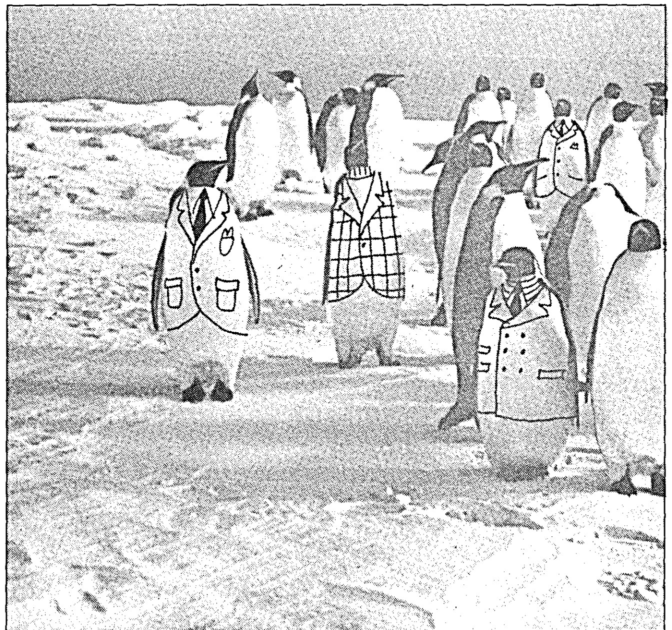


DSA consists of seven layers of functions and protocols governing data handling among network nodes. DSA's implementation of the bottom four layers makes physical exchanges across the network transparent to the end user.

Future Growth
DSA is an important part of Honeywell's implementation of its Distributed Systems Environment (DSE). Future DSA developments will support fully-distributed transaction processing with system-supplied coordination, control, and recovery, load leveling, and resource sharing across computers. This type of peer network will allow host and satellite processors to cooperate as full equals in distributed systems. The open architecture will be further enhanced to meet evolving international network standards while protecting investments in systems already installed. Additionally, data bases will be partitioned across multiple processors with automatic access and updates at all locations. Thus DSA is part of an evolution to fully distributed systems with globally accessible resources.

More on Distributed Processing Networks
For an in-depth description of the DSA open architecture call our toll free number, 800-343-6294 (in Massachusetts call 617-552-2264) or write Honeywell, 200 Smith Street (MS 487), Waltham, Massachusetts 02154.

CIRCLE 84 ON READER CARD



You can be yourself at RCA

We don't care if your sartorial taste runs to the casual or conservative; or if you walk, waddle or strut.

Give us creative thinking, well grounded in computer technology and a broad knowledge of man's needs, today and tomorrow.

Give us that, and we'll give you a great place to work.

Our people work in small intimate groups. The atmosphere is stimulating. And personally satisfying.

We're engaged in some of the most interesting engineering projects of our day—developing large-scale, multi-purpose computers.

Other RCA technologies range from underseas to outer space. This makes it easy to reach experts in almost any field when a problem pops up.

We're moving ahead fast in a rapidly expanding field. There are openings at all levels. Opportunities for advancement are excellent.

Our prime need is for engineers with vision, who can combine a thorough understanding of computers with unique inventiveness.

If this sounds like your kind of place, your kind of work, we invite you to get in touch.

Your background or education should include the design of circuits, micro-circuits, logic, memory, power supplies, systems, communications, or design automation.

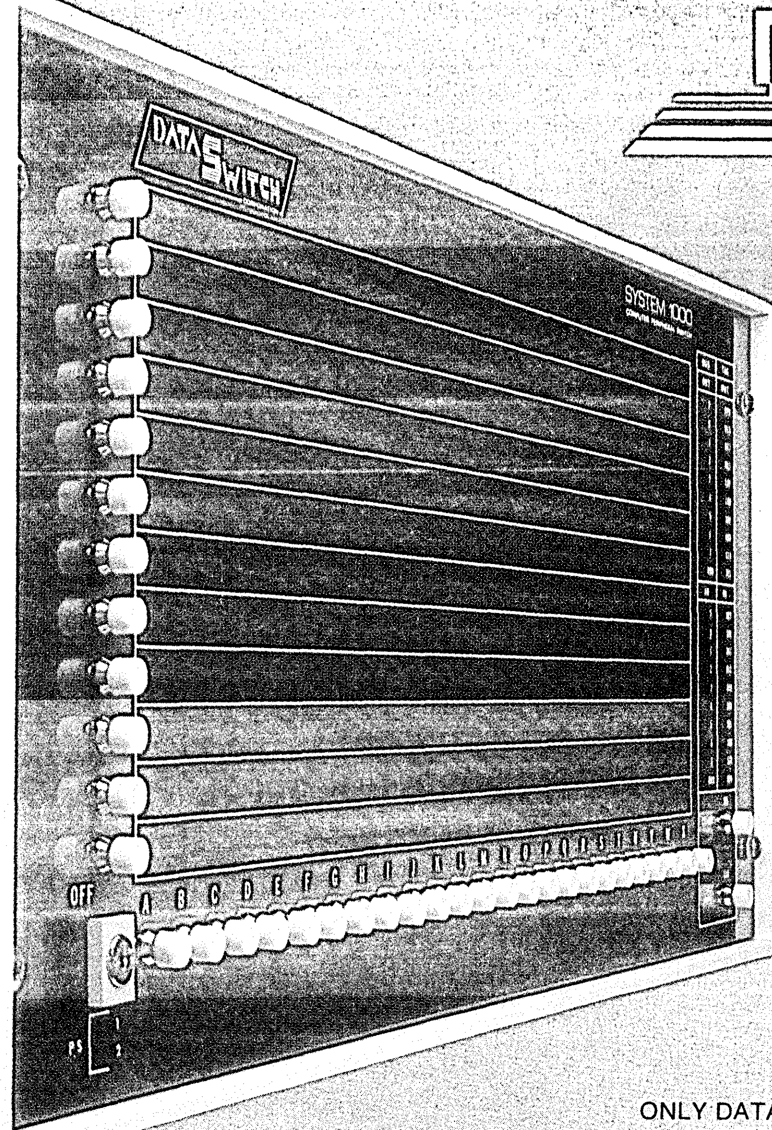
Mail your resume to Mr. J. H. Nostrand, Dept. HW-1, RCA Information Systems Division, Bldg. 13-2, Camden, New Jersey 08102. We are an equal opportunity employer.

RCA

DATA SWITCH CORPORATION

builds large scale peripheral switches for today's IBM computer systems

-IBM <u>still</u> doesn't*



The Data Switch System 1000 dynamically switches any I/O control unit used with any IBM or IBM compatible CPU (even the newly announced 3880 Disk Storage Controller).

ONLY DATA SWITCH OFFERS ALL OF THESE FEATURES

- Matrix sizes to 16x24. One system replaces several IBM 2914's, or 3814's
- State-of-the-art solid-state semi-conductor switching
- Nanosecond switching speeds
- "Data Streaming" Support
- Dual inter-active remote controls (up to 400')
- Continuous configuration displays
- Dynamic or "immediate" switching
- Self-diagnostics
- Redundant power, plus battery back-up
- Field Upgradable (on-line in most cases)
- Optional micro-processor control. (System 1030, 1100, or 1150)
- Price/Performance-ratio unequalled in the industry

Even if you are not currently switching high speed control units (like the 2835/2305), wouldn't you want your peripheral switch to be a System 1000 ... the System with the *future* built in.

Data Switch has more large scale peripheral switches installed than even IBM — ask us for a customer list.

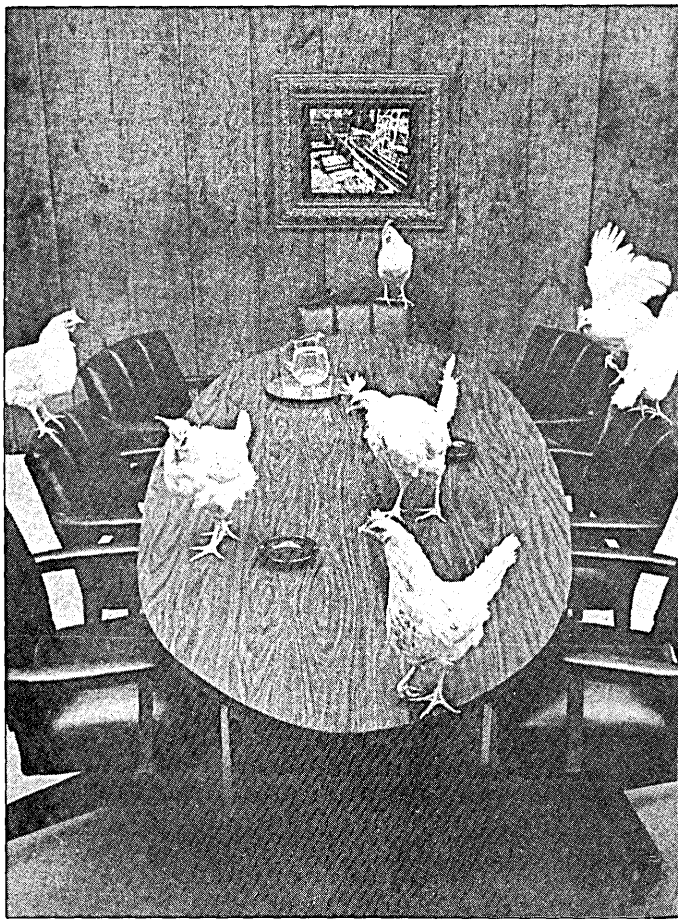
We're switching specialists.

DATA SWITCH CORPORATION

***Not even with the new IBM 3814.**

444 Westport Avenue, Norwalk, CT 06851, (203) 847-9800, TWX 710-468-3210

CIRCLE 86 ON READER CARD



The executive committee has just decided in favor of buying the IBM 1800.

They didn't really take a hard look at any other computer. That might have left them with a gutsy decision to make.

And the fact is, it takes guts *not* to buy from IBM.

It takes guts, for example, to buy an SEL 810B from us, Systems Engineering Laboratories. Instead of an IBM 1800 from IBM.

Even though the SEL 810B is a much better machine.

We prove that every day to people who know computers. But then, all too often, the decision moves upstairs for approval and here's what happens:

"Well, maybe the IBM 1800 does have its faults," says the little voice inside, "But IBM is IBM and if anything goes wrong, who can point a finger at us?"

Nobody, maybe. But we'd like to point out a few things they're missing by buying "security," instead of the best real time computer available.

The SEL 810B is faster than the IBM 1800 — 750 nanoseconds versus 2 or 4 microseconds.

At Systems Engineering Laboratories, we design and deliver custom front-end equipment with the SEL 810B. IBM doesn't with the 1800.

We'll deliver an SEL 810B in 90 days. It takes a year to get the IBM 1800.

The price difference is startling. You can actually buy two SEL 810B's for the price of a typical 1800.

Ask IBM about all this and you may get a sermon on service. We know our service, too. But we say a computer exists to work, not to be worked on.

Please understand we're not cocky, just confident. And there's nothing we'd like better than to show you the differences between the SEL 810B and the IBM 1800.

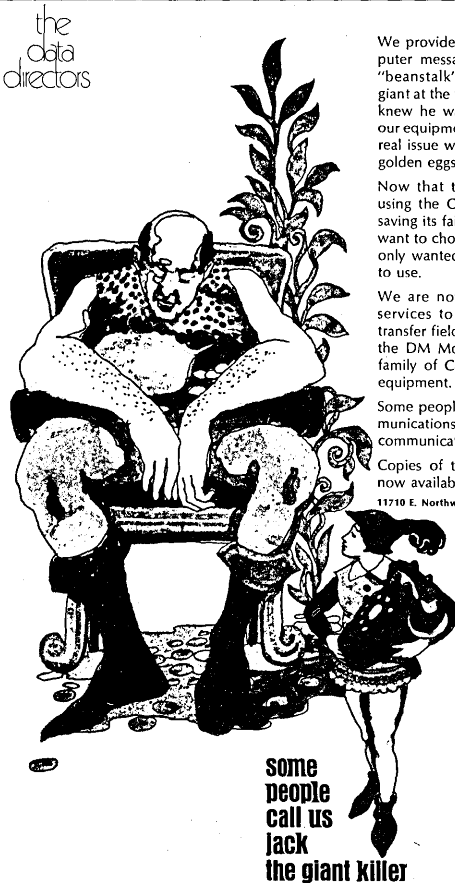
After that, you may decide to request a repeat performance for your executive decision-makers. And they may surprise themselves with a lion-hearted decision.

For a demonstration, call Joe Popolo at Systems Engineering Laboratories in Ft. Lauderdale. The number is Area Code 305/587-2900. Or write P.O. Box 9148, Ft. Lauderdale, Florida 33310.

Systems Engineering Laboratories

CIRCLE 32 ON READER CARD

the data directors



We provide the link that gets a computer message from one end of the "beanstalk" to the other. When the giant at the top tried to push us off, we knew he wasn't really worried about our equipment damaging the stalk. The real issue was those carefully guarded golden eggs.

Now that the computer industry is using the Carterfone alternative, it is saving its fair share of gold. We didn't want to chop the beanstalk down. We only wanted it available for everyone to use.

We are now engaged in extending services to the entire modern data transfer field. We have recently added the DM Modem 318 to the growing family of Carterfone communications equipment.

Some people call us Carterfone Communications Corporation . . . and that communicates just right.

Copies of the Carterfone legend are now available by writing:

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42 CIRCLE 15 ON READER CARD DATAMATION

KENNEDY MODEL 3110 beautifully designed, beautifully simple to interface, and oh, so beautifully built!

We've designed and built our Model 3110 to be beautiful — inside and out. Beautifully simple to interface. The tape deck provides gap generation, vertical and horizontal parity generation, all the IBM compatible check characters plus providing a write clock pulse for strobing data into the tape deck. And in addition, Model 3110 is available in non-formatting models.

Beautifully simple to maintain. No jumbo boards — we've used small functional printed circuit boards, simplifying troubleshooting and reducing spare card stocking costs. And all mechanical and electrical test points and adjustments are accessible from the front.

Beautiful performance. The 3110 operates at synchronous speeds up to 25 ips with its high performance single capstan drive and has read/write rates up to 20K Hz at 800 bpi.

Price — that's the really beautiful part.
Write or call for the beautiful details.

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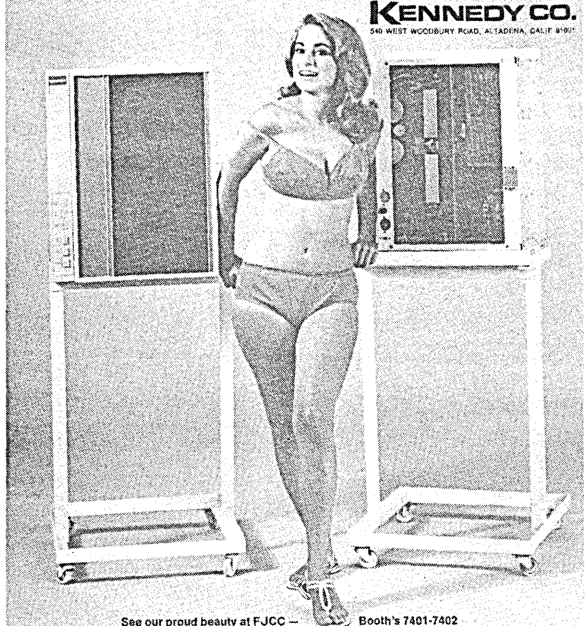
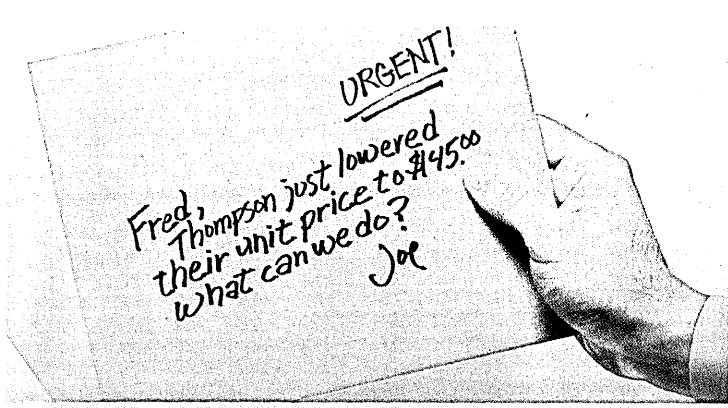
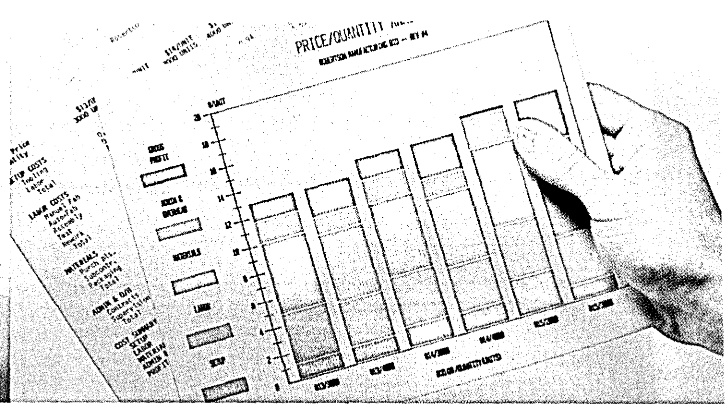
540 WEST WOODBURY ROAD, ALTADENA, CALIF.



November 1969 CIRCLE 95 ON READER CARD 337





Now when this comes down the pike at 10:15...

you can come back with this at 10:30.

Your competition's just changed their sales strategy, and you've got to respond.

Making a *quick* decision isn't enough. You've got to make the *right* one.

And with the HP 125, you can do both.

The HP 125 has VisiCalc® — the software that turns your screen into an electronic spreadsheet. You can see what the effects of lowering your prices will be in seconds. And preview a variety of options in minutes.

If you need to look at sales data stored in your company's mainframe, the HP 125 can get it for you. Because, besides being a powerful personal computer, the HP 125 works as a terminal in your data processing network.

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So you really can go from quandary to solution in a quarter of an hour. Or less.

And with the HP 125's word processing, you may even have time to get out a quick memo of your own.

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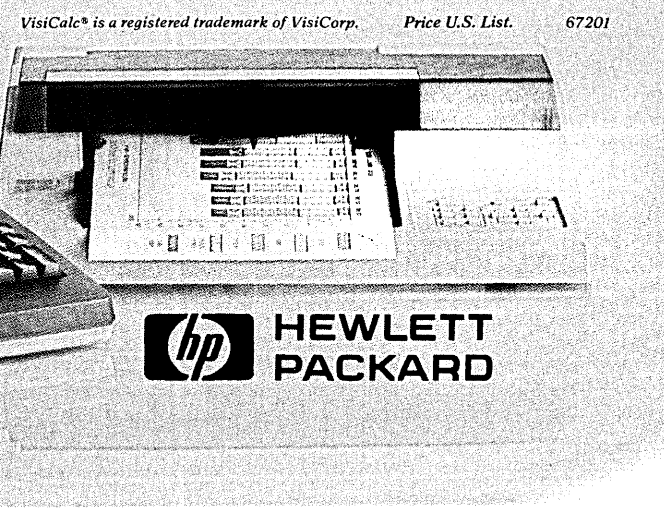

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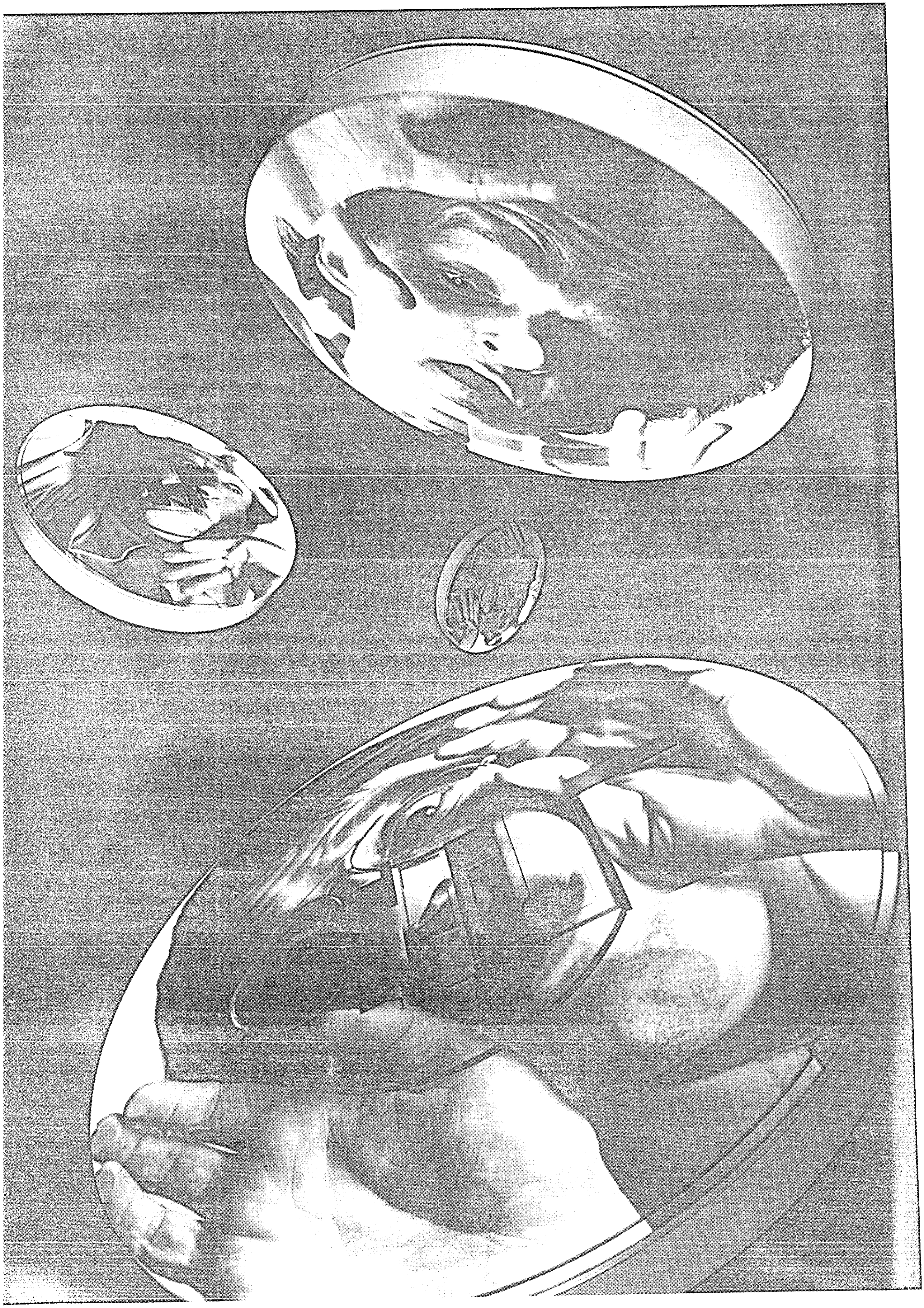


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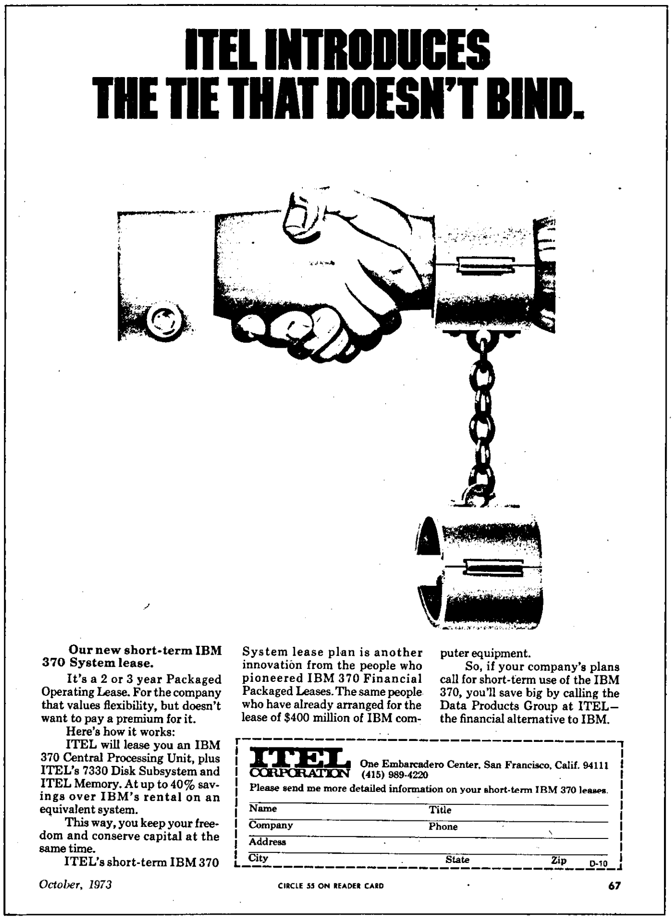
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October, 1973
CIRCLE 55 ON READER CARD
67


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"We use Intermec scanners to track sub-assemblies at every key stage in production. It helps us monitor costs, productivity and smooth production snags."
Control Inventory.
"With Intermec, we have up-to-the-minute data on receipts and disbursements. We've cut inventory costs and record keeping mistakes."
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"With Intermec, my inspectors enter their dispositions with a wave of a wand. The computer tells them immediately if there are any parts missing. Management reports summarize rework and component failure."
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"When engineering makes a product change, I know the exact location of all the items affected. With Intermec bar code labelling, I know if the work gets done."
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Intermec is the only company that manufactures a complete line of bar code printers: portable and on-line readers, and top quality wands specifically designed to meet the tough demands of industry.
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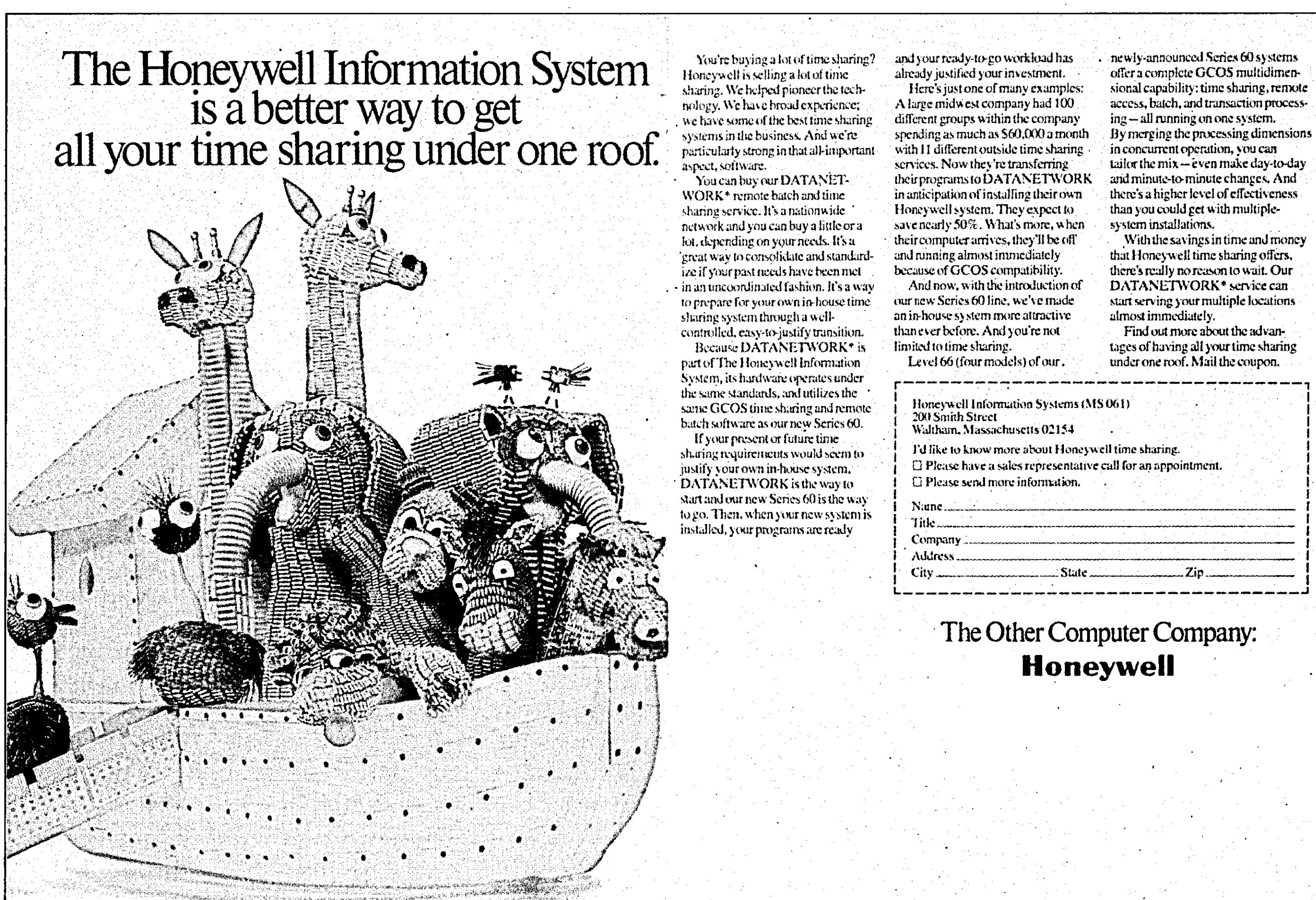
The Future is Bar Code.
CIRCLE 114 ON READER CARD
BAR CODE How to turn better data into higher profits


The Honeywell Information System is a better way to get all your time sharing under one roof.
You're buying a lot of time sharing? Honeywell is selling a lot of time sharing. We helped pioneer the technology. We have broad experience; we have some of the best time sharing systems in the business. And we're particularly strong in that all-important aspect, software.
You can buy our DATANETWORK* remote batch and time sharing service. It's a nationwide network and you can buy a little or a lot, depending on your needs. It's a great way to consolidate and standardize if your past needs have been met in an uncoordinated fashion. It's a way to prepare for your own in-house time sharing system through a well-controlled, easy-to-justify transition.
Because DATANETWORK* is part of The Honeywell Information System, its hardware operates under the same standards, and utilizes the same GCOS time sharing and remote batch software as our new Series 60.
If your present or future time sharing requirements would seem to justify your own in-house system, DATANETWORK is the way to start and our new Series 60 is the way to go. Then, when your new system is installed, your programs are ready and your ready-to-go workload has already justified your investment.
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The CalComp Computer Graphics Glossary

Source:

A complete spectrum of computer graphic peripherals from CalComp

In the dynamic world of computer graphic peripherals, only CalComp can offer a complete line of quality products spanning the entire spectrum of input and output devices. Whether you are an OEM systems integrator, a multiple-product end user, or simply trying to build the best possible graphic workstation for a particular application, CalComp is *the* source.

Quality products and attractive new pricing.
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More and more industries are discovering that computer aided design is a competitive necessity, and the market is expected to quadruple by 1986. Today's graphic workstation environments already include computer rooms, offices, trucks, ships, drilling platforms and more. But unlike so many new companies with single product offerings, CalComp offers more than 40 different products—digitizers—displays—plotters—to allow you to configure a system to meet your needs.

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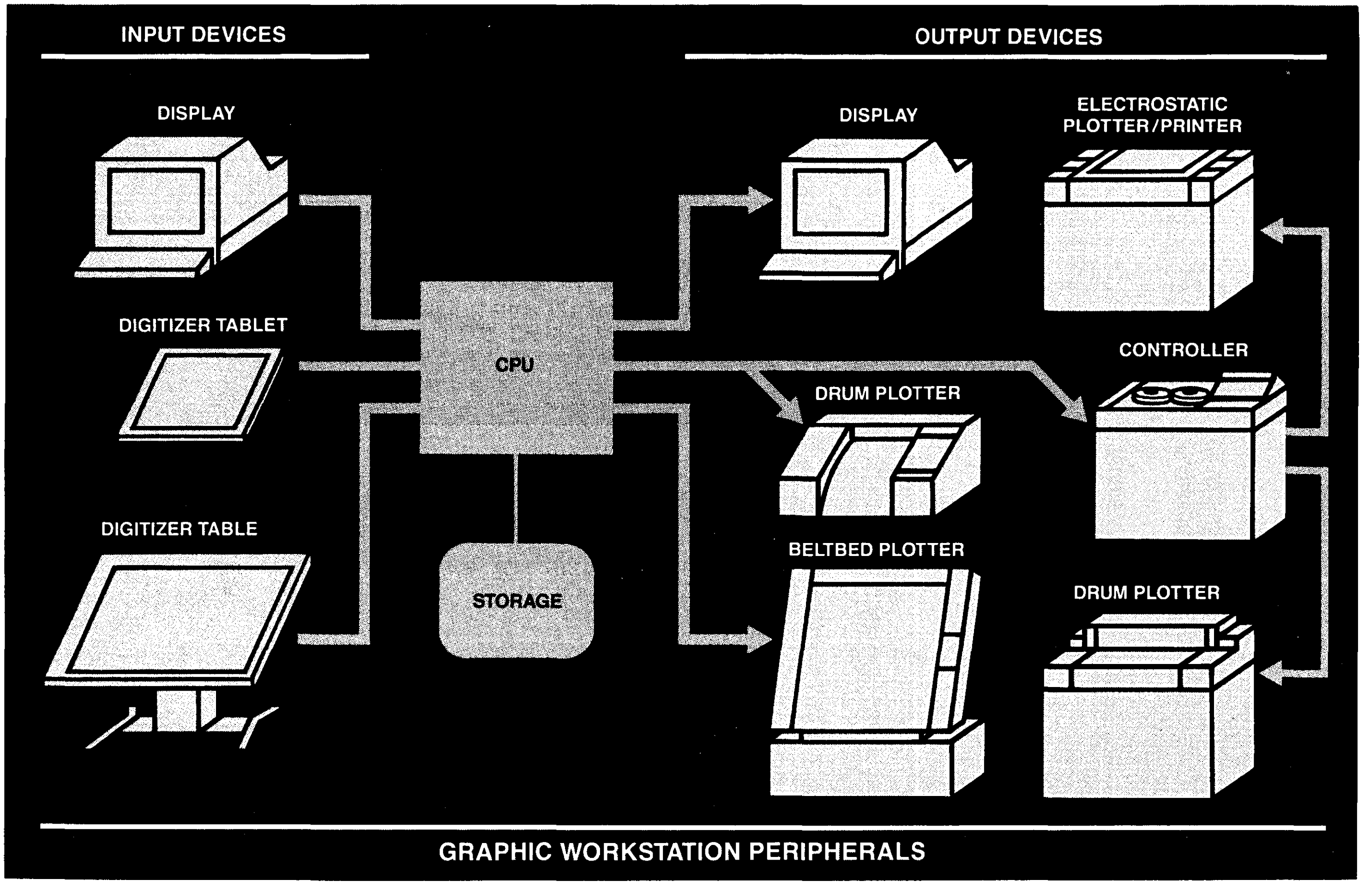
- CalComp has online, offline and combination controllers driving its plotters, including those that can run both pen *and* electrostatic plotters.
- Providing a new definition for the term "interactive," is the new 4000 Series of Vistagraphic™



Displays:
Resolution - 640 x 512, 1024 x 768, 1024 x 1024
Models - Color or Monochrome
CPU - Dual Motorola MC68000

Digitizers:
Tablets - 11" x 11" to 24" x 24"
Tables - 24" x 36" to 44" x 60"

Drum Plotters:
Widths - 11," 36," 54," 72"
Speeds - 4.5, 10, 30 Inches/Second

Flatbed Plotter:
Plotting Area - 48" x 82"
Speed - 30 Inches/Second

Beltbed Plotters:
Plotting Area - 34" x 59" - 52" x 80"
Speed - 30 Inches/Second

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Resolution - 100, 200 Dots/Inch

Displays, available in both monochrome and color. Two microprocessors are used, one devoted to display processing and the second for peripherals and communications.

Service protects your investment.
With more than 15,000 graphics systems installed worldwide, CalComp understands how *vital* responsive service is. Backing CalComp's superior parts and labor warranty are over 75 field service offices. And with our Maintenance Alert Program, if problems cannot be solved quickly, we'll call in our senior national technicians to get you back on line without costly delay. Our ability to maintain and service our equipment throughout the world underscores CalComp's commitment to stand behind its products *and* its customers!

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For hardware, software, supplies, service and advice, no one even comes close to CalComp as the single source for all your computer graphic peripheral needs. A call to your local California Computer Products sales office listed in the white pages will do the job. Or write to CalComp, Product Marketing, Department M/S 52, 2411 W. La Palma Avenue, Anaheim, CA 92801.

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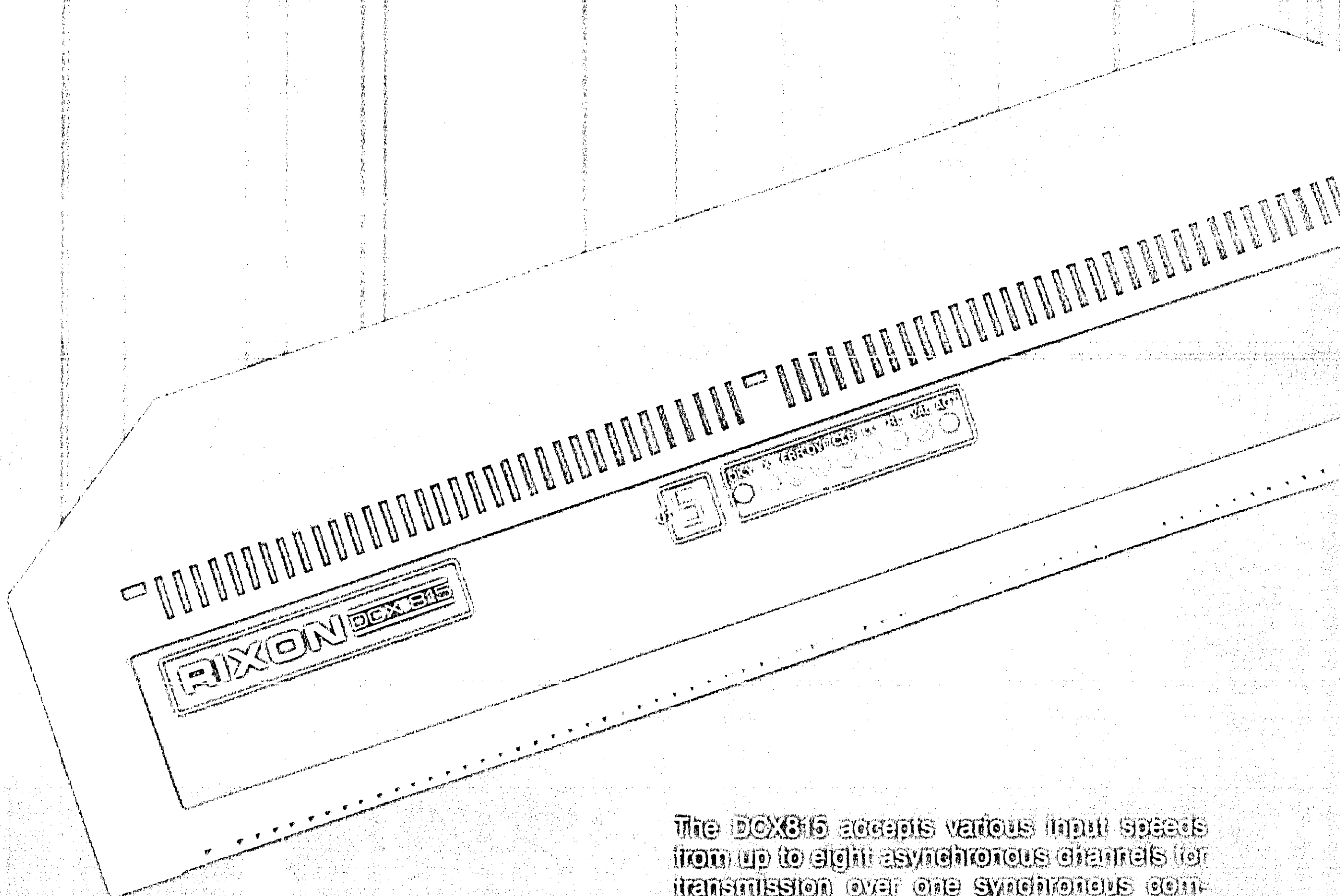
CIRCLE 104 ON READER CARD

NEW RIXON STAT MUX



THE NEW RIXON DCX815 4/8 CHANNEL STATISTICAL MULTIPLEXER BREAKS THE PPR INDEX

PRICE-low price, plus an economical reduction in line costs.

PERFORMANCE-this full-featured four or eight channel statistical multiplexer surpasses the competition with throughput and benefits.

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Protect your investment with the PPR index leader.

The DCX815 accepts various input speeds from up to eight asynchronous channels for transmission over one synchronous composite line at 9600 bps.

The DCX815 is known for its ease of installation, composite link utilization indicator, ABR (Automatic Baud Rate detection), error-free transmission, unbalanced baud rate, unrestricted intermix, flyback buffering, terminal flow control, and diagnostic test features and LED's.

Rack mountable card units may be intermixed with RIXON modem units in the RM80 RACK MOUNT UNIT with the DCX825 32-channel Stat Mux.

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CIRCLE 105 ON READER CARD

Datamation's second editor remembers the fun and the turmoil on Pico Boulevard.

DATAMATION–THE EARLY DAYS

by Sandy Lanzarotta

For the record. I freely admit that I was not the first editor of DATAMATION magazine. Some of my friends like to say that I was the first "real" editor. Nevertheless, Charles R. Kluge, who was listed as editor on the masthead of the first three issues, was real enough—as real as his name.

Kluge worked in New York on the first two issues, which were printed in New Jersey. The October 1957 issue, the very first, reported on the Eastern Joint Computer Conference that was held in Washington that year. I forget the main subject of the second issue, November/December 1957, but I do remember the cover. Both of those first issues had the ugliest covers I have ever seen. They were truly awful.

The cover design problem was fixed, however, when the decision was made to move DATAMATION's editorial office to Los Angeles. The Carson-Roberts Agency of Beverly Hills designed a new cover and a complete format for the magazine, including the distinctive DATAMATION logotype that has survived these 25 years.

But before telling you about the magazine's westward migration, there are some things you need to know about the company that published DATAMATION, Thompson Publications, and about its publisher, Frank Thompson.

Headquartered in Chicago, Frank Thompson's company published two magazines—an industrial R&D book called *Industrial Laboratories*, and another publication aimed at college engineering students. He also published a magazine in Los Angeles, *Western Electronic News*, where I was hired as associate editor in October 1957. That same month, Thompson bought a magazine called *Research and Engineering* as a tax-loss carry forward.

As I remember it, *Research and Engineering* and *Industrial Laboratories* were competitors. There probably wasn't room in the late '50s for two trade magazines covering industrial research, and *Industrial Laboratories* was clearly the better of the two, so Thompson bought the other folks out.

"If I felt enormously confused, I was way ahead of practically everyone else in the company."

While Thompson was negotiating for what was to be his new acquisition, he was being told by friends and people in his company that he ought to turn the new property into a magazine covering the computer business. At the time, there was only one trade magazine in the computer field—*Computers and Automation*, published in the Boston area. It had a one-man staff and rather modest circulation. It also occasionally ran science-fiction stories.

Several key people helped convince Frank Thompson that a new magazine should be created to cover the rapidly growing computer industry. The prime persuaders included: Earl Wilken, then a space salesman for Thompson in Los Angeles and now associate editor of *Editor and Publisher* in New York; Don Prell, then a vice president with an electronics firm in Santa Monica and now a senior executive in a bank holding company in Los Angeles; and Joe Landon, then a vice president at Thompson, now retired. They also recommended that the editorial office be located in Los Angeles because it was then one of the principal centers of computer activity. So the decision was made and Frank tapped Kluge, then an associate editor of *Industrial Laboratories*, to be editor.

While many people take credit for dreaming up the name DATAMATION, it is generally believed that Wilken created it. Prell also credits Wilken with the name, although he remembers discussing it with John Diebold before the first issue came out.

For tax reasons, the *Research and Engineering* name had to be retained for a while. So until mid-1959, DATAMATION's official name was *Research and Engineering—The Magazine of Datamation*, perhaps the longest name for any trade magazine in this century. During its first three years of publication the magazine was bimonthly. The first monthly issue came out in January 1961.

Back in those bimonthly days, Kluge put out his two eastern editions before heading for Los Angeles. I was presented to him as his associate editor in late December 1957 and in January 1958 we set up shop in part of a large room at the Thompson Publications office on Pico Boulevard in Los Angeles. We were right across the street from Rancho Golf Course, for years the site of the Los Angeles Open.

My memory of working with editor Kluge is rather dim because our association didn't last very long. Kluge had moved into the company apartment over the office, where he lived while he looked for a permanent residence. Every weekday morning he would come down to work. He had the shortest commute I had ever heard of. One Monday morning about two weeks into January, Kluge didn't come down. We waited for a while and then someone got a key to the apartment so we could go up and make sure he was okay. The apartment was empty.

Kluge had left a note saying he couldn't stand Los Angeles, hated the freeways, and didn't much like his new assignment. He also declared his intention to go back to Chicago. He did just that and I think Frank Thompson gave him his old job back. I believe he eventually became editor of a magazine in Canada.

Meanwhile in Los Angeles, deadlines were approaching for this editorless magazine for which advertising was being sold. Landon and Wilken took the easy route to solving that one. They asked me to fill in until a permanent editor could be found. I agreed, but for the remainder of 1958, I continued to be listed as associate editor. Frank Thompson called himself editor and publisher, but he was in Chicago running the company. I was in Los Angeles and I had the assignment.

I looked around and couldn't quite believe where I found myself. Here I was, the graduate of a small, liberal arts college with a history major and a journalism minor, with seven years of general reporting and editing experience, installed as editor of the leading (practically the only) computer publication in the country. If I felt less than supremely confident, if I felt enormously confused, I was way ahead of practically everyone else in the company. Toward the end of that first year, soon after the fifth issue had been published, I saw editor Thompson at a company meeting. "Hell of a fine issue," he said. "Enjoyed it a lot. Didn't understand a word in it."

I must confess that I didn't much understand the magazine either. And I was writing all the copy and editing articles. I got by with a lot of help from my friends.

Prell was the mainstay. He knew the business from the inside and was able to point me in the right direction during most of that first year. We spent hours together every month going over news releases and articles. Then I would go back to the office and put the magazine together piece by piece.

The second most important influence on me in those early months was Fred Gruenberger, a computer specialist at Rand Corp. I don't know where I met Fred, but I'm sure glad I did. I convinced my management that I needed some rather fundamental help and they let me hire Gruenberger, who provided a specially tailored course in computers and computing. He not only explained how computers worked, he told me how the industry of that time worked—who was doing well and who wasn't, who the white hats and the black hats were. He gave me information I couldn't have found in any book. And finally, he taught me how to write a program. It was a simple, dinky little program but it actually ran on a Bendix G-15 and I could then look programmers in the eye and tell them I knew where they were coming from.

I also learned a lot from another Rand man, Paul Armer. Armer was then running Rand's Computer Sciences Dept. and was, and still is, highly regarded in the industry. He spent many hours discussing industry developments with me and was very encouraging and supportive. Armer was later to become an official advisor to DATAMATION, a role he filled for many years. Bob Patrick, Herb Grosch, Dan McCracken, and Jack Granholm were four more computer experts who helped me survive as editor the first few years.

DATAMATION's staff developed very slowly. Management wasn't exactly sure of what they had going and they wanted to make the magazine a paying proposition as quickly

THE SPIRIT OF DATAMATION

DATAMATION is more than a magazine. It is a spirit—a spirit that is shared by the hundreds of people who have contributed their time and talents to making the magazine the most influential and well-respected computer publication in the world.

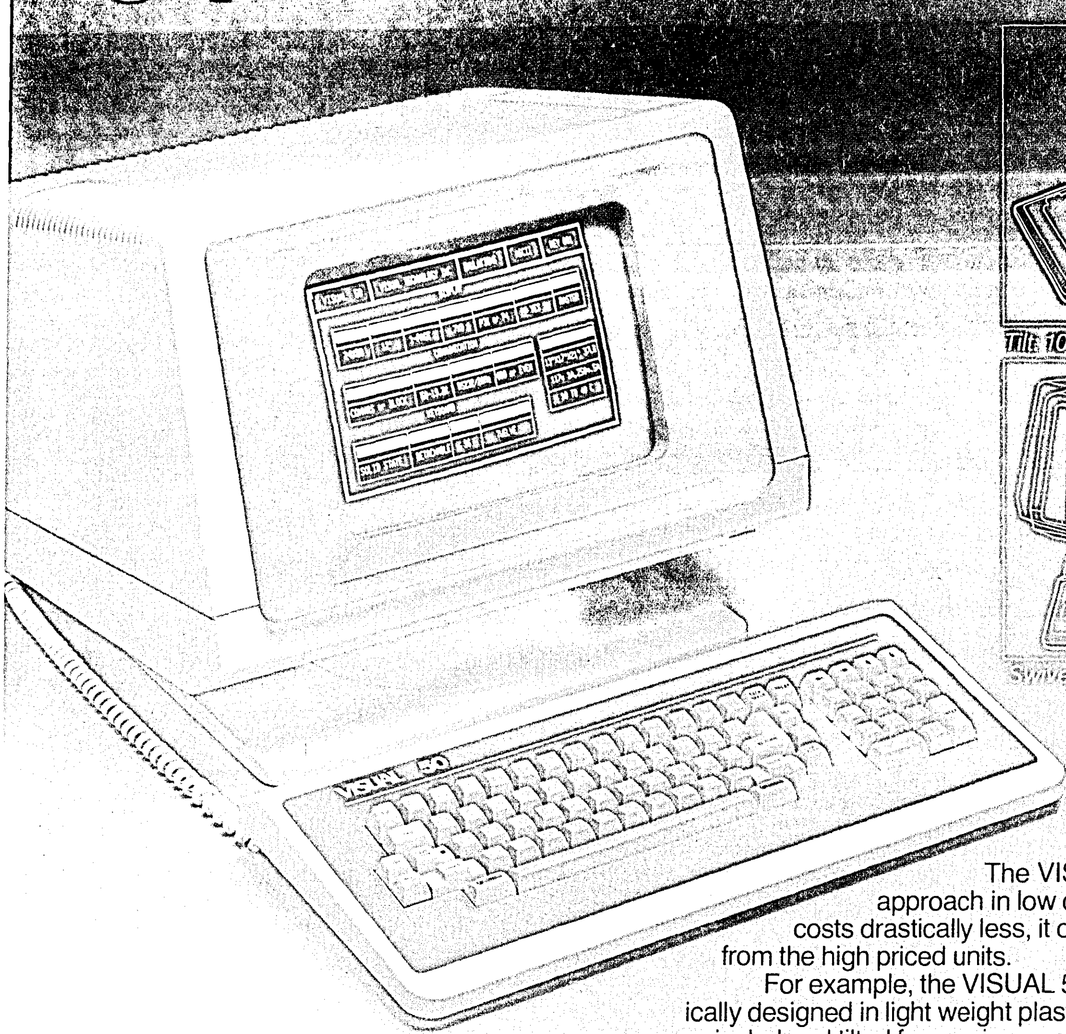
To capture top honors, DATAMATION has enlisted the help of top-notch people. The magazine's all-pro editorial team is backed by an equally enthusiastic sales squad that continues to make DATAMATION one of the most profitable books in the business. The magazine has also been blessed with great talent on the graphics side—talent that has turned DATAMATION into the most distinctively designed and artistically creative publication in the industry.

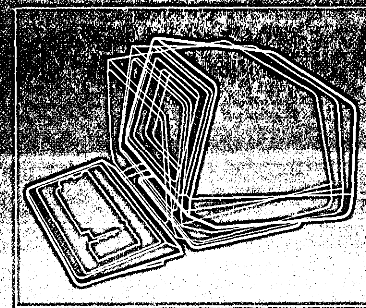
Over the years DATAMATION has been a showcase for many of the industry's outstanding journalists. Writing with objectivity and creativity, these hard-hitting reporters and incisive editors were the industry's first real word processors. Today those skills have been carried on in the magazine's new breed of wordsmiths, who continue to churn out editorial copy that's noted for its insight and foresight.

Making sure DATAMATION stays foremost in its field is the magazine's coterie of contributing editors. Top-rated specialists in various fields of the information industry, these advisors keep DATAMATION staffers up to date and on their toes.

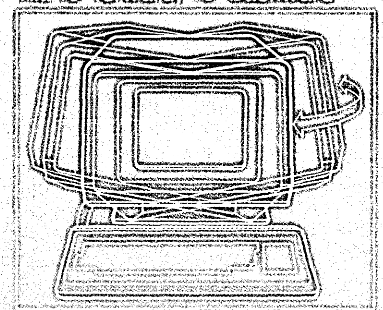
To many old-timers and industry buffs, DATAMATION is an institution, an institution that seems to have a life of its own. But the lifeblood of any institution is its people. And it's the people at DATAMATION—people past and present—who have indeed made the magazine the prestigious and premiere publication it is today.

VISUAL presents ergonomic elegance and high performance in a low-cost terminal.





Tilt 10° forward, 15° backward



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The VISUAL 50 represents a new approach in low cost terminals. Although it costs drastically less, it offers the features you expect from the high priced units.

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Another distinctive feature of the VISUAL 50 is its emulation capability. VISUAL 50 is code-for-code compatible with the Hazeltine Esprit,™ ADDS Viewpoint,™ Lear Siegler ADM-3A™ and DEC VT-52.® Menu driven set-up modes in non-volatile memory allow easy selection of terminal parameters.

And you're not limited to mere emulation. As the chart shows, the VISUAL 50 has features and versatility the older, less powerful low cost terminals simply cannot match.

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Service available in principal cities through Sorbus Service, Division of Management Assistance, Inc.

FEATURE COMPARISON CHART

FEATURE	VISUAL 50	Hazeltine Esprit	ADDS Viewpoint	Lear Siegler ADM-5	Televideo 910
Tilt and Swivel	YES	NO	NO	NO	NO
Detached Keyboard	YES	NO	YES	NO	NO
N-Key Rollover	YES	NO	YES	NO	NO
Audible Key Click	YES	YES	NO	NO	NO
Menu Set-Up Mode	YES	NO	NO	NO	NO
Status Line	YES	NO	NO	NO	NO
Full 5 Attribute Selection	YES	NO	NO	NO	YES
Smooth Scroll	YES	NO	NO	NO	NO
Line Drawing Character Set	YES	NO	NO	NO	NO
Block Mode	YES	YES	NO	NO	YES
Insert/Delete Line	YES	YES	NO	NO	YES
Bi-Directional Aux Port	YES	YES	NO	YES	NO
Columnar Tabbing	YES	YES	NO	NO	YES
Independent RCV/TX Rates	YES	NO	NO	NO	NO
Answerback User Programmable	YES	NO	NO	OPT.	NO

See for yourself

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CIRCLE 106 ON READER CARD

A partition was put up, so the staff finally got its first office. It was truly a horrible setup.

as possible. To accomplish that, we borrowed heavily from the resources of the other Thompson magazines. A lady in our New York office handled circulation, which began at 23,000. Production was initially carried out by the *Western Electronic News* staff in Los Angeles.

I wrote and edited all the copy, laid out each page of the magazine, and assembled a dummy of each issue. I then mailed the whole mess to Chicago where a camera-ready copy of each page was produced. The Chicago crew sent the pages back to me for proofing and I sent corrected pages back to them. Then the material was sent to Minneapolis, where the magazine was printed. Honest.

I did most of the editorial work for three years. But I had some staff help fairly early on. In mid-1958 Bette Howe (now Bette Howe Prell—she married Don) joined DATAMATION as production manager. She turned out to be a godsend. Within a few months, she was not only handling all the advertising traffic, she was also writing copy for the new product, literature, and people departments and taking care of much of the magazine's correspondence.

In mid-1959, I hired Paris free-lance writer Etienne Guerin as our European editor. He provided us with good copy for several years. About that time, Herb Grosch signed on as a contributing editor. Even then, in the late 1950s, Grosch had a colorful and controversial reputation in the computer business. He had the great knack of being able to convey his unorthodox views of the industry in his writing. A lot of people violently disagreed with things that Grosch said and wrote, but no one ever accused him of being dull.

About a year later, in the fall of 1960, I received an okay to hire a full-time editorial person to work on the magazine. Hal Bergstein, fresh from New York, heard about the opening and came by to talk. Bergstein was smart, aggressive, supremely confident, and a good writer. The first three qualities came through very quickly during our interview. He also had impressive writing samples. So Bergstein joined the party.

Managing editor Bergstein brought a new element to DATAMATION. Mike Wallace was just getting started on local Los Angeles television about then, and Hal was right out of the Mike Wallace school of reporting. He made the computer people he interviewed uncomfortable. He asked tough, penetrating questions and almost demanded answers. There weren't many reporters doing that then. The people who ran this business granted interviews. They were not used to being taken over the coals. Bergstein, as might be expected, was tossed out of more than one office. He wrote great copy. He became the third editor of DATAMATION.

Things began moving comparatively fast by late 1960. Cleve Marie Boutell joined the magazine as production manager. Boutell was and is one of the most talented graphic arts people I ever met. And we hired her, at first, to wrap and ship ad plates. This was roughly equivalent to hiring Picasso to work in the mail room. We didn't keep her at the wrapping table long. By January 1961, Boutell became art director. She's the person who turned out the dozens of spectacular DATAMATION covers during the '60s and '70s.

Now the staff was growing and space was getting tight. So tight that by the end of 1960, we had to do something. DATAMATION had been sharing one of the large offices with two Thompson salesmen, but with the addition of Bergstein, a part-time editor, Pat Anderson, and a secretary, the situation became impossible. Something had to give.

Someone came up with the great idea of putting up a plywood partition on the left side of the reception area to create an office. This was done and the partition was painted, appropriately, gray. Thus, the DATAMATION staff got its first office.

It was truly a horrible setup. The partition was placed at an angle to create a passage from the front door to the hall. The resulting office was therefore shaped a little bit like the lower half of the State of Israel. We squeezed three people into that space and when we sat back after moving in, there was nothing to do but laugh. For months after the big move, whenever visitors came to our office and saw our quarters, their reaction was absolutely predictable, and could usually be summed up in three words: "This is it?"

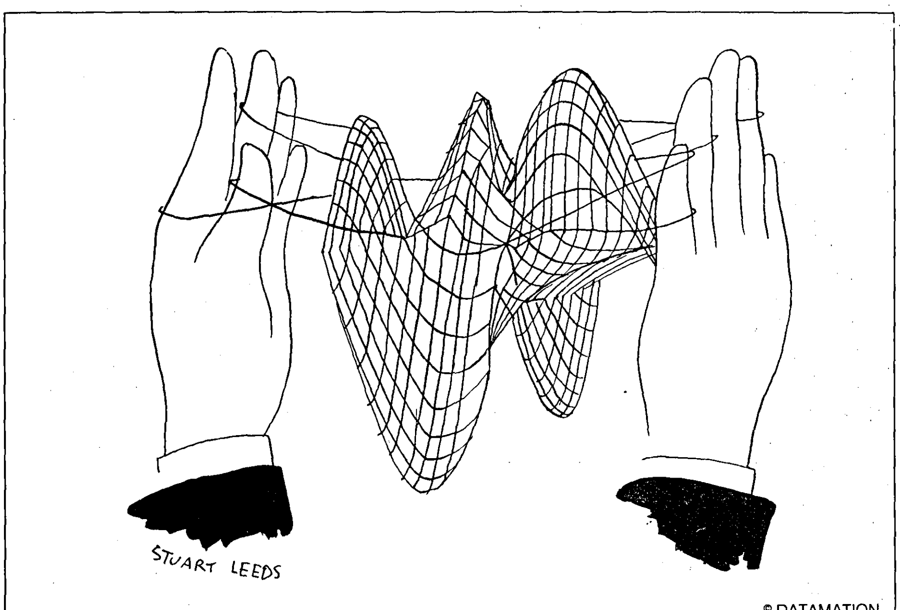
Most people thought of DATAMATION as being part of a publishing empire, probably in a high-rise, with the editorial department occupying two entire floors. Our humble digs were quite a shock. Fortunately we did most of our editorial contact work on the phone or out of the office.

The last issue of 1960, November/December, had over 100 pages. In January 1961 we published our first monthly issue. Dan McCracken, Graham Jones, Ascher Opler, and Allen Newell wrote articles under the general heading "The Path Ahead for Computing." Other articles analyzed the use of computers in the 1960 elections. Grosch wrote about Remington Rand's third-generation Univac 1107 scientific computer.

And so it went. We had come a long way in three years. DATAMATION had made the grade. We had gone monthly. There was no stopping us now.

I edited my last issue in April 1961. It was time for me to try something new and Bergstein was chomping at the bit. He took over as editor and did a great job. When he left the magazine in 1963 to join Max Palevsky at Scientific Data Systems, DATAMATION found another fine editor in Bob Forest—ex-Burroughs, ex-free-lancer, and a naturally good writer and editor. Forest took over a successful magazine and made it even better.

In the late '60s a much larger DATAMATION staff picked up everything and moved to Pasadena. The last link with the early days had been broken. I occasionally drive by the building on Pico Boulevard now and I have to smile when I remember a little of the fun and the turmoil involved in giving birth to an institution. ✻



CARTOON BY STUART LEEDS

Sandy Lanzarotta heads the corporate affairs office for Xerox Corp.'s western operations in Los Angeles.

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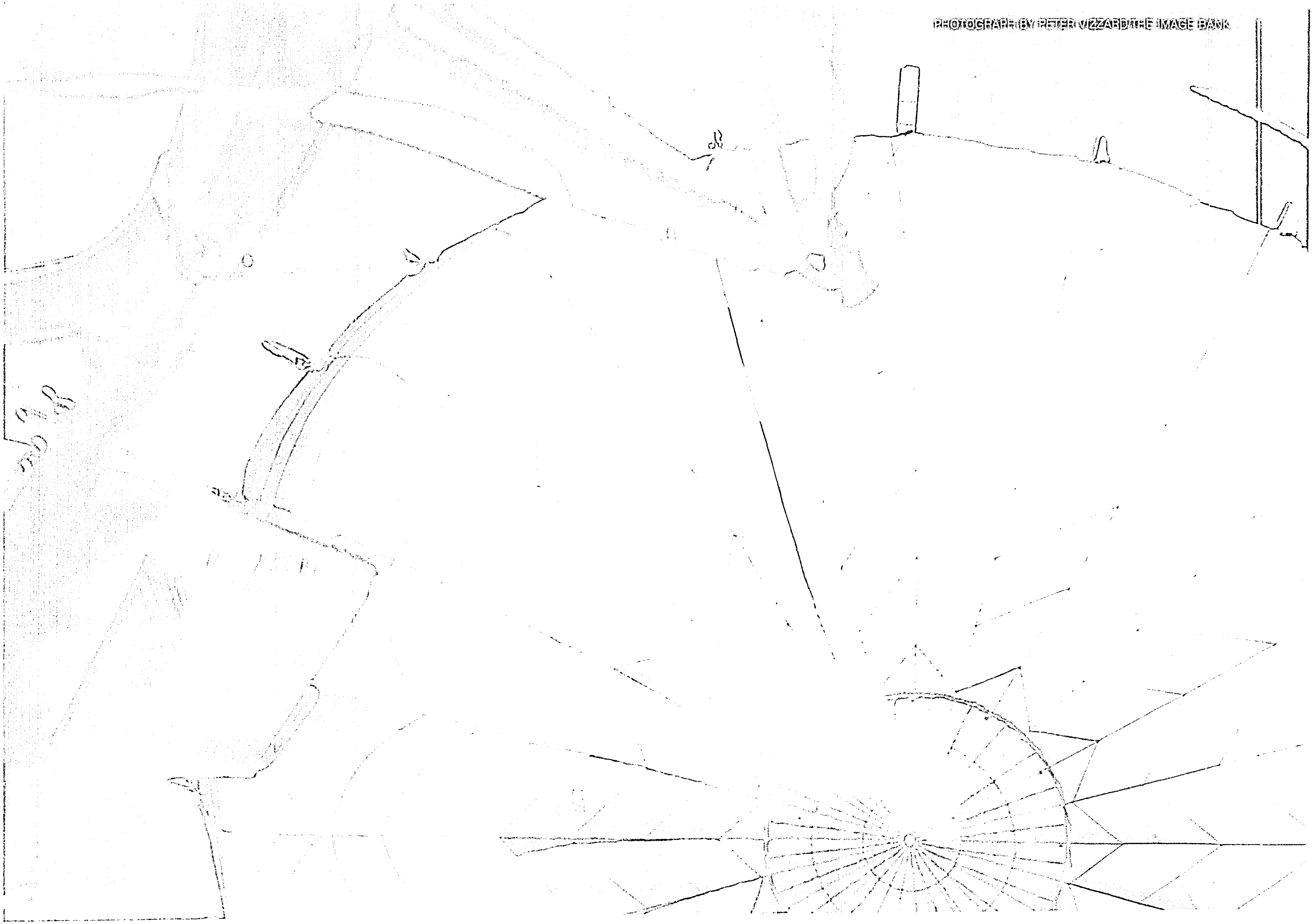

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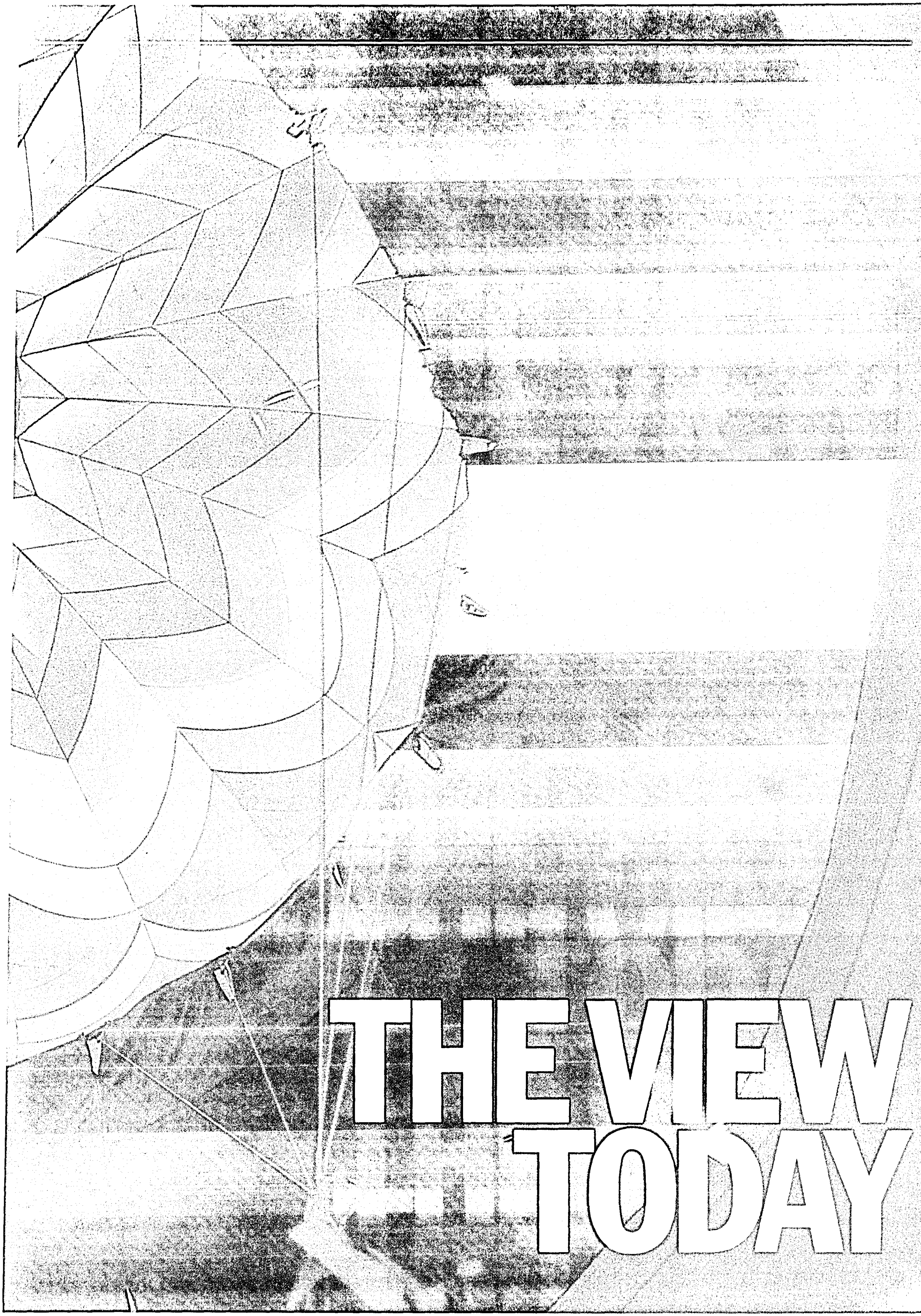


THE VIEW TODAY

WANNA BET?

DATAMATION asks some office automation soothsayers to put their money where their mouths are.

by Kenneth Klee

The discussion, forecasting, planning, and advertising of office automation is a booming business, one that perhaps outstrips the actual practice of this new art.

Researchers are busy counting decisions and diagraming the structures that support them. Analysts argue over the average capitalization of office workers, the better to compare these people with farmers. Manufacturers plan, advertise, and (in many cases) build whole lines of office automation products. The trade press tirelessly chronicles the exploits and pratfalls of the vendors and the leading edge users bold enough to experiment with the gear that's causing all the fuss.

Most of us, in fact, sit in traditional offices and experience the new automation via newsletters that envision office system sales topping $10 billion by next Tuesday, market studies that describe giant companies in big trouble, and magazine articles like this one. The information usually comes to us on paper, and the paper is often stained with coffee.

So where is office automation? When will it arrive, and how will we know when it's here? Most basically, *what* is office automation?

These questions, and others like them, were put to Bruce Hasenyager, who as vice president for information systems at Kidder Peabody has been managing one of the country's most ambitious OA projects.

"It depends," he answered. "What are you trying to write?"

"Something expansive; it's for our anniversary issue. Trouble is, the matter seems to have been adequately discussed, at least for now. You find yourself wanting to wait a couple of years to see if anything really happens."

"Something's happening now," said Hasenyager. "In analyzing it, though, I think we're a bit like the blind men inspecting the elephant. Maybe you should ask each of us what we're finding."

"A list?"

"Sure, Get some different perspectives. Call it 'Things that will be true of the automated office no matter who's right.' "

"Are there such things?"

"Ask around."

Eric Smithback, an associate actuary at CIGNA, the giant insurance firm that resulted when INA of Philadelphia married Connecticut General, is a knowledge worker, a fairly sophisticated end user of computer services, and, one reckons, of the ilk that manufacturers of office systems are trying to reach.

"What's an office system?" he wanted to know.

"An attempt to integrate the tools that office workers use to do their jobs."

"You want to network my desk?"

"Not exactly. Does your department have word processing?"

"Sure."

"Can you use it for messaging?"

"Yes, but it's easier to use the telephone. They say they're going to upgrade the messaging; I might start using it then. Right now I use it for memos."

"Is it useful?"

"Yes and no. It used to be that you'd write a memo, give it to a secretary and she'd type it. Then she'd correct it using white out or whatever, and we'd send it. Now she brings it back after she's put it into the machine, and because it's in the machine and it's easy you start making style changes. Then she has to bring it back again, and this time around you just check the changes and maybe don't notice if a paragraph's been blasted out of there. If everything's gone okay, what you end up with is a stylistically superior memo that's taken longer to produce. What's that worth? The essential information was there the first time around."

"Well, what's your prediction for the office of the future?"

Smithback thought for a moment. "That we'll have to wait and see," he said.

So much for a user. Other people, however, are in the business of looking to the future, and figuring out how to get there from here. One such is Amy Wohl, president of Advanced Office Concepts, a Bala Cynwyd, Pa., consulting firm, and organizer of the office automation sessions at this year's National Computer Conference. Asked to produce a prediction on which she'd bet the rent, she produced the following:

"What you've got is a stylistically superior memo that's taken longer to produce."

"Office automation will change the way all office workers function. With more than 50 million workers currently employed in American offices, this means we will be profoundly affecting our entire society. But we could not take on the task of training this many workers in new work techniques with our present office systems. We'll need systems that are intuitive and tutorial, to minimize and ease the training process. To the extent that we succeed in building friendly systems, we will greatly increase the speed and scope of office automation's impact."

For Wohl, ease of use is the sine qua non of office systems, and training in the use of new information handling methods will have to be contained in the software that drives the machines. This is owing to the size of the educational task; there aren't going to be enough instructors to go around, and interactive training is much more effective than manuals. A given workstation, moreover, will have to be set up to instruct users at different levels of sophistication. A novice will need a friendly stroll through the system's basic functions, while an experienced user will want a crisp exposition of its more advanced capabilities.

Wohl sees some software that already exhibits this kind of helpfulness, and cites the record processing function in a DEC word processing package as an example. "It's a visual tutorial," she says. "By the mid-to-late '80s," she predicts, "you won't be able to sell systems that lack these training features."

Related thoughts came from Ted Nelson, computer visionary, founder of Project Xanadu—the hypertext publishing system (March, p. 169)—and author of *Dream Machines/Computer Lib* and *Literary Machines*. Nelson is currently designing interactive systems for Datapoint Corp. in San Antonio.

"To make office automation happen," he said, "the first thing we'll have to do is get the systems designers to spend some time in the videogame parlors. Most of the people who've been producing these systems know next to nothing about how to do it. The good ideas are coming from the kids, who have been skateboarding into the parlors for years."

What do videogames have that office systems need? "Vividness! Clarity! Sound effects! Look at Pac-Man. Without ever having seen it, you can use the system at a low level of play. Then, without consulting any manuals, you can ascend to higher levels."

Does this mean we'll want sound effects in office workstations? "Of course," answered Nelson. "Why not use several senses? Why not a ptew-ptew, ray-gun sort of sound for delete, and for filing maybe a climactic lilting and the faraway sound of a door closing?

"What designers have to consider," he continued, "is the *virtuality* of the system—a combination of the conceptual structure of a thing and its feel. The games makers understand this." Nelson feels that the cottage software industry spawned by the personal computing phenomenon has taught us a lot about virtuality. VisiCalc is a program that exemplifies the concept and has contributed a lot to the "liberation of the screens."

Nelson added that he's been offering the same view of interactive systems design for many years; indeed, his vision of the office of the future bears a striking resemblance to Project Xanadu ("a storage system in which documents are held in their most natural form and linked sideways to each other") with video front ends.

"What's been wrong with computers all along," he said, "is that they've been run by narrow professionals trying to take what people are doing and warp it to fit a machine they've created in their own image. Now, as computer power spreads, people are taking the opposite approach. Atari and Lucasfilm may well get together and come up with the best office system of all.''

And what about the companies that hope to sell all these machines? No view of the future of office automation would be complete without a call to Wall Street. Industry analyst Ulric Weil of Morgan Stanley had this to say:

''The optimists project that the 45% to 50% annual growth rate achieved by Lanier, Wang, et al. in recent years will continue. That isn't going to happen.

''The simple, mostly standalone secretarial-clerical part of the word processing market will be relatively easy to sell in.

The novice will need a friendly stroll through the system's functions.

Based on anticipated possible cost savings as defined in a 1979 Booz Allen & Hamilton study, that market is already 60% penetrated.

''But the tougher and by far the larger part of the market—automating the work done by professionals and managers—is only 20% occupied, and gains will be much harder to come by in this area. While it's clear in general that office systems for managers can provide significant productivity gains, proving it for a specific company can be costly, time consuming, and at times fraught with political peril. Bringing office systems to this class of workers means a restructuring of the organization, including a sharp reduction of costly staff, overhead functions, and a shrinkage of the need for middle management. Corporate inertia will limit expansion of office automation suppliers to 30% or 35% annually over the next five years.''

Weil has more to say on the subject in his new book, *Information Systems of the 80s; Products, Markets, and Vendors* (Prentice-Hall, 1982). While he offers this analysis to confute some of the Street's more starry-eyed bulls, Weil doesn't exactly come off as the most bearish of analysts; a 30% annual growth rate is not shabby. Who does he think will capture choice pieces of this rapidly expanding pie? Weil doesn't hesitate: ''Vendors who have integrated systems, and know how to sell them as such.''

That it will be crucial to be able to integrate the various forms that information takes in an office is no secret. In fact, it forms the backbone of more than one corporate strategy. Andre Schwager, general manager of Hewlett-Packard's information networks division, was asked for a vendor's-eye view of the future. He responded:

''Office automation as a whole is now in its teenage years. We started out by focusing on secretarial tasks; now we're moving to other areas. There really isn't a road map, just a lot of growing—and some stumbling.

''The view that HP is taking is to look at the office as a total system. Consider a guy who wants to send new prices to district sales offices. His intent is not to write the memo, revise the memo, mail it, and receive confirmation from the people at the other end. What he wants, simply, is for the information to get from here to there. Yet some people have focused on automating each step, as if it were an end in itself. We feel that integrating all the forms that information can take—words, data, pictures, and voice—and allowing them to flow freely in a single system will allow users to concentrate on the end—what they want to accomplish—rather than the means.''

There are others, however, who question whether most managers will in fact use the new tools—no matter how good they are—in the right way. Consider the comments of Philip Dorn, a New York consultant and longtime industry observer:

''The office of the future is a noble concept that will never have any serious impact on corporate productivity because for every dollar saved in the office, corporate managers will demand another five dollars' worth of data to make simple decisions. Until American business people learn to overcome 'analysis paralysis' and throw away their spreadsheets and quarterly reports, the only ones who will profit from office automation will be those who sell the equipment.''

Which certainly gives one pause; perhaps it's analysis paralysis that plagues the implementation of office automation itself. Still, there are important changes going on out there. Even though the blind men failed to agree on the nature of the elephant, none of them disputed its existence. Bruce Hasenyager was asked to name something that would be true of office automation no matter who's right.

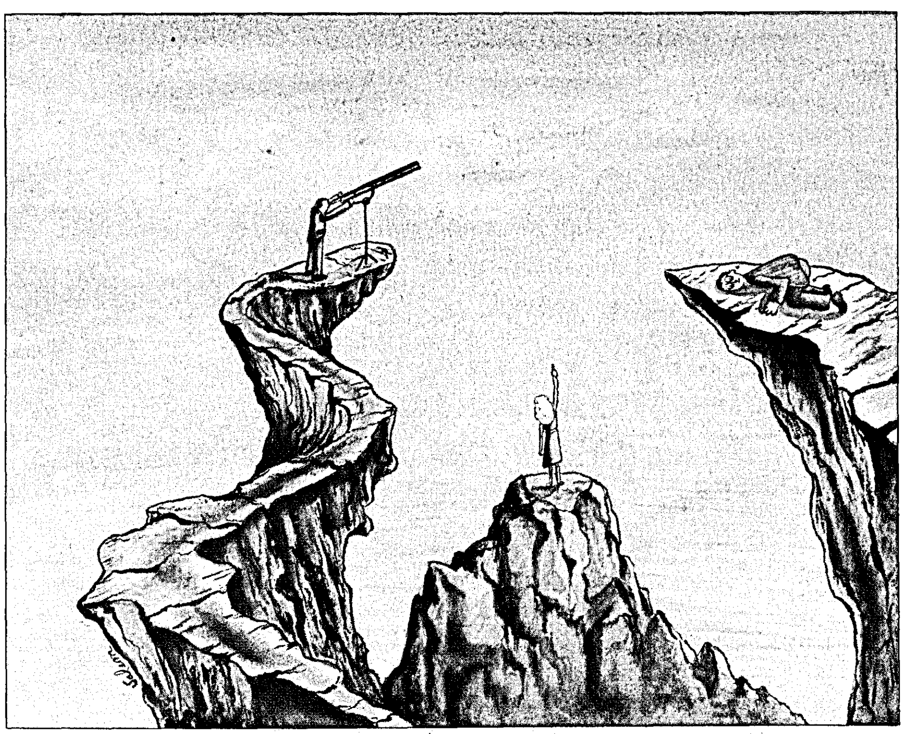
''Fair enough,'' he said. ''The technology of the automated office will amplify the behavior of the people working there. It will allow good managers to manage better, insightful professionals to contribute more, good support staff to support more, and ef-

"Atari and Lucasfilm may well get together and come up with the best office system of all."

fective teams to synergize more easily. It will also allow confused managers to obfuscate situations more thoroughly, bad leaders to charge off more rapidly in the wrong direction, fools to make their foolishness more quickly and more broadly known, boors to be more boorish, and bores to be more boring. In addition to the pleasures of broader spans of control and crisper decision-making, we will have the pains of information addiction and electronic junk mail.

''We'll see the same kinds of amplification in organizational cultures; the technology will sharpen their charactertistics. Decentralized firms will be more distinctly decentralized. Centralized organizations will be more firmly under central control. Cultures where analysis and quantification are valued will be able to wallow in numbers, tables, charts, and graphs. Players in competitive cultures will be able to organize and execute their moves more rapidly and with more depth of analysis. Collegial cultures will be able to form, reform, and coordinate ad hoc working groups and share decision processes more effectively.''

A kind of synthesis, that: 50 million of us work in offices, and the way we do our work is going to change greatly. Beyond that, we can say that the changes we make will either integrate or isolate us, educate or alienate us, enrich or impoverish us, free us or bind us. We're going to be just as we are now, only more so.



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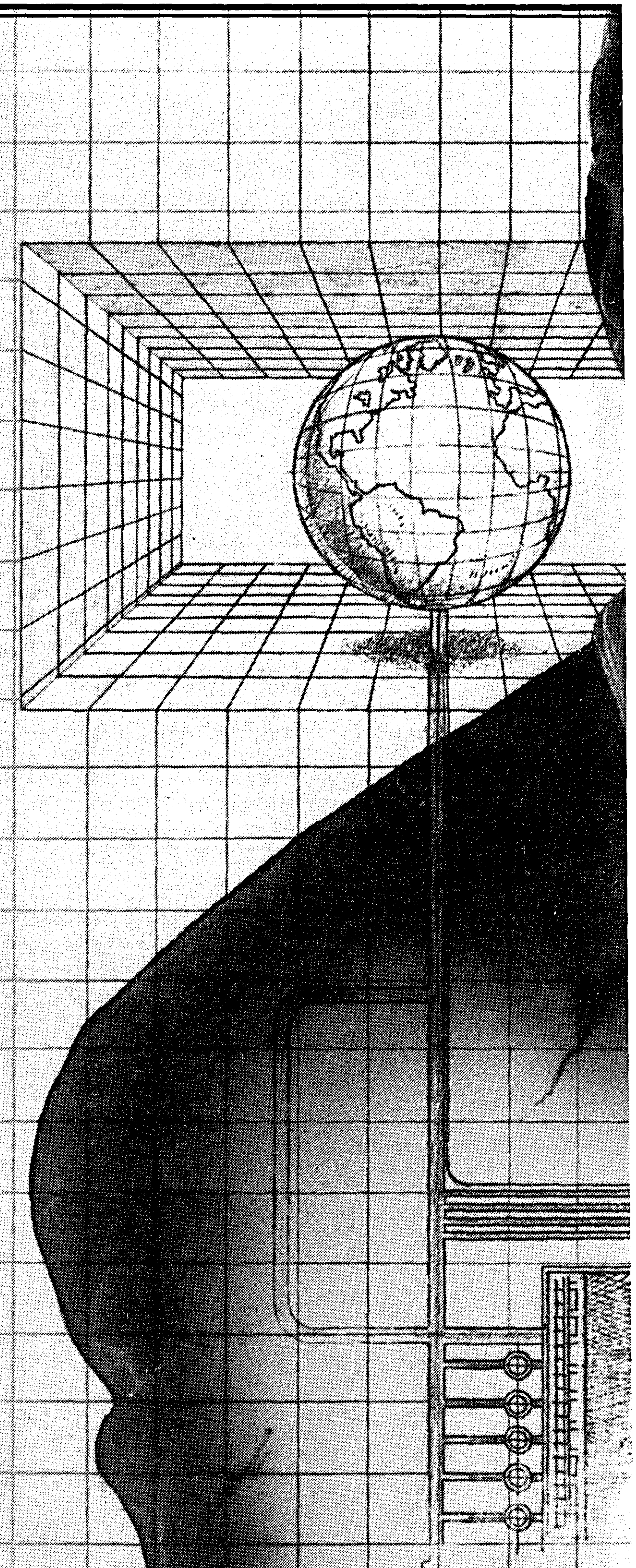
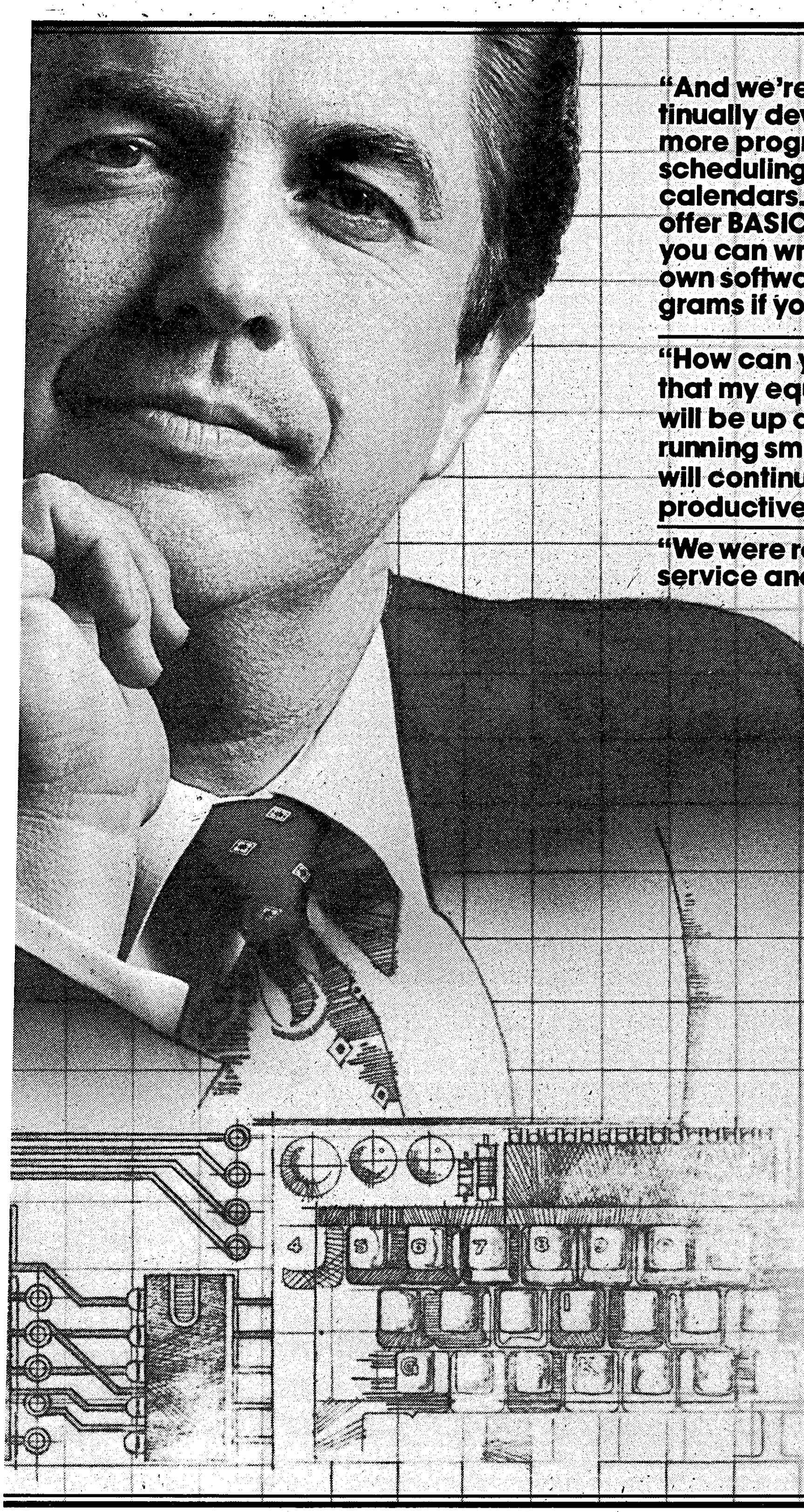
"Lanier equipment is multifunctional. We have the applications packages you need right now for records management, mathematical functions, bar graphs and statistical typing. Since our products are multitasking, your staff can type an inventory report while integrating a list of names, addresses and individual information into a form letter in the background, and print out a new product proposal — all at the same time.



"Glad you asked."

Wes Cantrell, President, Lanier Business Products, Inc.



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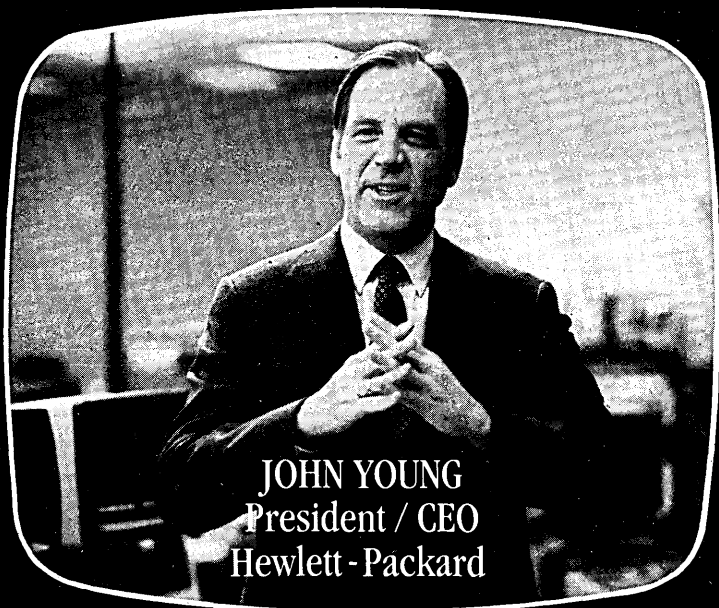

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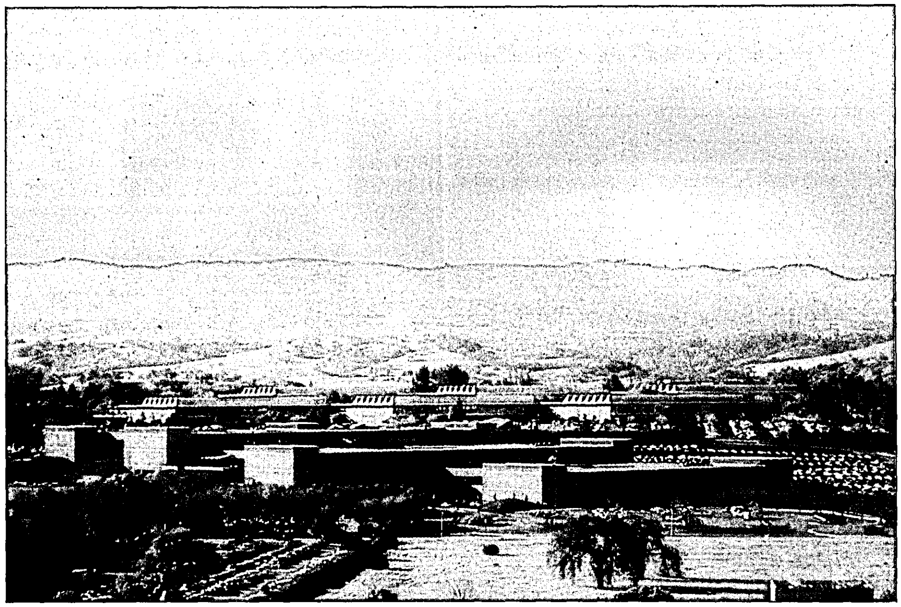
CIRCLE 109 ON READER CARD

VALLEY OF THE CHIPS

California's Silicon Valley has blossomed in the past 15 years as a nexus for makers of semiconductors, disk drives, IC chips, and other computer hardware.

by Edward K. Yasaki



SILICON VALLEY: Land prices and housing costs have escalated beyond sanity.

PHOTO COURTESY OF HEWLETT-PACKARD COMPANY

Tom O'Rourke had had enough. In his 17 years with General Electric, he had moved his family eight times. His six children were all born in different places. He had signed on with GE after graduating from college and had joined its fledgling computer operation in Phoenix in the fall of 1957. By 1965 he was a regional manager and found himself comfortably situated just south of San Francisco. It was here that O'Rourke decided to start a computer service bureau operation called Tymshare. Why in Silicon Valley? "Because I didn't want to move," he replies candidly.

The weather is one reason O'Rourke wanted to keep his family in Silicon Valley. The climate is a factor usually overlooked in analyses of this area, but it may help explain why so many semiconductor manufacturers and other high technology firms were created there. To be sure, the start in the area of the early electronics companies such as Varian and Hewlett-Packard was influenced by the presence of nearby Stanford University, but MIT is near Boston and CalTech is near Los Angeles, and no Silicon Valleys emerged there.

Instead, a heavy concentration of semiconductor manufacturers grew in an agricultural area that extends some 30 miles from north to south, a valley with mountain ranges to the east and west, and with the southern extremity of San Francisco Bay running down the middle. In the world of Rand McNally it goes by the moniker of Santa Clara Valley. In this armful of real estate, where pears and apricots are still being grown but in diminishing quantities, one passes through communities like Palo Alto to the north and Mountain View, Sunnyvale, Santa Clara, and San Jose to the south. At its bulging waist are towns like Cupertino, Saratoga, and Los Gatos. In more recent years, with room for expansion becoming scarce, companies have been building in Milpitas and Fremont to the east.

But in between the communities at the base of mountains to the east and the older clutch of semiconductor and computer companies in the western half of Silicon Valley is land that only recently has begun to be developed. It tends to be lowland, barely out of cultivation, the site of much flooding last January during unusually heavy rains. It is in this area that the makers of Atari computers recently signed up to buy 65 acres for some $34 million—close to $12 a square foot—just for the land on which to build a headquarters complex. Land prices in this area have increased twentyfold in the last 10 years. Although $500,000 for an acre of prime commercial land may not sound inordinately high, especially when paid by some large, impersonal corporation, consider a view homesite in the prestigious Los Altos Hills community overlooking Silicon Valley, a little more than an acre. The price, again only for the land: $250,000.

There is an inflated sense of importance that has caused land prices and housing costs to escalate beyond sanity in the valley. Compounding this problem has been a shortfall in new housing, lagging significantly behind the creation of new jobs in the valley. The county's population grew fourfold in the last three decades, from 290,000 in 1950 to more than 1.25 million in 1980. It is currently estimated that by 1990 there will be 125,000 more jobs in Silicon Valley, but only about 70,000 more housing units. That means 100,000 people employed in the county will be living in some other county.

By 1990 there will be 125,000 more jobs in Silicon Valley but only about 70,000 more homes. Some 100,000 valley employes will have to live in another county.

Already the pattern is obvious. Such locally based companies as Amdahl, Hewlett-Packard, Intel, National Semiconductor, and Tandem have built factories and research facilities in places like Washington, Oregon, Texas, and Arizona, as well as in other parts of this state and in other countries. So far, no major firm has moved out its headquarters, although that remains a possibility.

Semiconductor industry consultant Steve Szirom, however, doesn't think it is likely. He sees Silicon Valley as the world's largest skill center for semiconductors, perhaps analogous to what Paris was in haute couture and Saville Row in menswear. "There's no other place like it in the world," he says. For this reason, he sees the semiconductor makers maintaining their technical and professional staff in the valley to continue their research and design functions, while moving production capabilities elsewhere.

As a skill center, the valley has attracted other businesses that serve local companies. They include venture capital companies, banks with special departments to work with high technology firms, and investment bankers. But one also finds independent IC chip design houses, mask-making companies, design processing companies, wafer and chip-testing companies, and high-rel houses that will burn in a product after it's been manufactured. And, of course, a legion of consultants who can tell you how to do all those things better.

Helping to keep those companies in business is a recent trend toward the design and use of both custom and semicustom chips (October '81, p. 63). As recently as five years ago, industry pundits were saying that the high costs of constructing new wafer fabrication facilities would keep new companies from entering the semiconductor manufacturing business. According to Szirom, the cost to equip a new fab facility was about $5 million in 1976. By 1980 that cost had risen to $15 million, and today it's closer to $25 million—and that does not include the land or the building.

Despite this, Silicon Valley today is dotted with startups equipped to produce custom and semicustom IC chips. Szirom attributes this to new tax laws that make investment more attractive. There's now more venture money in the valley than qualified people with startup plans, he says.

As a skill center, Silicon Valley is also an ideal home base for computer manufacturers. Some were started by former employees of those same semiconductor houses, but some are based in the valley specifically to be close to the sources of the technology and new developments in integrated circuits. A recent study of desktop computers and workstations built around the 16-bit microprocessor found that 17 makers of those so-called supermicros are based in the valley. In addition, the presence of companies such as Apple, Atari, and Commodore attracts new software ventures, whether to produce utility software, applications packages, or video games.

The granddaddy of them all, Hewlett-Packard, started in a garage on Addison Street in Palo Alto even before silicon was discovered in the valley.

Also choosing to be close to the action are Amdahl, Four-Phase, Magnuson, Tandem, and Trilogy. Amdahl Corp. started in rented quarters within walking distance of its current corporate headquarters and manufacturing facilities in Sunnyvale. In its early days Four-Phase Systems occupied a facility in Cupertino that looked more like a small shopping center built around a central parking lot. From there the company moved across a freeway, where there was room for expansion, eventually occupying a 560,000-square-foot headquarters complex—and then having to build on adjoining land another 210,000 square feet. The much younger Tandem Computers began operations in Cupertino before building its headquarters complex in 300,000 square feet, and now is adding 140,000 square feet in an adjacent building.

But the granddaddy of them all, Bill Hewlett and Dave Packard's company, started in a garage on Addison Street in Palo Alto, even before silicon was discovered in the valley. The company's first production line was in a building that now houses an antique shop, located less than a mile from Hewlett-Packard's new corporate headquarters. Since then, of course, the company has come to occupy numerous facilities in Palo Alto, Sunnyvale, Santa Clara, Cupertino, San Jose, and elsewhere.

Despite its name, then, Silicon Valley is home for more than semiconductor makers. It would appear that a clear majority of all disk drive manufacturers in the world are also based here. Indeed, the moving-head disk drive industry began here. "When IBM conceived of what became the RAMAC, they did their development work at 99 Notre Dame Street in downtown San Jose," says James N. Porter, publisher of the *Disk/Trend* reports. He recalls that the RAMAC was in development from the early 1950s and introduced in 1955. The mainframe vendor also did a lot of its disk media development work in downtown San Jose before IBM built its plant and laboratories in south San Jose.

The success of the RAMAC led to the development of the first removable disk pack, which was introduced in 1962. The drive was the IBM 1311, which was to become the 2311; the pack was the 1316. With the System/360 in 1964, IBM also brought out the 2314 drive with the 2316 pack.

"If there's any drive that really made the disk drive industry what it is today, it's probably that drive," says Porter about the 2314. "The independents started up, basically, to make drives in that technology class." When IBM began shipping the 2314s in the mid-'60s, it became clear that there was a huge market for this kind of storage device, but it was not until about 1969 that the first of the drives came out of the independents. These vendors were Memorex, Century Data, and Information Storage Systems (ISS).

Memorex, based in Santa Clara, is believed to have been the first with a 2314 look-alike, which appeared a year after it brought out its version of the 2311. (Century, located in southern California and not in Silicon Valley, shipped about the same time.) Memorex was formed by people from Ampex Corp. to make magnetic computer tape. Their success in the marketplace also motivated them to coat disk platters, which led them into the drive manufacturing business. By contrast, ISS was started by the so-called Dirty Dozen, refugees from IBM in San Jose who set up shop in Cupertino to make their version of the 2314.

In 1965 IBM introduced the small 1130 computer, which came with a single disk cartridge drive that used the same technology as the 2314—same heads, same platter, but only one disk. When this drive caught on, it also caught the attention of Diablo, developer of the daisywheel printer, as well as Caelus Memories, maker of disk media, and Iomec. These companies formed the first wave of the independent disk drive industry in northern California. "And out of this technology base," says Porter, "came a lot of the smarts who went on to start other companies in other areas too."

Despite its name, Silicon Valley is home for more than semiconductor makers. A clear majority of all disk drive manufacturers in the world are also based there.

Porter credits the concept of the floppy disk drive to a New England company, Laboratory For Electronics, perhaps dating back to the 1950s. IBM was the first to produce the device, but Memorex gets credit for shipping the first oem floppy drives in 1972. Along about this time, a new company was formed by Alan Shugart, who had been in charge of overall disk drive development at IBM San Jose before joining Memorex in 1969. He left Memorex to form Shugart Associates, only to be ousted in an early management tiff. But Shugart Associates, now a

part of Xerox, today employs some 3,100 people worldwide and is shipping some 5,000 floppy and rigid disk drives each day.

Also in Silicon Valley are the two companies that led the formation of the independent Winchester drive business, IMI and Priam. The founders of both companies came out of Memorex—IMI to make an 8-inch drive and Priam to go with a 14-inch model. As happened in the early days of Shugart, IMI went through some terrible moments during its formative days, leading to the resignations of cofounding president David Britton and executive vice president Geoffrey Lee. They then founded Britton-Lee in nearby Los Gatos to develop a database processor.

Alan Shugart, meanwhile, went on to found Seagate Technology and pioneer the 5¼-inch Winchester drive. One of his cofounders, Syed Iftikar, vice president for mechanical engineering, has since gone off to start yet another company, SyQuest Technology, on the eastern fringes of the valley, to invent the 3.9-inch (100 millimeter) Winchester drive. Thus the valley has no shortage of entrepreneurs. Behind each spreadsheet there lurks a business plan.

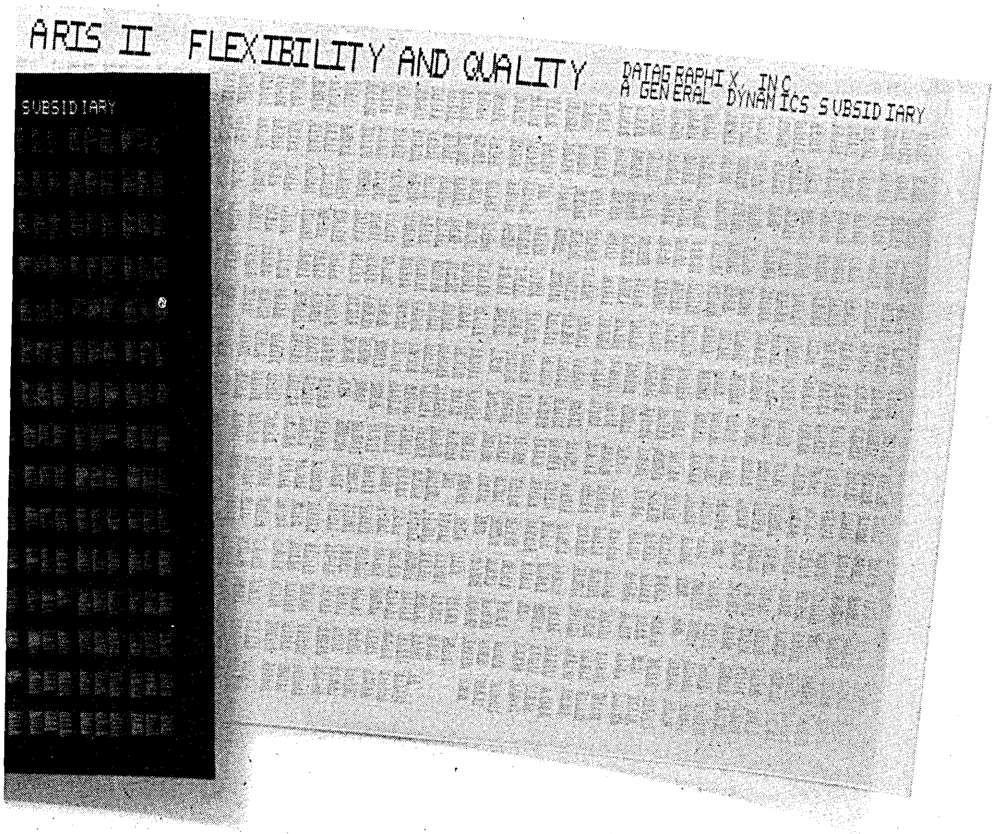
In Silicon Valley, one finds innovative ideas taking form not merely in such things as product design or manufacturing process, but also in employee relations.

But in Silicon Valley one finds innovative ideas taking form not merely in such things as product design or manufacturing process, but also in employee relations. At two companies at least, Rolm and Intel, employees are given three-month sabbaticals after seven years on the job. A number of firms hold periodic beer busts for employees. Rolm also gives them access to indoor basketball courts, a gymnasium with exercise equipment, racquetball courts, an outdoor course for runners, and indoor and outdoor swimming pools. All this at a headquarters complex situated in a parklike setting with a meandering stream.

Such perks have obvious advantages in a company's ability to recruit and retain employees.

But companies today not only must compete with other companies in Silicon Valley; they also must compete with other skill centers being set up in places like Research Triangle Park in North Carolina, near such institutions as the University of North Carolina, North Carolina State, and Duke. Similarly, there's the proposed Massachusetts Technology Park in the Boston area, including a microelectronics center to be funded by the state and local industry.

Still, there's always the weather in Silicon Valley, a factor that tends to draw and retain people, a factor that tends to keep local companies from moving their headquarters staff out of the valley, a factor other areas cannot match. ☼



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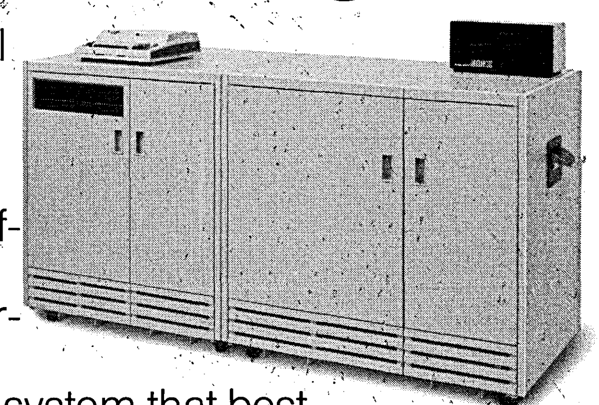

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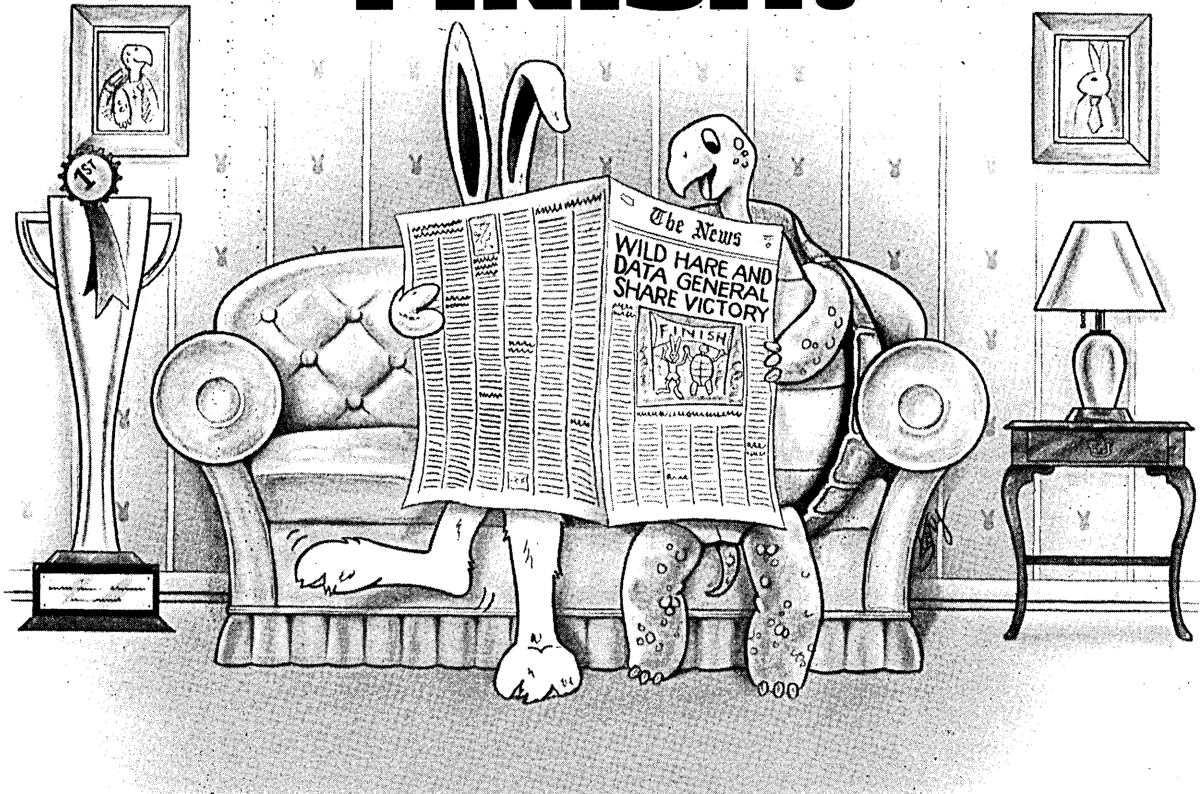

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INCEST IN ORANGE COUNTY

The Southern California area is a hotbed of high technology, but you need a scorecard to keep track of the companies and the people as they conduct their transactions.

by Edith Myers

Not too long ago, it was not much more than a quiet collection of orange groves outside Los Angeles, and aptly named. But times have changed in Orange County, and today a better name might be Computer County. The last quarter century has seen the computer industry take root here so zealously that it has displaced oranges as the distinguishing feature of the area. Since the 1950s, the blossoming of the industry has brought with it an explosion in population and a vast influx of money, to the point where it ranks with its upstate cousin, Silicon Valley, as one of the major hotbeds of high technology in the country.

The computer industry in Orange County is homegrown and self-pollinating. It's family, and it's incestuous. Companies in the county guard their employees the way other companies guard their trade secrets, but hardly ever with as much success. As companies are created, spun off, acquired, sold, or buried, as they prosper or flounder, their employees hop around faster than anyone can keep track. Indeed, the most commonly asked question in the county is, "So who's he with now?"

The industry began to take shape in the area in the late 1940s. One of the first companies to form was the Electronic Engineering Company of California (now EECO) in 1947. EECO originally was a punched paper tape products manufacturer and only got into computers in 1969. By then, however, they were significantly behind the times.

The other seminal firm in the county was Beckman Instruments, which moved in from Pasadena in 1954, a year before Disneyland opened in nearby Anaheim. The influence of EECO and Beckman has been so great that their founders, Burgess Dempster and Arnold Beckman, are considered "the grand old men of electronics in Orange County," according to Louis B. Horwitz, president of Datum. Datum is a spin-off of Astrodata, which in turn is a spin-off of Beckman. Both Dempster and Beckman are still associated with the firms they founded.

Another Beckman offspring was MicroSystems, itself a father to several firms. In early 1969, Beckman alumni Fred Cox and Ken Allen spun Microdata out of MicroSystems. William Roberts and Ray Ball, both also from Beckman, joined the firm as officers. But two years later, Cox left Microdata to form California Data Processors to produce PDP-11 minicomputer emulators. Ball left Microdata at about the same time to join another Beckman spin-off, Tempo Computers, but then rejoined Cox at CalData in June 1972. CalData was eventually sold to Data 100 and moved to Minneapolis, but both Ball and Cox remained in Orange County, the former to help found Able Computer Technology and the latter to found and run Emulex. Allen meanwhile left Microdata to form Micro V Corp. to produce a line of business computers called Microstar.

Micro V was founded and still is located on Sky Park Circle, a sprawling collection of offices and manufacturing facilities near John Wayne Airport. Some county observers believe they would be rich if they had a nickel for every high-technology company started in the Sky Park Circle complex. It's that big.

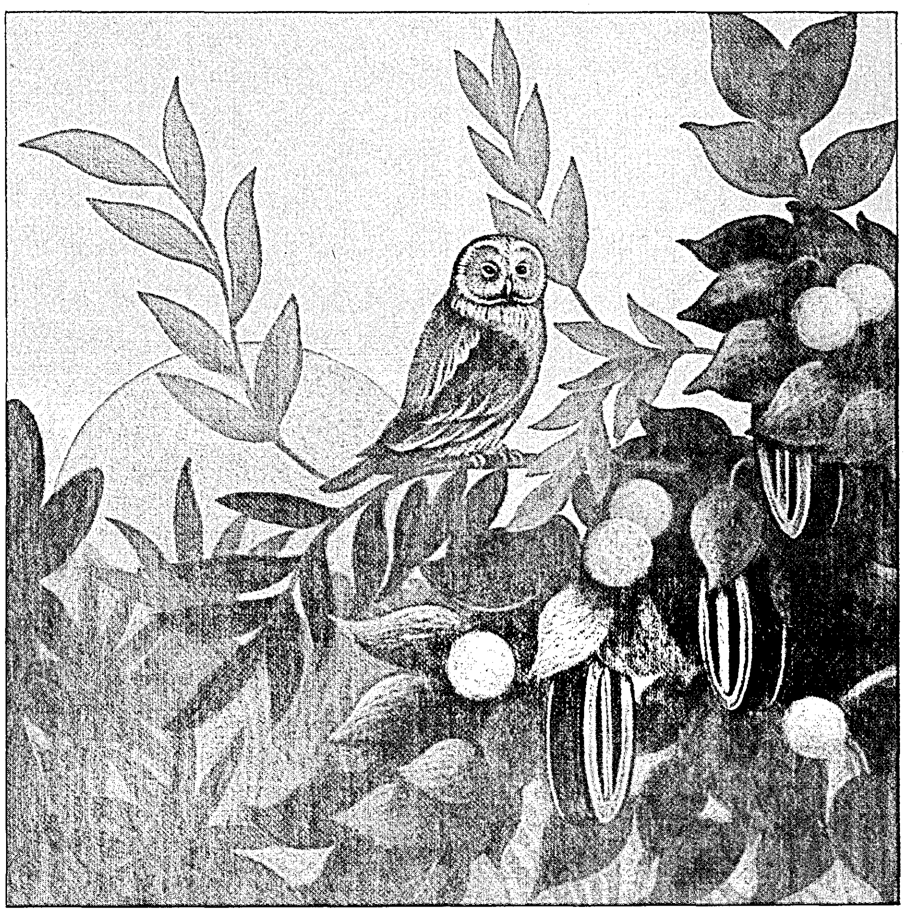
Why did the county become such a haven for the computer industry? As is the case in Silicon Valley, the climate does not hurt. Orange County has some 42 miles of attractive, sandy beach within easy access. "I don't mean that people go to the beach on their lunch hour," says Tara Blyer, who has worked in both Silicon Valley and Orange County. "It's part of their way of life. You can't get to the beach from Silicon Valley."

The atmosphere is also quite relaxed. "Almost all of the buildings are built around patios," Blyer says. "And there's the long weekend, beginning with Friday lunch." Blyer's current employer, Beverly Johnson, explains, "There are more restaurants per square mile here than anywhere else in the world. Everyone goes out to lunch on Friday and stays. You can't get into a restaurant parking lot in Orange County on Friday afternoon."

Orange County has especially been attractive to startup companies, at least partly

The influence of EECO and Beckman Instruments has been so great that their founders are considered "the grand old men of electronics in Orange County."

because their founders came from other area firms and did not want to move. Take the case of Ronald O. Murr, an ex-IBMer who did stints at Beckman, Raytheon Computer, Microdata, and CalData before landing at Peripherals Interface Co. (Pico). Soon thereafter, Beckman spin-off Datum acquired Pico, and Murr became the director of engineering of Datum's computer products division. The firm dropped the Enhancer line of minicomputers on which he had been working and



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Murr left to start his own firm. Today, six years after its founding, ROM Systems is still putting together mini-based systems under his direction. Another Datum manager who left to start his own firm was Randy Knapp, who took several people from his peripheral equipment division and formed Western Peripherals, now WesperCorp.

On the Microdata side of the Beckman family, Richard Pick started his own systems house on Sky Park Circle in 1973 to develop an operating system based on microprogramming, which ultimately became the basis for Microdata's Reality System. Pick worked with Microdata on a consulting basis after Richard Pick & Associates was firmly established, but he left the Beckman spin-off during stormy litigation. Pick then started another company to offer the Evolution system, based on his operating system, but in early 1980 he sold out to his employees.

Another Microdata alumnus, Bud Bleininger, left to help form General Systems International, but in early 1981, he left that company to found Tecstor in Huntington Beach to produce large capacity 14-inch disk drives. Bleininger had originally been a part of Century Data Systems, a source of a number of spin-offs on the peripherals side of the industry. Indeed, Century has gone all of the Orange County routes. After its formation, it was acquired, only to disappear, and later be reacquired and put on sounder footing. It was created in 1968 by George Canova, who came out of Scientific Data Systems, with the help of a $1 million advance from California Computer Products president Lester L. Kilpatrick. In 1973 CalComp acquired Century and got into the IBM plug-compatible tape and disk memory market.

Century Data Products has gone all of the Orange County routes. After its formation, it was acquired, disappeared, was reacquired, and firmly established.

After its acquisition, Century became CalComp's oem Memory Products Division and lost its independent identity. It resurfaced in November 1978, however, when a debt-ridden CalComp sold it to Xerox Corp., which reinstated its original name. Yet through all these changes, Century has remained in the same Anaheim facility. "I've changed companies twice and never moved my office," says Dick Carlton, an executive who has been with Century through most of its life span.

Kilpatrick, meanwhile, entered the securities market with a startup called Newport Securities Corp. He also became a director of a tiny firm called Systonetics, Inc., which markets a project management software package. Kilpatrick hired Richard I. Tanaka to be the president of the fledgling firm a year ago. Tanaka had been associated with Kilpatrick as senior vp of CalComp, and had served with Lockheed Missiles and Space Corp. He is best known for heading, at various times, AFIPS, IFIP, and IEEE.

The startups in Orange County are not entirely homegrown. Al Cosentino was moved by Management Assistance Inc. to the county in 1973 to take over its subsidiary, Basic Four Corp. When he was eased out of Basic Four, he started Business Systems Products, Inc., and in true county tradition took some Basic Four people with him. About a year later, in 1977, Microdata president Don Fuller brought Cosentino in to be a vice president of the firm, which had been acquired by McDonnell-Douglas. It was "an offer I couldn't refuse," Cosentino says.

When Microdata was reorganized last year, Cosentino again found himself eased out. He took some friends from Basic Four and became president of EECO Computer Inc., a subsidairy of the original EECO. And so it comes full circle.

But the days of spin-offs and startups may be drawing to a close in Orange County. "The industry has matured to a point down here," Johnson says. The '60s and '70s were the "big era for the small computer entrepreneur. There are still people looking for their big opportunity, people who want to get shares of stock, people who have been in the industry 20 years who are looking for their last chance to get in on the ground floor."

Their opportunities may be diminishing as the character of Orange County changes, however. The area is "becoming more of a corporate headquarters center," Johnson says, with growth more in the service companies—small systems houses, software services, lawyers, accountants, and advertising—than in the traditional hardware and programming companies.

And indeed some startups are moving out, such as the companies created by Dave Methvin and Larry Goshorn. They had been employees in one of the original Orange County electronics firms, an R&D lab called Decision Controls. In 1967 the lab's parent company, Data Machines, was taken over by Varian, and later became the minicomputer operation of Sperry Univac. The company moved, but Methvin stayed behind to form Computer Automation and Goshorn remained to form General Automation. Methvin has since taken his startup to Boulder, Colo., and Goshorn left General Automation behind to start International Robotics Intelligence north of San Diego.

The county has changed, and it will continue to change. A shortage of blue collar housing is becoming severe, causing companies to move their manufacturing operations elsewhere. The median income is rising, up to $40,000 a year now, and the average cost of a house is $143,000. But even now the migration isn't over. Rather, it seems as if Orange County is only slowing down its frenetic pace as it reaches its geographic and economic limits.

After all, the orange groves deserve a fighting chance. ✲

STARTUP FEVER IS SPREADING

The combination of available venture capital and new technologies has the entrepreneurs on the move.

by John W. Verity

"Money is the seed of money," said Rousseau in 1754. He might well have been describing the entrepreneurial computer industry of 1982, in which a cascade of capital is seeding startup companies of all descriptions. Venture money is flowing thick and fast these days, as if it were on tap to anyone showing a reasonable business plan.

The ferment of technology, talent, ambition, and big bucks has brought back a taste of the late 1960s' go-go years, when just about any venture with a name ending in "-ex" or "-tronic" could easily raise cash. Now, teams of engineers and marketeers seem to leave large corporations almost weekly, each setting out to conquer a particular market niche of unmined potential.

The range of computer startups is broad, to say the least. Rodent Associates of Sunnyvale, Calif., is working on an "optical mouse," according to founder Steven T. Kirsch, who funded the company out of pocket. Symbolics Inc. of Woodland Hills, Calif., has raised more than $9 million to bring out a LISP computer. Cosmos Computer Corp. of Campbell, Calif., was founded earlier this year by former Zilog chief Manny Fernandez and others who have raised $4.3 million to bring out an as yet undisclosed oem computer.

"I'd estimate that about 50% of the venture capital invested in the last few years has gone into computer hardware and software companies," says David Brophy, professor of finance at the University of Michigan. "The biggest category after that is biomedical equipment, much of which itself uses computer technology."

The latest wave of computer startups has been caused, observers say, by a combination of economic and technological factors. Capital is moving into the computer industry because it is apparently one of the few industries in which the U.S. can lead the world.

In a word, computers are a best bet in terms of high-technology investments. Unlike steel or automobiles or less sophisticated electronic goods, computers are something the U.S. still makes well. Moreover, they lend themselves to highly automated manufacturing, offer much opportunity for added value, and seem virtually limitless in their

WHERE'S THE NICHE?

There's no shortage of startup companies in the computer industry these days. Opportunities for the savvy entrepreneur abound in hardware and software. The following is a list of startups, by no means complete, that has been compiled by DATAMATION. Where no number is given for capitalization (NA), the company is either privately held or has declined to provide the necessary information.

COMPANY/ LOCATION	DATE OF FORMATION	BACKGROUND OF PRINCIPALS	CAPITALIZATION	PRODUCTS OR SERVICES
Adaptec, Inc. Santa Clara, Calif.	1981	Shugart Associates, Siliconix, Computhink	$1.7 million	LSI disk controllers
Bridge Communications Cupertino, Calif.	1981	Zilog	$1.4 million	Local networking products
CADTEC Corp. San Jose, Ca.	1980	Intel, IBM	$3 million	CAD software
Censtor Corp. San Jose, Calif.	1981	Memorex, Univac/ISS, Dastek	$1.7 million	Vertical recording technology
Charlton Associates, Inc. Irvine, Calif.	1981	Century Data Systems	NA	Manufactures small rigid disk drives
Computer Aided Engineering Sunnyvale, Calif.	1982	Magnavox, Intersil, Hewlett-Packard	$2.5 million	CAD software for IC design
Cosmos Computer Corp. Campbell, Calif.	1982	Zilog	$2.5 million	Oem computer systems
Creative Communications Systems, Inc. Santa Clara, Calif.	1982	Zilog, Exxon Enterprises	$1.5 million+	Office systems
Envision Corp. San Jose, Calif.	1981	Spectra Physics, Hewlett-Packard, National Semiconductor	NA	Color printers and crt terminals
Epic Computer Products, Inc. Fountain Valley, Calif.	1982	Lear Siegler, Crown Manufacturing, MQI Computer Products	$3 million	Manufactures and distributes small computers
Florida Computer Graphics Lake Mary, Fla.	1981	Datapoint, Data General, Basic Four	$2 million	Color graphics computer systems
Franklin Computer Corp. Pennsauken, N.J.	1981	Delta Data Systems, Bower Associates	NA	Apple-compatible personal computers
Gateway Communications, Inc. Irvine, Calif.	1981	Control Data	$1.4 million	Network gateways and workstations

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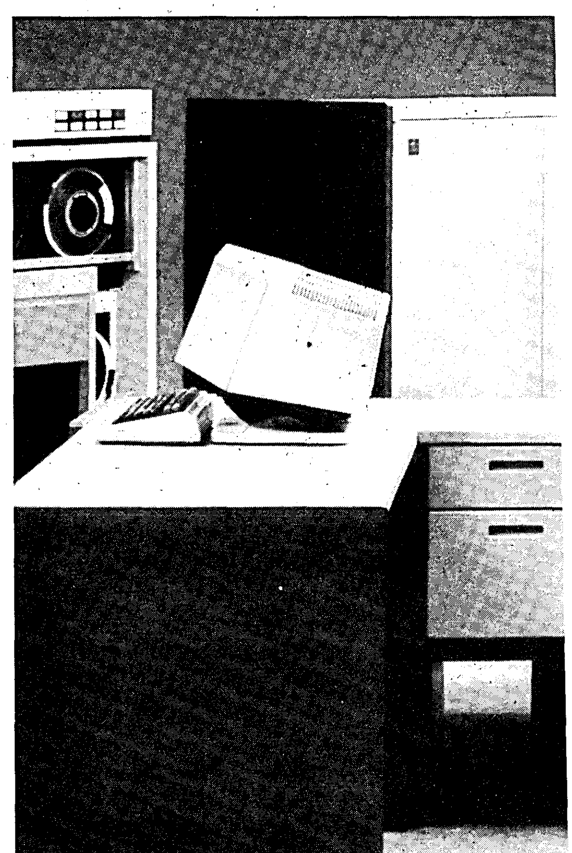

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COMPANY/ LOCATION	DATE OF FORMATION	BACKGROUND OF PRINCIPALS	CAPITALIZATION	PRODUCTS OR SERVICES
IBIS Systems, Inc. Duarte, Calif.	1980	Memorex, Storage Tech	$23.2 million	Builds and markets large-capacity disk drives
Integrated Office Systems San Jose, Calif.	1980	GTE Telenet, Serafini Associates, Hitachi	$4.8 million	Systems for field sales forces
IXO, Inc. Culver City, Calif.	1981	Parker Bros., Mattel	$7 million	Handheld terminals
Kebert Corp. Dallas, Texas	1982	NA	NA	Software for IBM System/ 34 and 38
Lightning Software Palo Alto, Calif.	1981	NA	NA	Educational software
MicroOffice Systems Technology Fairfield, Conn.	1981	Exxon, Timex	$500,000	Portable turnkey systems
Peripheral Marketing Mountain View, Calif.	1981	Micro Peripherals Inc.	$1.25 million	Sales and service of peripherals and other components for small systems houses
Prism Management Systems, Inc. Dallas, Texas	1981	ICL	NA	Software brokerage services
Productive Resources Cumming, Ga.	1981	NA	NA	Systems generation software and consulting
Pyramid Technology, Inc. Palo Alto, Calif.	1981	Rolm, STSC	$3 million	32-bit Unix computers
Qubix Graphic Systems Saratoga, Calif.	1982	Calma/GE, Ramtek, National Semiconducter	$2 million	CAD systems for oems
Raster Technologies, Inc. Troy, N.Y.	1981	Rensselaer Polytechnic Inst.	NA	Graphics display systems
Ridge Computers Sunnyvale, Calif.	1980	Hewlett-Packard	$1.5 million	High-performance computers for engineers
Rodent Associates Sunnyvale, Calif.	1982	NA	NA	Optical mouse
SOLOSystems Sunnyvale, Calif.	1981	American Microsystems	$1.5 million	Workstations for COBOL programmers

application. Indeed, as a nonpolluting, entertaining, low-energy machine, the computer may be the most nearly perfect piece of high technology yet invented.

"What you're seeing is a continued investment in electronics," says Brophy, who regularly surveys the scene for the Venture Capital Association of America. "It's still unusual to see venture capital companies, those that supply the capital to startups, stray very far from that well-worn path."

The technology of computers has of course changed dramatically in the past decade, enabling more companies to enter the industry and creating a broader market for computerized goods. The three most important developments in technology have been the invention of the microprocessor, the growth of data communications networks, and the increasing sophistication of software. Each has helped open a wide vista of potential applications, many of which were previously unthinkable.

The microprocessor in particular has made it possible to bring computer products to market with little of the development headaches or costs once associated with a new

The three most important developments in technology have been the microprocessor, data communications, and the increasing sophistication of software.

product design. In the '60s, for instance, the small computer was a relatively rare item, and to customize a computer product line to a specific application was costly and risky. Now, with micros as powerful as some mainframes and as plentiful as rabbits, it is a simpler task to devise a system from scratch and market it successfully.

The price of computer hardware has been slashed because of the micro, and whole new markets have opened up for personal computers, word processors, and small business machines. But this growth would not be nearly so spectacular if it were not for advances in data communications and software. Software has made the new machines more easily marketable to existing markets and created whole other new ones. Data communications provides the skeletal structure that lets the small computers function as remote processors.

As venture capital market observer Brophy points out, it was also a drastic drop in capital gains tax rates that originally prompted the current venture capital craze. Once as high as 50%, the rate was reduced to 28% in 1976 and immediately set off a flurry of startups. "That change [in the rates] rekindled interest in the equity market. It was coincidental that at about that same time the microprocessor began appearing in calculators and soon thereafter in microcomputers. There was tremendous interest once those two factors came together," the University of Michigan professor says.

Moreover, Brophy comments, a rather large number of middle-level managers were at the same time itching to get out of large corporations and go the entrepreneurial route. IBM, Xerox, Hewlett-Packard, Ampex, and Digital Equipment, to name a few, saw their ranks thinned by startups. Some observers suggest that another such wave is now occurring as literally thousands of persons work independently on software packages for microcomputers.

Typical of the well-funded startups coming to market with a system of unique design aimed at a specific market is Synapse Computer Corp. of Milpitas, Calif. Founded in 1980 by former Data General, Perkin-Elmer, and Hewlett-Packard people, the company plans to grab a big piece of the fast-growing transaction processing market, which is projected to hit the $20 billion mark by 1986. That's enough to justify easily the $8 million of venture capital Synapse has garnered from a host of backers.

The action in today's peripherals market is in devices like small Winchester-type disk drives, backup tape units, and crt terminals.

Like many entrepreneurs, Synapse president Mark Leslie had dreamed of running his own company for many years before getting his big chance. After a few years at Scientific Data Systems, Leslie joined Data General, where he got a strong whiff of the intoxicating entrepreneurial spirit. In 1976, he knew he "wanted to do it," and in 1979 he found himself "looking for a vehicle."

Also looking around to hitch his wagon to a fast-moving star was Elliot Nestle, a chief designer of computers for Interdata (now owned by Perkin-Elmer). The two men knew each other well and between them came up with the idea for the Synapse N+1 computer, a machine designed specifically for a wide range of transaction processing applications. Leslie remembers the two of them trying to raise seed money a year before they actually got it but finding their business plan too sketchy to convince any investors. "I'm kind of glad we didn't get the money right off because the delay made us rethink our strategies that much more carefully."

The first round of venture capital financing came through in late 1980 when $1.6 million was gained for developing the system's specifications. Then, a further $6 million was raised in May 1981.

The company's product is typical of many new, high-powered machines introduced in recent years in that it uses off-the-shelf hardware entirely. Designed to handle high-volume, multiterminal transaction processing tasks, the computer is composed of many Motorola 68000-based processors connected in a such a manner to enhance security, throughput, and reliability, says Nestle.

"The manufacturing technology does not stretch the state of the art much," he comments. "The key manufacturing issue for us is testing seven complex wiring boards once they're stuffed. That takes some careful work and planning."

COMPANY/ LOCATION	DATE OF FORMATION	BACKGROUND OF PRINCIPALS	CAPITALIZATION	PRODUCTS OR SERVICES
Spartacus Computers, Inc. Burlington, Mass.	1981	IBM	NA	IBM-compatible machines with remote control facilities
Star Computer Systems, Inc. Torrance, Calif.	1981	Control Data	NA	Turnkey systems for lawyers
SyQuest Technology Fremont, Calif.	1982	Seagate Technology		100-mm rigid disk drives
Synapse Computer Corp. Milpitas, Calif.	1980	Data General, Perkin-Elmer	$8 million	Builds and markets transaction processing systems
Taurus Software Corp. San Francisco, Calif.	1981	DEC	NA	CP/M software tools
Telesis, Inc. Chelmsford, Mass.	1981	Computervision, Vydec/Exxon	$8.5 million	CAD/CAM systems for small and medium-sized companies
Telesoft San Diego, Calif.	1981	CCH Computax	$3 million	Ada compilers and related products
Tricom Systems Hayward, Calif.	1981	NA	$600,000	Turnkey systems for auto repair shops
Valid Sunnyvale, Calif.	1981	Two Pi	$2.5 million+	Computer aided engineering systems
Vertex Peripherals Corp. San Jose, Calif.	1982	NA	$3 million	Disk drives

More important to the firm's success than board testing, Leslie notes, was the assembly of a good management team. "The venture capital guys invest in teams, not ideas. No matter how good a system you've developed, or how big your market is, they want to see a strong team of individuals first. They filter out the bad teams early on."

Synapse hopes to ship its first computers later this month. Its employee roster will total about 85 people by year-end, according to Leslie. In addition to him and Nestle, management includes Stanton Joseph, former director of national federal marketing for Data General, as marketing vice president; Stanley Meresman, former director of finance for Verbatim, as vice president of finance and administration; Richard Garlick, former vice president of manufacturing at Computer Elections Systems, as vice president of manufacturing; and Jay Denny, former worldwide systems engineering manager at HP, as vice president of customer services.

One major difference between the nature of the companies starting up now compared to many that were launched in the glamour years of the '60s is the shift from IBM-compatible peripherals to smaller devices designed to work with microprocessor-based systems. The plug-compatible market isn't entirely dead—witness such relatively recent startups as Lee Data, making 3270-type terminals, and Masstor Systems, selling mass storage devices—but it has withered. The action in today's peripherals market is in devices like small Winchester-type disk drives, backup tape units and crt terminals. These products are sold primarily to oems

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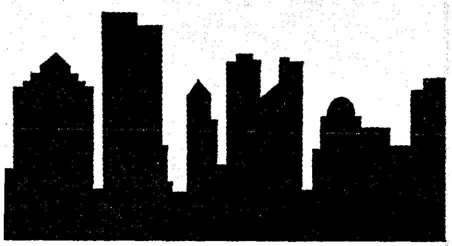

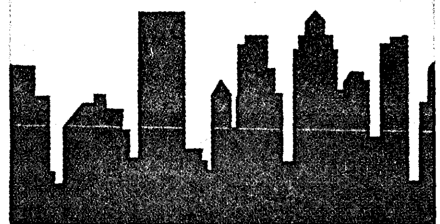

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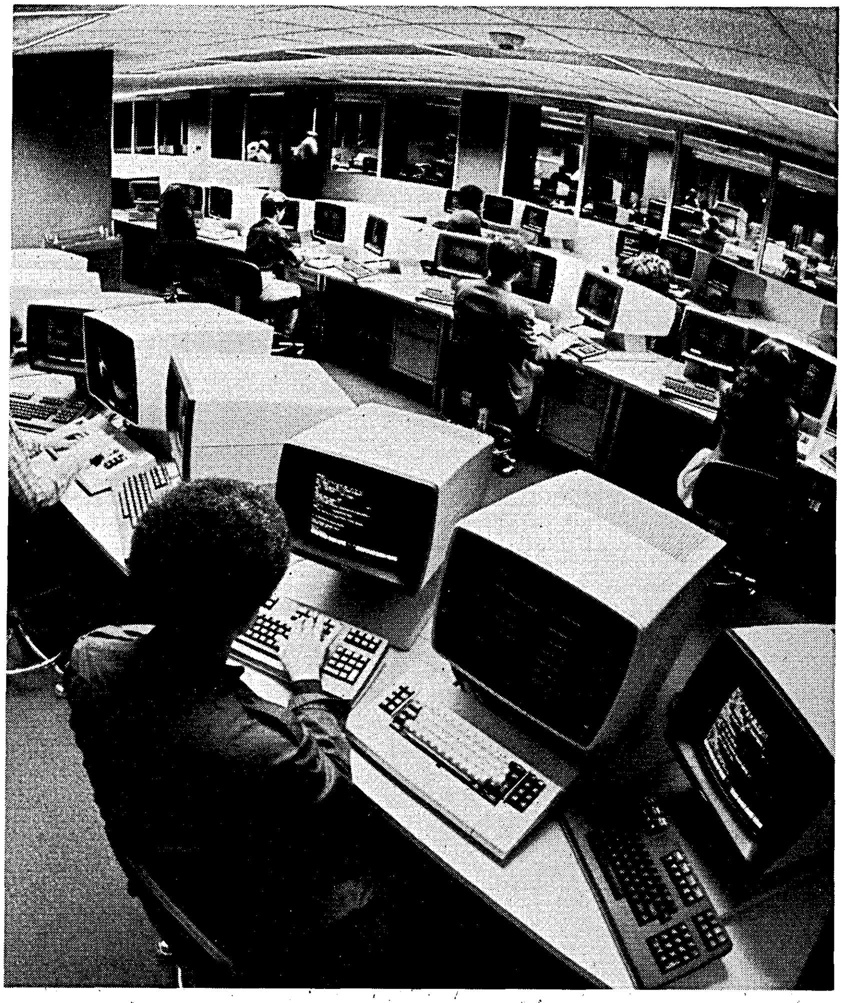


and systems houses, reflecting the high entry cost of selling end-user products as well as heavy competition from IBM.

As always, there are exceptions to the rule. Gene Amdahl has rounded up $50 million in venture capital for his new Trilogy Systems, which plans to compete head-to-head with IBM in the large systems arena, and Ibis Systems, a Duarte, Calif., startup, is working on high-capacity disk drives to go against IBM's top-of-the-line 3380 disk. Ibis has secured about $23 million of initial funding and expects to begin delivering gigabyte-range drives in 1983. The company is confident it can make it in the rough and tumble world of IBM compatibility because of the strong demand—growth as high as 40% a year—for mass storage.

Ibis, backed by more than $18 million in venture capital, will direct most of its early marketing efforts towards the oem disk marketplace. Already it has signed contracts with Cray Research and Amperif and others are on the way, says John Kjos, vice president of sales and marketing. "There's been a renewed interest in peripherals, especially

Some 5,000 companies are now at work on new products, most of them in the micro area.

disks, by computer manufacturers," he says. Although IBM-compatible versions of Ibis's drives will be available next year, the company does not plan to have a full field sales and service force in place until 1984 or so.

Interestingly enough, Ibis has not opted for thin-film read/write technology on its drives, claiming it has been able to achieve high densities with traditional ferrite heads and thin-film platters. However, the firm has set up an R&D company that will work on vertical recording, a technology that promises to boost disk performance in the future. Ibis's main financial backers have also set up related companies to make use of proprietary disk technology in small, Winchester-type drives for micros, according to Kjos.

While hardware may be what most people think of when the subject of new ventures comes up, software is increasingly the basis of new products. *Venture* magazine, based in New York, estimates that some 5,000 software-oriented companies are at work now on new products, most of them in the micro arena. While many of those firms are one- or two-man shops, several startups, like their hardware predecessors, are being backed with big venture capital. Telesoft of San Diego, hoping to cash in on the new Ada programming language, recently completed a second round of financing to the tune of $2 million. The money came from Welsh, Carson, Anderson & Stowe, a Wall Street venture capital group that has also invested in the highly successful VisiCorp and other software ventures.

Similarly, Communications Solutions Inc., of Cupertino, Calif., raised $600,000 through an R&D partnership so it can bring to market Access/SNA, a software package designed to help independent computer vendors emulate SNA cluster products such as IBM's 3270 and 8100 systems. Other recent software startups include Knowledge Engineering Inc., a Virginia company specializing in so-called artificial intelligence applications; Software Architecture and Engineering Inc., an Arlington, Va., company developing software tools; Prism Management Systems Inc. in Dallas, which is acting as a distributor for others' software products; and Pace Data Inc., in Woodland Hills, Calif., which offers programs and services to IBM System/23, 34, and 38 users.

Along with software, the CAD/CAM and local network markets have their share of new companies. Telesis Inc. of Chelmsford, Mass., has been formed to build and market low-cost (in the $85,000 and up range) CAD/CAM systems for small and medium-sized manufacturing firms. Chief executive is Pat de Cavaignac, who in 1973 founded Vydec, whose word processing equipment is now owned by Exxon. "I had enjoyed my ride at Vydec," he remembers. "Being an entrepreneur is pretty damn hard work. I won't say I'll do it a third time." Telesis began shipments in early July.

Also in the CAD market is Computer Aided Engineering of Sunnyvale, Calif., which was funded with $2.5 million in venture capital and is planning to bring out software systems designed to help integrated circuit designers.

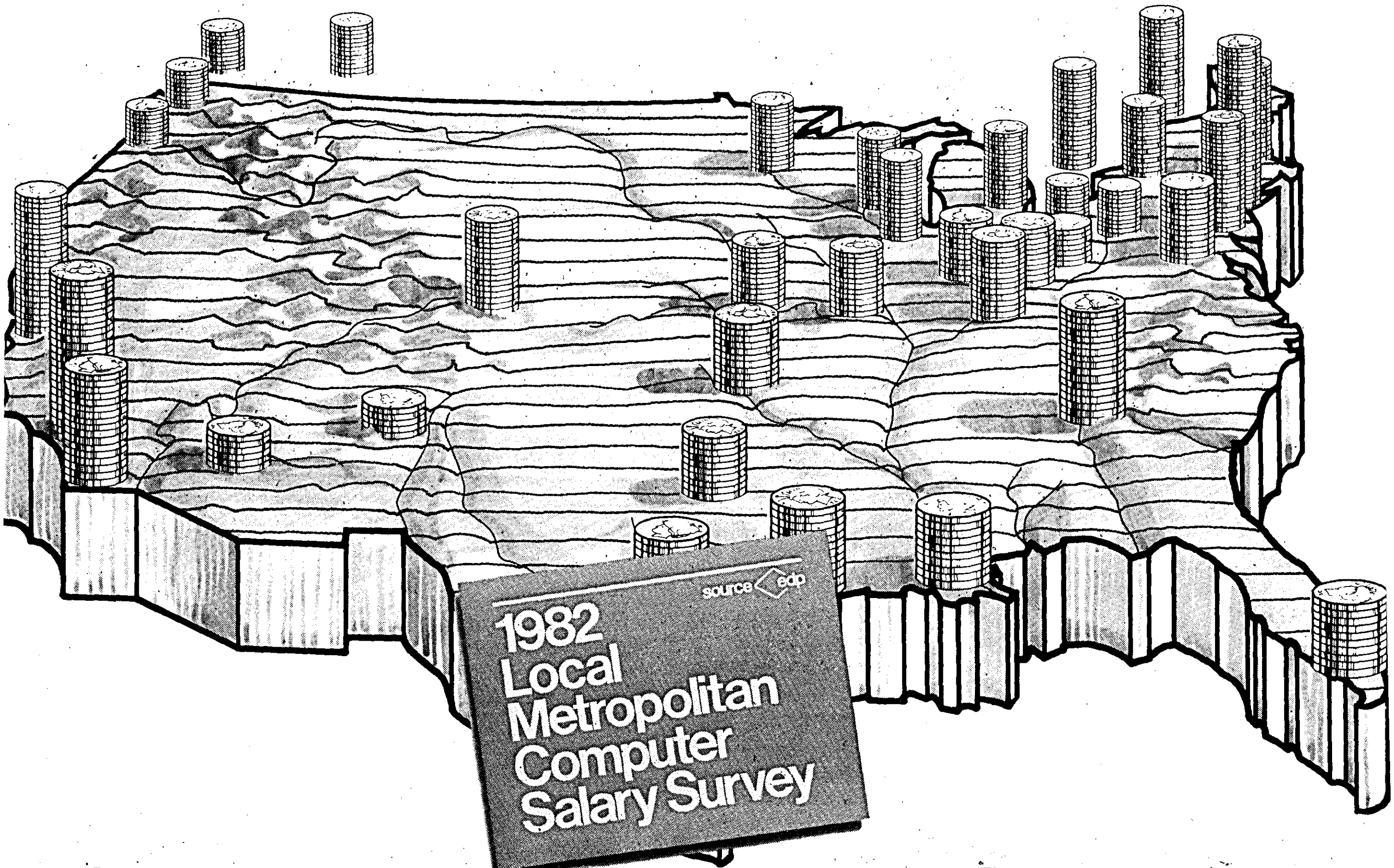
Envision Corp. of San Jose, Calif., has entered the color graphics marketplace with a line of printers and crt terminals that it plans to offer to oems. Formed in April 1981, the company is headed by former HP, Qume, and Spectra Physics executives whose entrepreneurial spirits were aroused by expected growth rates in color graphics of "at least 50%," according to William Elmore, director of marketing. "We had no problem getting money."

Says Envision president George Von Gehr Jr., "I always knew I'd [run my own company] but you can't predict the timing. It's an opportunity to exert leadership."

In the relatively new local network market is Bridge Communications Inc. of Cupertino, Calif., which is working on networking systems and gateways between differing local nets. For instance, the firm has plans to develop a gateway between Xerox's baseband Ethernet and Sytek's broadband LocalNet.

While the prospects of big money may seem the primary motivation for venturing out on one's own, there are unquantifiable aspects of running one's own show that are just as important to entrepreneurs. Many say they've never worked so hard in their lives as in the early stages of a startup, but they say that never before have they enjoyed their work as much. Often, the founders of new companies have left large corporations that seemed stagnant in comparison to the exhilaration of a new venture.

How Do Computer Salaries Stack Up in Different Cities Across North America?



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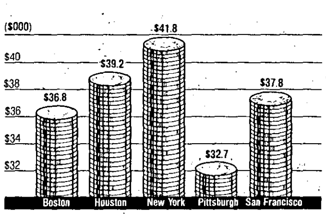

For example, if you're a Data Communications Programmer with over four years of experience, here's how your salary stacks up in just five of forty-five markets surveyed.

Survey breaks out salary data by market. Forty-eight specific positions are reviewed in each city. Included are position categories in programming, software, systems design, data communications, mini/micro systems, data base, EDP auditing, computer marketing, management and others—at various levels of experience and at different size computer system sites.

That means, for example, a Minicomputer Programmer with two-to-four years of experience will be able to determine what his/her peers make in cities ranging from Albuquerque to Vancouver or Akron to San Diego.

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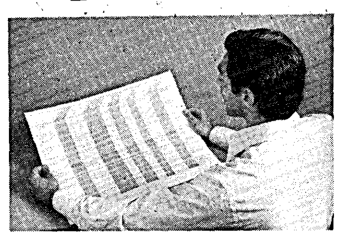

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Such was the case of the founders of Ridge Computers, a Sunnyvale, Calif., company that this year brought out a 32-bit scientific computer designed specifically for engineers. Recalls Bill Shellooe, marketing and sales vice president, many of the firm's founders were unsatisfied with the work they were doing at Hewlett-Packard.

"The recession hit and large companies cut back on R&D funding," Shellooe recalls. "Small, innovative engineering groups in a large organization can feel very stifled, especially when the company's products are locked into old, outmoded architectures. Ridge was a chance for many of us to do our own thing, the right way, as we saw it."

Thus, a small group of computer designers who were responsible for HP's model 3000/44 minicomputer left to found Ridge and design a 32-bit, high-performance scientific computer. "Some of our people had always wanted this kind of a machine for themselves, to do their own work," says Shellooe. The machine offers 8 MIPS of raw performance, a graphics-oriented interface, and a unique virtual memory architecture. Selling for under $100,000, the system is expected to appeal to mechanical, civil, and electrical engineers who have previously worked on time-shared mainframes. Ridge claims its machine has about twice the performance of a large Digital Equipment VAX computer and will handle up to four users. "It's for anyone who uses large programs or large arrays," notes Shellooe. "It's a new architecture that couldn't have been done five years ago."

Out on their own, Ridges's engineering team often works seven long days a week, and "harmoniously" at that, the Ridge man claims. "It's quite a thrill, it's adventurous."

Heartily concurring is George McQuilken, founder of Spartacus Computers, a firm planning to offer remotely controllable IBM-compatible computers. "There's something terribly exhilarating about running your own company," he says. "It's one of the few places where you select yourself to do the job. In a big company your legitimacy is always questioned. Someone else has always chosen you. But when you're on your own, no one asks why you're in charge."

The flip side of that feeling is one of isolation, the lack of a peer group with whom to share complaints, successes, and gripes. McQuilken, a long-time IBMer, points out that never before had he so unequivocally put his reputation on the line, to say nothing of his money. " 'What if I don't do it? What if I fail? How will I live?' I ask myself these questions all the time, knowing I'd be embarrassed if I flopped," he recalls. "Starting your own company is like volunteering to be a forward artillery observer."

But living by his pet homily, McQuilken says, "the only difference between an entrepreneur and a nut is success." He is confident in his quest: "The success rate in the industry is good. Four out of five startups survive. They may get acquired, but they survive." ✽

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VENTURE MARKET MYSTERIES

The country is now witnessing the "wild mood swings and erratic performance" of that mysterious market called venture capital.

by Ralph Emmett

The old adage of "go West, young man" might usefully be replaced by "go invest, young man." Invest your time and energy in the cultivation of high-technology "seeds" and visions.

Schools and colleges throughout the country are bulging with the computer whiz kids and entrepreneurial business managers of tomorrow. But today's variety is not as inclined to hide behind the skirts of an IBM or other "mother" sectors of the industry as previous generations were. They're ready to hike out on their own, to sow the seeds of future computer generations and innovations.

But it takes more than a creative idea. The modern-day entrepreneur most times must mate with a venture capitalist to ensure his progeny. And while many of us can identify with the headstrong and pioneering entrepreneur, we eye the venture capitalist and his world as mysterious and very private.

The reason for this, according to one veteran observer, is that the venture capital business is young and its personality is unformed. Says Stanley E. Pratt, "The venture capital business has only been institutional-

The new venture funds are as life sustaining to the high-tech entrepreneurs as the air they breathe.

ized since the late 1940s and is still subject to wild mood swings and erratic performance."

Pratt is responsible for the industry's bible, the *Guide to Venture Capital Sources*, as well as publisher and editor of *Venture Capital Journal*. "It's only since 1978, when changes in the capital gains laws created a more favorable investment environment, that the venture industry has become a reality for the high-tech entrepreneur," he explained.

During the past four years the new independent venture firms have created a number of funds to nourish and support entrepreneurs. Pratt says the average range is from \$20 million to \$60 million in size, though some are smaller and others larger.

To discover how vital these funds are to high-tech entrepreneurs, it must be understood that the venture capitalist comes from a very wealthy and powerful family—the Establishment—which has traditionally been "out to lunch" when the young entrepreneur came knocking at its door.

As Pratt points out, "Even at peak activity [1969], the public stock market—with total securities in excess of \$2 trillion—only supplied \$1.4 billion to small businesses," defined as having a net worth of \$5 million or less.

Says Pratt, "This declined to a pitiful \$16 million in 1974 and 1975." He added that the nation's dominant financial institutions are not a significant factor in providing capital for venture developments. He claims that life insurance companies and pension funds with over \$1 billion among them "seldom make direct small business investments." He describes the more than 14,000 commercial banks, with \$1 trillion in assets among them, as typically "risk adverse and credit oriented."

It can be seen, then, why the new venture funds are as life sustaining to the high-tech entrepreneurs as the air they breathe.

But, as Al Berkeley from the underwriting firm of Alex Brown & Sons, Baltimore, points out, maturing of the venture capital market over the coming years is vital to all of us. "If you assume that the flow of innovation is a constant, as it has been in the U.S., then the creation of a receptive venture capital industry and the marriage of the two is everything," Berkeley says.

Since 1978 the new funds have been receptive to the needs of cash-starved entrepreneurs who limped through the recession years of the 1970s. "Expansion capital was given to the most promising of these companies," Berkeley explained. "But now competition to get into these second stage financings, as they are known, has become fierce."

The result is that many venture firms have been driven into early and startup stages to secure their margins. "There is a feeling among the public that venture capital is synonymous with seed or startup capital for entrepreneurs," says Pratt. "Traditionally the independent venture firms have invested only 20% to 40% of their funds in startups. They generally prefer the less risky course of investing in a young venture that already markets to an existing customer base."

When the public market—that great unpredictable phenomenon—is hot, venture firms see a fast track to liquidity for their

"Traditionally the independent venture firms have invested only 20% to 40% of their funds in startups."

funds. Funds today run a 10-year cycle, on average, says Pratt. "Under the normal course of events you plant your seed, nurture it, and wait for the fruit to appear.

"But with a hot issues market there is a chance to shorten the cycle from sowing to harvest." (Harvest generally means the transfer of privately held entrepreneurial stocks, warrants, options, and securities to the public sector and the financial establishment—and the attendant profit or liquidity.)

"But there's a saying in this business

"I think I can arrange financing for your loan."

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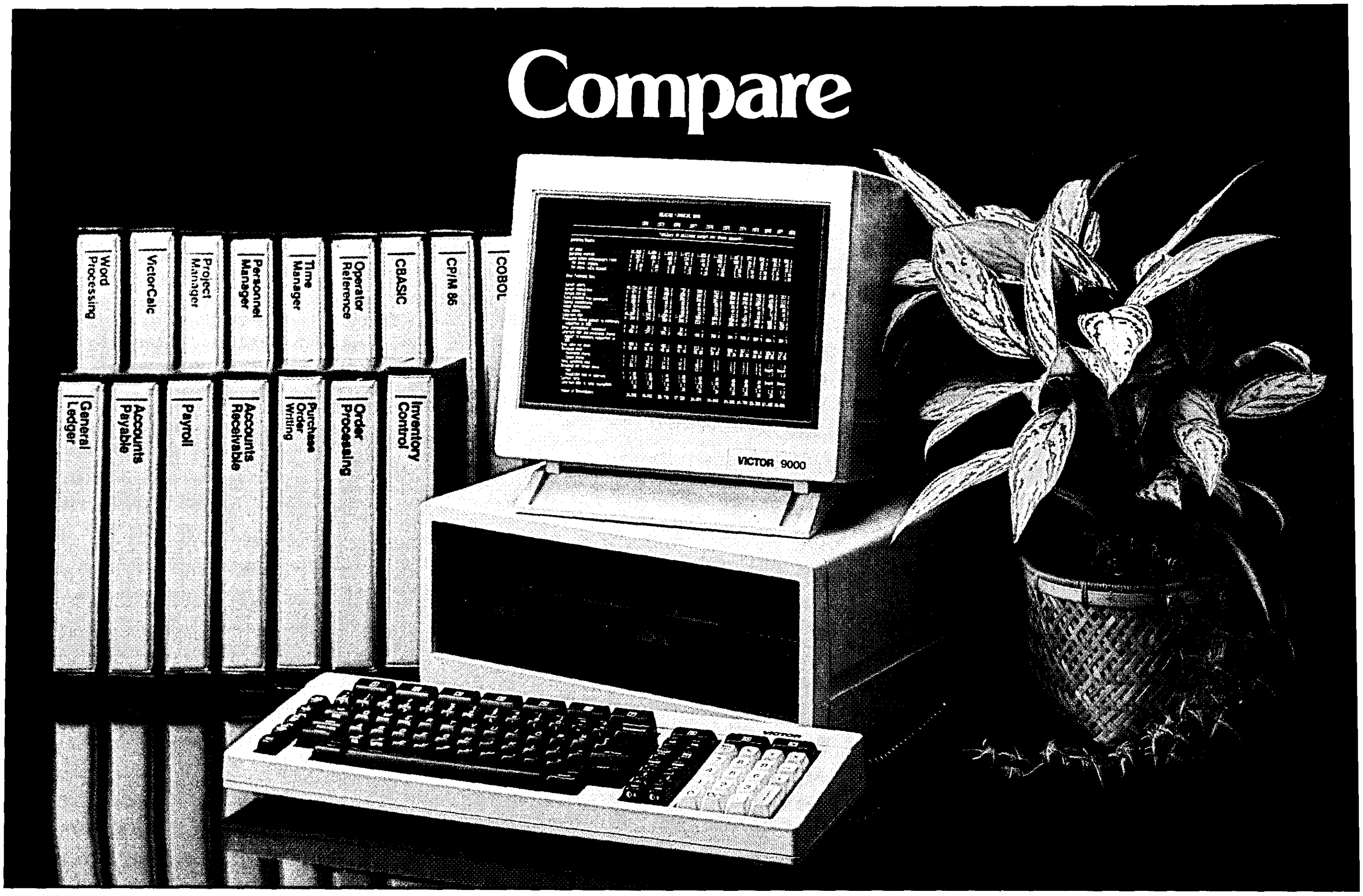
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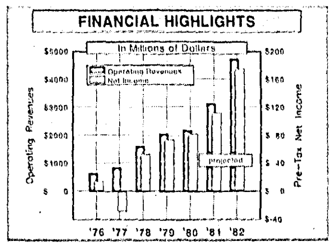

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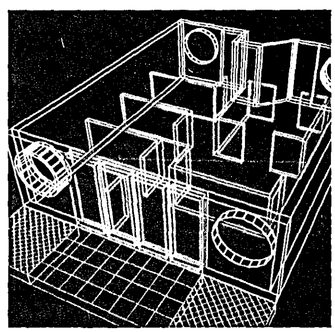

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that lemons ripen early, but pearls take a long time to materialize,'' Pratt adds.

Whether they're lemons or pearls is yet to be decided, but it's clear that the startup fever has heightened over the past two years. The roster of names has seemed to grow by the minute—Trilogy, Apollo, Plexus, Zentec, Iomega, Systel, Teradata, Novell Data Systems, and on and on.

In one area alone, the Tandem Computers-spawned market for nonstop/fault-tolerant computers, there have so far been six challengers: Stratus, Parallel Computers, Sequoia Systems, Dosc Inc., Synapse Computer, and August Systems.

Ironically, when the new issues market is cooking, even the lemons can taste sweet to venturers. This is what happened last year when the public opened its heart, and purse, to new and untested companies on an unprecedented scale. Venture Economics, Wellesley Hills, Mass., claims that a record 70 venture-backed firms had their initial public offerings last year.

Suddenly the venture capital business began to resemble a Las Vegas gambling den as new and old funds alike were drawn to the scent of easy money. Even staid and ultraconservative venture capitalists began covering every color and number on the wheel. Pratt estimates that the percentage of funds pumped into startups soared from about 25% to 50%.

For the past two years, the roster of startups seemed to grow by the minute—Trilogy, Apollo, Plexus, Zentec, Iomega, Systel, Teradata, Novell Data, and on and on.

Last year one noted venturist, Fred Adler, warned that a familiar pattern was emerging. He said that just as in the late 1960s, when some 80-plus minicomputer companies were spawned, venturers were being lured by the market and placing their bets too soon. Today you can count the survivors of those minicomputer startups on one hand. So having been through one long learning cycle and the inevitable recession that follows all stock market highs, Adler pleaded for a more disciplined and consistent approach.

Pratt took up the theme with this cautionary note: "No fund—especially those just formed by investors with no experience of previous funds—has developed a mature personality until it has been through a full 10-year cycle.''

Pratt says that such maturity is essential when a young venture fund has to come down from the nirvana of a hot stock market. That point has been hammered home this year. By April the public market for new equity issues of smaller companies had dived to less than one third of 1981 levels. The public and the financial establishment brought forth a chorus of "I told you so!" from veteran venturers by showing how fick-

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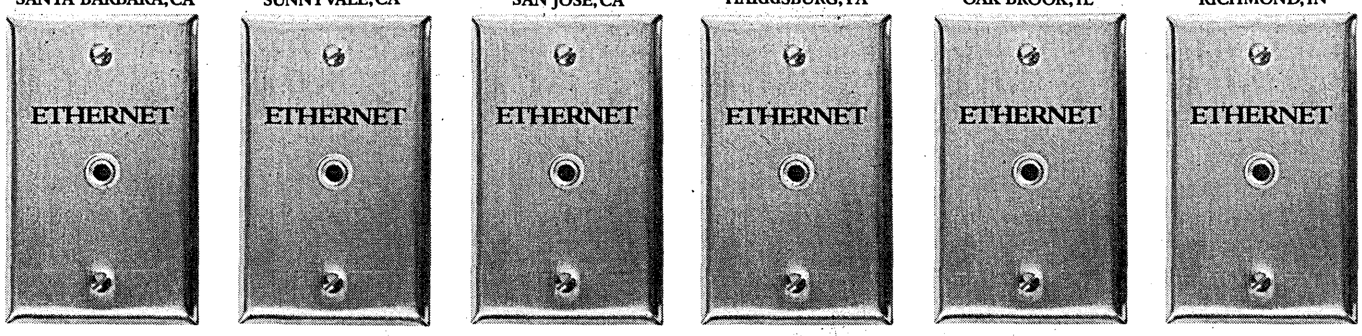

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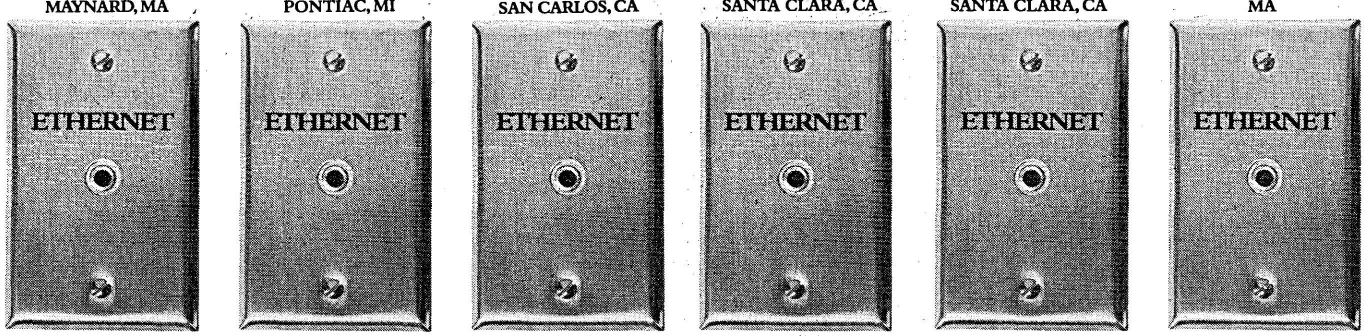

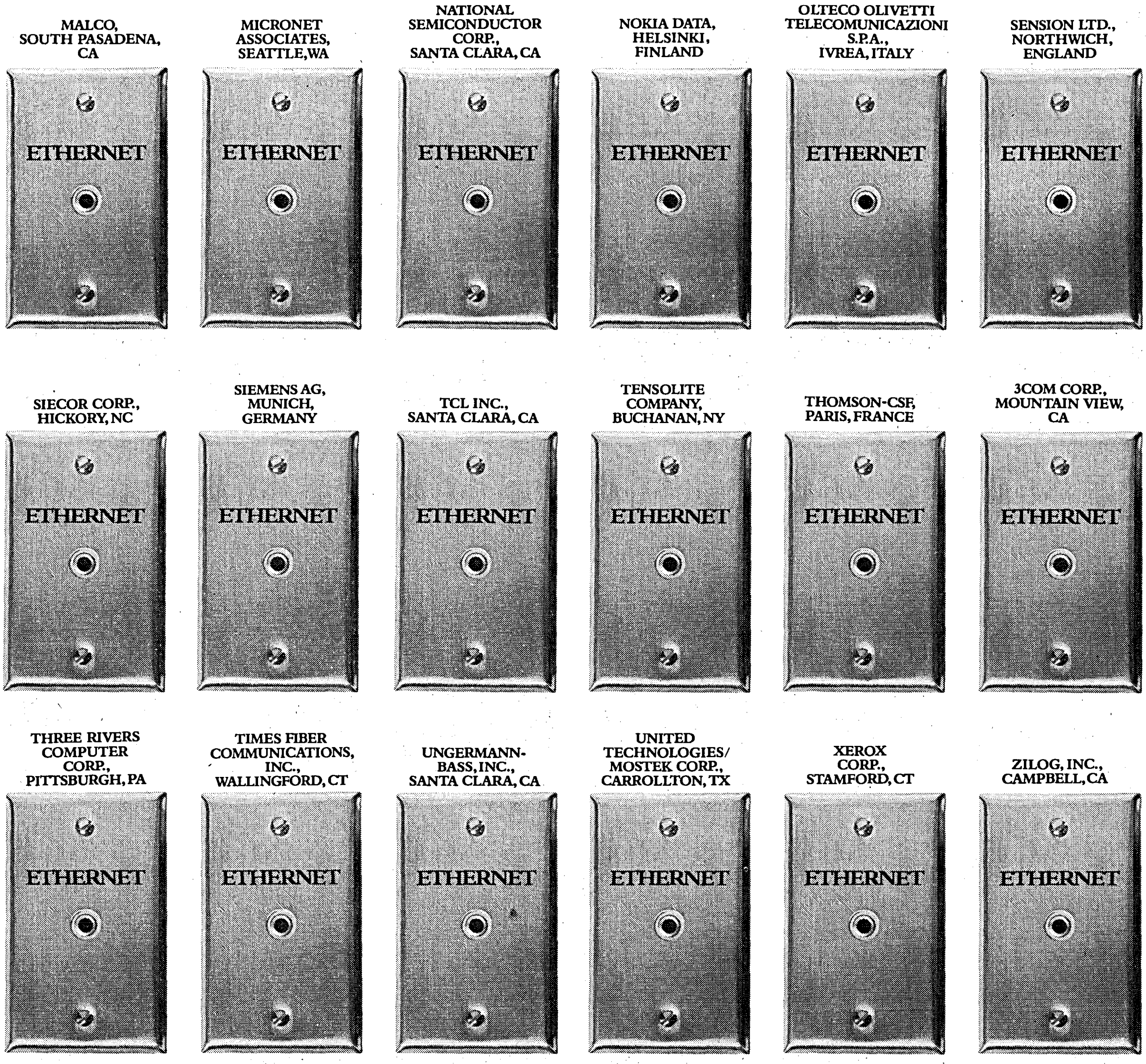

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le the business can be.

By the time some 254 new microcomputers saw the light of day at this summer's National Computer Conference, venture firms had already grown wary. "Many of them will probably languish in obscurity," says Alex Brown's Berkeley, "because venture firms have switched from startups to protecting their existing portfolios."

Pratt says the new issues market has cooled dramatically, and as a result more than 70% of each fund, on the average, is back in ongoing investments. "There'll probably be as much venture money invested this year as last [about $1.2 billion], but the majority won't be in startups and seed investments."

Because of this, there is a danger that the venture capitalists will overreact and bury themselves in risk-free investments. "The venture industry is naturally institutional at

By this April the public market for new equity issues of smaller companies had dived to less than one third of 1981 levels.

root," says William R. Chandler, cofounder of Bay Venture Partners, San Francisco. "Its people are graduates from a handful of business schools who all tend to think alike and share a skill for analyzing numbers."

Chandler says that without exposure to the seed level of entrepreneurism where gut feel and instinct are the order of the day, it will be difficult to separate venture firms from the financial establishment that spawned them.

Chandler says that some of the venture industry's father figures—men such as Adler, Tom Perkins (of Kleiner, Perkins, Caufield & Byers), and Mort Collins (DVS Partners III)—had learned this lesson and had become more rounded characters as a result.

"Some of these men are more like entrepreneurs than the entrepreneurs themselves. They consider it essential to be there at the seeding or creation of a product and to follow it through to market," Chandler explains.

Pratt comments that the leaders of the venture industry got so involved with startups last year that their young staffs—often fresh out of graduate school—were given no exposure to this seeding phase.

"Hopefully they'll now realize," says Pratt, "that what is needed is a master/apprentice approach to all facets of the venture business—seed, startup, first stage, second stage, and upwards to the point where the hand-over to the financial establishment occurs." He says that only from such an apprenticeship will we get a disciplined and consistent performance from the emerging venture industry.

Berkeley adds that the art of venturing lies in relating to people, not in analyzing numbers. "The venture industry must become a partner to American innovation in every sense of the word." ❋

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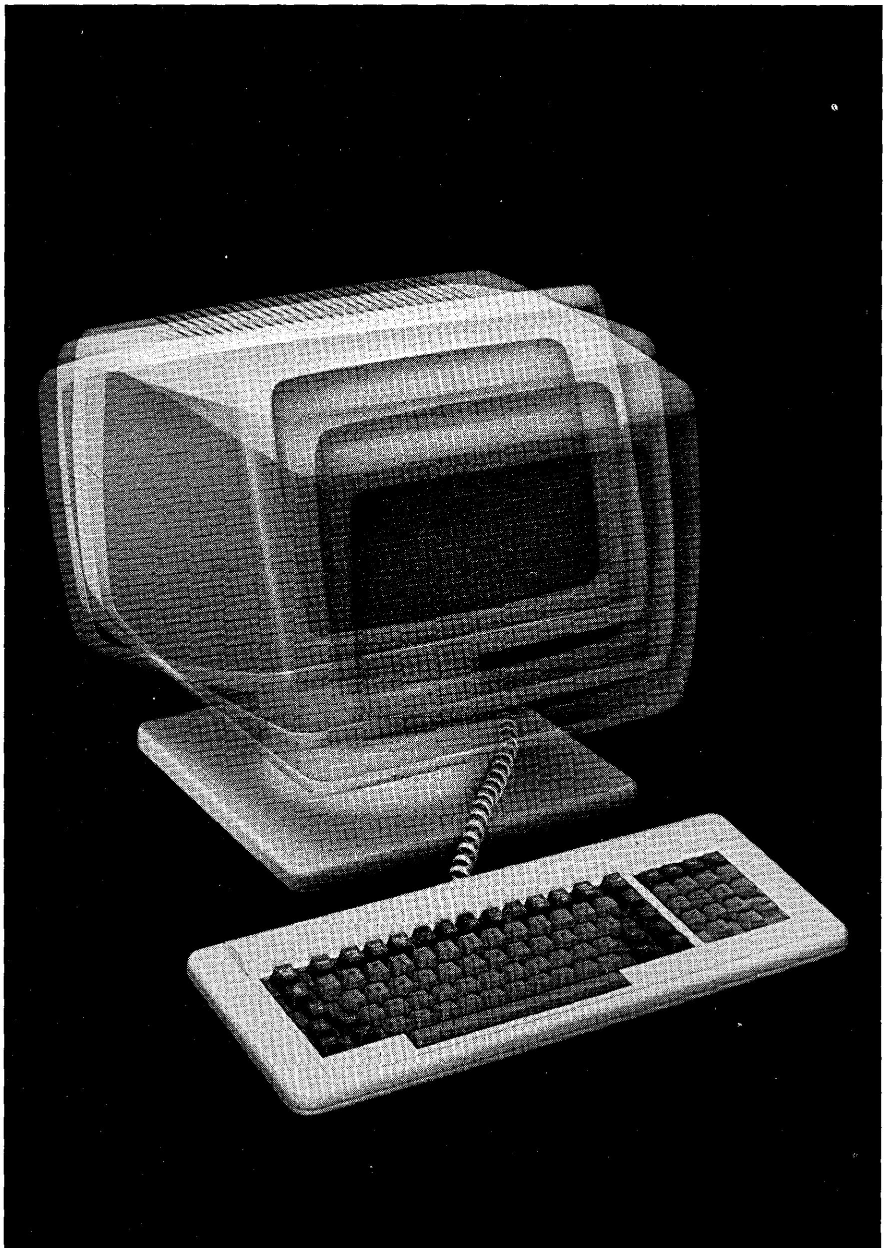

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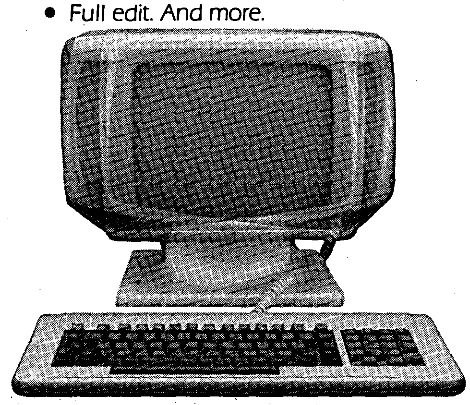

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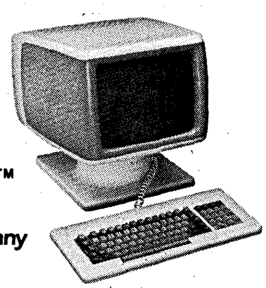

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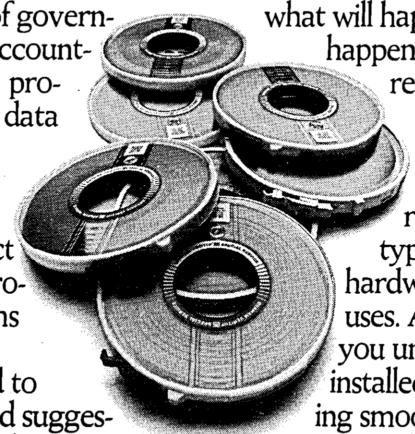

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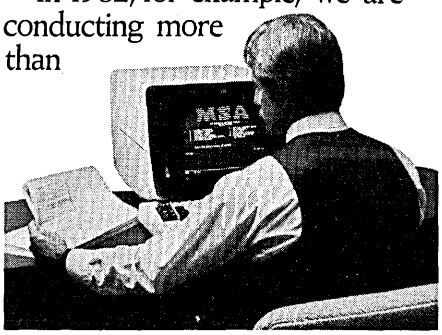

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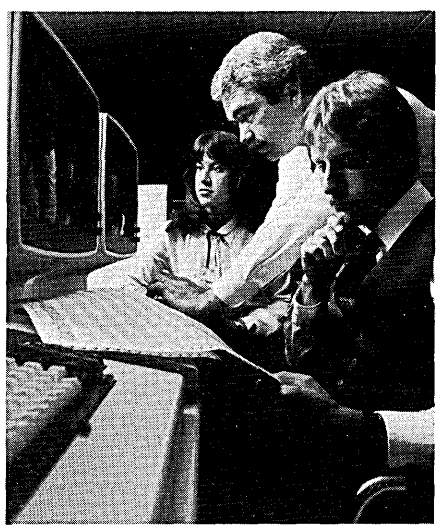

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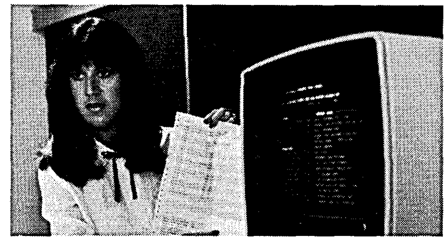

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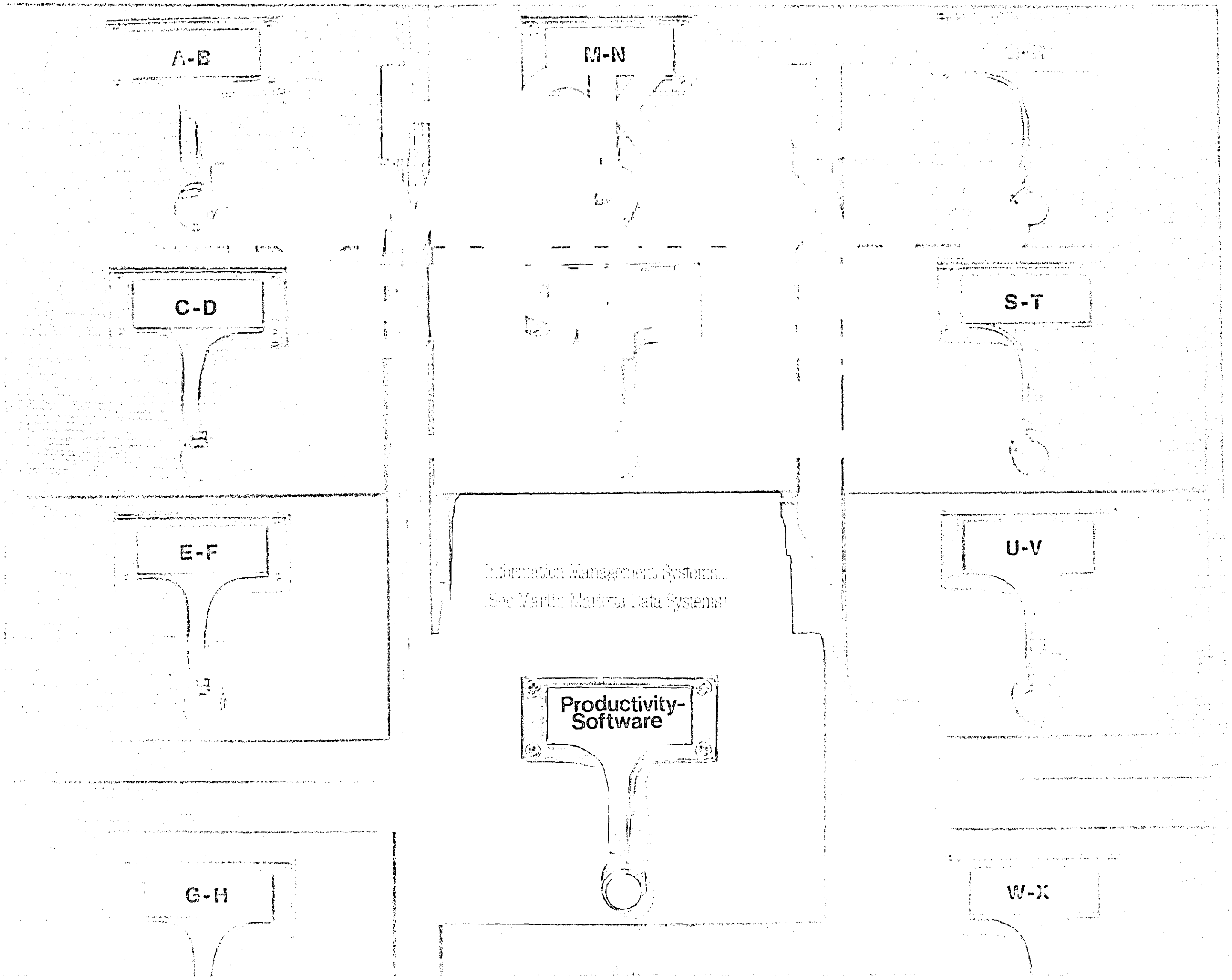

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INDUSTRY DWARFS DWINDLING

Snow White is still with us, but the ranks of the original seven computer industry dwarfs have been thinned. Today's mainframers face a new, more complex world.

by Jan Johnson

Analyzing the computer industry used to be a neat and simple activity. In the days of the vacuum tube machines, the '50s, the market was obvious, the purpose clear. Large corporations and agencies with lots of money, manpower, and huge columns of numbers to manipulate were the targets. Installed base was counted in tens and hundreds. The purveyors included many names that have since dropped off the pages of computer trade journals—Electrodata, Bendix Aviation, Royal Precision Corp., Underwood Corp., Electronic Computer Corp., Datamatic, Computer Research, and Alwac.

For the mainframers that survived—IBM and the remaining dwarfs now known as the BUNCH, or Burroughs, Univac, NCR, Control Data, and Honeywell—life in the '80s has grown considerably more complicated. Instead of one front to protect, there are literally hundreds of fronts. Companies feel forced to expand into a mixed bag of products encompassing superminis/minis, micros, graphics terminals, office workstations, front-end communication processors, and networks. Added to that is the awesome task of providing software for all.

For Honeywell, Burroughs, NCR, and to a lesser extent Sperry Univac and Control Data, application software and support has become a source of discord between vendor and user. If vendors can't supply it, users are going elsewhere. Honeywell, for instance, lost 22 replacement mainframe sales from its installed base of 1,083 (as of February 1982) to IBM. Second hardest hit was Burroughs, which lost 17 from its installed base of 950 to IBM, according to the DATAMATION/Cowen & Co.'s 1982 computer industry survey. Although nobody claims that the lack of software applications was the single prod behind a vendor shift, it was often cited as a major factor, particularly by Honeywell expatriates.

The '80s have also brought an explosion in the number and variety of end users. Now vendors not only have to sell and support the dp department with traditional application packages, but they have to deal as well with virtually every department in the company—engineering, accounting, advertising, marketing—each demanding a multitude of software applications from office automation to manufacturing and engineering applications, specifically computer aided design and manufacturing software.

Also sailing in with the '80s came several financial bombs, including the protracted U.S. and European recessions, high interest rates, and negative currency translation. But the bomb that carried the biggest bang came from IBM in the form of the 4300 series, followed by the 308X series. As William Easterbrook of the Wall Street firm of Kidder Peabody sees it, IBM's major price reductions have "permanently damaged profitability in the industry." Mainframers' margins went south, playing havoc with everyone's bottom line, including IBM's.

Marketing strategies and internal organizational structures of IBM and several BUNCH companies, most notably Honeywell and Burroughs, began to rupture and reform under pressures of lower return per unit sale, rising sales costs, a mature mainframe business, and the fact that the dp department isn't the only department buying computing gear. But though they're down, they are hardly out: the BUNCH is still in there punching.

NCR sits atop the heap, according to Easterbrook's criteria. Based on four leading indicators, NCR scored 15 out of 20. Top rating of five was given on the strength of potential order upturn, a four for financial strength, and threes both for leverage from software, service, support, and niche markets, and for product compatibility. NCR's strong showing in the potential order category stems from management's stated commitment to replace all major current product lines with new products over the next two and a half years, notes Easterbrook in his report on the BUNCH.

On the price/performance front, NCR hopes to gain a competitive edge by using a new 32-bit chip, designed and developed internally, in its terminals and in a new series of systems that will replace the core 8000 series. While announcements of these new lines are not expected until first quarter 1983, Easterbrook believes the company could bring them out sooner, "if need be."

The view of NCR from the DATAMATION/Cowen & Co. user survey is a bit more somber. The survey found there was a "tangibly lower level of installation activity for [1982] than was realized even in the difficult environment of a year ago." The outlook into '83, however, was mixed. On the one hand, fewer users indicated a need for capacity expansion, yet more users expressed uncertainty about their year-ahead requirements and more users had plans to upgrade to a larger NCR system. The survey report also says NCR

NCR hopes to gain a competitive edge using a new 32-bit chip.

is holding its own on the issue of margins: "The cost side of NCR's business remains sound and under careful control so that significant margin leverage should be achievable given an improvement in sales force productivity and sufficient revenue control."

Unlike some of the other BUNCH members, NCR has not undergone a major reorganization in the past few years. In fact, said one regional salesperson, the company organized along industry specialty lines back in the mid-'70s and has since tended to have a loose kind of line-of-business organization. Another distinguishing feature of NCR is its acquisition record, in particular Data Pathing and Comten. Data Pathing gave NCR entry into the manufacturing market through a line of shop floor collection devices, all of which can be connected to IBM equipment. Comten bolstered NCR's communications offerings; its front-end processor is also IBM compati-

ILLUSTRATION BY DOUG TAYLOR

ble. The Comten group is charged with developing a new generation of communication processors and various other communication-oriented software modules that will allow NCR gear to talk "easily" and "effectively" with other vendors' systems, according to the company. Another notable development was NCR's entry into the merchant chip market, a move that met with much criticism throughout the industry. After all, observers questioned, wouldn't NCR rush to meet in-house needs before filling merchant market demands?

Like most of the other BUNCH mainframers, NCR lacks the breadth and depth of IBM's software library. To counter that weakness the company has set up a special software program to seek out and encourage third party software development. The company has also marched into the office automation battleground, wielding a Convergent Technology intelligent workstation. (The only member of the BUNCH that has not jumped into that fray is Control Data Corp., but then again Control Data has consistently been a loner in its approach to the computer market, preferring to focus on the high end, the scientific and engineering users.)

Burroughs also jumped for the OA arena with a Convergent machine under its arms, calling it the B20. But there the similarity between Burroughs and NCR ends. Quite frankly, Burroughs has had a bad time of it since IBM announced the 4300. Burroughs was positioned to counter the IBM offering with its 900 series, but the counter plan crashed when the company ran into trouble on its logic circuit design. The work had to be scrapped and the company scrambled for outside assistance to get the 900 series up and running. As a result, it lost an estimated two to three years on the development of a whole family of products, particularly at the high end with the 4900 and the 7900. Word from Burroughs is that the two machines will finally be unveiled sometime in the fourth quarter, with shipments beginning in first quarter 1983.

Few dispute that Michael Blumenthal took on a bag of bad circuits when he took control of Burroughs in September 1980. The company had bad project management practices, bad service and support records, virtually no strategic planning, few operating statistics, and decision-making from the top down was the rule. Worse, Burroughs reported sales as soon as the product was shipped, but customers were not paying until they had an operating machine. The discrepancies were as much as two to three months, so operations were being financed with short-term, high-interest loans, making a muddy financial picture even murkier.

One of Blumenthal's first moves was to create staging centers where customer-ordered equipment could be assembled, tested, and checked off against the actual customer orders before final shipping. Of equal importance to the company has been the new quality assurance program instituted by the new management team. It begins with a staff level vice president of quality and works its way out into each plant and all project phase review meetings. Project phase review, by the way, is also a new idea to Burroughs. A tangible benefit from some of the channels is already evident in receivables: they used to be in the 90-day range, and are now down in the 50-day range.

Blumenthal's handiwork is everywhere; he's cut out losing product lines, taken huge write-offs, consolidated facilities, and dramatically reorganized staff, replacing about 20 people in the top 25 executive positions. In addition to reorganizing marketing along a line-of-business structure, he streamlined the corporate hierarchy so that fewer executives report directly to the ceo and chairman. It's no secret that Blumenthal intends to push decision-making back down into the ranks.

Like NCR, Burroughs has made a few major acquisitions in the past few years that garnered much attention. The purchase of Systems Development Corp. and Systems Research attest to Burroughs' commitment to improving its position in networking and communications. The Memorex acquisition met with the most controversy. Defended Blumenthal in a press interview, "I know

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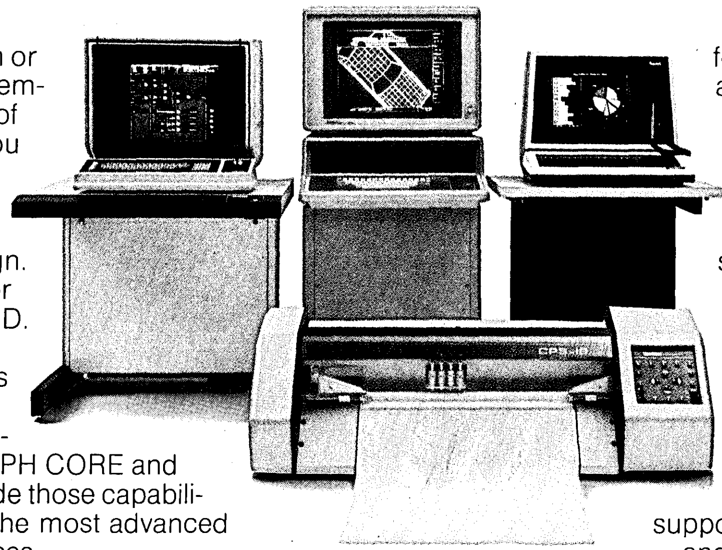

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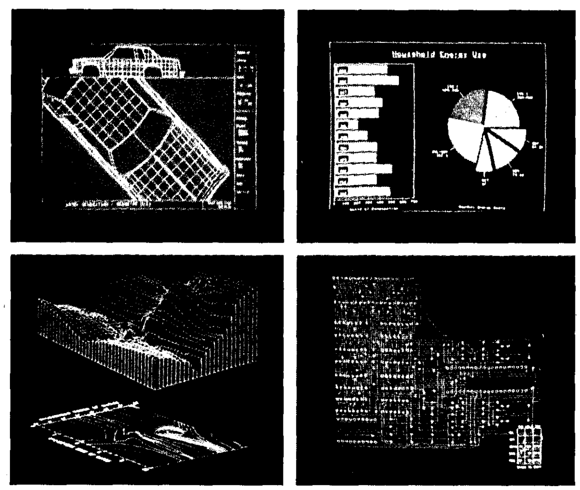

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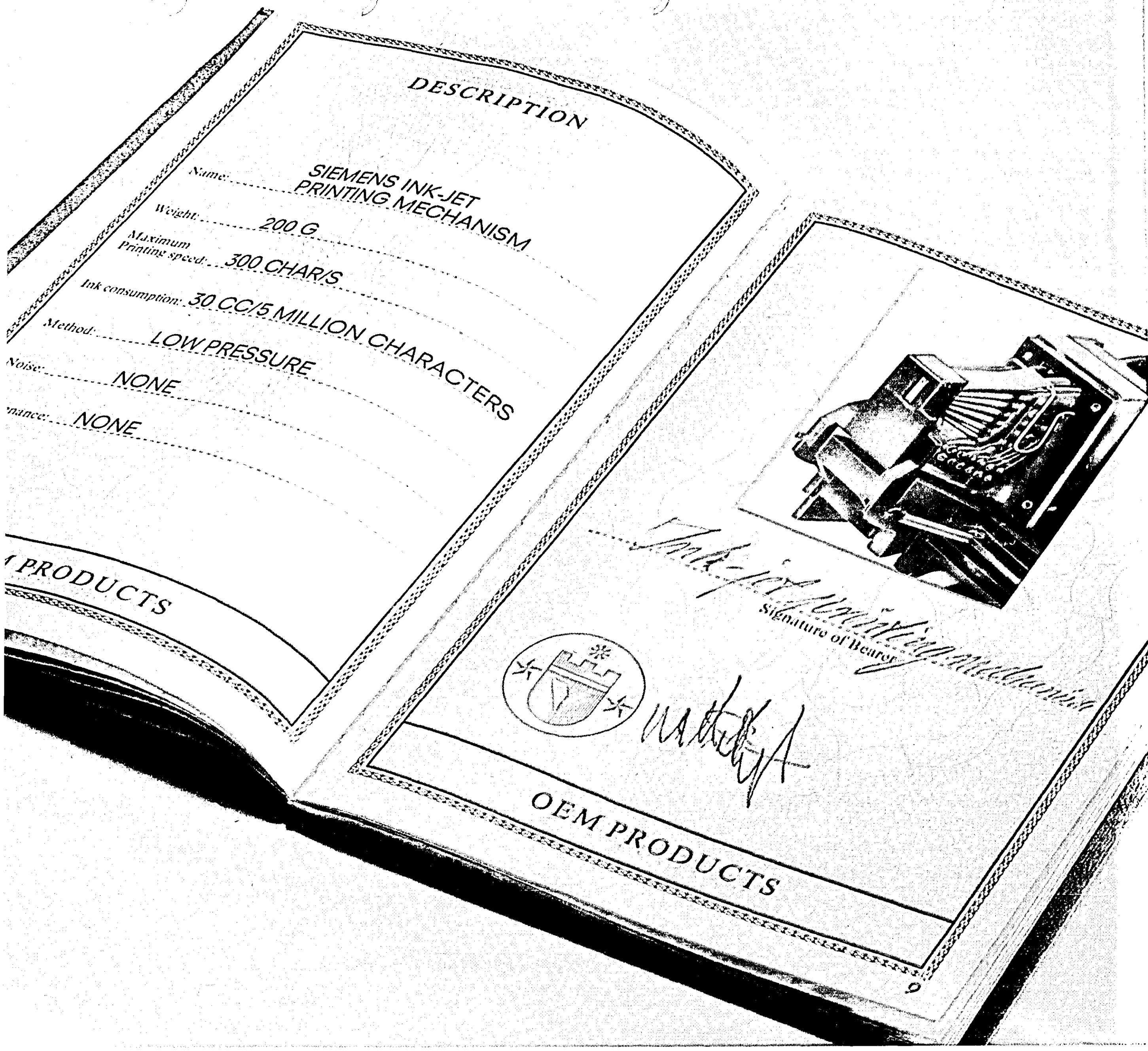

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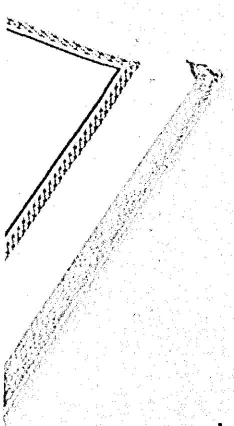

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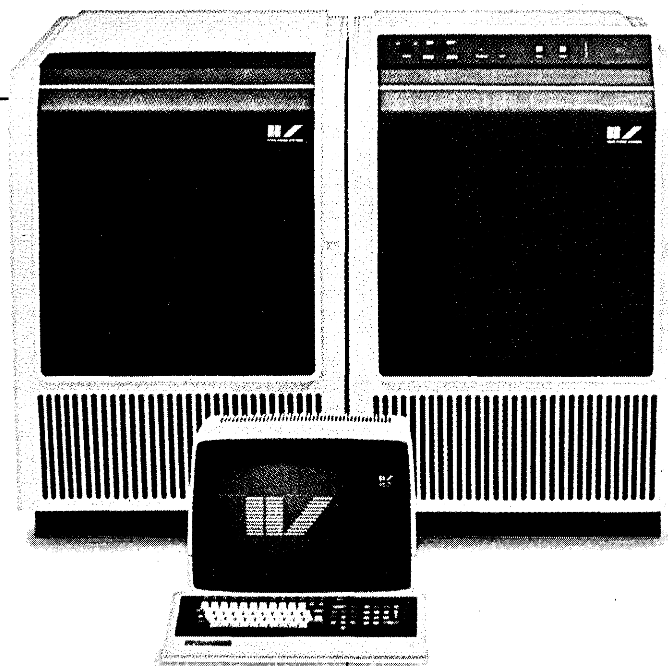

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CIRCLE 142 ON READER CARD

there were a lot of people who wondered why we would buy a company that had lost so much money. But we had done our homework and realized that most of those losses were due to factors that were behind them."

According to industry watchers, product costs are not expected to come under control until 1983, while the company's profit margins won't recover to their 1979 level until 1984. Burroughs, however, may surprise Wall Street. The company has corrected many critical problems and feels confident about its cash-flow situation, so the enthusiasm and new ideas coming out of the new Burroughs management team may tip the scales in the company's favor sooner than Wall Street thinks.

While NCR and Burroughs might be considered up-and-coming performers, Control Data appears to be on the down side of the cycle. CDC finished out 1981 with the best profits picture of any BUNCH member. Then the recession and quality problems hit the peripherals business. Of course it wasn't all the fault of peripherals; CDC's Commercial Credit Corp. was suffering its blows like the rest of the credit world. So was CDC's mainframe business, which is particularly dependent on the education and government markets. But CDC's profit problems may only be temporary. About the time the company encountered a slump in profits, it introduced a new family of computers, the 800 series. Meanwhile, CDC delivered its first 205 supercomputer in 1981, and 1982 orders are reportedly enough on target to cause some concern over at arch-supercomputer competitor Cray Research.

Although the 800 family gives CDC the widest range of performance of any BUNCH member, some CDC users were disappointed when the company did not produce virtual memory or switch to an 8-bit word structure from its current 6-bit structure. The 800 family appears to have been designed for the 8-bit structure, say several users, but the rumor from the CDC users meeting was that the company ran into software problems.

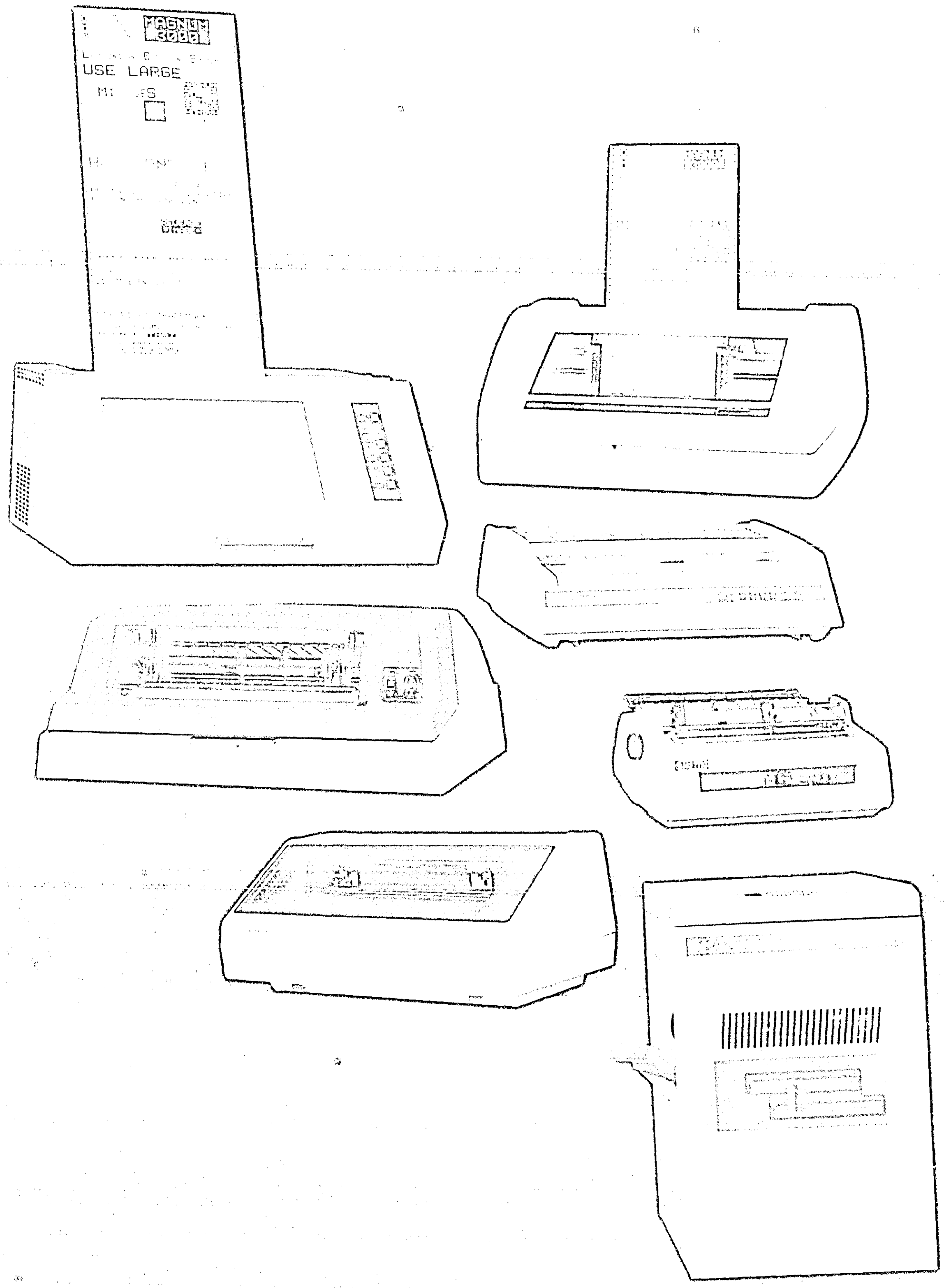
Tucked inside the 800 announcement were two addenda with potentially far-reaching implications. For the first time Plato, CDC's computer-based education concept, can run like any other application on the 800 series systems. No more delivering Plato over Cybernet, where the connect costs often eat up any justifiable benefit. A remote micro facility (RMF), which sells for about $775 per package, can be loaded into a micro such as CDC's 110 or an Apple, and the micro then can be connected to an 800 machine. RMF permits file and job transfers—the upper-level stuff where the real action takes place—between the micro and the mainframe. The company said it will be offering similar RMF packages for other major selling micros.

Meanwhile, the company continues on with what is often referred to as CDC's social responsibility programs. CDC has always taken a lot of heat about this direction, but it fits in nicely with the company's dedication to the services business. Through these programs CDC is building up some rather extensive databases in varied areas, from medical to rural farming. Observed Bernard Goldstein, partner with Broadview Associates, a firm that specializes in mergers and acquisitions within the services business: "In 1964 I sold a company, Computertext, to CDC. In the course of negotiations Bill Norris [chairman and founder of CDC] said to me, 'The computer services part of the computer industry is going to be a more important activity than the hardware part.' That was about 20 years ago, when words like those were heresy. It was an unbelievable statement." Now, Norris's vision is beginning to prove itself out, and CDC stands in a very good position to take advantage of the new age.

Univac faces some of the same erosion problems as Honeywell.

Of the last two companies, Sperry Univac and Honeywell, Kidder Peabody's Easterbrook picked Univac as the poorer performer. Again he applied his four-point criteria: strength of order upturn, financial strength, leverage from software, services, support, and niche markets, and the interfaceability of products. Both companies have

EENY, MEENY, MINY



taken some nasty knocks from other business areas—farm equipment for Sperry Corp. and residential and commercial controls at Honeywell. Although Honeywell appears to have been buffeted about most by the changing winds in the computer industry, it appears to be positioning itself for a new direction in the communications, networking, and videotex markets, judging from its recent rash of joint ventures, previous acquisitions, and staff reorganization. "It's pretty clear in my mind that Honeywell is not unaware of its plight. It has been my forecast that it ought to be looking for more aggressive markets, getting into some new markets or, alternatively, withdrawing or cashing in on some businesses which don't have much future," observed Harvey Poppel, senior vice president of Booz, Allen & Hamilton, New York. By default, Honeywell did just that this year when the French government forced its hand in the CII-HB joint venture. Honeywell agreeably reduced its holding in Cii from 49% to 19.9% and got $150 million as part of the deal.

The cashing in and redirection appear to be happening none too soon, for Honeywell's mainframe user base has been eroding. The DATAMATION/Cowen user survey turned up a continued "negative pitch" among users' attitudes toward HIS as a supplier. The report summarizes: "The potential for defections to other suppliers remains a definite long-term concern. Apart from the impressive penetration with the DPS 6, there is evidence of a gradual erosion of market share." The overall assessment of Honeywell is that the company has gotten better. Honeywell is credited with making some money and managing it well.

The survey's overall tone toward Univac is not so laudatory, especially toward its management. Univac faces some of the same erosion problems as Honeywell, but Univac does not appear to be making any significant redirections. Univac's F83 performance target seemingly will "depend heavily on garnering a fair measure of the 1100/60 business from outside the Univac base," judges the report. Meanwhile, the survey suggested modest shipment gains for Univac during calendar year '82. The sample did confirm that Univac's mix has shifted toward the 1100/60 and System 80s and away from the higher-margined 1100/80 line. The peripherals add-on plans were also found to be off "perceptibly from one year ago, presumably because of a weak economy." And there is still the knotty problem of how to move Univac's RCA-based user group over to the OS/1100 side of the house without a huge loss of user base. "Series 90 users display little enthusiasm for converting over to Univac's mainstay 1100 series hardware, although a growing component of that base clearly would welcome a lower cost migration path," noted the survey report.

Recently Univac has been very active in product development. This year the company announced its own array processing system, the APS. Shell Oil Co., Houston, took delivery of Univac's first APS in February. The follow-on, code named Eagle, is slated to be bigger, better, and faster (particularly in its scaler capabilities) than its predecessor, as well as compatible with all other OS/1100-based systems. Then in July Univac unveiled a follow-on to its top-end 1100/80—the 1100/90, code named Cirrus.

Meanwhile, Univac is not slighting the low end. It has tried to put together a small business system, spending "huge amounts of money" on the Varian acquisition and the BC7 project and getting basically nowhere. The outcome: Univac closed down Varian's California location and moved what was left of the operation to Salt Lake City. "Probably sometime this fall, September or October, we expect Sperry Univac to announce a fairly state-of-the-art small business system. This will not be a stopgap measure, but a two- or three-year entry," predicts George Colony, director of office systems research, the Yankee Group, Boston.

"The underlying strategy at Univac is to be a total industry supplier to our industry segments," said Charles Williams, formerly vp and general manager of the Americas division and now of the international division. The question is, can a Univac in today's market make that a successful strategy? ✲

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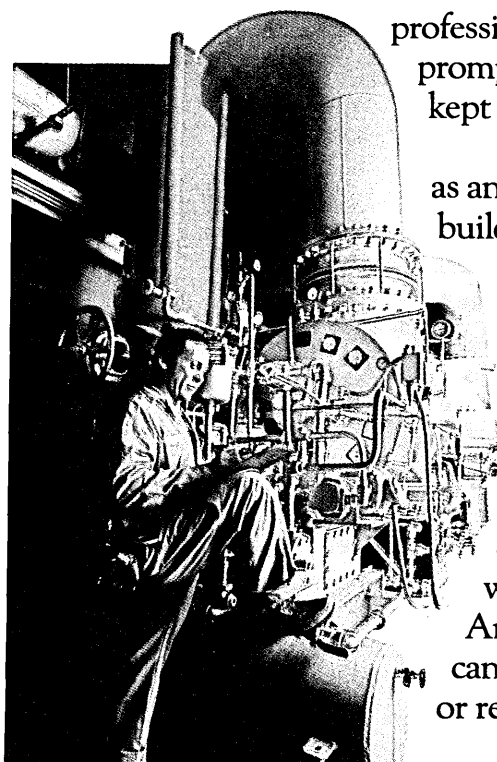

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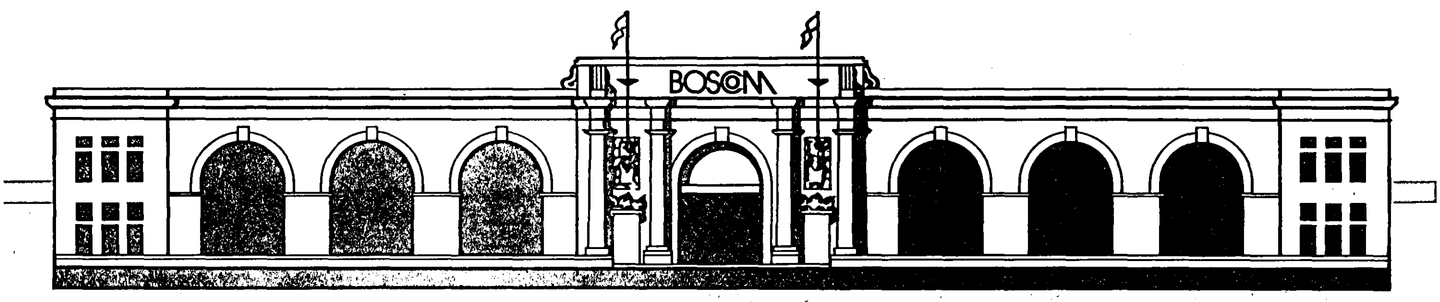

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PCM HURDLES

The race may not always be to the swiftest, observed Damon Runyon, but that's the way to bet.

by Edward K. Yasaki

Some of the trials and tribulations of being a manufacturer of IBM plug-compatible hardware became chillingly evident recently when employees of two Japanese companies were accused of purchasing stolen IBM trade secrets. All of the allegedly stolen material dealt with recent models of mainframes and peripheral equipment, the equivalent models of which the pcms are only now bringing to market. And with the government antitrust case against IBM finally dismissed, things could only go from bad to worse for the pcms, right?

Not necessarily, says Greg Kelsey, former Amdahl Corp. executive and now an analyst with Hambrecht and Quist. "I view that as the biggest non-event in the world." IBM had been "very certain" for the last five years and "absolutely certain" for the last two that it would prevail over the Justice Department, Kelsey notes, and had been acting accordingly in the marketplace. And yet, despite an uninhibited IBM, the pcms continued to grab an increasing share of the market.

In the pcm world, Kelsey sees the market for the largest mainframes growing the fastest. Users who have the most power today, he explains, are those whose power requirements in percentage terms are growing the fastest. "There is clearly a market opportunity there," he says, "and I think the suppliers who do things well will continue to take market share away from IBM gradually."

Consultant Omri Serlin of Itom International agrees that IBM is marketing its product lines aggressively. "IBM for the past few years has been breaking all the rules of the game. Instead of making it easy for the pcms by keeping high prices and relatively conservative marketing approaches, it is now behaving for all practical purposes like a startup." Not only has Big Blue become very aggressive in its marketing by working with new marketing channels and employing price discounts, but it has also made it tough for competitors to copy its products by producing a fast flow of new products and incorporating more of the architecture in microcode.

"The bottom line is that IBM has become extremely aggressive," Serlin notes, "and I think that bodes ill for pcms."

Equally cautious about the pcms is consultant David Gold of San Jose, Calif., who says, "I think there's an opportunity over the long haul, but I don't think it's going to be as exciting as it once was." He recalls predicting two or three years ago that IBM would begin burying more in its microcode, and adds, "I think that's starting to happen. The guys that will make it are those who bite the bullet and somehow have their own operating system software that is compatible to the extent that all the applications programs run on them. But they are going to have to isolate themselves from IBM's changes in hardware and microcode."

Of course, taking an old operating system and modifying it in this manner is an expensive and difficult process. Further, Gold observes, not many companies have the resources to support such an activity. The process of copying the logic of an IBM computer is becoming more complex. Reverse engineering a machine takes years, he notes, and you still can't be sure you have everything. As a result, he sees the future of pcms as being compatible with IBM's operating system without their hardware being a copy of IBM's.

Serlin, however, says this "doesn't change the nature of the problem. It just changes the time scale a little." The pcm, he explains, must still stay up to date on changes to hardware and microcode that IBM makes and then incorporate them into the pcm's operating system. But perhaps instead of making these changes three times a year, once a year will suffice.

Yet the original premise of the pcm business was that they would produce hardware that ran IBM's operating system and applications programs. This enabled the pcms to get around the problem of maintaining an army of software people by letting IBM do it. That's how pcms could offer their equipment so inexpensively. "Once you go into the software business yourself, then there's no difference" between yourself and IBM, Serlin says. "In fact, you're at a disadvantage because IBM has so much bigger volume than you do" and thus has economies of scale on its side.

Greg Kelsey disagrees with this bear-

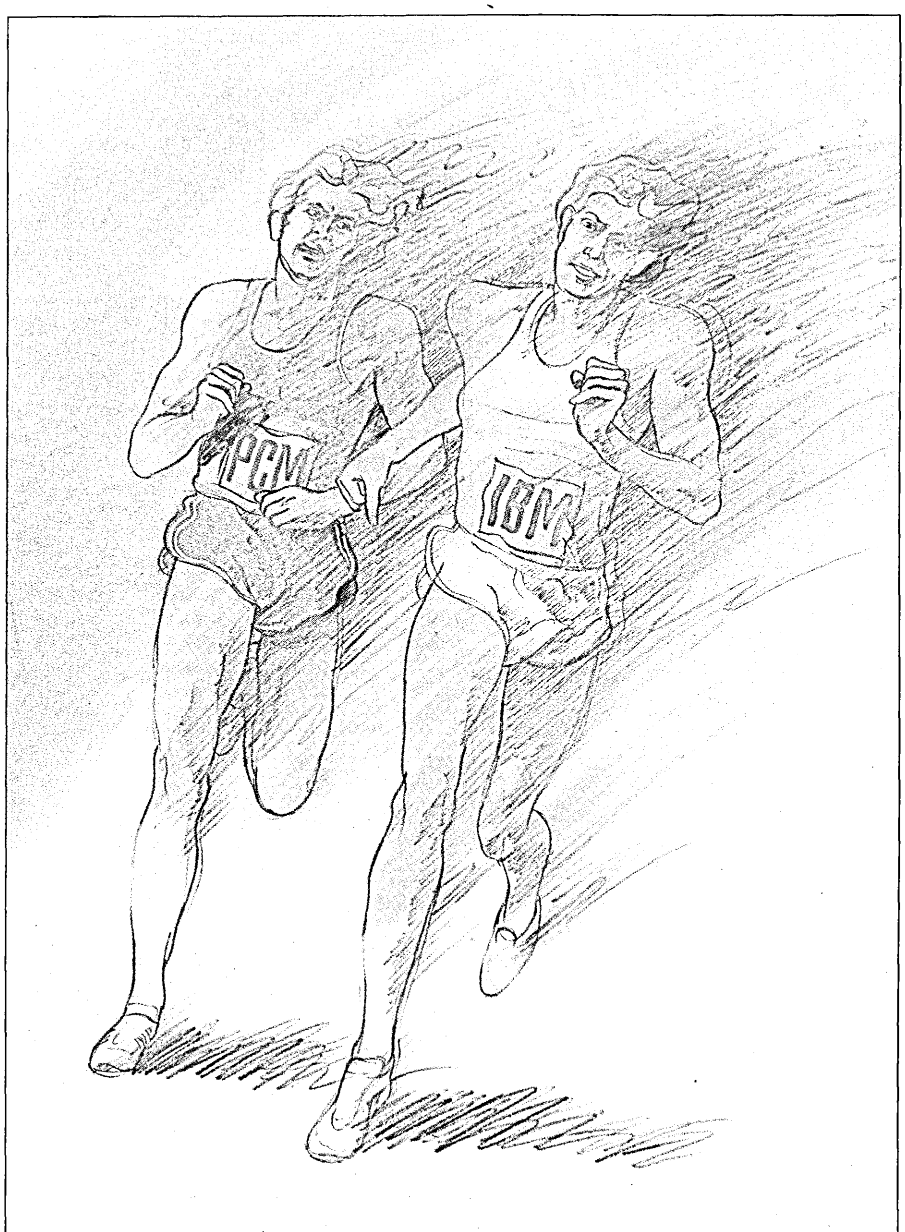


ILLUSTRATION BY IVAN POWELL

ish view, contending that people are wrong in thinking the pcm business is getting tougher. "I really don't think the ingredients requisite to compete successfully in that market have changed much," he says. The vendor must still have a better product or service to offer so that buyers will have reason to use it as an alternative supplier. "I think there's clearly a trend in the industry to realize that having just one vendor for anything as critical as data processing equipment is not a good idea," he adds. And thus the trend toward alternative suppliers.

But if life for the pcms is tough, what is the outlook for the so-called "BUNCH," the other mainframers? Kelsey politely says, "I think life is going to get, to varying degrees, increasingly tough for those companies." Others interviewed had less generous words for Burroughs, Univac, NCR, and the rest. "Except for Control Data, which has done a very good job of diversifying, I think the other guys are chasing a declining market share," says Dave Gold. "There are precious few end users who will decide today to go to any of the BUNCH," which leaves those vendors with the upgrade and replacement market, he adds.

"The bottom line is that IBM has become extremely aggressive, and I think that bodes ill for pcms."

Kelsey, who similarly recognizes that a company like CDC seems to have a better approach than the others, also observes that these vendors' users are taking new applications and increasingly developing them to run on IBM instruction sets. That maneuver bodes ill for the noncompatible vendors.

Martin Simpson, whose New York firm specializes in the study of high technology companies, says, "I've always thought that the strategy of imitating IBM and reverse-engineering IBM products is a very dangerous one." But he describes the IBM plug-compatible peripherals business as "not quite as complicated." Gold, too, still sees a future in pcms. But he says it's getting to be like a minefield, since IBM has vowed to become a serious competitor in all of its markets. The demand for peripherals, especially disk drives, grows at a healthy clip, caused directly by the need for more compute power. And Kelsey observes that IBM's problems last year with the manufacture of 3380 drives "highlighted the advantage of having more than one vendor." Installations with disk drives from both IBM and the independents had an easier time acquiring the necessary storage capacity than did those who have stayed strictly with IBM.

Simpson argues that being simply a vendor of pcm peripherals is not enough. "On a long-term basis," he says, "I think it's a very strong probability that these peripherals companies will not be able to survive with simply that strategy." And that explains why there had been moves to merge companies such as Storage Technology and Amdahl. It also explains why, when the merger attempt failed, STC began developing its own line of large-scale mainframes and why Amdahl is on the verge of announcing its own sophisticated disk drives. Once a vendor becomes successful in marketing one or two lines of products, it makes a lot of sense to expand its product offerings, thus leveraging its sales and support force.

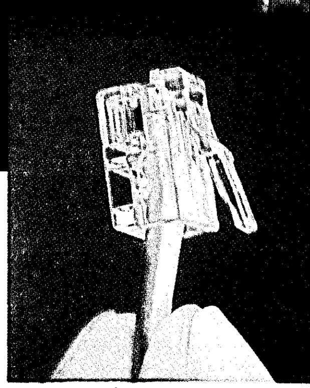
Of course, IBM compatibility is not the only game in town. Increasingly the industry is seeing the emergence of vendors of software and hardware compatible with systems from such companies as Digital Equipment, Hewlett-Packard, and Data General, for example. Earlier this year, there was a gathering in Atlanta billed as the first national DEC-compatible industry exposition, featuring upwards of 100 vendors of DEC-compatible products. A Seattle company makes an interface to Wang computers so that peripherals from independent suppliers can be used. Another company in that city claims to support the largest library of turnkey applications programs for Wang 2200 computers.

Still, the heaviest action is in the IBM game. And when the subject gets around to the two publicized R&D limited partnerships that raised millions of dollars for STC and Trilogy to develop large IBM-compatible mainframes, a number of people turn their thumbs down. Simpson, asked if he would put his own money into such a deal today, responds, "I wouldn't even put my clients' money into it." Kelsey also doubts they will turn into the world's best investments.

"I find it hard to believe that anybody coming to the money market today with the same kind of plan—that is, to compete straight on with IBM with plug-compatible equipment—would be very successful in raising any kind of money," says Serlin. He thinks more people today perceive that the business is based on premises that are difficult to defend.

Once a vendor successfully markets one or two lines of products, it makes sense to expand.

"I kind of feel that there is something immoral about this whole concept of trying to develop hardware that will run somebody's software," he adds. Serlin, former product and market analyst at Two Pi (now a part of Four-Phase Systems), says the pcm business is based on the idea of capitalizing on the investment of an IBM or a DEC, for example. It is a contention vigorously denied by people at pcm companies. But Serlin thinks the recent FBI sting operation, and charges that the Japanese were buying stolen secrets, raises anew this question of ethics. He's afraid the Japanese may try to justify their alleged actions by noting that market researchers for years have been obtaining IBM information on deliveries and product plans in whatever way they can. "It all smacks of bad morals," he says. ✽



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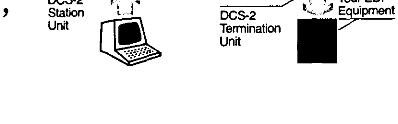

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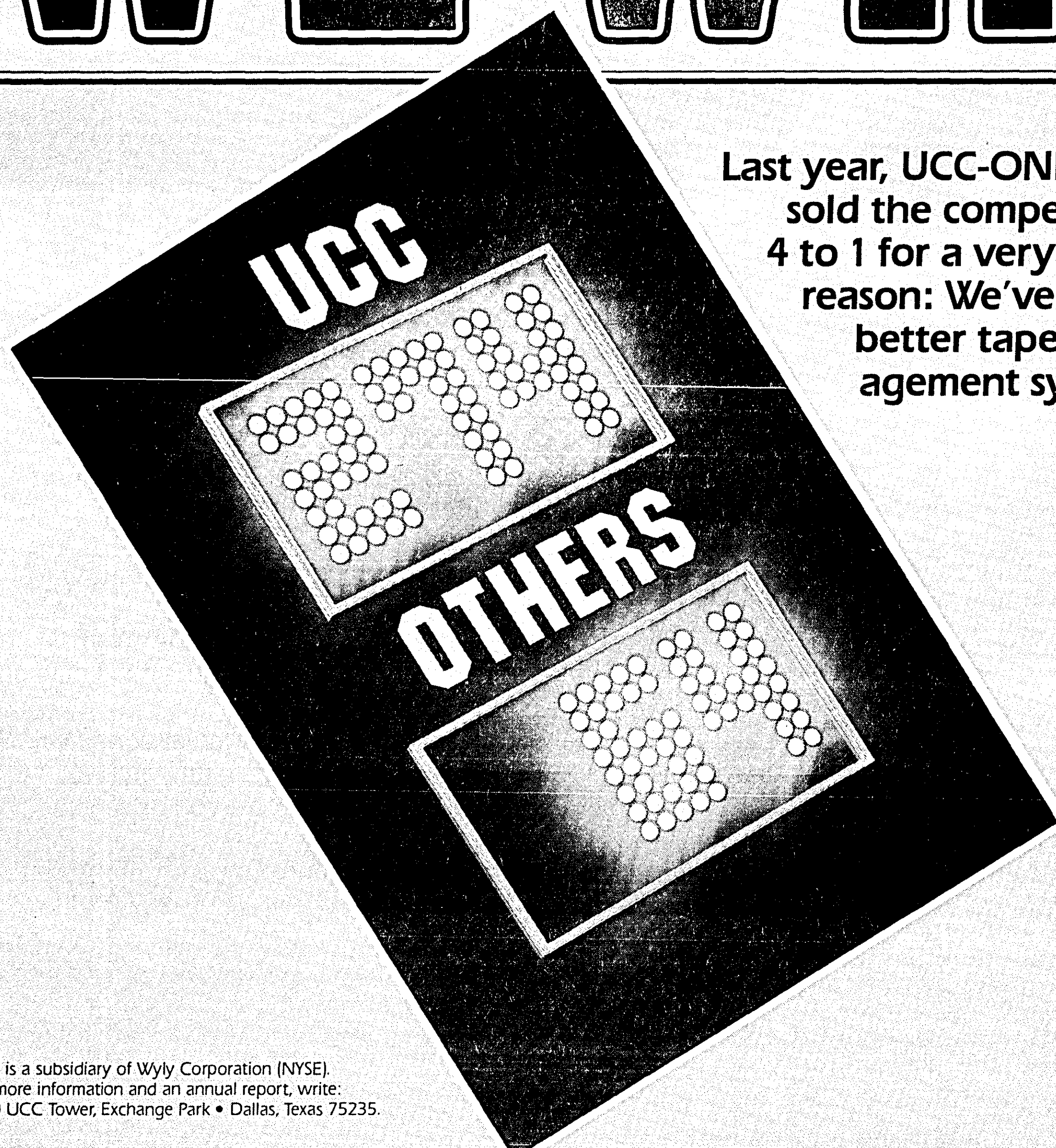

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ALAS, POOR MINI

Under siege from above and below, the traditional minicomputer may go the way of the dinosaur.

by John W. Verity

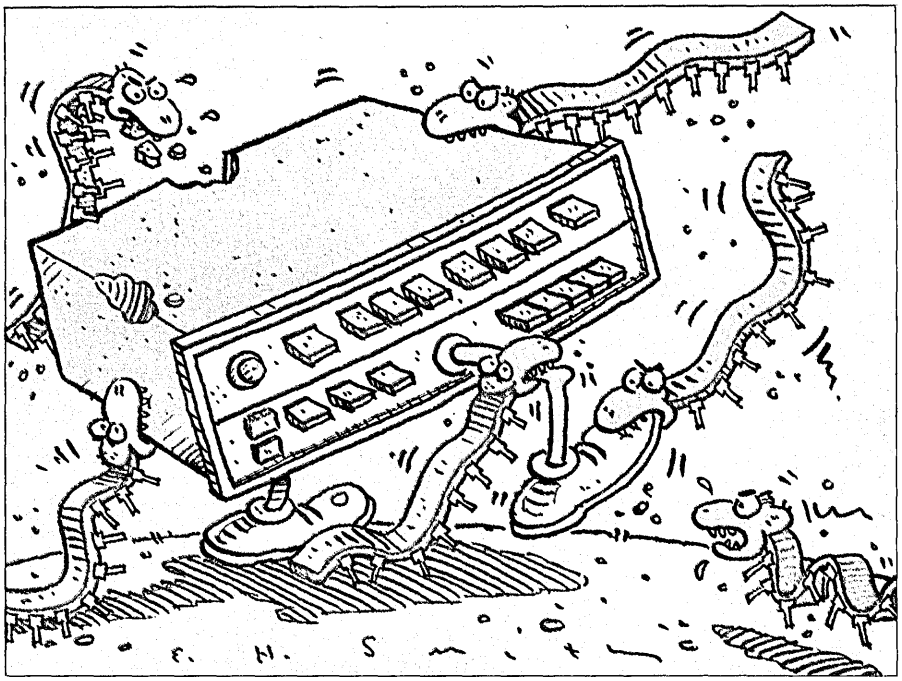

ILLUSTRATION BY ELWOOD SMITH

"Now here on our left, ladies and gentlemen, is the minicomputer. It was a species of computer that showed spectacular growth in the '60s and '70s, working its way into a host of market niches and challenging the dominance of the mainframe. Look carefully and you'll see the crude complexity of the machine. Its handwired boards and the front panel of toggle switches are two distinctive features . . . ."

Just such talk may one day echo through the darkened halls of some future technological museum. There, in the section dedicated to extinct computers, will sit the mini in all its faded glory. A machine that made fortunes for many, created a market for itself, and restructured the industry will end up on a swatch of dusty felt, framed only by the hundred-watt halo of an overhead bulb.

Or will it? Is the minicomputer really doomed to extinction? Must it go the way of punched cards, the abacus, and the dodo?

Minicomputers were first seen in laboratories, nurtured by technicians in white coats.

One doesn't have to take the Darwinistic analogy too far to conclude that the mini's very existence is threatened by the microprocessor. Both "species" compete for the same markets, investment dollars, and R&D efforts and it seem obvious that the less costly micro, should win. There's no percentage in predicting the future of the computer industry, but for now it seems as if the mini will have to adapt quickly to survive the micro's encroachment on its wide-ranging territory.

Although to this day the term minicomputer is a catchall, its use often brings to mind an image of "raw iron," a processor with little more than a power supply and toggled input to its name. Entering the computing scene in the early '60s, it was forced to live in the dark, often damp, shadows of the massive mainframe. It found a home in the regimented racks of obscure laboratories, where its evolution was tended to by technicians and scientists. They fed it paper tape at first, then found ways to attach teletypewriters and mag tapes. The mini grew up fairly quickly with such nurturing, enough so that it finally broke into the commercial data processing market in peripheral operations such as data entry, telecommunications, and data collection.

Much of this evolution apparently took place with little or no attention from industry giant IBM. It wasn't until 1976, almost 20 years into the mini's life, that the market leader gave the mini its conceptual okay and introduced its first true minicomputer, the Series/1.

By that time a dozen or so companies had made their names and fortunes selling minis for almost every conceivable use. On the West Coast were Computer Automation, Microdata, General Automation, Varian Associates, and Hewlett-Packard. Mini makers back East were located near Boston (Digital Equipment, Data General, and Prime), in New Jersey (Interdata and Digital Controls), and in Florida (Systems Engineering and ModComp). The companies had grown steadily through the '60s and accelerated into the '70s. At one point DEC showed growth rates of about 60% a year. Millions of dollars were made selling the machines for almost every conceivable use. The systems were at work digesting lab data, monitoring heartbeats, and checking energy usage. Indeed, it looked as if the minicomputer's scope was infinite: networks of them might someday predict the weather and manage huge databases.

Of course it was also at about the time IBM entered the fray—in the mid-'70s—that the microprocessor appeared on the horizon. The computer-on-a-chip was itself an infant then, but it wasn't long before the mini suffered from the micro's challenge.

A period of industry consolidation had shaken out the minicomputer makers, and some middle-tier companies like Computer Automation and General Automation began showing their weaknesses. Profits sagged, revenues leveled out. The mini was successful as a product only to those who had the resources to deck it out in peripherals and end-user software and to service it in the field. Some companies tried to hitch on to the distributed processing wagon, tying their machines to mainframes as remote processors, while others tailored their product lines for specific industries. It was also at about this time that mainframe makers saw the threat of the mini. Technology advances had brought the price/performance of minicomputers way ahead of the mainframe, and users were beginning to offload mainframe applications on to minis. Moreover, minicomputer software had developed enough to make the machine easier to program and to use. No longer was the mini a raw machine to be relegated to the back room. It was now a full-fledged computer with compilers, database management systems, high-capacity peripherals, and communications. Clearly, it was in the best interest of the mainframers to counter the mini's advances.

And that they did, introducing smaller versions of their mainframes that maintained software compatability while taking advantage of the lower costs mini technology

Mainframe manufacturers are pushing their way into the mini's traditional turf.

offered. IBM came out with the 4300 series, the bottom end of which was mini-oriented. Burroughs introduced the B 90, and Honeywell the Level 6. Instruction sets originally designed for multimillion dollar systems began appearing on what could only be described as minicomputers.

Thus began the squeeze that most assume will eventually force the traditional mini out of existence. From underneath come the micros, growing in power and dropping in price almost daily. From above come the mainframes, also dropping in price and designed to ward off erosion of their market share.

It is clear that many of the applications minis once handled—process control,

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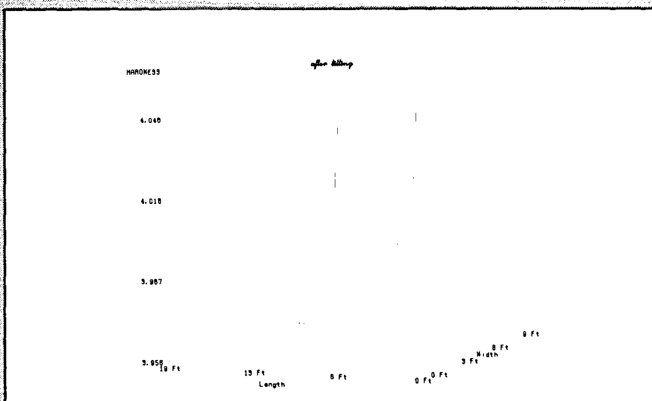

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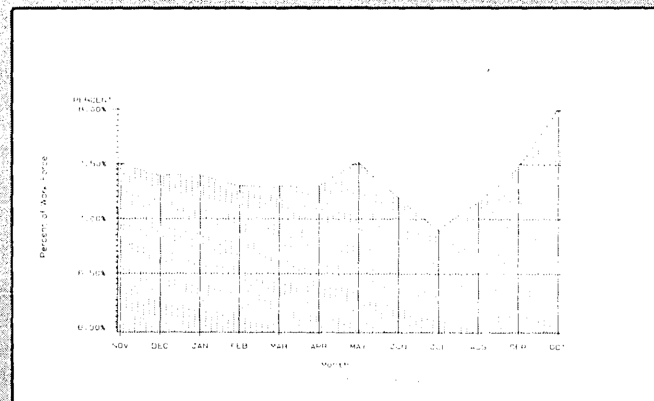
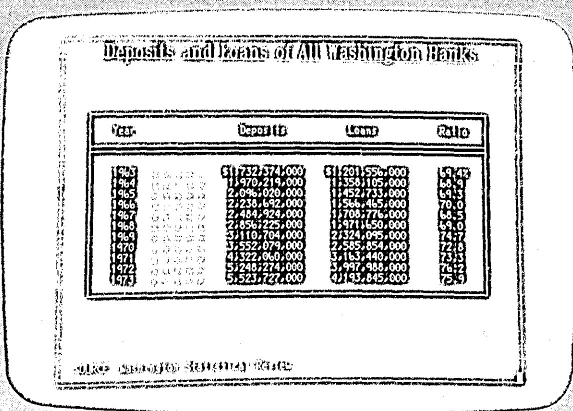


Hewlett-Packard 7221

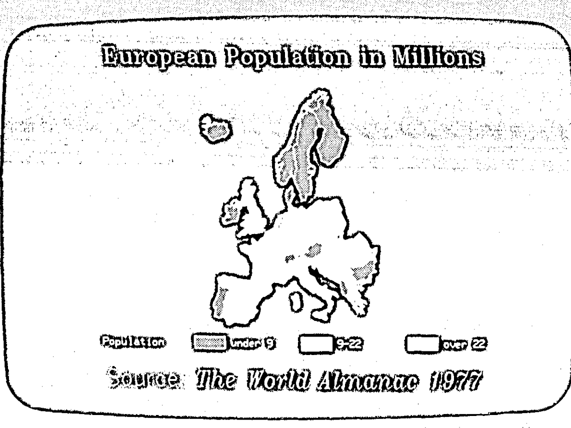
and more.



Deposits and Loans of All Washington Banks

Year	Deposits	Loans	Ratio
1963	$1,732,374,000	$1,201,556,000	69.4%
1964	1,970,219,000	1,358,105,000	68.9
1965	2,096,020,000	1,452,733,000	69.3
1966	2,238,692,000	1,566,465,000	70.0
1967	2,484,924,000	1,708,776,000	68.5
1968	2,856,225,000	1,971,650,000	69.0
1969	3,110,704,000	2,324,095,000	74.7
1970	3,552,079,000	2,585,854,000	72.8
1971	4,322,060,000	3,163,440,000	73.3
1972	5,248,274,000	3,997,988,000	76.2
1973	5,523,727,000	4,193,845,000	75.9

IBM 3279



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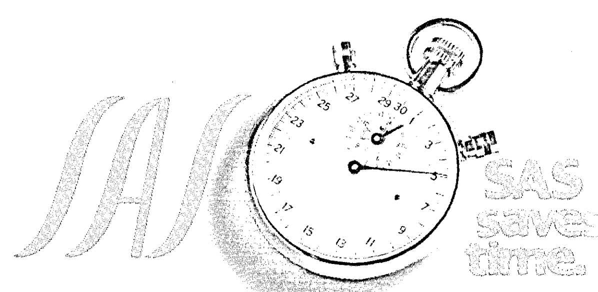
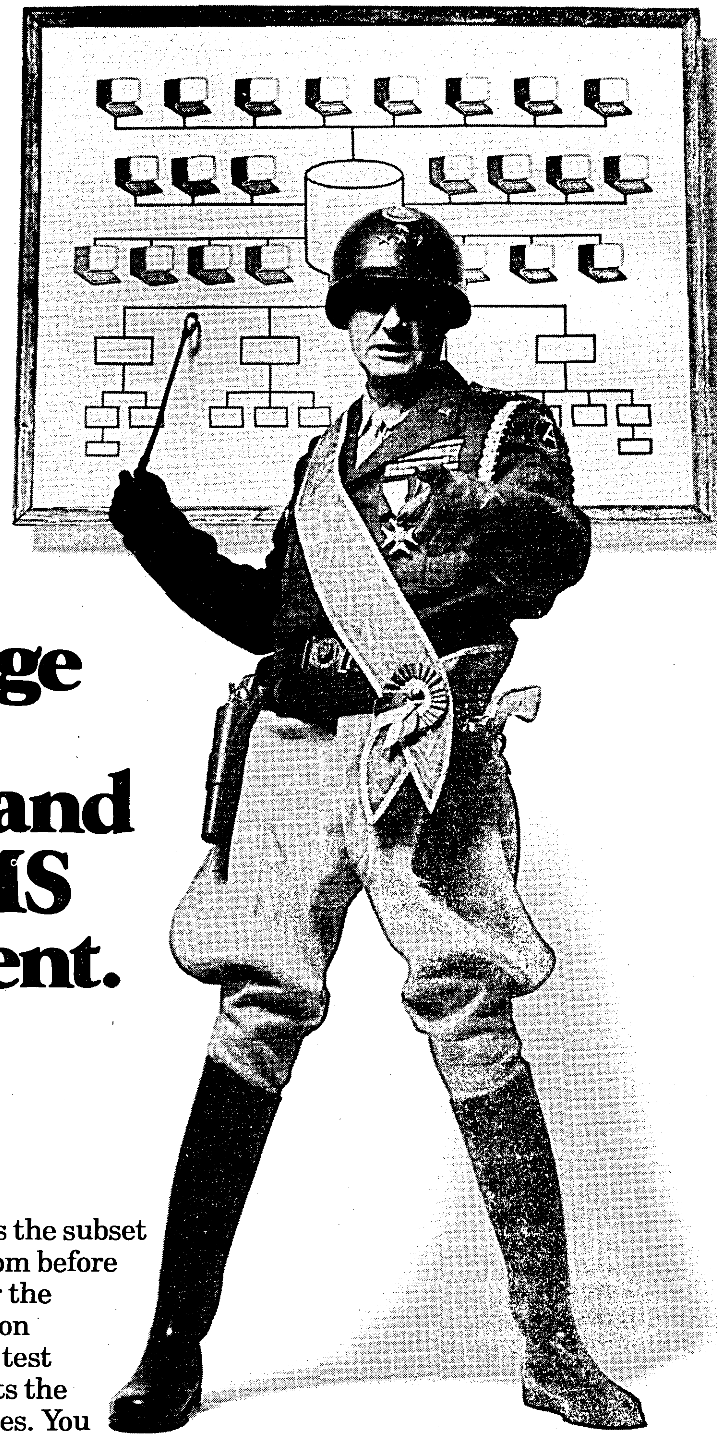
Whatever device you use, in batch or interactive mode, you can produce sophisticated charts, plots, maps and [illegible] dimensional displays with [illegible] that adds up to a big time-saving.

Best of all, SAS/GRAPH [illegible] the benefits of the [illegible] time in report writing [illegible] and as [illegible] 3500 OS [illegible]

A [illegible] saves you time [illegible]





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CIRCLE 177 ON READER CARD

data collection, and standalone business processing—can be done more cost-effectively with microcomputers. But the mini will live on, reincarnated, if you like, in the form of micros and so-called superminis. Several manufacturers have implemented their mini architectures and instruction sets in microprocessors. DEC has implanted the PDP-8, the Model T of minicomputers, and the PDP-11 on chips, while Data General has shrunk its Eclipse system into a micro-based machine. At the upper end, 16-bit minis have grown into 32-bit machines. DEC has come out with the VAX line, Data General with its MV line, and Prime with its 32-bit series.

Perhaps more than that of any other computer product, the minicomputer's very definition has been one that changes with

The mini may live on in spirit alone, having helped create a marketplace for small processors.

each nuance of technology. The prefix mini is after all a relative term and nobody ever really figured out a way of pinning down the threshold between the mini and the supermini and the maxi-mini and the mainframe. "It's about as big as a breadbox," one used to be able to say. One still can, except that these days the breadbox is a lot more powerful than last year's model.

Perhaps the minicomputer is only a spirit, a mythical machine whose definition will continue to change far into the future. Even now, when Hewlett-Packard can deliver a full MIPS processor on a single board, one is hard-pressed to draw the line between a mini and a mainframe. It may well turn out that the mini's legacy will in fact be the huge variety of small-scale computing applications it helped create. Like no other computer product, the mini opened the industry's eyes and showed that if you couldn't bring the job to the computer, it was possible to bring the computer to the job. ❋

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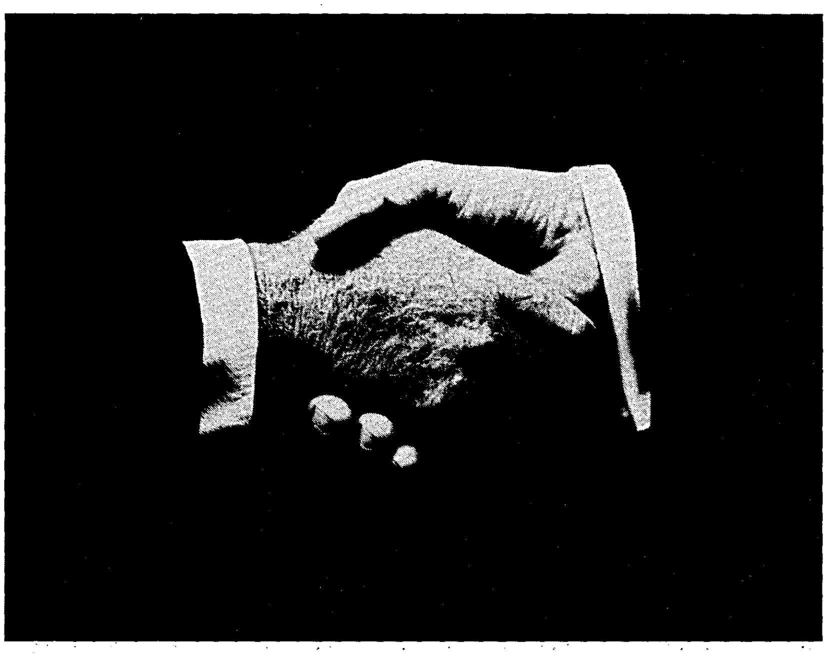

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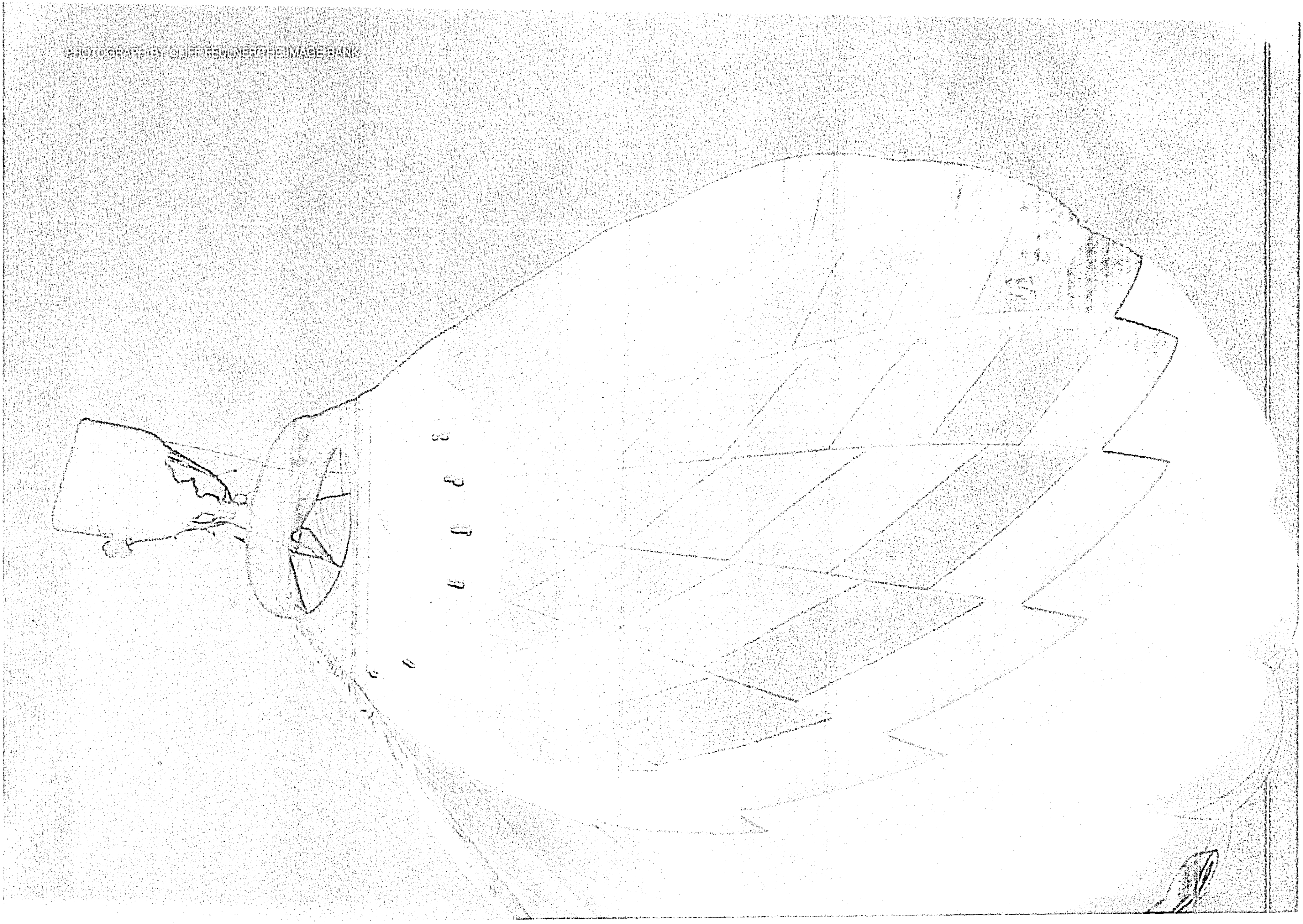

PHOTOGRAPH BY CLIFF FEULNER/THE IMAGE BANK

ASSURING THE FUTURE

We are woefully ill-equipped to control the fundamental changes our technology is causing.

FOR A NATIONAL INFORMATION COMMITTEE

by Milton R. Wessel and John L. Kirkley

We are entering the information age woefully lacking in information.

Our society is being transformed. New patterns of economic and social interaction are being created; the very roots of human society, the fundamental processes, are being altered by the worldwide impact of the computer/communications revolution. International trade, national boundaries, social customs, all our most cherished institutions, the way we live, work, and die, are undergoing an accelerated metamorphosis unprecedented in history.

But if the truth be known, most of us haven't the vaguest idea of what's going on. And that is why we are recommending the establishment of a national body to gather and organize data about this revolution so that we, as a country, can make informed decisions about the directions our technology and our society will take.

It is true that almost every country in the first, second, and third worlds, including the U.S., has its study committees, government white papers, social gurus and futurists. But all of us view the world through the myopic lens of our prejudices and perceptions.

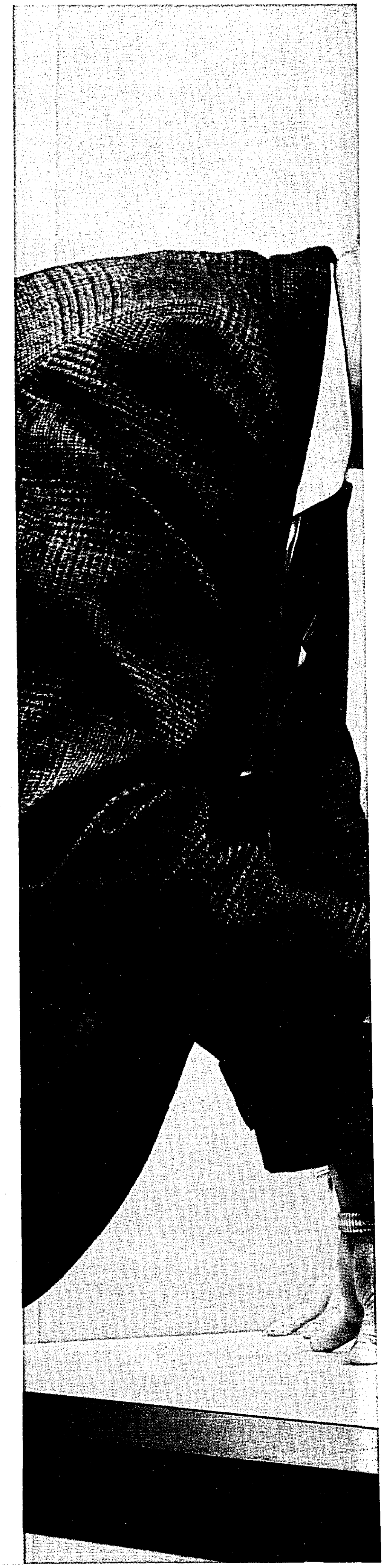
Some countries, notably France, the Scandinavian countries, and Japan, are further along than we in establishing national policies that indicate how computer and communications technology will be meshed into their social and economic institutions. France, in the wake of the NORA report, a government sponsored assessment of computer related technology, is wiring its schools and its cities. We may not like what the Swedes and Danes are doing, but at least those people have been leaders in passing privacy laws and dealing with the transborder flow of data. "Japan Inc." has become an accepted cliché for that country's tightly coupled relationship between government and industry. The U.S. has passed some privacy laws and completed studies on the implications of electronic funds transfer systems, but our approach has been far more piecemeal.

John Eger, a CBS vice president and former DATAMATION advisor, commented in a recent speech, ". . .let me acknowledge that what we are witnessing in the U.S. and abroad is a classic case of technology outstripping the law and the political and institutional framework established by it."

And that is the problem: the technology driving the computer/communications revolution is moving far faster than the ability of any of us, individually or collectively, to deal with it.

There are several reasons for our impotence in the face of such massive change. First, we are operating with outmoded assumptions. Our political and our industrial leaders, even within the computer industry where one would expect forward thinking to thrive, are steadfastly peering into the past to make their decisions. The industrial revolution, begun in the 19th century and accelerated in the industrial world since World War II, emphasizes a goods-oriented economy with clearly defined markets that are serviced by workers on the farms and in the factories. When we think of more jobs for the steadily swelling ranks of the unemployed in this country, we try to find ways to resuscitate the automobile factories, the steelworks, and the oil fields.

But in fact we are no longer just an industrial economy. We have become a service economy with over half our work force busy producing, storing, using, and transfer-



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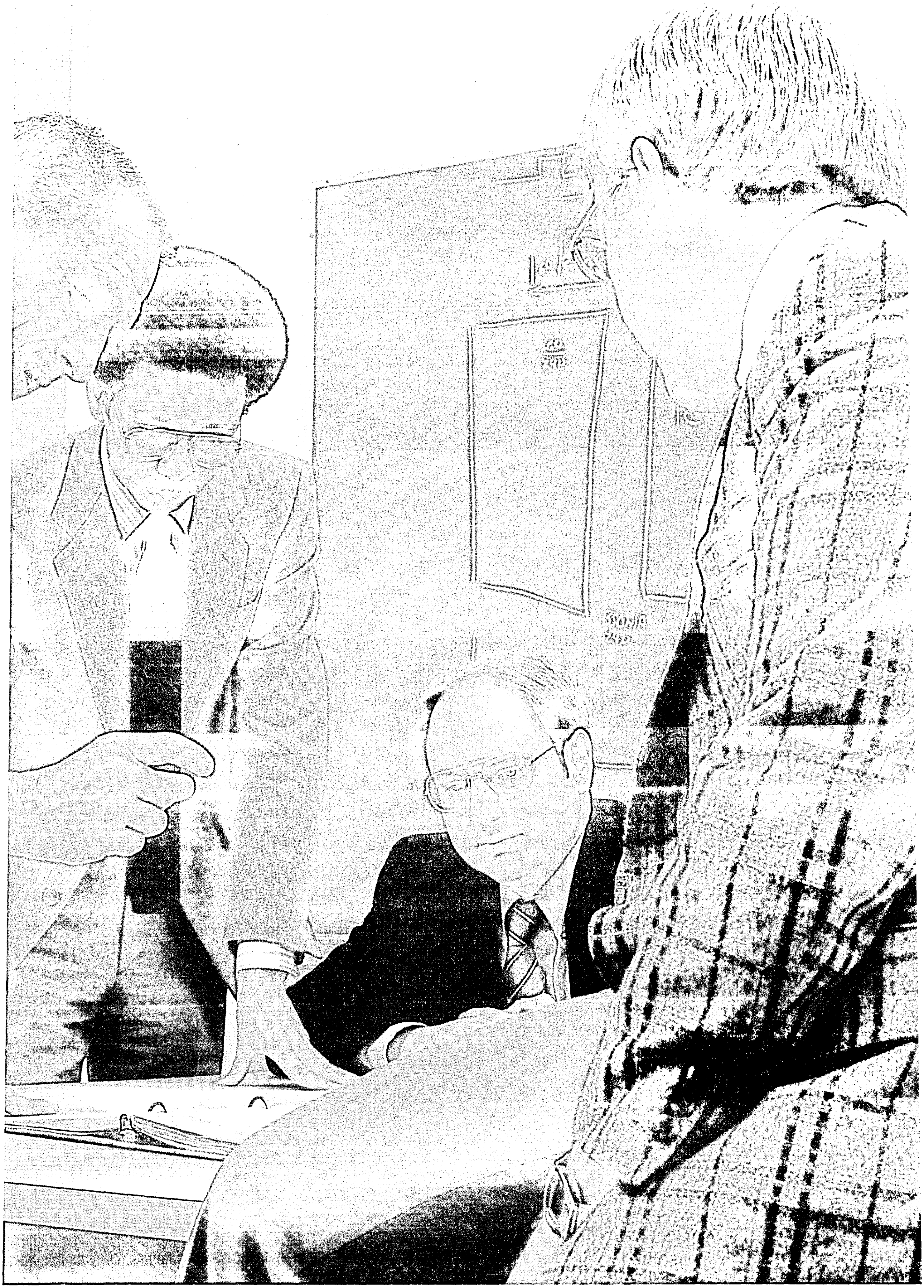


The computer/communications revolution may be a powerful catalyst toward disintegration.

ring knowledge or information. As Eger pointed out, "Almost half of our GNP is related to this activity, and considering the plight of our steel, shoe, automotive, and tv manufacturing industries, it is believed our strength in information services represents one of the greatest assets in our effort to shore up a sagging U.S. economy and enhance our ability to penetrate foreign markets."

A by-product of this 19th century mind-set is a failure on the part of our leaders and the public to recognize the extraordinary impact computers and communications are having on the economic and social fabric of our country. Computer literacy is growing, thanks to the ubiquitous computer arcades, home video games and personal computers, but the real, long-term impact of this tidal wave of processing power remains a mystery. We know the computer revolution is important; a lot of purple prose has been expended to the effect that our industry has invented the most significant technological advancement since the wheel or the discovery of fire. Discounting these hyperbolic excesses, it does seem to be true that computers/communications are fundamentally altering human life.

Compounding the lack of awareness of the magnitude of this revolution is a problem that is uniquely American, stemming from our frontier heritage and our innate distrust of monolithic government.

We set great store in our rugged individualism and its marketplace analog, the free enterprise system. We rely on the rough and tumble of the open marketplace to sort things out and we become justifiably concerned when any large organization, whether it be the government, a huge regulated monopoly, or a corporation, becomes so large and powerful that it threatens to overwhelm us and our competition.

AN ACHILLES' HEEL

But this same philosophy, which contributes so much to the competitive vigor of our domestic marketplace, can be an Achilles' heel in the international marketplace. Many other developed countries have realized the importance of these new tools and their governments have sliced bureaucratic red tape to support their national computer companies, maximize their position as exporters of technology, and protect against being overwhelmed by foreign imports.

We have been struggling for years with the Japanese to open Nippon Telephone and Telegraph to outside procurement; France is fiercely protectionist, especially in the minicomputer area; and other European countries are using "nontariff barriers" such as trade restrictions based on privacy and transborder dataflow laws to protect their domestic information markets. Canada's recently passed Bank Act, which restricts the flow of banking data to U.S.-based service bureaus, is an example on our own borders. Many foreign countries provide low interest loans, tax credits, research and development grants, and other financial incentives to support their domestic computer and communications industries. The U.S. is one of the few major countries that has not yet really begun to develop a national, coherent policy regarding its information industry.

Finally, despite our attempts to place limits on governmental growth and preserve the sanctity of the individual, we are being frustrated by the sheer size and complexity of the issues with which we are dealing and the corresponding size and complexity of existing institutions that by default are likely to be delegated the responsiblity for dealing with these issues.

Theodore Rozak in his passionate book, *Person/Planet*, states the problem succinctly. "Only now do we see that the *scale* of things can be an independent problem of our social life, a factor that may distort even the best intentions of policy. It has taken our unique modern experience with the public and private bureaucracies, the mass market, and state and corporate industrialism to teach us this lesson. We have learned that human beings can create systems that do not understand human beings and will not serve their needs."

We seem to be rapidly moving toward a form of social entropy; disorganization and randomness are setting in and the computer/communications revolution, rather than providing the glue that binds our economic and social efforts, may be a powerful catalyst toward disintegration.

One of the most obvious manifestations of our lack of focus is our showing in the international trade arena. When a handful of Arab countries can disrupt our transportation and energy systems, when the Japanese can cause widespread layoffs in our basic manufacturing industries, when companies within our own borders are selling wholesale goods to foreign firms who then sell them back to American consumers at dump prices and thus undermine American competitiors, when we attend international forums on privacy and transborder dataflow and have no national policy to expound—then, despite our technological advances and our economic power, we appear confused and vulnerable to the whims of the global marketplace.

Internally we don't seem to be faring much better. A few issues have caught the attention of our lawmakers. Concerns about privacy and electronic funds transfer have resulted in some legislation and not a few study committees. Regulatory agencies such as the FCC have unsuccessfully attempted to define computers and communications. Now the FCC is trying to draw the distinction between basic and enhanced services; it may run into the same problems as before. The courts, the Justice Department, and the antitrust laws have proven ineffective.

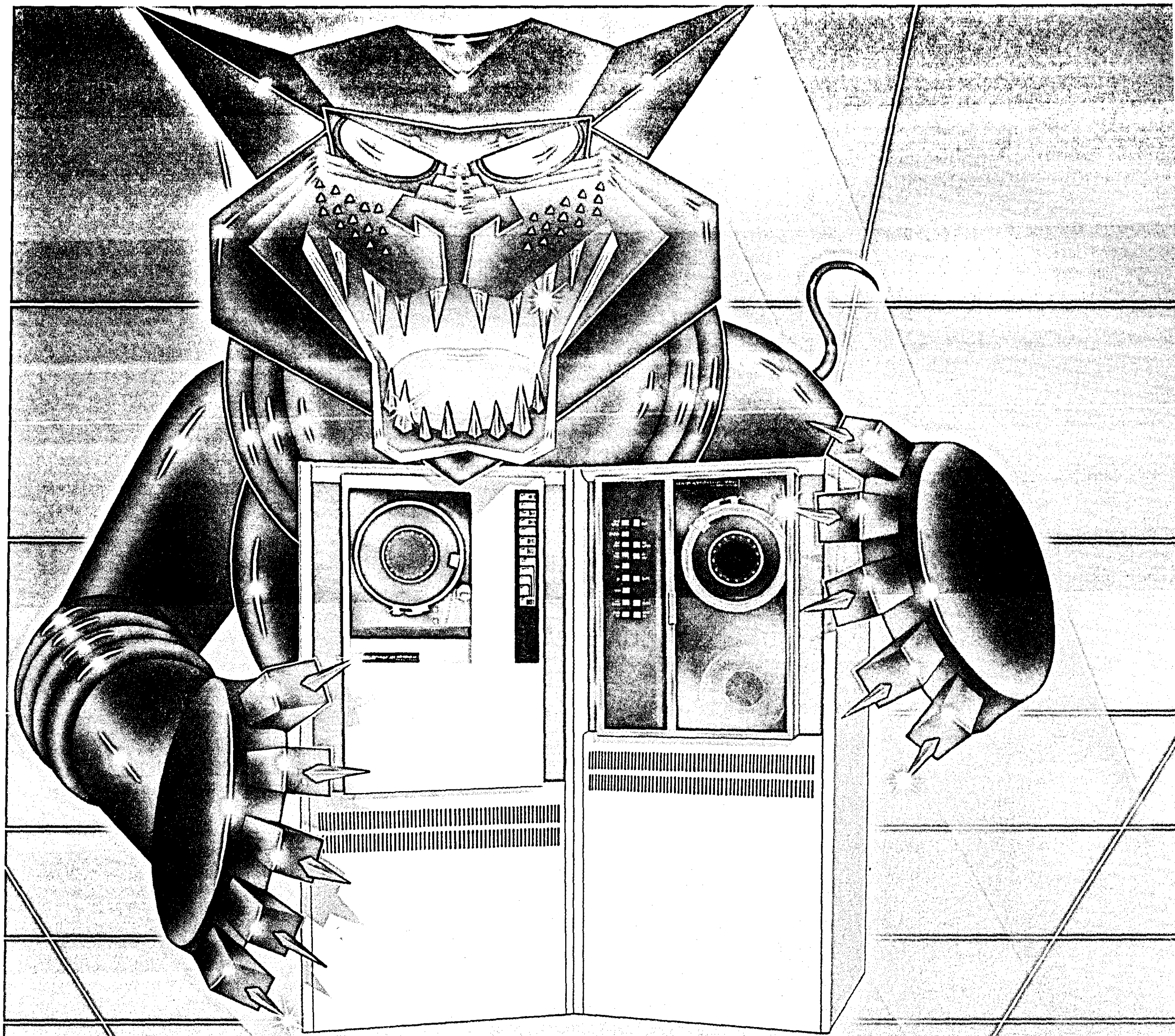
And Congress? Back in 1976 a Right to Privacy committee, headed by Nelson Rockefeller, complained in its report to the President titled "National Information Policy" that "the information policies emerging from the Congress continue to be developed in an ad hoc piecemeal fashion by numerous congressional committees struggling to frame responses without the benefit of a comprehensive overview of the field. And information issues have apparently been mounting beyond the congressional capacity to respond." The executive branch also came in for much the same criticism. Today, six years later, the confusion has been compounded; nothing has changed but the complexity of the issues.

But if the government is floundering, many large corporations both here and abroad are not. They correctly see the new information era as an enormous opportunity and they are moving swiftly to position themselves to take advantage of the information bonanza that is fast becoming a reality. AT&T happily shed its operating companies in return for a premier position in the information marketplace. Merrill Lynch, McGraw-Hill, Dun & Bradstreet, and Citibank are just a few of the large companies jockeying for position in the information age.

Many of these companies have come to realize that there is more to this information business than just making pots of money in the short term. They are acutely aware of the fact that information is power and that the actual control of the data is more important than the sophistication of the delivery system. Robert Weissman, a D&B vice president, made these comments at the time of his election as chairman of the board of ADAPSO in 1981: "Data is becoming a new control point in our information society. It is certainly growing faster than either cpus or lines of code. There is no famine in data—rather, there's plenty of it. In fact, more than can be handled, and data is becoming even more important. . .I pose a rhetorical question to you as we take a look, for example, at the importance of data versus software. As suppliers to your customers, would you prefer to have the best data management system. . .or would you want to have control of all the data that your customer needs?"

CONTROL OF DATA

It is this control of data that will ultimately determine who the major players are in the new information marketplace. The private sector is moving into the vacuum created by inadequate infor-



The ownership of valuable data is a fundamental practice in business.

mation and the lack of any effective national policy.

Three major ramifications of the use of data as a control point are: 1) a competitive struggle for the ownership of data with the probability that a scattering of very large, individually owned databases will develop; 2) use of data to leverage competitive advantages with the serious concern that tying and other monopolistic practices will be used; and 3) political entities, especially the federal government, will use data as a political control point, or as Weissman said, "as a basis for political power and survival."

Of course, the ownership of valuable data is a fundamental practice in business, no matter what the enterprise. In the computer/communications field, given the fast-moving pace of the technology and the intense competition, this is especially true. Although dealing with technology and not databases, the recent FBI "sting" operation that embarrassed Hitachi and Mitsubishi points to the great lengths (and dollars) to which companies will go in order to obtain proprietary data. .

But there is the possibility of an even more subtle abuse that can keep smaller firms from competing at all.

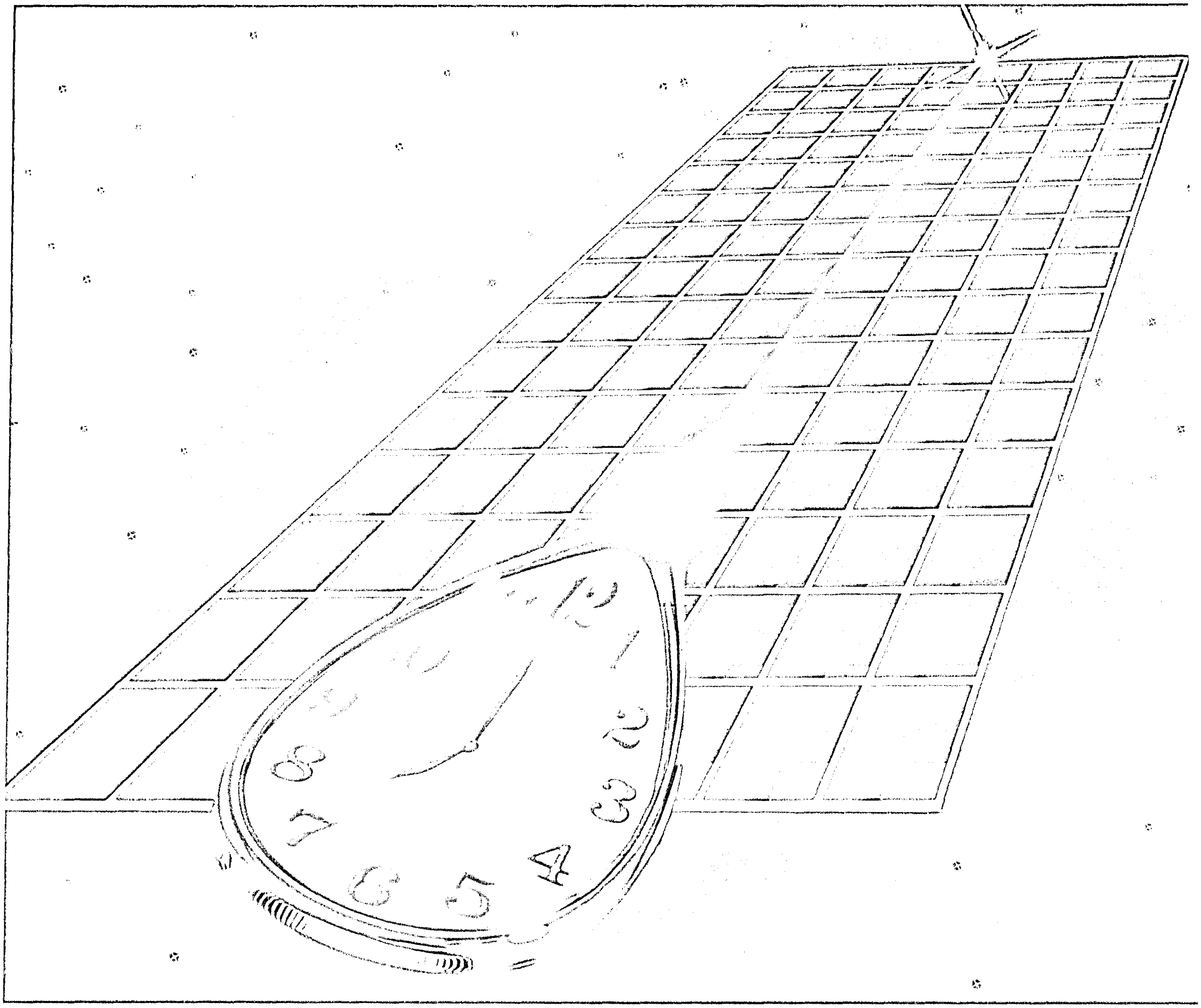
For example, Dennis Binder, an associate professor of law at Ohio, writing in the *Mercer Law Review*, discusses the legal retrieval system, LEXIS-OBAR, which, at the time the article was written in 1975, contained New York and Ohio statutes and cases, federal cases, and tax materials. SEC and FTC materials were scheduled to go on the system. Terminals existed in corporate law firms and major accounting firms.

There were several problems for what Binder calls the "average practitioner." First of all, the terminals were expensive. But even if the average lawyer could handle the capital outlay, the very nature of the information in the system discriminated against him. Because LEXIS is a commercial venture designed to maximize profits, it was designed for the corporate attorney who can afford to pay the freight. "For that reason," says Binder, "it will be a long time before the system contains materials, such as probate, real estate transactions, domestic relations, workmen's compensation, landlord-tenant, and criminal law, which are geared to the average practitioner who is primarily concerned with 'bread and butter' law."

Clearly, in the last seven years the LEXIS database has become far more comprehensive, but it still discriminates. And, in a legal conflict between a large corporation and a small client, the use of LEXIS could give the corporation a decided advantage despite the merits of the case.

Or consider the *New York Times* database, an extensive and useful service. It is, in fact, so useful that other newspapers and other media, both large and small, thoughout the country, could find it quite economical to drop their own morgues and rely solely on the *Times*'s database. Eventually the *Times*'s stories would become the only source of journalistic history. What the *Times* reports, what the *Times* thinks, becomes reality. As other viewpoints, as other data, simply vanish because of the lack of accessibility, the informational content of the world becomes less rich, less varied. It is a subtle form of involuntary thought control much more effective than the heavy-handed techniques of totalitarian regimes.

One of the most striking examples of data as a competitive control point is the movement towards a national electronic



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Privacy considerations aside, a closed system could have a disastrous effect on competition.

funds transfer system. Under the banner of economics of scale, EFTS represents a major opportunity for a few huge institutions to dominate the retail credit market and eventually be the major partners in a closed-loop system that could sound the death knell for many small firms.

Consider, for example, a future EFTS system that links the point-of-sale terminals in major department stores with an EFTS system. The computer/communications hookup includes the wholesalers supplying the department stores, the credit authorization company, and the market research activity within the bank. You, the consumer, no longer have a wallet full of credit cards. You have found that one of the few major EFT suppliers can supply all your credit needs and so, when you activate your home shopping terminal or use your coded EFT card, you set off a chain of events that activate the control nodes in this closed loop system. Your purchase is recorded by the store and at the same time your account with the bank has been automatically debited. The store's inventory of that item is reduced by one unit and if the inventory falls below a certain point the wholesaler is automatically notified to ship a predetermined number of replacement units. Information about your purchase becomes a part of the system, yielding information about you as an individual and as part of a class of consuming individuals (age, salary, geographic region, etc.). These proprietary data are then used by the bank and the retailers to enhance their competitive position still further.

It sounds convenient and efficent, and it is. But this type of closed system, privacy considerations aside, can have a disastrous effect on competition.

According to Professor Binder, "We could end up with two national bank cards controlling a large percentage of the retail credit in the country. If the past practices of oligopolies in our economic history is any indication, the two systems could end up as Tweedledum and Tweedledee. Entry barriers would be prohibitively high. In addition to confronting two established brand names, the potential entrant would also have to set up a national consumer-POS system. Credit service could deteriorate and competition in such matters as terms of payment could decline. . .The presence of individual credit plans is lost; credit could become expensive to both consumers and retailers."

AT THE WHOLESALE LEVEL

A further brake to competition would also occur at the wholesale level under such a closed system. The major department stores would naturally tend to deal with wholesalers who could qualify as participants in the system; in other words, the large name brands that could afford the ante to hook into this elaborate electronic network. Smaller, perhaps more innovative manufacturers would find themselves squeezed out by the giants and a further reduction in the variety of goods and services available to the consumer, as well as in price competition, would take place.

But most important would be the control of the data. The bank would be in a prime position to gather extensive information about the consumers and the retailers on the system. This knowledge would not only be immensely valuable, but its ownership by the few monolithic banks would effectively stop any competition in its tracks. By using these data in different ways, the banks could move into other competitive areas with devastating results to the smaller firms that stood in their way. This trend is already visible, with Citibank being the most aggressive.

Neither weather, nor traffic, nor unexpected delays can keep a 3M transceiver from getting your message through.

The control of data will ultimately determine who the major players are in the new information marketplace.

The FTC, in an "Economic Report on Corporate Mergers," put the danger in perspective: ". . .When large conglomerate enterprises engage in systematic reciprocity, industrial bigness and conglomeration rather than real economy threaten to become the keys to business excess. The ultimate result is an inflexible economic system composed of an industrial elite knit together by the exchange of reciprocal favors."

Electronic funds transfer may be one of our most discussed computer systems, but few people appreciate that it represents a combination of computing, communications, banking, and information. Until now most of these ingredients have been available separately. One common EFTS model, however, is to offer the system as a packaged or bundled product—take it all or leave it all; the parts are not separately available. EFTS, then, is a rebundling of products that were formerly unbundled.

The phenomenon of unbundling has been a major impetus to competition in the computer industry. IBM's 1956 consent decree with the U.S. government resulted in the unbundling of computer services and the creation of Service Bureau Corp. (SBC), an event that many see as marking the birth of the computer services industry. In the 1969 IBM unbundled much of its software from hardware and gave a major competitive boost to the computer software industry. Unbundling has been the subject of a number of other such developments, though of less significance.

The rebundling of EFTS thus represents a reversal of an important pro-competitive computer industry trend of many years' standing.

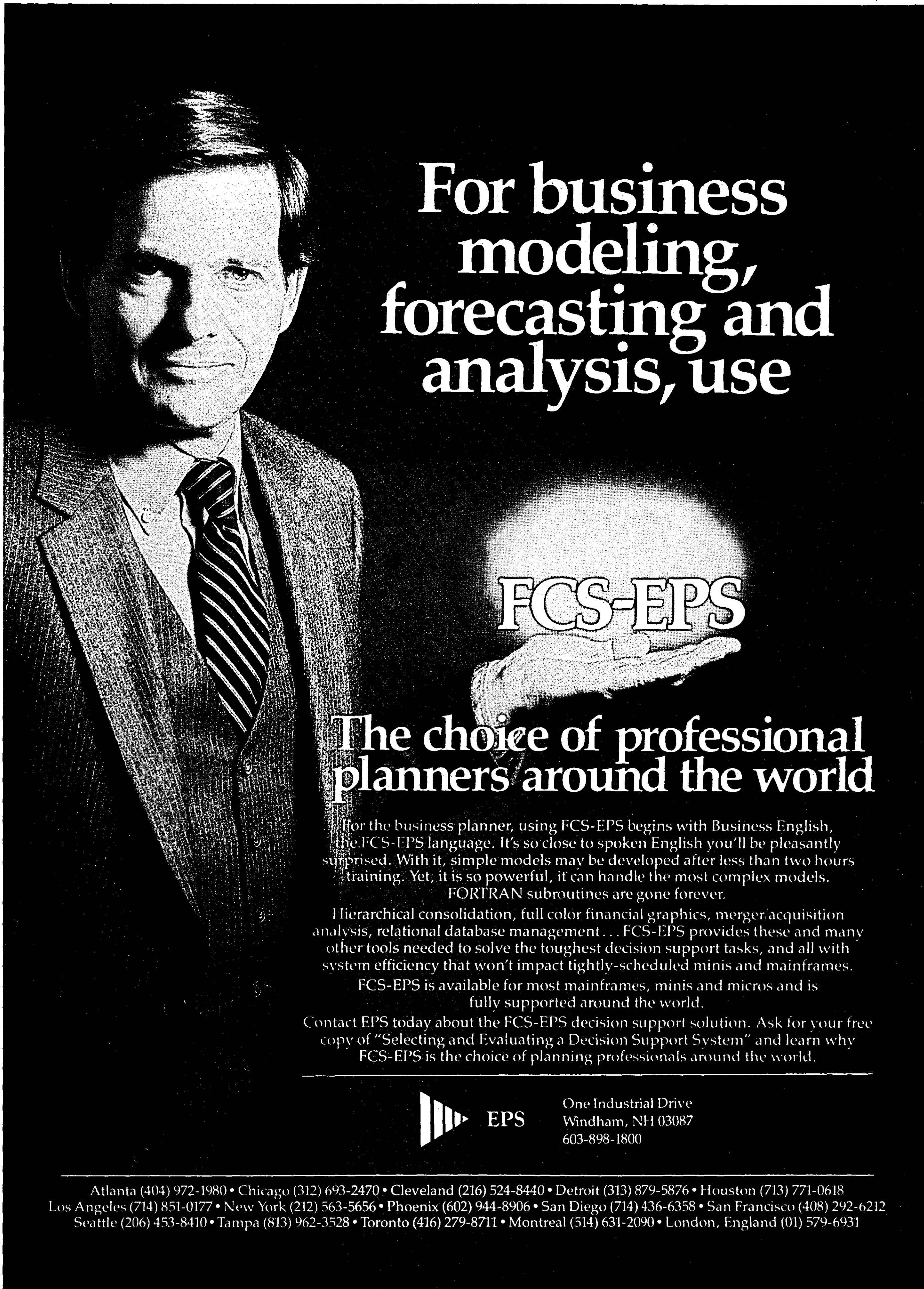
Perhaps even more significant is the fact that one of the bundled ingredients is information. Information promises to be the future point of dominance and control of computer systems. Until the early 1970s, hardware was the key ingredient; these were the years of IBM dominance. Now the key is shifting to software because of the proliferation of different computer systems through the minicomputer, microcomputer, distributed data processing, networking, large-scale memories, and other developments of the last decade made possible by the chip. As technology advances and software becomes ubiquitous and less proprietary, the shift will be to information.

Our message is simply that he who controls the data will soon control the whole system, for better or for worse.

If concentration of power in the private sector through the use of computer/communications systems has its pitfalls, this consolidation within the government can be even more dangerous.

A report issued this spring by the U.S. Office of Technology Assessment, titled "Computer Based National Information Systems Technology and Public Policy Issues," discusses some of the problems associated with large, complex information systems. "It is not hard to. . .envision the potential damage that could be caused by the failure or misuse of such systems as they grow larger, more complex, and more centralized.

"Some of the risks may be *physical*, as in the air traffic control example or with a computerized nuclear reactor safety system. Others may be in the form of *economic* losses, such as the failure of an automated securities market. Still other risks may be *social*, for example, if the larger data systems such as the National Crime Information Center or an EFT payment system were misused by the government or by private concerns to



CIRCLE 188 ON READER CARD

As we enter the information age, we have little usable information about the processes we are engaged in.

exert undue contol over individuals."

There is another severe potential loss, one that occurs when the public and private sectors collide. If, for example, the power to control the EFT system is concentrated in the hands of one or two large organizations, or if a few huge computer companies become utilities, squeezing out the smaller service bureaus, the government would be forced to regulate the organizations, treating them as public utilities. Although, as Binder comments, this might be better than allowing them to become unrestrained monopolies, past experience with government regulation indicates that we would see a stifling of innovation and technological progress.

These few examples of losses in international trade, the growth of oligopoly and monopoly, and increased governmental bureaucracy, only hint at the complex issues that the computer/communications revolution is creating. We are awash in books, pamphlets, reports, and articles on the information age. Yet nowhere does there seem to be anything resembling a comprehensive and comprehensible view of what's actually going on. Nor are there any guidelines available to tell us how to go about constructing a unified national place for coping with the emergence of the information age.

Of course we can do nothing. The advocates of a totally free and open marketplace would find this the obvious choice: let the marketplace decide. And perhaps that is the answer, but let's know what we are doing and why.

Nowhere is it written that science and technology must proceed unchecked. Nowhere is it guaranteed that technological innovation will solve the problems that technology has created and that information policy should take a back seat to the frantic razzle-dazzle of high-tech competition. The more our systems become encompassing, the more we need to systematically confront and understand them.

For, as James Rule says in his book, *The Politics of Privacy*,* ". . .when very sophisticated technologies go wrong, the consequences may be extraordinarily unacceptable—so much so that the possibility of avoiding such technologies altogether, or of systematically limiting certain of their applications, must be taken seriously as one of the options for rational planning."

*James Rule, Douglas McAdam, Linda Stearns, David Uglow, *The Politics of Privacy*, New American Library (1980).

NEED FOR RATIONAL PLANNING

If we are to engage in rational planning, one of the prerequisites is information. It is one of the ironies of our time that, as we enter the much-heralded information age, we have so little usable information about the very processes we are engaged in. As we mentioned earlier, massive amounts of literature about the information revolution exist in almost every conceivable format, but its accumulation has been piecemeal, fragmented, a bibliographic barrier that is enough to deter even the most dedicated planner.

Before we can make fundamental policy decisions that will affect our long-term national welfare both at home and abroad, we must cull the data about our current situation from the myriad of sources available and bring them together in some comprehensible fashion. And that is why we are recommending the formation of a working body patterned to some degree after the Temporary National Economic Committee (TNEC) of the late 1930s.

The newly created body should be peopled with the best minds we have.

The United States had emerged from World War I as a major economic power, but the euphoria of the '20s ended in the great depression. TNEC was established to develop data that would allow society to plan for the future and not let another depression bring this country to its knees. Participants included the best economic minds of the time. Their work had enormous influence because it represented the most coherent, unbiased body of data about economic conditions in the U.S. that had ever been compiled.

We need such a body to deal with the massive confusion surrounding the computer/communications revolution. Like TNEC it should bring together the best minds we have, and its participation should include experts in technology, government, international trade, and societal issues, as well as economics. Because we are in a transition from an industrial society to an information society, the committee's members will have to be comfortable in both worlds. As Amitai Etzioni observed in a *New York Times* op-ed piece in June, we have been and will continue to be a two-track society for a long time to come, with strong elements in both the industrial-based sector and in high-technology industries.

This new body—let's call it Temporary National Information Committee, for want of a better name—could be funded by either the private sector or the government or both. The key is that there be no strings attached.

TNIC's primary charter will be to create a database, a coherent body of information about the computer/communications age we are now entering and how it is affecting our lives economically, politically, and ethically. This database should be freely available to all who wish to use it; in other words, it should be accessible in a variety of ways.

TNIC should be a publisher. Bibliographies will be essential, but even more important will be the committee's job of bringing together all the random sources of information and informed opinion and organizing them into an accessible and coherent whole.

As clarity begins to replace the confusion that a runaway technology is creating, we, as a nation, will be able to make decisions regarding the size of our institutions, how our technology will be employed, and what our posture should be with regard to international trade. We will be able to at least take a stab at measuring the risks associated with implementing these technologies and decide whether the benefits outweigh the dangers.

In short, we will be able to move away from our too often employed modus operandi of making a mess of the present and then hoping that future generations will clean things up. We need our latter-day TNEC, and we need it now. ❋

Milton R. Wessel has been general counsel to the Association of Data Processing Service Organizations (ADAPSO) since 1966 and is general counsel to the law firm of Parker, Chapin, Flattau & Klimpl. He has been teaching law, especially as it relates to computers, at Columbia since 1972 and has taught at Duke, Georgetown, New York University, and Stanford. He is the author of six books and first proposed the idea of a present day TNEC for the computer/communications industry in 1969.

John L. Kirkley is the editor of DATAMATION.

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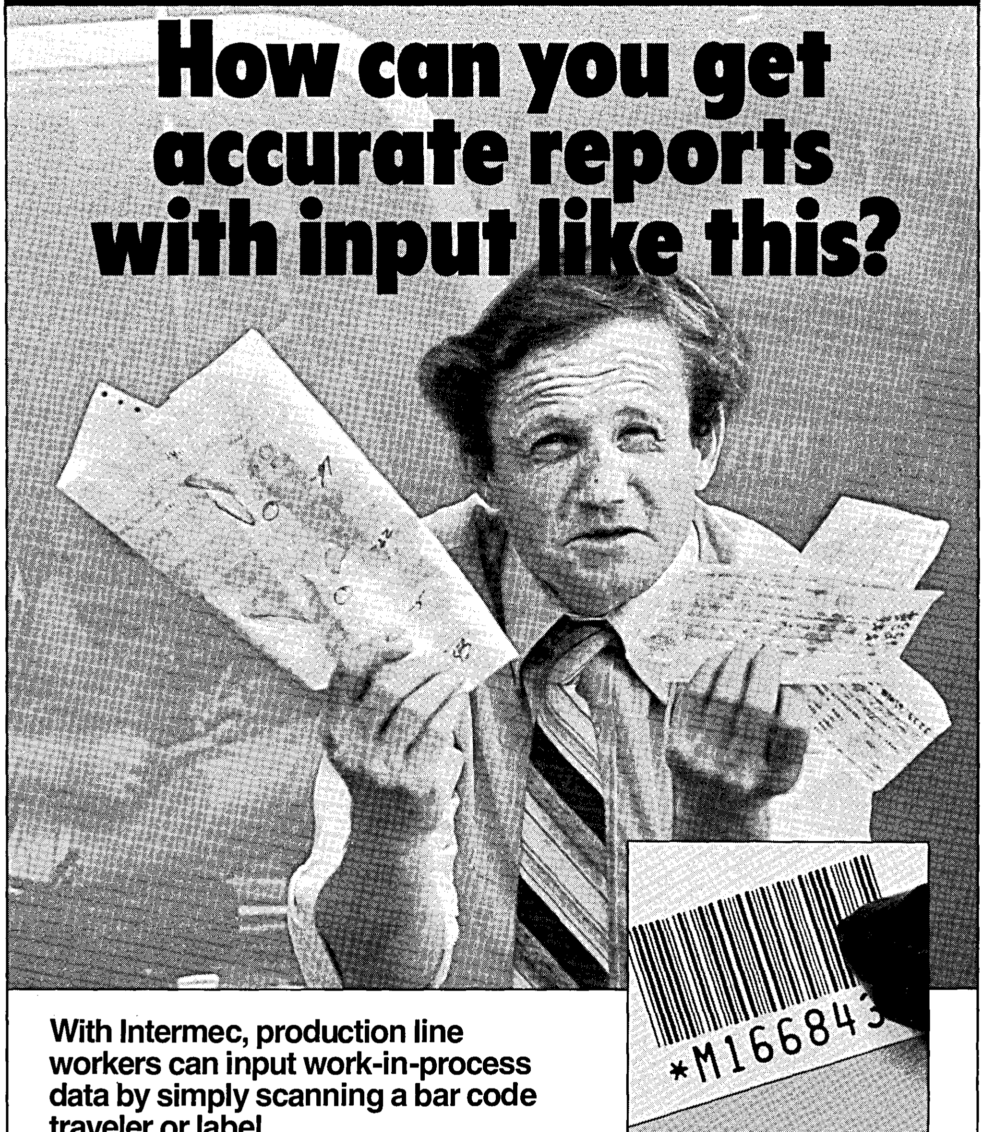

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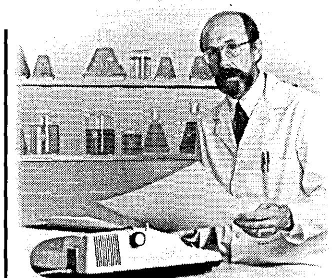

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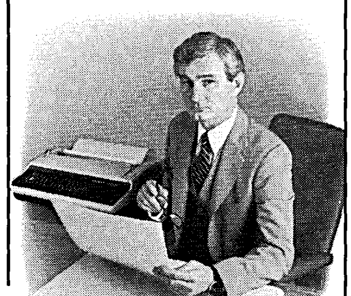

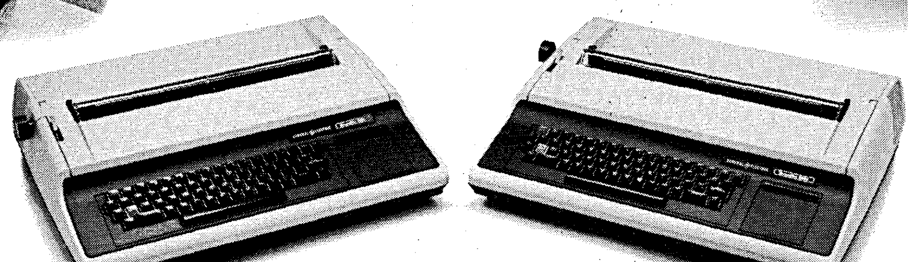

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GENERAL ELECTRIC

CIRCLE 194 ON READER CARD

One imponderable aspect of automation is just what effect it will have on the labor force.

AT THE MERCY OF MACHINES

by Englebert Kirchner

"Office automation will enable American business to create 20 million new jobs before the end of the century." That's the prediction of Paul Strassman, vice president of Xerox's Information Products Division.

"There are 20 million office workers in this country whose jobs will be put at risk in one way or another by office automation." So says Karen Nussbaum, president of 9 To 5 National Association of Working Women and a local executive of the Service Employees Union.

Neither statement can be dismissed out of hand. A very plausible case can be advanced that automation will make office work both more productive and more satisfying for the individual worker. There are equally cogent reasons for believing that it threatens bitter industrial and social conflict.

Interestingly, both those who emphasize the promise of office automation and those who stress the threat are in agreement on two points. One is that automation will change the way work is done in the office more radically and extensively than it has ever been changed before. The other point of agreement is that in the U.S., neither business nor our society at large is paying enough attention to this prospect, the problems it poses, and the opportunities it offers.

There has been some noticeable stirring of interest in the subject lately, marked by a spate of newspaper articles and by a day's testimony before a Congressional subcommittee. To people like Strassman and Nussbaum, though, that is still a far cry from thinking hard, as they believe we must, about what office automation can do for us or might do to us.

Of course, workers in offices are not the only ones whose lives are being changed by automation. The effects of automation on other work environments, though, seem much easier to predict, and it is also easier to feel confident in these cases that we know how to cope with the changes that will occur.

Robotics, widely considered the quintessence of the futuristic, actually is something new only in the technological sense. Economically, it is no more than the most recent phase of a continuing process that dates back to the very beginning of the industrial revolution: the substitution of machine labor for human labor in the performance of specific, discrete tasks. Whether the machine is controlled mechanically, electromechanically, or electronically is economically irrelevant. For all its microcircuitry, a robot is first cousin to the sewing machine and the farm combine.

Robotization obviously will eliminate some jobs, causing what labor economists call "temporary dislocations" in the labor force. Such dislocations can be extremely damaging to workers and businesses alike, but there also are ways of keeping the damage within acceptable limits. By way of evidence, there is the recent history of the printing trade.

When highly automated printing and typesetting machinery first appeared on the scene, unions and management almost reflexively locked horns. The upshot was a rash of bitter, often long-drawn-out strikes, which helped to kill off a significant number of major newspapers. Eventually, the unions recognized that featherbedding was not the answer to their problem, and management discovered the advantages of work force reduction by attrition and by attractive severance pay and pension offers. In the end, automated machinery was accepted as a fact of life by everyone in the printing industry. Against the demise of those metropolitan newspapers can be set the appearance of a considerably larger number of successful suburban and neighborhood papers, most of which owe their existence in large part to the favorable economics of printing automation.

The effects of automation on white collar work outside the office are comparably straightforward and predictable. The classic instance probably is the supermarket scanner, which makes it unnecessary to put a price label on every item on the shelves and eliminates much of the human labor involved in inventory control, checkout, and the like. This kind of automation, too, is putting some people out of work—but not in the supermarket chains making the most extenive use of

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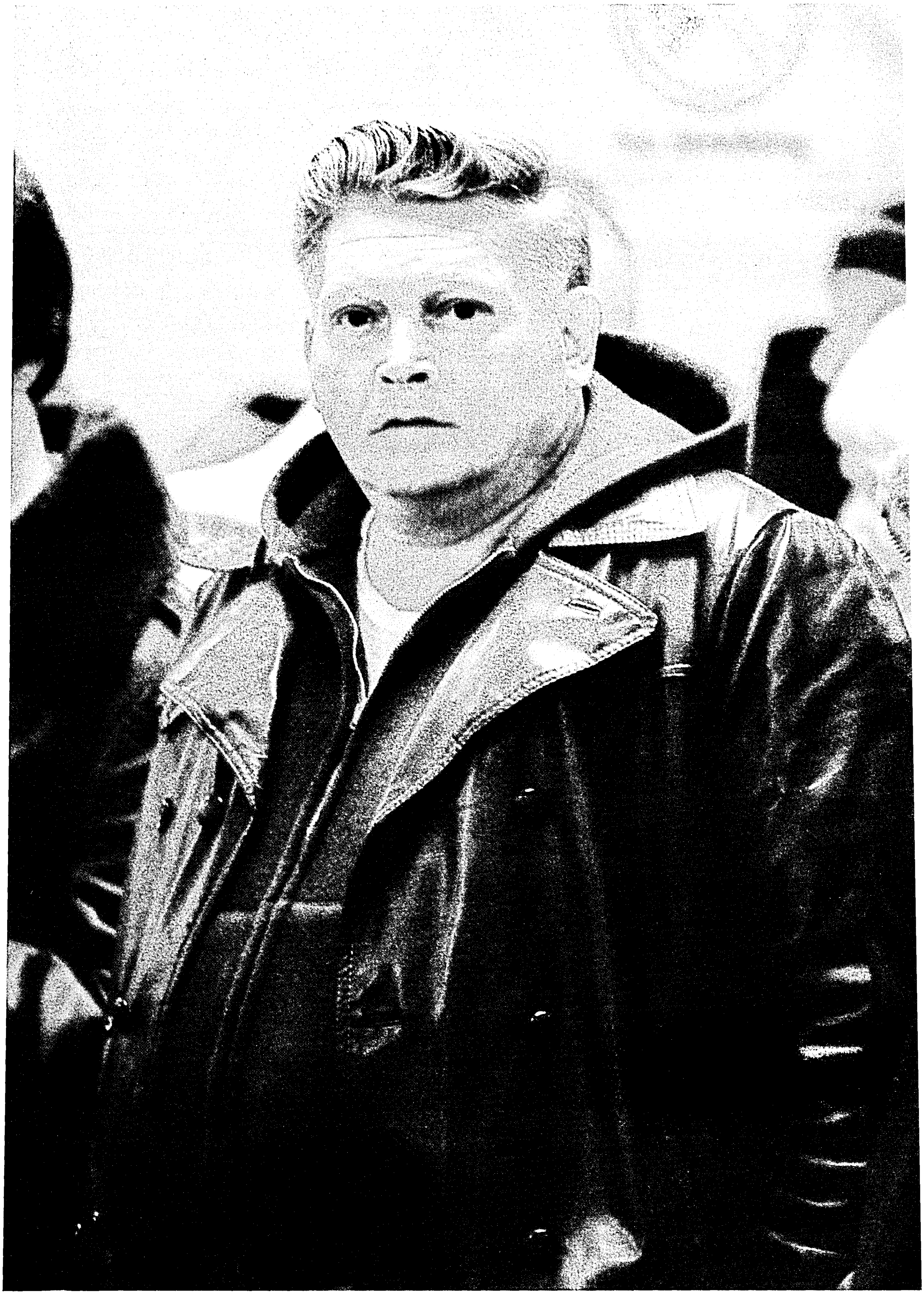

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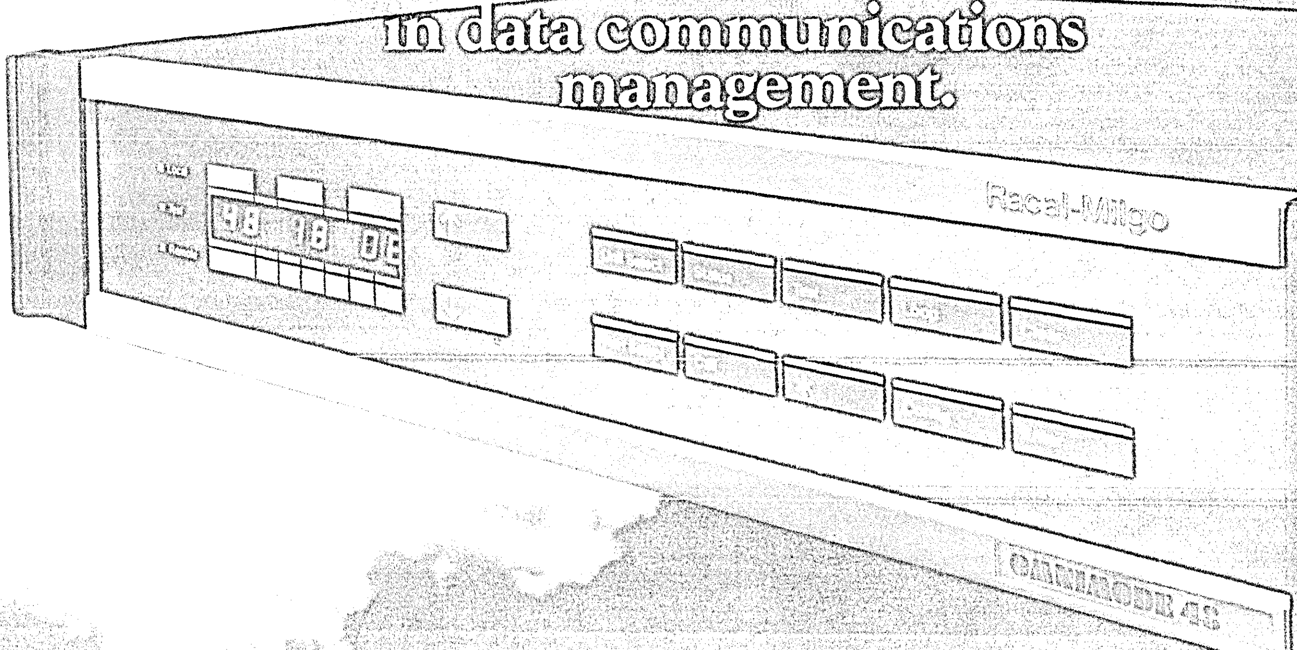

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Automation will change the way work is done in the office radically and extensively.

scanning, according to a recent study by the federal Department of Labor. On the contrary, these chains have been growing and are employing more clerical workers than ever before. As they have expanded, though, they have forced some smaller supermarkets and grocery stores out of business. This is where jobs are being lost.

That is a real cost, but it is a cost that Americans clearly consider acceptable. That some small businesses are being displaced by bigger and more automated ones is not the kind of spark that sets off intense conflict in our society.

If these effects of automation can be predicted, why are the implications of office automation so much harder to sort out? For one thing, because the numbers are so much larger. According to the latest estimates, something like 10 million office employees in the United States already work with video terminals, and this number is bound to keep rising sharply, considering the 40% growth rate that the office automation industry is expected to sustain into the mid-'80s. This is automation on a scale that neither robotics nor retail-level devices like the supermarket scanner will soon, if ever, attain.

Another, more basic cause of uncertainty is that no one yet knows what the chief justification for office automation will turn out to be: cutting costs or promoting growth.

These two objectives are not mutually exclusive, but even so, they are profoundly different in their implications. Not the least of the differences is that cost-cutting tends to be a short-term objective, while expansion in the nature of things must be a longer-term goal.

TWO OPPOSING SCENARIOS

Realizing that two very different, though equally natural, answers can be given to the first question of all—"Why office automation?"—helps one to understand why two completely contradictory scenarios, one optimistic and the other pessimistic, are advanced by those who have thought most intensively about the effects of office automation. It also helps one to understand why it is so difficult, at this fairly early stage, to decide firmly which scenario is the more believable.

The conflict between the two scenarios shows up most clearly in what they predict will happen to the traditional hierarchical structure of the office—the pyramid that, from a broad base made up of typists, file clerks, and other low-level clerical workers, tapers up to the boardroom at the top.

According to the pro-automation scenario, the bottom of the pyramid will be sliced right off. Fully routinized office jobs, like filing and keypunching and other essentially repetitive chores, will gradually be taken over by automated machinery. At the same time, there will be a massive expansion at the slightly higher level of technical and professional employees. Thus the traditional pyramid will be transformed into a squatter, somewhat bulbous figure strongly reminiscent of the onion-shaped steeples of many East European churches.

Or, in the numbers of a recent projection by Strassman: while the total U.S. labor force is expected to increase by 20% in the course of the '80s, technical and professional jobs will grow by 30%. Actually, most of this growth is projected for jobs that might best be described as "quasi-professional" (though that's not a term often used by labor statisticians). These jobs will require a measure of specialized skill, but a skill primarily acquired on the job rather than through extensive formal training.

Whatever their level of formal education, all members of that greatly expanded technical and professional category foreseen by the automation enthusiasts will use advanced information processing machinery in their work, partly for such nuisance tasks as digging information out of the files but mostly for intensive direct interaction with coworkers as well as with customers and other contacts outside the organization. As these optimists see it, automation will literally fulfill that long-standing promise of the futurologists: office work will become more satisfying because there will be less drudgery and more human interaction.

To get to this occupational pot of gold, the optimists start from observations about the nature of office work and of productivity gains that contradict a good deal of conventional wisdom but are nevertheless highly persuasive. Most office work, they note, is relatively unstructured. You can write a brief and yet informative job description for riveters on an assembly line (they rivet), supermarket checkers (they ring up sales, collect money, and make change), or the lowest-level office workers like file clerks (they file) or pool typists (they type). At any higher level of office work, precise job descriptions become very difficult or impossible to write except at stupifying length. That's why expressions like "in charge of" or "responsible for" start creeping in. It's because roughly 75% of all office work is quite weakly structured that white collar jobs are endlessly reshaped and reshuffled to fit the people hired for them.

TWO KINDS DIFFER MANY WAYS

In office work, therefore, "effectiveness" gains in productivity are much more important than "efficiency" gains, Xerox's Strassman explains. The first of a good many differences between these two kinds of productivity is that efficiency can be improved either by holding output constant and reducing input (measured in hours of work) or by increasing the output for a given input. Thus the result can be either expansion (if output is increased) or contraction (if input is reduced).

Effectiveness, on the other hand, is gained only if output is increased—providing, of course, that there is not matching rise in input. Any manufacturer, for example, can improve efficiency productivity by eliminating all overtime while keeping up his production level. But if he wants to improve his effectiveness productivity, he must, without letting his labor costs go up too much, make more of the products he is already selling or add to his product line or switch to products on which he can make a higher profit.

It is obvious that efficiency productivity can remain a purely internal affair (if it involves input reduction only), while effectiveness productivity must be market-linked. Neither additional output nor new products will do any good if there is no market for them.

Finally, the two kinds of productivity differ in the way they fit various jobs and in the way they can be measured. Efficiency gains are relevant to individual jobs only if these are highly structured, Strassman contends. Riveters are more efficient if they place rivets faster and file clerks if they file faster; the productivity gains are readily measured by counting rivets or pieces of paper.

Most office jobs, being weakly structured, cannot be linked to productivity in this straightforward and conventional fashion. The notorious difficulties of pinning down exactly what the employee does in these jobs and of unambiguously distinguishing his contribution from that of other white collar workers makes it equally difficult to specify, in any meaningful sense, what is to count as an efficiency gain in terms of individual jobs and how any such gain is to be measured. The welter of intangibles is just too profuse and dense.

For effectiveness gains, elusive criteria of individual productivity are not problematic, for they don't apply in the first place. As the crucial feature of such gains is a rise in salable output, they are inherently the result of collective effort—the collaborative achievement of the entire organization, which can only be measured on a collective basis.

Highly interactive collaboration, Strassman points out, is precisely the characteristic mode of operation in office work at all but its lowest levels. It follows that the big payoff from office automation will be reaped only if the new machinery is used primarily to promote effectiveness productivity, which is a fancy way of saying it must be used to promote expansion into new markets.

For all its microcircuitry, a robot is first cousin to the sewing machine and the farm combine.

The demand is there, he asserts, for much higher levels of output from those sectors of the service industries that rely most heavily on automatic information processing. Given the data-handling capabilities of full-scale automation, opportunities for innovation and expansion abound in fields like health and education, entertainment, financial, trade, and other business services—enough opportunities to produce those 20 million additional white collar jobs.

The catch is that this forecast and others like it are based on assumptions about the American economy and about American management that skeptics will find all too easy to challenge. The biggest assumption is that a decade of stagnation has not set the economy irreversibly on a course toward what MIT economist Lester Thurow has tagged the "zero-sum society," in which no sector or group can gain economically without a corresponding loss being inflicted on some other sector or group. On the contrary, people like Strassman staunchly assert, sooner rather than later the economy, led by the service sector, will reenter a period of growth comparable to that of the '50s or '60s.

That's based on the further assumption that management will have the imagination to recognize the new business opportunities in the era of office automation and will exhibit the ingenuity to make the most of them. On that score, Strassman readily admits, it is impossible not to have doubts. There is altogether too much evidence that management has become committed to an essentially defensive style and is obsessively preoccupied with annual or even quarterly financial results.

It seems questionable, too, if top management appreciates the importance of another assumption behind the optimistic scenario: that the organization and style of office work will have to change as drastically as will the machines in the office. For people like Strassman are not indulging in rhetoric when they say that the expansion they foresee will be the result of "creative and organic" group effort. They deeply believe that the truly effective automated office will have to operate in a distinctly informal, freewheeling fashion that gives the individual employee more autonomy and elbow room than is compatible with the rigid lines and layers of authority of the traditional office hierarchy. This new style of operation, closely akin to that of the small entrepreneurial firm, will demand a new style of managerial control, they grant, that many top executives will fiercely resist. But genuine success in large-scale automation is not to be had at any cheaper price.

THEY JUST DON'T BELIEVE IT

Most of the people who are apprehensive about the effects of office automation acknowledge that, in principle, it can make white collar work more productive as well as more satisfying. Nor are they likely to deny that under the most favorable circumstances the optimists' scenario could come true.

In their view, economic pressures and traditional management attitudes will combine to make cost-cutting rather than growth promotion the decisive, motivating force in the application of office automation. As a result, the traditional office pyramid will be pinched in at the waist: the jobs primarily slated for elimination are clerical supervisors and other skilled clerical workers.

In geometric terms, the outcome predicted by the pessimistic scenario is a discontinuous figure: a shortened and narrowed pyr-

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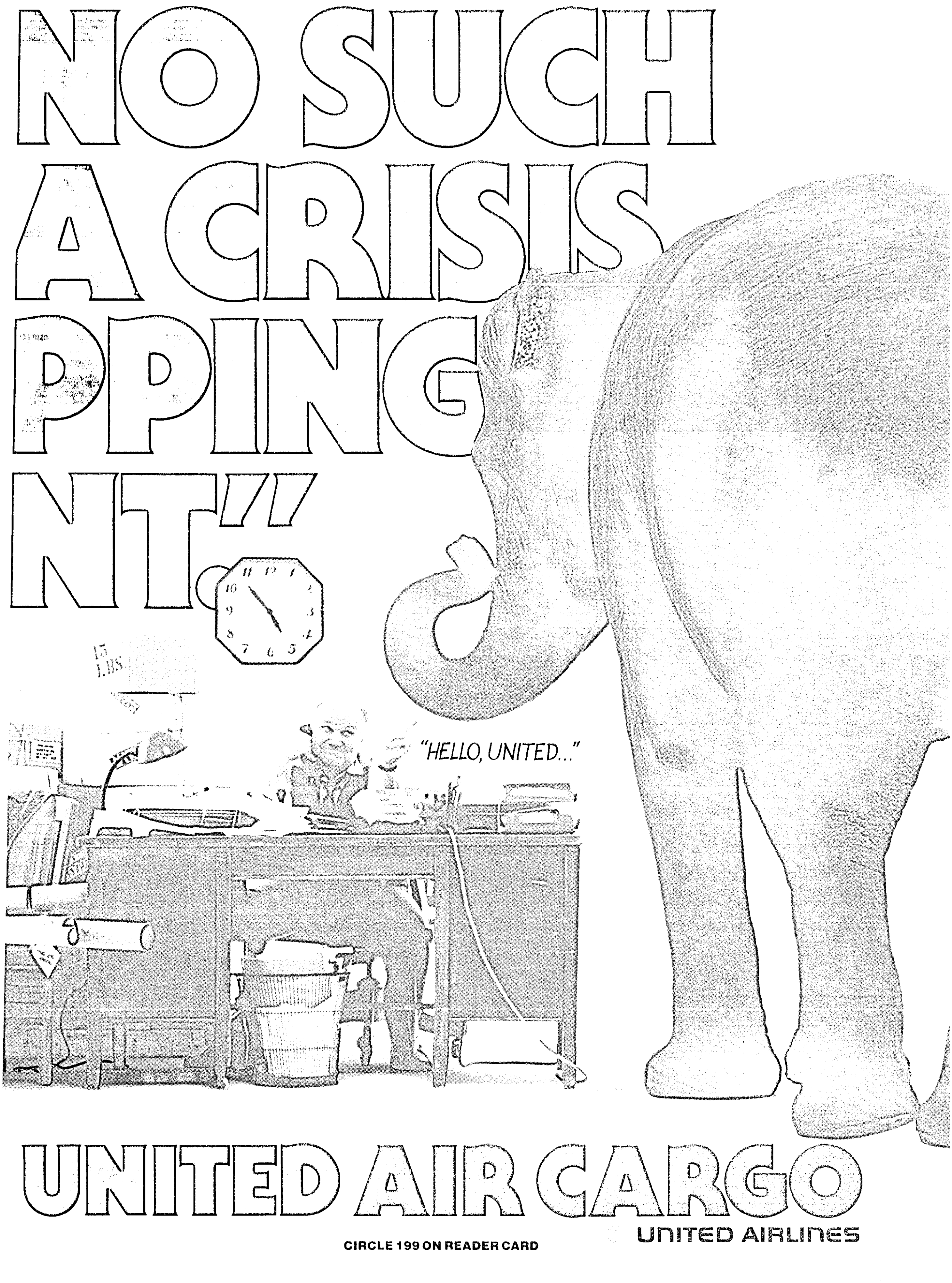
ANYTHING GOES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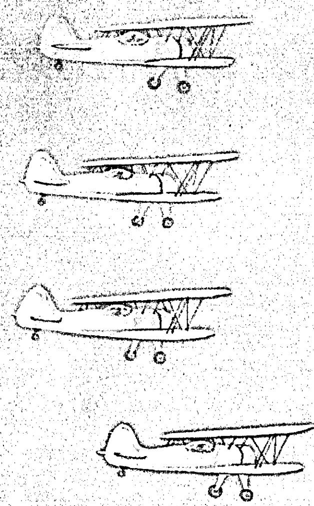
1200 bps FDX

1200 bps FDX

0-300 bps FDX



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Two Racal-Vadic innovations have made this quadruple modem possible. First: Automatic Adaptive Equalization which allows the modem receiver to change its filtering under varying telephone line conditions. Second: A built-in general purpose 16-bit microprocessor to perform the analog signal-processing functions of all four modems.

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Packaging is important, too, Ma. Racal-Vadic's VA1681 chassis mounts in a standard 19-inch rack and can hold up to eight quad modems — and as many as 48 modems will fit into a 7-foot-tall cabinet for use at central computer sites. A single VA4400 can be housed in a compact stand-alone cabinet for remote-terminal use.

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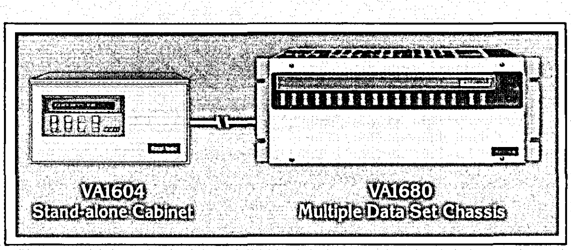
The VA4400 is truly a modem for all reasons, Ma. Better write or phone today for full details.



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RACAL

CIRCLE 200 ON READER CARD

In the pro-automation scenario, the bottom of the pyramid will be sliced right off.

amid atop a broader base of routine drudgery more soul-destroying than ever before. At the higher skill levels, automation indeed will make office work more satisfying, but at the bottom "the office of the future means little more than a re-creation of the factory of the past," as Karen Nussbaum's 9 To 5 group has put it. Low-level clerical work will be more rigidly and extensively compartmentalized, compelling each worker to repeat the same sequence of routine chores all day long. As control and monitoring functions are automated, workers will become veritable extensions of the machinery, which will dictate the pace at which they must perform. The continuous and varied human contact characteristic of conventional office work will become a thing of the past, and so will the chance of advancement to supervisory positions and higher skill levels.

As evidence, critics like Nussbaum can point to some large companies that have in fact taken this kind of assembly line approach in automating routine clerical work. There is also some evidence to back up their claim that low-level clerical employees are not getting much of a share, if any, of the financial rewards of automation. In 1979, full-time VDT operators averaged only $7 a week more than typists; in banking and insurance, both among the most computer-intensive industries, clerical wage levels fell short of national averages by from 8% to 19%.

The authors of the pessimistic scenario tend to see the clerical work force as doubly helpless because most of it lacks strong unions to protect its interests. Many of them, consequently, believe that only action by the federal government can keep routine office work from being turned into assembly-line operation. The interventions they have suggested range all the way from regulations prescribing frequent rest breaks for VDT operators (at least in the government's own offices to start with) to legislation that would guarantee clerical workers a voice in decisions about the introduction of new technology.

Such visions of industrial democracy almost certainly can be set aside as scarcely realistic, but health regulations for office work seem more clearly within the realm of possibility. Nor is it inconceivable that, if office automation leaves clerical employees feeling worse off, they will overcome their traditional reluctance to join a union.

The prospects for significant action on behalf of clerical employees either through legislation or by unions are the harder to assess because of yet another imponderable aspect of office automation: what follows from the fact that four out of every five clerical workers in the country are female? Does that make it more or less likely that office routines will become jobs for low-caste workers permanently set apart from the rest of the white collar labor force?

Is that where the biggest question mark belongs? Or does it apply to the pessimists' extrapolation from what is still very limited evidence (as it could not otherwise be this early in the age of office automation)? Or to the optimists' confident assumption that the economy will rebound and that top management will not flub the challenge of office automation?

We can just let the answers to such questions creep up on us. Except that seems bound to lead to painful surprises at all levels of the pyramid made up by the country's 51 million white collar workers. ❋

Englebert Kirchner is a New York-based freelance writer and editorial consultant.

In the computer battle, lawyers fight with Latin phrases and dp persons retaliate with jargon.

THE LAW AND DP: A CLASH OF EGOS

by Thomas K. Christo

For some years now there has been a proliferation of something called "computer law," and with it, "computer lawyers." There are volumes of books, periodicals, learned treatises, essays, speeches, courses, seminars, articles, and any other manner of written and spoken pronouncement on the subject (to which this meager article will be yet another addition). I will here take a rather schizophrenic approach and have the temerity to suggest that there is no such thing as computer law (nor can there be). There is, and will always be, only the Law. The entire question of whether or not there should exist some specialized field of law to deal with data processing is one that is mostly the result of the ambition, egocentricity, and self-impressed attitudes of those afflicted with training in either of those professions. I hope to chronicle how this could be so and suggest ways to cure it.

The first thing we do, let's kill all the lawyers.
Shakespeare, *King Henry VI*, Act IV

Have you ever tried to speak with a lawyer? It's a very interesting experience. Many can turn a simple conversation (about the weather, their girl friend, or boy friend, a sportscast) into a labyrinthian multisyllabic exposition worthy of only the most esoteric linguistic scholar. (See, I just did it myself.) What happens, then, when lawyers or judges (glorified lawyers) are confronted with data processing jargon and acronyms? One esteemed judge's introduction to his scholarly appellate opinion on a computer case is illustrative: "This case is a paradigm of complex litigation, rivaling the complexity of the cybernetics era which from it arises [Henry Coffin, Chief Judge for the First Circuit Court of Appeals]." Before anyone goes faulting dpers for using terms like "interface" or "real-time," one well might go after judges and lawyers who use words like "paradigm." More so, since they've been at the business of communication (or attempted communication) a lot longer than this infant industry of ours.

In law school, students are trained, you see, through the memorization and regurgitation of centuries-old case decisions, statutes, and treatises. Through this three-year process, their cerebral faculties may easily become warped, and they become mere shadows of their former reasonable selves. Year after year, our law schools turn out cadres of bespectacled, three-piece-suited persons. They perceive their sole purpose in life to be the analogizing of any fact situation they encounter to previous case decisions learned or to be learned in the future. The lengths they will go to, and the attendant contortion of reasoning to get there, approach quasi-mystical levels akin to how many angels fit on the head of a pin.

For example, there is a doctrine in the law called the Parol Evidence Rule ("parol" is a fancy word for oral). It mandates that "no written agreement which is a complete expression between the parties be varied, altered or amended by parol (oral) evidence." In other words, if you've taken the time to negotiate and write down your agreement and sign it, you can't later say you agreed to something else. In data processing, of course, users often sign written agreements. They seldom have had any choice in the matter, however, and the agreements themselves are preprinted affairs presented by the vendors on a take it or leave it basis with a remarkable degree of similarity in terms from vendor to vendor (but more on that later). A controversy therefore inevitably arose when one aggrieved user who signed IBM's machine services agreement complained that there was an oral agreement to provide software from IBM's "free" collection of packages during its bundled era in the late 1960s.

IBM lawyers argued that since the parties had signed a written agreement for the lease of computers, the Parol Evidence Rule would bar any assertion of an oral agreement. The user's lawyer argued that the written agreement was only for something called hardware while the oral agreement was for software. Since software was a separate and distinct subject, the argument went, a written agreement for hardware should in no way be

PHOTOGRAPH BY WHITNEY LANE/THE IMAGE BANK

Attempting to repossess a software system is similar to trying to repossess a song or thought.

deemed to preclude such a separate oral agreement. Sounds simple, doesn't it? That single question occupied the trial judge and several witnesses and attorneys for over two weeks of hearings and a voluminous number of pages of case citations and legal argument. After all, data processing is data processing, and just because a written agreement doesn't mention a particular component, it doesn't mean that it is not the entire agreement between the parties. Eventually, saner minds prevailed and the court agreed that software was indeed different from hardware (although not professing to know what the difference was). The written agreement did not bar assertion and proof of the oral one.

MOTION TO REPLEVY SOFTWARE

In another software-related case years later, the vendor's lawyers made a motion to "replevy" (a fancy word for repossess) a software system. The case law and the applicable statute stated that the only things that could be repossessed were "chattels" (a fancy word for tangible goods). The user owned all of the tangible goods (hardware, tapes, disks, etc.) on which the software was stored. Therefore, the user's lawyer argued, the vendor's motion was similar to trying to repossess a song or a thought, and simply could not be done. In an effort to dramatically make his point, the lawyer called to the stand the vendor's vice president at the hearing on the motion. He presented the vendor witness with a library tape clearly labeled "vendor XYZ system" and asked, "Is this what you want to repossess?" The vp replied, "Yes, this is what we want." With much flourish, the lawyer then proceeded to plug in a degausser and erase the tape. He then handed the same tape back to the witness and asked the same question: "Is this what you want to repossess?" The vp had no choice but to respond "No." The lawyer was feeling quite pleased with himself for having made the point that the system was not tangible, when the judge leaned over the bench and said to him: "Sir, have you just destroyed evidence?" The judge then proceeded to analogize a software system to "a chair" and ordered replevy of the system. It may have been interesting to see what would happen when a U.S. marshall was dispatched to go to the user's data processing shop and "replevy" the software system by sticking his hand into the cpu's circuitry and getting it without disturbing the circuits. The court of appeals, however, mercifully stayed the order (perhaps to relieve the marshall of being electrocuted when he tried it) and the case was eventually settled.

These two software anecdotes (culled from actual data processing cases) might well give any computer person gray hairs when he contemplates whether or not his field of endeavor does have equal protection under the law. But read on, and rest assured there are solutions (to be revealed to you in due time).

The Law is an ass, a idiot. . . .
Mr. Bumble in *Oliver Twist*,
by Charles Dickens

Scholars have observed that our "cybernetics era" is simply too complex for the traditional legal approaches. Thus, the need for computer law and computer lawyers. Even the senior judge of our land, Chief Justice Warren Berger of the U.S. Supreme Court, has stated that in his opinion many complex fact cases should not be tried before a jury; that our jury system was fashioned for a simpler age, and mere laymen should not be expected to grapple with complex situations in order to come to a decision. Setting aside for the moment the question of what makes Mr. Justice Berger think that judges have any corner on intellect, his and other comments give rise to an even more basic question: is the law and the existing legal system equipped to handle complex disputes? Since I have been giving it to the lawyers for some words now, it's time to take a swipe at the dpers in order to answer that query.

At every turn, noncomputer persons are bombarded with the marvelous current and prognosticated uses of the computer. It is said that computers keep track of what we owe and bill us, tell us how much we have in the bank to pay the bills, and even follow us through the legal process of being sued, convicted, and punished for nonpayment. The financial aspect of our lives is not the only one which is being supposedly invaded: computers keep track of what we watch on tv and then tell network bozos what to cancel and what to continue for programming; they monitor our early defense warning system, and tell even bigger bozos when to press that infamous red button; they keep track of what we ingest and what we are allergic to, as well as our entire health history, in the sometimes vain hope that some anesthesiologist or medical technician won't inadvertently kill us with the wrong drug or treatment while we are hospitalized; they are teaching our children, running our watches and clocks (some of which talk to us), telling us when to put gas in our cars, and even playing games with our family (PacMan is the hopscotch of the 21st century).

All of this is lumped into a phenomenon loosely described as the computer age or the computer revolution. It is generally accompanied by rosy or scary (depending upon your point of view) Orwellian-type predictions for future applications and uses of this wonderful new technology. It is little wonder then that many non-data processing persons have come to respect and fear the computer. It is respected as some sort of deity-like noncreature that is omniscient and all-powerful. It is feared as some sort of transistorized Frankenstein's monster that was created by man and can now no longer be controlled.

Obviously, therefore, lawyers and judges are somewhat apprehensive about their own and their field's ability to address data processing-related disputes. Just as lawyers have a tendency to retreat into Latin phrases and complex sentences and case precedent, data processing persons (whenever questioned or challenged) instinctively respond with jargon, acronyms, and a general air of superiority. Many a financial manager has walked away feeling stupid after asking a simple question of his data processing manager (like "why don't our accounts receivable figures balance?"). Of course, it is a lot easier to retreat behind a wall of jargon instead of answering a question simply and succinctly. Besides, it makes a person feel important to talk in foreign-sounding words that no one else understands. Beyond these defensive and ego-generated motivations, however, lies a much deeper cause for the problem.

GROWTH OF THE INDUSTRY

The growth of data processing as a separate definable industry within the last three decades is unprecedented in the financial history of the Western world. Billions of dollars have been spent (and earned) by vendors because the view exists that computers are all-knowing, all-powerful, and perfect in every way. If you've got a problem, the computer can solve it—if not today, wait 'til next year. New models will do the job.

There is no other product or industry held in such reverence. Any marketing attempt for most products based on such a claim to perfection and omniscience would inevitably be ridiculed and discounted. But if you start by describing your product in totally foreign lingo and treat anyone who is not within data processing as a simple idiot who doesn't understand our modern times, you might just be able to pull it off. This is precisely, I submit, what the technocracy has done: it has played on the insecurities of non-data processing persons to describe in flowery terms and acronyms what amount to rather simple forthright tools. They are products that can assist some people (but not all) and that are very definitely fallible (as all of us who have been in data processing painfully know).

Thus, the very sales hype that has been responsible for dp's success has come back to haunt it by creating a wealth of misimpressions about the field and its products. It has isolated dpers from the rest of society—including the law and lawyers who are supposed to protect that society. This isolation is

Dp and the law are ships that pass in the night, isolated from each other and from society.

compounded with that created by lawyers and judges who have the same desire to hype their own wares. The law has isolated itself from the rest of society with its own specialized phraseology and terminology. Data processing and the law are therefore two rather imposing ships passing in the night, isolated—by their own choice—from the rest of society and from each other. In order to help each other, all of us, lawyers and dpers alike, must get back to the basics.

Reason is the life of the law, nay, the common law itself is nothing else but reason. . . .
First Institute, Sir Edward Coke

The basics in the legal arena are known as the common law. Many lawyers would do well to heed Sir Coke's words, written in the early 17th century. At the heart of any legitimate legal dispute is a mining question: who got the gems and who got the shaft. When one inquires, as Chief Justice Berger did, whether some situations are simply too complex for a jury, he is really begging the question. By definition, if one can't reduce a dispute to simple terms and my ultimate mining question, then one simply doesn't have a legitimate dispute.

The recent trend toward arbitration is a prime example of this evasion (rather than meeting) of the problem. Arbitration is a procedure where persons who have signed up with the American Arbitration Association sit as fact finders on a dispute between two aggrieved parties. This procedure, the story goes, is a lot less cumbersome and formal than the legal system and can save a lot of time. In some situations it certainly is an expedient way to settle a dispute. In others, however, it has the effect of depriving all parties of any true justice. The arbitrators on a given dispute are typically chosen from a list of those deemed qualified in the factual background of that dispute. In other words, data processing professors, consultants, and lawyers are the arbitrators who sit on a computer matter. The dp-related parties therefore feel more comfortable speaking in their own jargon to those of their kind. This not only has the effect of perpetuating (rather than dispelling) the isolation from society which is our primary problem, but also deprives everyone of a fresh perspective and an ultimate answer to my mining question. We must remember that ours is a very young, very incestuous industry. The close-knit data processing community has sprung up overnight, doesn't communicate with anyone else, and is therefore full of biases, prejudices, and preconceived notions of how things operate.

If you, vendor or user, have any legitimate dispute, what you should really be looking for is a fair, unbiased determination of that dispute (without preconceptions or prejudices one way or the other). The jury system, derived from the common law, forces us to reduce all questions to simple, easily understood ones expressable in small-syllable words. If it can't be done, we should really question the correctness of our position in the first place. If a lawyer can't do that, then he should really question his competence (or the correctness of his client's position) in the first place.

Thus, it is not the law that is an ass or an idiot—just some judges, lawyers, and technocrats. Case precedent, although sometimes illustrative, is by no means controlling in all situations. Just because a given computer user or vendor lost a particular case doesn't mean another user or vendor should lose. What each past case represents is merely the parties' efforts to answer the mining question in their particular and unique fact pattern.

As schoolchildren become trained on computer theory and grow up to become lawyers, judges, and jurors, it will be much more difficult to pull the wool over their eyes, and they will be less susceptible to the data processing-generated clichés of today. Even now it is apparent that many data processing disputes have in fact successfully concluded in the courts. They have been concluded by lawyers and data processing persons with the foresight to press their point—and the ability to explain that point simply. Juries and even an occasional judge have somehow muddled through and made studious decisions affecting just about every facet of data processing. They are clearly still the exception, however, and not the rule.

Until education and consequent familiarity (which will breed contempt) catch up with data processing, we had better start talking to each other. Rather than making ourselves feel important by using esoteric language (whether we are lawyers or data processing persons), we should start communicating in the Queen's English (or the language of the day in whichever country we find ourselves).

Data processing people should take heart and realize that the basic law is there to address legitimate grievances. Lawyers, too, should take heart and realize that a computer is little more than a fancy can opener with a lot of buttons. When both of these groups receive their required revelations, they can then turn their attentions to giving the shaft back to the party who deserves it—and the common law will gladly afford them their opportunity. ✲

Thomas K. Christo is a trial lawyer, consultant, and lecturer in the field of computer law. He currently restricts his active practice and concentrates on writing and consultation to other attorneys throughout the world. He is based in North Hampton, N.H.

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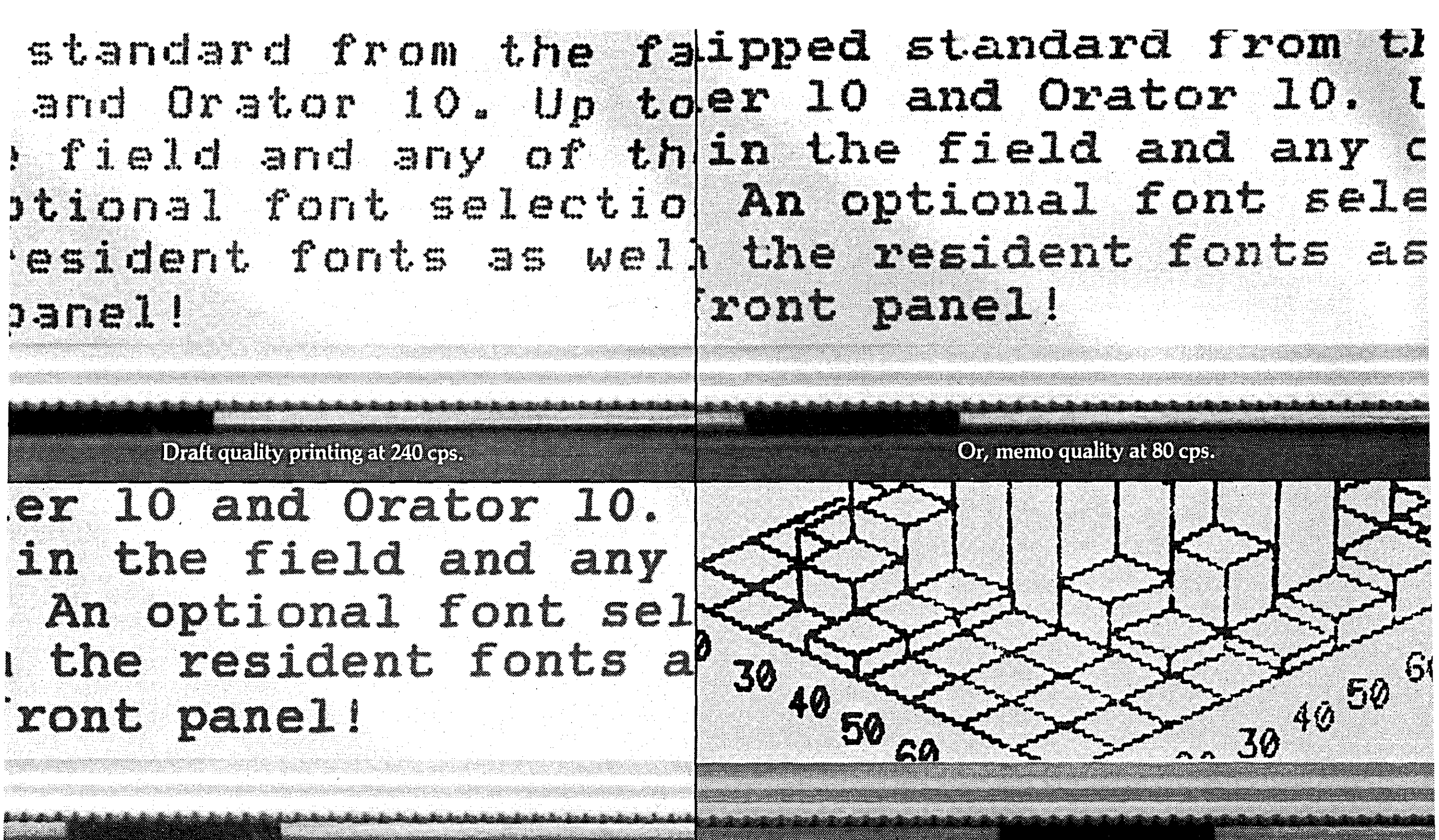

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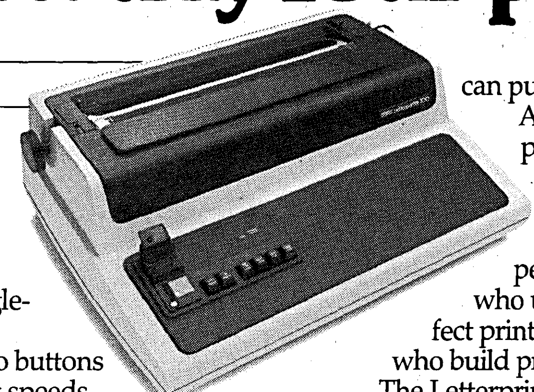

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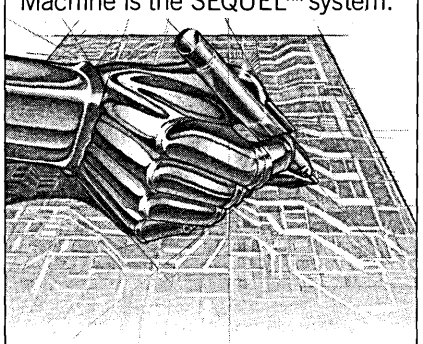

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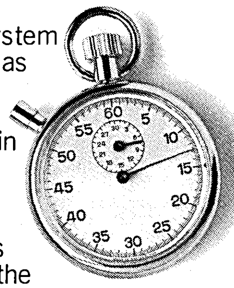

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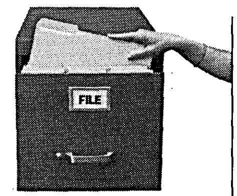

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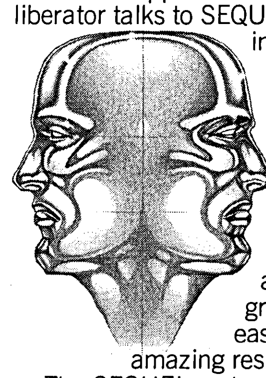

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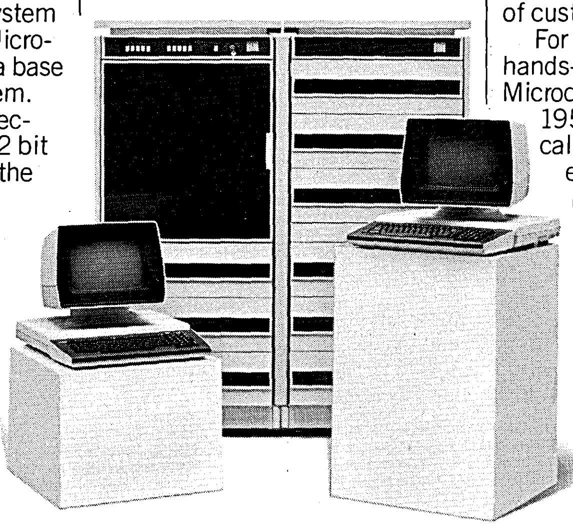

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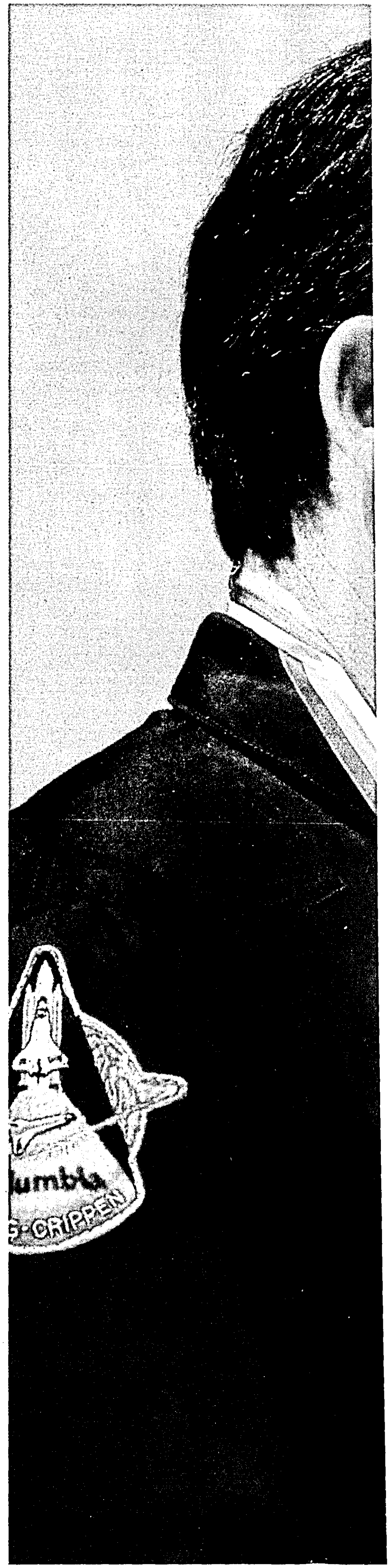
Control Data's chief challenges the industry to devise new policies for managing technology.



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KEEPING AMERICA FIRST

by William Norris

An awesome task confronts this country if it is to retain world technological leadership. Our once strong competitive position in technology has been steadily eroding as other countries have taken a number of steps to accelerate technological development and application. Broadly speaking, our competitors have expanded research and development, increased the number of trained scientific and technical personnel, reduced the cost of capital for industry, and fostered growth in targeted areas.

Clearly, the greatest progress in advancing and exploiting technology has been made by Japan in targeted industries where the Japanese government has promoted cooperation among industry members at the base technology level as a key ingredient for success. Also, tariff and nontariff barriers to outside entry have accorded preferential domestic market treatment to industry members.

Automobile, steel, and shipbuilding were the principal Japanese industries targeted for development in the generation after World War II. Today, microelectronics and computers have replaced them as the most highly subsidized industries. This approach is an ominous threat that has serious implications for virtually all modern industries because of the pervasive and rapidly growing application within them of microelectronics and computer technology products and services. In other words, superior microelectronics and computer technology provide the critical basis for competitive advantages in other industries. Beyond the threat to industry is the threat to our national security. The United States can ill afford to lag in semiconductor and computer technologies, which underpin the superiority of most of our weapons systems.

An adequate response to the challenges to our technological leadership requires myriad actions. Most can be grouped into these broad categories: federal foreign and domestic policies, actions by individual states, and private sector initiatives.

The multiplicity and interrelationship of needed actions require that a comprehensive industrial policy eventually be forged in this country, but there is no process or entity responsible for devising such a policy, nor is there a consensus that one is needed. At the same time, of course, actions are under way that are de facto elements of such a policy.

Due to the absence of an overall policy, however, only limited means are available to consider the trade-offs among the many interrelationships associated with any given action. Fortunately, a growing debate concerning the need for a policy *does* exist. If every affected sector of our society became involved and the plethora of relevant experience, both in this country and abroad, were drawn upon, I believe a consensus would emerge for a meaningful industrial policy.

What I see as an entity responsible for formulating U.S. industrial policy would not be a replication of the Japanese Ministry of International Trade and Industry. The American approach should be in keeping with our traditions, which avoid bureaucracy and rely upon the private sector to the fullest practicable extent.

One approach would be to appoint a commission operating under the aegis (staff

Unlike Japan, the U.S. should rely heavily on the private sector to manage technical cooperation.

support and funding—not administrative) of the White House. It would involve senior representatives from government, business, labor, and other sectors. It would conduct studies to provide the necessary background to formulate policy alternatives for consideration by the private sector and federal and state governments.

A considerable amount of time will be required to reach a consensus, however, and we must therefore move ahead on a parallel track with whatever actions are necessary to preserve our rapidly declining technological leadership.

PRIVATE SECTOR EFFORTS

By far the greatest and most rapid progress in responding to the challenge can be achieved by increasing our efficiency in developing and applying technology, especially the latter.

There is a propensity in our country to concentrate more on developing technology than applying it, because the task of creating knowledge is organizationally less complex and often less costly than using it to satisfy the needs of the marketplace. Hence, there are vast amounts of unused and underused technology in the laboratories of government, academia, and business.

The most striking evidence of the need to apply technology more effectively is provided by Japan, which has derived many of its important products from technologies generated in the U.S. and Europe.

A necessary step in achieving greater efficiency is a vast increase in technological cooperation. This must include cooperation within industries, between large and small companies, and among industries, universities, and government.

Industry cooperation. In the U.S., industry is suffering from enormous needless duplication of research and development. The use of basic knowledge by one party should never preclude its use by another. For every corporation to rediscover what others have already learned represents waste of the most pernicious sort, not only to each of them—but also to society. Many different applications of the same base technology can be derived to promote effective competition in a broad spectrum of final product and service markets.

Companies in high-technology industries have practiced a variety of forms of cooperation over the years. Cross-licensing of patents is common. Joint ventures, mainly short-lived, among two or three companies have proved to be useful. Technology exchange agreements, some between firms participating in the same market, some between supplier and customer (as in the case of semiconductor and computer firms) are not unusual. Trade associations and technical conferences are still other forms of cooperation.

But none of these adequately addresses the dual needs for large-scale efforts and for the minimization of unwarranted duplication in the use of technical resources.

Fortunately, these needs are beginning to be recognized. The Semiconductor Industry Association has created the Semiconductor Research Cooperative. A second effort, now being planned, has the objective of establishing the Microelectronics and Computer Technology Corporation (MCC), which will be owned, operated, and managed by a significant number of companies in the U.S. computer and semiconductor industries. MCC represents a cooperative effort to develop a broad base of fundamental technologies for use by individual members who will add their own value and compete against each other in individually chosen markets with products and services of individual conception and design.

Cooperation between large and small business. To fully appreciate the enormous potential of greatly increased cooperation between large and small business, it is necessary to review a few relevant factors.

First, in addition to the vast amounts of underutilized technology in their laboratories, large companies have assets in the form of underemployed management and professional personnel.

Second, small business is uniquely important in our society. It was the foundation on which America was built and achieved greatness. It is still the primary means for realizing individual initiative. And it provides more products, services, and jobs relative to our GNP than does small business in any other country.

Third, studies show that small companies produce 24 times more innovations per dollar than larger ones.

Fourth, we have a well-developed securities market where equity capital can be raised by small enterpreneurs. It is unique to America.

By making available its underused technology and by offering its professional and management assistance to a small company, a large company can realize additional income from past investment. Also, through equity investments in and R&D contracts with small companies, large companies can more economically gain access to new products and markets. Three years ago, my company started making equity investments in small companies, many of which are now developing products and services that will be marketed by Control Data.

COMPANIES MUST WORK TOGETHER

This type of program accentuates the strongest attributes of both large and small enterprises. The small company, which is inherently more creative and flexible and has lower overhead, can develop new products and services sooner for less, whereas a large company, with its vast resources, can excel in marketing.

The potential of cooperation between large and small business can hardly be overemphasized. Since this opportunity is not nearly as readily available to other countries, we must capitalize on it, just as the Japanese capitalize on the unique properties of their culture.

University-industry cooperation. An essential underpinning for expanded industrial cooperation is a closer linkage between industry and academia to more efficiently create and transfer new knowledge and to better train more people.

Critical U.S. shortages of scientific and technical personnel and lagging support for research have been well documented. The need for much greater cooperation between industry and universities is recognized. This support must include increased financial aid for research and a sharing of facilities and skilled personnel. In addition, it must include the use of computer technology in the learning process to improve its efficiency and quality.

Federal domestic policies. In the area of federal policy, recent changes in tax policy to encourage increased research and experimentation and capital investment are steps in the right direction.

The new Small Business Innovation Act requiring federal agencies with annual R&D budgets exceeding $100 million to allocate 1.25% of their annual procurement budgets to small business will prove to be highly beneficial in expanding technological innovation in our country.

A number of additional federal actions should also be taken:

- High technology working group. In the absence of an industrial policy, a work group should be established under the aegis of the Department of Commerce to prepare a list of high technologies, existing and potential, that are critical to the U.S. competitive position, along with recommendations to accelerate progress or fill any gaps. Several million dollars, most of it furnished by industry, have been spent in this country developing a list of militarily critical technologies—so there is a precedent.
- Foster technological cooperation. Another action would be for the highest levels of government, especially the President, to advocate widespread technological cooperation—by both articulating the need and describing its merits.
- Antitrust. A third and related action would be legislation to amend our archaic antitrust laws. One of the most important would be a change in tenor from current legislation,

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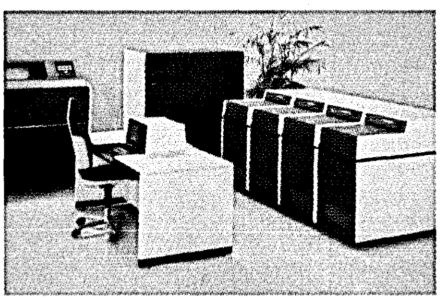

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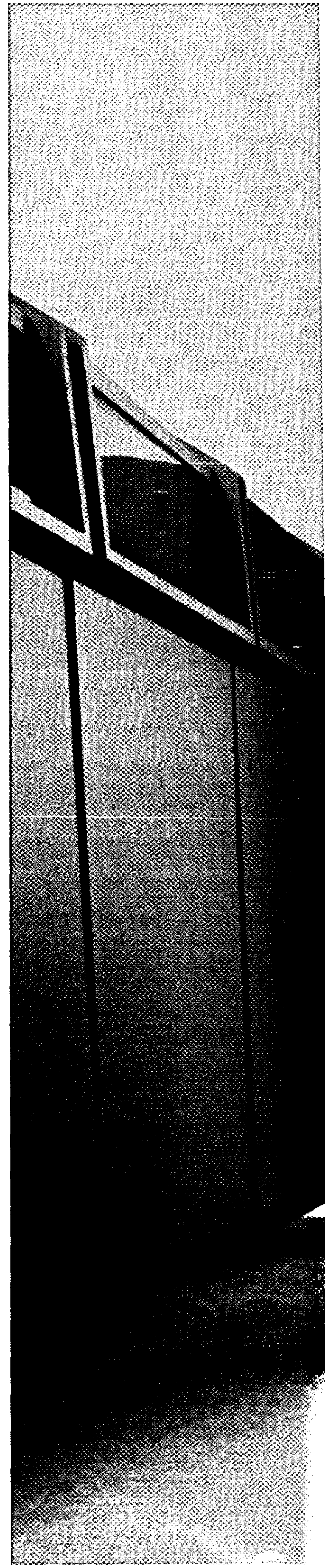

Small businesses represent a strong suit in America's technological hand.

which sometimes permits technological cooperation, to legislation that encourages it. Antitrust laws and Justice Department guidelines on compliance currently require lengthy and complex analyses—and even then, in virtually every situation, legal opinions have varying degrees of ambiguity. This tends to discourage cooperation.

The proposed Joint Research and Development Facilities Act of 1982 and other similar bills pending in Congress recognize this by providing procedures for advance certification of an R&D cooperative effort that will assure that the government will not take action against it. They also provide varying degrees of protection from private-party treble-damage lawsuits, another major deterrent to cooperation. Although an important step in the right direction, these proposed legislative actions don't go far enough, mainly because the certification process is burdensome and the outcome uncertain. These flaws, however, can be corrected.

- Scientific and technical information. Another action relates to the gathering, evaluating, and distributing of scientific and technical information (STI) generated in federal government laboratories. Federal government support in this area is decreasing. At the same time, the present system of disseminating technology is terribly inefficient. It isn't possible, in a short paper, to outline a complete program for improvement. The first step, however, is to place the responsibility for assembling and disseminating STI with those responsible for conducting the R&D. The Stevenson-Wydler Act passed late in 1980 does this, but it has yet to be implemented despite the urgent need.

State Policies. States should play a much larger role in the development and application of technology. For years, many states have been financing agricultural research. More recently, a number have been supporting research in selected fields such as health sciences, bioengineering, and microelectronics.

Every state should now encourage expanded technological effort by establishing university-industry research projects, tax credits to stimulate large business to make its underutilized technology available to small business, and appropriation for funding first and second phase research grants to individual entrepreneurs and small companies in amounts ranging from $25,000 to $100,000.

The second phase grants would be matched by the private sector, and the entire program would be similar to the highly successful National Science Foundation Small Business Innovation Program.

Foreign policies. A badly needed foreign policy is one that promotes much greater technological cooperation between the United States government and governments of other countries. Areas for such cooperation include basic research in fusion energy, high energy physics, health, environmental protection, radioactive waste management, space and ocean science, and composite materials. The potential for creating research results for the use and benefit of all countries is very great.

Much more could be said about foreign policies—or any of the other issues mentioned—if not for space constraints. To summarize, however, the actions advocated in this essay, if implemented promptly, will greatly improve the process of mobilizing and utilizing our technology resources more effectively. And while those actions are under way, we can continue ascertaining whatever additional steps we must take to guarantee retention of our technological leadership.

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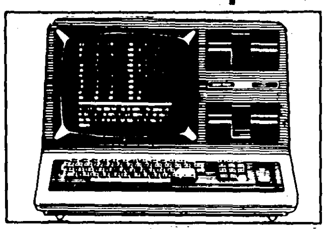

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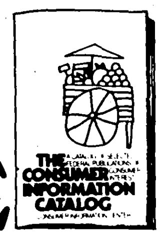

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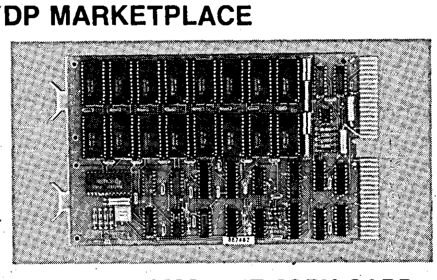

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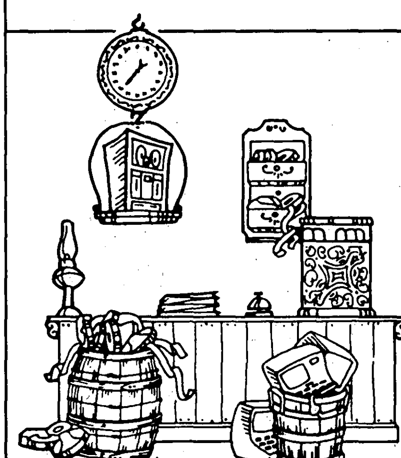

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For his pioneering contributions to geostationary communications satellites, Dr. Harold Rosen of Hughes has been given the prestigious Alexander Graham Bell Medal by the Institute of Electrical and Electronic Engineers. Rosen is credited with conceiving the first practical geostationary communications satellite, which orbits 22,300 miles high and appears to hover in the sky. A single satellite covers over a third of the globe. Early satellites orbited at low altitudes and would have required a large orbiting fleet and complicated tracking procedures if continuous communications were to be provided.

A complete 3-D microelectronic 32x32 array processor is significantly closer to being demonstrated now that Hughes scientists have fully interconnected a stack of two wafers. Each of the wafers has a 32x32 array of aluminum feedthroughs migrated through the silicon wafer, forming low resistance paths across the wafer. Micro-spring bridges made for each unit cell of the array connect one wafer to the other. Improvements in fabrication and assembly techniques led to a performance yield on bridge/feedthrough interconnections of better than 99%.

Scientists have tracked the ash plume from the Mexican volcano El Cinchon with the aid of a weather satellite. Daylight and infrared pictures from GOES-5 (Geostationary Operational Environmental Satellite) clearly showed the April 4 eruptions even from 22,300 miles in space. Subsequent images revealed the plume rising high into the stratosphere and across the Yucatan peninsula. The dust now rings the planet in a wide band. Because El Cinchon blew far more dust into the stratosphere than did Mount St. Helens in 1980, scientists are speculating on the volcano's long-term effects on world climate. GOES-5 was built by Hughes and is operated by the National Oceanic and Atmospheric Administration.

Through intimate teamwork between engineering and manufacturing functions and ever-increasing use of computers, electronics firms are boosting productivity even as their products grow more technically advanced. Computer-aided design and manufacturing routinely offer productivity improvements on the order of 4-to-1, and sometimes as high as 10-to-1. Furthermore, locating engineering and manufacturing together fosters the technical sophistication needed to design and build high-technology products. Hughes has stressed this philosophy in its five-year capital investment program by devoting nearly half of the total $1.5 billion for merging manufacturing and engineering. One new facility supports advanced electro-optical products. The complex, covering 1.75 million square feet, is one of the largest and most sophisticated structures of its kind.

Career growth opportunities exist at all levels at Hughes Support Systems for a variety of engineers qualified by degree or extensive work experience. They include systems engineers and software and hardware design engineers for major simulation and test equipment programs. Also, field engineering posts throughout the U.S. and the world offer travel, autonomy, and responsibility for the life cycle of Hughes electronics systems. Phone collect (213) 513-5235. Or send your resume to Professional Employment, Dept. SE, Hughes Aircraft Company, P.O. Box 9399, Long Beach, CA 90810-0463. Equal opportunity employer.

ADVERTISERS' INDEX

*OEM Demographic Edition

Personal privacy may be an inalienable right, but are we sure Big Brother isn't watching us?

PRIVACY: STILL THREATENED

by Robert Ellis Smith

It's doubtful that in 1957 the readers of DATAMATION expected the new computer magazine to devote many pages to social issues. The business of the magazine was computer management, programming, new applications, advances in hardware and software, and personnel changes. The only social issue you might have expected to read about in a computer magazine would have been the effect of automation on employment, a subject directly related to management.

Yet, in the past several years these pages have been filled with articles about social issues, most of them under the catchall rubric of privacy. Many readers whose jobs are devoted to the purely technical aspects of computing and many more whose jobs do not involve collecting information about people may wonder why a professional computer magazine devotes space to an issue that often seems far removed from computer sciences.

DATAMATION is not alone; most of the trade publications report frequently on developments in the privacy area. The National Computer Conference and other gatherings of the computer faithful always include a session or two on privacy and related matters. At this year's NCC in Houston there were more than half a dozen sessions on this topic.

Computer professionals have shown a healthy concern for the privacy issue since at least 1965, when the public was outraged by a proposal for a Federal Data Center—a databank of all the essential bits of information about each American citizen. Why is it that computer professionals showed such immediate concern? Did they know more than the general public about the potential for harm from computer-based systems?

Atomic scientists were late to voice social concern about nuclear warfare and nuclear energy development. Even today, there must be several trade journals in the field that do not report on the social aspects of nuclear fusion. Professionals in chemistry are not assaulted by environmental issues in their trade publications and at their annual meetings.

Is it that computer professionals tend to be more "liberal," more receptive to "progressive" concerns? Or is it that they see the privacy issue as an opportunity to apply their skills to solving problems while advancing in their field? Professionals in other fields may view social issues as threatening to their livelihood. The privacy issue seems to affect the computer industry in the opposite way. It has turned out to create countless opportunities in computer security, in "human based" systems, and in consumer-oriented applications. This particular social issue, unlike most, is good for business—at least the computer business.

Or is the computer profession involved in the privacy issue because the lay public had nowhere else to turn? Have computer types been able to control the public debate on this issue because they are the only ones with the essential knowledge?

Whatever the reasons, this issue called privacy has been thrust upon this profession and this industry in a way that is rare in American public life.

Although the response within the profession has varied, most of it has been favorable. Whenever computer professionals participate in the interdisciplinary groups that tackle the subject, they are in the forefront, warning of the dangers of unbridled computer development. The Department of Health, Education, and Welfare task force in 1973 and the Privacy Protection Study Commission in 1977 are examples. On the other hand, computer managers, as distinguished from programmers, manufacturers, and theoreticians, have responded the way managers often respond to social concerns: "It costs too much." "Nobody wants it." "We're no worse than anyone else." "We don't need laws; we need voluntary compliance."

One reason for the varied response is that privacy in the computer field includes several different concepts. One is computer

PHOTOGRAPH BY JOHN LEWIS STAGE/THE IMAGE BANK

Have dpers controlled the privacy debate because they are the only ones with the essential knowledge?

security. Many professionals make the mistake of thinking that privacy is synonymous with security. It is not, although security is, obviously, one important component of the total privacy issue. Because computer security is a finite subject, one with a bottom line, managers grasp it most easily. It is also a subject they must face whether or not the public is concerned about personal privacy. Systems must be secure in order to operate properly, in order to preserve a company's assets, and in order to provide accountability, in addition to protecting the confidentiality of personal information stored in them. Consequently, there has been lots of activity in the security field.

Most users have developed precautions for physical security and have conducted risk analyses to determine possible threats to the system and the costs of protecting against them. The National Bureau of Standards has developed an encryption code that is generally available.

Yet systems remain incredibly vulnerable to those who would rip off assets or alter data. At a meeting sponsored by the Department of Commerce in May, representatives of major banks, businesses, and government agencies simply admitted that their systems were not protected against unauthorized access. Their best bet, they said, was to hire and retain trustworthy employees. But there is nothing new about that idea, and the astounding masses of personal data, monetary assets, and trade secrets stored in computer systems demand solutions that are more complete. If the computer systems cannot be designed in such a way as to withstand most anticipated attacks, perhaps they should not be used for storing and transmitting things of such value.

And that brings us to another aspect of the privacy issue: computer crime. The profession wasted a good deal of time in the 1970s debating whether computers cause crime or people do. In the 1980s the response has been primarily legal. At least 14 states have amended their criminal codes to deter and punish crimes committed with or against computer devices. Participating states are Alaska, Arizona, California, Colorado, Florida, Georgia, Illinois, Michigan, Montana, North Carolina, New Mexico, Rhode Island, Utah, and Virginia. Federal and state prosecutors have begun to train investigative personnel in the intricacies of computers so that law enforcement can try to stay one step ahead of the computer criminals.

Still, frustrated clerks and high school students can penetrate systems with apparent ease. Computer systems, even in the 1980s, are designed and installed with the matter of unauthorized access raised as an afterthought. It's like building a skyscraper, then tearing out most of the interior because the architects and engineers forgot to include door locks and fire escapes.

FAIR PRACTICES CODE

Privacy in the context of data processing is more accurately referred to as fair information practices. The HEW task force in the early 1970s and an IBM Corp. special study issued at about the same time arrived at the identical conclusion: providing strict secrecy of personal information may not produce a result that makes sense for the consumer (the "data subject") or the organization (the "data custodian"). The individual might want certain information disclosed, especially if it were favorable information and the disclosure were in his or best interests. And the organization couldn't perform its function efficiently if it didn't use and disclose the information it collected. What HEW arrived at, in lieu of a strict rule of secrecy, was a code of "fair information practices," inspired by the code of fair labor practices in the 1930s. It was decided that fairness in handling personal information is more crucial than secrecy, even though it is more difficult to define.

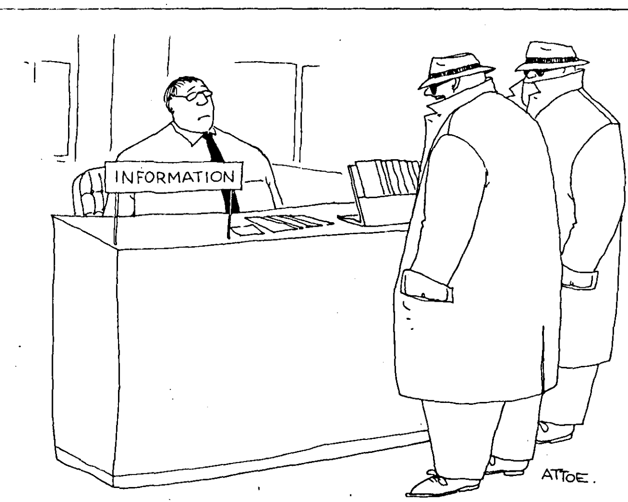
The code requires that the custodian take responsibility for timeliness, accuracy, and security of the information. It gives an individual the chance to learn about the information kept on him or her and to correct it as necessary. It also states that personal data may not be used for a purpose other than the one for which it was gathered, unless the individual grants his or her consent.

In a flurry of legislative activity that thrust the computer profession into the political arena, the code was included in hundreds of laws passed in the 1970s by Congress and the states. The Privacy Act of 1974 and counterparts in nine states obligate government agencies to follow the code; the same obligation was placed on universities and public schools. The credit-reporting industry and the criminal justice community are also covered, and in a few states insurance companies and health-care providers must abide by variations of the code.

These principles are a matter of law with regard to public and private databanks in most of Western Europe (Sweden, Norway, Denmark, West Germany, France, Austria, Iceland, and Luxembourg). Hungary and Israel have similar laws, and Great Britain is soon to follow. In order to do business in these countries, most major U.S. corporations have adopted the code voluntarily. Employees and customers of these companies remain mostly unaware that the companies have publicly committed themselves to disclosing personal information in their files to the individuals involved and permitting them to correct the information.

And so this aspect of privacy protection—fair information practices—has become bureaucratized in the 1980s, just as equal opportunity became bureaucratized in the 1970s. Each federal agency and many states have an FIP office or a privacy office, and there are reams of regulatory do's and don'ts. There are at least three publications that report only on privacy, and court cases under the Fair Credit Reporting Act and the Privacy Act are now voluminous enough to attract the eyes of ambitious attorneys.

The drawback of bureaucratization is that the issue is reduced to its minutiae and is taken for granted as long as there is paper compliance—like the boilerplate small print in a sales contract. This has happened with privacy. On the other hand, bureaucratization means that the issue has achieved a certain permanent recognition and that an aggrieved victim does have a recourse, if he can find it in the regulatory maze.



"You know too much."

CARTOON BY STEVE ATTOE

OTHER PRIVACY THREATS

Not all threats to privacy come from computers; we also worry about wiretaps, lie detectors, unreasonable searches and seizures, intrusive press coverage, television surveillance, identity cards, peeping Toms, and gossip. It's been interesting to see how professionals in the computer field have been drawn into these debates simply because of their professional interest in the databank aspects of privacy. This has been a healthy development both for the computer field and for the socially concerned types, who can use broader civil liberties involvement.

Upon closer examination, of course, each of these issues does involve computer applications. Wiretaps and polygraphs have been linked to the fruits of computer technology to make them more pervasive and more intrusive. The idea of plastic ID cards for all citizens is attractive to some people because computer technology would permit more efficient ways to keep tabs on the population.

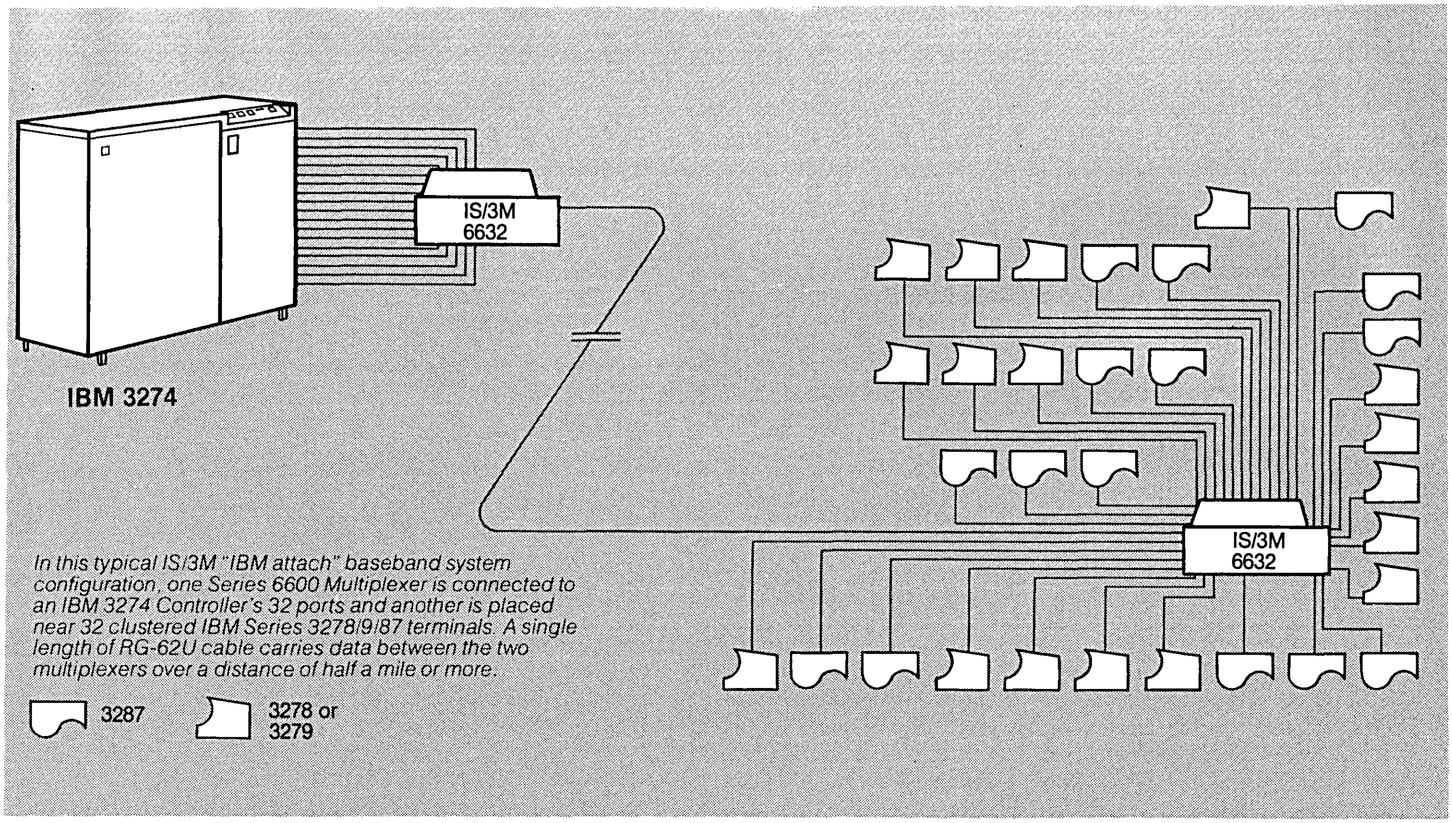
The principle of unreasonable searches comes into play with regard to computer matches, which compare one automated list with another to determine who is on both lists. The yield from manual comparisons would not make the effort worthwhile, but automated matches are cheap and rapid.

The federal government began the matches in the late 1970s with a computer run of welfare recipients against persons on the federal and District of Columbia payrolls. The idea was to catch persons on both lists because most gainfully employed people do not qualify for public assistance. This was done with great fanfare about detecting welfare cheats and saving millions of dollars. As it turned out, many of the people on both lists were properly there, either because they were earning less than the amount that would disqualify them for welfare payments or they had recently lost their jobs and joined the welfare rolls. Where there were truly accurate matches, the amount of money in question often made prosecution unwarranted (although the deterrent effect of the publicity was probably useful in cutting down on fraud).

Naturally there were embarrassing cases of computer error, in which persons were misidentified in the matches. People assume that data within a computer system is valid simply because it is in machine form. In Massachusetts they ran one month's payrolls against a second month's welfare rolls. They should not have been surprised that many people showed up on both lists, without any wrongdoing on their parts.

The Reagan Administration has gone into the computer match business with a vengeance as part of its war on waste and fraud. It is going after veterans with loans and other benefits, food stamp recipients, Medicare users, students with federal loans, housing beneficiaries, and others.

Computer professionals should be wary of this effort because they know the



In this typical IS/3M "IBM attach" baseband system configuration, one Series 6600 Multiplexer is connected to an IBM 3274 Controller's 32 ports and another is placed near 32 clustered IBM Series 3278/9/87 terminals. A single length of RG-62U cable carries data between the two multiplexers over a distance of half a mile or more.

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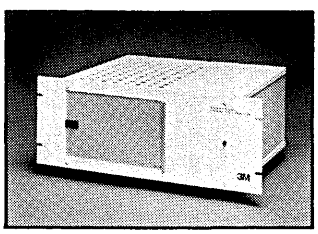

Series 6600 Multiplexer, available with 4, 8, or 32 input/output ports.

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CIRCLE 250 ON READER CARD

The right to privacy has historically been a response to threats from new technological applications.

vulnerabilities of the best-laid dp plans. They should also appreciate the unfairness of running these matches against only certain disadvantaged members of the society. And they should be alert to the civil liberties violation. The framers of the Bill of Rights outlawed a general search of a whole neighborhood even if the government had evidence of wrongdoing in the area. Cumbersome as the process was, the authors of the Fourth Amendment required the government to go to a magistrate, with specific information about criminal activity, to secure a warrant permitting searches of a specifically named premises for a specific purpose. Would they have been receptive to a general search of all welfare recipients' records, or all food stamp recipients' records, or all student loan borrowers simply because computers make the general search cheap and easy (and also allow it to be conducted without the victims' knowledge)?

It was fashionable in the 1970s to say that the old legal principles developed before the age of electronics were inadequate to govern the automated information society. But perhaps we are discovering in the 1980s that the old principles still apply. The right to privacy as a legal principle, after all, was conceived in a time when new technology—photography, telegraphy, high-speed printing, and sound reproduction—seemed to threaten the sanctity of the individual. In calling for recognition of a right to privacy in American law, Louis D. Brandeis gave as his rationale in 1890: "Numerous mechanical devices threaten to make good the prediction that 'what is whispered in the closet shall be proclaimed from the housetops.'

"Gossip is no longer the resource of the idle and of the vicious," he wrote, "but has become a trade, which is pursued with industry as well as effrontery." It's important to remember that the right to privacy, in its short 90-year history in the United States, has continually been a response to threats from new technological applications. In the revival of the privacy issue in the past two decades, it has been the computer business that has provided the mechanical device that makes possible the gossip trade on a large scale.

In that 90-year period, American courts have recognized a right to privacy in four sets of circumstances: when a person or organization intrudes upon another's solitude (computer-generated telephone solicitation to the home?), when there has been a public disclosure of embarrassing private facts (computer printouts of each employee's participation, or lack of it, in the annual United Way campaign?), publicity that places an individual in a false light in the eyes of the public (an outdated news story retrieved from an automated newspaper database or publication of misleading computer match results?), and the use by one person of another's name or likeness for the first person's profit (the renting of computer-generated mailing lists with sophisticated demographic information about individuals on the list?). The preelectronic principles perhaps have more relevance than we had realized.

CONSUMERS AND COMPUTERS The best way to look at privacy in today's context is not from the narrow perspective of computer security or computer crime or even fair information practices. Privacy is really a catchword for *consumerism* in computers, and the nature of that consumerism is changing as the nature of the computer applications change.

The focus in the 1970s was on massive databases and their potential threat to individual rights. Those databases are still with us, partly because the Reagan Administration seems to have an interest in expanding them in the federal government, but the emphasis in the early 1980s has shifted to concern about interactive communications systems that use both computing and communications technology. In these applications, the personal information is kept not for record-keeping purposes so much as to complete a transaction. And the information seems perpetually in transit, not stored in a memory somewhere. These interactive media operate in real time, affording the opportunity for Big Brother to alter a person's conduct as well as to learn about it after the fact. It's the difference between discovering from a person's credit card records that he traveled to Cleveland last month and discovering that he is now in Cleveland asking for authorization to charge a purchase. Given enough incentive, the snooper could attempt to alter or prevent the transaction.

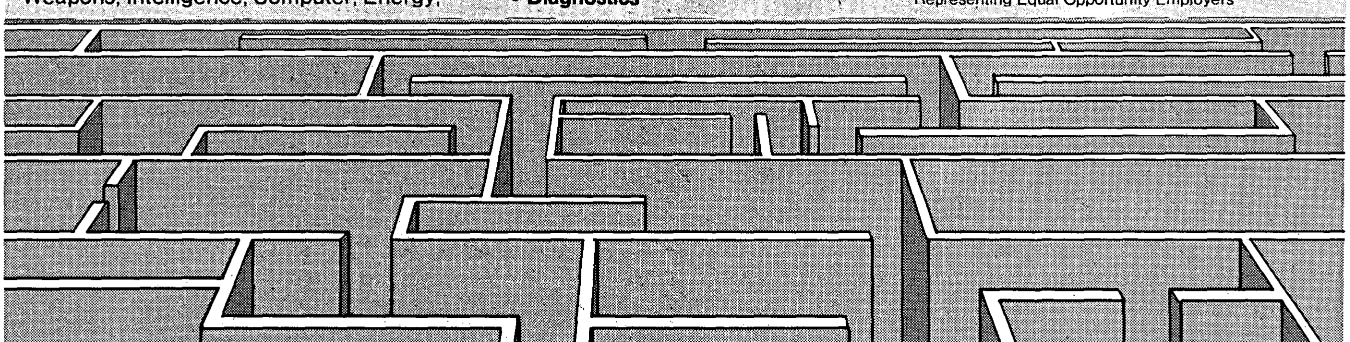
Not only must data in interactive systems be encrypted so that they are not stolen or abused, they must also be authenticated to make sure they were not altered in transit. One security specialist now discerns two types of computer wiretapper: the passive one who intercepts a line to monitor it and the active one who intercepts it to alter the flow of information. Large amounts of money are transferred electronically now, and this increasingly involves individual consumers. Is anybody in the field bold enough to say that electronic banking systems are safe enough now to assure users that interceptions will be unlikely and that all possible precautions have been taken to assure that outsiders will not have access to the sensitive personal information that flows through these systems?

Electronic mail and interactive home cable systems raise the same issues of privacy. Only now, after the developmental stages of these innovations, are specialists in the field trying to figure out how they can be safeguarded in the consumer's interest (see "Home Information Systems: The Privacy Debate," July, p. 100).

CHOICES THROUGH HOME TV

The interactive cable systems in Columbus, Ohio, and two dozen other communities permit consumers to make several choices through their home tvs—ordering products, ordering special pay tv offerings, voting on public issues, or requesting additional information on products or services described in television programming and advertising. Whenever you mention consumers and choice in the same breath, someone in this entrepreneurial economy of ours is going to take an interest. Information of this kind is simply too tempting for commercial interests to ignore, and it is especially valuable because it is gathered and stored electronically and therefore available instantaneously. It can easily be combined with other readily available data concerning home size, neighborhood, income level, and the like. And it can be obtained without the knowledge of the individuals involved. It should come as no surprise that the major interests in the cable business are firms with experience in direct marketing, including Time, Inc., Fingerhut, and American Express.

It's unlikely that companies like these will pass up the opportunity to use the marketing information compiled on consumers' choices in the interactive cable systems. In spite of this, the main concern about privacy in cable has not moved away from the fear that Big Brother is going to keep a computer list of all the dirty movies each of us orders.



The ultimate aspect of the privacy issue is the possibility of complete social control.

As long as the privacy issue does not go beyond that, consumers will laugh off the threat and figure out a way to guard against it. No, the threat in cable systems is not so much from the government keeping tabs on the pabulum we absorb from our new multichannel tv sets; it is that commercial interests will completely manipulate us by collecting information about our choices, tailor-fitting advertisements for each household, and blurring the distinction between commercial and program content on television.

Two states have passed privacy protection laws affecting cable systems. The first, Illinois, prohibits the installation of equipment that can observe individuals in their homes and restricts the disclosure of subscribers' viewing habits or identities. Wisconsin's law addresses only the information aspects of the new communications media. It imposes a fair information practices code on cable systems, restricting disclosure of viewer data without consent. There is a similar proposal before the New York legislature. Some municipalities have included privacy protections in their cable ordinances, and one of the leaders in the field, Warner Amex, has published its own voluntary code on privacy. The Warner Amex code reserves the right of the company to rent or sell individual information about viewers, after the subscriber has been given an opportunity to remove his or her identity from lists disclosed by the company. In its 450-word code, the company pledges to maintain physical safeguards on the sensitive information in its possession. The company will comply with government requests for individual data only when there is legal compulsion in the form of a court order or subpoena and after the individual has been notified, if this is not prohibited by the terms of the legal process.

We are still in the early stages of developing appropriate consumer protections in the cable field. As in other aspects of privacy protection, many of the problems remain hypothetical, and technology may render legislation obsolete as soon as it is passed.

The trend toward home computers will have an interesting effect on all this. Knowledge of and skills in electronic dp have become so decentralized that more dp technology may now be in the hands of non-dp professionals than is in the hands of professionals. This may mean that large segments of the population, especially the young, have lost their awe of the computer. The trend may also mean that individuals who work for large organizations may develop their own ways to collect and process information, thereby placing themselves beyond the reach of laws or company policies providing safeguards. Fear of large, impersonal databanks motivated the current concern about privacy. Perhaps now that computer power is in the hands of one's neighbor and one's neighborhood small business, that fear will diminish.

On the other hand, with information bases in the hands of millions of individuals and their home computers, it will be difficult if not impossible to inventory them, much less regulate them.

Still, even though the current focus has shifted to interactive transactional systems and even though computing has become decentralized, the massive databanks are still with us. They are now virtually limitless in their storage capacity and in their abilities to sort and categorize people.

This brings up the ultimate aspect of the privacy issue: the possibility of complete social control by whatever organization or cabal is in possession of the personal databanks and the communications technology.

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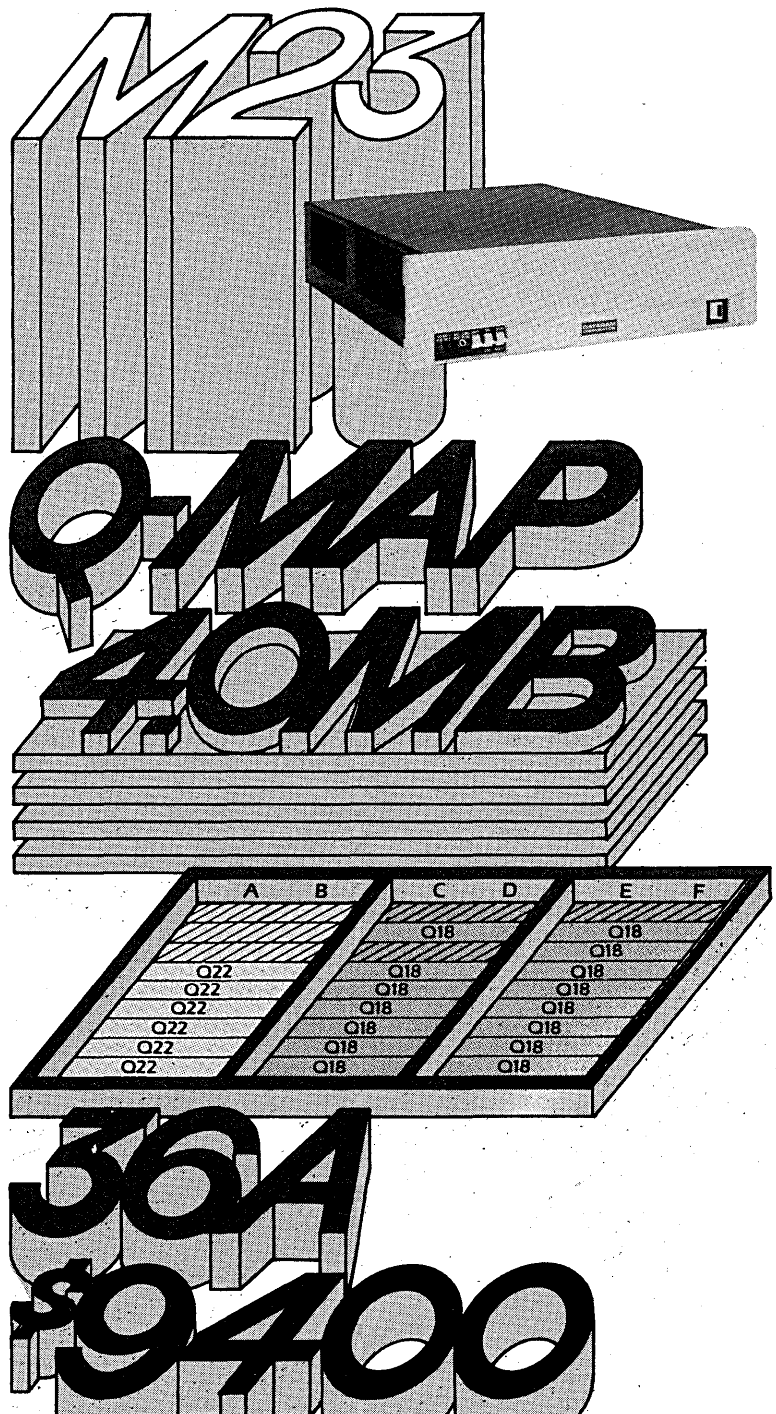

DATARAM CORPORATION

CIRCLE 228 ON READER CARD

Do we realize that all the elements for an Orwellian society are in place?

This is the "1984 factor." Aside from a few editorials and "what if" books, it is rarely fully discussed in polite company. People generally nod and agree that, yes, the nightmare of a computer-controlled society could occur. Then the conversation turns to fine-tuning current laws and regulations. People can still become more outraged by unwanted mail advertisements or an erroneous credit report than they can by the potential threat of the Orwellian anti-utopia. And so the technicians' and the politicians' attentions are focused on direct mail and credit reports. We reserve the rhetoric for the "1984 factor" but in our actions we attack the finer points of the privacy issue.

Do we realize that all of the elements for an Orwellian society are in place? Just about every salient fact about an individual is in a computer file somewhere. No large organization in our society is without massive computer power. There is widespread camera surveillance of the population in banks, shopping centers, public streets, hallways, even residences. The computer databanks are capable of being linked with each other, if only the populace would accept the idea.

We don't often discuss this because the ultimate horror of a computer-based tyranny is so unthinkable that we prefer not to think about it. In this way, the privacy issue is like the issue of nuclear war. The possibilities of disaster are with us every day and the potential damage is horrifying and irreversible.

Like the debate on nuclear war, this aspect of the privacy issue gets shoved aside. Conferences and publications focus on amending the privacy act or making a computer system secure. We do not face the broader and more difficult question of how we can direct technology and public policy so that we do not become a society transfixed by computers that know everything about us and can pinpoint the transgressors among us.

If it happens, it will not come about suddenly, but bit by bit. Acquiescence to computer matches today; tolerance of luggage searches at the airport yesterday; agreement to more tv cameras downtown tomorrow; adoption of a plastic ID card for all citizens after that; and their enthusiasm for audio and video surveillance in our homes via our new cable hookups to make us more secure; and finally nationwide acceptance of the idea that all of an individual's transactions with the government or a commercial enterprise should be reported, without objection, to a computer system, and that those whom the computers cull should not be entitled to full participation in society.

This debate is perhaps a long way from a risk analysis or a fair information practices plan. It involves us as citizens as well as professionals. But it is an essential debate if we are to avoid simply pushing the ultimate privacy issue to a succeeding generation. The privacy issue is rare because it involves the technical, academic, commercial, financial, political, legal, medical, sociological, and communications communities in our society. With their diversity as a base, the debate should go forward in the mid-1980s on the question: can America avoid becoming a computer-dominated society in which risks are impossible and mediocrity is rewarded (and duly noted in the automated record)? ✻

Robert Ellis Smith is publisher of Privacy Journal, a Washington monthly newsletter; a member of the American Bar Association privacy committee; and author of Privacy: How to Protect What's Left of It.

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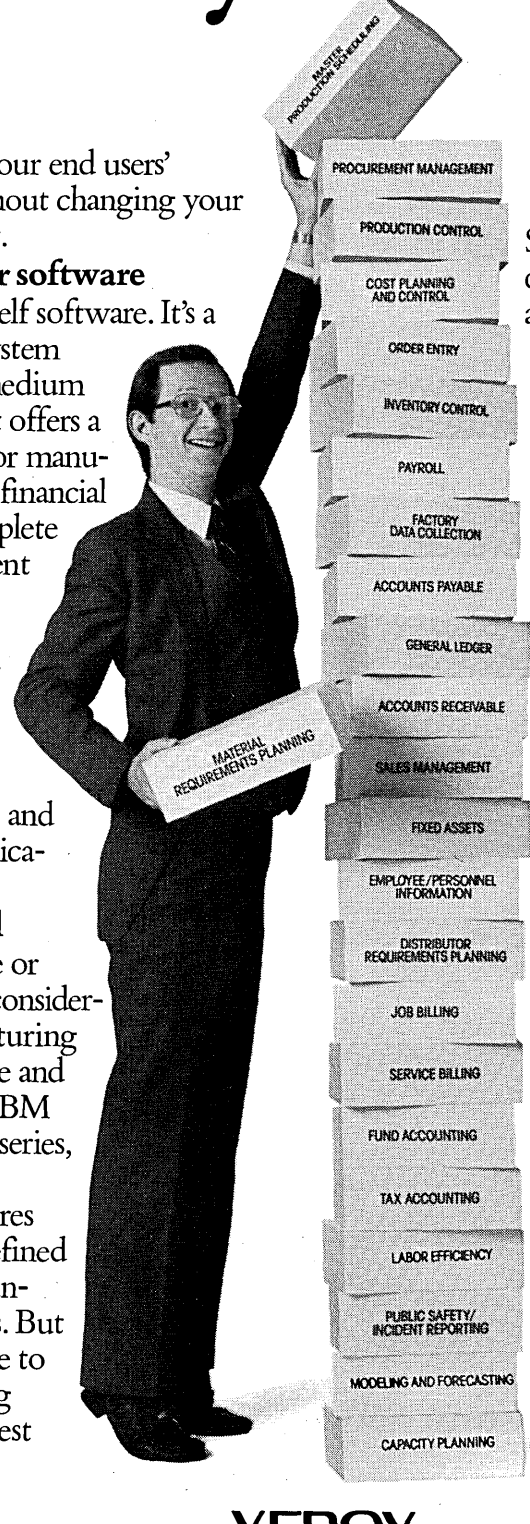

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