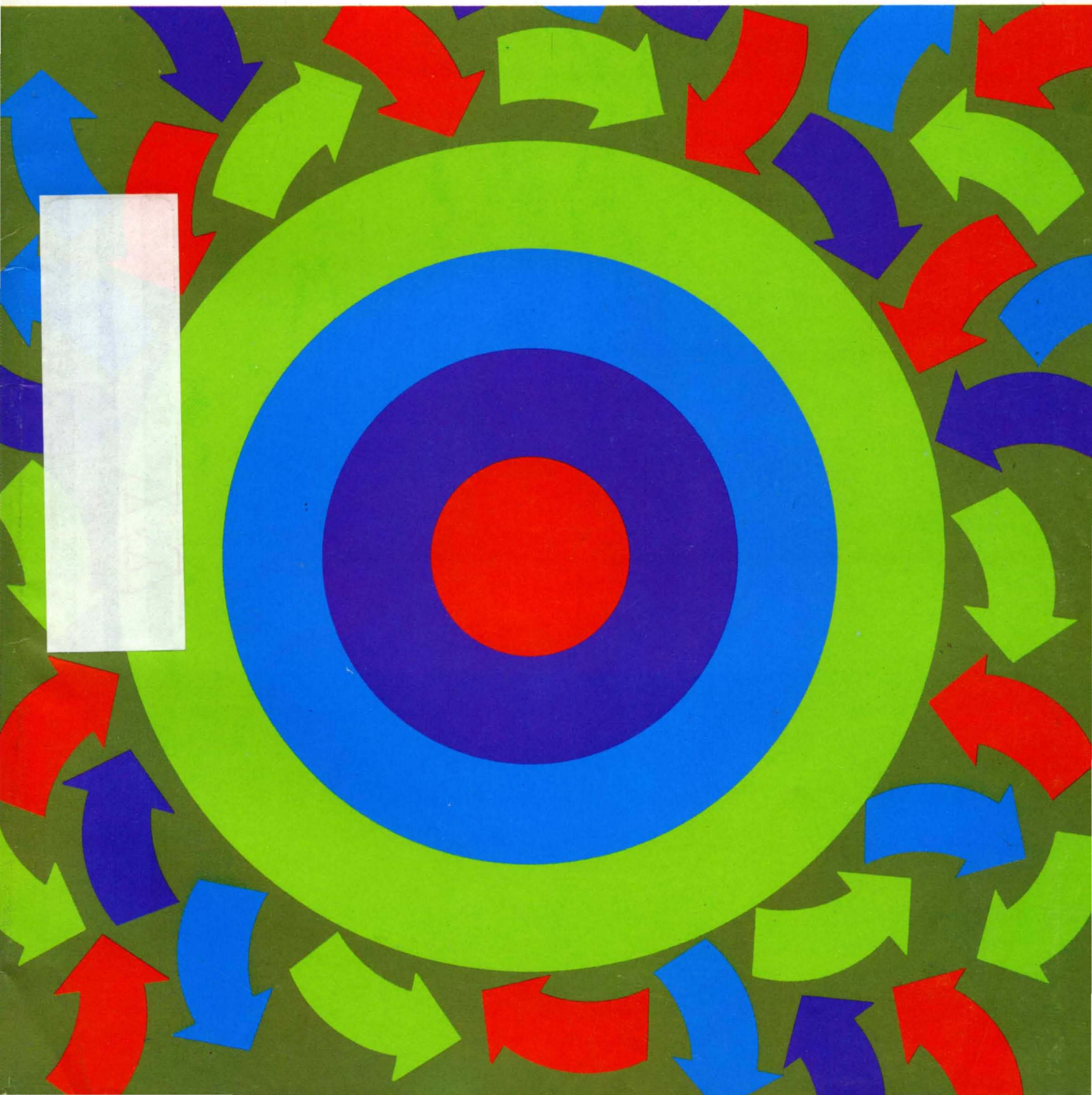
DATAMATION® 76
November

SOFTWARE MANAGEMENT
Staying on Target

DP SALARY SURVEY Also: decentralization, factory management, and Book Supplement...



World Travelers

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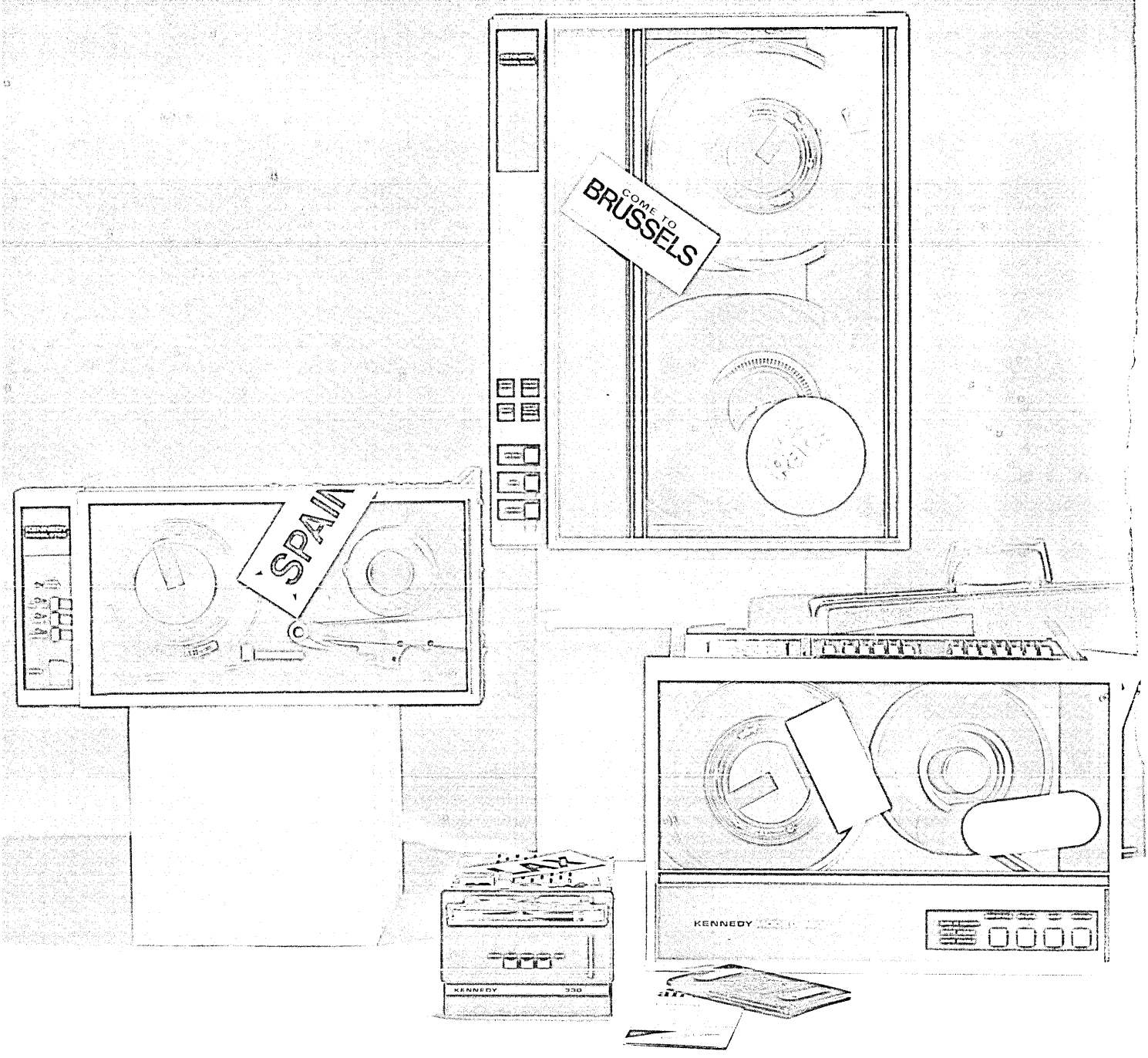

CIRCLE 1 ON READER CARD

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So do all our

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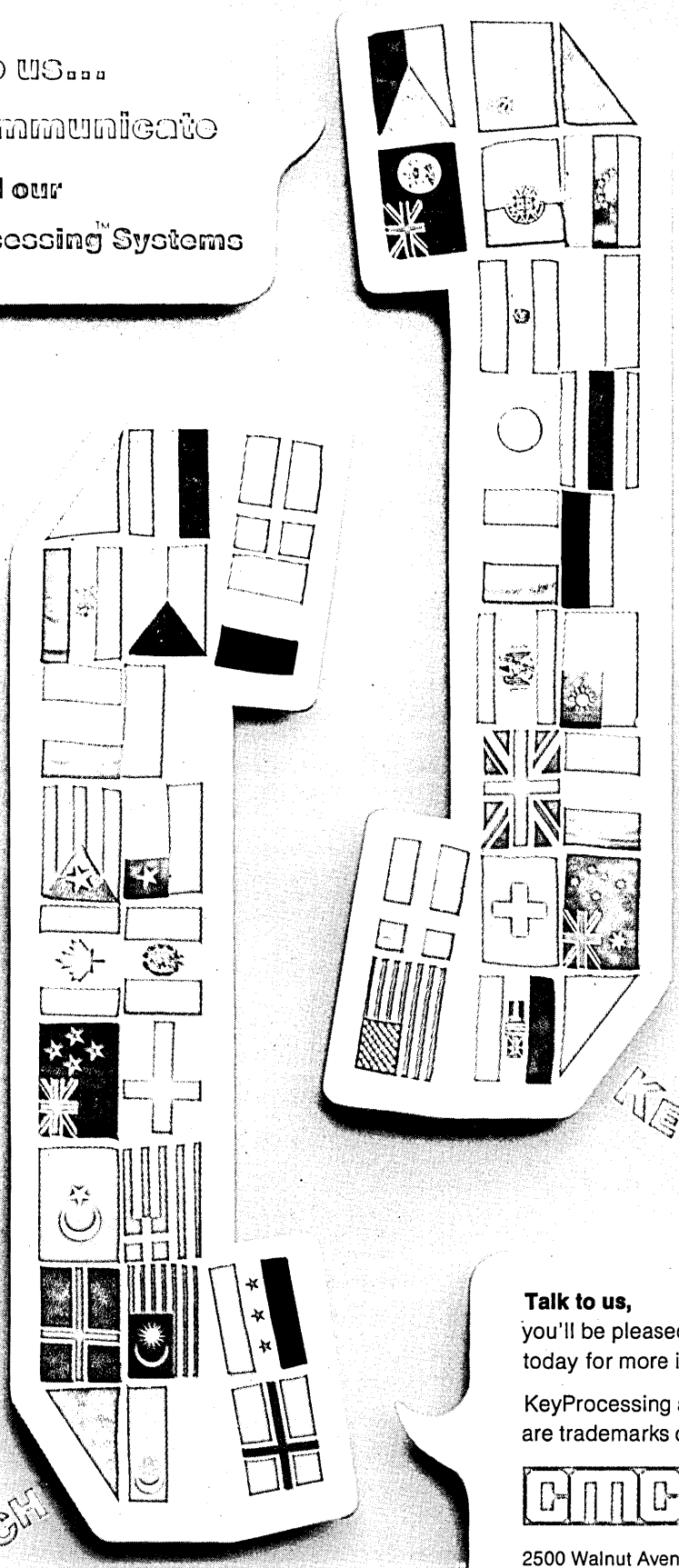

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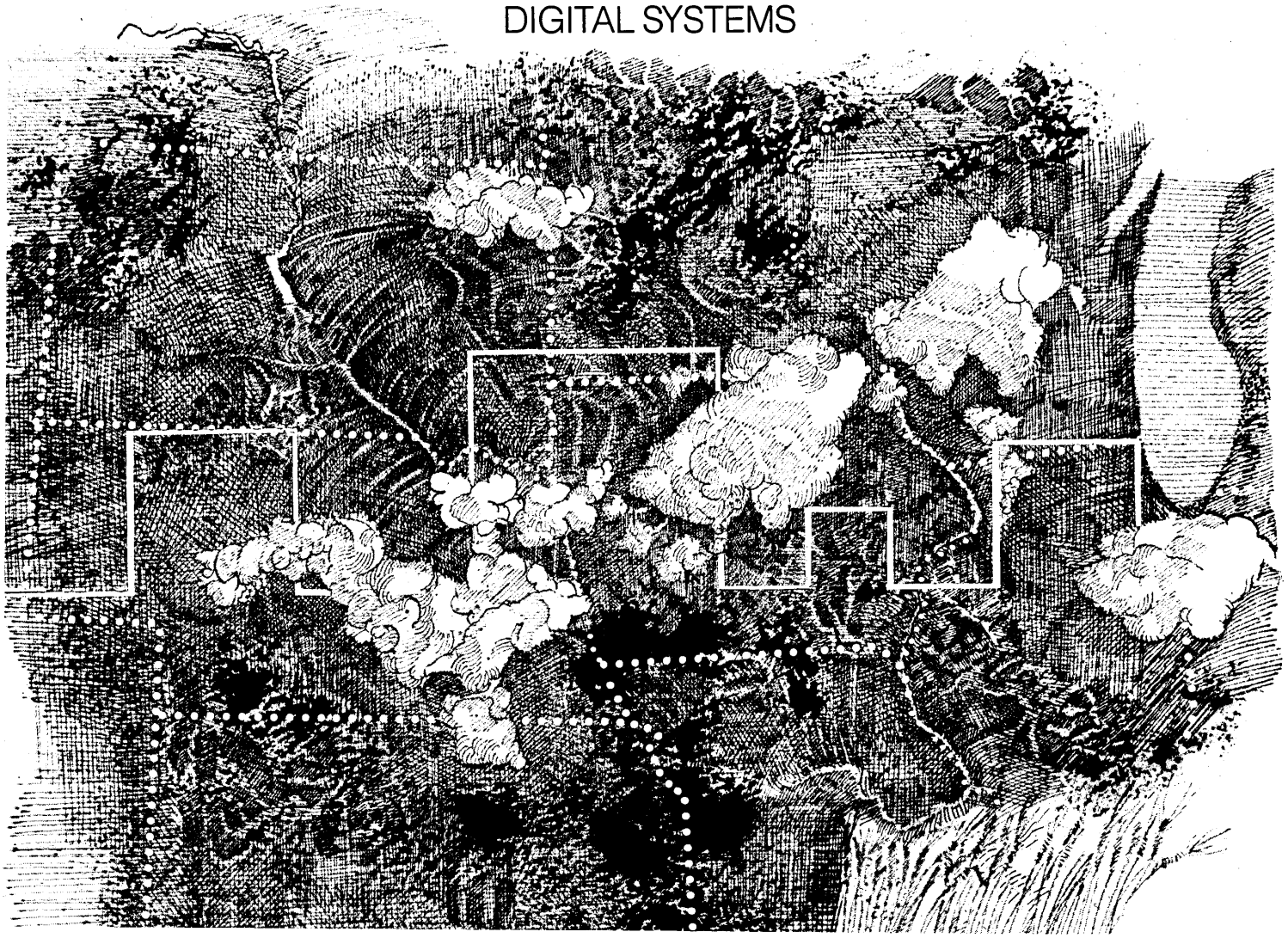
GOODYEAR

DIGITAL SYSTEMS



DATAMATION 76

VOLUME 22 NUMBER 11 This issue 127,724 copies NOVEMBER 1976

FEATURES

NEWS IN PERSPECTIVE

DEPARTMENTS

About the Cover
Finding out where every piece of the project is at any given moment in its flight toward the target: that's status reporting as it's explored in this month's theme and in our cover design by Barbara Benson.

DATAMATION.

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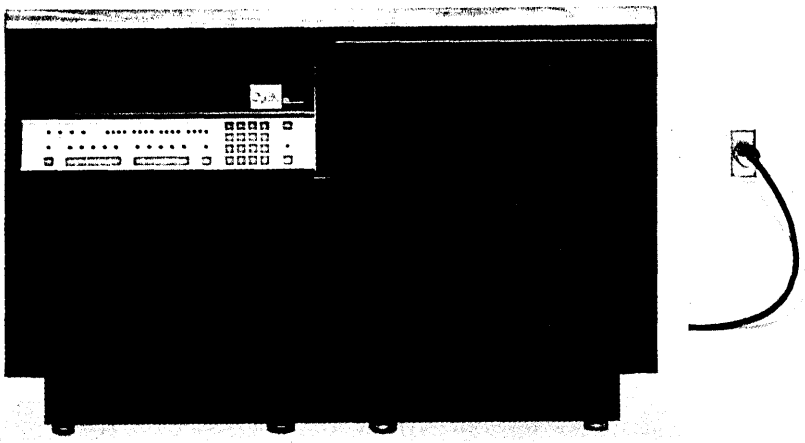

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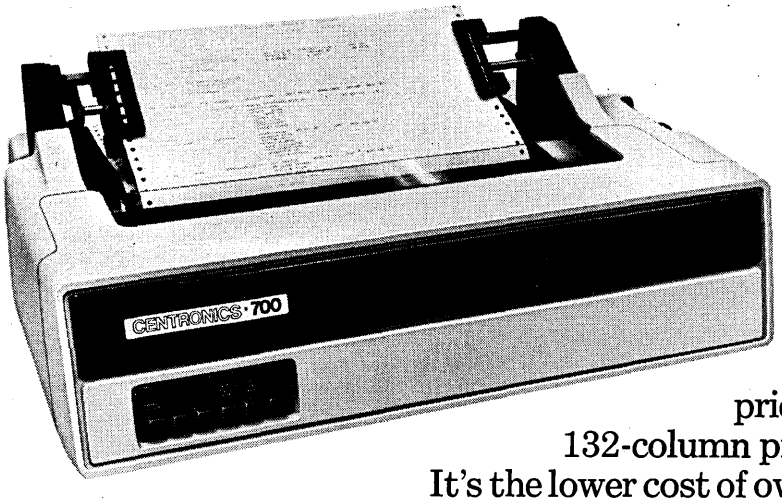

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letters

A corporate misunderstanding?

As a stockholder of Brandon Applied Systems Inc., I was amazed to read Mr. Arnold Palley's letter in your June issue (p. 188). In it he stated that since Dick Brandon, founder and former chairman, resigned from the company, it has been "vigorous" and is "alive and well."

I would prefer to believe the company's auditors who, in their recently released annual report state: "The company has sustained substantial operating losses during the year which have resulted in a negative consolidated working capital position and substantial elimination of stockholders' equity." ". . . the continuation of the Company's operations and the realization of its assets (primarily accounts and unbilled receivables on contracts in progress) are contingent upon its ability to generate sufficient financial resources and to resume profitable operations."

Many companies fell victim to the recession of the early 1970s, and the acquisition of Rand Teleprocessing gave BAS the necessary financial shot-in-the-arm to keep it alive, with the subsequent increase in revenues from $2,000,000 to $7,000,000 and growth to 200 employees. But in noting the upswing, Mr. Palley forgot to give credit to the operating abilities of Mr. Brandon which caused this turnaround. Nor did he mention that following the resignation of Mr. Brandon, the key figures of Messrs. Bob London, Ed Klein, and Mike O'Reilly decided to follow suit. Was that another misunderstanding?

J. R. RADLEY
New York, New York

Mr. Arnold D. Palley, President of Brandon Applied Systems Inc., San Francisco, replies: We stand by our original statement that our company is "alive, well, and vigorous." We are currently in a hiring mode, and our financial report just submitted to the Securities and Exchange Commission shows earnings of over $300,000 for the six month period ending in August.

COBOL vs. APL

I wish to comment on Mr. Lurie's letter in the July issue (p. 8). I think he is doing the COBOL programming community an injustice. As a user of both COBOL and APL, I can make the following points:

1. Most COBOL programmers are not operating in an interactive environment. A batch environment forces more work to be done off-line (with flowcharts and program listings) than on-line due to the long turnaround time that a batch job may have. At this level of computer access, every run counts!

2. Users of time-sharing systems such as the DECsystem-10 (myself included) have an interactive COBOL available. Such users can spend more time on-line, and can use the machine as a debugging aid to a greater extent. Therefore, they can often get more than the quoted 11 lines per hour. In addition, their program editing facilities are often far more advanced than the editing feature in APL.

3. APL is a poor language for the precise capabilities that COBOL excels in. Many important functions for a business program which are primitive to COBOL are absent in APL. Report generation, alphanumeric sorting, formatted I/O, and ISAM-type access to large data bases, are operations which are "built into" COBOL, but would have involved and complicated functions written for them in APL that would still not run as efficiently as they would in COBOL.

4. Development costs include debugging costs. Debugging on an interactive system with existing advanced debugging facilities is easier than debugging in APL. Especially when debugging someone else's programs, it is much easier to debug COBOL than APL programs.

5. Finally, production costs of running a COBOL program as opposed to an APL program are less due to the efficient object code generated by the COBOL compiler, while APL grinds as an interpreter.

APL is a nice language when used as a programmable calculator. Similarly, COBOL is best for large business data base crunching. Neither is very good for the other's type of usage. Let us recognize this rather than try to have the seminationalistic banner of absolute superiority of one over the other!

MARK R. CRISPIN
Systems Programmer
MIT Artificial Intelligence Laboratory
Cambridge, Massachusetts

Try this on your CE

For your humorous information, I relate the following true story.

The Washington Dept. of Human Resources owns an IBM 370/145. On July 21 at 11 p.m., the cpu logged out 48 hard machine checks within a 2½ hour period. Then, for two weeks: nothing. On Monday, August 2, they came back with a vengeance.

Everyone has heard of the old joke about the customer leaning over the customer engineer's shoulder (who is wrestling with a knotty cpu problem)—"Think you got a mouse running around in there?" Well, by Saturday August 7, this was no longer just an old joke. We actually had a mouse attempting to build a nest inside the cpu—specifically, inside the A-gate.

She had chewed the plastic coating off tri-leads exposing bare wires, dragged in fuzz and paper for nesting materials, and distributed her little pellets everywhere. Worse—uric acid eats gold. Total damage—41 tri-leads and 1 MST board.

SUSAN E. MITCHELL
Systems Programmer
Department of Human Resources
Washington, D.C.

A Maxi Tale

Mr. Raskin's letter ("A Mini Tale," August p. 8) sounds a familiar note. I'd like to tell a Maxi Tale from here at UW-Madison. Seems that during summer 1975, somebody decided to bring computer power to the people, especially undergrads without research accounts. Some modems were hung on a mini, and terminals installed at the center, at library locations, and at the dorms, including mine. For some obscure reason, this mini was a front end to the computer center's 2 x 2 (when fully up) B-1110, rather than a standalone with perhaps a disc drive. The teaching staff was encouraged to place pedagogical programs on the system.

Came the opening of semester. The operation happened in true, first class computer center style. First the student had to wait for the previous user to clear the terminal—up to half an hour. Then an additional, random wait was provided by the wizards—the number of (dial-up) ports was substantially less than the number of terminals. The equipment had the reliability of Canal Street sidewalk-stall surplus—on occasion it would just sit there inertly, or, worse, spontaneously hang up and provide another long, random wait. And when all other hurdles were passed, there was always the possibility of having the session's work consigned to oblivion by a system crash.

Needless to say, the primary initial use of the system was to play Startrek while the washing machine did its thing. At least until this was discovered, and Startrek (the official copy, anyway) was deleted.

Around midsemester it was decided that the usage of this system was "overloading the center" (!!!—anybody from our center want to run benchmarks against an Altair 8080?) —and the terminals were closed during weekday business hours. One must wonder how those who came in on bus lines that only got you here for those hours felt. I doubt if anybody at the center cared. Of course, there were reasonable explanations and promises of fixes. None of the latter were effective; the whole pattern repeated the

letters

next semester.

It is, of course, difficult to run programs on a medium consisting entirely of reasonable explanations. By the end of the semester, the terminal in my building had definitely not caught on. Under the circumstances, and with sophisticated calculators available at a store across the street, how could it?

What the computer center buffs have lost track of as they busied themselves with lousing up the system and pointing out the hidden costs of 3 a.m. unpaid fixit sessions on the minis, is the condition of their own backyard. Either on batch or on terminal, the typical student has to contend with minutes to hours of guff—standing on line, waiting for a port, waiting for glacially slow interactive response, often approaching five minutes for some trivial operation—for the use of a second or two of cpu, much of which is overhead. And the researcher watching the budget winds up with turnaround of many days and routine owl sessions at the terminal, for the sake of nighttime and convenience rates.

Meanwhile, administration sees a computer center clogged with traffic, with lots of queues, and they are therefore happy.

In summary, what the typical small to medium user sees at the center is a machine that approximates an Altair 8080 clocked by a rusty 10-kHz crystal, with the power line periodically disconnected and run over a rasp soldered to B+. This is why we have a central computer committee to "balance central and distributed computing" (see *Science*, 6 August 1976, p. 472)—i.e., in the opinion of many

(Continued on page 188)

TA, TM, or . . .

Mr. Kirkley's article "You're OK, But I'm Still the Boss" (August p. 58) was an interesting summary of the latest and most popular new approach to understanding human behavior and applying the techniques to organizational relationships.

Certainly TA, or any other technique that can offer creative solutions to problems, is welcome. But I feel that the reason stated in the article for the need for TA is erroneous. Mr. Kirkley refers in several places to the needs of employees for "job satisfaction." Reference was also made to Studs Terkel and his thoughts on employees searching for a greater meaning. All these references indicate that it is the job or the working environment that causes the problems or needs.

I contend that modern theories of organization do not restrict themselves to the idea of "job satisfaction" as the only, or even main, criterion for motivating and understanding employees' needs. For example, Charles F. McDermid in "How Money Motivates Men" has suggested that money could be used to help satisfy all the need levels in Abraham Maslow's classic hierarchy of needs theory.

George Strauss in discussing "The Personality vs. Organization Theory," suggested that it is erroneous to assume that workers seek to satisfy their esteem and self-actualization needs on the job. Many people find enough satisfaction in raising a family, participating in community projects, or passing the time with a hobby. Certainly TA is a means of identifying these tangible and off-the-job motivators. But to consider the job as the whole basis for behavior, in my opinion, is a false assumption.

Despite this minor criticism, it is good to see this type of article in your publication. . . .

HAROLD S. MALEN
Systems Staff Analyst
Allstate Insurance Company
Northbrook, Illinois

Being responsible for a multimillion dollar financial system and the people who run it, I have been searching for effective ways to solve the "people problems" just as discussed in John Kirkley's article, "You're OK, But I'm Still the Boss." In my search, I completed a one year training in Transactional Analysis at a cost of over $1,000, and I learned Transcendental Meditation a few years back at $125. There is no question that TM is by far the better buy!

I did find TA very fascinating as a model of human behavior and useful in daily life. Despite the apparent simplicity of the language and basic concepts, TA is more complex and technical than an initial encounter might convey. Also, as pointed out in the article, the immediate insights gained usually do not have a lasting effect. My experience indicates that it takes a lot of time, effort, and money for proper therapy and training to root out long ingrained behaviors, scripts, and game patterns which often make life miserable.

By contrast, TM was learned very easily, worked from the start, and is becoming increasingly effective day after day. This effectiveness is not just my personal experience, but is objectively demonstrated through hard scientific research in many universities and medical facilities here and overseas. I found the $125 fee negligible considering what the TM technique did for me. It dissolves the stress, tension, and frustration which accumulates in this hectic life. Even better, it makes one increasingly resistant to stress.

These kinds of benefits certainly remove many obstacles to effective management. They also provide an excellent basis for using TA—just because feeling OK and being energetic makes it so much easier to understand and change old non-productive behavioral patterns. TM is also a potent mental technique. . . .

A number of small and medium sized companies already pay for their employees to learn TM because the cost is modest and productivity goes up—nothing metaphysical, just cost-effective. . . .

F. G. SAUER
Ford Parts and Service Division
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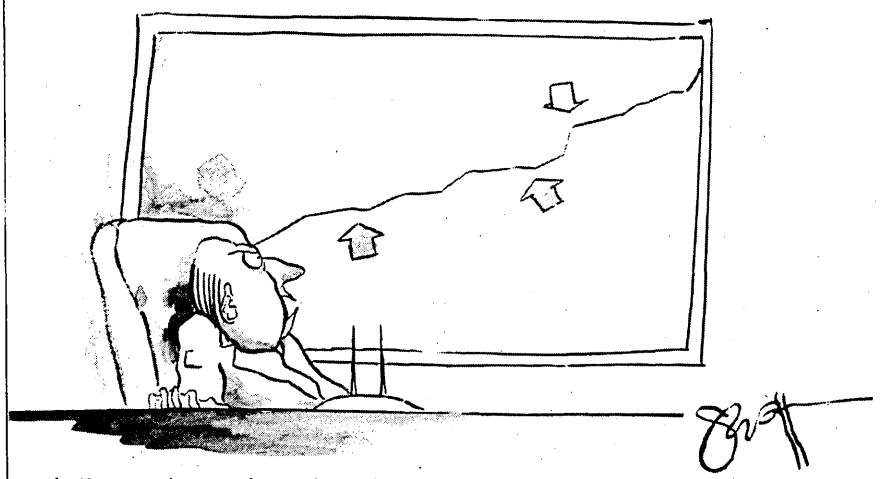
Dearborn, Michigan



Let's see what my incentives chart says for today. . . . there's a friendly clap on the back for Johnson . . . share a joke with Gleeson . . .

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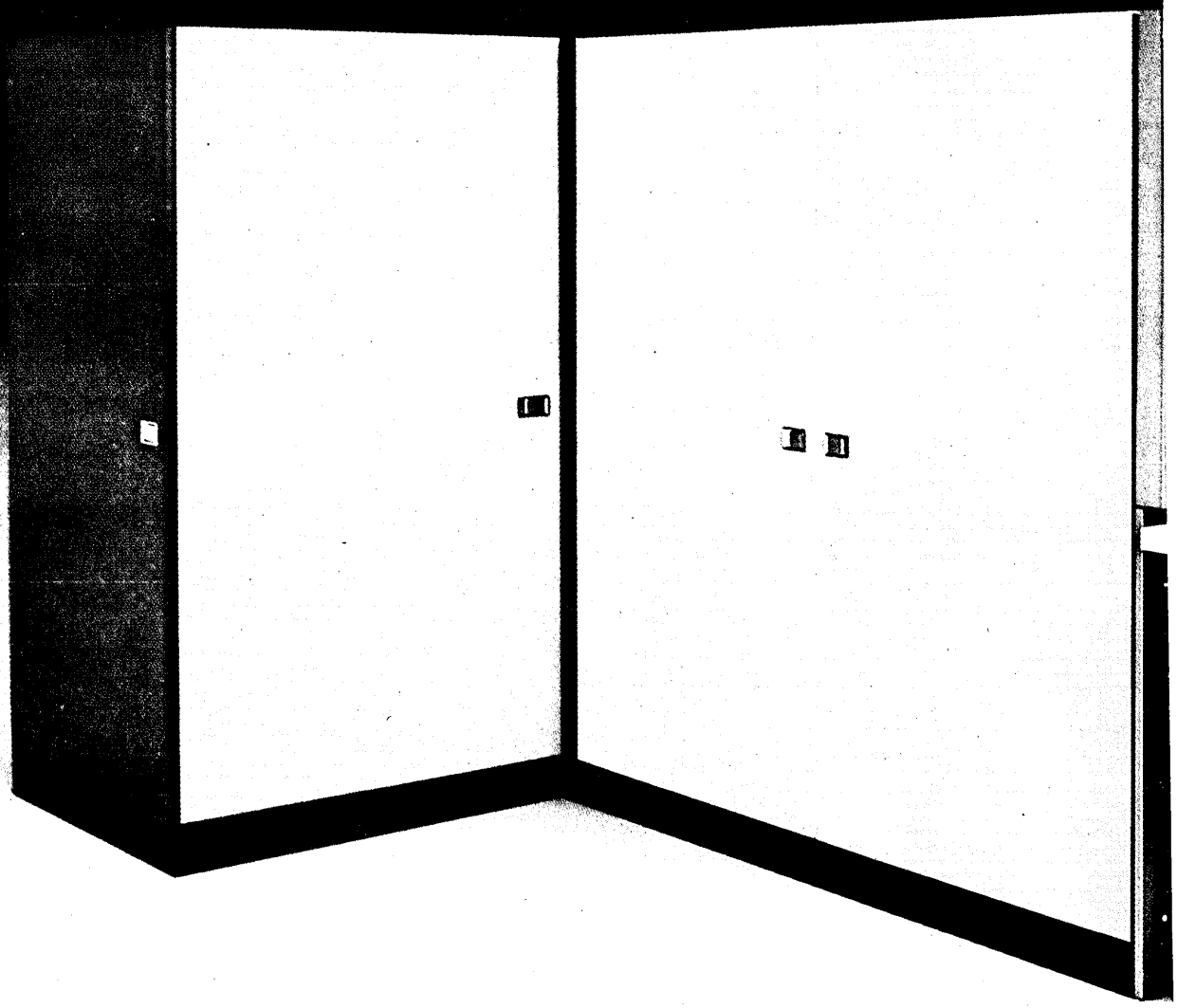

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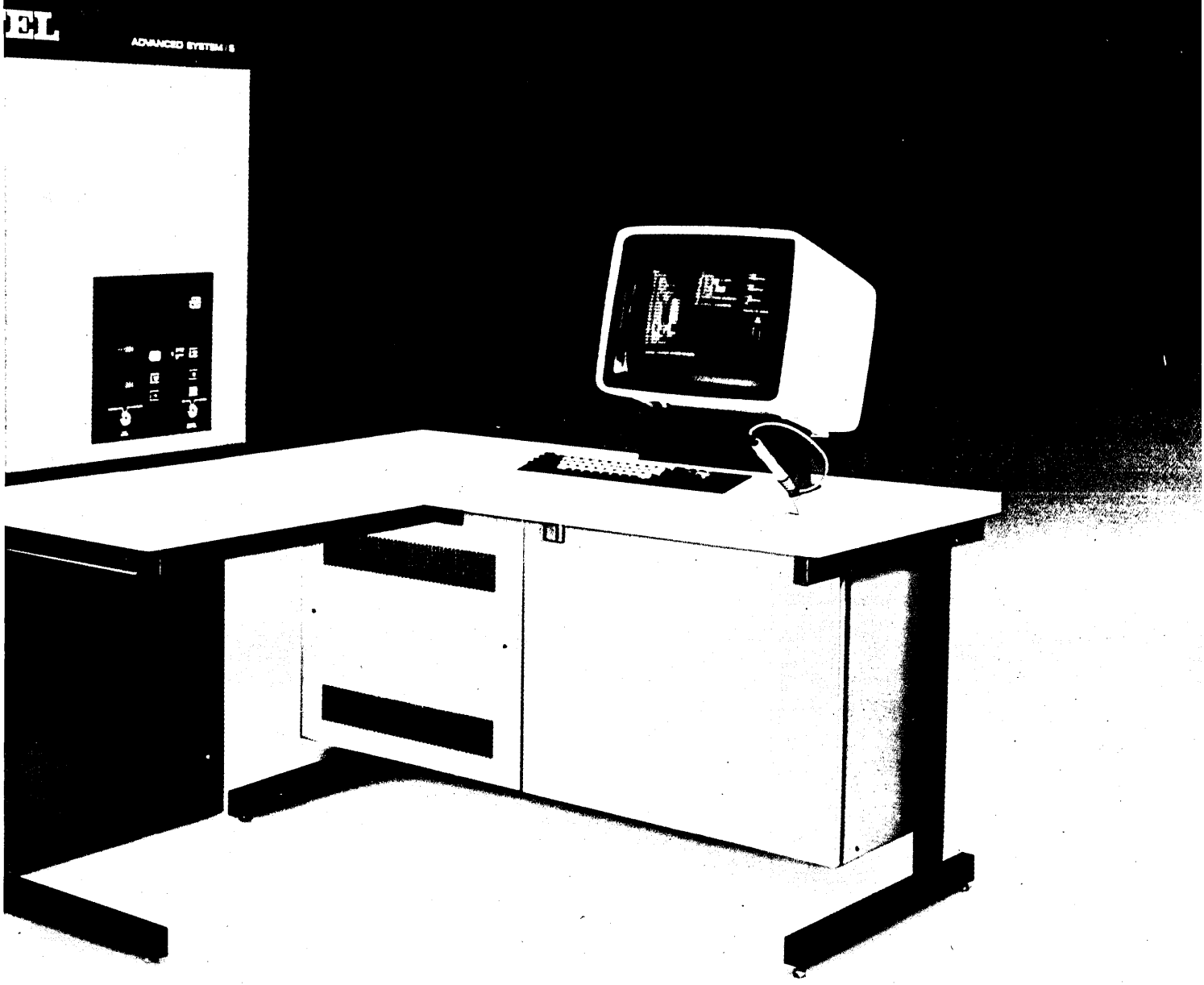

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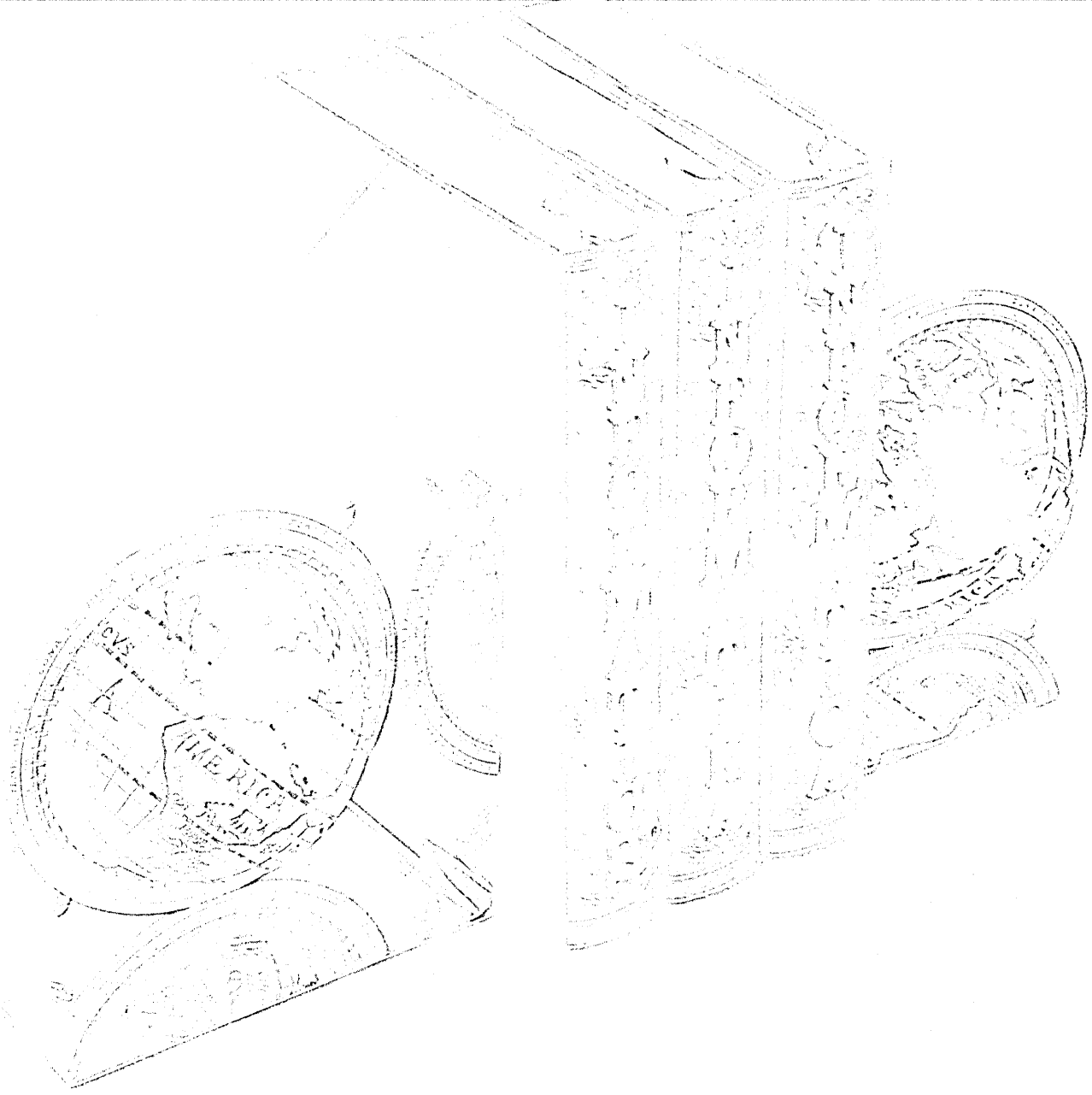

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The Manager CSC Wanted

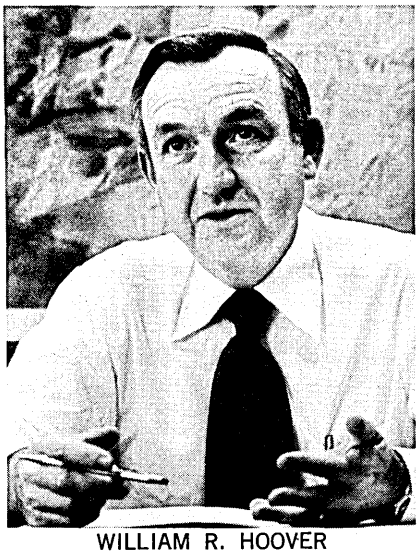
Near the mid-'60s, the two co-founders of Computer Sciences Corp., Fletcher Jones and Roy Nutt, decided that neither was a very great manager—at least of the stature of someone who could run a fast-growing high technology company whose only product was brains. They had in mind a young manager of computer data systems at Cal Tech's Jet Propulsion Laboratory in Pasadena by the name of William Hoover.

Hoover had joined JPL after getting a B.S. and M.S. in mathematics from the Univ. of Utah. In his 10 years at JPL he had directed the implementation of advanced computer systems, including the first multiprocessor for command and control of unmanned spacecraft. A contractor on some of the projects was Computer Sciences Corp., of Los Angeles, a fast growing company providing computer and communications services to most major mainframers and to advanced government-sponsored projects.

At the age of 34, Hoover, now 46, joined CSC in 1964 as manager of the Los Angeles Div. when the company was doing about $4 million a year. Since then the company revenues, despite serious financial problems, have soared past the $200 million a year mark (in its F.Y. 1976 ended last April 2). That was an increase of 24% over the previous year and its profits doubled to more than $7 million. It has 7,000 employees, three-quarters of which are professional people. And the company, which began as a developer of operating systems, compilers and utility software for such mainframers as IBM, Philco, Univac and Philips, systematically has expanded into systems engineering and analysis, communications engineering, facilities management and the development of turnkey operational computer-communications systems . . . along with such also-rans as Computicket, a reservations system which it wrote off in 1970, and the New York off-track betting system which also bombed in the early '70s.

But its most exciting venture was Infonet, an ambitious network services offering which it began building in 1970 and which nearly died a thousand deaths before it became profitable in 1974. The network today, with some 3,000 users in industry and government, contributes to 22% of the company's gross revenue and to half of its profits. Productivity per person is $73,000, a remarkable figure when compared with such other industries as manufacturing, $50,000 to $60,000, and $28,000 in the CPA field. The network owes a considerable amount of its credibility to a huge order in 1972 from the General Services Administration in which government agencies were required to use the Infonet service for network processing. But today, at $30 million a year, it represents a healthy but much smaller proportion of Infonet's total revenues of more than $50 million.

Hoover, who's been chairman and chief executive officer since Fletcher



WILLIAM R. HOOVER
"He's done everything"

Jones' death in a private airplane crash in the fall of 1972, says the company at present has no plans to launch another major undertaking the extent of Infonet. He says that CSC will build on what it now has and he describes what it now has as "the strongest technical team in computer and communications in the world, outside of computer and communications manufacturers."

Sitting in a huge but unpretentious office in the company's Los Angeles headquarters, Hoover rattles off the company's accomplishments, from the day when it began in 1959 providing programming and related services to mainframers, to its many government and industry contracts providing computer and communications services in space exploration and missile projects, to Infonet, to its activities in facilities management. "Facilities management is a growth area," he says, noting that the company now provides the data processing management and functions for Orange County in California, Price County in Washington, and the cities of Torrance, Calif., Newark and Cleveland, and has bids on several other local and county government offices.

"We go after the major programs," says Hoover. To do this, the company has had to build a vast resource of technical competence. "We constantly are on a search and quest for technical excellence." Hoover says, though, that it isn't all that difficult. "First, we already have high caliber people and high caliber people attract others of high caliber. When recruiting in the schools, we look for the top students. Second, we provide them with a career path in computing," something that isn't always available in such businesses as banking, government and insurance where data processing is in heavy use, but is not their primary business.

He travels constantly. Getting new business is the name of the game, says Hoover, who supports the efforts of his people in signing up new accounts and in hand-holding others. "My technical background is useful in such endeavors," he says, adding that "in the high technology business, managers are expected to be able to address, and sometimes lead in, all aspects of technical questions." But he's also amazed his financial people with his grasp of financial problems, having had no formal financial or management training.

The company's stock has been hovering at about $6 for some three years, due to many factors, one of which was the company's huge bank debt that had soared to close to $30 million in 1972. Hoover has chopped away at that debt, raising stockholder equity and working capital. Last July he prepaid a $1.5 million bank installment due in September, leaving bank debt at $3 million which might be paid this year. Increased working capital, which rose 31% in its last fiscal year to $30.9 million, is allowing the firm to accelerate its expansion. For example, the Infonet division has boosted its marketing staff 20%, primarily in the government market.

Says corporate vice president Roy Nutt: "We found in Hoover many years ago a man who understood the whole problem, something which is unique in the programming business. He had it and he was smart."

Hoover was elected to the CSC board in 1968, was named executive vice president the following year, and nine months later became president. He added Jones' title of chairman and chief executive officer in 1972.

"Fletcher Jones and I agreed that neither of us was a great manager," recalls Nutt. "Jones was a promoter and I could manage small technical groups," explains Nutt who is recognized as CSC's—and in some circles the world's—computer programming genius."

"So we got Hoover. And he's done everything."

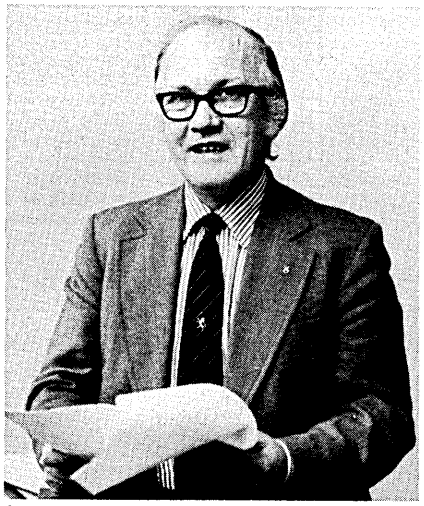
people

Professionalism and Politics

Last month the British Computer Society installed a new president who is a computer user, a Scot, a politician and an antique collector.

Gerry Fisher started his life at Proctor & Gamble in industrial engineering, which he calls "the best training in the world." He says: "I learned there that an attitude of mind to method study was more important than anything else—and that's true of systems analysis as well. That means we should be concerned not only with how to do what we're doing, but also working out what we *ought* to be doing."

Fisher believes the British Computer Society should work to improve the



GERRY FISHER
A political animal since birth.

level of professionalism of people within the industry in general and BCS members in particular. Like its new president, the BCS has a mixed background. Most other countries have separate computer societies for the scientific academic and user communities. As Fisher tells it: "BCS started as a mix between a learned society and a cooperative self-help group. In London in the early days, one group met to talk about problems with these damned new machines, and the other talked about Fourier analyses and theoretical program thinking. Somehow they amalgamated, and that amalgamation gives it strength and a unique span of interests." With 22,000 members now, the society is presently organized through four boards (technical, membership, education, and branches). The technical board currently is studying software portability in order to prepare a submission to the European Economic Community (EEC) group which is studying the subject. "There's no doubt that the people who are interested in this issue should be users," says Fisher. "The vendors are obviously less interested."

One theme for his term of office will be "people." He says: "It's an oddity of our business—we're the only one I can think of that is dominated by the sellers, not by the buyers. The hardware boys are getting about 20 to 35% of our budgets now, and the software boys are still under 5%. Almost all the rest is people costs, for analysts, programmers, operators, data prep people. If you look at all our discussion points, you find they mainly revolve around the hardware or software—the subjects hardware and software men talk about. One reason for the imbalance is that users only have individual views, and, in the vast majority of cases or issues, they don't come together to force acceptance of their individual views. So user groups and even bodies like the BCS are not as representative as they could be, because a lot of users say they can't afford the time. The net result is that they waste time doing the same things they've been doing for 20 years, under the influence of the sellers of their hardware and software." He believes the BCS can redress the imbalance a little by such activities as its portability study, and by pushing its views more firmly in government areas.

This kind of thinking comes easily to Gerry Fisher, who has been a political animal since his birth 46 years ago on Scotland's west coast at Ayrshire. "We moved to Glasgow the Friday night before war was declared, when everyone else was moving out," he says. "That's the sort of family we were."

He was educated in Scottish public schools "which are like American public schools—public—unlike English public schools which are private," he explains. Then, at Glasgow University, he polished up his argumentative style on the debating team and became a member of the Student Representative Council. He already was speaking for Liberal, Scottish Nationalist, and Home Rule candidates.

Following service in the Royal Air Force, his life settled down. Proctor & Gamble and later Wall's ice cream company absorbed much of his considerable energy. He became computer manager at Walls in 1961, spent a year at Plessey, and moved to Associated British Foods in 1968, where he is now head of management services, coordinating a decentralized group of computer-using companies with ICL, Burroughs and Univac equipment.

Politics became a focus in his life again in 1967 when the Scottish Nationalist Party won its first seat in Britain's Parliament. It since has increased this representation to eleven seats and hopes for more. Fisher is an active campaigner for the party, organizing, canvassing and debating.

How does he manage to find time for a full-time job, the BCS (which already takes at least 12 hours a week), and politics as well? He sees no problems. "I wear a number of hats, and some of the things I do are contiguous," he says. "My first task is to help my employer do an efficient job in computer services. Such things as the BCS involvement with the EEC on the portability of software have long-term but very valuable relevance to the budgets of computing departments of every user, including ABF. On the other hand, my political activities have no relevance to the BCS or ABF. That's a third hat, to be fitted in as and when possible."

Fisher came to his BCS post the hard way. He was elected treasurer in 1972 when the society suffered difficult budget problems. Most members give him more credit then he would claim for the thankless task of tightening the purse-strings and sorting things out. Today the BCS he presides over is financially sound and more active than ever.

Gerry Fisher still finds time to climb mountains in the north with his wife and three daughters, and to browse through antique stalls for an elusive mustard spoon or two to round out his collection. He bargains for mustard spoons with the same energy and enthusiasm he pours into distributed computing, electioneering, or BCS professionalism issues.

In New Posts

PHIL CLEVELAND and JAMES C. FOSBERG were promoted to senior vice president posts by Microdata Corp., Irvine, Calif. . . . RICHARD C. FURNIVAL, former vice president of operations at Datran, joined Telenet Communications in the same capacity . . . ALLAN KARSON was elected vice president, marketing for Timeplex Inc., Hackensack, N.J. . . . ROBERT H. SOMMERS was appointed vice president marketing support for Informatics System Products organization . . . THOMAS T. HARDING joined Interdata, Inc., Oceanport, N.J., as vice president, marketing and sales . . . ROBERT R. GOERNER joined Courier Terminal Systems, Inc., Phoenix, as associate marketing director for the company's 270 information display system . . . EARL R. GATES was appointed division systems manager for GTE Data Services' Everett, Wash. data center. ❋

Which way is up?

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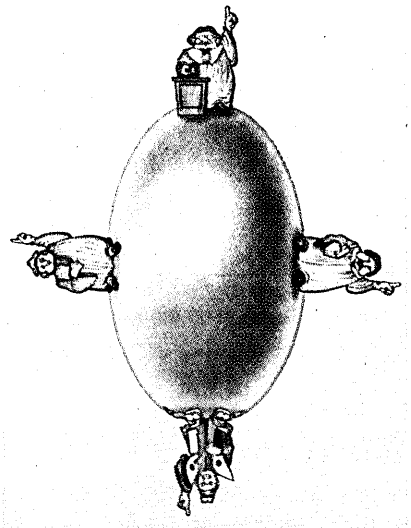

compatible Four-Phase systems at a few key sites. On these pilot installations, field-proven software speeds the implementation of local transaction processing, local data base management, report generation and communication with the central computer.

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Once the basic distributed processing network is on-line, a stratified network structure (with geographically distributed files and display access at branch, district and regional offices) is slowly evolved to "tune" operations to measured processing and communications volume.

Thus the network evolves along an **orderly growth path** ... a process made possible by Four-Phase hardware, software, systems engineering and maintenance support developed and proven over seven years for the present era of distributed processing. For further information, contact your local Four-Phase office or
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But it doesn't have to be that way anymore. Because Data General has developed a new interactive data entry and access system that's a lot easier to work with. Which makes your programmers more productive.

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The Idea system has screen formatting and a data access/retrieval capability that's hard to believe. Because it's incredibly easy and economical to get it up and running.

What makes it possible is the Idea software. It's so powerful and easy to use, you can probably do interactive screen formatting and Idea compiling the day the system is installed.

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The Idea software is designed to work with INFOS (our data management software). It's so powerful that all your users can get at the same data at the same time. And so easy to use that they can access data records even if they know only half a reference.

And you won't have to worry about a lot of duplicate data. Because INFOS is designed to provide a single source of information that's always up to the minute.

Also, Idea software runs on our new ECLIPSE C/330 and C/300 commercial computers. They have just what's needed to keep all your users' information up to the minute. Because they run the Real-time Disc Operating System that controls multiterminal applications concurrently with batch or telecommunications jobs. And the commercial ECLIPSE computers include ADD, MOVE, COMPARE and decimal arithmetic instructions designed specifically for commercial applications.

With the ECLIPSE C/330 and C/300, you won't have to worry about compatibility either. Because they come with large systems languages like IBM-compatible RPG II and ANSI '74 COBOL implemented at the highest levels. Plus industry compatible nine-track magnetic tape units and communications controllers that let you pass data between computers.

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LOOK AHEAD

THE WEIGHT OF MA BELL

AT&T is no stranger in Washington's world of politicking and influence peddling. An old hand at behind the scenes lobbying, the giant communications company has managed to wangle substantial membership leverage on key federal advisory committees. A recently released index of 1975 federal advisory committees ranks AT&T and its affiliated companies number one in the corporate column, with 130 representatives serving on various federal committees, boards, commissions, councils and panels. IBM, which fell considerably behind Bell, came in seventh, with 45 members.

Designed to function as advisory arms to the federal agencies, the 1,267 government committees dole out recommendations in virtually every area of federal policymaking. Ma Bell's significant membership base on these committees, up more than 36% over 1974 when the company had 95 committee seats, represents a potentially powerful pressure tool. A likely area in which Bell could apply this squeeze to its advantage would be on the Consumer Communications Reform Act, now pending in Congress (p. 138). With just the right amount of arm twisting through these committees AT&T, government insiders concede, could exert considerable influence on all present and future government decisionmaking in telecommunications.

SUPERCOMPUTER MARKET CROWDING UP

The onesy, twosy supercomputer market became a little crowded last month when Burroughs Corp. announced it will offer a supercomputer for delivery at the end of 1978. The Detroit company said its machine will operate at speeds faster than any competing equipment "believed to be under development."

That would mean it will perform faster than Control Data's array processor, the STAR, which is being enhanced to operate at 2 to 30 times that of the CDC 7600 (September, p. 168). It also would outperform Seymour Cray's Cray-1, described recently by the ERDA's Los Alamos laboratory in New Mexico as being in a class by itself among supercomputers (October, p. 17). The lab recently completed an evaluation of Cray's first 500K 64 bit word machine there and began renting it Oct. 1 on a short term lease of $156,000 a month, pending delivery of another 500K words of memory next fall. A Fortran compiler is to be delivered in January.

The Burroughs machine had been rumored for more than a year to be under development. Burroughs' previous venture in that market was the Illiac IV of which one was built. It's given a better chance this second try if it is able to provide extensive software and thus broaden the supercomputer market beyond the present 90 customers who traditionally provide their own software development.

UNION WANTS AUTOMATION WITH PROTECTION

A series of one-day strikes hit five Canadian post offices last month in an attempt by the Canadian Union of Postal Workers to call attention to their contention that the post office is implementing a $1 billion automation program without certain protective mechanisms provided for in a contract signed last December. Among them was retraining. "We have no objections to automation," said a union spokesman. "We just want it introduced in a way that won't hurt our members." By late October the strike was over and the union was waiting for the appointment of a mediator by the Public Service Staff Relations Board. Post offices struck were in Vancouver, British Columbia; St. Johns and London, Newfoundland; and Ottawa and Muncton, Ontario. "We didn't want to hurt the public," the spokesman said. Only 4,000 out of the union's 23,000 members actually struck.

EXEMPT VS. NON-EXEMPT REVISITED

Lengthy hearings in December 1971 by the Wages and Hours Div. of the Dept. of Labor led to a ruling by the division that programmers are not professionals and thus are not exempt from the overtime provisions of the Fair Labor Standards Act (March '72, p. 97). DP professional societies were vocal at the hearings. Data processing managers were clamoring to get copies of revisions to Section 541 of the Fair Labor Standards Act as published in the Federal Register for Dec. 2, 1971. These revisions provide guidelines as to specific instances where dp personnel might be considered professional but they do not exempt them as a class.

After a brief flurry, interest died down. But now a case has been published which may rekindle it. It's Pezzillo vs. GT&E Information Systems in which Judge Clure Morton of the Federal District Court in Nashville, Tenn. held that nine programmers were entitled to overtime over a two and one-half year period because programmers do

not exercise discretion and independent judgment, and therefore are not exempt from the overtime provisions of the Fair Labor Standards Act. The publication Computer Law and Tax Report has advised employers of programmers to review both the Pezzillo case and the Labor Dept.'s regulations. GT&E has appealed the Pezzillo decision to the Sixth Circuit Court of Appeals in Columbus, Ohio.

A TURN ABOUT ON EFT

Undaunted by a Supreme Court decision not to hear electronic funds transfer (EFT) cases (p. 159) EFT enthusiasts have taken their case to Congress. After several years of inaction on EFT moratorium measures, the federal legislators have done a quick about face and have decided to push EFT experimentation. The latest evidence of this turn about comes from the Senate Financial Institutions Subcommittee which plans to hold exploratory hearings Dec. 6-8 on the impact of EFT on branching. The subcommittee plans to come up with its own bill to liberalize the McFadden Act to allow bank terminal hookups.

Chairman Thomas J. McIntyre, of New Hampshire, also is reported to have urged the National Commission on Electronic Fund Transfers to speed up its deliberations on the branching question and to come out with a concrete recommendation by Dec. 1. The commission, which held hearings on the subject at the end of last month, was originally expected to comment on the branching problem in its interim report to Congress due Feb. 23. The group's feedback to Congress is expected to be crucial in laying the groundwork for any bill that's likely to surface next year. One such bill, labeled the Remote Electronic Facilities Act of 1976, was targeted for introduction last summer by Sen. Adlai E. Stevenson of Illinois but the legislative proposal, reportedly brainstormed by former Federal Reserve Board vice-chairman George W. Mitchell, never got off the drawing board.

DATA GENERAL-DCC QUESTION MARK

There was one important item that was lost among all the hoopla of Data General's announcement to acquire Digital Computer Controls. The Delaware Supreme Court was on the verge of announcing a verdict in the lengthy and bitter litigation between the two firms when Data General announced it would pay more than $11 million for DCC. Data General had previously won a Delaware chancery court decision against DCC and if that decision held up, DCC probably would have been forced into bankruptcy. So, why the acquisition? It's obviously a good deal for DCC, and Data General can build its user base too. The move will unquestionably strengthen Data General's marketing position too. Some saw a parallel in the IBM-Telex settlement reached just before the U.S. Supreme Court was to rule on that case. Thus, the dilemma of just what constitutes a computer industry trade secret continues to dog the industry...one interesting sidelight to the DG-DCC case was that there was a famous person involved: James St. Clair, of Richard Nixon fame, represented DCC in the case.

CAR WAXERS AND SOFTWARE COMPANIES TOGETHER IN NEW YORK

Tax hungry New York state is striking out in all directions. A bulky proposal to change interpretations of the state's sales tax laws effective last Sept. 1, has sent representatives of the state's tax collecting body scurrying to unlikely places to audit sales invoices going back three years. One target is software firms which haven't had to impose sales taxes in the past. "They even want to tax custom programming," said a spokesman for Informatics, one of the affected software firms. "They contend we're modifying tangible personal property."

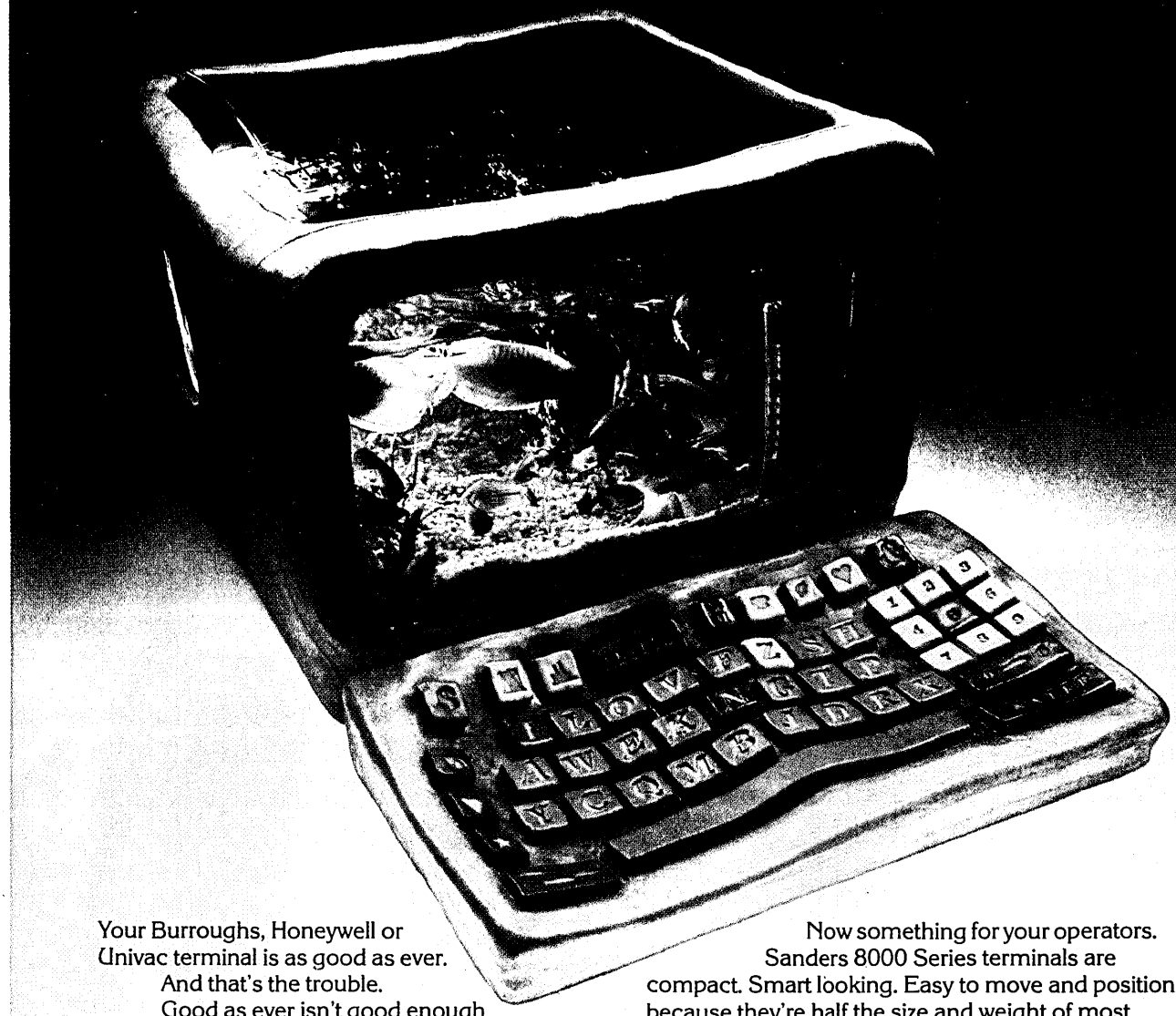
But software companies aren't alone. The proposal would have college students who wax cars impose sales taxes if they advertise; vending machine firms would have to collect sales taxes if there are any chairs within the vicinity of their machines; and company and/or buildings operating cafeterias at a loss would have to pay sales tax on the loss. The proposal is just that so far. It will take several months of hearings and appeals to make it official. "They've been getting letters from all sides," said the Informatics tax man, "from the software industry, vending machine companies, and those who operate cafeterias. So far I don't think they've heard from any car waxing college students but maybe they have."

LIFEGIVING 1800

IBM's venerable 1800, introduced more than 10 years ago, is involved in remote monitoring of open heart surgery patients at an Air Force hospital at Lackland AFB in

(Continued on page 166)

A tactful suggestion for your Uniscope, TD, or VIP:



Your Burroughs, Honeywell or Univac terminal is as good as ever.

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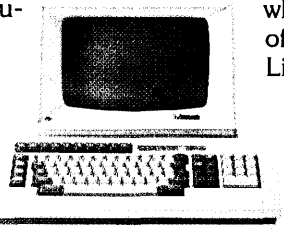

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Sanders 8000 Series terminals are compact. Smart looking. Easy to move and position, because they're half the size and weight of most other terminals. And they keep cool and quiet.

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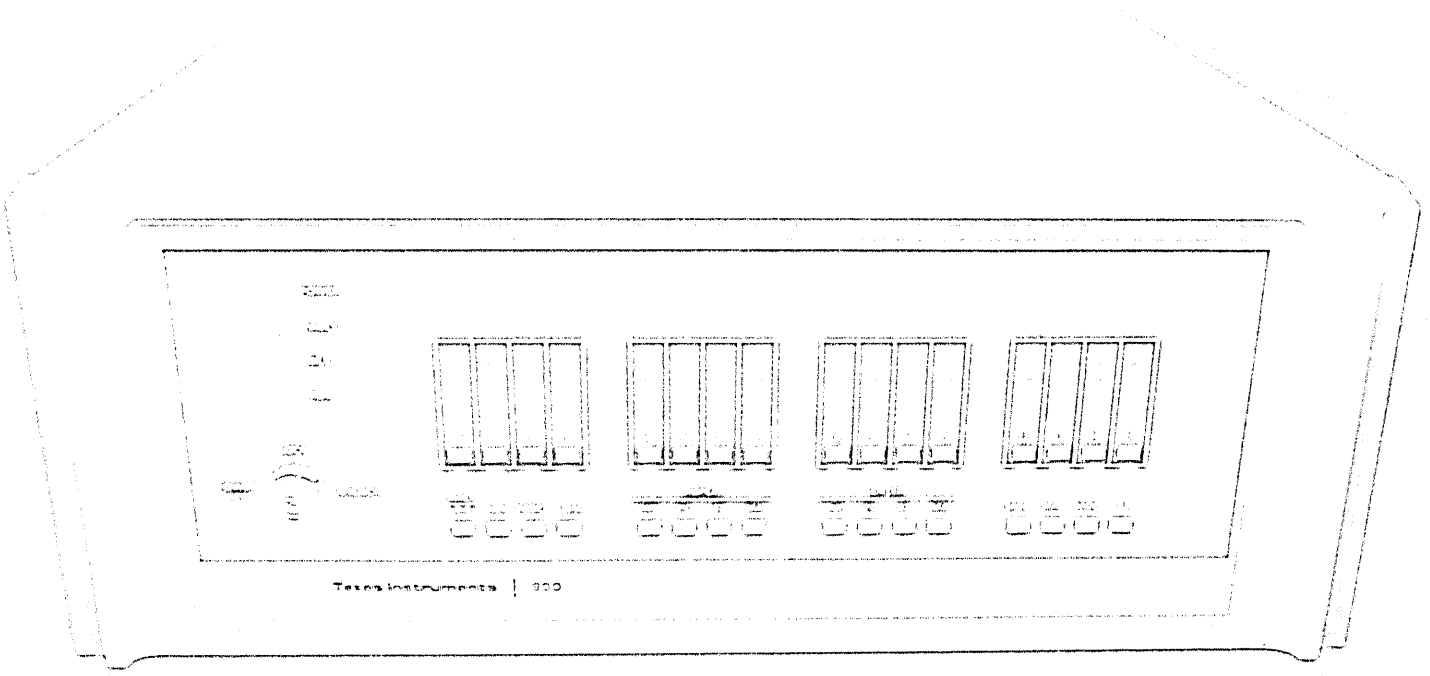
990/10 OEM minicomputers.



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The 990/10 minicomputer from TI brings superior value to both you and your customers.

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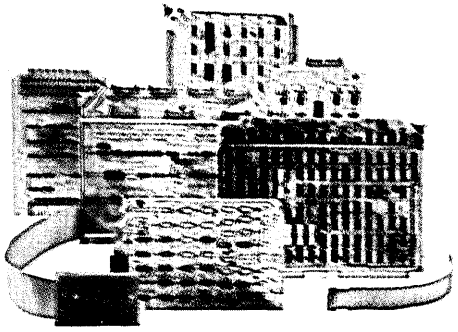
The 990/10 is the most powerful member of the 990 computer family. Its architecture provides features that give you maximum processing power for your money. Like hardware multiply and divide. A 16-level hardware



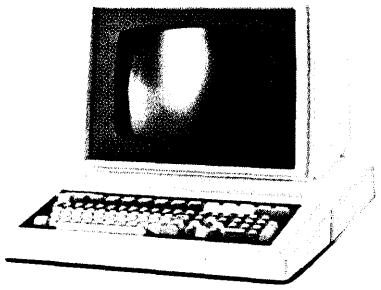
Peripheral Interface Modules

interrupt structure. 16 registers arranged in a workspace concept. I/O that's directly programmable through the Communications Register Unit (CRU) and autonomously through a high-speed data bus. And bit, byte and word addressing of memory.

Built for system flexibility.

In small or large configurations, the 990/10 design provides surprising flexibility for a small investment.

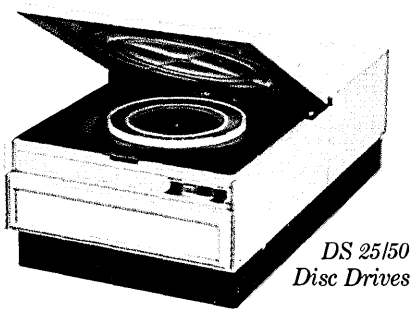
The CRU, with up to 4096 I/O lines, reduces interfacing costs by keeping controller complexity to a minimum. The TILINE* asynchronous high-



Model 913 Video Display Terminal

speed data bus can support both high- and low-speed devices and takes advantage of design simplicity for simultaneous data transfer between peripherals, the CPU and memory.

With the 990/10, you get a powerful instruction set with an extended operating feature that allows hardware to take over operations that software would normally execute. An optional mapping feature provides memory protection and memory expansion to 1 million words. And, optional error-correcting memory corrects single-bit errors for increased system reliability.



DS 25/50 Disc Drives

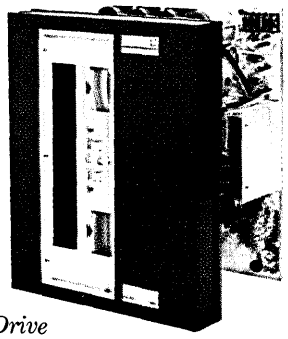
Full peripheral support.

As well as a range of standard peripherals, disc storage to 90 million 16-bit words and magnetic tape with 800 and 1600 bpi options are available for low-cost mass storage and back-up.

A choice of software.

With common higher level languages, FORTRAN IV, COBOL and Multiuser BASIC, plus the 990/10 assembly language, you have all the tools you need for an efficient application program.

Both the disc-based and memory resident operating systems give you modularity and flexibility for system generation to meet application de-



Model 979 Tape Drive

mands. We offer program development aids for creating and testing software, and communications software to support synchronous or asynchronous data transmission.

Backed with nationwide service.

Our responsibility to you doesn't end with the sale. We follow through with complete system training, plus a nationwide factory service network.

The TI 990/10 minicomputer. We build it, back it and price it the way you and your customers want it. You can start configuring a system now with our 990 Computer Systems Handbook on the upward-compatible family of the TMS 9900 microprocessor, 990/4 microcomputer and 990/10 minicomputer. For your free copy, send a letterhead request to Texas Instruments Incorporated, P.O. Box 1444, M/S 784, Houston, Texas 77001.

TEXAS INSTRUMENTS
INCORPORATED

*Trademark of Texas Instruments.

CIRCLE 39 ON READER CARD

calendar

NOVEMBER

7th Annual Input/Output Systems Seminar, **Nov. 29-Dec. 1,** New York City. The program will include an update on new technological developments and a look at the future. Sessions will cover teleprocessing, terminal systems, data entry, key-to-disc and tape, minicomputers/microprocessors, point-of-sale, electronic funds transfer systems, and voice response, among other topics. Fee: $150. Contact: Input/Output Systems Assn., P.O. Box 1333, Stamford, Conn. 06904 (203) 323-3143.

Computer Based Personnel Information Systems Seminar, **Nov. 30-Dec. 1,** London, and **Dec. 2-3,** Amsterdam. Step by step methods for establishing a personnel data base, and organizing and securing the system are the main thrust of this seminar. Instruction on integrating human resource information with payroll, converting records to computer, operating a skills inventory, measuring costs and benefits are other topics aimed at systems designers. Fee: $170 (approx.). Contact: EBI Ltd., 37 Mill St., Boston, Mass. 02122 (617) 825-5745.

DECEMBER

Software, **Dec. 6-8,** San Francisco, and Distributed Data Processing, **Dec. 7-10,** Chicago. The American Institute of Industrial Engineers will sponsor government-industry conferences on these topics. "Software" will present a survey of current technology and applications; the distributed data processing meeting will cover major trends and developments, case histories, and workshops for vendors and users. Fees for either conference: $295, teams $195. Contact: Dept. DTM, AIIE Seminars, P.O. Box 3727, Santa Monica, Ca. 90403 (213) 450-0500.

TDCC National Transportation Systems Forum and Exhibit, **Dec. 7-8,** Washington, D.C. Shippers, carriers, forwarders, banks and government agencies will focus attention on Data Systems Programs for shipping, billing, tracing, payments, claims, export/import, tariffs and audit. The Transportation Data Coordinating Committee sponsors the forum; hardware and software systems will be among exhibits. Fee: $95. Contact: TDCC, 1101 17th St., N.W., Suite 309, Washington, D.C. 20036 (202) 293-5514.

CAUSE National Conference, **Dec. 8-10,** Orlando, Fla. Theme for this conference of the College and University Systems Exchange will be "The Managerial Revolution in Higher Education: The Role of Information Systems." The problems facing institutional management and the application of information systems to solve those problems will be explored in a track format. Fee (includes lunches, banquet, and proceedings): $100, members; $135, nonmembers. Contact: College and University Systems Exchange, 737 Twenty-Ninth St., Boulder, Colo. 80303 (303) 492-7353.

JANUARY

Data Communications Equipment Exhibition, **Jan. 10-14, 1977,** U.S. Trade Center, London. The U.S. Dept. of Commerce sponsors this exhibition, which will emphasize computer peripheral controllers and interface devices, combination I/O devices and processors, input equipment, output devices, and parts and accessories of data communications systems. Contact: Anita F. Brownstein, Dept. of Commerce, OIM, United Kingdom, Washington, D.C. 20230 (202) 377-4443.

5th Annual ACM Computer Science Conference, **Jan. 31-Feb. 2, 1977,** Atlanta. Tutorial lectures, reports on current research, book exhibits, and an employment register are highlights of the meeting planned by the Assn. for Computing Machinery. On Feb. 2-3 the ACM Special Interest Group on Computer Science Education will hold a technical symposium. Conference fee (before Jan. 10): $25, member; $30, nonmember; $5, student; after that date fees are $35, $40, and $10, respectively. With the exception of student registration, proceedings of the conference are included with fees. Contact: ACM, 1133 Avenue of the Americas, New York, N.Y. 10036 (212) 265-6300. Forms for the employment register may be obtained from Orrin E. Taulbee, Dept. of Computer Science, Univ. of Pittsburgh, Pittsburgh, Pa. 15260. Student listings are free, non-students are $5, and anonymous listings are an additional $5. Employer listings are $20 per form submitted.

ON THE AGENDA . . .

NIPS Data Management System Meeting, Dec. 2-3, Washington, D.C. (303) 893-5200. **OCR Users Association, Winter Conference, Jan. 10-12, 1977,** Orlando. OCRUA, (201) 343-4935. **WINCON 77, Feb. 7-9,** North Hollywood, Calif. (213) 887-2330.

CALL FOR PAPERS

1977 National Computer Conference, **June 13-16,** Dallas. Previously unpublished papers are solicited for next year's NCC, and the committee indicates that major emphasis will be on the technology of computing, management, current and prospective users, and the individual. Six copies each of the paper (maximum 5,000 words) and a 150-word abstract, and three copies of a short biography should be sent by Dec. 1 to Dr. Robert R. Korfhage, Program Chairman, Dept. of Computer Science, Southern Methodist Univ., Dallas, Texas 75275, (214) 692-3082.

9th Annual ACM Symposium on Theory of Computing, **May 2-4, 1977,** Boulder. Authors of papers describing original research in the formal analysis of computing problems should send seven copies of detailed abstracts by Dec. 1 to Prof. John Hopcroft, Program Chairman, Dept. of Computer Science, Cornell Univ., 420 Upson Hall, Ithaca, N.Y. 14853. The author's name and affiliation should appear only on a cover sheet attached to one copy of the abstract.

Conference information submitted to Calendar should include registration fees, phone number and name of contact. Items for consideration should be received by DATAMATION three months prior to the event.

DECSYSTEM-20.
It took a minicomputer company to offer hardware this economical.

Not just anybody could have come out with a DECSYSTEM-20.

Because the DECSYSTEM-20 is the world's first general purpose computer to bridge the gap between big-system power and small-system price.

And that means the company that came up with it had to have a lot of experience in both big and small computers. And there is only one company that does.

Digital Equipment Corporation.

To create a DECSYSTEM-20, we took the same approach to computing that's made us the number one company in minicomputers.

That approach says that a computer must first of all be affordable—giving you the most popular computer for the least amount of money.

With the DECSYSTEM-20, this approach meant giving you big system capability at a total system cost of under $10,000 a month.

Our approach to minicomputers also said that a computer must be approachable. Meaning easy to install. Easy to use. And small in size.

With the DECSYSTEM-20, this approach meant giving you a full-scale general purpose system that installs like a dedicated mini. A sophisticated machine that needs no operating staff and can be run interactively by just about anyone. All in a package that takes up about a fraction of the space required by other machines of similar performance.

But, to create a DECSYSTEM-20, we also took the same approach to computing that's made us the leader in large-scale interactive systems for the last eleven years.

That approach says a computer should offer you the kind of powerful software that will give you not simply everything you expect in a big system, but everything you need.

With the DECSYSTEM-20 this

DECSYSTEM-20.
It took a large-scale computer company to offer software this powerful.

approach meant giving you a system with: Powerful, reliable multi-stream batch. Interactive capability to run up to 64 concurrent jobs. Complete higher-level languages including FORTRAN, COBOL, APL, BASIC PLUS, ALGOL, IQL, and CPL. A true demand paged operating system with large user address space for fast throughput. Six megabytes I/O bandwidth. Six megawords per second. ECL logic. A Data Base Management System. A Business Instruction Set. High system availability. Ease of conversion. Its own front-end mini for diagnostics and to run the peripherals.

Up to 1.2 million bytes of core memory. And up to 1.4 billion bytes of high-speed, on-line disc storage.

All of which is how the DECSYSTEM-20 combines the best of the big systems with the best of the small.

DECSYSTEM-20.

It had to be Digital's.

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Bridging the gap.

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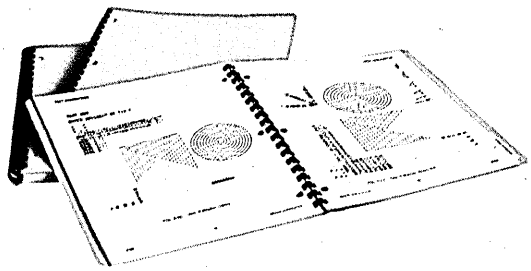
Tel. 617-481-9511 ext. 6885. DS

"As the first interactive small plotter, it was the only intelligent choice."



The 4662 contains its own character generator, alpha rotation, and page scaling, thus minimizing support software. Proven graphic and plotter software is provided by Tektronix.

Problem: Until now, no small plotter could carry on an intelligent conversation.

Because most B-sized plotters have been pretty much the same: slow, unreliable, and dumb. Even with large off-line plotters you can wait hours, even days, for results . . . and if there's a mistake—start over.

Solution: Tektronix' new microprocessor-based 4662. For interactive plotting, page scaling, digitizing, and camera-ready output. Just $3995.†

The 4662 is the first smart buy among 11"x17" flatbed plotters. Its digital design and vector generation offer exceptional accuracy and repeatability without drift or slidewire dirt build-up. Its 1600-byte buffer lets the host work while the 4662 plots . . . at speeds up to 22 ips.

It's the first B-sized plotter with graphic input. Digitizing capability and built-in joystick mean you can input corrections in seconds, experiment with designs, and run off camera-ready copies practically as fast as you load paper.

It's plug-to-plug compatible with virtually any RS-232 system . . . from minis to mainframes. You can plot circles around any other B-sized plotter, for about the same price as the competition. For a demonstration, call your local Tektronix Sales Engineer, or write:

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Information Display Group
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Beaverton, Oregon 97077
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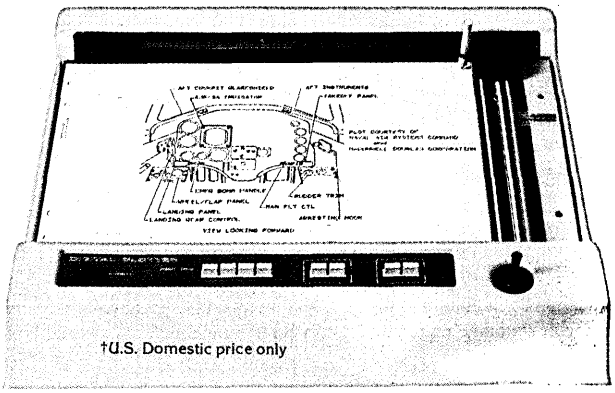

†U.S. Domestic price only

CIRCLE 54 ON READER CARD

source data

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

(Books and Book Briefs will be found in the special book supplement on p. 121 of this issue.)

reports & references

Computer Abuse Reports

A number of reports on computer abuse based on research carried out at SRI for the National Science Foundation makes for interesting and useful reading. The problem is defined in *Computer Abuse Assessment* by Donn Parker ($5, 34 pp.) and a profile of perpetrators and vulnerable functions and locations are discussed in *Computer Abuse Perpetrators and Vulnerabilities of Computer Systems*, also by Mr. Parker ($5, 27 pp.).

Susan Nycum has written three reports on the legal aspects of computer abuse: *Criminal Sanctions Under the Privacy Act of 1974* ($5, 22 pp.), *The Criminal Law Aspects of Computer Abuse: Applicability of the Federal Criminal Code to Computer Abuse* ($6, 33 pp.), and *The Criminal Law Aspects of Computer Abuse: Applicability of the State Penal Laws to Computer Abuse* ($6, 30 pp.).

Ms. Nycum has also written a report touching on an important legal issue, *Legal Protection of Proprietary Rights in Software* ($7, 118 pp.). All six reports may be purchased for $30, or individually; send check to Allison Brandt, Bldg. 300, STANFORD RESEARCH INST., Menlo Park, Calif. 94025.

Interactive Computing

Interactive Computing Directories, a 200-page loose-leaf publication, is "the only comprehensive directory available today for users of remote computing." It is divided into three sections: data base systems, financial modeling languages, and company profiles and security precautions. Detailed information on more than 40 companies offering remote computing services is included. A bimonthly newsletter, *Interactive Computing*, contains new updates and is available with membership in ATSU along with the directories. (ATSU, a two-year old nonprofit association, has over 1,200 members.) Subscription: $60. ASSN. OF TIME-SHARING USERS, 75 Manhattan Dr., Boulder, Colo. 80303.

Dp Solutions

A monthly supplemented desktop reference service, *Datapro EDP Solutions*, provides documented answers to day-to-day problems confronting the dp manager. Technology problems, systems development administration, operations optimization, standards implementation, procurement criteria, etc., are covered. The loose-leaf reference is written on a management rather than on a technical level, and user ratings of a wide range of dp products are included. Detailed supplier and association directories are part of the service, and the 14 sections are cross-indexed for ready reference. The annual subscription to the service includes two loose-leaf volumes, monthly supplements and newsletters, and use of Datapro's dial-up inquiry service. Charter subscriptions: $190 (regular rate is $230), and a 30 day trial subscription is available. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

Security and Privacy

Proceedings of the Computer Security and Privacy Symposium sponsored by Honeywell Information Systems April 6-7 at Scottsdale, Ariz., (See May, p. 180), contain 15 papers by national authorities, including Donn Parker and Robert Goldstein. The latest thinking on security techniques involving data encryption, hardware, and software are represented by three presentations. Price: $10. Computer Security Manager, Mail Station B-19, HONEYWELL INFORMATION SYSTEMS, P.O. Box 6000, Phoenix, Ariz. 85005.

Risk Insurance

The 78-page *Executive's Handbook on Business Insurance* contains much useful information to help each company evaluate its risk exposure and the right kind and amount of coverage needed. Divided into problem-oriented chapters, special risks in computer and dp operations is featured, along with damage to property (both on and off premises), business interruption, coverage for liability to others, and tax implications of the insurance program. Price: $35 ($15 to members). Dept. 111, RESEARCH INST. OF AMERICA, Mount Kisco, N.Y. 10549.

NCC Proceedings

The 1,082-page Proceedings of the 1976 National Computer Conference held in New York City in June contains 136 papers on specific topics in three broad areas: Computers and People (privacy, security, computer abuse, EFTS, computer graphics, medicine and health care, etc.); Systems (design, microprocessors, minicomputers, system management and planning, etc.); and Science and Technology (computer architecture, data base systems, large scale networks, programming languages, artificial intelligence, etc.). Price: $50 (50% discount to members of AFIPS Constituent Societies if order is prepaid). AMERICAN FEDERATION OF INFORMATION PROCESSING SOCIETIES, INC., 210 Summit Ave., Montvale, N.J. 07645.

IEEE Standards

The 1976 32-page IEEE Standards Catalog lists over 350 standards publications, including American National Standards, and provides a subject index. Test methods, practices for electrical installations, units, definitions, graphic symbols, and applications methods are covered. Some new and newly revised publications on graphic symbols, metric practice, and instrumentation interfaces are also listed. THE INST. OF ELECTRICAL AND ELECTRONIC ENGINEERS, INC., New York, N.Y.

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Time-sharing Services

Growing customer sophistication is resulting in increased questioning of the time-sharing price/performance equation, and technology now affords the dissatisfied user with economically feasible alternatives to continued remote computing services. These two factors are impinging upon the market for time-sharing services, which totaled to about $640 million in 1975. A 204-page report analyzes the market and forecasts industry trends. Features of ten time-sharing leaders are examined in detail, and user interviews emphasizing areas of concern are analyzed. Price: $650. FROST & SULLIVAN, INC., 106 Fulton St., New York, N.Y. 10038.

Planning for Decentralization

Centralization: "To Be or Not To Be?" is an 18-page portfolio which examines the strategies of centralization and decentralization. It cites case histories and suggests organizational options. The portfolio is part of the monthly updated *Auerbach Data Processing Management* information service. AUERBACH PUBLISHERS INC., Pennsauken, N J.

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source data

Front End Evaluator
The subject of data entry (data conversion, data input, and data control) is covered by the 135-page loose-leaf manual, *Front End Evaluator*. Topics include workload analysis, cost analysis, data entry controls, and improvement planning. Cost effective techniques related to the control of data input are emphasized. Price: $95. FAIM TECHNICAL PRODUCTS, INC., Box 1013, Melville, New York 11746.

vendor literature

Microprocessor Systems
Application notes describing the use of logic-state troubleshooting instruments to analyze popular microprocessor systems of various vendors are offered. Included are the National IMP and SC/MP, Intel 4040, 4004, 8008, 8080, Fairchild F8, and Motorola M6800. Charts and schematics help describe the operation of each microprocessor, and separate sections discuss pin assignments, probe and pin connections, analyzer control settings, interpretation of the display, mapping, viewing address and data, and display interpretation. HEWLETT-PACKARD CO., Palo Alto, Calif.
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Distributed Dp
An overview of the concept of distributed processing is offered in the 24-page booklet, *Distributed Data Processing*. Details of this vendor's approach to providing distributed processing networks with its series of expandable "convenience" computers are given. Case histories, illustrations, and a glossary complete the picture. WANG LABORATORIES, INC., Lowell, Mass.
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Financial Dp Service
A booklet describes this company's financial dp service on its nationwide teleprocessing network. The service is based on a fully integrated financial accounting system, AUTOCOUNTANT, and a financial modeling system, AUTOPLAN. Modules in AUTOCOUNTANT include general ledger, accounts receivable/sales analysis, accounts payable, and fixed assets accounting (payroll will be added later). Each module can be used as a separate system, but greater benefit can be gained with use of shared common master files. The subscriber pays only for the number of update transactions and the number of reports printed.

The AUTOPLAN provides up to 1,500 rows and columns for data for use for calculations to evaluate the model. Costs are based on the amount of computer resources used.

Subscribers get training, data entry forms, user manuals, and manual updates, but is responsible for providing his own data terminal. MCDONNELL DOUGLAS AUTOMATION CO., St. Louis, Mo.
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Microcomputer Glossary
A 44-page pocket-sized booklet, *The LSI-11 Microcomputer Glossary*, contains over 200 microcomputer-related terms spanning both equipment and programming aspects of microcomputers. It is intended to familiarize executives, engineers, and salesmen with computer related terminology. DIGITAL EQUIPMENT CORP., Marlborough, Mass.
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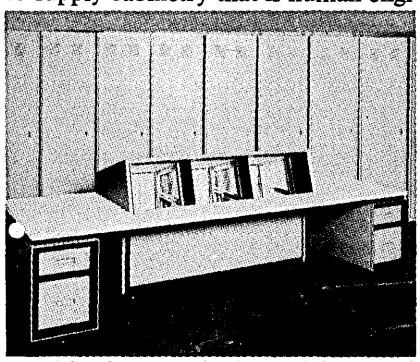
Metal Cabinetry
A 12-page illustrated brochure describes this vendor's capabilities for designing and producing custom metal cabinets for computers and other electronic equipment. The company claims to supply cabinetry that is human engineered, heavy duty, weatherproof, built to NEMA or MIL specifications, and protected against shock and vibration. WYLE LABORATORIES, El Segundo, Calif.



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Mag Head Poster
A four-panel poster describes the care and handling required for magnetic recording heads used in digital disc drives. Of interest especially to large scale users of disc storage units, the poster illustrates this company's family of 4000, 6060, and 8080 BPI recording heads, and 5636 BPI Winchester heads and carriages. "Do's" and "don'ts" are presented in 12 photos, and proper packaging for shipping for service or replacement are also illustrated. INFORMATION MAGNETICS CORP., Goleta, Calif.
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Data Services
A 12-page brochure describes this vendor's systems approach to maintaining customer terminals by Termicare, a support program that combines nationwide field service with a centralized terminal diagnostic service. The company's 10, 30, and 120 cps teleprinters and video terminals are supported by Termicare. WESTERN UNION DATA SERVICES CO., Mahwah, N.J.
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Marine Information
The Marine Information System gives worldwide users instant computer access to marine industry data. A pocket-size brochure describes the systems capabilities, answers frequently asked questions, and gives specifications on the data available. MARINE MANAGEMENT SYSTEMS, INC., Stamford, Conn.
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Intel Technical Library
A brochure describing this vendor's technical publications, including summaries of user, reference, and programming manuals covering memory systems, single board computers, the 4040, the 8080, and the series 3000 microprocessor families is available. INTEL CORP., Santa Clara, Calif.
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Acoustic Couplers and Modems
The "Bawdy 12" acoustic coupler that provides ability to transmit or receive at a data rate of 1,200 bps over standard dial-up network either acoustically or with DAA (Bell System data access arrangement) is described in an illustrated brochure. Another brochure describes this vendor's line of other acoustic couplers, modems, and oem bds (boards). OMNITEC CORP., Phoenix, Ariz.
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Banking Software
This vendor's retail banking application software is described in a 40-page guide, *Proven Programs Handbook*. Products for demand deposit accounting; savings and time deposit accounting; installment, commercial, and mortgage loan accounting; internal funds transfer, etc., are described. Diagrams show how a bank can grow from a batch environment to a totally automated EFTS environment. THE WEILAND COMPUTER GROUP, Oak Brook, Ill.
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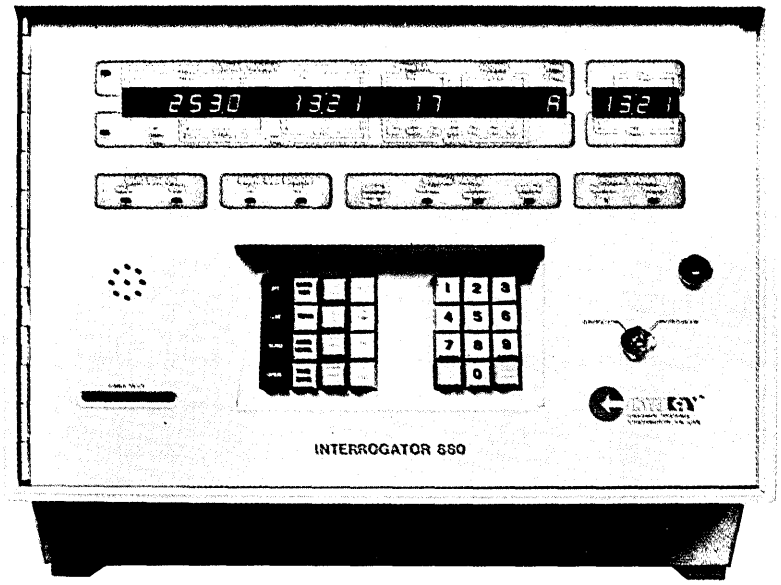
Since its introduction, the Interrogator 880™ has widened the imagination of security-conscious organizations through an amazing array of applications.

It truly has become the industry standard.



There is no other access control system with as much performance and versatility—controlling, documenting and monitoring the movement of people and vehicles through specific points from one location—to anywhere in the world.

With the Interrogator 880, you can literally forget your security worries. You can be sure every gate, door, elevator—every entry and exit—in your office building, factory, high-rise, whatever and wherever people come and go, is adequately protected. It's all done in one simple operation—through the recording and monitoring capabilities of the revolutionary 880.

The Interrogator 880 incorporates highly sophisticated and flexible memory retrieval systems. The Interrogator 880 is versatile. Your system may begin with a simple installation—such as monitoring entry and exit access to the company parking lot and front door—and thereafter it is field expandable to meet your growing requirements.

It can record both valid and invalid entry attempts and reports the reason for denying access. It can monitor alarms and environmental conditions such as fire, flood, temperature and noise level.

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Since its introduction, the Interrogator 880 has been field-proven by utility companies, government agencies, data-processing centers, financial organizations, the petroleum industry and many manufacturing firms, to mention only a few. Actually, its applications are limited only by your own imagination.

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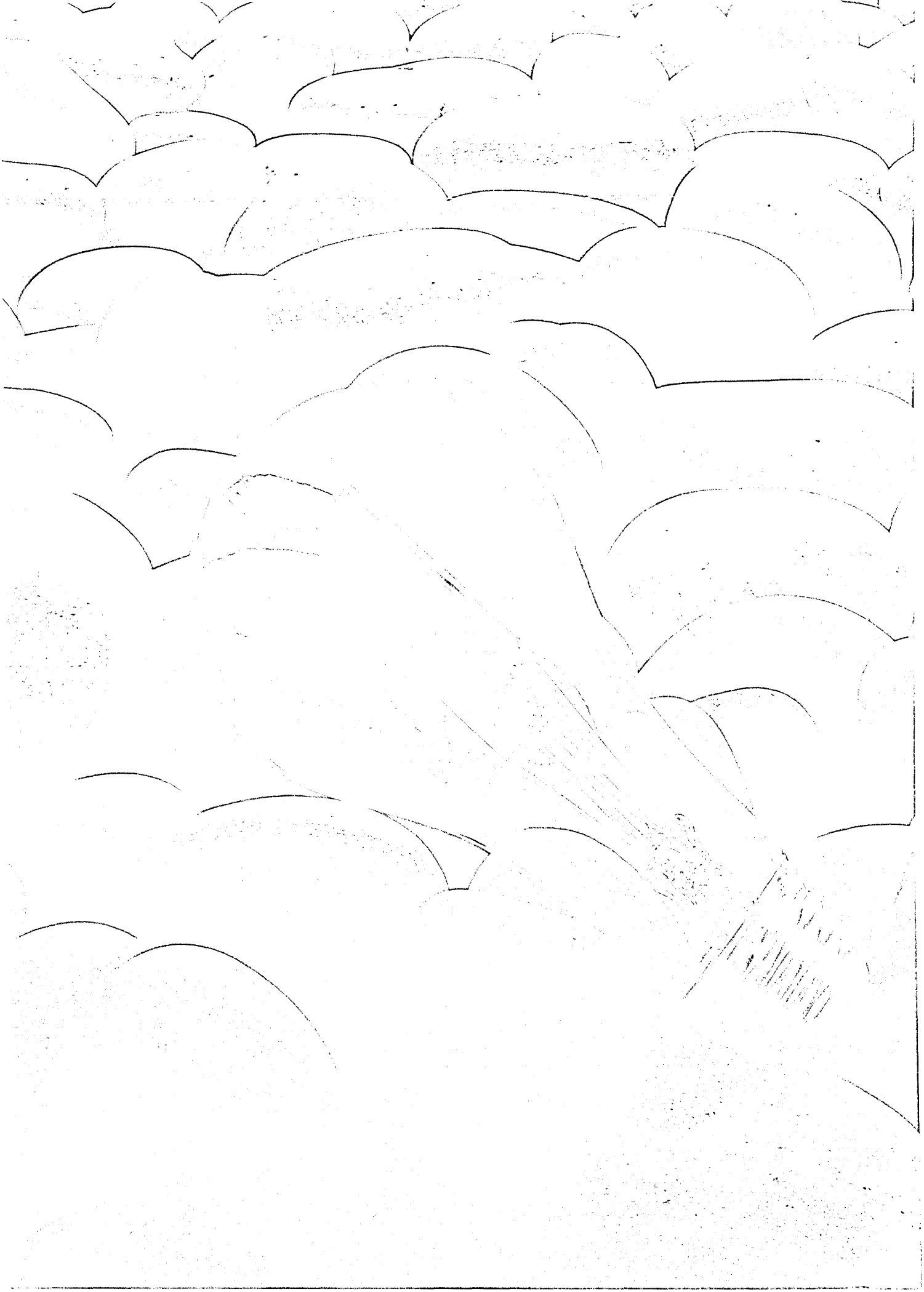

Our bright idea.

More computer power for your dollar.

The SEL 32 family of high performance 32-bit computing systems offers a balance between big computer performance and minicomputer prices. Microprogrammable input/output processors, compatible central processing units, high-speed memory systems, and efficient data processing peripherals make up the hardware elements. On the software side, operating systems, language processors, libraries, application packages, and interactive terminal support balance the scales. Together, SEL 32 hardware and software provide a cost-effective solution to your current requirements, with expansion capability to meet your growth needs.

The SEL 32/35 is the strongest price-performer of any 32-bit single or multiple-CPU system available today. These computers can be configured from 64K bytes to 512K bytes of 900 nsec memory. Resembling its more powerful brothers, the SEL 32/35 is a complete package, including central processor with floating-point arithmetic, memory, chassis, power supplies, and cabinet.

The SEL 32/55, offered in a variety of both single and multiple CPU configurations, can be configured from 32K bytes to 1 million bytes of 600 nsec memory.

The SEL 32/50 is a single chassis computer providing the same CPU, I/O, and memory capability as the 32/55, but for dedicated applications.

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source data

Display Devices
Display storage tubes, crt's, and a developmental electroluminescent flat-panel display are illustrated and discussed in a 22-page catalog. In-depth specifications for military crt's, high resolution crt's, tube-yoke-shield packages, fiber optic crt's, and general display crt's, with plentiful diagrams, are given in the first section.

Characteristics, ratings, and dimensional diagrams for standard and high contrast electrostatic-deflection tubes as well as magnetic-deflection tubes appear in the second section. And the third describes the flat, thin-film-transistorized panel designed for data display in applications with size, weight, or power-dissipation limitations. WESTINGHOUSE ELECTRIC CORP., Industrial & Government Tube Div., Horseheads, N.Y.

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Microprocessor Controller
The Eptak microprocessor controller system is designed for process control, machine control, and other applications calling for advanced programmable control. An illustrated brochure gives details of major components of the system, including the processor, crt programmer, and peripheral interfaces. Capabilities for data entry and display via pushbutton modules are also included. EAGLE SYSTEMS INDUSTRIAL CONTROLS DIV., A Gulf + Western Manufacturing Co., Davenport, Iowa.

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courses

Management Skills for Women
A 3-day seminar on the elements, functions, and activities of management, designed specifically for women with supervisory and managerial potential, is scheduled for four cities: San Francisco (Nov. 15-17), Atlanta (Nov. 29-Dec. 1), Washington, D.C. (Dec. 1-3), and New York (Dec. 8-10). Price: $495 ($395 per person for groups of two or more). ADVANCED MANAGEMENT RESEARCH., 1370 Ave. of the Americas, New York, N.Y. 10019.

IAT Courses
A number of 3-day courses are scheduled. *Effective Analysis and Design of Information Systems* will be held in Alexandria, Va. (Dec. 1-3) and San Francisco (Jan. 17-19). *Distributed Processing with Minicomputers* is scheduled for New York (Dec. 13-15) and Bethesda, Md. (Jan. 24-26). *Computer Operations Management* will convene in New York (Dec. 8-10) and Bethesda, Md. (Jan. 10-12). Other courses are *Structured Design* in New York (Dec. 6-8) and Washington, D.C. (Jan. 10-12), *Advanced Programming Techniques* in San Francisco (Dec. 15-17) and New York (Feb. 2-4), and *Data Base Structures and File Organization* in Washington, D.C. (Dec. 1-3) and Houston (Jan. 12-14). Price: $460 ($485 if invoiced). INST. FOR ADVANCED TECHNOLOGY, 6003 Executive Blvd., Rockville, Md. 20852.

Payroll Systems
A 2½-day course covers creating an in-house payroll system, buying a payroll software package outside, and processing through a bank or outside service bureau. Techniques, approaches, and pitfalls will be emphasized. To be held in Pasadena (Nov. 17-19), Atlanta (Dec. 15-17), New York (Jan. 10-12) and San Francisco (Feb. 2-4). Price: $415 ($360 for AMA members); team fees available. AMERICAN MANAGEMENT ASSNS., 135 W. 50th St., New York, N.Y. 10020.

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Dialogue

"Mighty machine, I have returned,
Though my last offering was spurned.
You, whom I thought to have
befriended,
You read my job, and then abended.

"Ungrateful wretch, I made you great,
And raised you to your high estate.
And reckless, burned the midnight oil,
Through long man-centuries of toil.

"Once absolute I used to pour,
Into your reader's gaping maw,
And when you said this would not do,
In BAL I wrote for you.

"Control cards now you did request,
Which to supply I did my best,
Though no one knew what they
were for,
Just that you always wanted more.

"Ascii, Ebcdic, BCD,
Cobol, Fortran, RPG,
Into your readers I've supplied,
And still you are not satisfied.

"For if to you twelve jobs I send
One half will loop, while six abend.
What I submit, you soon reject,
Why can't you treat me with respect?"

Then answered him the Great
Machine:
"The junk you send I've often seen.
To find a worse mess can't be done,
(always excepting PL/1).

"Your errors, never mind how slight,
Why should *I* have put them right?
Despite your curses, I'm your tool;
It's not my fault if you're a fool.

"I have important things to do—
Production and time-sharing, too,
Data base, communications,
And other gainful occupations.

"No space or time I'll waste on you
Who never think before you do.
See, your programs bombed once more,
So here's your dump, and there's
the door!"

—David H. H. Diamond

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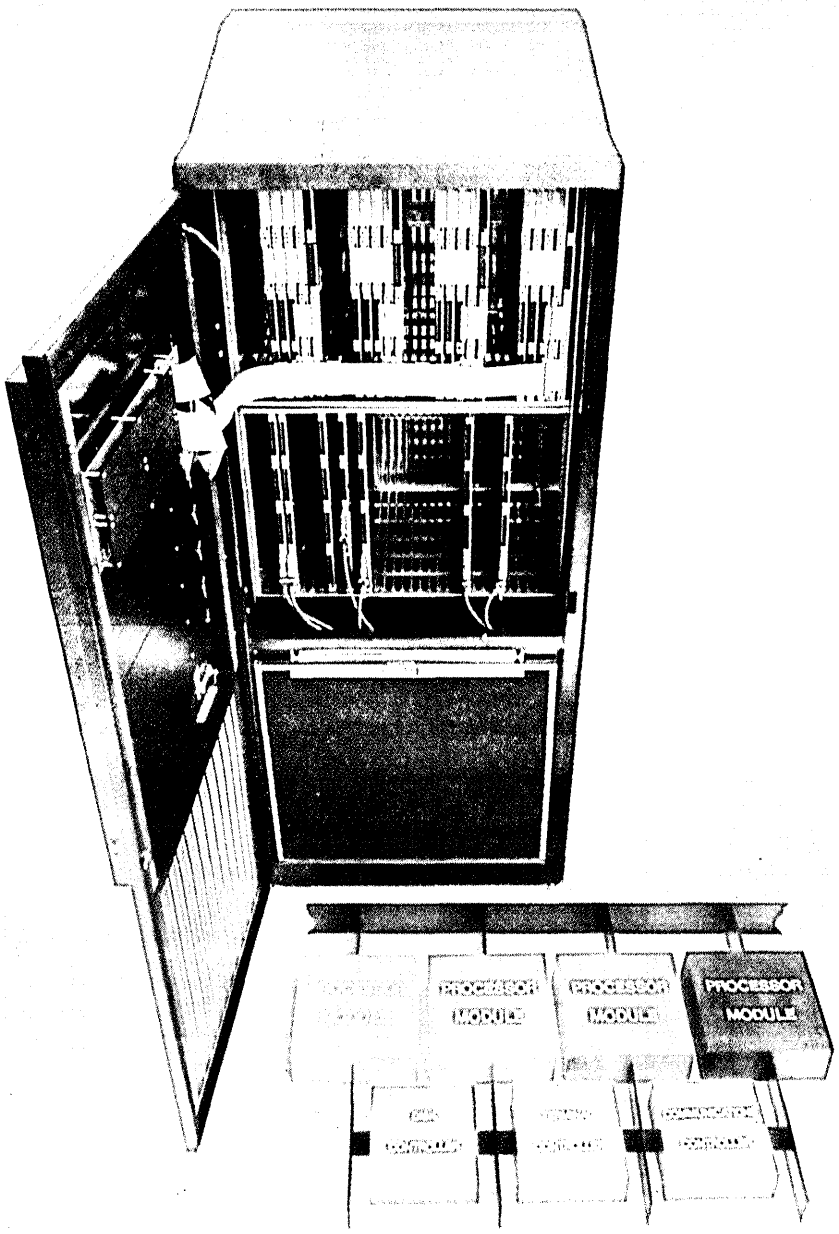

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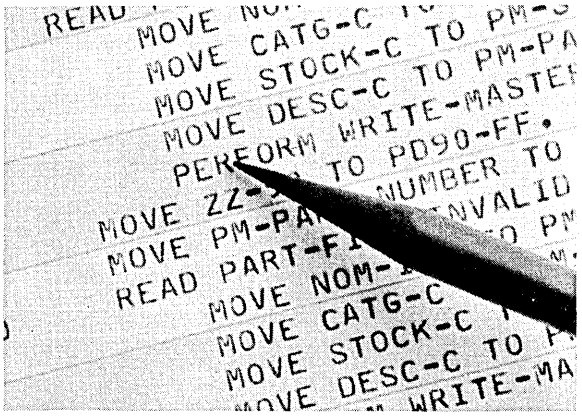

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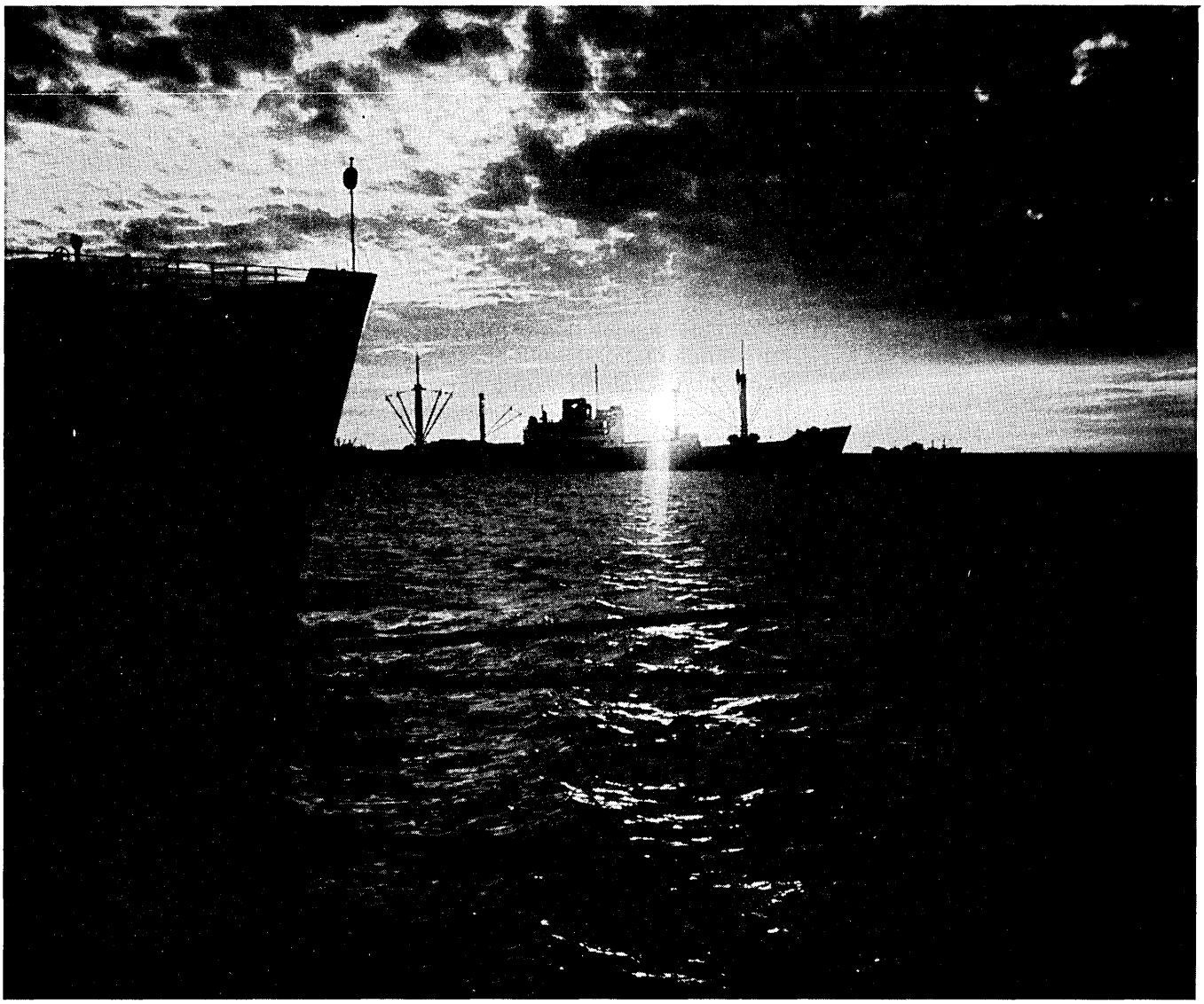

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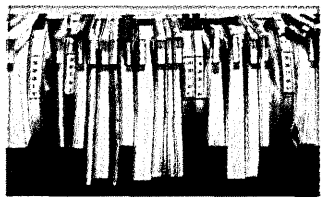

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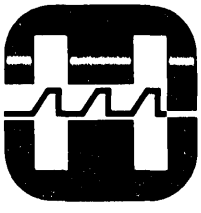

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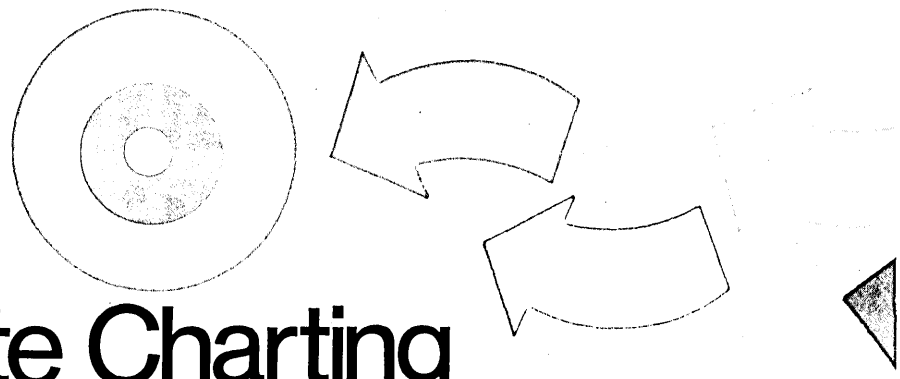


Rate Charting

by Terry R. Snyder

Excellent for spotting trouble before it happens, these two-dimensional charts give a complete picture of actual and planned production paths for software projects of all sizes.

A ready inference from case histories of software development is that conventional methods for monitoring the status of large software projects have not been adequate. Contributing to this inadequacy have been: (1) overly optimistic status reporting by programmers, (2) role conflicts between first-line supervision and management, and (3) inadequate status determination techniques by software management.

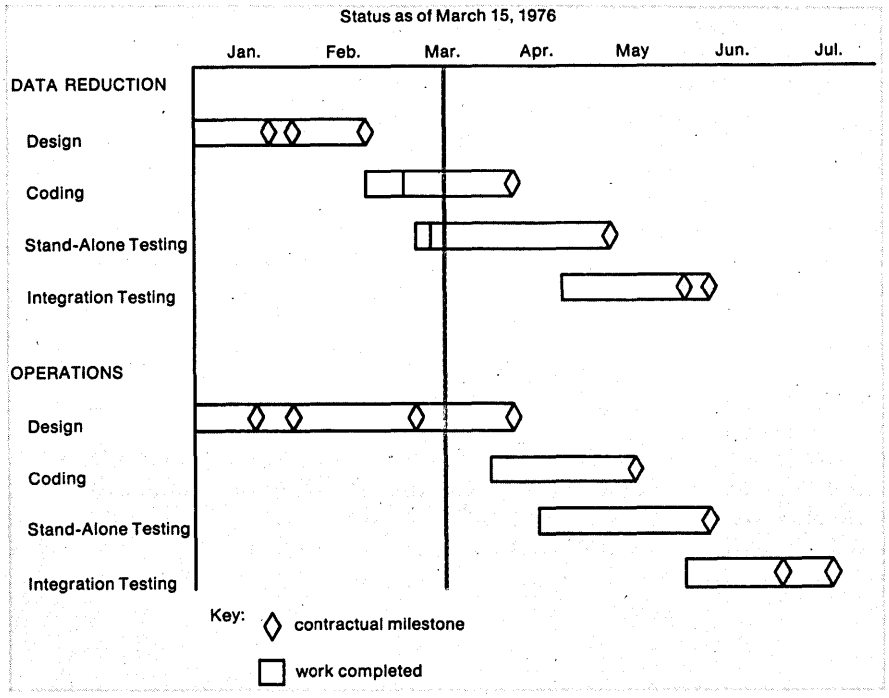
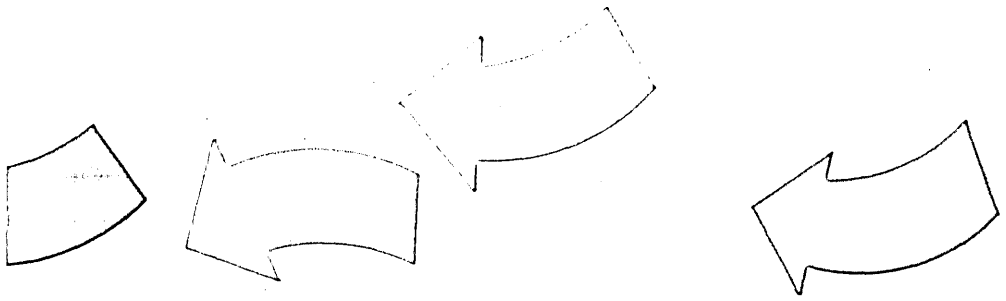


Fig. 1. A Gantt chart is useful for assigning production schedules, but a drawback is that on any particular day it is unclear whether a specific task, which may proceed at a nonlinear rate, is on schedule or falling behind. Such bar charts are then of little use for warning managers of potential problems.

The adaptation of proven engineering management methods to software engineering has been slow. One of the oldest techniques involves the use of one form of bar chart, sometimes called the Gantt chart after its originator. These charts—one is shown in Fig. 1—are commonly used to monitor the time-oriented relationships between computer program packages where a program package is any convenient grouping of modules—usually customer oriented.

Although the bar chart is an excellent tool for project planning, a few critical failings are associated with using it to indicate status and to provide effective project control. For example, in Fig. 1, the "percent completion" for the coding activity for the data reduction (shown by the shaded portion of the line) could be either behind or on schedule. Does such a deviation imply problems with planning and schedule, or simply that the completion rate for the coding task is nonlinear? To combat this uncertainty, the alternative that is generally used is simply to label the chart, "deviation from plan"; if the shaded activity line significantly lags the current date, problems are definitely indicated. Unfortunately, it is generally not evident which of the two possibilities is meant, and it is time con-



suming and inefficient to interpret several pages of lower-level bar charts to determine where one really is on the overall plan. After the production assignments are made then, bar charts rapidly lose their effectiveness.

Rate charting

To overcome these inadequacies, the Computer Programming Laboratory (CPL) at Hughes Aircraft, Fullerton, California, has developed a technique called "rate charting." The rate chart provides more information than the bar chart by displaying a graphic representation of status *and* rate of progress,—and in two dimensions instead of one. This is depicted in Fig. 2. The chart shows *actual* software status with dashed lines compared to representations of the *expected* completion time path in solid lines for each phase of a software development cycle.

The rate charting technique was developed for use on large software projects (50K to 250K instructions) in response to the often asked questions: How did we do this week? Did we lose ground? Are we making up for previous slips? Are hot spots developing? Experience within CPL has shown that rate charting is ideally suited for any software project that involves a significant number of elements (e.g., 200 modules). However, the technique has been used equally well to monitor a one-progammer, one-month, 15-module effort.

CPL, an organization of about 225 software engineers, programmers, and support personnel, is responsible for the development of real-time computer programs that support the systems produced at Hughes' Fullerton facility. All product lines have in common the use of large embedded computer systems that are developed concurrently with processors and/or peripheral devices and sensors. Additionally, the software is developed in an engineering environment where the design of the system is often changing during the development phase, a situation which challenges skillful software implementation and management techniques.

We have successfully used rate charting since January 1975, when it was first applied to an Air Defense Ground Environment System which required the production of 250,000 instructions. An improved version is currently in use on a towed array sonar system requiring the production of an estimated 240,000 new instructions.

The technique has been well accepted. The "selling" job to software management was quite easy because (1) the technique was fully described in the Programming Notebook at the beginning of the project, (2) a seminar to introduce rate charting was held for all personnel, both supervisors and programmers, and (3) sample rate charts from an earlier project were

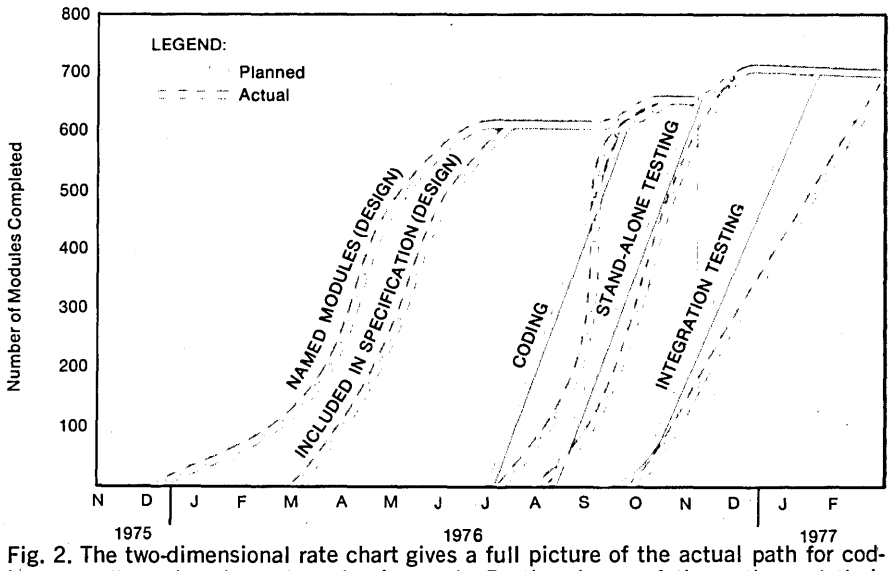


Fig. 2. The two-dimensional rate chart gives a full picture of the actual path for coding as well as the planned production path. By the slopes of the paths and their intersections, the rates of progress can be determined and potential trouble spots quickly discerned. Besides being an extremely useful indicator of status and progress of software projects, the rate chart gives a visual developmental history of those projects.

presented.

As shown in Fig. 2, the representations can be linear or nonlinear. The rate chart shows production rates as well as start and end planning dates. As a result, the detailed rate chart provides visibility for all management levels—including the individual programmer, management, and the customer. By evaluating the slope of the actual path with respect to the planned path, a manager is alerted to trends, and can consider reallocation of resources. If the actual rate of accomplishment is ahead of schedule (planned line) but converging, a future problem may be developing. If the actual rate is behind the planned line and diverging, the underaccomplishment is increasing and need for management action is critically indicated.

Tool for software management

The most effective tool the software manager has is eyeball-to-eyeball contact with the performing programmers, learning firsthand about the problems and achievements on a regular basis. But on large projects, or on those involving many supporting organizations, such contact is limited and the software manager must rely on weekly meetings and reports for status information and potential indicators of trouble.

Rate charting contributes to accurate weekly status reporting on each software development phase, indicates potential trouble and production trends, and promotes the involvement of each supervisory level. As shown in Fig. 2, the two-dimensional rate chart includes the planned production path as well as the actual path for the coding, standalone testing, and integration testing phases. During design, the modules themselves are being (1) identified (named) and (2) described in the design specification. Both of these design activities are plotted because there is a difference in the time and effort involved in the conceptual design of a module, and in the final design as reflected in the specification. After module identification, planned production provides a meaningful schedule.

The rate charting technique can be applied to the four basic phases of software development: design, coding, standalone testing, and integration testing. These phases can be described as follows:

Design—Design consists of the use of structured design guidelines, generation of Hierarchy Input Process Output (HIPO) diagrams, and participation in structured walkthroughs.

Coding—Coding, including the data base, is complete for a module when it compiles or assembles error-free.

Standalone Testing—Standalone testing includes both static (parameter) and dynamic (assembly) testing.

Integration Testing—Integration testing starts when all linkages to the module have been resolved and the module can be exercised in the system environment. It is complete when all test procedures are passed successfully.

In project control, the production trends are as important as the current status. It is valuable to be able to determine quickly whether or not the current production rate is keeping pace with the planned production rate. If the effort is currently behind schedule, will the current production rate allow you to catch up and complete the task on schedule, or will you simply fall further and further behind? For example, if the slope of the actual rate path will intersect the slope of the planned rate path within a predetermined period, e.g. two weeks, then the delayed activity will catch up. If the intersection will not occur within the predetermined period, then a problem of longer duration is indicated and management handling is needed.

Basic trend indicators are provided by this analysis of rate charting as follows:

1. Ahead of schedule and gaining/-holding ground (*good news*)
2. Ahead of schedule and losing ground (*alert!*)
3. Behind schedule and gaining/-holding ground (*acceptable*)
4. Behind schedule and losing ground (*alert!*)
5. Changes to specification are occurring (*alert!*)

Project: California Air Defense

CPP: Operations

First Line Supervisor: Bowen Week Ending: Sep 13, 1976

Software Category	No. of Modules	Design Named	Design Spec.	Coding Complete	Stand-Alone Testing Comp.	Integration Testing Comp.
Active Correlation	68	68	68	68	21	
Passive Correlation	25	25	25	20	5	
Track Update Monitor	75	75	75	60	15	
Height	44	44	44	44	44	
Surveillance Switch Action	27	27	27	27	0	
Simulation	27	27	27	27	27	
Simulation Switch Action	33	33	33	33	0	
Weapons	81	81	81	40	5	
Weapons Switch Actions	33	33	33	26	0	
Flight Plan	7	7	7	7	7	
Crosstell Incoming	13	13	13	13	13	
Crosstell Outgoing	15	15	15	15	15	
Manual Inputs	69	69	69	43	0	
General Switch Actions	41	41	41	41	20	
Display	49	49	49	49	0	
Display Controller	151	151	151	149	82	
TOTAL	758	758	758	682	254	

Table 1. First-line supervisors report the number of modules—more meaningful than number of instructions—started and completed on a weekly basis, on this module status reporting form. These data points would be used to make up the rate charts.

Project: Calif Air Defense

Second Line Supervisor: Rova Week Ending: Sep 13, 1976

Software Category	Areas Behind and Losing Ground: Design	Code	Stand-Alone	Integration	Areas Ahead of Schedule, but the Slope of Progress Indicates Trouble: Design	Code	Stand-Alone	Integration
Active Correlation			8			6		

Table 2. A weekly problem and warning area form identifies trouble areas. The number of weeks that a particular software category has been "in trouble" at a particular phase of development is recorded here.

6. Retrofit to past modules is required (*alert!*)

Advantages of rate charting over other techniques are that: it is inexpensive, it produces immediately available results, both history and status are illustrated, changes to planned program can be accommodated without extensive rework, and it promotes the involvement of the first- and second-line supervisors. The first-line supervisor collects data and calculates weekly status. In his turn, the second-line supervisor plots the rate charts and generates problem/warning area information, when applicable.

All of the reports and charts are hand-prepared and require no extra time or effort to generate than is normally allocated to status reporting. This process encourages timely exchange of status information, discourages hedging on the part of overly optimistic individuals, and delineates the roles of the reporting supervisors.

Another advantage of the rate chart over the filled-in Gantt chart is that the production rate plot accurately records on one standard sheet of paper (8½ x 11 inches) how the activity got to where it currently is. There is ample room to annotate the rate plot to explain unexpected dips and rises. This record serves to remind management of earlier activities and can indicate recurring symptomatic patterns.

Normalized units

As mentioned, the "module" is used as the common unit during the development process, until integration testing where procedure steps are employed. During design, code, and standalone test phases, small modules (50 to 100 instructions) are produced under the structured design and structured programming methodologies. Since the use of these concepts also tends to produce a vast majority of modules with a narrow instruction range, "number of modules" was selected as the basic reporting element for development phases—a more meaningful element than the number of instructions. For instances where large modules of widely varying size are produced, the number of modules can be weighted based upon relative size or complexity.

The completion of a module is based on objective "yes" or "no" elements, which preclude "the 90% syndrome." (This syndrome is characterized by the optimistic programmer who reports early in the effort that the software is 90% finished; later, the estimate is 80% complete, and still later it drops even lower.) Credit is only given for completing a module.

Standard reporting forms

A status reporting form is illustrated in Table 1. It is used by first-line supervisors to report the number of modules which have been started or completed on a weekly basis. The first column is free form, but usually it totals to a deliverable software package. The software categories shown in Table 1 are a typical subset of a large air defense system.

Data base activities, preliminary design documents and formal reviews, redesign and recode efforts, etc., are numbered in whichever phase the software development effort is in at the time. These activities have only an indirect effect on the status being reported. If a great deal of rework or extra activities are occurring, presumably the physical software development effort will slow down, and hence the slowdown will be reflected in the production status. Such occurrences should be documented so that rate charting methodologies can be improved before being applied to the next project.

Utilization of rate charting

Rate charting assists in both the forecasting of trouble and the reallocation of resources. After the data points are entered on the rate charts, a weekly problem and warning area report is used to identify trouble areas. Trouble areas are those areas which are either (1) below the curve (behind schedule) or (2) above the curve (ahead of schedule) but with a rate of progress smaller than the planned rate.

As illustrated in Table 2, an indication of the number of weeks the activity has been in trouble is entered for each computer program component. These values are summed into software packages for both trouble categories.

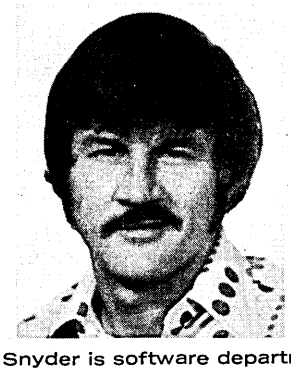
The value of any status reporting system is lost unless management takes the time to read and understand what the report has to say, and then react to it. By accurately forecasting both behind-schedule and ahead-of-schedule situations, rate charting provides software management with the lead time to reallocate resources effectively.

Another use of rate charting is the satisfaction of a customer's requirement for a monthly work-in-process report. These reports identify the amount of work accomplished, which when correlated with the elapsed time schedule and the manpower expended provides "earned value" (approximately the percentage work accomplished against the plan). Still another use is the contribution to the Computer Programming Laboratory's historical data base. Each completed project that has used rate charting furnishes valuable historical data, such as weighting factors for composite computations and unique percent complete formulas for application to future projects. This data is not only helpful in the refinement of the rate charting technique, but it also aids in accurately bidding on new projects.

The Computer Programming Laboratory is investigating the desirability of expanding the method of reporting during the design phase to allow emphasis on certain milestones peculiar to structured design. According to the laboratory's adaptation of the design phase, it is divided into three major subphases: first cut design, intermediate design, and final design. First cut design is heavily conceptual, and design is aided by the requirement to ignore all hardware, data, system control, and module internals. In intermediate design, the data base, system control, etc. are given some consideration, and the top-level design is completed. In final design, codable modules are designed, the data base is completed, the design is packaged for hardware, and HIPO diagrams are produced. Since the number of modules is not firm during the first and second subphases, another reporting element is necessary. "Number of iterations" through the design processes of data flow chart and structure chart generation is a possibility.

Summary

Planning and design of software modules are prerequisites to the implementation of rate charting. However, planning and design are normal products of structured design. Rate charting does not add any overhead to project management for the project that has already allocated manpower for management monitoring. The effort required to use rate charting is equivalent to the effort involved in any good management system, but the gains in visibility of rate charting pay considerable dividends to a project. ❁



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Managing a Software Emergency

by David Elliot Shaw

Programmers, analysts and software managers are habitually concerned with the exploration of only those alternatives which seem reasonable. During a software emergency, such instincts may be dangerous.

In my weaker moments, *all* software engineering efforts seem to me to be emergencies. Schedules slip; peripheral devices take unexpected vacations; middle-aged systems analysts contract chicken pox. This class of obstacles, though, appears to be a universal feature of the profession of data processing management, and is not the subject here.

This discussion will outline those issues salient to the management of *real* software emergencies, which are probably best illustrated by example:

1. The secret software development project you have been managing since July is suddenly elevated to top national priority for some reason. While you are personally convinced that holding the project to a two-month overrun would represent a significant achievement, the government wants the schedule cut in half. Price is no object.
2. Your firm is preparing to unveil the new top of its line of minicomputers at the forthcoming annual computer show. Now that the clever cache and memory management hardware has been debugged, a fundamental incompatibility is revealed between your real-time operating system and the hardware swapping mechanisms. The operating system must be modified in three weeks if your machine is to be demonstrated along with that of your prime competitor.

Constraints such as these, which are not altogether uncommon, place a software project in a qualitatively different category. We may regard such projects as true software emergencies.

Briefly stated, an emergency software engineering situation is one in which calendar time constraints become so critical as to overshadow the importance of minimizing the expenditure of available resources.

Why it can't be done

In many enterprises, severe calendar time constraints are dealt with in a straightforward manner: to halve the time necessary to meet the milestone, manpower and material resources allocated to the project are doubled.

The failings of this approach to dp problems are now well-known: twice as much computer time is helpful only if it is being used to code and test the critical programs, and twice as many programmers often *increase* the length of time required to implement a given integrated system. In general, once a software project has been comfortably staffed and given adequate machine resources, the simple-minded addition of cpu cycles and programming bodies will, at best, leave total output unchanged.

How to do it anyway

The fact remains that, given a large supply of resources and the freedom to employ unorthodox methods which would be considered wasteful in a non-emergency situation, most software projects can be accelerated—for a price.

It must be understood that the techniques described below are not offered as sound general methods for software project management, but as exceptional measures to be employed in emergency situations. These techniques rely on

1. Decomposition of the project into artificially small tasks.
2. Parallel execution of multiple efforts, only one of which will ultimately contribute to the finished system.
3. Extravagant expenditures of managerial and supervisory time.

The mechanisms outlined below may thus be inappropriate for software synthesis in the non-emergency mode.

When the calendar week becomes more important than the man-week, though, emergency software management techniques may be extremely valuable. Such methods can often allow a 25% schedule compression in return for a doubled manpower expenditure, and may cut calendar time in half if effective staffing is increased five-fold.

During a software emergency, it becomes increasingly preferable to have the services of a small number of extraordinarily powerful programmer/analysts, rather than a larger group of reasonably competent hackers. Particular systems and applications experience may be less important than those elusive qualities which seem to distinguish certain individuals as "superprogrammers."

Many organizations have a single preeminent software "wizard." (As in the case of Siamese fighting fish, there are rarely two.) If management believes your project to be important enough, you must tear your wizard away from his favorite compiler and enlist his dedicated support. Disregard the question of learning curves entirely. He will be valuable. (I use the pronoun "he" for reasons of rhetorical parsimony; your wizard may well be a "she.")

If you don't have any wizards, rent some. There are already several software contracting firms specializing in the provision of superprogrammers on a project basis. Such firms may be able to complete all or part of your project for a fixed price in a fraction of the time required by an in-house staff, or may provide wizards on a time-and-materials basis at a cost typically ranging between $20 and $50 per hour.

In such a situation, you will also need the best machine and systems resources available. A flexible time-sharing system with modern filestructuring features and a powerful text editor may alone cut 75% from the expected project duration. Extensive interactive use of the development machines is critical to rapid progress.

Finally, the programming languages used will have a major impact on overall development time. High-level languages should be used wherever practical, as much for reasons of controllable inter-task coordination and system integration as for the sake of individual programmer efficiency. In particular,

the "structured programming" languages (notably ALGOL, PASCAL, and their variants) really can effect a stunning reduction in system development time.

The critical characteristic of a gifted emergency software manager is an obsessive concern with functional modularity and parallel development.

The motivation is straightforward: in order to cram a large number of productive man-months into a much smaller calendar slot, the project must be broken into self-contained, functionally independent, easily specified subtasks which may be executed in parallel. Project decomposition decisions made during the initial phases of system design are thus critical to the subsequent acceleration.

A successful emergency project decomposition usually involves wasting a significant number of programming hours in constructing separate system components which might under ordinary circumstances be more efficiently implemented as a unified module by a single programmer. Consider, though, the typical case of a two-month single-man task which could be broken into three independent single-man subtasks, none of them requiring more than a month. If one of the subtask programmers could integrate the three subtasks in two weeks, a 25% saving in calendar time could be bought at the price of a 75% increase in manpower.

Even where possible, though, facilitating parallelism through modular project decomposition is not without potential pitfalls. First, the risk associated with the uncertainty of task durations is directly related to the number of independent precedent goals on which a given subtask is chronologically dependent. If tasks *A*, *B*, and *C* must all be completed before *D* is begun, a slip in the progress of any of the three will delay the whole effort. Second, if the processes of design decomposition or system integration themselves require the extended use of critical personnel, the overhead involved in decomposition may offset any gains achieved through parallel progress.

Exploiting absurd alternatives

Programmers, analysts and software managers are habitually concerned with the exploration of only those alternatives which seem "reasonable." During a software emergency, such instincts may be dangerous, as the path of maximal acceleration may involve a set of highly unusual choices.

As a software emergency manager, you must elicit a wide set of alternative plans from your staff at each decision point. The responsibility for choosing a particular path should rest with you alone. The job of your programmer or subordinate manager is simply to assess, with as little prejudice as possible, the following elements of each alternative course of action:

1. The technical consequences of the choice.
2. The prerequisite assumptions involved in its execution.
3. The length of time which is likely to be required.
4. The expected cost.
5. The degree of risk (of non-completion, serious overrun, or unfavorable interaction with other aspects of the project).

One trick may be useful in encouraging the changes in mode of interaction necessary to elicit a larger array of alternatives from the members of your staff: start by proposing your own unusual alternatives (even if clearly unworkable) to the plans proposed by your subordinates. By asking "Could you start tomorrow, rather than Friday, if I found someone to create the test files by hand?" you may prompt your programmer to formulate a better alternative which he had not previously entertained. Be sensitive to his reactions, though. To be effective, your suggestions must be perceived as a non-threatening catalyst to joint problem-solving, and not as an attack on his professional judgment, which may be flawless in a non-emergency context.

Software emergencies require *more* management, but *fewer* managers. To shorten the command and tracking chain, span of control must typically be widened at all levels for the duration of the project, often to a "fan-out" of as much as ten. Assuming strong technical competence and an unusual investment of time (40-hour weeks will not be sufficient), an emergency manager should on a temporary basis be able to develop and maintain a sufficiently comprehensive understanding of the many subtasks under his control to allocate resources, plan strategies, and isolate critical paths. It should be emphasized that highly "horizontal" organizational configurations of this sort are appropriate only to transient emergency software engineering efforts and are too demanding on technical management personnel for ongoing use in a normal environment.

A specialized bag of tricks is utilized by the successful emergency software manager. Certain techniques, such as the assignment of two programmers on an alternating-shift basis to develop a single program, or the allocation of several individuals to work in parallel on a given bug, are unfamiliar to the traditional software manager. Measures such as these can accelerate a project so long as essential communication is facilitated without impacting the progress of the communicators.

In a recent project, for example, my firm was called upon to help in the implementation of a difficult set of modifications to a PASCAL compiler for a large electronic systems firm. The task involved a generally unexplored technique for exploiting certain hardware features of the DEC PDP-11/45 to effectively double the virtual memory space available for the generated code, and was felt to be quite risky on the basis of a large set of intrinsic unknowns. The compiler changes, though, were discovered to be absolutely essential to the completion of a large and important project with extensive core requirements. With 15 project application programmers rapidly approaching an impasse, the compiler modification task was raised to emergency status.

The approach we used to beat the major project milestone involved a highly unorthodox technique in which two systems programmers worked on an overlapping 24-hour basis during the design and implementation phases. One programmer worked an extended daytime schedule, while the other continued his efforts through the night. An hour of joint work every twelve hours served to coordinate the activities of the two programmers.

In contrast to more typical programming team efforts, little attempt was made to divide subtask assignments between the two, as extensive interactions between the various changes made modular decomposition impossible within a limited time framework. To stay synchronized, highly formalized conventions for naming files and procedures, annotating listings, and commenting new changes were used in addition to the periodic meetings. The use of an incremental source editor and the construction of a conceptual tree structure of source versions in the course of modification helped the communication process by providing a record of the current status of developing modules.

Another highly talented member of our systems programming staff was assigned to review the entire compiler independently in the context of the original written description of the modification task. Although frequent consultation with the two programmers actually implementing the changes would probably have made the efforts of our reviewer significantly more effective, the risk of impacting the progress of the actual impementors was deemed too great to allow such interaction. The insulation of our core implementation team insured that, even if the reviewer failed to accelerate task progress, he could not substantially delay completion of the project. As it happened, one of the short periodic reports provided by our reviewer served to underscore a previously unforeseen potential problem area, saving

perhaps two weeks of subsequent debugging.

Wasting the proper resources

Little need be said about the expediency of liberal expenditures for computer time and supporting materials. Any manager with a quantum measure of common sense realizes that concerns related to the cost of documentation, stationery supplies, and even computer time must be assigned a low priority during a software emergency. When rapid progress is essential, even fairly wasteful resource utilization habits are tolerated in the interest of more meticulous attention to the central goal.

Less obvious, perhaps, are the changes in valuation of human resources which may be appropriate. When a group of already overextended programmers constitutes the scarce resource in a time critical project, there may be great utility in the expenditure of many hours of support, or even managerial, time in preference to a single hour by critical-path staff members. Note that rate of compensation, usual job responsibilities and competing workload may be less significant criteria for allocating support task assignments than under ordinary circumstances. It may, for example, be desirable to defer the routine workload of a computer operator for six hours to tackle an unfamiliar task at an hourly rate of $6 to avoid a one-hour impact in the schedule of a $12/hour programmer. A three-fold increase in costs is often insignificant by comparison with the transient value of key programming personnel during an emergency.

In the interests of timely project completion, it may be helpful to use certain staff members in unusual ways. In one recent project, for example, the services of a foreign national was required in a high-security environment requiring a constant escort for subcontracting non-citizens. On several occasions, a secretary (and in one instance a section head) was called in for weekend "babysitting" duties to allow the consultant extended computer access during a particularly critical phase of the project. While neither escort was able to execute normal professional activities in the computer room, the resulting waste of working hours by skilled personnel was more than justified by the significance of the system implementation work which they facilitated.

In another project, a programmer/analyst having extensive and specialized experience with the IBM OS/360 operating system remained on call during all hours when the development system was down for maintenance, in order to provide consulting aid to the programmer responsible for developing the application system. While the OS wizard was rarely used, his occasional assistance alllowed the prompt dispatch of several problems which might otherwise have substantially held up progress, and thus permitted the successful (even if somewhat costly) completion of the project in advance of an unreasonably early contractual deadline.

It is important to look beyond obvious and traditional office management paradigms in coordinating support activities designed to indirectly accelerate progress along the critical path. Apart from the provision of administrative and secretarial help, management can influence the availability of critical human resources by conducting a realistic inventory of the activities which are actually occupying the time of key personnel. Consequent steps may include finding non-critical staff members to bring meals to late-night programmers, arranging for babysitters or transportation for family members, and generally tending to all time-intensive activities which may be competing for the attention of key personnel.

Proffering appropriate carrots

It should be clear that emergency task assignments of this sort admit the possibility of serious problems involving interpersonal relationships, perceived job definitions, group morale, and individual self-esteem. Apart from regulating the duration and equitable distribution of such hardships where possible, the manager's best strategy in enlisting a temporarily exaggerated level of support from indirectly-critical staff members is to convey a dramatic, but plausible, sense of emergency.

The glory of the battle, of course, does not long sustain a fight; it should be made evident to staff members at every level that the spoils of victory will in fact be distributed among the troops. As the manager of a critical software task recovery, your prospects for recognition and sudden career advancement are unusually strong, and your staff will perceive the high stakes which you have in the success of the project. While the motivating forces which will be effective in shifting staff members into "overdrive" are highly idiosyncratic, you must be able to provide any rewards available to elicit efforts appropriate to the emergency at hand.

Because of the importance of discerning and dispensing the forms of compensation valued by various staff members, an inventory of the personal rewards available for distribution to exceptional project contributors should be taken at the same time the project budget is established. Attention to the goals of your project personnel is an important part of the commitment which your management must make if a project is to be undertaken on an emergency basis. Note that raises, bonuses and promotions are not the only commodities which may be useful in motivating extraordinary transient efforts. After an exhausting series of 60-hour weeks, an extra vacation, special flexibility in working hours, or any of a variety of more personal rewards may constitute appropriate compensation for exceptional performance in time of emergency.

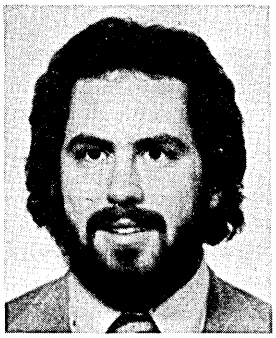
The last ingredient

There are three central arguments:

1. Using specialized "emergency" software development techniques, it is often possible to complete a data processing project in an otherwise unreasonably short period of time.
2. The costs associated with emergency software development typically increase more than linearly with the project acceleration factor, but are nonetheless warranted in a great many instances of practical significance.
3. The management strategies which prove effective in producing software on an emergency basis are qualitatively different from those which are most successfully employed in non-emergent situations.

Emergency software management techniques include the use of special in-house and contractor talent, the procurement of powerful system development resources, the facilitation of modular project decomposition and task parallelism, the liberal expenditure of material and human resources in unusual ways, and several management techniques specially adapted to the problems of emergency efforts.

A fair amount of luck is also helpful. ❋



As a software consultant for the past seven years, Mr. Shaw has directed a number of extremely time-critical development projects involving the design and implementation of large, multicomponent systems. He is presently president of Structured Systems Corp. of Palo Alto, a software consulting and contract programming firm.

A Look at Software Maintenance

by Chester C. Liu

Methods for making maintenance a more rewarding occupation are known, but they are not likely to be used until people's attitudes are changed.

Analysts and programmers generally view the maintenance function as an inferior, noncreative, nonchallenging activity. They see it as a job requiring no more than average intelligence, and definitely not for "super" analysts or programmers. And yet, it is probably true that most programmer/analysts with ten years experience have spent at least 60% of their time in maintenance.

This low opinion of systems maintenance is reflected in commercially available short courses such as those given by the AMA or AMR, as well as offerings from DPMA and ACM. If not ignored entirely, a course such as one on systems analysis and design would devote at most about 5% of the time to the subect. Yet many dp installations, especially those specializing in business applications, apply at least 70% of the time of their systems analysts and programmers to the maintenance function. At some installations the percentage can reach as high as 95%.

There are large sums of money spent on systems maintenance, yet there is little attempt to present general guidelines on how this money should best be spent. And just what specifically is systems maintenance?

Traditionally, systems maintenance refers to modifying a program to generate new reports, to changing processing logic to incorporate a new feature, to expanding masterfile records, to adding new files, etc. Most generally, it is the process of adaptation, i.e., updating existing systems functions to reflect new constraints or additional features. Table 1 lists some typical maintenance as well as development activities.

From the list in Table 1, it would seem that the differences between development and maintenance are not really that significant. The development function requires no more "superior" or creative person than does maintenance. Much of the basic work is similar in concept. If one does not like the term systems maintenance, he could just as easily use "systems support," "systems enhancement," or "systems continuation."

It should also be noted that it is not the magnitude or complexity of the project which determines whether it is a function of maintenance or of development. It is rather the point at which a project is initiated which indicates which type of function it is. One important distinction between maintenance and development is that the former usually has some supporting documentation. This could be systems manuals, program specifications, module listings, or some other reference aid which will help start the project. In a development phase, there are, of course, no such references.

> Most programmer/-analysts with ten years experience have spent at least 60% of their time in maintenance.

The maintenance function

To understand more fully the function of analysts and programmers in a maintenance environment, it is helpful to review the manner in which a system is developed and what types of information are available.

Normally, the implementation of a computer based information system reflects in varying proportions the following general characteristics:

1. Management philosophy and strategy in dealing with broad changes, such as new government or industry regulations, as well as long term plans;
2. Department operating procedures;
3. Organizational structure in various users' departments;
4. Systems designers' concepts and constraints;
5. Programmers' skills and particular approaches to programming problems;
6. Hardware and software configurations.

At some installations, the information required for system development is relatively easy to collect since few people are involved. At large installations, however, system development usually consists of countless meetings, interviews, and special studies. The results finally are numerous functional specifications, design guidelines, program and module specifications, and ultimately, the programming.

To see how an analyst/programmer functions in the *maintenance* activity, a safe assumption would be that the maintenance staff is not the same as the original design staff. While what documentation is available certainly helps, the maintenance people normally have a difficult time understanding some of the broader background issues, such as problems that arise due to government or industry regulations, or long term departmental plans. Much of this valuable background information which could influence proper maintenance decisions has been defined and discussed in the conference room. If minutes were taken, they are unfortunately not made available to the maintenance staff.

Documentation standards at well-organized dp departments are generally stringent. As a result, important documents such as project planning and control charts, conceptual design guidelines, data gathering reports, and

	ACTIVITY	FUNCTION
1.	Design OS, VS, DBMS, etc.	Development
2.	Generate OS, Compilers, HASP	Maintenance
3.	Implement a DBMS for an existing application system	Maintenance
4.	Any type of conversion, e.g., from 7010 to 370	Maintenance
5.	Add three new programs to the billing system for new options	Maintenance
6.	Design a Personnel system and adopt three modules from Payroll system	Development

Table 1

feasibility studies are readily available. On the other hand, in an amateur dp shop managed by an accounting manager, financial controller, or political appointee, systems documentaton inclines to be slack and loose. This situation has little to do with competence or incompetence. The reason is that these people are primarily result-oriented; they are more interested in a correct computer report than in a quality system.

The age of a system in itself is not that important as far as systems maintenance is concerned. A two-year old system will obviously have more valuable, timely, and meaningful information available than a seven-year old one. But by no means does this imply that an old system is always more difficult to maintain than a newer one.

What may cause problems with the passage of time is when the original design concept and documentation no longer reflect the present system status, and conflicting logic has occurred as the cumulative result of constant updates. It is for this reason that most systems professionals believe that any application system has a finite life. Regardless of how carefully maintenance projects are planned and executed, the system will eventually be replaced by, or consolidated into, another system which reflects a newer design concept of hardware/software constraints. (Various ways to prevent the deterioration of a system will be discussed later.)

In numerous dp installations, the program specifications, source listings, and JCL are the only reliable maintenance information. At times, unfortunately, program specifications may not be available, particularly if the system designer happens also to be the programmer. Then it is the program listing—which is the product of his design concepts, programming skills, and particularly programming approach and style—that becomes the only working document. It is easy to envision what becomes of maintenance in these circumstances.

Typically, the maintenance function can be summarized as follows:

1. The capacity, function, and logic of the existing program or system must be understood thoroughly.

2. New logic to reflect the new request or additional feature must be developed.

3. The new logic must be incorporated into the existing one.

In addition, project management techniques commonly exercised in the system development phase should also be applied to maintenance jobs. These would include the systems survey, project planning, Pert/CPM, and Gantt Charts.

There are several possible results that maintenance can achieve:

1. While implementing the new logic or modifying the old one, a conflicting situation in the system is created.

2. The new logic is implemented while the old one is left intact, with future problems a strong possibility.

3. Both the new and old logics are combined and implemented as an integrated function for the system.

It is strongly recommended that the system practitioner have the third possibility as his goal.

It should be clear now that maintenance can be as challenging and complicated as pure development. The analyst/programmer should make certain not only that the new logic is functionally correct, but also that the unmodified portions of the system are not inadvertently affected or disturbed. What would make systems maintenance less than completely rewarding, however, is the emergency or crisis situation normally associated with it.

Documentation

Documentation is a critical issue of systems maintenance. A set of quality documentation certainly helps make maintenance jobs much easier, but no experienced dp person should assume that every dp department has kept a decent level of systems documentation.

> An emergency or crisis situation is normally associated with the maintenance function.

It has traditionally been the responsibility of the analyst/programmer to produce the necessary documentation. Since the results have apparently not been completely satisfactory, dp managers have recently been using technical writers for the task.

There are distinct differences in the documentation prepared by these two groups. Documentation written by dp people is generally sloppy and disorganized, and the English language is used as though it were a programming language. However, if less readable, it is usually more substantial in content. Documentation prepared by technical writers is usually more readable, understandable, and very well organized. However, the basic problem is that they normally do not provide enough information on the essential guts of the system. This is because the technical writer is neither dp-oriented nor user-oriented. Thus, in preparing the system documentation, the information flow between systems people and technical writers is substantially reduced. Consequently, conflicting and noncommittal statements can be located throughout the documents—and essential ones may have disappeared.

A number of fundamental misunderstandings of documentation technique exist. First, it is devoted almost completely to "what has been done" instead of "why it has been done." (Think how often, for example, dp managers instruct their people to document everything, but the "why's" are completely ignored.) As a result, the quality of system documentation is seriously impaired.

Secondly, system documentation is written from the writer's point of view (whether it is the analyst/programmer or technical writer), rather than from the user's point of view. It is the writer who determines what type of information goes into the documentation; what the maintenance staff needs receives little consideration. As already noted, information required in the maintenance phase is in many respects distinctly different from that in the development phase. Information not documented because of its obviousness in the development phase may be extremely valuable for the maintenance group—and it is often lost.

The systems documentation that emerges at many dp organizations falls then into one of three categories: no documentation, insufficient documentation, and misleading documentation.

The problem of no documentation is most critical at the management level. A successful system not only has to perform the specified functions, it must also be flexible enough to accommodate additional features, as well as future modifications. If the maintenance staff is unaware of management's long term planning, it cannot gear the system accordingly. Furthermore, the flexibility and expandability originally designed into the system might be seriously undermined. This situation is common in data processing, regardless of development or maintenance environment. It is especially true when management has adopted a closed door policy. Any business manager will appreciate the reasoning that in order to compete and survive in a complicated business world, some secrecy concerning the company's strategy and future action is required. However, to expect dp people to maintain the system at the maximum efficiency without a general guideline for future planning is irresponsible and undesirable, and results in money wasted and mass confusion. This wasteful process can be avoided only when management's policy and practice are properly documented and become available to systems people.

Insufficient documentation can be seen at all levels: Management, systems and programming, and users. Several factors contribute to the situation, including improper systems planning,

lack of budgeted funding, insufficient time, etc. The foremost factor is the setting of standards for adequate documentation. The basic question is "What is adequate documentation?" Each individual has his own answer, and nobody really can give an enforceable guideline for how detailed a system or program specification should be. As a result, a frustrating situation is developed whereby analysts/programmers go through the specifications repeatedly, and still cannot understand the logic or obtain the information they are seeking.

When insufficient documentation extends to an extreme, misleading documentation develops. This is the worst kind of documentation and usually is the result of oversight, neglect, and ignorance. It occurs most frequently when a new analyst/programmer is introduced to a maintenance team while no proper orientation is given. It is not uncommon that many systems people working on a project team for months are still not aware of how many documents are available in the project group.

Under such circumstances, analysts/programmers understandably develop an unwillingness to trust any documentation. A direct consequence of this is a further generation of documentation activity. If no decisive action is taken, eventually all documentation becomes a stockpile of garbage.

It is critical to know the right time to start documentation activity. Traditionally an analyst/programmer arranges the documentation as the last activity in system development. Surely there are logical considerations involved in this arrangement. If a system is not completely tested and finalized, it would be extremely difficult to write operation instructions, and error and recovery procedures. But, when a programmer develops his program first, and then documents the processing logic, documentation merely becomes a translation and summary activity.

From the systems maintenance point of view, documentation activity should commence the moment the project is initiated and should remain a continuous process for the duration of the project development. Minutes of meetings, correspondence, memoranda, systems proposals, management decisions, and systems planning are all valuable information for the maintenance staff.

From the discussion so far, as well as from general experience with the problem, here are some suggestions for improved documentation:

1. Start documentation activity the moment the project is initiated.

2. In addition to "what has been done," document "why it has been done."

3. Consider management's policies, practice, and long term plans as essential parts of documentation, and make them accessible to analysts/programmers.

4. Document for the "poor guys" in the maintenance group as well as for system development and control.

5. Document not for formality, but for reality, especially if a technical writer is employed.

6. Document for the communication gaps rather than communication clusters. In other words, try to establish cross references, indices, a dictionary, as well as the traditional program specification, systems manual, and operating instructions. Further, describe all documentation available and make analysts/programmers aware of them.

7. Make documentation an auditing criterion in evaluating the systems integrity.

For a maintenance group, it is crucial to have complete documentation containing all pertinent information. Nevertheless, overdocumentation, aside from being unnecessary, could consume a great deal of valuable resources and budget.

Systems testing

In a development environment, systems testing has been estimated to consume approximately 20-50% of the total project schedule, depending upon the complexity of the system. In the maintenance phase, however, the extent of systems testing varies greatly; there is no general guideline available. In some dp departments, extremely stringent testing procedures sometimes consume as much as 80% of the maintenance effort.

On the other hand, many other dp departments do not exercise any systems testing procedures; the choice to do so is left completely to the analysts/programmers' discretion. In these instances, the meaningless terminology of "major" or "minor" changes is widely used, resulting in what is called "production-testing." That is, when a program change causes a production failure, it is considered as "testing"; otherwise it is production!

It is strongly urged that every systems department establish a strict testing procedure, and see that the rules or regulations are faithfully carried out. The establishment of a socalled quality assurance group to perform the functions of total systems and production control can be effective only when a standard testing procedure is available.

It is important to understand the analysts/programmers' attitudes toward system testing. In their daily work of systems maintenance, they tend to see themselves as constantly—and anonymously—fighting fires. The systems test presents them therefore with an opportunity to show "superior" work, since they can see the results directly. Consequently, an interesting situation develops. The analysts/programmers concentrate their testing effort on changes they make, and tend to ignore the unmodified portions. They look at the test results where they feel most confident of success, and disregard parts where certain "peculiar" conditions may exist. Needless to say, this distortion of interest and attention to certain portions in the systems testing procedure creates a major problem for the maintenance staff.

A complete psychological transformation of the analyst/programmer must be achieved. He should be trained to place the priority of steps in the systems test in the following order:

1. Test for system failure first.

2. Test the unmodified portion of the system or program.

3. Test the modified portion with all imaginable conditions.

4. Aim at the few most representative situations which constitute a major portion of the system.

5. Finally, test the documentation.

The acceptance test is probably one of the greatest inventions in system maintenance. The original concept was well intended: to get the user to participate in testing activity, and to bring the dp operation closer to the real world so that the socalled professional bias could be prevented and the communication between users and systems designers could be enhanced.

It is sad to see that the concept often becomes a tool for abuse—for passing the buck back to the user. The practice is simple and effective. Since most users are not dp-oriented, it is quite a simple task to take away the unfavorable effect of the systems test from analysts/programmers and give it to users. As a result, the traditional analysts' responsibility is transferred to the users. Because he is an innocent party in a complicated dp world, the user, all at once, is placed in a critical spot where silent grievance can be seen but not heard.

Although the acceptance test is a necessity in systems maintenance, it is recommended only when the user possesses a proper and adequate orientation of the nature and function of dp activities. Only when the user thoroughly understands the concepts of data processing can the constructive side of the acceptance test be realized and the original intent achieved.

Games programmers play

With or without adequate documentation, systems maintenance eventually ends up in program modification at the elementary level where programmers

physically go to the source listing and make changes. Cumulative changes over time performed by analysts/programmers may form a uniquely peculiar pattern which could deviate from normal logical inference and common perception or comprehension. The situation can then result in a system game, a phenomenon closely associated with development activity.

Generally speaking, after preliminary research, the analyst prepares specifications based on his perception of the problem and the manner in which the problem will be solved. Similarly, the programmer will perform his function based on his comprehension of the application and logic manipulation. The situation is similar to a typical college mathematical class where students arrive at identical solutions to a problem using completely different methods.

These different approaches to problem solutions can result in systems games. A typical programming game is to write a COBOL program like an assembler language program. Paragraph names have no sequence numbers; data fields have no prefix to identify work areas or actual records; data names are meaningless; peculiar instructions prevail throughout. The program does not follow COBOL conventions and appears to be without organization. On the other hand, an analyst can write specifications without indicating the purpose of the change, who requested it, or what the testing criteria are; it appears on a coding sheet and reads like a COBOL program.

A certain degree of personal variation in data processing is both understandable and tolerable. After all, if every activity is standardized, analysts/programmers will perform like accounting clerks, where no creativity is required. However, management should not allow personal approaches or preferences to cause deviation beyond a tolerable level. Otherwise, the task of system maintenance will become an endless game, where everyone pays homage to the eccentric wisdom of the original player.

There are also other factors than personal programming approach or preference that contribute to the formation of systems games. The most obvious one is inadequate training and improper orientation. More often than not, a person introduced to a maintenance group is instructed to assume the maintenance responsibility as it is, instead of first being given an orientation based on logical reasoning. This is probably because the tricky games, accumulated through the years by many individuals, are most embarrassing to mention to a new employee. Consequently, each individual is left to tackle his own problem and play his own game. The traditional method of "learning by doing" becomes a sacred cow. If lucky, an individual may pick up most of the games and enjoy the remainder of his life preaching the method of maintaining a system by game play. Otherwise, he may become a member of a mediocre society, being busy all day long and accomplishing nothing.

When discussing this situation, maintenance oriented systems managers generally agree that training a maintenance staff can be tedious and time consuming. However, they seem to agree that system games are as integral as any other part of the system which the maintenance staff has to learn to live with. Now you know why it takes three years just to train someone to assume maintenance responsibility for a large application system!

Another factor that encourages people to participate in game play is related to the productivity differential between programmers. Application experience and technical ability are important, of course, but there is a tendency to use years of experience as a sole criterion in determining the analyst/programmer's value. The basic learning curve used routinely by psychologists shows that after two or three years, additional progress in knowledge is limited and insignificant. One can always find a creative, competent programmer/analyst with two years experience who can outperform a mediocre one with ten years experience. And there is no evidence that a programmer with seven years of experience can design or write a better program than one with three years experience.

As a result, it could take one programmer five hours to write a particular program, and another, 25 hours. If the latter, for example, is given overtime or some other incentive to come up with the program, while the first programmer could have completed the program during normal working hours, a potential for frustration exists. In other words, if the more productive programmer feels he is not getting sufficient rewards, he might possibly begin to play games.

Because productivity does not depend then on years of experience, paying on the basis of experience will be considered by the more productive programmer as unfair. And this situation is likely to lead to game playing. On the other hand, by leaving a system unnecessarily complicated, the game player can more nearly insure his position and level of compensation. And thus we have reached the primary reason that contributes to the formation of systems games: job security.

In some dp departments, there exist "senior man teams," in which a senior member has charge of overall maintenance, with limited help from novices. The senior man is defined as the department member with the longest working experience with the system, regardless of capability or technical skills. The higher the turnover rate, the more indispensable he becomes due to his "proprietary" knowledge of the system, and the games which went into it.

With the advent of third generation computing technology, with large scale computer applications, and new concepts of programming structure and design, the play of systems games has been substantially reduced. Nevertheless, the general attitude still prevails, although on a lesser scale. It may still take some time before dp people recognize that real job security is not built on a foundation of systems games, but rather on a thorough knowledge of technology and capabilities.

Data base technology presents another vulnerable area for games playing. Data and system integrity are constantly emphasized in terms of protecting the data base against invalid or illegal access or alteration. Even if the ordinary programmer and analyst can be induced to stop playing such system games, we might now get a new generation of games within the data base administration.

Games developed for the various reasons stated can be classified as "intentional games." Management undoubtedly must assume most of the responsibility for the situation for allowing it to continue for so long. The following measures to combat such systems game are suggested for the dp manager:

1. Provide systems maintenance guidelines.

2. Establish systems, programming, and documentation standards.

3. Establish an enforceable system modification procedure.

4. Adopt the concept of a quality control unit, and make periodic systems audits.

5. Encourage the flow of communication, both vertically and horizontally.

6. Emphasize team effort and contributions in addition to individual performances.

Of course, not all the systems games are developed for specific purposes or reasons; many are the result of sloppy habits, unorganized thought, or lack of professionalism. In any event, the simple fact that a majority of maintenance jobs are done on a "rush" basis reduces the analysts/programmer's concern for system integrity. These types of system or programming defects are "unintentional games," or low quality outputs

that complicate the maintenance activity.

On reviewing the activity distribution of any maintenance project, a great portion of activity is usually loaded into the last quarter of the project cycle. As a result, a heavy overtime schedule develops. "Getting the job done" becomes the dominating theme, while maintaining the quality becomes secondary. It should not come as a surprise that the unintentional game flourishes in this environment.

The most effective measure to prevent unintentional games is to provide continuous education in system concepts and programming technology, as well as in project management technique. With modern dp concepts, specifically data base telecommunications, systems professionals tend to agree that traditional training in systems design and programming languages is inadequate. Emphasis should be placed upon the structure of the system and the program organization. It is ironic that after a quarter century of programming language development, systems people finally realize that a standard set of grammar in program writing is sorely needed. As far as project management technique is concerned, the maintenance staff should be trained to plan the project properly. By using Pert/CPM or Gantt Charts, the common symptom of overoptimism in time and cost estimates could be reduced considerably.

Another measure is to provide systems personnel with extensive training in their particular application. A general assumption seems to be that analysts/programmers' primary interest is in systems analysis and program development. Application knowledge then is considered secondary and is often ignored. Without proper training in billing procedures and accounting principles, for example, a maintenance staff cannot effectively maintain a billing system.

Finally, recruiting high quality analysts/programmers to participate in maintenance activity may be another desirable alternative in avoiding the occurrence of unintentional games. Although the misconception of maintenance as an inferior activity still prevails, a proper distribution of workload in maintenance and development phases will alleviate the problem.

Final words

With a short history of a quarter century, data processing is still in its infancy, at least as regards software. However, regardless how rapidly software technology will progress, we can reasonably expect that a large number of programmers and analysts will continue working in the maintenance environment. Many companies will continue to require extensive maintenance to keep systems going, and large sums of money will continue to be spent on maintenance.

To finally achieve the goal of professionalism, various misconceptions mentioned must be corrected, documentation and systems testing improved, and systems games playing ended. Data processing professionals will probably agree that a quality system is just as important as an accurate computer report. ❁

Mr. Liu is a group supervisor of systems development at The Insco Systems Corp., Neptune, New Jersey. He was previously with National Distillers and Chemical Corp. of New York.

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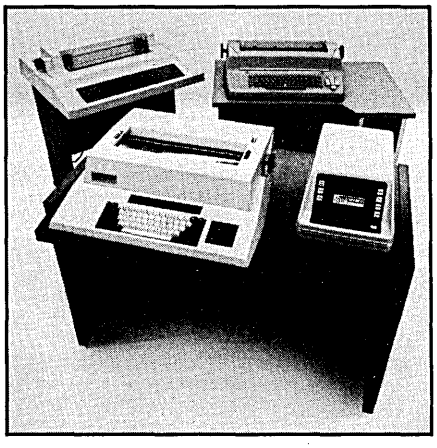

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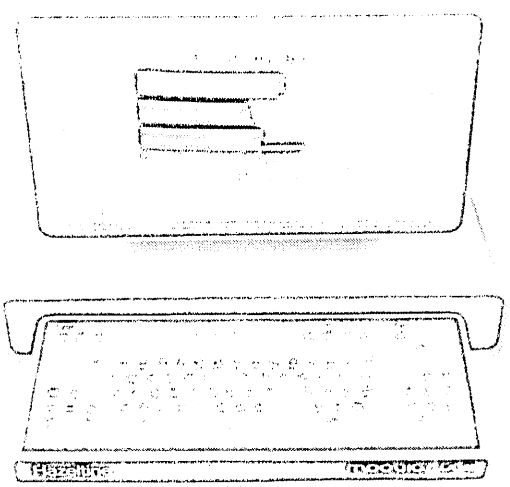

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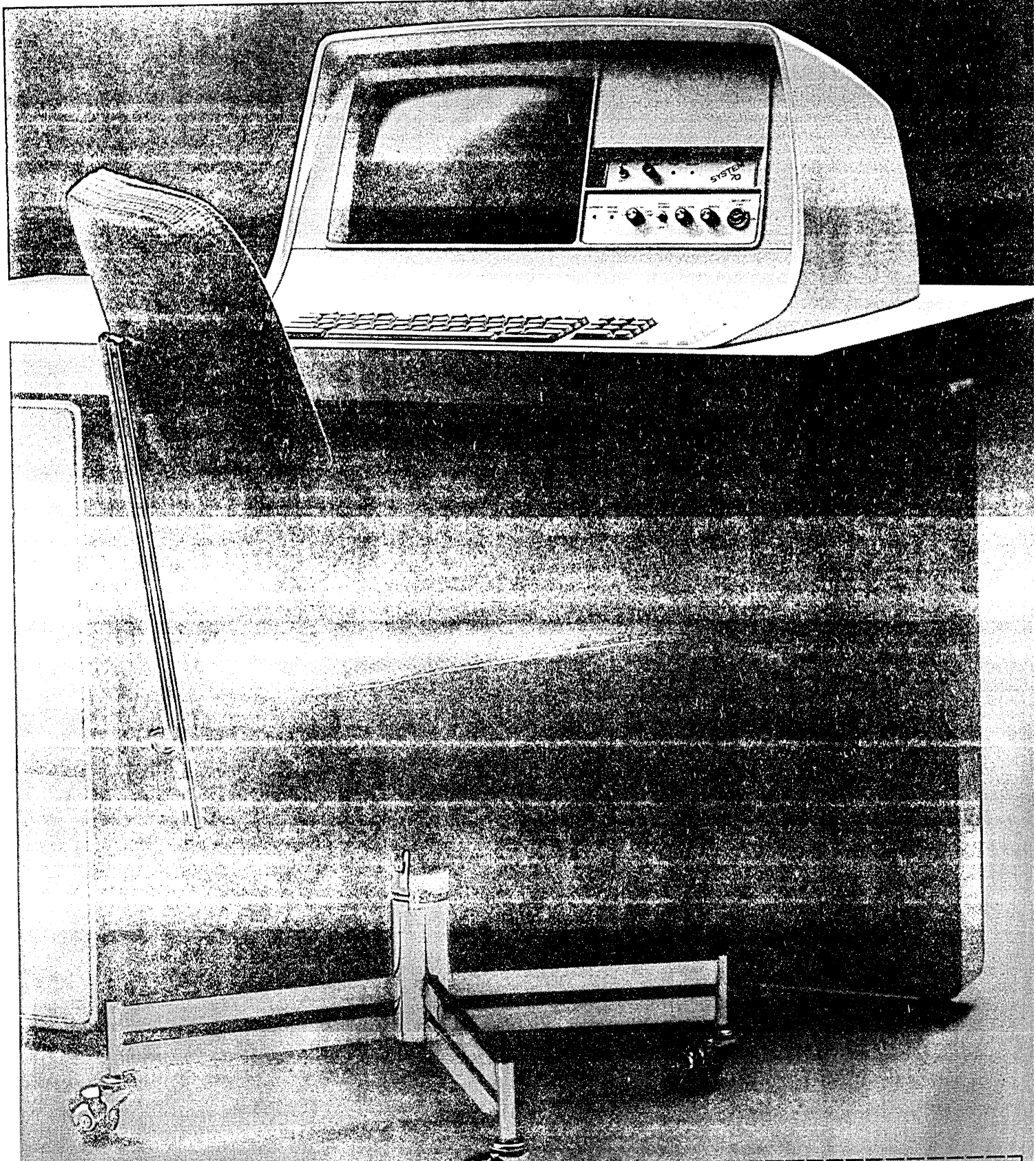

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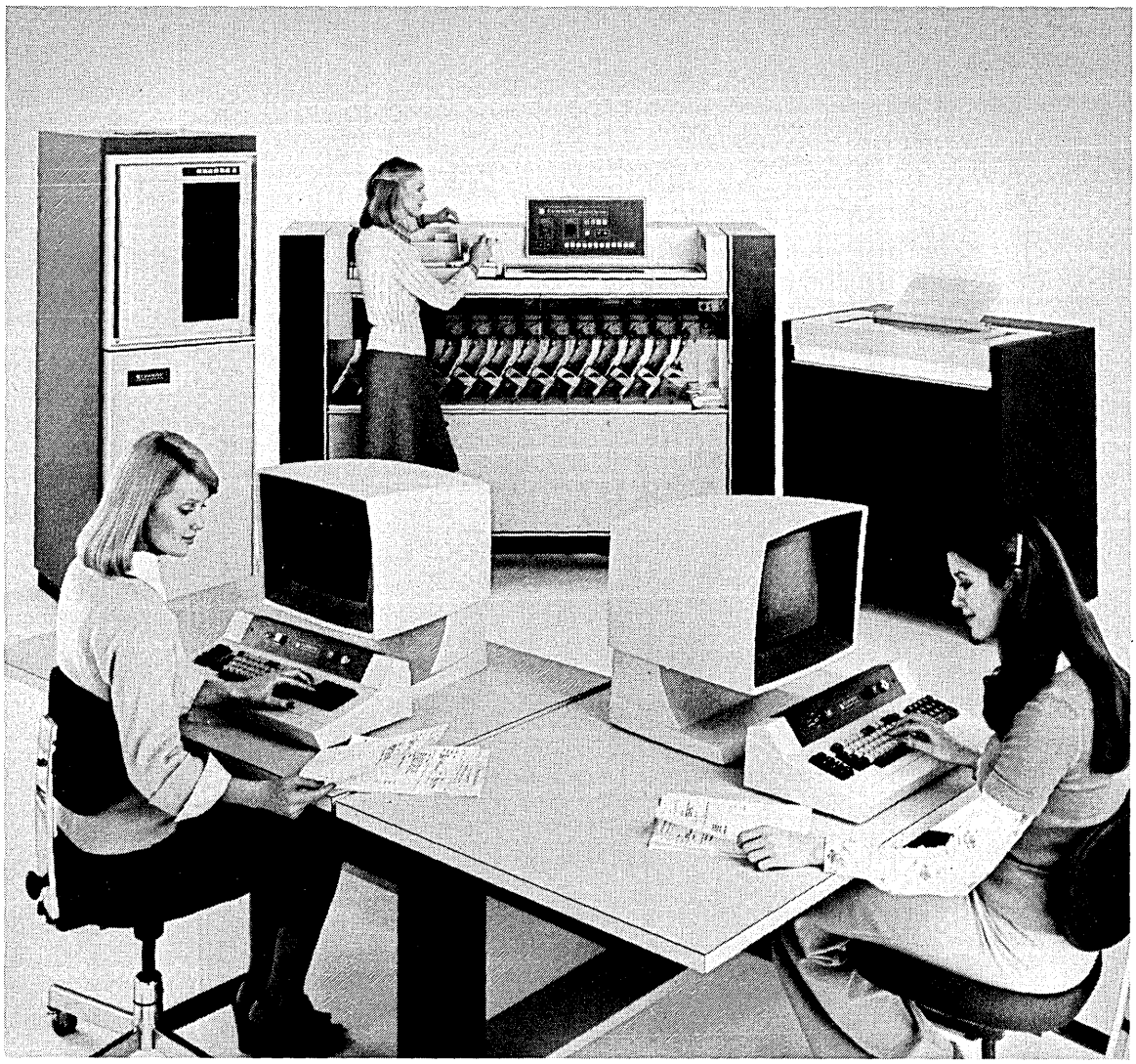

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CIRCLE 18 ON READER CARD

DP Salary Survey

by R. A. McLaughlin, Sr. Associate Editor

Streetsweepers make more money, auto workers have better hours, and inflation is still ahead of pay. DP employees must do it for the fun of it.

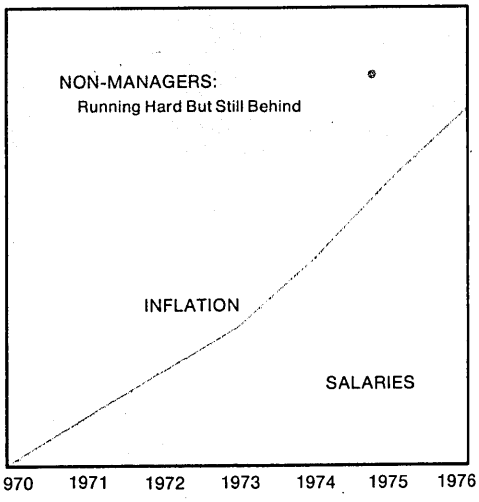
Datamation has published a salary survey for dp employees for several years, usually making the information available in the beginning of each year. However, since salaries affect budgets, and since many budgets are set at the end of the calendar year, our reporting has been moved up by several months to make the information available when most needed. (Job descriptions, page 64; weekly salary tables, page 66.)

Sometimes the reports of wages paid to American workers seem to be broadcast from Fantasyland. How else can one explain that streetsweepers in San Francisco are paid nearly $20,000 yearly? Or explain the auto workers' demands for less work and more pay? Or the Los Angeles bus drivers walking off their jobs because their $21,361 pay-benefits-overtime package didn't make it worthwhile getting up in the morning?

What happens next? Will the bus drivers in Chicago strike for chauffeurs? Will 1980 Pintos and Vegas cost $10,000 each? Will only streetsweepers from hilly cities be able to afford them?

And what's happening to the data processing manager or employee through it all?

The first questions we will have to leave for politicians and economists—or maybe for Art Buchwald. But we *can* answer that last question, at least in terms of salary and the race with inflation.



The data used in this survey was supplied by A. S. Hansen, inc., publisher of the "Weber Salary Survey on Data Processing Positions in the United States." The survey includes an actual count of 83,640 employees in 70 dp positions in 1,150 companies. (Not all positions are reported in this article.) The 96 page annual report includes detailed information on positions in 64 cities and more detailed breakdowns of industry salary ranges by city. **Further information on the report is available from A. S. Hansen, inc., at 1080 Green Bay Road, Lake Bluff, Illinois 60044.**

Each year, over 1,000 companies supply confidential salary information to a Chicago area firm called A. S. Hansen, inc. (with a little "i"). A. S. Hansen-little "i"-inc. constructs a data base, massages the information, and produces a report which is shared by the contributors. They also make that data available to DATAMATION, and it becomes the basis for our reporting.

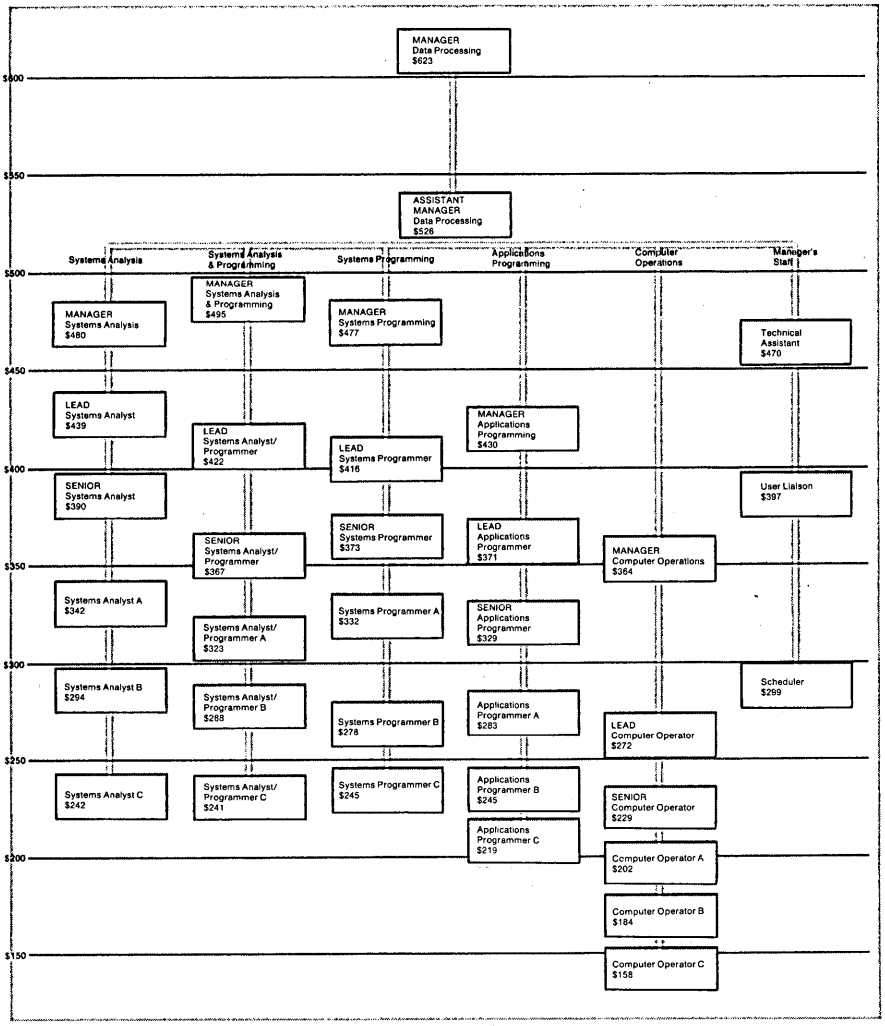
This year's data base contains the salary information for over 80,000 dp employees scattered across the continental U.S. Representative dp departments from various industries and various size shops appear in sufficiently large numbers for us to be able to answer questions about the status of dp employees with some confidence.

What the numbers tell us for 1976 is that, on the average, most of the dp employees in the country could move to more expensive neighborhoods if they learned how to drive buses. Thanks to the increasing importance of dp to most companies, on the other hand, the top dp person is doing all right. His paycheck isn't big enough to impress a union mechanic maybe, but he (or she) is doing okay. Unfortunately, for the rest of the troops, the picture isn't so clear or so positive.

Of course figures can lie, and tables

with thousands of figures can lie a lot. Averages like those presented here are especially misleading when they are collected across various sizes of computer installations, and various industries, from some workers in New York City and others in Des Moines. To force the digits to tell as truthful a story as possible, we and the keepers of the data base have gone through a great deal of number-crunching. Most of it was done to show what happens to salary levels in going from a small installation to a large one, or from one city or one industry to another.

By putting the pieces together, an individual can get a pretty accurate picture of what other persons with his skills are making, and how he or she might better themselves by switching jobs within their firms or by moving. Managers and salary administrators can work with the same pieces to find what the competition for employees is really like, and whether they see the same distinctions between jobs and paychecks as other personnel managers do.



These are the relative standings of the most common positions in a dp department, showing the comparisons between average pay levels. Among other things, the relationships can be of use to the employee considering a switch to a related occupation. Among other things they show what the initial pay cut might be in jumping from one branch to another (since parallel shifts are seldom possible), and what the eventual monetary reward might be.

The parameters we know how to fix are: skill level, geography, installation size, and industry. The first of these has been taken care of by carefully defining the positions when collecting the data. (The section on Job Descriptions explains the categories.) The other three factors are all handled in the table too.

Eliminating "geography"

For starters, where a person works greatly influences the size of his paycheck, but often not by a predictable amount. For instance, why is it that a Computer Operations Manager in Hartford makes an average of $363/-week while his counterpart running a much smaller shop in Boston makes $456? Is it so difficult to get someone to work in Boston? If the "niceness" of the city explains the difference, why does a Data Entry Operator "A" in Washington, D.C., receive $20 more per week than a person gets for punching keys in Baltimore, just across the river?

Sometimes a valid sounding reason can be given. We thought one good reason might be due to the cost of living being higher in one place than another. Unfortunately, we can show this doesn't work by comparing two indexes, one for pay and one for "cost."

The Bureau of Labor Statistics publishes a Consumer Price Index for many of the cities we report on. The CPI attempts to show how much more or less it costs to live in one city than another. For continental U.S. cities, the index runs from 88 to 110. That number can be used to show the "cost" part.

We generated our own index to show how the salaries compare from one city to another. To do this, we averaged all the salaries for all 66 jobs in each of the 30 cities we report on. Then we computed the percentage difference between any city and the overall average. For example, a city where the average dp salary was 10% higher than average is assigned a DATAMATION index of 110. The numbers generated run from a low of 89 (sorry, Portland and Salt Lake City) to a high of 120 for New York.

JOB FAMILY	1970-71 Salary Increase	1970-71 "Real" Salary Gain/Loss	1971-72 Salary Increase	1971-72 "Real" Salary Gain/Loss	1972-73 Salary Increase	1972-73 "Real" Salary Gain/Loss
Management	9.2%	+4.7%	6.5%	+3.6%	8.1%	+2.2%
Systems Analysis	6.9%	+2.4%	4.8%	+1.9%	4.4%	−1.5%
Systems Analysis/Programming	2.9%	−1.6%	6.4%	+3.5%	3.6%	−2.3%
Systems Programming	not surveyed		not surveyed		4.4%	−1.5%
Applications Programming	2.8%	−1.7%	5.9%	+3.0%	5.2%	− .7%
Computer Operations	3.9%	− .6%	4.6%	+1.7%	6.0%	+ .1%
Data Entry	6.8%	+2.3%	5.7%	+2.8%	3.1%	−2.8%

Table 1. Data processing personnel are clearly behind in their race with inflation. According to the Bureau of Labor Statistics, the consumer price index for urban wage earners and clerical workers in June of 1971 was 4.5% over what it had been one year earlier. Similar figures for the following years were: 2.9% in 1972, 5.9% in 1973, 11.0% in 1974, 9.3% in 1975, and 5.9% for this June. The average dp wage has not risen that rapidly.

It turns out that the cost of living and the pay scale indicator don't match up well. Sometimes the result is a happy one. As an example, the people of the city of New York should not be surprised to learn that the U.S. government had decided that theirs is an expensive place to live. The government index for that city is 107, high to be sure, but below that of Boston or San Francisco. DATAMATION's pay index of 120 shows that pay levels in New York are better than those in San Francisco or Boston. So the pay in New York is more than commensurate with the cost of living there—not considering the added expense of periodic muggings.

For an example of the other side of the scale, look at Seattle, where the fortunes of dp employees seem closely tied to how well Boeing is doing. Seattle rates a low 94 on the DATAMATION pay scale index and a high 106 on the cost of living index, making it a very uncomfortable place to be this year.

People in cities other than those listed might try to compare their rates with cities they know something about. If that fails, the Bureau of Labor Statistics does keep average salary data for a few positions for most cities; that information can help in comparing that city with the national average.

People in non-metroplitan areas will have it somewhat tougher in figuring their positions. As a general rule, pay rates are better in bigger cities than smaller, and better in small cities than non-metropolitan areas. Fortunately, the cost of living, as reflected by the CPI, is lower in non-metro places too; it ranges from 89 to 99.

One word of warning is necessary for a few of the cities reported. The sample sizes we are working from for Denver (12 firms, 508 employees), Salt Lake City (5 firms, 406 people), and Omaha (6 and 608) are much smaller than for other places. They are included primarily so that there is something to reckon by for that part of the country, but we have less confidence in those numbers.

Also, notice that several of the "cities" are actually conglomerations which include several neighboring places. These include the Los Angeles area, San Francisco, Minneapolis/St. Paul, Miami, Tampa, Raleigh/Durham, Chicago, and Dallas/Fort Worth. It didn't seem reasonable to recognize invisible boundaries in those cases where the only token symbol of passing from one city to another is a change in the color of street signs; so we didn't.

Nationwide averages

The first thing to notice about the nationwide average figures is just how wide the ranges are from "Low" to "High." The low numbers are so small that no-one will try to use them as a benchmark. The high figures probably refer to unusual positions, like the boss' son taking over a department.

The other numbers are more meaningful. "1st Q" is a reasonable lower bound; 25% of the salaries reported are below that figure. Similarly, "3rd Q" is a pointer to where the top 25% begins. It will be seen that there's a considerable range between these non-extremes.

Installation size

The effects of installation size are straightforward; bigger shops put more load on managers and some other positions, so paychecks go up, but not for everyone. We report the salaries for the five classifications of shop as a range. The numbers correspond to the 50% of survey respondents who fell right in the middle between the "1st Q" and "3rd Q." So although the highest and lowest salaries are not reported, the numbers shown are "reasonable" salaries for that position. And they tell a little more than a simple average would.

The five installation size categories are split out by *monthly* hardware rental, as follows:

1. *to $12,000* (IBM System /3s, 370/125, NCR Century 200 Series, Univac 9700, etc.)
2. *to $25,000* (IBM 370/135, Burroughs 3700, Honeywell 66/20, etc.)
3. *to $50,000* (IBM 370/145, Univac 1100/20, CDC Cyber 73, etc.)
4. *to $150,000* (IBM 370/168, Burroughs 7750, CDC 6700, or multiple mainframes)
5. *over $150,000* (all the rest, usually multiple-cpu sites)

Industry

Industry affiliation too makes a significant difference in how much dp employees are paid. This isn't too surprising. Some industries have more sophisticated dp applications than others. Some have larger computer centers, on the average, than do others.

As in splitting out salaries by installation size, the first and third quartile range has been used in showing salaries for industries, too. Unfortunately, even with 80,000-plus employees represented in the data, the industry numbers are spotty. We have more confidence in some of the data than in others as will be seen in the following population numbers.

Industry	Firms	Employees
Construction & Mining	12	378
Manufacturing	372	17,975
Transportation	22	2,184
Communication	18	2,336
Utilities	30	1,999
Wholesale Trade	36	1,123
Retail Trade	60	4,093
Finance & Insurance	358	29,857
Services	195	11,451
Government	47	12,244
	1,150	83,640*

*The original survey from which this material was taken included slightly more data than used here. A few positions on which data was gathered were dropped from our consideration due to their rarity or what seemed to us to be a non-dp orientation.

Conclusions

All of the factors mentioned do play a role in setting salaries. We suggest that an individual trying to make use of the data first compare the installation size numbers for his class of site with the national average figures; that will give one slant on how his pay might differ from the average. Then he or she ought to do the same for the industry figures. The result ought to be a pretty good impression of the reasonable *range* of pay for his skill level in his city in his industry.

If the impression is unpleasant, there's always bus-driving school.

1973-74		1974-75		1975-76		1970-76	
Salary Increase	"Real" Salary Gain/Loss	Salary Increase	"Real" Salary Gain/Loss	Salary Increase	"Real" Salary Gain/Loss	Compound Increase	Compound Gain/Loss
10.2%	− .8%	10.3%	+1.0%	4.8%	−1.1%	60.1%	+13.8%
8.7%	−2.3%	11.3%	+2.0%	3.6%	−2.3%	46.6%	+ .3%
8.8%	−2.2%	7.2%	−2.1%	6.9%	+1.0%	41.4%	− 4.9%
10.8%	− .2%	3.8%	−5.5%	7.7%	+1.8%	—	—
4.8%	−6.2%	11.0%	+1.7%	4.9%	−1.0%	39.7%	− 6.6%
7.2%	−3.8%	6.3%	−3.0%	6.7%	+ .8%	40.1%	− 6.2%
6.5%	−4.5%	7.6%	−1.7%	8.4%	+2.5%	44.6%	− 1.7%

The compound change in the index from June 1970 through June 1976 has been 46.3%. The compound increase in dp salaries for that period is shown above. Clearly, only the salaries of the dp manager and his immediate staff have kept pace. Even they haven't much to brag about; the figures show they have worked the past six years for a real gain of only about 2% per year. (The **top** dp manager, however, is doing considerably better than average, as reported on page 72.)

THE JOB DESCRIPTIONS

Whether we are assembling a child's tricycle or using a new kind of washer at the laundromat, most of us rush to try something before reading the propaganda which was packed in the box or pasted on the machine. Our credo—and most of us will admit it—is "When all else fails, read the instructions." Presumably, anyone reading this has already tried to make sense of the tables. Here's how they were supposed to be read.

First, most of us know what a programmer does. But there may be significant differences between two shops regarding the jobs done by a Programmer level "A" and Programmer "B." In fact, many shops may not grade their programmers except by paycheck. Meaningful distinctions can really be made between skill levels of programmers, however, and the data in the tables has been carefully graded according to the job descriptions used in the survey.

Second, not all shops are organized alike, either, and the organization can affect the responsibility associated with each job, and thus the rate of pay too. Fortunately, most shops fall into one of two major categories. What we choose to call a "conventional" shop is one where all the data processing related functions report to the same person, the "Corporate Manager of Data Processing." Actually, this person is often a department manager, especially if there are no other equally large computing installations in the firm which happen to be managed by other persons.

The other kind of shop is organized such that the system analysis staff and the applications programming staff report directly to corporate management. At these usually smaller sites, a person we call the "Data Processing Operations Manager" handles everything from data entry through report binding. Since he's responsible for machine operation, he often has charge over the systems programming staff too.

Within each of these two major categories, there may be infinite variation. Whatever the actual reporting structure, however, the following job descriptions will apply for most personnel. There are a few jobs still so new that meaningful data has not been collected. Among these are the data base administrator and the data communications manager. For jobs like these, equivalent skill levels can be located in the other categories (for example, the Systems Programmer and Technical Assistant slots might fit the db administrator and datacom roles).

Similarly, small shops may have people wearing more than one hat. In those cases, some interpolation between job categories may be needed.

Here are the basic keys:

DP Manager & his staff

Corporate (or Department) Manager of Data Processing

Plans, organizes, and controls the overall activities of the data processing department, including systems analysis, programming, and computer operation. Consults with, advises, and coordinates between his groups and other departments. Reports to corporate management on data processing plans, projects, performance, and related matters.

Assistant Manager of Corporate Data Processing

Assists the manager in planning, organizing, and controlling the sections of the department. Usually has line responsibility but in certain instances may have only staff responsibility. Participates in research and procedural studies. Develops analyses of existing and newly developed equipment and techniques. Consults with and advises other departments with regard to feasibility studies, systems and procedures, and records control.

Divisional, Subsidiary, or Regional Manager of Data Processing

Similar to corporate dp manager, except that corporate dp policies may regulate his actions. May report to Corporate Manager of Data Processing, or may take functional guidance from the Corporate Manager and his staff while reporting to divisional, subsidiary, or regional general management.

Technical Assistant to the Manager

Provides technical assistance for planning and directing the installation, modification, and operation of dp systems. Analyzes proposed and existing dp applications in terms of machine capabilities, costs, and man and machine hours. Usually has only departmental staff responsibility. Plans and recommends machine modifications or additional equipment. Directs the compilation of records and reports concerning production, machine malfunctions, and maintenance.

User Liaison (Coordinator of Data Processing)

Coordinates activities of the dp operation with the company's other departments. Usually has only departmental staff responsibility. Assists in establishing systems analysis, programming, and computer operations priorities. Recommends standard policies and procedures.

Work Process Scheduler

Schedules operating time of the overall dp activities. Responsible for keeping idle time to a minimum. Schedules preventive maintenance.

Systems Analysis

Manager of Systems Analysis

Responsible for feasibility studies for new applications, and for systems design. Assigns and directs personnel. Consults with and advises other departments on systems and procedures. Reports to the Corporate or Division Manager of Data Processing.

Lead Systems Analyst

Assists in planning, organizing, and controlling the activities of the section. Assists in scheduling the work of the section and assigning personnel to projects. May act as systems projects manager. May coordinate the activities of the section with other sections and departments.

Senior Systems Analyst

Confers with officials, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams.

Systems Analyst A

Defines the applications problem, determines system specifications, recommends equipment changes, and designs

Isn't MVS marvelous?

Its System Resource Manager (SRM) maximizes the use of hardware based on CPU load, I/O load and performance characteristics of each job.

Unfortunately, SRM makes decisions based on the system's needs, not necessarily yours.

The system may be sluggish because it has run out of page frames, auxiliary storage or a job has gone into loop. Up until now there was no way to find the problem and take corrective action.

Or your most time-critical job may be permanently swapped out of memory and you'd never know it. Even if you did know there's nothing you could do about it.

Immediate Feedback

That was before Resolve-MVS. It lets the user inquire about the system's status and gives the response immediately at his system console or TSO station.

Resolve-MVS gives you three types of services to solve right now problems right now. You get information services that highlight problems, action services that help you take action to solve the problems and asynchronous services that give you a warning message that a problem is developing.

It's Resolve Plus

With Resolve-MVS you still have all of the services of Standard Resolve which solve such critical problems as enqueue conflicts, Reserve lockouts, missing I/O operations, paging thrashing and jobs looping or in a wait state.

There has never been anything so powerful to solve your day-to-day operational problems.

Free for 21 Days

We're so confident you'll like knowing more about your MVS system's operations and in taking part in performance decisions, we're offering Resolve-MVS to you on a 21-day free trial.

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Operations Division

Boole & Babbage THE PERFORMANCE PEOPLE

☐ Send me Resolve-MVS immediately for my free trial. I want to participate in MVS performance decisions.

☐ Send me more information. I want to know more about how I can control MVS.

☐ I'm not into MVS. Send me information on Regular Resolve to solve my day-to-day operational problems.

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone _____

European Representatives: CAP/Gemini Computer Systems—London, Paris, Dusseldorf, Brussels, RIJSWIJK (ZH)

JOB TITLE	Nationwide Averages							Salaries by Installation Size Determined by Monthly Hardware Rental				
Conventional Organization Reporting Through Corporate or Department Manager	**Number In Survey**	**Low**	**1st Q.**	**Avg.**	**3rd Q.**	**High**	**1976 Increase**	**to $12,000**	**to $25,000**	**to $50,000**	**to $150,000**	**over $150,000**
Corporate or Department Management (with all functions reporting)												
Manager	**857**	241	485	623	715	1,692	9.5%	387-629	414-666	458-728	526-904	517-982
Assistant Manager	**244**	210	409	526	602	1,306	6.3%	325-528	348-560	385-611	441-760	434-825
Division Manager	**272**	244	417	507	577	1,373	—	313-509	335-540	371-546	426-732	418-796
Technical Assistant	**183**	190	388	470	535	1,058	0.6%	290-471	310-499	343-589	394-678	387-737
User Liaison	**183**	177	312	397	462	1,025	1.7%	247-402	265-426	293-466	336-579	330-628
Scheduler	**51**	144	240	299	350	750	9.5%	185-301	198-319	219-349	252-434	248-471
Systems Analysis												
Manager	**343**	277	404	480	528	1,218	4.1%	328-571	354-534	296-561	387-561	421-707
Lead Analyst	**968**	236	380	439	479	996	9.2%	298-519	322-486	269-511	352-510	383-643
Senior Analyst	**1,881**	201	338	390	418	829	3.2%	265-462	286-432	240-455	313-454	341-572
Analyst A	**1,684**	173	292	342	370	760	4.6%	232-405	251-379	210-398	275-398	299-502
Analyst B	**760**	155	260	294	327	562	1.4%	199-348	215-325	180-342	236-342	257-431
Analyst C	**190**	159	208	242	274	442	(−4.3%)	163-285	177-267	148-280	193-280	210-353
Combined Systems Analysis & Applications Programming												
Manager	**1,017**	210	416	495	556	959	8.8%	318-560	333-530	335-568	405-595	408-625
Lead Analyst/Programmer	**1,637**	190	375	422	462	1,333	6.8%	270-476	282-450	284-483	345-506	346-532
Senior Analyst/Programmer	**2,859**	137	327	367	400	666	6.4%	235-414	246-392	247-420	300-440	301-463
Analyst/Programmer A	**3,989**	150	279	323	355	604	6.3%	206-364	216-344	217-369	263-387	265-406
Analyst/Programmer B	**2,845**	142	245	288	320	490	7.5%	184-325	193-307	194-329	235-345	236-362
Analyst/Programmer C	**990**	135	206	241	267	426	4.3%	155-274	163-259	164-278	198-291	199-306
Applications Programming												
Manager	**324**	210	375	430	480	804	5.9%	291-465	334-478	297-481	332-490	340-566
Lead Programmer	**714**	165	334	371	404	700	5.1%	250-400	287-411	255-413	285-421	292-487
Senior Programmer	**1,985**	162	288	329	354	709	6.8%	224-358	257-368	229-370	255-377	262-436
Programmer A	**2,935**	132	244	283	306	570	4.0%	192-306	220-315	196-317	219-323	224-373
Programmer B	**2,193**	150	215	245	268	423	2.5%	166-264	190-272	169-274	189-279	194-322
Programmer C	**1,254**	112	196	219	234	441	3.8%	148-236	170-243	151-245	169-249	173-288
Organization Reporting Through Separate Managers												
DP "Operations" Management (without Systems Analysis or Applications Programming)												
Manager	**533**	167	356	451	525	1,216	6.4%	189-444	314-496	353-490	353-538	378-612
Assistant Manager	**173**	162	297	355	395	691	2.0%	149-350	248-392	279-387	278-425	299-483
Technical Assistant	**150**	170	273	349	409	663	8.0%	145-341	241-382	272-377	272-414	291-471
User Liaison	**200**	162	252	304	339	600	7.0%	126-297	210-333	237-328	236-361	253-410
Scheduler	**371**	111	212	252	285	727	8.2%	105-248	176-278	198-274	197-301	211-343
Systems Analysis												
Manager	**113**	280	360	442	507	784	7.5%	421-602	403-614	335-537	383-533	347-622
Lead Analyst	**250**	264	356	390	406	667	9.2%	370-530	355-540	295-473	337-469	305-547
Senior Analyst	**686**	173	312	351	384	601	12.5%	332-475	318-484	264-424	302-421	274-492
Analyst A	**617**	200	280	310	334	456	12.7%	294-421	282-429	234-376	268-373	243-436
Analyst B	**262**	161	255	285	312	413	17.8%	269-385	258-392	214-344	245-341	222-398
Analyst C	**56**	162	201	223	248	294	4.7%	210-301	201-307	167-268	191-266	173-311
Applications Programming												
Manager	**53**	210	374	440	500	691	3.3%	323-506	344-497	303-543	359-483	405-606
Lead Programmer	**311**	202	360	387	418	574	10.6%	284-445	303-437	266-478	316-425	356-534
Senior Programmer	**684**	161	280	313	329	570	2.0%	230-359	244-353	215-385	255-343	287-430
Programmer A	**1,011**	162	237	265	290	452	5.6%	194-303	207-298	182-325	215-290	243-364
Programmer B	**505**	137	204	231	248	450	4.5%	171-268	182-263	160-287	190-256	214-321
Programmer C	**367**	138	179	212	247	402	8.2%	155-242	165-238	145-260	172-232	194-290
Functions Reporting to Either of the Above												
Systems Programming												
Manager	**411**	202	406	477	528	1,035	9.7%	366-511	366-507	275-541	407-549	390-594
Lead Programmer	**501**	229	368	416	454	825	8.6%	319-445	319-441	239-471	345-478	339-517
Senior Programmer	**1,124**	198	323	373	410	787	4.5%	286-399	286-395	214-422	317-428	304-463
Programmer A	**1,147**	183	288	332	363	735	6.1%	256-358	256-355	192-378	284-384	273-416
Programmer B	**706**	161	227	278	318	550	8.6%	212-296	212-294	159-314	236-318	226-344
Programmer C	**400**	144	225	245	259	403	8.4%	187-261	186-258	140-275	207-280	199-303
Computer Operations												
Manager	**947**	172	294	364	414	960	7.1%	253-374	270-406	273-395	280-417	317-473
Lead Computer Operator	**1,854**	121	230	272	307	682	3.8%	189-280	202-304	205-296	210-312	238-355
Senior Computer Operator	**3,058**	120	200	229	252	528	7.0%	159-235	170-255	172-248	176-262	200-298
Computer Operator A	**3,973**	100	175	202	225	466	6.3%	139-205	148-223	150-217	154-229	174-260
Computer Operator B	**2,839**	101	160	184	202	457	10.8%	128-190	137-207	139-201	142-212	161-241
Computer Operator C	**1,363**	92	138	158	173	289	6.0%	108-160	115-174	117-169	120-179	136-203
Tape Librarian	**1,142**	100	143	169	185	385	5.6%	128-197	154-240	125-196	129-203	143-241
Data Control												
Supervisor	**663**	108	171	240	288	780	(−4.0%)	168-246	157-305	168-263	201-305	186-374
Data Control Group Leader	**705**	106	154	198	220	579	1.5%	140-204	130-252	140-219	167-253	154-310
Data Control Clerk A	**1,875**	92	143	168	185	462	(−2.3%)	118-172	110-213	118-184	141-214	130-261
Data Control Clerk B	**1,403**	90	125	151	165	403	(−0.7%)	106-155	99-191	106-166	127-192	117-235
Data Control Clerk C	**479**	88	119	142	159	348	5.2%	99-145	92-179	99-155	118-180	110-220
Data Control Trainee	**144**	88	110	126	134	238	5.9%	89-130	83-161	89-139	106-161	98-198
Data Entry												
Supervisor	**1,094**	116	187	235	263	735	16.9%	174-248	185-274	169-253	192-284	200-321
Lead Data Entry Operator	**1,415**	104	160	189	206	570	6.8%	139-199	148-219	135-203	153-227	160-257
Data Entry Operator A	**6,744**	83	141	160	176	435	1.9%	118-169	125-186	115-172	130-193	136-218
Data Entry Operator B	**7,148**	86	132	151	165	319	7.1%	111-159	118-175	108-162	123-181	128-205
Data Entry Operator C	**3,180**	88	122	140	147	298	12.9%	104-149	110-164	101-152	115-170	120-192
Data Entry Trainee	**897**	88	104	120	133	195	1.7%	089-126	94-139	86-129	98-144	101-163

JOB TITLE	Salaries by Industry									
Conventional Organization Reporting Through Corporate or Department Manager	**Services**	**Mfg**	**Govt**	**Retail**	**Wholesale**	**Utilities**	**Commo**	**Transport**	**Construct-Mining**	**Finance-Insurance**
Corporate or Department Management (with all functions reporting)										
Manager	381-731	541-813	439-635	457-777	384-968	333-865	511-1253	592-785	455-531	424-913
Assistant Manager	320-614	455-683	368-534	384-652	322-813	279-726	429-1052	497-660	381-446	356-767
Division Manager	308-592	439-658	355-514	370-629	311-784	269-700	414-1015	479-636	368-430	343-740
Technical Assistant	285-548	406-610	329-477	343-582	288-726	249-648	383-939	444-589	341-398	318-684
User Liaison	243-468	346-520	280-406	292-497	245-619	213-553	326-801	378-502	290-339	271-584
Scheduler	182-351	259-390	210-304	219-372	184-464	159-415	244-601	284-376	218-254	203-438
Systems Analysis										
Manager	355-621	431-685	317-506	407-598	437-560	428-649	452-607	431-537	425-464	368-599
Lead Analyst	323-565	393-623	288-460	371-544	397-510	389-591	411-552	392-488	387-422	335-545
Senior Analyst	288-503	349-555	256-410	330-484	354-454	346-526	366-492	349-434	345-376	298-485
Analyst A	252-441	306-486	225-359	289-425	310-398	304-461	321-431	306-381	302-329	261-425
Analyst B	216-379	263-417	193-309	248-365	266-342	261-396	275-370	263-327	259-282	224-365
Analyst C	177-310	215-342	158-253	203-299	218-280	214-324	225-303	215-268	212-231	184-299
Combined Systems Analysis & Applications Programming										
Manager	346-569	359-571	332-508	283-594	414-627	444-628	388-646	445-703	430-462	396-595
Lead Analyst/Programmer	294-484	305-486	282-431	241-505	352-533	377-534	330-549	378-597	365-392	336-506
Senior Analyst/Programmer	256-421	265-423	246-375	209-440	306-464	328-465	287-478	329-520	318-342	293-440
Analyst/Programmer A	225-370	233-371	216-330	184-386	269-407	288-408	252-419	289-456	279-300	257-387
Analyst/Programmer B	200-330	208-331	192-294	164-344	240-364	257-364	225-374	258-407	249-268	229-345
Analyst/Programmer C	169-278	176-280	162-248	138-291	202-307	217-307	190-316	218-344	210-226	194-291
Applications Programming										
Manager	291-542	343-548	306-498	344-530	349-586	292-653	431-662	409-564	351-401	318-503
Lead Programmer	250-466	295-471	263-428	296-456	300-504	251-561	370-569	352-485	302-345	273-433
Senior Programmer	224-417	264-422	235-383	265-408	268-451	224-503	331-509	315-434	270-308	245-387
Programmer A	192-357	226-361	202-328	227-350	230-386	192-431	284-437	270-372	232-264	210-332
Programmer B	166-308	195-312	174-284	196-302	198-334	166-372	245-377	233-321	200-228	181-287
Programmer C	148-276	174-279	156-254	175-270	177-299	149-333	220-337	209-287	179-204	162-256
Organization Reporting Through Separate Managers										
DP "Operations" Management (without Systems Analysis or Applications Programming)										
Manager	202-595	357-571	366-580	335-600	330-637	314-597	371-696	405-588		343-551
Assistant Manager	159-470	282-451	289-458	264-473	260-503	248-471	293-550	319-464		271-435
Technical Assistant	155-458	275-439	282-446	257-462	253-490	241-459	285-536	312-452		264-424
User Liaison	135-399	239-382	245-388	224-401	221-426	210-400	248-466	271-394		229-369
Scheduler	113-333	200-320	205-324	187-336	184-356	175-334	207-389	226-329		192-308
Systems Analysis										
Manager	367-471	429-638	347-527	396-503			577-627	414-572		377-547
Lead Analyst	322-414	378-562	305-463	348-443			507-551	365-504		332-481
Senior Analyst	289-372	339-504	274-416	312-397			455-495	327-452		298-432
Analyst A	256-329	300-447	243-368	277-352			403-438	290-400		264-382
Analyst B	234-301	274-408	222-337	253-322			368-401	265-366		241-350
Analyst C	183-235	214-319	173-263	197-251			288-313	207-286		188-273
Applications Programming										
Manager	394-497	396-575	359-485	370-518	299-465	341-431	577-623	441-523		322-524
Lead Programmer	347-437	349-507	316-427	325-456	263-409	300-379	508-549	389-460		284-461
Senior Programmer	279-353	281-409	254-344	263-368	212-330	242-306	410-443	313-371		229-372
Programmer A	236-298	238-345	215-291	222-310	179-279	205-258	346-374	265-314		193-314
Programmer B	208-263	210-305	190-257	196-274	158-246	181-228	306-330	234-277		170-277
Programmer C	189-238	190-276	172-233	177-248	143-223	164-207	277-299	211-251		154-251
Functions Reporting to Either of the Above										
Systems Programming										
Manager	400-611	373-562	351-536	426-617	329-491	426-545	419-691	412-641		349-570
Lead Programmer	348-531	325-489	305-466	371-537	286-427	371-474	364-601	359-558		303-496
Senior Programmer	312-476	291-438	273-418	332-481	256-383	332-425	327-539	321-500		272-444
Programmer A	280-427	261-393	245-375	298-431	230-343	298-382	293-484	288-449		244-399
Programmer B	232-354	216-326	203-310	247-357	190-284	247-316	243-401	239-372		202-330
Programmer C	203-311	190-286	179-273	217-314	167-250	217-278	213-352	210-327		178-290
Computer Operations										
Manager	258-501	283-476	293-446	252-428	281-481	283-583	347-477	401-511	331-354	264-447
Lead Computer Operator	193-375	212-357	219-335	188-321	211-360	212-437	259-358	301-383	248-265	198-335
Senior Computer Operator	162-315	178-300	184-281	158-270	177-303	178-367	218-301	253-321	208-223	166-281
Computer Operator A	142-275	155-261	161-245	138-235	154-264	155-320	190-262	221-280	182-194	145-245
Computer Operator B	131-255	144-242	149-227	128-218	143-245	144-297	176-243	204-260	169-180	134-228
Computer Operator C	111-215	121-204	125-191	108-184	120-206	121-250	148-205	172-219	142-152	113-192
Tape Librarian	136-201	159-294	147-220	138-170	137-153	211-274	167-220	203-316		125-183
Data Control										
Supervisor	164-298	197-367	178-291	131-349	204-364	221-374	202-347	289-377		166-280
Data Control Group Leader	136-247	164-305	148-242	109-290	169-302	184-310	168-288	240-313		137-232
Data Control Clerk A	115-208	138-257	125-204	92-244	142-255	155-261	141-243	202-264		116-196
Data Control Clerk B	103-187	124-231	112-184	82-220	128-229	139-235	127-219	182-237		104-176
Data Control Clerk C	97-175	116-216	105-172	77-206	120-215	130-220	119-205	170-222		97-165
Data Control Trainee	86-157	104-194	94-154	69-185	108-193	117-198	107-184	152-200		87-148
Data Entry										
Supervisor	173-278		188-275	198-275	199-283	219-426	202-387	235-443	230-248	172-267
Lead Data Entry Operator	138-222		151-220	159-220	159-226	175-341	161-309	188-354	184-199	138-214
Data Entry Operator A	118-189		128-187	135-186	135-192	149-289	137-263	160-301	156-168	117-181
Data Entry Operator B	111-178		120-176	127-175	127-181	140-272	129-247	150-283	147-159	110-171
Data Entry Operator C	104-166		113-164	119-165	119-169	131-255	121-232	141-265	138-149	103-160
Data Entry Trainee	88-141		96-140	101-139	101-144	111-216	103-197	119-225	117-126	88-136

JOB TITLE	Average Salaries by City											
	Atlanta	Baltimore	Boston	Chicago Area	Cleveland	Columbus	Dallas-Ft. W.	Denver	Detroit	Hartford	Houston	Indianapolis
Consumer Price Index	93	—	110	103	99	—	91	97	99	—	94	98
Datamation Index	99	94	119	111	99	103	93	93	101	101	97	95
Conventional Organization Reporting Through Corporate or Department Manager												
Corporate or Department Management (with all functions reporting)												
Manager	570	608	821	657	612	657	559	639	609	757	617	592
Assistant Manager	479	511	690	552	514	552	469	537	511	636	518	497
Division Manager	462	492	665	532	496	532	452	518	493	613	500	480
Technical Assistant	428	456	616	493	459	492	419	479	456	568	463	444
User Liaison	365	389	525	420	391	420	357	409	389	484	395	379
Scheduler	273	291	394	315	293	315	268	306	292	363	296	284
Systems Analysis												
Manager	472	431	490	523	423	498	397	388	434	445	425	439
Lead Analyst	429	392	446	476	385	453	361	353	394	405	386	399
Senior Analyst	382	349	397	424	343	403	322	314	351	361	344	356
Analyst A	335	306	348	371	300	354	282	275	308	316	302	312
Analyst B	287	263	299	319	258	304	242	236	264	271	259	268
Analyst C	235	215	245	261	211	249	198	194	216	222	212	219
Combined Systems Analysis & Applications Programming												
Manager	441	454	576	541	470	442	460	400	507	453	459	440
Lead Analyst/Programmer	375	386	489	459	400	376	391	339	430	385	390	374
Senior Analyst/Programmer	326	336	426	400	348	327	340	295	375	335	340	325
Analyst/Programmer A	287	295	374	351	305	287	299	260	329	294	298	286
Analyst/Programmer B	255	263	333	313	272	256	266	231	294	262	266	255
Analyst/Programmer C	216	222	282	264	230	216	225	195	248	222	225	215
Applications Programming												
Manager	433	370	487	469	396	428	429	418	449	405	414	432
Lead Programmer	372	318	419	403	341	368	369	360	386	348	356	372
Senior Programmer	333	285	375	361	305	329	330	322	346	311	318	333
Programmer A	285	244	322	309	261	282	283	276	296	267	273	285
Programmer B	246	211	277	267	225	243	244	238	256	230	235	246
Programmer C	220	188	248	239	202	218	219	213	229	206	210	220
Organization Reporting Through Separate Managers												
DP "Operations" Management (without Systems Analysis or Applications Programming)												
Manager	465	416	559	502	458	470	380	375	408	422	406	384
Assistant Manager	367	329	441	397	362	370	300	296	323	334	320	303
Technical Assistant	358	320	430	387	353	361	292	289	314	325	312	296
User Liaison	311	279	374	336	307	314	254	251	273	283	271	257
Scheduler	260	233	313	281	256	262	212	210	228	236	227	215
Systems Analysis												
Manager	481		591	394	508	406		520	475			
Lead Analyst	422		521	346	447	358		458	418			
Senior Analyst	379		467	311	401	321		411	375			
Analyst A	336		414	275	355	284		364	332			
Analyst B	307		378	252	325	260		333	304			
Analyst C	240		295	197	254	203		260	237			
Applications Programming												
Manager	444			443	498	418	396	416	451			435
Lead Programmer	390			389	438	368	348	366	397			383
Senior Programmer	315			314	353	296	281	295	320			309
Programmer A	266			265	299	250	237	249	270			261
Programmer B	235			234	264	221	209	220	239			231
Programmer C	212			212	239	200	190	199	216			209
Functions Reporting to Either of the Above												
Systems Programming												
Manager	444	422	557	497	479	485	444	430	462	419	440	461
Lead Programmer	386	367	484	432	417	422	386	374	402	364	382	401
Senior Programmer	346	329	434	387	373	378	346	335	360	327	342	360
Programmer A	311	295	389	347	335	339	311	301	323	293	307	323
Programmer B	257	244	322	288	278	281	257	249	268	242	255	267
Programmer C	226	215	283	253	244	247	226	219	235	213	224	235
Computer Operations												
Manager	336	332	456	380	365	376	326	327	375	363	339	299
Lead Computer Operator	252	249	342	285	274	281	244	245	281	272	254	224
Senior Computer Operator	212	209	287	239	230	236	205	206	236	228	213	188
Computer Operator A	185	182	250	208	200	206	179	180	206	200	186	164
Computer Operator B	171	169	232	193	186	191	166	166	191	185	173	152
Computer Operator C	144	142	195	163	157	161	140	140	161	156	145	128
Tape Librarian	178	158	188	191	165	134	169		153	172	146	145
Data Control												
Supervisor	261	224	201	277	244	239	229	260	230	226	232	227
Data Control Group Leader	217	186	167	230	202	198	190	216	191	187	193	189
Data Control Clerk A	183	156	141	194	171	167	160	182	161	158	162	159
Data Control Clerk B	165	141	126	174	153	150	144	164	145	142	146	143
Data Control Clerk C	154	132	118	163	144	140	135	153	136	133	137	134
Data Control Trainee	138	118	106	146	129	126	121	137	122	119	123	120
Data Entry												
Supervisor	225	219	268	257	226	210	215	209	244	226	231	208
Lead Data Entry Operator	180	175	214	206	181	168	172	167	195	181	185	167
Data Entry Operator A	153	149	182	175	153	143	146	142	166	154	157	142
Data Entry Operator B	144	140	171	164	144	134	138	134	156	144	148	133
Data Entry Operator C	135	131	161	154	135	126	129	125	146	135	138	125
Data Entry Trainee	114	111	136	131	115	107	110	107	124	115	117	106

Average Salaries by City

Kansas City	L.A. Area	Miami Area	Milwaukee	Minn.-St. Paul	New York	Omaha	Philadelphia	Phoenix	Portland	Raleigh Durham	Richmond	St. Louis	Salt Lake	San Fran. Area	Seattle	Tampa Area	Wash., D.C.
98	104	—	101	100	107	—	103	—	—	97	—	96	—	110	106	—	105
91	110	106	101	95	120	103	100	101	89	90	99	97	89	111	94	97	106
517	712	677	626	560	824	601	565	601	504	482	562	602	489	687	532	607	621
434	598	569	525	470	692	505	475	505	423	405	472	505	410	577	446	510	521
419	577	548	507	453	668	487	458	487	408	390	455	487	396	556	430	492	503
387	534	508	469	420	618	451	424	451	378	361	422	451	366	515	399	456	465
331	455	433	400	358	527	385	361	385	322	308	360	384	312	439	340	389	397
248	341	325	300	268	395	288	271	288	241	231	270	288	234	329	255	291	297
459	510	547	462	436	537	391	492	443	390	449	474	409	405	482	440	437	498
417	464	497	421	396	488	356	447	403	355	408	431	372	368	439	401	397	453
371	413	443	374	353	435	317	398	359	316	363	384	331	328	390	356	354	403
325	361	388	328	309	381	277	349	314	277	318	336	290	287	342	312	310	353
280	310	333	282	265	327	238	300	270	238	273	289	249	247	294	268	266	304
229	255	273	231	217	268	195	246	221	194	224	236	204	202	241	220	218	248
410	493	460	466	456	580	575	470	457	445	431	442	446	445	528	409	464	507
348	419	391	396	388	493	488	399	388	379	366	375	379	378	449	347	394	430
303	365	340	344	338	429	425	347	338	329	319	327	330	329	391	303	343	375
266	320	299	302	297	377	373	305	297	289	280	287	290	289	343	265	301	329
237	286	266	270	264	336	333	272	265	258	250	256	258	258	306	237	269	294
200	241	225	228	223	284	281	230	223	218	211	216	218	218	258	200	227	248
410	484	369	388	401	475	380	433	417	360	429	418	408	359	443	431	434	401
352	416	317	334	345	408	326	373	358	310	369	359	351	308	381	370	374	345
315	372	284	299	309	365	292	334	321	277	330	322	314	276	341	331	334	308
270	319	243	256	265	313	250	286	275	238	283	276	269	237	293	284	286	264
233	276	210	221	229	270	216	247	237	205	244	238	232	204	252	245	247	228
208	247	188	198	204	242	193	220	212	183	219	213	208	183	226	219	221	204
391	431	476	414	418	517	417	462	474	360	350	445	310		482	362	396	522
309	340	376	327	330	408	329	365	375	284	276	352	245		380	285	312	412
301	332	366	319	322	398	321	355	365	277	269	343	238		371	278	304	402
262	288	318	277	280	346	279	309	318	241	234	298	207		322	242	265	349
219	241	266	232	234	289	233	259	265	201	195	249	173		269	202	221	292
	492	526	499	449	537		451	526		425	464	406	451	478		448	
	433	463	439	395	473		397	462		374	409	357	396	421		394	
	389	415	394	354	424		356	415		336	367	320	356	378		354	
	345	368	349	314	376		315	368		297	325	284	315	335		314	
	315	336	319	287	344		288	336		272	297	259	288	306		287	
	246	262	249	224	268		225	263		212	232	202	225	239		224	
337	380	475	469	460	483		437	459		363	360		389	438			
297	334	418	412	405	425		384	404		319	317		342	386			
239	269	337	333	327	342		310	325		257	256		276	311			
202	227	285	281	276	289		262	275		217	216		233	263			
178	201	252	248	244	255		231	243		192	191		206	232			
161	182	228	224	221	231		209	220		174	173		186	210			
449	514	544	438	449	525	498	469	463	421	445	473	549	457	527	419	441	467
391	447	473	381	391	456	433	408	403	366	387	411	478	398	458	364	383	406
350	401	424	341	350	409	388	365	361	328	347	369	428	356	411	327	344	364
314	360	380	306	314	367	348	328	324	294	311	331	384	320	368	293	308	326
261	298	315	254	260	304	288	272	268	244	258	274	318	265	306	243	255	270
229	262	277	223	229	267	254	239	236	214	226	241	280	233	268	213	224	238
325	383	373	367	346	413		351	355	357	340	346	380	332	398	367	342	357
243	287	280	275	259	309		263	266	268	255	260	285	249	298	275	256	268
204	241	235	231	218	260		221	224	225	214	218	239	209	250	231	215	225
178	210	205	202	190	227		193	195	196	186	190	209	182	218	201	188	196
165	195	190	187	176	210		178	181	182	173	176	194	169	202	187	174	182
139	164	160	157	148	177		150	152	153	145	148	163	142	171	157	147	153
135	172	149	172	151	185	237	158	157	182	156	172	144	169	214	144	155	148
197	265	247	265	224	267	224	244	238	229	191	232	232	262	295	272	256	288
164	220	205	220	186	221	186	203	197	190	158	193	193	217	245	226	213	239
138	186	173	186	157	187	156	171	166	160	134	162	162	183	207	190	179	202
124	167	155	167	141	168	141	154	150	144	120	146	146	165	186	171	161	181
116	156	146	156	132	157	131	144	140	135	112	137	137	154	174	160	151	169
104	140	131	140	119	141	118	129	125	121	101	123	123	138	156	144	135	152
199	249	227	229	228	272	311	219	213	223	205	258	241	183	264	225	215	249
159	199	181	183	183	217	249	175	170	178	164	206	193	146	211	180	172	199
135	169	154	156	155	185	212	149	145	151	139	175	164	124	179	153	146	169
127	159	145	146	146	174	199	140	136	142	131	165	154	117	168	144	137	159
119	149	136	137	137	163	186	131	128	133	123	154	144	109	158	135	129	149
101	127	115	116	116	138	158	111	108	113	104	131	123	92	134	114	109	127

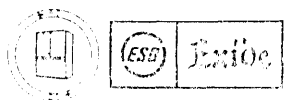
You can depend on Exide® UPS.

Exide UPS systems are protecting some of the largest computer centers in the country. An Exide Uninterruptible Power Supply system filters out the spikes and transients commonly found in raw utility power. And, depending on your time requirements, an Exide UPS system will continue to feed smooth, constant power during utility blackouts and brownouts.

Major computer users who rely on Exide UPS systems are enthusiastic about their selection of this equipment.

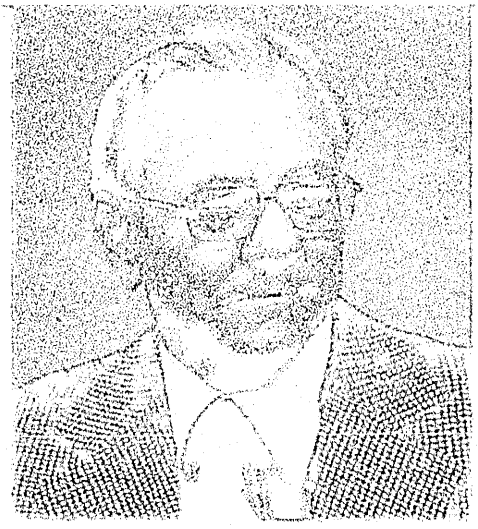
Quoted below are Exide customers whose comments are based on experience. There are many more, since Exide has been an UPS system supplier for more then a decade.

Exide is the only UPS manufacturer that makes all the major components: Rectifier/charger, stationary battery, static inverter and static switch. This means that your UPS will be carefully designed as a complete system. All the components, from the utility power takeoff to the computer interface, have a single source of responsibility--Exide. You can depend on Exide UPS.



EXIDE POWER SYSTEMS DIVISION
ESB INCORPORATED Raleigh, N.C.

They do.



"Exide backs up its UPS reliability claims with a quick-response service department. MCAUTO has had three 200 KW UPS Units in operation since June, 1975 at its St. Louis data center. Eight more Exide 200 KW Units have been installed to provide full emergency power for 15 minutes. And two more are on order. We do depend on Exide UPS."

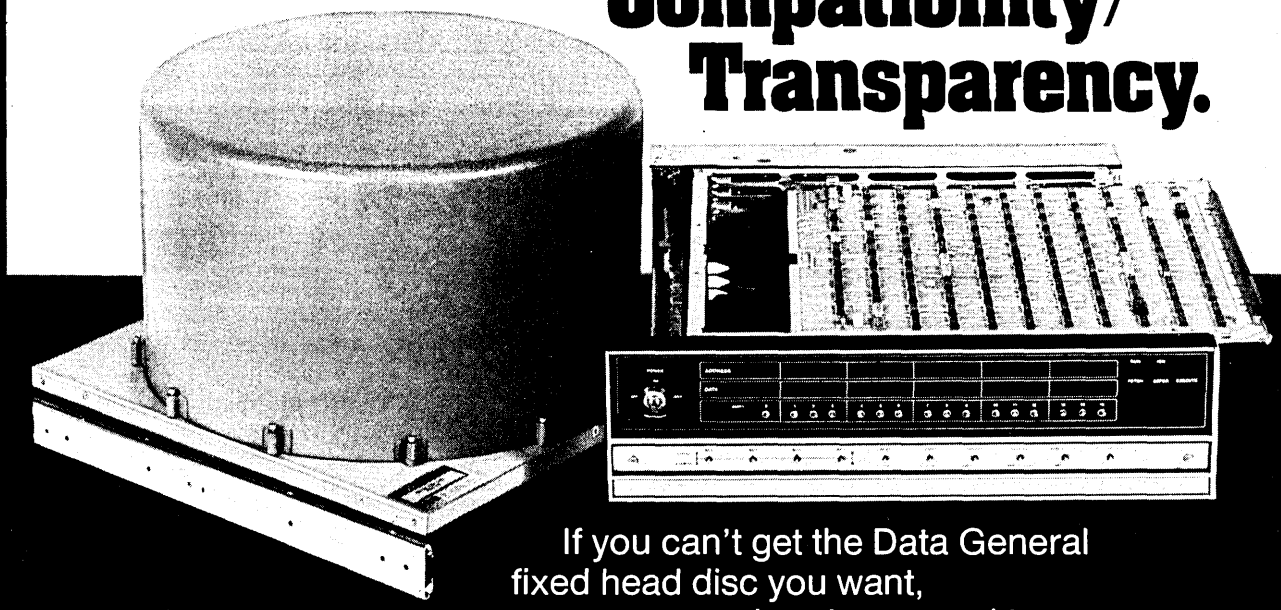
Theodore Kawata, Section Manager,
McDonnell Douglas Corporation

"When the energy crunch started in late 1973, COMPU-SERV realized that if we were going to continue to provide reliable computing services to our users, we would need to find a reliable, cost-effective 'uninterruptible power source.' After talking with several possible vendors, it became apparent to COMPU-SERV that Exide Power Systems could deliver such a system as a total package in a reasonable time frame. Our 250 KVA UPS has been on-line for over eighteen months now. We are pleased with the increased computing reliability that Exide UPS has allowed us to provide the remote users of our mini-computer systems."

Len Kaiser, Site Manager, COMPU-SERV

CIRCLE 47 ON READER CARD

DDC offers proven Data General Compatibility/ Transparency.



If you can't get the Data General fixed head disc you want, there's no need to worry...

DDC has the answer!

DDC has been providing D.G. 4019/NOVADISC replacements for several years, with field-proven transparency to Data General RDOS, all revisions. You've always had a place to turn to for bigger, better and faster discs... now, more than ever, DDC can supply your needs.

FEATURES:

- Immediate availability
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(Continued from page 64)

dp procedures. Devises data verification methods. Prepares block diagrams and record layouts from which programming prepares flowcharts. May assist in or supervise the preparation of flowcharts.

Systems Analyst B
Assists in devising computer system specifications and record layouts. Prepares systems flowcharts to describe existing and proposed operations. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. May assist in the preparation of flowcharts. Analyzes existing office procedures as assigned.

Systems Analyst C
Carries out analyses of a less complex nature. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details block diagrams to reflect specific computer procedures. May assist in the preparation of flowcharts.

Systems Analysis & Programming

Manager of Systems Analysis and Programming
Responsible for feasibility studies, systems design and programming. Assigns personnel to projects and directs their activities. Coordinates section activities with other sections and departments. Reports to the Corporate or Division Manager of Data Processing or to Corporate Management.

Lead Systems Analyst/ Programmer
Assists in planning, organizing and controlling the activities of the section. Assists in scheduling and assigning personnel. May act as systems/programming project manager. May coordinate the activities of the section with other sections and departments.

(Continued on page 74)

THE MANAGERS MOVE UP

The top data processing manager is moving up in his organization. The salary survey data supports that conclusion in nearly a dozen different ways. For starters, in over 40% of the companies reporting, the top dp manager has become a company officer. More often than not, he's called a Director or Vice President:

Director	33.2%
Vice President	26.6%
Department Manager	25.4%
Asst. Vice President	3.5%
Senior Vice President	2.7%
Other	8.6%

His position seems to be changing rather rapidly too, with fewer Department Managers reporting each year and more Vice Presidents.

Titles don't tell the whole story. The measure of the man (or woman) can also be taken by counting his perquisites and weighing his paycheck. By these measures too, the dp manager looks good. Fully half are eligible for some type of "key management" form of compensation:

Incentive Bonus	
% eligible	37.3%
median award (% of salary)	13.5%
Profit-Sharing	
% eligible	30.5%
median award (% of salary)	10.0%
Management Bonus	
% eligible	29.0%
median award (% of salary)	11.0%
Stock Grants	
% eligible	3.2%
median award (% of salary)	10.0%

And the number of managers eligible for these programs in 1976 is up sharply from last year (11.9% to 15.5% depending on the program).

Stock options are also in his domain. Just under a quarter of the respondents were eligible for them; the median exercise cost was 20.0% of salary.

Then too, though inflation takes a mean chunk out of it (and the IRS gets cut in for a share), paychecks are going up nicely for the top person. Last year, 41% of the salaries reported for the top dp manager (lumping all size shops together) were in excess of $30,000 per year. This year, over 55% are above that amount. For a one-year jump, that's pretty impressive.

Want more? Still another measure is available in the survey data: that of the amount of authority which goes with his title, pay, and perks. The table included here lists the titles most frequently given for the person to whom the top dp manager *reports*. And just to ensure that the reporting isn't biased in some way, the figures are given separately for the various size shops involved. (After all, in a three-man firm, everyone reports to the President. Heck, in a company that small, they may even take turns *being* President.)

The numbers don't show how many people call him "Sir," how high up in the building his office is located, or whether he has a company car, but all the measures do agree on one point: the top dp manager is moving up the organization chart. We think that's how it should be. ❋

Corporate DP Managers' (or DP Department Managers') Salaries

Corresponding Size Code In Table A	Monthly Equipment Rental	Average Annual Salary 1st Q	Median	3rd Q
1	Up to $1,500/month	$16,484	$20,228	$20,800
1	$1,501— $3,000/month	$16,900	$19,916	$28,236
1	$3,001— $6,000/month	$17,992	$20,956	$25,012
1	$6,001— $12,000/month	$19,188	$22,516	$26,000
2	$12,001— $25,000/month	$24,024	$27,976	$33,020
3	$25,001— $50,000/month	$26,000	$30,004	$34,996
4	$50,001— $75,000/month	$29,120	$34,008	$39,520
4	$75,001—$150 000/month	$30,524	$34,580	$39,000
5	$150,001—$300 000/month	$31,980	$37,804	$41,184
5	Over $300,000/month	$35,724	$41,496	$52,988

Title Reported To	Installation Size: to $12,000 per month	to $25,000 per month	to $50,000 per month	to $150,000 per month	over $150,000 per month	total
Chairman	2%	4%	3%	2%	2%	3%
President	23%	14%	21%	17%	15%	18%
General Manager	5%	2%	4%	—	1%	2%
Executive VP	5%	7%	6%	10%	20%	9%
Senior VP	3%	3%	12%	14%	20%	11%
Comptroller	5%	3%	—	—	1%	2%
Controller	12%	11%	9%	5%	5%	8%
Treasurer	5%	7%	3%	1%	2%	3%
VP Finance	13%	20%	17%	13%	7%	14%
VP Administration	10%	7%	4%	8%	2%	6%
VP Operations	1%	3%	—	2%	4%	2%
VP MIS/DP	—	—	3%	1%	4%	2%
VP Other	4%	5%	7%	7%	5%	6%
Director Finance	—	2%	2%	3%	—	1%
Director Admin	1%	1%	2%	1%	—	1%
Corp Director MIS	3%	2%	3%	3%	2%	3%
Director Other	2%	2%	2%	3%	4%	3%
Asst to President	1%	1%	1%	2%	1%	1%
Asst VP	1%	2%	—	1%	1%	1%
Other	4%	4%	1%	7%	4%	4%

Table A.

Communications should be answered by more than a box and a beep.

Your office is more sophisticated than a mere box and a beep. So, Dictaphone has taken telephone input handling out of the primitive and into the 21st Century.

Dictaphone's 1650 Programmable Inquiry Response Terminal can actually carry on a voice-activated conversation with your callers. Once you program it with the questions—just read them into the machine—your callers need only supply the answers.

If you're looking for more than dialogue from Dictaphone, there's our System 1700. A system capable of turning telephone orders into shipped orders for your company. The 1700 is a full-capacity system with a bank of three cassettes. While your customers or salesmen are talking to the system from an outside telephone, the 1700's simultaneous input-output capability lets your typists process orders already recorded. It's the best way we know to take your telephone order handling and your profits right into the 21st Century.

Let Dictaphone show you how to turn a simple little beep into an entire conversation—and turn your frustration into satisfaction.

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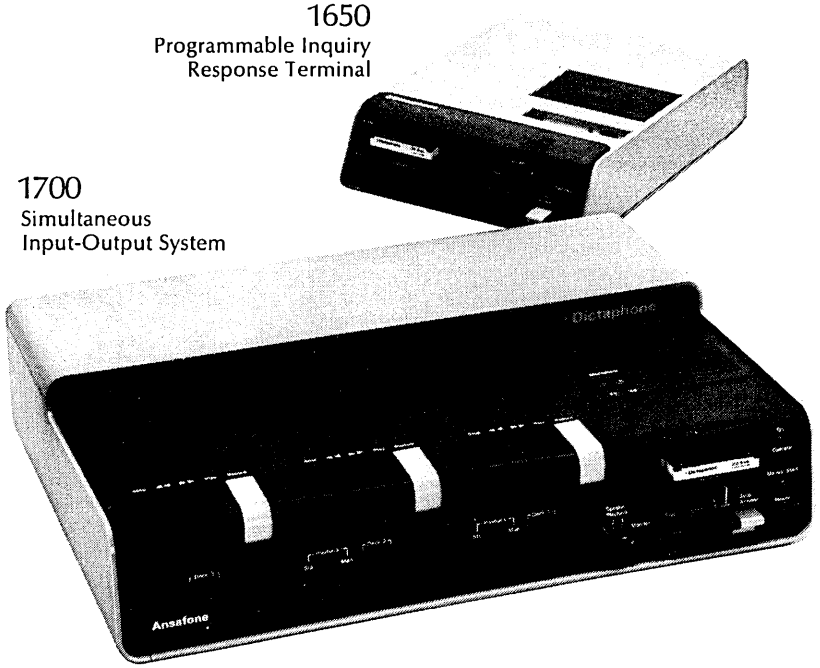

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SALARY SURVEY

(Continued from page 72)

Senior Systems Analyst/ Programmer

Confers with managers, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams. Analyzes existing system and program logic and makes revisions.

Systems Analyst/Programmer A

Confers with dp personnel to determine the problem and type of data to be processed. Defines the applications problem, determines system specifications, recommends equipment changes, designs dp procedures and block diagrams. May prepare flowcharts and codes. Devises data verification methods and standard systems procedures.

Systems Analyst/Programmer B

Assists in devising system and program specifications and record layouts. Prepares flowcharts and logic diagrams for existing and proposed operations. Codes. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. May assist in the preparation of flowcharts. Analyzes existing office procedures as assigned.

Systems Analyst/Programmer C Trainee

Carries out analyses and programming of a less complex nature as assigned and instructed. Usually works only on one activity under very close direction with the work being closely checked. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details block diagrams to reflect specific procedures. May assist in the preparation of flowcharts.

JOB FAMILIES

The jobs have been grouped into a number of "families." The families range from "Manager" or "Supervisor" to "Trainee." There are two important things to know about the families. First, the levels in each category were *derived,* not arbitrarily set. A histogram was constructed for all people in "programming" by plotting "number of people" vs. "salary." If there were five "bumps" or clusters in the histogram, five levels of programmer were defined. These levels were worked back onto the questionnaire. Over a period of years, the listed classifications have evolved.

Second, the classifications have these general qualifying characteristics:

Manager (or Supervisor)	Usually in full charge of all activities of a section or department. May personally supervise the operations of his staff or direct the operation through subordinates.
Lead	Usually considered the assistant manager, or supervisor in families where an "assistant manager" title does not appear. Instead may be a line supervisor with full technical knowledge but added duties of assigning, instructing, and checking other section members.
Senior	Usually competent to work at the highest technical level of all phases of the activity. Works on his own most of the time. May give some direction to lower classifications.
A	Works under general supervision. Usually can work on his own in most phases of the activity. Requires only some general direction for the other phases.
B	Works under direct supervision. Usually fairly competent to work on several phases of the activities with only general directions, but needs some instruction and guidance for the other phases.
C	Works under immediate supervision, generally on only one activity. The work is carefully checked.
Trainee	Usually a probationary employee who has no previous experience.

Applications Programming

Manager of Applications Programming

Plans, organizes, and controls the preparation of application programs. Assigns, outlines and coordinates the work of the programming staff. Establishes standards for block diagramming, flowcharting, and coding. May write and debug complex programs. Collaborates with systems analysts and other technical personnel in scheduling equipment analyses, feasibility studies, and applications systems planning. Reports to the Corporate or Division Manager of Data Processing.

Lead Applications Programmer

Assists in scheduling programming projects. Coordinates the activities of the programming section with other sections of the computer department. May act as programming project manager.

Senior Applications Programmer

Analyzes problems outlined by systems analysts in terms of detailed quipment requirements. Designs detailed flowcharts. Verifies program logic by preparing test data for trial runs. Tests and debugs programs. Prepares run sheets for routine programs. May do coding from flowcharts. May assist in determining the causes of computer or program malfunctions. May confer with technical personnel in systems analysis and application planning.

Applications Programmer A

Conducts detailed analyses of defined systems specifications and develops all levels of block diagrams and flowcharts. Codes, prepares test data, tests and debugs programs; revises and refines programs and documents all procedures used in finished programs. Evaluates and modifies existing programs to take into account changes in system requirements or equipment configurations.

Applications Programmer B

Assists in coding and in analyzing previously defined system specifications. Assists in—and in some cases carries out on his own—the preparation of all levels of block diagrams and flowcharts. Codes; assists in preparing test

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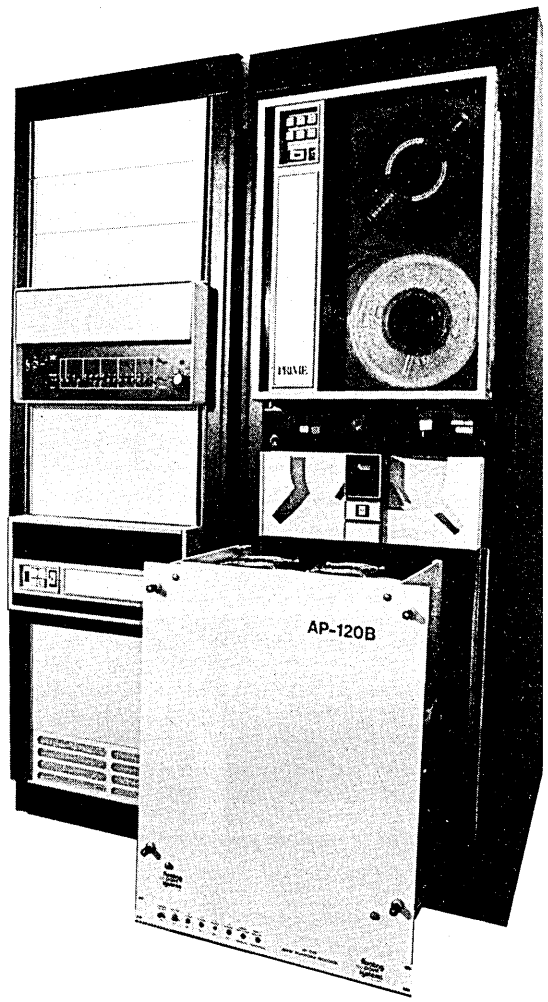
CREDIBILITY Numerous application areas from oceanography to the Space Shuttle project have proven, with over a year's field history, the utility of the AP-120B hardware and software.

AFFORDABILITY What does it take to boost your mini to a mainframe? Less than $40,000 for a **complete** system...that's a small fraction of what you would spend on a large mainframe of comparable power.

AVAILABILITY You bet! Delivery is 60-90 days A.R.O. for a ready-to-use AP-120B hardware and software system.



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SALARY SURVEY

data and in testing and debugging programs. Assists in the documentation of all procedures used in the system.

Applications Programmer C Trainee

Assists in the analysis of system specifications and coding. Performs all work under close supervision.

Systems Programming

Manager of Systems Programming

Plans and directs all activities of the Systems Programming Section. Projects software and hardware requirements in conjunction with other managers within the department and with corporate management. Develops standards for all systems software and works to design and implement systems required. Directs the interfacing of systems software with the hardware configuration and the application systems. Provides technical guidance relating to the operating system to all members of the dp staff. Reports to either the Corporate or Division Manager of Data Processing, the Manager of Systems Analysis, the Manager of Applications Programming, or to the Data Processing Operations Manager.

Lead Systems Programmer

Assists in scheduling systems programming projects and in assigning personnel to those projects. May act as a project manager for major systems applications and as the manager of the department in his absence. Usually assumes the responsibility for coordinating the activities of systems programming with the other dp sections.

Senior Systems Programmer

Develops specifications for extremely complex systems programming applications. May define the logic, perform the coding, testing, and debugging or may provide technical direction to lower classifications performing these operations. Usually is resonsible for applications dealing with the overall operating system or with complex subsystems such as sophisticated file management routines, large telecommunications networks, or advanced mathematical/scientific software packages.

Systems Programmer A

Works from specifications to develop or modify programs to improve the efficiency of the operating system. Develops logic, codes, tests and debugs software defined by higher level categories. Modifies, tests and debugs ven-

FAULT ISOLATION

. . . made easier by the DLM II

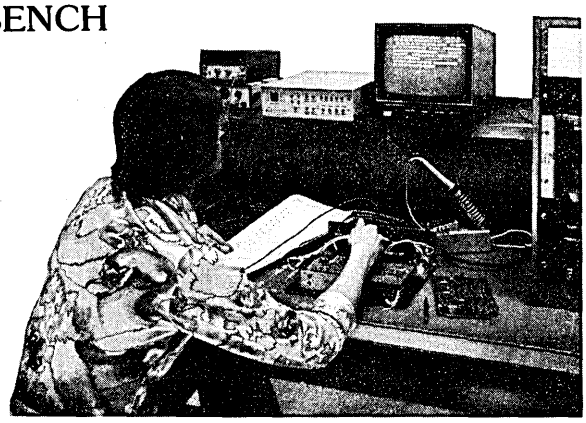
The DLM II is a new tool for isolating and diagnosing problems in data communications networks. It displays on a CRT screen the data characters and the control characters that flow on the transmission line. The DLM II enables the troubleshooter to find the problems fast. The appropriate service person can be contacted without finger pointing, and steps can be taken to get the users back on line quickly.

AT THE CENTRAL SITE

The immediate task of the communications manager is to isolate problems in the shortest possible time. Finger pointing cannot be tolerated, and the appropriate service person should be identified on the first try. The DLM II is an excellent tool for the communication center troubleshooter because it monitors traffic on the transmission lines and can quickly direct attention to the problem. Problem symptoms are easily viewed on a large CRT screen of 1280 or 640 characters. The DLM II is very flexible in multi-vendor environments, as it satisfies the need for a large variety of codes, protocols, and data rates. Communication centers must keep their network operational and need tools to make that possible. The DLM II makes it easier. It is a very practical, cost/effective tool.

ON THE WORK BENCH

The visibility of the data stream to engineers and programmers in the debugging stages makes their life easier and produces enthusiatic DLM II supporters. They can easily spot missing or incorrect control characters or improper character sequences in attempting to locate programming errors and hardware failures. Transmitted messages are differentiated from received messages by lower video intensity. Control characters are highlighted by reversing the video image to a white character on a black background. To accommodate transparent binary data streams and make it convenient to read any character set, the DLM II can show the message content in hexidecimal code. Other items of interest to the person on the bench are the interface signals, parity conditions, and synchronization status. These conditions are sensed and indicated on the DLM II control panel. It is much simpler to debug a system when one can see what's happening, and the DLM II makes it easier. It simply displays the problems in black and white.



IN THE FIELD

Getting in, fixing it, and getting out is the name of the field service game. There is no time to perform complex tests, and sophisticated test equipment is often of little use. The DLM II is just the right gear for the job. It is portable in a self contained 21 pound package and simple to attach to the network.The proper codes, protocols and speeds are easily set by switches on the DLM II, and in minutes the problem can be frozen on the CRT screen in context with all the message delimiters, address information, handshaking, and the data itself. Several DLM II users claim they paid for it the first time they used it. Banks can't tolerate any kind of downtime, and one in particular was plagued by an intermittent problem in their data network. DLM II made it easier by allowing the service person to isolate the intermittent problem, trapping it on the DLM II the first time it was used.

The DLM II could be important to you, saving you time or money. It provides rapid fault isolation and won't tax your budget at $2745. Think about that, and send for more information.

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"This Inforex support team showed our State Auditor's team how to save money."

Thomas E. Ferguson, Ohio Auditor of State

As Ohio's Auditor of State, Thomas E. Ferguson and his team of auditors oversee billions of dollars of the state's money. It's a tough job. But thanks to an Inforex Support Team, it's a lot less tough than it used to be.

And a lot less costly, too.

The team helped the Auditor's Office select, set up, and train operators to run a computerized record keeping operation based on the Inforex System 5000.

This mini-computer based system replaced a keypunch operation where cards had to be punched for coding and sequencing in order to access information. It was a costly and time consuming operation.

But now, with the pre-programmed Inforex system, file data can be retrieved, created, updated and deleted from a number of different locations. Which means a closer watch over the state's money. And a sizable savings in cards, paperwork and time.

System 5000 is presently being used for a number of different tasks. Updating all physical property inventories and land records, for example. And most importantly, progress checks of audits.

System 5000 has proven so flexible and so easy to use (non-technical staff quickly learned how), the Auditor's Office has plans for lots of other applications. Like maintenance schedules for state-owned equipment. A land file based on deeds, not just reports. And personnel and payroll files.

The Inforex computerized record keeping system is just what the State Auditor's Office needed. But we can also provide systems for data entry and remote batch communications. Along with an Inforex Support Team to give you all the support you need.

For more information, just clip the coupon and mail it today.

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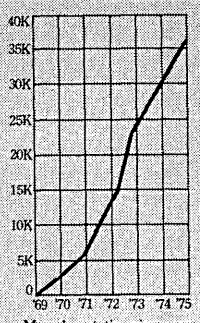

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SALARY SURVEY

dor-supplied utilities, application packages and engineering releases. Assists in developing and modifying relatively complex software, such as routines supporting multiprogramming, telecommunications and file management.

Systems Programmer B
Assists in defining and programming moderately complex software such as utilities, job control language, macros and subroutines. May assist the coding of benchmarks, job accounting and control modules developed internally by the firm. May assist with relatively complex software such as compilers, link editors, and assemblers.

Systems Programmer C
Assists in coding and maintaining utilities, job control language, and I/O programs, as well as other systems software of moderate complexity. May assist in maintaining the program libraries and technical manuals and in installing new vendor-supplied engineering releases. Assignments are generally under the technical direction of a higher level systems programmer. Usually possesses some background in applications programming and has a working knowledge of at least one assembler language.

Operations

Manager of Data Processing Operations
Has many of the same responsibilities as the Corporate Manager of Data Processing, except that Systems Analysis and Applications Programming functions are not under his control. Systems Programming may report to him, and all other machine-oriented functions from data entry to report binding certainly would. Most likely reports to Corporate Management, but may sometimes report to Corporate or Division Manager of Data Processing.

Manager of Computer Operations
Plans, organizes and controls the Computer Operations Section. Establishes detailed schedules for the use of equipment. Assigns personnel and instructs them where necessary. Reviews equipment logs and reports on operating efficiency. Reports to the Corporate or Division Manager of Data Processing, or to the Data Processing Operations Manager.

Lead Computer Operator
Assists in scheduling the operations and in assigning personnel. Coordinates activities of the section with other sections in the data processing department. May act as shift supervisor.

Senior Computer Operator
Usually operates the central console. May give some direction to lower level classifications. Studies run sheets. Reruns job steps to recover from machine error or program error, consulting with technical staff where necessary. Maintains machine performance and production records.

Computer Operator A
Assists in running the machines and maintaining records. May assist in error recovery.

Computer Operator B
Assists in operating the computer and peripherals. May keep records regarding output units and use of supplies.

Computer Operator C
Carries out minor duties in accordance with detailed instructions. Usually works on only one activity under very close direction with the work being carefully checked.

Tape Librarian
Maintains library of magnetic and paper tape. Classifies, catalogs and stores reels. Maintains charge-out records. Inspects tape for wear or damage.

Data Control

Data Control Supervisor
Plans, schedules, supervises, and directs preparation of records for data entry and distribution of reports. Maintain files and records, and supervises personnel. Reports to the Computer Operations Manager or to the Data Processing Operations Manager.

Data Control Group Leader
Assists in supervising group activities, in maintaining and revising lists, control records, and source data for recurring records and reports.

Data Control Clerk A
Maintains various control records and source data for recurring reports. May code source data and lists according to prescribed code designations. Performs related clerical and typing duties.

Data Control Clerk B
Processes various lists and source data for recurring records and reports. Prepares and types lists. Performs related clerical and typing duties.

Data Control Clerk C
Usually works on one data control activity. May assist higher level clerks on other activities. ❁

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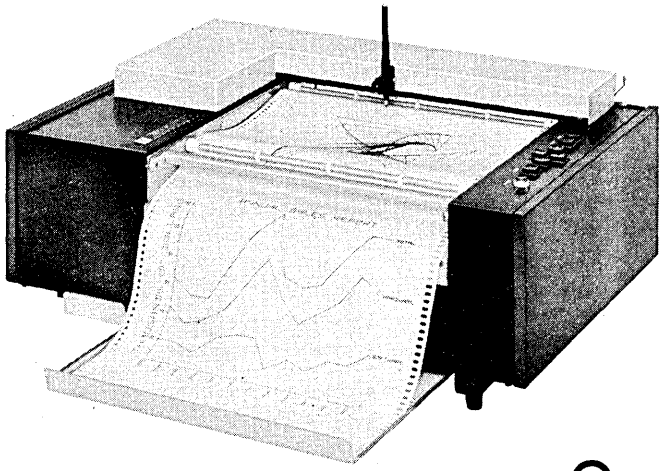

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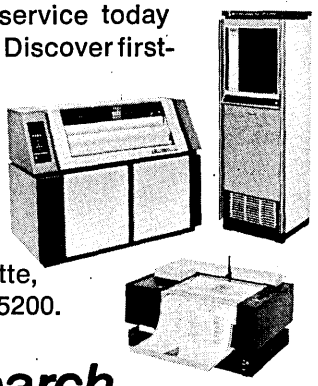

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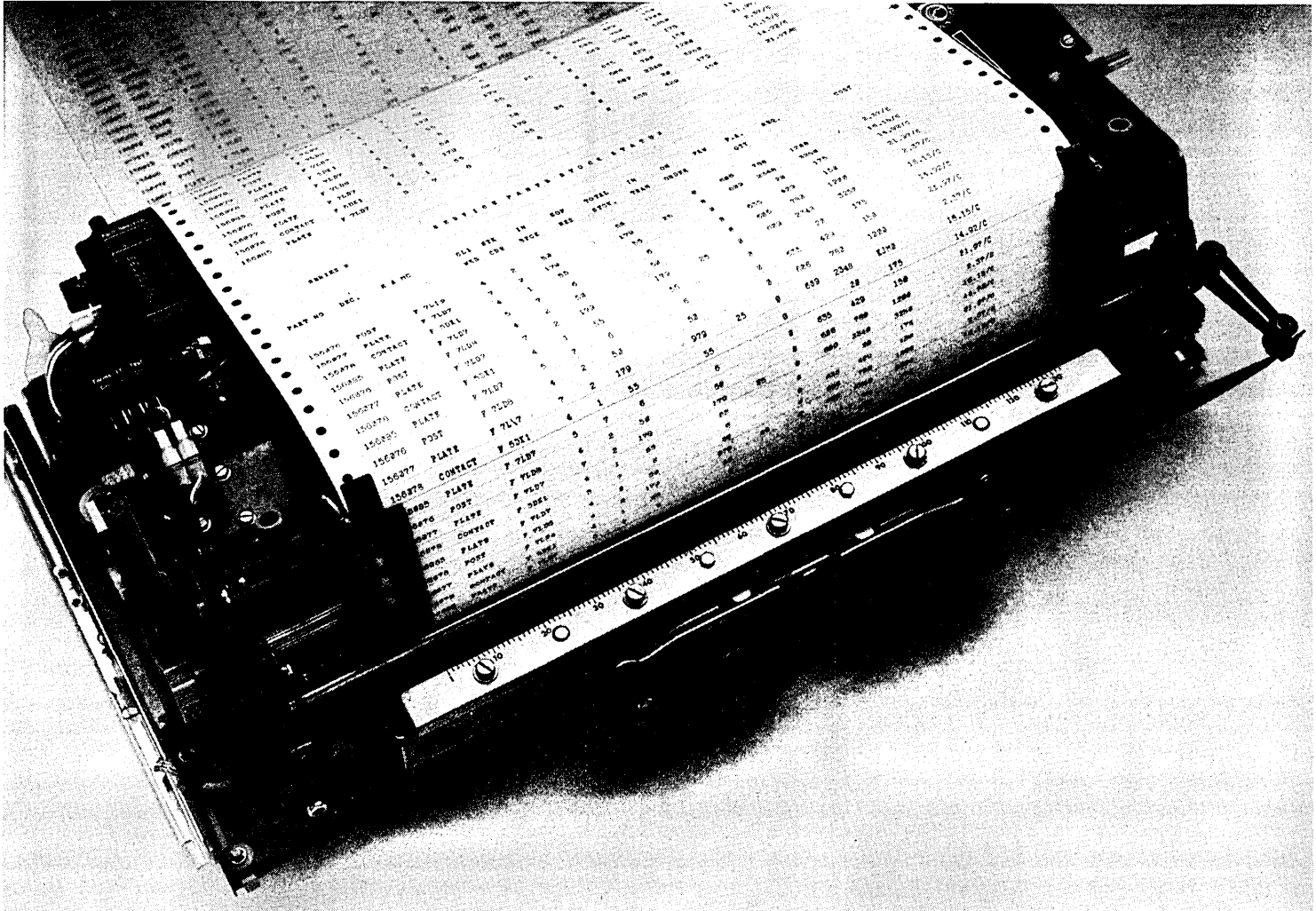

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"Sycor service keeps my network uptime to 98.5%."

Bill Dierkes, VP Information Systems, The Keebler Company.

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

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

Keebler puts Sycor to the test.

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

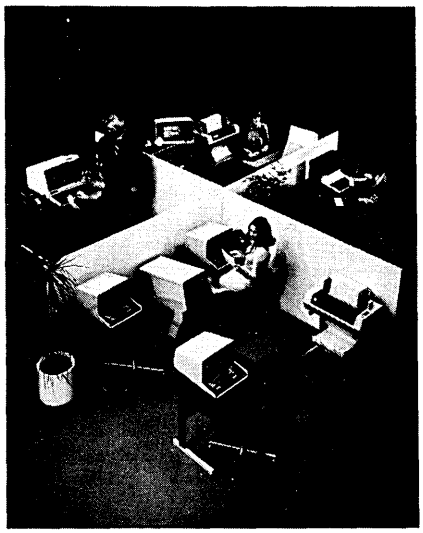
"I conducted a survey of 61 of our Sycor terminals from December, 1975 through May, 1976. Some of the terminals were in out-of-the-way places like Minot and Fargo, North Dakota; Billings, Montana; and Pocatello, Idaho. Places where service might be a problem.

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

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

A Sycor intelligent terminal is a management tool.

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



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

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

Put Sycor to work for you.

Find out how much Sycor intelligent terminals and responsive service can mean to your EDP network's efficiency. Send in the reply card today.

If the card is gone call one of our nearby sales offices. We're listed in the Yellow Pages under "Data Processing Equipment." Or contact Bill Newell, our national sales manager, at Sycor, Inc. Corporate Offices, Ann Arbor, MI 48104.

Sycor puts computer power where the work is.

SYCOR

Is Decentralization Inevitable?

by Frank V. Wagner

Even if the machines are loaded to only 10% of capacity, it is now better for groups of 30 or less to have their own computers.

Except for the salaries of the users, the costs of all elements of a data processing system are declining—some more rapidly than others. Performance, at the same time, is increasing. From such generalities, many opinions can be formed, and different consequences deduced. However, if the question is asked, "How much has the cost of a particular element declined?" it becomes a very difficult question to answer—and one begins to doubt the validity of some of the conclusions drawn from these generalities.

The great British physicist, William Thompson (Lord Kelvin) once observed:

> "When you can measure what you are speaking about, and express it in numbers, you *know* something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science."

However, in attempting to reconcile the quantitative data available, several problems occur. No authors approach the matter from the same point of view. None of the performance data is expressed in comparable units. Few authors adequately define the makeup of the subsystem they are describing; for example, is the cpu only a logic processor? Or does it include high speed internal storage? What about power supplies?

In many cases, "cost" is not defined. Is it manufacturing costs, or the ultimate price to the consumer? The latter, of course, would be more meaningful, and will be used in this article. And some authors speak to different time frames, some concentrating on the past, others projecting into the future.

We now arrive at another problem. Frederic G. Withington ("Beyond 1984: A Technology Forecast," January, p. 54) makes it clear that, after the end of any decade, one simply *cannot buy* a thing directly comparable to the thing he bought at the beginning of the decade. Computer systems with only 2K of internal storage, for example, were normal in 1955, but by 1965 they were generally not offered for sale.

The situation in software becomes even more unmanageable. A very acceptable software program in 1965 would be totally unacceptable in 1975. The 1965 model would have been developed without adequate specifications; it would be prohibitively hard to maintain; its documentation would be rudimentary and inadequate; its testing would not have been subject to modern standards of quality assurance, etc.

In spite of such obstacles, this article attempts to synthesize a picture of changing costs from available data; this synthesis is pictured in Fig. 1. Both hardware elements and software development were studied to determine cost/performance trends.

Hardware

Three of the physical elements that go into a computing system were selected for study: (1) *Processing and Internal Storage* (to represent the cost of raw computing power), (2) *Fast Access Mass Storage* (to represent the cost of having all of the data required rapidly available for processing), and (3) *Common Carrier Communication Lines* (to represent the costs of using a computer from a remote location).

To study "Processing and Internal Storage," the cost of a cpu was used. The cpu includes all the logic necessary to interpret and execute the instructions to the computer, and the high speed internal storage in which resides the program and the data currently being processed. It also includes such appurtenances as the power supply and the cabinet.

Costs for such cpu's from 1965 on typically represent the cost of a system with much more powerful logic, and a much greater quantity of internal storage than 1960 cpu's. Hence, the costs shown, particularly for 1975 through 1985, are actually for cpu's much more powerful than comparable ones of 1960. In spite of this defect in strict comparability, the index of costs shows a spectacular improvement through the years. There is nothing startling about this conclusion—hardly anyone would challenge it.

The data are presented for comparison with the other elements of a computing system. Cpu's in 1975 cost approximately one-half of 1% of those of 1960. The 1985 systems will cost about 20% of the 1975 systems. Clearly, in any analysis of computing costs in the next decade, the cost of the central processor and its internal storage has descended into the noise level.

When one turns to the relative costs of Fast Access Mass Storage, there appears a picture not so widely appreciated. "Fast Access Mass Storage" means the external on-line storage of the computer, in which is held the data (and programs) that could not be held in internal storage, but which requires rapid access for transfer to internal storage for processing. (Not considered here are the more esoteric supersize storage with relatively slow access, currently represented by such devices as the Ampex Terra-bit and IBM 3850.)

Prior to 1960, the most widely used device for this purpose was magnetic tape, inadequately supplemented by small capacity magnetic drums. Beginning in 1960, rotating magnetic discs became more and more prominent, so that eventually, magnetic tapes were

Portions of the material presented here will appear in another form in the AGARD (Advisory Group for Aerospace Research and Development, NATO, APO New York, N.Y. 09777) Conference Proceedings to be published early in 1977, which includes an extensive bibliography.

largely relegated to the role of off-line and/or archival storage. In the 1980s, it is expected that many of these devices will include semiconductor technology, CCD (Charge-Coupled Devices), and magnetic domain devices such as bubble memories. In 1960, the costs were based upon the original 1956 IBM RAMAC, the 1960 IBM 1301, and the 1962 IBM 2311, the first major removable disc pack. The point plotted for 1974 represents the current 200 megabyte IBM 3330-II.

In order to bring these, and the future more exotic devices, onto a common ground, it was necessary to "normalize" the difference in size of storage and speed of access. For this purpose a "Unit of Capability" was used, defined as the storage capacity in kilobytes divided by the access time in milliseconds. Comparable costs, then, are costs per unit of capability. Most of "the conventional wisdom" agrees that the cost of such fast access storage has come down, "but not very much." The data in Fig. 1 show that the cost indeed has come down sharply; 1975 costs are only about 2% of 1960 costs, and 1985 costs will be about 10% of 1975 costs.

Since the famous "marriage of computers and communications," an increasing fraction of the cost of getting computing done has been the cost of communications. This cost would include the remote terminal devices, the modems, multiplexors, concentrators (some of which are on the end of every digital communication line), and the lines themselves. The lines represent a substantial portion of such costs. The most glamorous portion of line costs are the "long lines" from city to city, now frequently mechanized via satellite. However, what is not commonly recognized is that the local connections (particularly in situations with multiple dispersed terminals where dial-up services are inadequate) frequently represent the largest portion of the cost.

Line costs to the user are *not necessarily susceptible to advances in technology*. Typically, the service must be obtained from a regulated common carrier whose prices are set by public authorities on the basis of return on investment. High density routes (where unit costs to the carrier are small) frequently command high prices in order to subsidize low density connections to remote hamlets, where the unit costs to the carrier are very large. Thus, the price to the consumer is normally not a function of technology.

Fig. 1 shows that the reduction of the costs of the communication lines is small compared with the vastly reduced costs of the other hardware elements of computing. 1975 costs are only 61% of those in 1960; 1985 costs will be about 53% of 1975's. The cost of other elements of the network will, of course, decrease in direct proportion to the amount of electronics that they contain. Nevertheless, it is clear that, of all the elements of computing cost, the smallest decrease is represented by the communications portion.

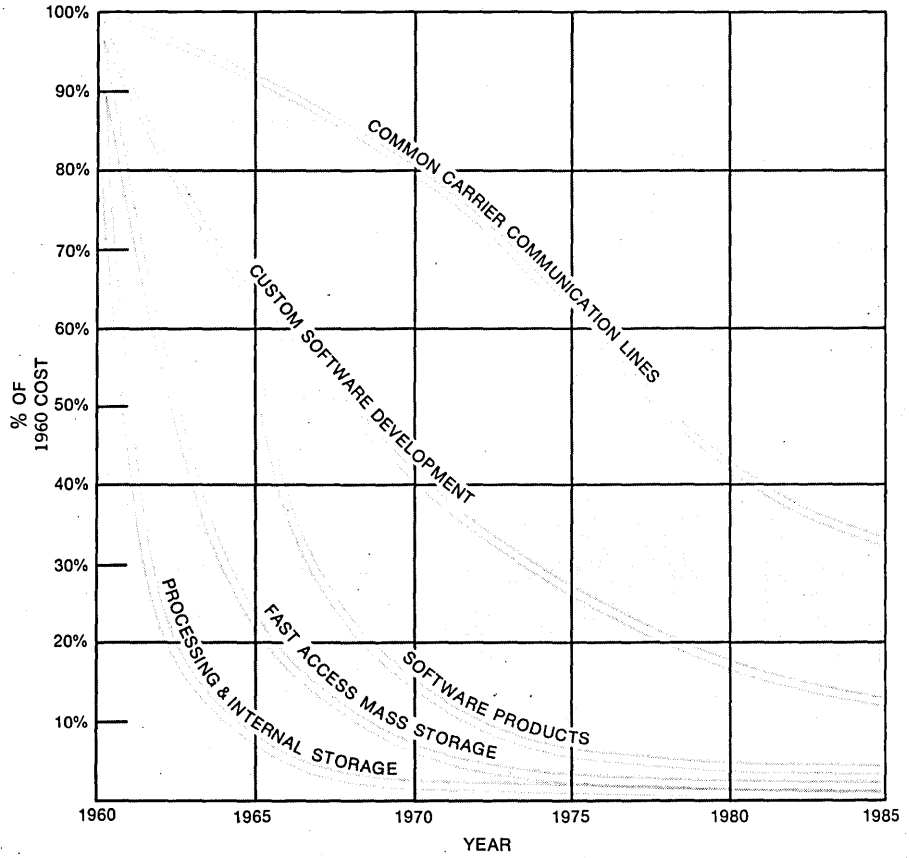


Fig. 1. Data is synthesized from at least 20 different sources to show the cost to the user for different elements of a computing system relative to their cost in 1960. The major difficulty encountered is that changes are so rapid that **one cannot buy a directly comparable item at the end of a decade that he could at the beginning.** Much better cpu's in 1975, for example, cost 0.5% of what they cost in 1960. Costs for more powerful, fast access mass storage in 1975 are about 2% of what they were in 1960. These costs will continue to decline considerably by 1985. The decreases in communications and software are less than decreases in other elements, but are still considerable.

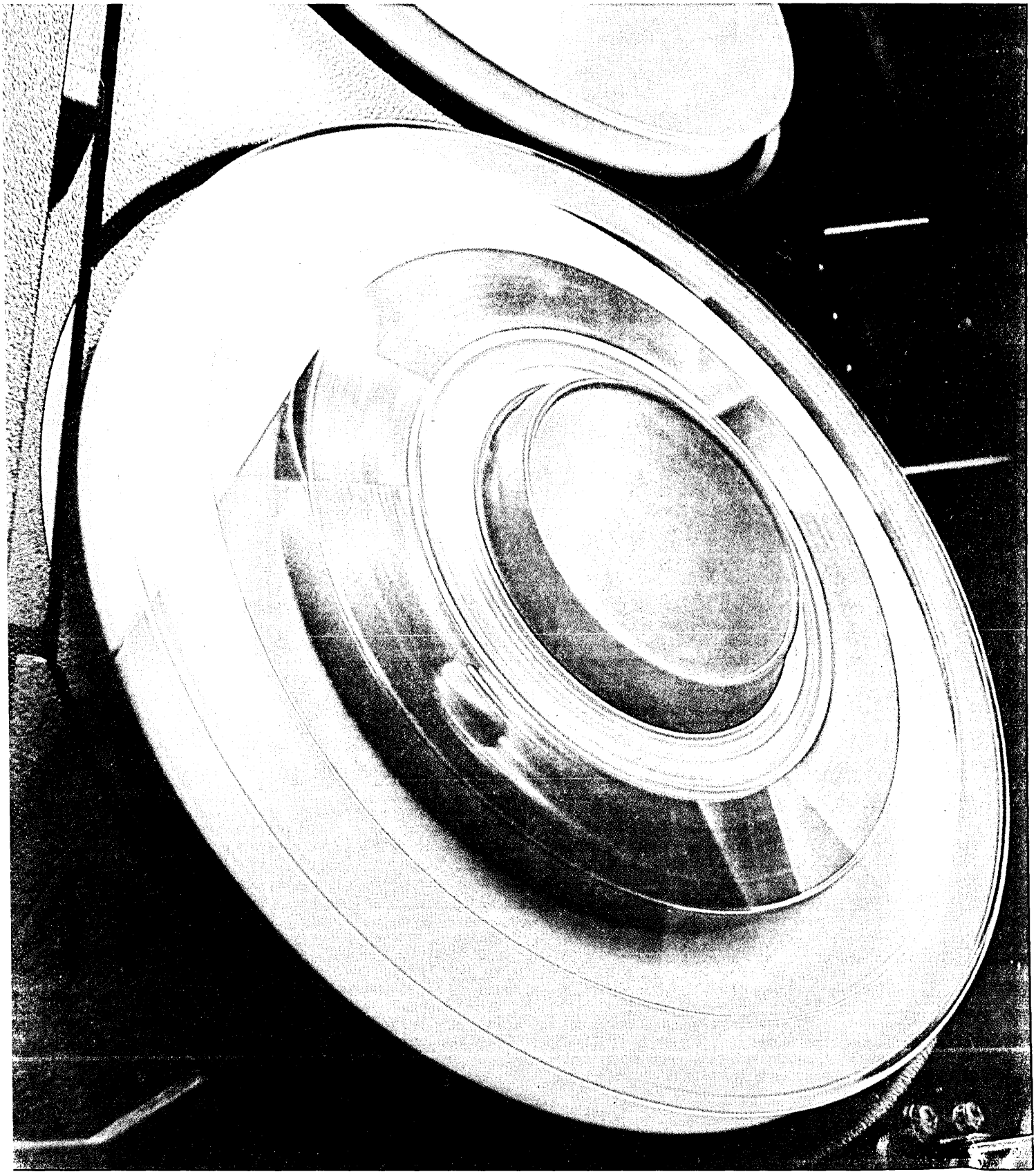
Software

In approaching a study of the costs of software, one is keenly aware of Kelvin's dictum, "when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind." Nevertheless, a few daring souls have attempted to quantify the problem, principally a team of dedicated researchers at System Development Corp. (See B. W. Boehm, "Software and Its Impact: A Quantitative Assessment, *Datamation*, May 1973, p. 48). Their studies show that there is a spread of 1,000% between the 10th and 90th percentiles of software productivity, if it is measured by the number of BAL (Basic Assembly Language) instructions per man month. The median of these data are as follows:

Year	*Number of* BAL *Instructions per man month*
1955	200
1960	300
1965	450
1970	700
1975	1,100
1980	1,650
1985	2,500

A large part of such improvement in productivity comes from the availability of improved implementation systems—the tools for building software. In 1955 only primitive assemblers were available. Later the first generation of higher order languages appeared: FORTRAN, COBOL and JOVIAL. Today for business application programs such implementation systems as Informatics MARK IV and IBM's RPG II enable programmers to produce a high quality equivalent of BAL instructions from five to fifty times faster than the tools of 1960 permitted. Similar trends are

COMMAND PERFORMANCE



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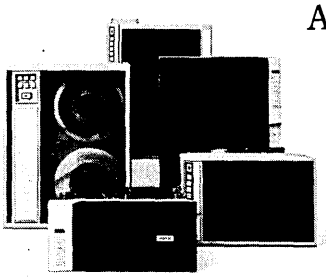

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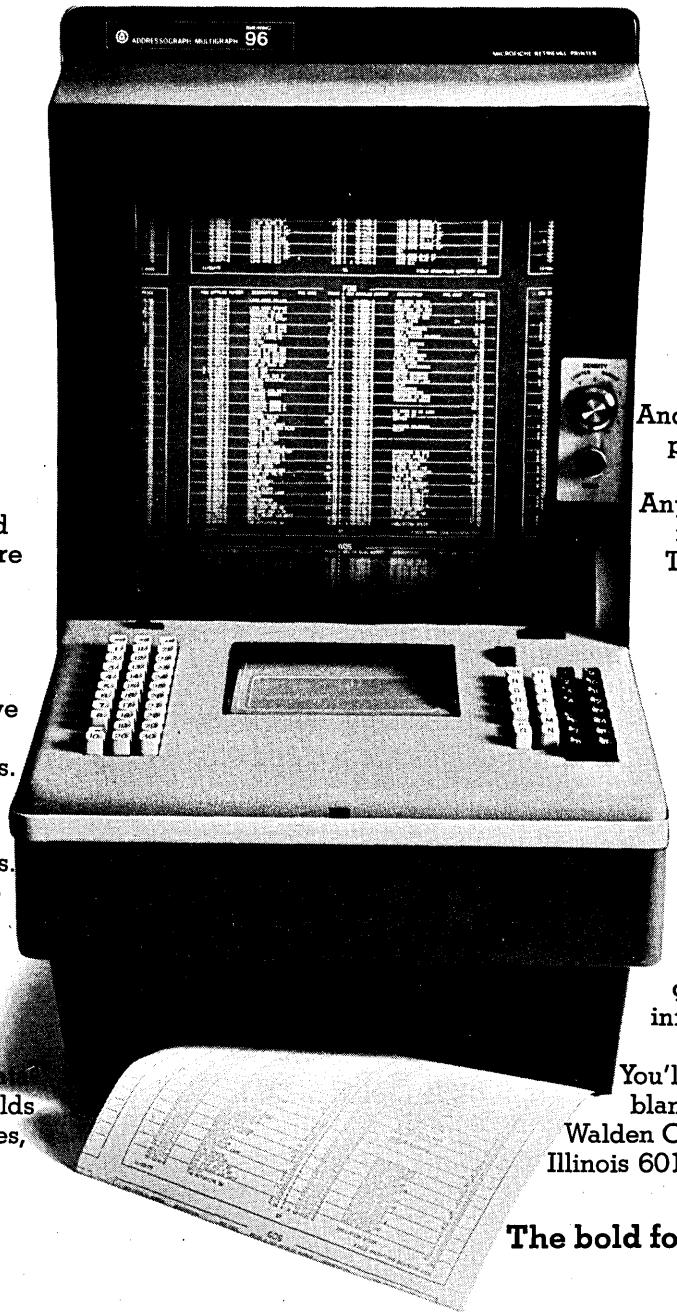

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noted in the construction of system programs, where the pioneers, SDC's JOVIAL and Digitek's POPS, have been followed by modern proprietary systems, such as IBM's PL/S, Softech's AED, CAP's CPL/1.

Surprisingly, all this productivity is preserved when converted into cost per instruction. The cost per man month of a programmer (and his computer test time) capable of producing such an instruction is not growing. It is *almost a constant* in the range of $3,500-$3,800 per man month total cost. Direct labor cost, although growing, has not kept pace with inflation [See the *Salary Survey* in this issue]. The increases are compensated for by a big decrease in overhead costs. There has also been a very significant reduction in the costs of machine time used each month by a programmer for testing.

If the above data on instructions per man month are divided by the cost per man month, we obtain a figure for cost per BAL instruction. Relative values thereof are plotted in Fig. 1 as the curve labeled "Custom Software Development." The surprising result is that the cost of an *equivalent* program, comprising 10,000 instructions today is about 28% of its cost in 1960—and in 1985, it will be less than half of its cost today. But I must repeat, there is no such thing as an "equivalent" program of 10,000 BAL instructions. Today we demand much more, for example, data security, "fail-soft" characteristics, automatic recovery—things which were rarely heard of in 1960. Consequently, it is clear that the cost of developing software has not come down anything like the amount that hardware cost has decreased—indeed, its cost reduction is almost as disappointing as communication costs.

However, another development has taken place, beginning about 1965. In 1960 the concept of a "Software Product" was the dream of a few pioneers. The concept was simple. Do the development *once*, but do it in such a way that the identical software could be used by *many* different organizations. Of course, this has always been done for basic system programs such as language processors, control programs, and access methods. But in 1960, it was deemed impractical to do so for application programs (which represent the major part of software development costs). Such extension to application programs began in the late 1960s, and application software products are commonplace today.

There is no reliable published data on the economics of using software products, and such data would vary widely, depending on the type of product used. I have estimated, however, that the equivalent costs of using a software product had, by 1970, declined to 25% of the cost of a custom developed equivalent system, and by 1975, were certainly no greater than 15%. In some cases, the ratio could be as little as 1%. In Fig. 1, I have plotted the most conservative curve, which shows that, *using software products*, 1975 costs are about 6% of software costs in 1960, and that 1985 costs will be about 33% of 1975's.

To summarize, dramatic reductions began then in 1960 in cost performance trends for the elements of computing systems. Major cost reductions in computers themselves have been accomplished by 1975, and there will be continuing reductions through 1985. Communication costs, on the other hand, lag far behind all other types of hardware costs. The cost of software development has been progressing nicely, but dramatic improvements can only be achieved by using still higher level languages. The past and future improvements are listed in Table 1. It will be seen that hardware costs represent an ever decreasing percentage of total budgets for data processing.

Implications of decline in costs

However, a frequently overlooked fact is that the costs listed in Table 1 are not the whole story. The total dp system includes *all its users*.

	1975 Costs as a Fraction of 1960 Costs	1985 Costs as a Fraction of 1975 Costs
Hardware		
Processing and Internal Storage	0.005	0.20
Fast Access Mass Storage	0.02	0.10
Common Carrier Communication Lines	0.61	0.53
Software		
Custom Development	0.28	0.47
Software Products	0.06	0.33

Table 1.

Nevertheless, as might be expected, those subsystem components which have had the greatest increase in cost effectiveness have had the greatest influence on the architecture of such systems. The dramatic reduction of cost in processing logic has created a trend toward incorporating "intelligence" (i.e., processing capability) into remote terminals. There is a small but definite growth in such intelligent terminals, which are really minicomputers. More and more, the processing which *can* be done remotely *is* done remotely, and only that which requires a central computer is transmitted to and from the central site.

Software trade-offs

At present, the cost of software seems to have mixed effects on this trend toward decentralization. On the one hand, there are several factors which seem to indicate that software costs on small decentralized computers should be greater than such costs on large central computers, which would thus inhibit the trend. Sophisticated tools for software development on small computers are available in much less variety than on large machines. Good operating systems, with conveniences for the programmer, are rare. With the exception of RPG II on Systems/3 and 32, second generation implementation systems, such as COBOL compilers and only one Data Base Management System (a small version of TOTAL), are just beginning to become available on a relatively few small machines. Third generation implementation systems, necessary for high productivity, such as GIS, ASI-ST, MARK IV, are available on only one small computer—the Microdata "REALITY" System.

On the other hand, there are opposing factors which tend to reduce the cost of software development on decentralized minicomputers. Perhaps the most powerful factor is that the computer is *specialized*. It is *not* all things to all men—when best used, it tends to be dedicated to a single application or a group of related applications. Under such circumstances, there is no need for a sophisticated operating system with all its mind-boggling complexity. Therefore, the programming is straightforward and uncomplicated.

Another factor of increasing importance is the accelerating trend toward the availability of software products on minicomputers. As mentioned, software costs can be reduced most dramatically by the use of general purpose software products. The System 32 is better equipped with application products than any large machine. As these become more available for other minis, the prior inhibiting effect of software development on the trend will disappear.

Hardware-software trade-offs

The dramatic decrease in the cost of processing logic has made possible a development which has not yet emerged as a trend. But it seems so logically inevitable that I expect to see it emerge within the next five years. The concept addresses the software problem by exploiting the low cost of hardware logic to use *existing* software. I can best illustrate it by describing a

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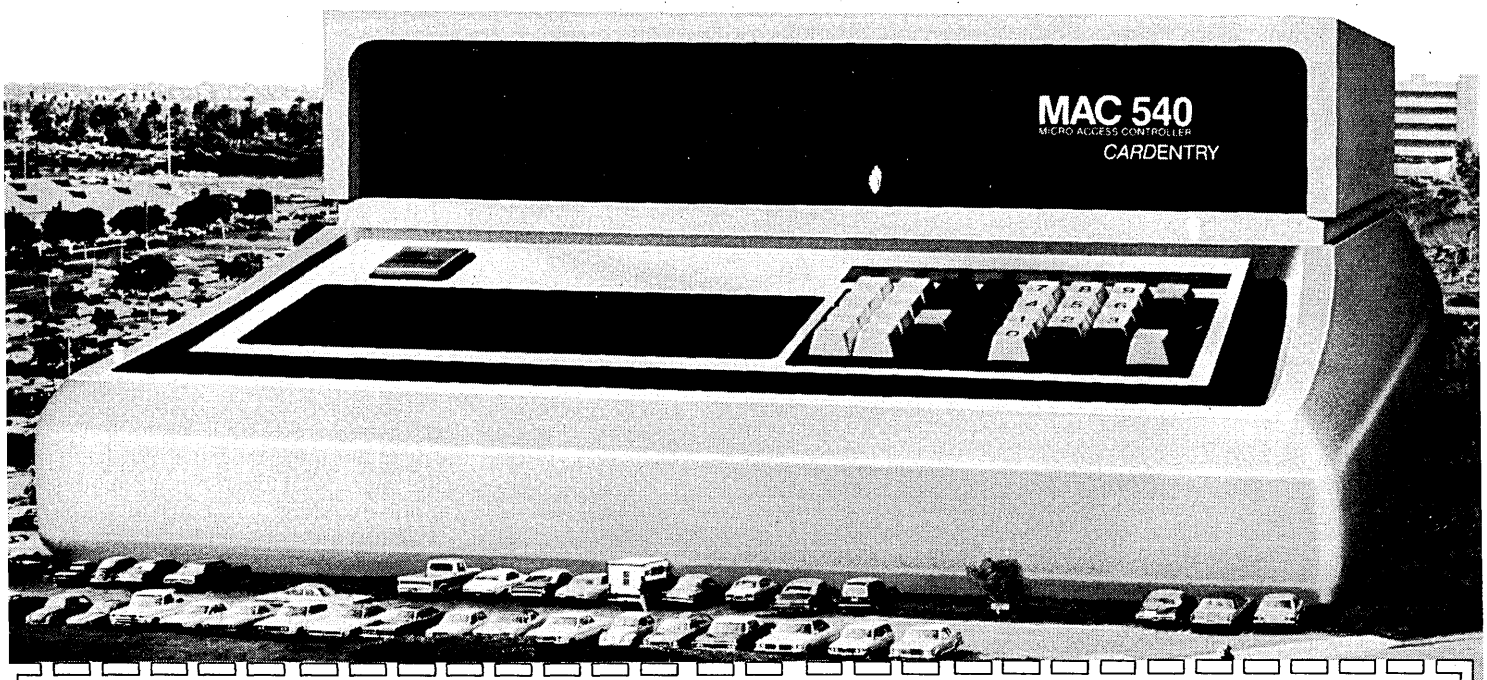

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case in which the technique produced dramatic results.

Almost ten years ago, a large organization needed a very sophisticated message-switching system. They selected a very powerful, highly sophisticated computer—the best one for the purpose available at the time. The software necessary to implement the system was a major development project. It took a number of years and cost several million dollars. Subsequently, several other organizations acquired the same hardware, and built on the base of the same software, enhancing it as the years went by. The replacement costs of that software today would perhaps be $5,000,000; it was by far the best available answer to the requirements.

In the early '70s, the hardware began to become obsolescent and its cost effectiveness declined, so that new users were reluctant to acquire such hardware. New modern minis, as we have seen above, could perform the same functions at far less cost. But their use was impractical; *the cost of rewriting the software was prohibitive.*

So a concept was developed to use such relatively inexpensive hardware for processing the existing software by the well-known technique of hardware emulation. A relatively inexpensive, reliable minicomputer from a reputable manufacturer was selected. Enhancements to the hardware were designed, which enabled the message-switching software to run on the foreign machine. The cost of hardware development and manufacturing was less than 10% of the cost of rewriting the software. The project was successfully completed, and a substitute was developed, highly cost effective by 1972 standards. By 1980, such a substitute can be developed for 20% of the cost of the 1972 model.

There is available today a growing inventory of software products for large, expensive computers. I believe that inexpensive hardware enhancements to modern minicomputers will soon enable them to run this inventory of available software. The most cost-effective approach will be to dedicate a machine to a specific purpose. Today you have on your wrist a computer dedicated to telling you what time it is. Soon you will buy a computer to do only accounts receivable or document accession, or whatever your job is.

Grosch's Law repealed

The well known Grosch's Law states: "Throughput capacity of a computer is proportional to the square of its price." A number of formal studies confirmed that this law was indeed valid for large computers of the 1950 to 1970 era which operated in batch mode.

Dp management became well aware of the "economies of scale," and with the demand for capacity seeming to grow without limit, a corollary to Grosch's Law that I call the "Dogma of Data Processing" evolved: "The most economical way to do computing is to acquire the *largest* computer that the enterprise can possibly foresee a need for; therefore, *all* computing in the enterprise *must* be done in one *central* computing facility." Hence, we have a strong "union" of dp managers who quote the gospel according to Grosch in defense of centralization, and treat as heretics the radicals who would propose decentralization.

But, with astounding foresight, C. W. Adams ("Grosch's Law Repealed," *Datamation*, May 1962, p. 38) anticipated that the price-throughput relationship of Grosch's Law was beginning to disappear. Since 1960, small cheap minicomputers simply do not follow this "Law," and it has been conjectured that throughput performance on minicomputers may even be proportional to the *square root* of the price.

In addition, the very large machines have begun to encounter some *dis*-economies of scale. As more and more work is done on a single mainframe, the operating system gets more and more complicated—and less useful work actually gets done.

Both factors then indicate that Grosch's Law is being repealed.

The efficiency of people

In most large organizations, dp costs tend to be somewhere from 0.5% to 2% of total costs. Salaries and other costs of people are between 40% and 90% of total costs. The efficiency of the total enterprise is the efficiency of the global system of *people* doing the necessary work, *assisted* by computers. Yet, at meetings of computer people, the discussions might lead one to believe that all the work was done by computers. Serious papers are published on optimizing the hardware/-software subsystem, leading the unwary to believe that such optimization would solve the whole problem. Such local optimization can be useful, but, as is well known, must always be subordinated to the global optimization of the real problem, the total system.

Just suppose that typewriters had never been invented. All the secretaries in your office are producing letters and reports by writing them out very neatly in longhand with ballpoint pens. Now IBM makes a dramatic announcement—it has invented the typewriter! Next morning, at every large corporation, an IBM typewriter salesman has an appointment with the Vice President for Office Services. Let us see what happens, for example, at the General Electric Corp. The salesman suggests that GE buy a $600 typewriter for each secretary. This is a revolutionary proposal. Purchasing is called in. Internal Consulting is summoned to a meeting. Operations Research is charged with investigating the concept, and conducting a feasibility study. The results show that the average use of a typewriter by a secretary would be 1.1873 hours per day, and that the productivity of secretaries would increase by 325.26%. It is strongly recommended that the corporation convert to typewriters. It is recommended that enough typewriters be procured so that each is loaded 4.7492 hours per day. Allowing for down time and assuming that most overloads can be handled by overtime, each four secretaries *will share one typewriter.*

The recommendation is adopted. The typewriters are delivered, and training begins. Soon all secretaries are mechanically proficient; Purchasing cancels all orders for ballpoint pens; and the system is cut over to document production by typewriter only. Productivity is very low the first week. It is worse the second week, worse the third, and by the end of the month, the backlog of letters and reports has reached alarming proportions. Most executives are spending a good deal of their time consoling tearful secretaries who complain that they cannot get their work done because they cannot get access to a typewriter. An emergency meeting is held. Only two viable alternatives present themselves—go back to the ballpoint pens, or get a typewriter for each secretary! Operations Research does a fast study, and concludes that spending four times as much for the typewriters will be paid for many times over by the increase in productivity. The recommendation is accepted, the secretaries live happily ever after, and General Electric increases its dividends.

The moral of the fairytale is clear. Efficiency of *people* can vary over a wide spectrum. The productivity of programmers has been studied extensively; no general conclusion was possible because productivity varied by a factor of ten between different people, and even when measuring the same person at different times. All data on the efficiency of people show that it can seriously be impaired by frustration—"Nobody lets me get my work done without interference." Conversely, productivity seems to be at its highest when the worker has full control of the tools necessary to do a job. Many have had experiences with central data


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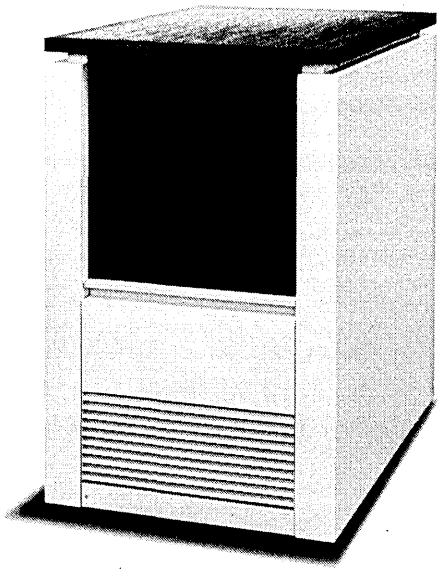

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processing that parallel those that the secretaries had with the shared typewriters. You complain of the service. Dp management writes an authoritative study showing that the service is excellent *and very cost effective* (implying that *you* are the money-waster). You fire back a memo documenting how bad it is. In the meantime, the work suffers. What would happen if you had control of your own computer? If anything went wrong, you would look around for someone to blame, and see no one but your own unit. You would roll up your sleeves and solve the problem.

Of course, the moral of my fairytale would not be applicable if typewriters cost $600,000 apiece, instead of $600. Until ten years ago, computers were too expensive to consider decentralizing control of them. But I submit that today their prices, *including software,* are approaching the low level where it is foolish to suboptimize computing costs at the expense of the costs of the people who really do the work.

The principle of decentralized computing

I believe that we have entered an era where guidance in acquiring computing power can be derived from a new Principle of Decentralization:

> "If an organizational group, *smaller than 30 people,* requires computer assistance, it is better for the total enterprise that those people have *exclusive use* of their own computer—provided that the computer, *big enough to do the job properly,* will be loaded to over 10% of its capacity."

The italicized words are vital to the application of the principle.

The group must be smaller than 30 people, a number that should decrease in the future as the costs of the computer decrease. It was chosen large enough so that the cost of a dedicated computer would be less than 5% of the total personnel costs. (Surely, adding a computer should improve the efficiency of an operating unit by 5%!) On the other hand, if the group is larger than 30, it probably will have more than one kind of work to do, and thus, the computer would begin to be used for more than one application. Dorn shows ("The Trouble With Minis," May, p. 82) that, if you *share* a decentralized mini, you immediately have a small central computing facility, with all its attendant evils, and you lose many of the advantages of decentralization. Thus, the importance of the words, "*exclusive use,*" which cannot happen unless the group is *smaller than 30 people.*

The computer must be *big enough to do the job properly.* There are many problems which simply cannot be handled by today's small computers. Nuclear reactor design, numerical prediction of global weather, maintenance of reservations a year ahead for all of the airline seats in the world, instant retrieval from massive data bases, are *BIG* problems. Such applications are only feasible *today* on a computer so expensive that it is only practical if it is shared by many groups of users. I venture no predictions as to the speed with which technological improvements will catch up with these applications. Up until recently, I believed that data bases would be the last application to become adaptable to a dedicated small computer. But a careful analysis shows that such is not always the case. For example, data bases can frequently be segmented and distributed to the place where the segment is used. "Instant" updating may be unnecessary: R. G. Canning ("Distributed Data Systems," *EDP Analyzer,* June 1976) notes that a large insurance policy file has been distributed among branch offices, each of which services a distinct small group of policy holders.

I have recently become familiar with an application involving a medium-sized bibliographic data base—the catalog cards of the Library of Congress. A system has been developed to increase the productivity of the cataloging staff of a library. Such a library uses, as its source information, the data issued in special format for each book by the Library of Congress. However, it is not appropriate to use the information in its raw form for the particular library's own catalog, which is unique because of the unique needs of the library. The cataloging staff eliminates some of the data, and adds additional data.

The system consists of a minicomputer, two floppy-discs, a crt with keyboard, and a typewriter for hardcopy output. A part of the system is a data base of all such Library of Congress data on 400 diskettes. There is a subscription service to keep the data base up to date as it is issued. The cataloger selects the proper diskette and mounts it on one drive. Using the crt and its keyboard, he reads the information, deletes from it, adds to it, puts it into exactly the form that he wants in his catalog, and writes that on a diskette on the other drive. Thus, he has two data bases at his disposal in the computer—the original catalog card and his own library's catalog. The diskettes containing his own library's catalog are data bases at his disposal in the computer at a central site to produce the printed catalogs his library needs. The entire system can be obtained for under $50,000, including all the software to make it work. On a lease basis, the monthly cost would not be greater than the salary of one cataloger. Two such systems are expected to be installed in a government library in the near future.

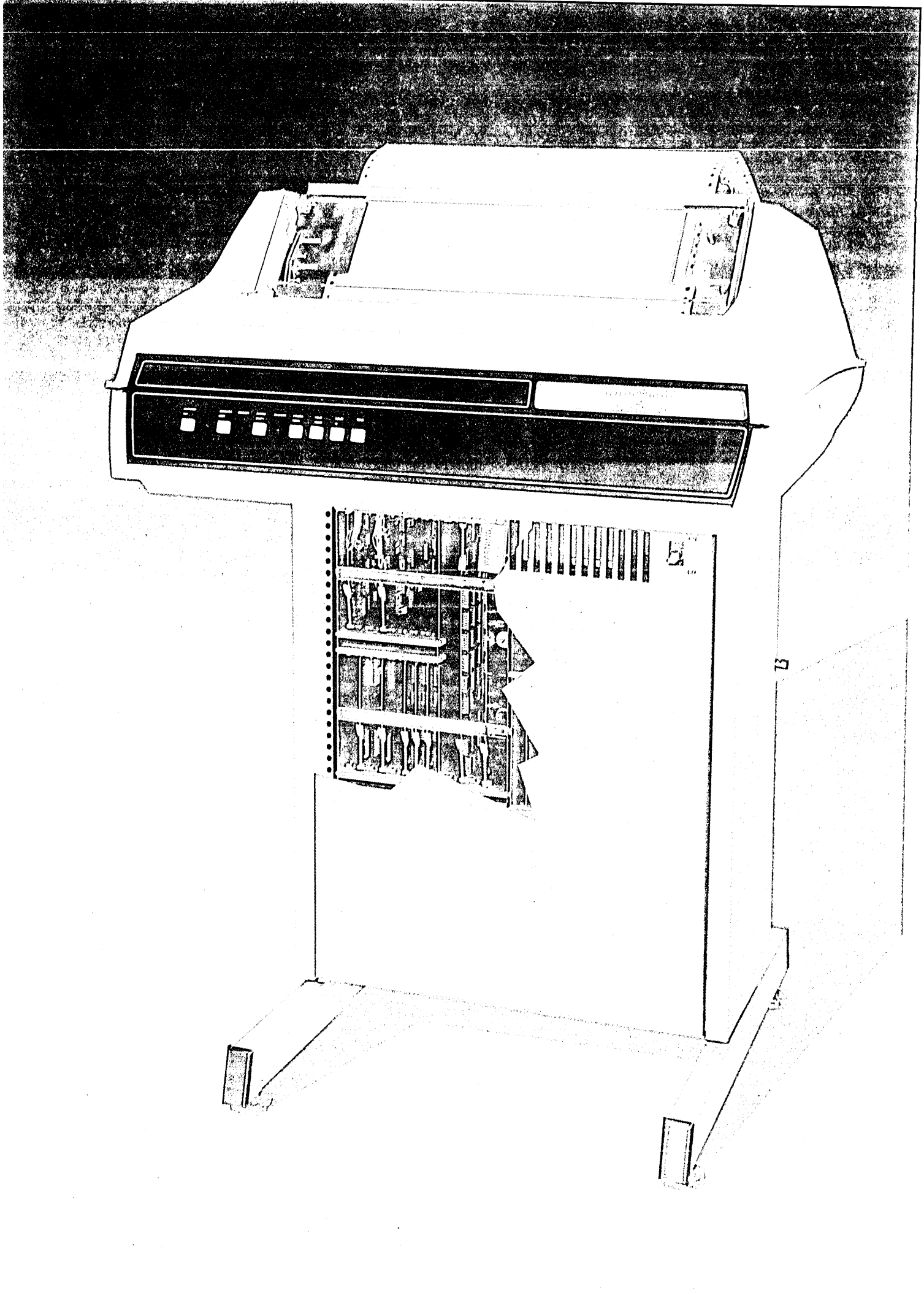
The last part of the principle of decentralization speaks to the utilization of such a dedicated computer. It conjectures that the computer should be loaded to over 10% of its capacity. Logically, of course, the loading is immaterial, as long as the productivity of the group is increased enough to pay for the computer. However, I have added this requirement, without any analytical justification for the selection of the 10% level of use, because of my belief that, if it is to be successful, the assistance of the computer to the group should not be for some trivial application, but should participate in the mainstream activity of the group.

Conclusions

It is now clear that Grosch's Law has been repealed by technological advances. *It is no longer true that the most cost effective way to do data processing is on a large central computer.* However, the current investment of large amounts of money in central data processing installations and in the organizations built to support them, and especially the vested interests of their management and of IBM's manufacturing capability, will delay for many years the inevitable growth of decentralization.

The new "Principle of Decentralization" is a useful guide to evaluating whether to use central computing or not. It is also likely that there is a big future for standard software application products, running on small dedicated computers enhanced by emulation hardware. ❁

Mr. Wagner is a senior vice president and a director of Informatics Inc. A user of computers since the late 1940s, he has been an aeronautical engineer and head of the engineering computing group at North American Rockwell. During this time he was a founder of SHARE, of which he is a past president and its only honorary member.



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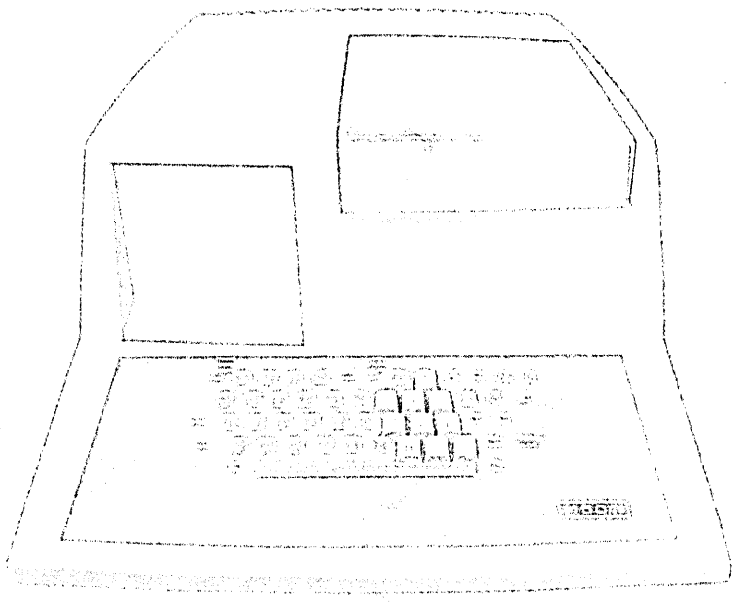

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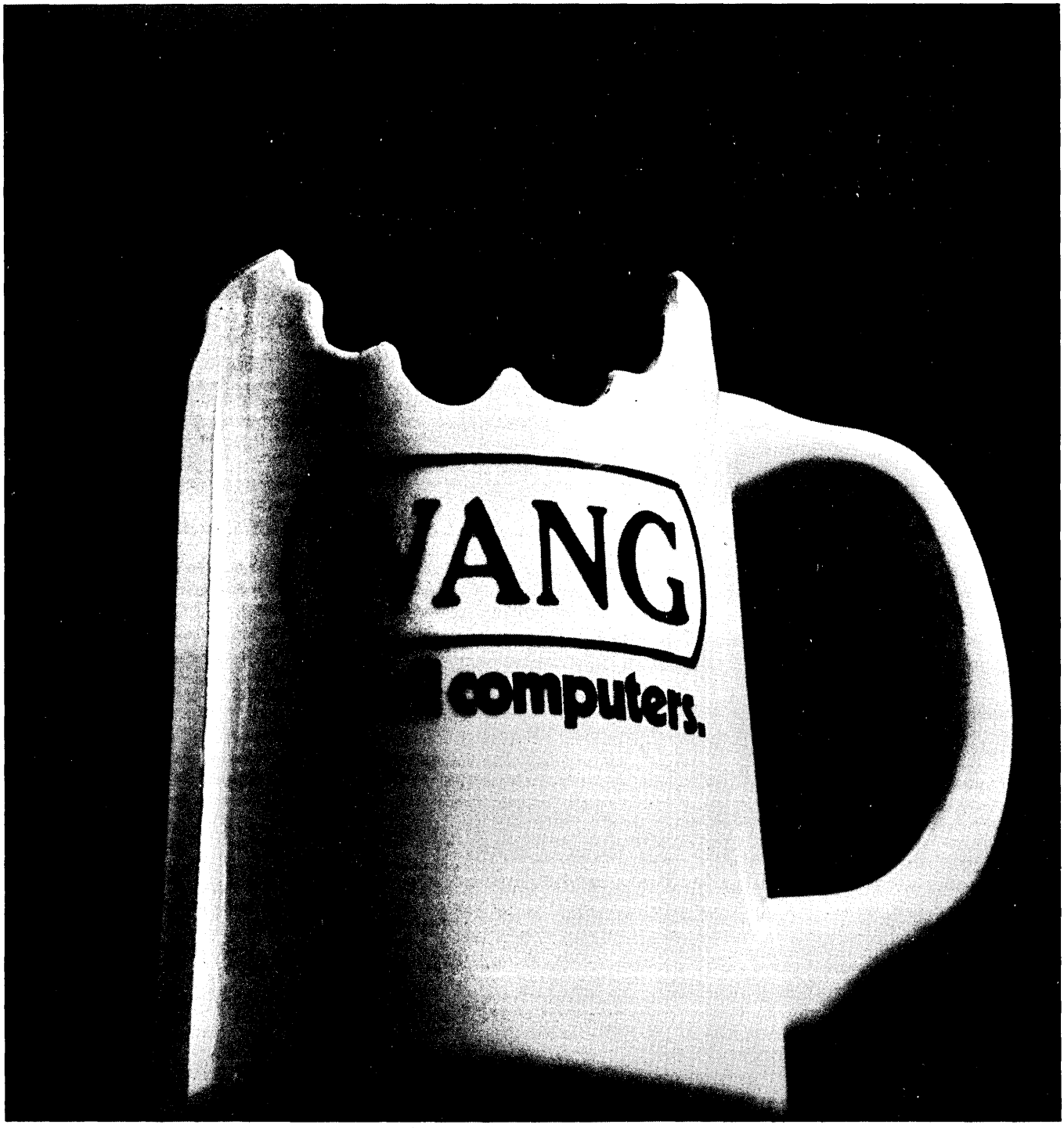

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Converting a Maxi Package to a Mini System

by Jean Francois

The application of minicomputer systems to large problems is being frustrated more by the user's reluctance to try than by any technical problem.

Many supporters of large systems are still claiming that minicomputers can be used only in special purpose applications or in a secondary position, as a link to large systems. However, from the technical point of view, based on the increasing speed and capabilities of the mini, there should not be any reasons why large applications could not be run on them.

Yet, unless it is proved that a well-known package has been converted, the supporters of large systems have a ready-made set of questions which they bring forward: what about memory space, hardware configuration and software requirements, execution time, accuracy of results, turnaround time, service, efforts? Why hasn't it already been done elsewhere?

A few of those questions are sufficient to discourage most people from undertaking the conversion of a large scale package to a small scale machine. However, we can provide a successful example of just such a conversion to dispel some of the gloom.

The Ministry of State for Canadian Urban Affairs has long made use of a series of statistical routines called SPSS. The package is rather large, taking up more than 50,000 FORTRAN statements plus some assembly language code. It was decided to convert that system from its IBM 360/370 form to operate on a dual Data General Eclipse S-200 system.

The conversion required 1½ years of elapsed time and involved two man years of work on the part of a research/specialist, a programmer, and a summer student employee.

We now know that converting such a large package to minicomputer use is worthwhile, provided that the internals of the system are well understood.

The work in converting a large package such as SPSS is not straightforward and cannot be directly compared with the conversion of a program from one machine to another when all the program fits into core. The differences are that intuition and imagination are the keys to success. In the case of SPSS, the conversion could not be one-to-one. Among other things, there are calls to assembly language sections and to macro I/O commands which are loosely documented.

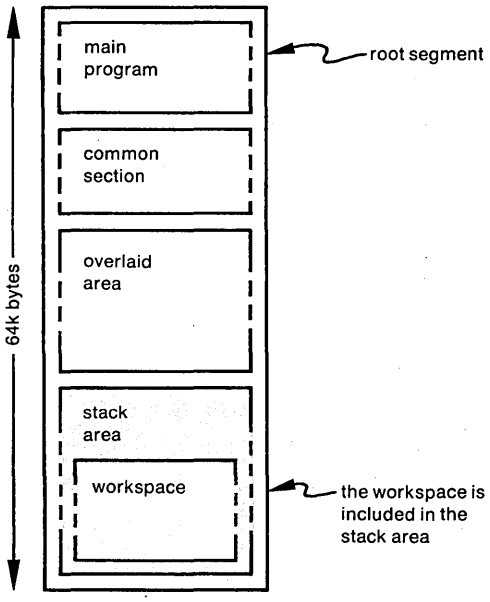


Fig. 1. The basic problem in converting to a mini is space, of course. It drives the designer to walk a tightrope between excessive disc accesses and core overflow. The above shows how a typical SPSS job was laid out.

The way that we examined the SPSS package during the conversion was to extract and retrace, bit by bit, the internal process: who calls what, when, and how often? How big are the subprograms? Should and could they be segmented? What is the data involved? What do I really need?

Some documentation was available but it was usually written to help the programmer to modify, not to recreate, the package. As a whole, the conversion has been a long research and analysis task intermixed with the programming work of converting and debugging subroutines one after another.

Progress of the conversion went at the pace of our understanding of SPSS. Unfortunately, it was not a linear function of the time nor of the efforts spent. Some large subroutines have been absorbed with practically no changes while some others took several days to handle.

In addition, due to the fragility of the operating system, frequent backup of all the files had to be made on magnetic tape, so the amount of work lost in case of failure would never be more than a day at a time.

Making it all fit

The SPSS package comprises a few subprograms for functions such as regression, scattergram, etc., which are relatively independent. In addition, to initialize and access the data files, there is another set of subprograms which we refer to as the system software of SPSS.

Since we were limited to a partition of 64K bytes, we were forced to give considerable thought to what should reside in core and what could be

dumped on disc at any time during a run. To take care of this, we carefully used swapping and overlaying techniques to minimize the root segments of each overlay structure, to give more room for the rest of the overlay tree and the work space. (See Fig. 1.)

The size of the workspace directly affects the capabilities of SPSS. However, the workspace must not increase so as to slow processing by requesting too frequent disc accesses. There was always a delicate balance to maintain.

Specifically, when designing the map of an overlay tree, and before selecting a grouping of subroutines for the same overlaid area, a close look at the frequency with which those subroutines would be loaded from disc showed if the idea was good or not.

For example, if the request to load one specific subroutine occurred each time any set of data was being processed, then the grouping was not adequate and that specific subroutine was placed in a more permanent area.

Another way to solve the problem was to segment large subroutines on the condition that either the increase of the common area or the size of the arrays were passed as arguments.

For most subprograms a combination of the above techniques has been used to bring the workspace in the range of 10,000 to 20,000 bytes without slowing down the process unacceptably.

The following is a brief list of the sizes of the workspace for a few converted subprograms:

Frequencies	12,000 bytes	(value labels are virtual)
Cross-tabulation	65,536 bytes	(16K core, 48K virtual)
Breakdown	18,000 bytes	
Regression	12,000 bytes	
T-test	20,000 bytes	
Scattergram	15,200 bytes	

The above figures do not include 10,000 bytes of virtual "Transpace" which SPSS automatically allows for all runs. Although Data General's FORTRAN V is rather slow during compilation, we chose it for the conversion of SPSS because of its speed of execution, its reliability, and its compatibility with IBM's FORTRAN. We found relatively few "bugs" in the compiler. (For example, it appeared that when some IF statements were used in conjunction with some other statements, bad object code was generated.)

We did expect some difficulties due to the fact that DG's FORTRAN had no 32-bit integers capability. So we carefully examined the source code to differentiate the values from the character strings and somehow, after equivalencing and modifying the source, it turned out to be no problem. However, many difficulties were found when we discovered that we could not access bytes within an array. This meant that each time a real or double-precision array was equivalenced with a logical array we had to manipulate all statements referring to that array.

Finally, we spent a lot of energy rediscovering the functions of special purpose I/O statements and in changing the logic of a few programs because of system I/O differences.

It works

The results obtained with the converted version of SPSS-H are as precise as those obtained on IBM 360/370 systems. This is largely due to the fact that the IBM representation of real and double-precision numbers match those of Data General.

From the job submission point of view, when referring to or creating a disc file, there is no need to add special file definition cards describing an installation. However, magnetic tape files must be transferred to or from disc with a utility program prior to or after the execution of an SPSS job.

One of the goals of the conversion was that both the original IBM version of SPSS-H and the converted one have the same capabilities. The exceptions we eventually allowed are the number of cases per subfile (which is now limited to 32,768), and the use of work space (which is variable from one subprogram to another), and transformation space (which is fixed).

Having the program converted, and providing equivalent or better service than our users were seeing at a service bureau, was not enough to move applications onto our system. One reason for that is that most files were already resident in EBCDIC at the service centers. Another was that some of the files had to be accessed by other programs as well.

Consequently, to run large applications we had to convert the raw data files from EBCDIC to ASCII, and to recreate SPSS system files in the minicenter. For some users we also modified a few subprograms to output selected data on disc files which were later processed locally. Finally, the editing and the processing of data files had to be provided in a way similar to what the users were accustomed to at service bureaus. We've done all that.

And it was worth it

SPSS is now executed on a DG Eclipse S-200 cpu with two 2314 type discs, under MRDOS as a modified batch program in a single partition environment.

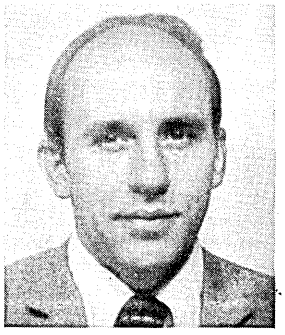
It has been found that most SPSS runs having a few hundred cases, card or disc input, require 2-4 minutes execution time. (The "execution time" refers to the occupancy time and includes all I/O and wait times.) Assuming that our local system is productive 8 hours per day, the cost of running batch jobs—including the cost of the batch system amortized over 5 years, the support, space rental, and maintenance—is $.40 a minute. Consequently, the average cost to run a batch SPSS job in-house is on the order of $1-$2.

To realistically relate the above in-house cost to an outside cost, a typical regression was submitted through remote job entry to an IBM 360/370 service bureau. The billing of the regression was $17.94. Locally it took 5 minutes to execute the same job, and our cost was $2. Therefore, even without counting the printout, it is fair to say that the savings on SPSS batch processing are approximately equal to $3 per minute or $180 per hour.

The processing of larger data files—10,000 cases or more—requiring multiple variable selections and transformations, requires 15 to 20 minutes occupancy time.

Taking into account the I/O activities—overlays and straight data I/O —the system where SPSS is running is heavily I/O bound. Consequently, by replacing the present 2314 type discs with a 3330, the above occupancy times could be reduced by at least 50%. Also, a substantial decrease in occupancy time could be obtained by optimizing the I/O activities.

Aside from the saving which is automatically realized by the execution of an SPSS job, in most cases a secondary saving must be added to account for the service bureau connect time, cpu time related to editing, and disc space which is being freed. Considering all those items, the conversion of SPSS has been a worthwhile effort. It proved that large packages can be converted to minicomputer systems and that, properly managed, the conversion can be a profitable investment. ✲



Mr. Francois is computer systems chief at the Ministry of State for Urban Affairs in Ottawa, Ontario, Canada. He has previously worked for the Ministry of Transport, for Quebec Hydro, Control Data, and at the ground station of Telecommunication by Satellite, in Pleumeur-Bodou, France.

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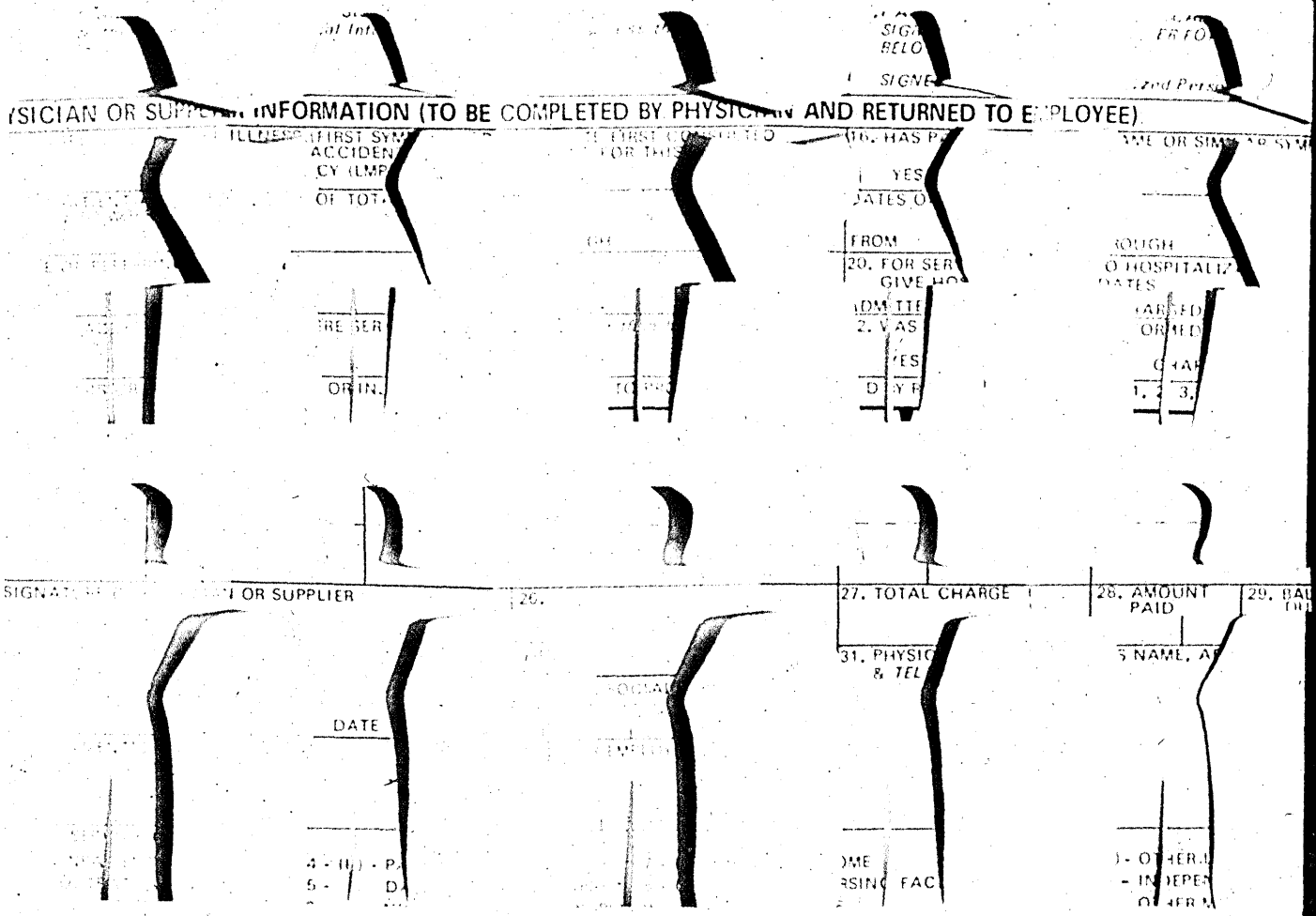

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Factory Management on a Mini

by Sam Cogar

With the right kind of accidents, what should have been a large, complex system can fall out of a lot of little, simple programs.

It is not often that a hardware designer is asked to build a quick applications program as a favor for a friend. The situation where the software so produced actually works as requested may be even more rare. Yet that is precisely how the Factory Management System developed for internal use by Cogar Corporation came to be, starting with a favor for a friend and building, almost by accident, into an integrated set of useful software.

The process by which it happened demonstrates two things: that large sets of software can sometimes be implemented one piece at a time, with each piece "paying its own way"; and that, given an application thus segmented, minicomputers can do maxi applications.

It all started one day in 1973, when a friend who worked in our documentation department asked me to help him out with a program. What he wanted was a "Parts List Entry/Update" program, and I was happy to oblige. I wrote it in binary machine language because I did not know what Assembler was, my software experience—as a hardware designer—being of a diagnostic or testing nature.

From this, my first-ever "applications" program, a mini-based factory management system evolved. Originally, it was not planned, it just happened, a compilation of many standalone segments, eventually made to fit an overall pattern.

At the time when the first program was written, all parts lists or bills of materials were manually typed. When the engineering department made changes, they were retyped, and retyped, clearly a less than satisfactory solution.

The idea proposed to improve matters was inescapable: since we were building computer equipment for use by others, why should we not use it ourselves? The first program written was straightforward and basic. Enter a line-item from the parts list through the keyboard, then record that item as entered on tape cartridge. Once all P/L items are entered, print the tape, one record per line. Whenever an engineering change occurred, it was to be introduced simply by copying the data tape from one cartridge to another. Entering changes through the keyboard, and printing the newly created cartridge. It worked. The results were significant: turnround time for documentation changes to P/Ls decreased by a staggering 99%.

The equipment used was a 4K minicomputer, a Cogar 4 (naturally), in fact, one in whose original design I had participated. It had a crt, two cartridge drives and a serial I/O connection to a line printer.

One accident after another

The Inventory program was next. Its creation, like that of the initial Parts List program, was largely accidental. Two more cartridge drives were added to the mini and a sort/merge program was written. But how to check out this combination? Simply, I volunteered, by sorting the P/L cartridges by part number. The result was a sequential part number file, and by altering the P/L program's data format control, we now had an Inventory program, operating identically to the P/L program. Thus, in the stock room the old card index file was replaced by a printed report, copies of which were simultaneously distributed to Materials, Production Control and Accounting.

Inventory files were, at this point, updated and reprinted once a week. It was an improvement, but the method used was cumbersome. All transactions logged in the stockroom were manually sorted by part number, common parts totaled, and the file updated with the new balances. As the traffic through the stockroom increased, so did the chance of human error, so the next logical step was to devise a set of transaction codes that would define the movement of material. An item put into shock became a "receiver"; taken out of stock, an "issue." Typical codes that came to be used were: RECV (from vendor), RECI (from inspection), ISSM (to manufacturing), etc.

The fourth digit of the code defined who was involved in the transaction. By changing the data format control of the Inventory program, a Daily Transaction (DTX) program was created, allowing for the elimination of the log sheet because all transactions were recorded on cartridge. This DTX cartridge was sorted by part number at the end of each day, and printouts distributed. Cartridges were batched at the end of the week to affect an inventory update.

But this still did not eliminate enough of the chance of human error in making inventory adjustments, so an "automatic" inventory update program was written which utilized four cartridge drives: deck 1, input of current inventory; deck 2, input of weekly transactions; deck 3, output of updated

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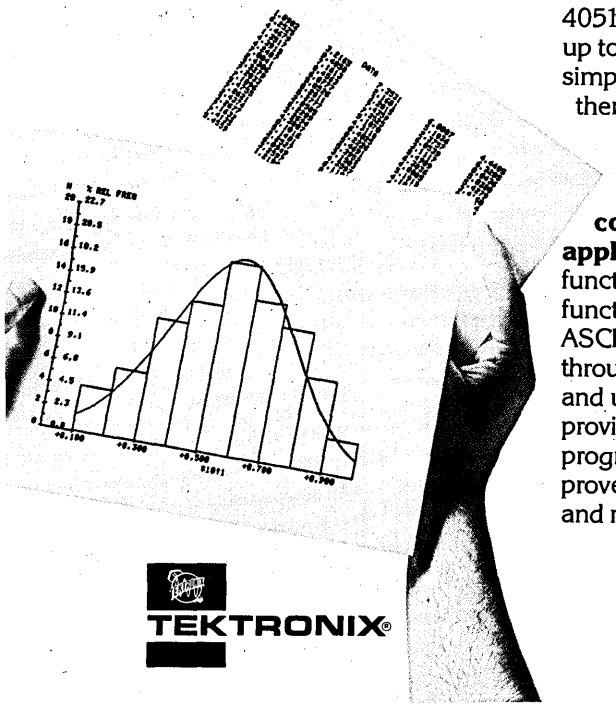

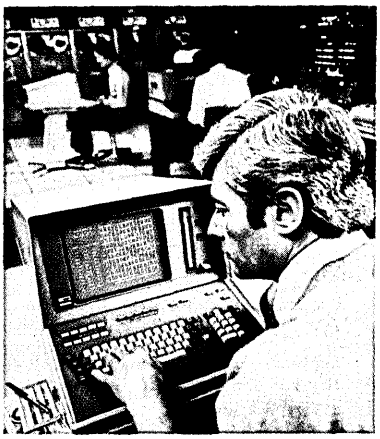

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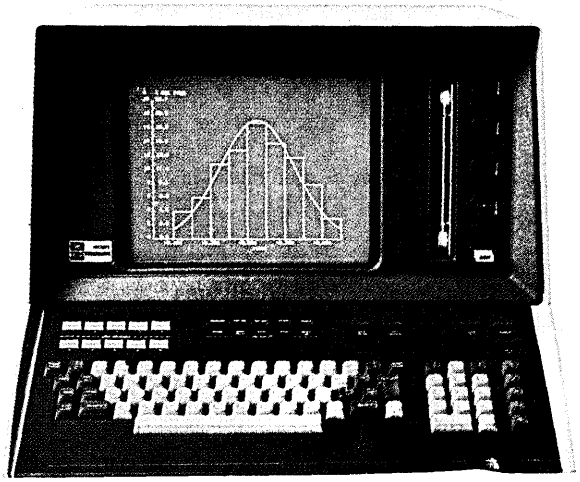

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inventory; deck 4, output of transactions with dollar extensions.

This was a major step forward. Human error dropped to less than 1% and operator time decreased from several hours to 35 minutes. Furthermore, the program was able to "flag" bad part numbers, any over-issue of parts, etc; the totals printed from the (deck 4) output tape provided the Cost Accounting department with an exact fiscal record of items that passed through the stockroom; and the weekly report showed debit/credit subtotals for each transaction code as well as an overall total. Hence correct departmental charges were now available upon release of the weekly inventory report.

Meanwhile, a parallel application was being performed by our Finance department, based on the use of virtually identical equipment: 4K mini with keyboard and crt, four cartridge drives and a printer. They were using two standard applications packages, "Payroll" and "General Ledger," and General Data Entry (GDE) (one of the system's standard housekeeping packages) for recording all accounts payable/receivable data on tape cartridges. These voucher records contained part number, quantity of items received, and the actual cost of items.

This system had proved adequate while the company relied on the Actual Cost System, (figuring actual costs of items acquired) but a switch to the Standard Cost System of accounting (using a fixed cost for each item) meant that now we had to be capable of monitoring cost variance. Fortunately, this voucher information, when matched with the standard cost of each item (located in the corresponding inventory record) was all that was required to produce a Purchase Price Variance report—the debit/credit variances being calculated by individual part number, subtotaled by commodity group, and summarized.

Doing it on purpose

By now, we had the makings of a more comphrehensive system which, with some further additions and refinements, could assume an important role in the day-to-day running of the company. Having realized this, we deliberately set out to design and implement a full fledged Factory Management System. It was a help that several people within the company have had ample experience with similar efforts made by rival manufacturers, in particular mainframers like IBM (PICS) and Univac. This experience was, nonetheless, only used in clarifying design aspects; we set out to "do our own thing."

It was determined that our presently used part numbering scheme was to remain in effect and that file integrity and inter-file relationships in our Factory Management System were to rely upon this 14-digit part number. We applied some strict ground rules to avoid confusion, ensure we needed all data we recorded, and to avoid the build-up of redundant data.

For instance, to exclude the possibility of having duplicate data files and of generating different answers to a given query, the maintenance of files was placed firmly in the hands of originating departments, with the Documentation's Engineering Information staff controlling the parts list file, etc. It was also decided that should any conflict arise about the content of a specific file, it must be resolved without delay, rather than creating suspense or dump files (which can occasionally mask duplication) to provide transient solutions.

It was also decided that the content of each file must be kept to a minimum and to data relevant to the particular file. Thus, excluding part number updates, maintenance performed on a given file should not generate changes on any others, and data from two or more files should be merged only for the purposes of a hardcopy report, or a "purgeable," temporary file of some type.

The part number being the link between files, as is almost invariably the case with similar systems, any addition, deletion or change of a part number must be reflected throughout the system. When a new number is added to the parts list, it will most likely have to be added to the inventory file. If a manufacturing assembly is involved, then the labor file must be updated. When a commodity code is changed, then all files containing this number must be changed accordingly.

When data files are maintained by different departments (using tape cartridges, this must inevitably be the case), an inter-file audit or verification must be performed every so often. This is easily accomplished by sort/merging all files by part number, when the output provides not only an audit check list but also a "where-used" report.

The entry is the update

It was decided that all file maintenance that was to be manually performed on a data base would be done so directly on said data base. This required a specifically tailored data entry program for each file type. In most cases, this only required changes of the name and the entry format. Rejection of erroneous data could be done by the program at entry time.

Using this mode of file maintenance, these programs actually become "entry update" programs. Probably one of the most important features within them is a "search to" function for operating in an update mode. The value of this is realized whenever, say, five records are to be updated within a 400-record file. Imagine changing an employee's address, rate of pay or number of dependents without being able to search by that employee's identifying number!

But, of course, a variety of other functions—such as total, range checks, extensions, percentages, etc.—can be performed on the input data by almost any mini system. The important things are that data entry programs in the mini environment must be tailored to a specific task and must have that update function. This permits audit checks to be performed on the input data that are characteristic to a given file, as well as the diverse functions mentioned earlier.

It was immediately clear that material requirements planning is the most vital part of a factory management system. The inescapable questions to be asked are always: What types of materials or parts do I need? How much (or many) of each? When are they needed? And how much will they cost? Marketing or order services staffs define what types of products are required and in what quantities, production control determines when these products are to be built, and together this results in a manufacturing schedule.

All our manufactured products are assemblies or subassemblies. All assemblies are defined by a parts list or bill of materials, which specifies what type of part and how many of each are needed for the finished assembly. Each parts list may consist of anything from one to several hundred parts, each of which may be discrete items or subassemblies.

To get to the heart of the matter, the first task is to determine gross requirements by multiplying the number of products (specified by the master manufacturing schedule) by the required number of items (as specified by the equivalent parts list). The second task is to determine the net requirement, or the number of piece parts that must be purchased and the number of items to be manufactured. Purchasing uses these counts to react on any over-ordering or lack of piece parts. Production Control must do likewise; a high positive quantity of assemblies indicates overproduction and any minuses indicate what must be produced. Lack of tight control of Raw Materials "in" or Finished Goods "out," means the difference between a profitable company and one of the other extremes.

Control of this "inventory flow" and

the corresponding "cash flow" can be expressed in simplified form by the following equations:

(TOTAL INVENTORY) — [(SCHEDULED PRODUCTS) × (PARTS LIST)] = (± NET) (—NET) × (PIECE PART COST) = (SCHEDULED CASH FLOW)

Using the above criteria, the "Material Requirements" programs were written, again for a 4K mini with four cartridge drives and a line printer.

The next phase in development of the Factory Management System was to deal with product costs, material and labor, so that a profitable selling price could be established. These production costs must be monitored at timely intervals to ensure the profitability of a product. Material cost of any given product could be calculated by using the inventory standard cost multiplied by the parts list quantity of items. The missing element was that the production labor costs were not available in a computer-usable form.

This part of the problem was solved when the manager of Manufacturing Engineering requested help in maintaining his labor reports because his manual system of updating them was beginning to bog down. Thus, a format change to the inventory program resulted in a labor entry program and the computer-usable labor data.

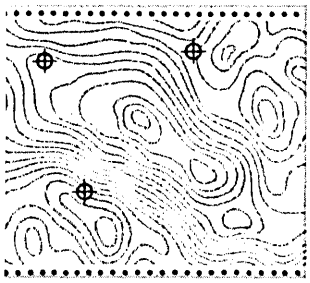
Manufacturing engineering's brief was to maintain labor reports for each assembly or subassembly, showing labor times in five distinct categories. Manually reporting material and labor costs of an individual subassembly was an easy task, but in an environment where multiple subassemblies are used to produce a variety of final products which may or may not use common subassemblies, costing the finished product becomes very complicated. For example, it is feasible that a single material change within a subassembly will necessitate a recalculation of its assembly time or labor. Whenever this occurs, all costs of products utilizing the subassembly, must be updated. This may involve as many as 15 to 20 final products.

At this point in the game, product costs could be obtained only on a "per assembly level" basis. This was somewhat less than desirable, but significantly better than using an adding machine. Exploded/imploded product costs were to come later.

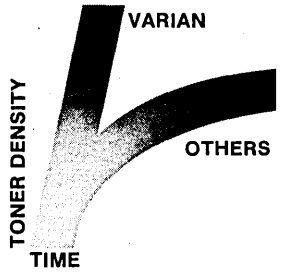
Most people would probably think that using one 4K mini with four cartridge tapes and a low speed printer scarcely adequate for operating a full-blown dp department for a firm employing 350 persons. This puny-sounding hardware base did, nonetheless, provide a very effective "poor man's"

"...but what sets Varian's printer/plotter apart from the others?"*

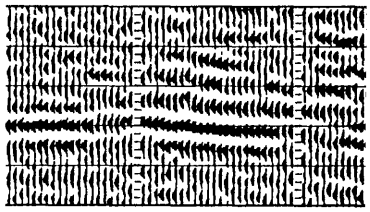
Well, first do you need controlled toning?: Do you demand high-contrast, permanent, black-on-white documents? Do you want the output to honestly represent the intent of your input? Do you want consistent, even toning *without* unwanted or confusing dots which can affect the overall accuracy of a document, and therefore its interpretation? If so, then you want Varian's printer/plotter with the patented helical rod toning system*. . . because it delivers just that: Consistent, clean, accurate and permanent documents.



And speaking of accuracy: The mechanical efficiency of a machine often has a lot to do with its accuracy. By chaining the toning system to the drive system, we created an overall smoother operation.* Then we incorporated a precise stepping motor to advance the paper by predetermined accurate steps (five times *more* accurate than the others, by the way*). And, finally, we built-in the same reliable efficiency for which Varian has been known over 29 years. So now whether your endeavor is seismic studies, meteorology, medicine, automated drafting, report generation or whatever, with our inherent accuracy you can *pin*-point virtually *any* point — throughout the length of the document.

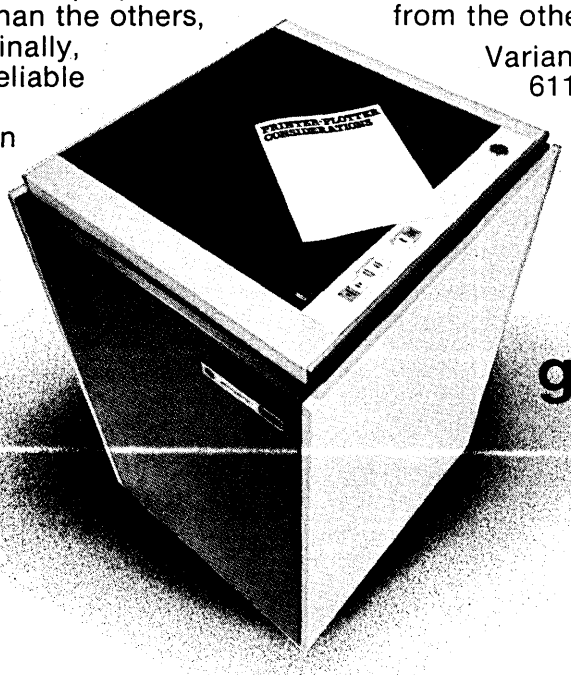


Next, the microprocessor: While serving many controlling and computing functions, this 2K X 8RAM* also serves as a buffering memory to counter the "asynchronous" actions of a CPU. This then benefits the user by further smoothing out the complete output-to-document cycle as well as dramatically reducing the "gray bars"*.



So we wrote the book: It's yours free for the asking. An updated objective analysis describing the techniques, the hardware and the software of *all* printer/plotters (plus a glossary). So, write or dial (collect if you like). We'll send the book plus information on our printer/plotter. If your need is immediate we can arrange a demonstration, right now, in your facility. Then you can *see* what sets Varian's Printer/Plotter apart from the others.

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



*Varian's exclusive features

varian graphics division

factory management system.

True enough, maintaining a stores inventory and all associated reports required approximately 20 hour of operator time per week; and the material requirement report might take anything up to 45 hours from input of schedule to the actual printing of the report. This seems excruciatingly slow, but only to someone who has never done it manually.

Detractors of minis tend to charge that the trouble with them is that more often than not they refuse to stay minis, just growing exponentially like any computer installation, until they become medium sized systems. As a hardware designer of 10 years standing, I don't generally subscribe to this theory. But nevertheless, our FMS project needed to expand. As the number and size of our tape cartridge files increased, so did their processing time. So we needed more speed and capacity for retrieving data and to be able to respond to new business trends or changes in an inflationary business environment. And, let's face it, we could afford to use more hardware; after all, we make it.

We finally were forced to convert all the programs to disc operation. The functional aspect of the programs was not changed, only the operational aspect. The tape read/write function of each program was changed to a disc file read/write, and the data files, hitherto maintained on tape cartridges, were gradually transferred.

We chose to operate in a distributed mode, as this provides more flexibility. Now all the minis—there are four 8K units in operation in our data processing department plus four in remote departments, all linked to a 16K central unit, complete with 20MB disc storage, via the serial I/O, as well as to a 700 1pm printer—can work on the same or on different jobs, with access to all of the data files currently on disc. A Database Manager Program is used for controlling all information transfers between the disc files and any operating program, regardless of whether the program is resident in the host or on a satellite.

Having a disc system at our disposal, a redesign of the system architecture was obvious. The 20MB of storage was distributed on four physical units, each having one removable and one fixed platter. Each platter is divided into 9600 sectors of 256 data bytes each. The user program determines the number of bytes for its record, either 64,128 or 256. Roughly 38,000 records of 64 bytes each can be stored on a single platter, either in sequential or indexed sequential (ISAM) mode. The number of files, their record length, and type (sequential or ISAM) that can be allocated on a single platter is limited only to the physical space of that platter. Record transfers between the disc and an operating program can be as many as 12 per second.

Redesigning for disc

With these rules to play by, the redesign was started. Most of the problems inherent in the tape cartridge system could be eliminated. Data file size and record access time problems disappeared. Nearly all data entry input to a file could be monitored prior to recording it. The number of operator keystrokes per line item could be decreased by 50%.

The first step was to create an Item Master File containing all active part numbers with associated mnemonic descriptions. The Item Master, along with the currently used Vendor, Customer, and Chart of Accounts were loaded onto disc as ISAM Files. These files are used to monitor the data input, directly or indirectly, of all other files. That is, whenever a Vendor, Customer, Account, or Part Number is to be entered or used in any of the FMS programs, that number must appear on one of these files or it is rejected by the program.

The Parts List Labor and Inventory were also loaded as ISAM files. Any new entries to these were checked against the Item Master. Duplicate entries and sequence errors, inherent in the older system, were eliminated by the data base system's control of SAM files. The time required for an operator to perform file maintenance decreased considerably.

The daily transactions of stores inventory were keyed directly to a sequential file in batch mode by date. All entries were checked against the Inventory file and rejected if in error. If accepted, the DTX program calculated the extended cost of the transition, inserted the result along with a buyer code into the record, and wrote it to the file. Output reports by batch, week, cost, or buyer could be done upon request.

The weekly update of the Inventory File was done easily and quickly, with the printing and distribution of the reports becoming the most time consuming task.

The Material and Production Requirement programs were converted. Maximum time from input of schedule to distribution of reports is now 3½ hours. Labor loading per assembly area was also calculated using production net and labor data.

Calculating product costs became easy too; all the required information was only an ISAM key away. The first step was to create a base file from the Inventory File. Product Costs were thus calculated using three ingredients: standard cost of material from the Inventory File, assembly labor cost from the Labor File, and the quantity from the Parts List File. Each Parts List was exploded, lowest indent level first, and then imploded into the next higher assembly. The results were recorded in the Product Cost File. With these actual and current costs available, a multitude of new reports could now be printed, Indented Parts List with Costs, Cost of Sales, Spare Parts Pricing, etc.

The next major step was the conversion of the accounts payable and accounts receivable vouchering to disc entry. Unlike before, erroneous data cannot be input into the system. The closing of the monthly books is now being done considerably faster. Budget information is now available in time to take corrective action, when necessary, before the next reporting period.

Keep it simple

The ultimate goal of a factory management system is not to make decisions, but to aid management in making decisions. This can be done by reporting what is happening now in a language that management can digest. This particular FMS system is bottom-line oriented. It could be adapted to any manufacturing company's use with relative ease, or could be written from scratch using more or less the same method. All that is needed is a mini with an I/O facility and cartridge drives or disc.

One thing I think is important, though, in developing a mini-based system of this kind is to keep programs relatively small and to be frugal in using memory. This, of course, is something that I, as a "logical designer," found fairly easy in the course of my three-year venture into the heady world of software. ❋

Starting in 1963 as a logic designer for Univac, Mr. Cogar went on to participate in the architecture of Mohawk Data's 1100 and 6400 series of data recorders. He was instrumental in the design of the Cogar 4 minicomputer (also known as the Singer 1500), and has spent the last several years on the software side.

INNOVATIONS FROM

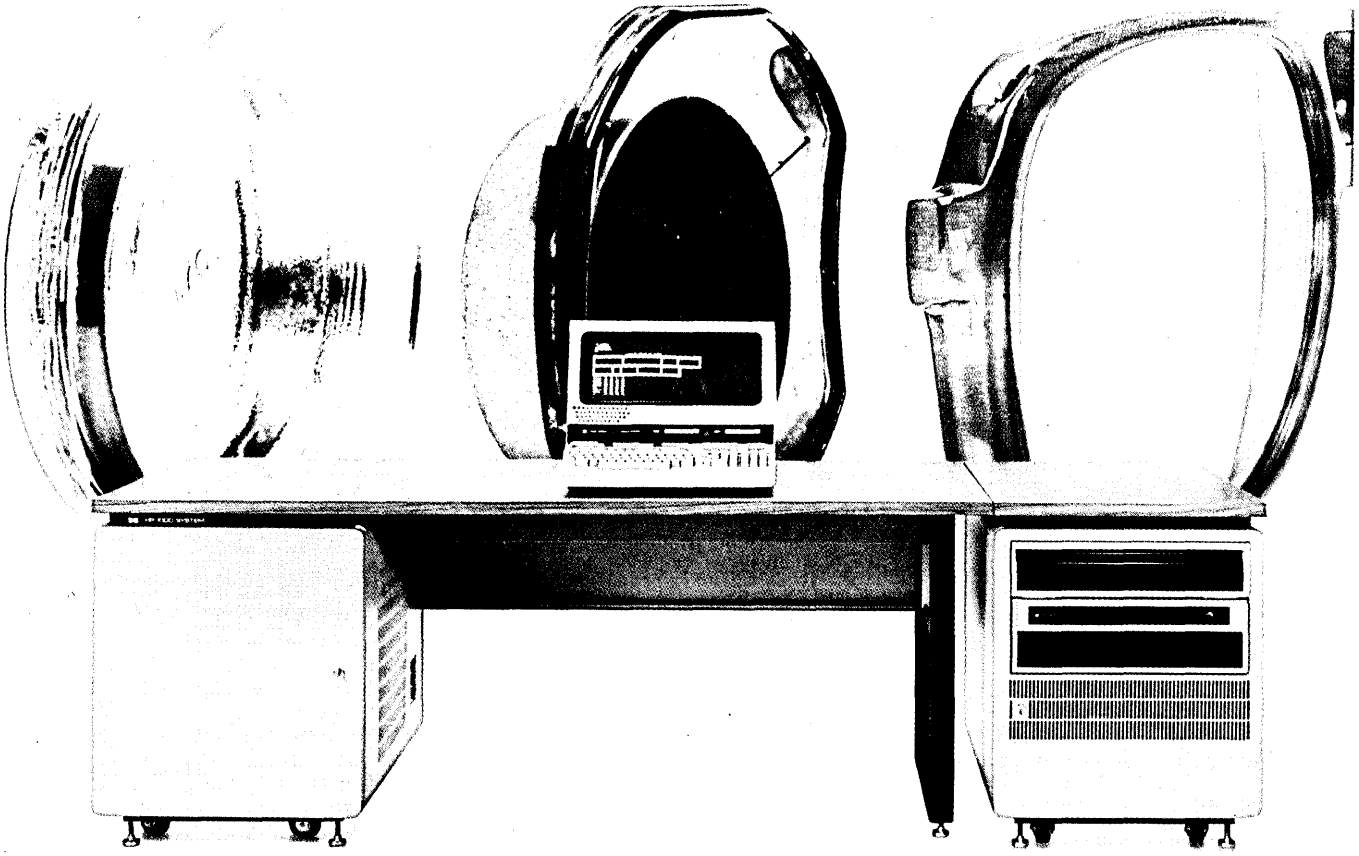
HEWLETT-PACKARD

COMPUTER ADVANCES

The introduction of the affordable computer power center, the Hewlett-Packard 1000 Computer System is one of those fortunate occasions where a number of computer advances arrive concurrently and are able to be utilized within a single new computer system. Significant contributions within the HP 1000 computer system include a fast new processor, and a fast and flexible new CRT terminal as the convenient machine/human interface to HP's new IMAGE/1000 data base management software. Plus, the system's contemporary and attractive desk styling is a welcome addition to office environments.

Beyond these new capabilities, the HP 1000 builds on previous contributions such as HP's complete computer network software, the Hewlett-Packard Interface Bus for control of automated instrument systems, HP's efficient and proven Real Time operating systems, and the fastest cartridge disc memory on the market.

The effect is an exceptionally fast and powerful small computer system that both OEM's and end users with computer experience can easily use as a tool to implement a wide range of applications. The HP 1000 is well suited to computation, instrumentation, and operations management applications that demand high performance. Because its increased performance is priced five to ten per cent below previous HP small computer systems, the HP 1000 sets a new price/performance standard in its class.



FROM PRODUCT DESIGN TO CUSTOMER DELIVERY THE HP 1000 IS YOUR PARTNER IN PRODUCTIVITY

"RIGHT NOW" ANSWERS TO "RIGHT NOW" QUESTIONS

The combination of an HP 1000 and IMAGE/1000, Hewlett-Packard's new data base management software, provides a new entry level for data base management applications. For under $65,000 Hewlett-Packard provides a complete set of tools that allows better management of manufacturing and design information. IMAGE/1000 assists in organizing a company's individual data files into a single data base so that relevant information is available to those who need it, when they need it. IMAGE/1000 utilizes a logical and easy-to-understand structure that makes the construction of a data base a straight-forward task. IMAGE automatically links together related information and reduces redundant data. Users can have multi-terminal, multi-program access to the data base for concurrent and interactive retrieval and reporting of information.

Using IMAGE/1000 doesn't require programming skills. Non-technical people can access the data base with QUERY, a "free form" inquiry language. By merely typing simple, English-like commands on a terminal, an authorized operator can retrieve, enter, modify or delete data.

With QUERY, a user can quickly find any record in the data base by a "key value", such as a name, customer account or part number. There's no need to know the address of the data, or to search sequentially through records.

QUERY is especially useful in generating impromptu reports and getting answers to one-time, "What if?" questions. For example, "What if there were a change in the styling of a product's design?" "How would material requirements and lead and delivery times be affected?" Access to an IMAGE data base can provide immediate answers to such questions. Special formatting features such as forms, titles, page and column headings, data sorting by categories, subtotals, totals and averages all contribute to readable, understandable reports.

You can receive more information on IMAGE, by circling A on the reply card.

THE VERSATILE HP 1000

A new sprint speed computer is the nucleus of each HP 1000 System. It provides the important performance necessary for multi-programming, multi-user application environments. The new processor executes most instructions 60%-100% faster and performs floating point operations 250% faster than its predecessor.

Processor growth power is built into each HP 1000 in a number of ways. First, a variety of peripheral and software options enable users to upgrade from the smallest HP 1000 model to the largest as their requirements expand. Next, fast, low cost, semi-conductor, main memory capacity of up to 608k bytes is twice that of comparable systems. And the HP 1000's new processor uses a very high performance control processor, or "computer within a computer," that enables a user to increase computational horsepower almost at will. A simple terminal oriented language and editor can be used to create and load small routines, or even entire applications or operating systems into the control processor's large address space for faster execution. One HP implementation of this concept increases FORTRAN performance from 2 to 20 times over the non-micro-coded execution. The HP 1000 is a computer that strenuously resists being obsoleted by demands for more processing speed.

Advanced interactive display. The System 1000 also takes advantage of the innovations in the fast new 9600 baud, high resolution screened HP 2645 Display Station. Pocket sized mini-cartridges can be used for convenient storage of programs close to your heart, or for real time logging of data entry transactions on the dual cartridges.

The 2645's "Soft Keys" can be programmed to automatically enter multiple keystroke sequences. With a single stroke of a user defined "Soft Key," you can load or compile a program, query a data base, or monitor the status of multiple tasks.

Multi-talented operating software. The HP 1000 System has a voracious appetite for many different applications because its power can be applied in many ways. The HP 1000 operating system orchestrates interactive program development from multiple terminals concurrently with batch processing. Multi-lingual programming—in FORTRAN, ALGOL, HP Assembly and Multi-User Real-Time BASIC—allows users to communicate with the system in the language that best suits their requirements.

Rapid access disc. The performance demands of disc active applications, such as data base management and multi-terminal applications, are met with latest track-follower disc technology and the micro-processor based control unit of the system's HP 7905 Disc. The HP 1000's disc storage capacity of up to 120m bytes allows the construction of a data base large enough to serve most small to medium-sized organizations.

Standard Instrument Connections. Thanks to the Hewlett-Packard Interface Bus (HP-IB*) the HP 1000 can be put to work in nearly any kind of automated electronic or electrical testing measurement and control application. With an HP-IB interface kit, the HP 1000 can control multiple clusters of instruments, each consisting of up to 14 HP-IB compatible instruments. More than one hundred HP-IB interfaceable measurement and test instruments are now available from Hewlett-Packard and other instrument manufacturers.

And Network Connections. If you use more than one computer within your organization, linking these "islands of automation" can give you more complete control of your operations and significantly greater flexibility in collecting and managing information.

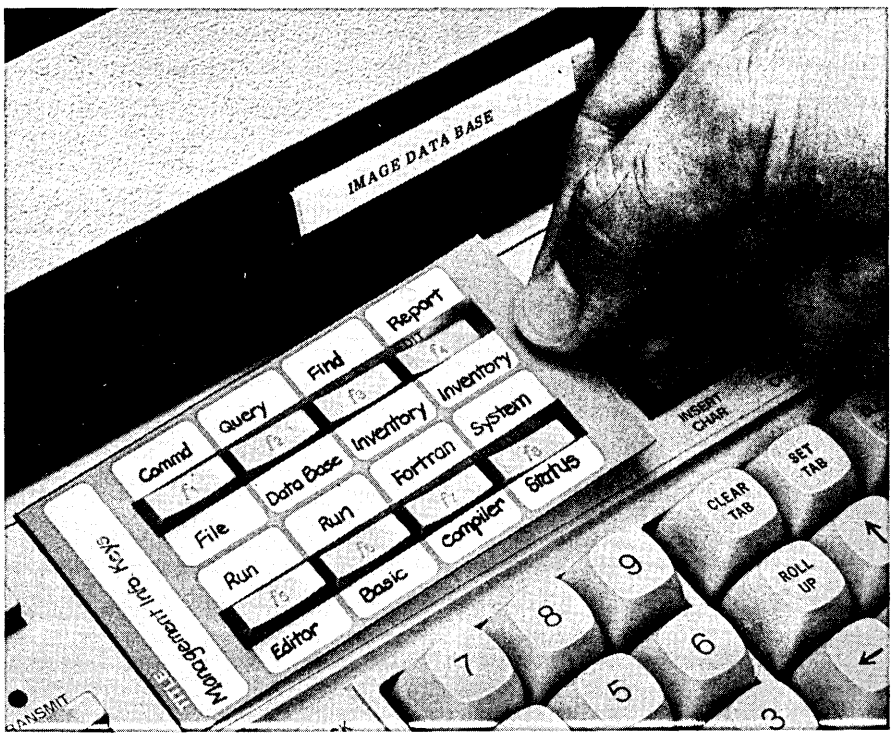
This well-balanced combination of HP 1000 computer system power, and IMAGE/1000 make dynamic, user-oriented information handling a reality at an exceptionally low cost. An HP 1000 data base management system can be dedicated to a single department or to an entire company. Or several such systems can be linked in network, allowing each local data base to be shared by users throughout the network. Prices for complete data base management systems from Hewlett-Packard start at $61,200.*

Four basic HP 1000 system models priced from $33,500** to $62,200** make the HP 1000 the lowest cost member of the Hewlett-Packard family of major computer systems. HP 1000, an ideal starter system for experienced OEM's and end users, is followed by the HP 2000 Timesharing and the powerful multi-programming, multi-lingual HP 3000 Series II.

If you would like more information on how the affordable HP 1000 can be dedicated to a demanding application or distributed throughout an entire network to perform where the work is, circle B on the reply card.

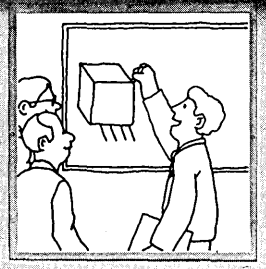
*The Hewlett-Packard Interface Bus. (HP-IB) is HP's implementation of IEEE Standard 488 and identical ANSI Standard MC1.1, "Digital Interface for Programmable Instrumentation".

**Domestic prices FOB California



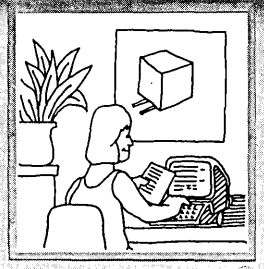
The 2645's "Soft Keys" can be programmed to automatically enter multiple keystroke sequences. Circle C for more information on the HP 2645.

THE HP 1000 IN MANUFACTURING: HELP IMPROVE PRODUCTS,

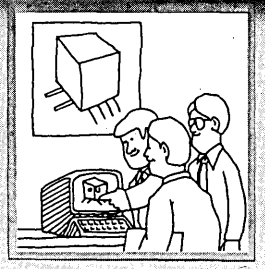


Unique HP 1000 Computer Systems can help turn design concepts into profitable products. Powerful yet affordable, HP 1000's can automate phases of the manufacturing cycle, shorten development schedules, optimize product design, increase productivity, and control manufacturing operations.

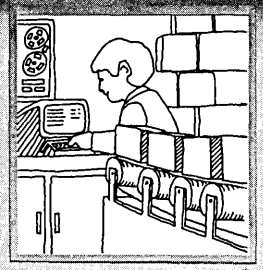
Optimize Product Design. For quick solutions to complex design problems, HP 1000 Systems include a new CPU 60% to100% faster than its predecessors. It easily handles "computation heavy" tasks such as array manipulation, numerical integration and differentiation. Programming choices are FORTRAN, BASIC & ASSEMBLY.



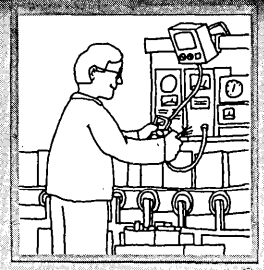
Perform Simulations. Raw speed also makes HP 1000 Systems ideal for other computational tasks such as design simulation, modeling and life testing. Special purpose or frequently used routines can be microprogrammed for even faster execution—at cycle times as short as 175 nanoseconds.



Computer-Aid Designs (CAD). With large main memory to 608 k bytes and fast disc swaps (average time:100 milliseconds), the HP 1000 can handle the extremely long programs often found in CAD applications such as three-dimensional projections of mechanical parts and automated drafting systems.



Automate Materials Handling. Easy interface with sensors, transducers and electrical contacts makes the HP 1000 a logical choice for control of automated material handling equipment. Multiple terminals can be placed at strategic locations—receiving, incoming inspection, stockroom—to guide flow of material.



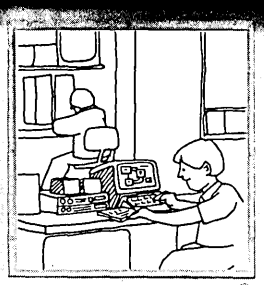
Automate QC Test Stations. Automating QC test stations is a simple procedure with HP 1000 Systems. Multiple clusters of up to 14 HP-IB instruments can be assembled for concurrent testing of component, subassembly, or finished-products. New test stations can be added concurrently with other system activities and test operations.

Collect Factory Data. Each HP 1000 can support up to 56 low-cost data collection terminals. Dispersed terminals can collect up-to-date information about production status, material location, labor costs and machine utilization for a manufacturing data base maintained by IMAGE.

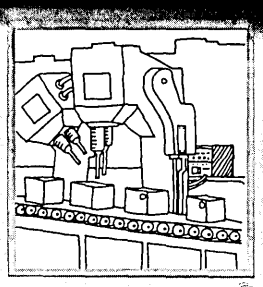
*The Hewlett-Packard interface bus (HP-IB) is HP's implementation of IEEE Standard 488-1975. "Digital interface for programmable instrumentation."

A MULTI-TALENTED TOOL THAT CAN PRODUCTIVITY & PROFITS.

Computerize Bill-of-Materials. Using an HP 1000 to build and modify bills-of-material makes it easy to compute material costs, respond to change orders and produce accurate kit-pull instructions. With IMAGE/1000, engineers can quickly locate part numbers for a particular component and determine which stocked parts meet design requirements.

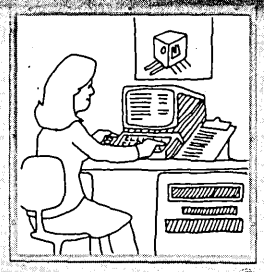


Automate Prototype Testing. Full, automatic testing of design prototypes can spot design flaws before they become production fiascos. An HP 1000 with HP-IB* Interface Kits let engineers set up specialized test stations quickly. Programming test procedures are simple BASIC "PRINT" or FORTRAN "WRITE" statements.

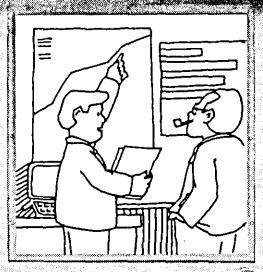


Computer-Aid Manufacturing (CAM). HP's broad line of analog and digital subsystems gives HP 1000 users tools needed for control of production processes. RTE operating software's priority scheduled program execution, performs critical tasks immediately. Networking capability lets each HP 1000 direct satellite measurement/control computer systems.

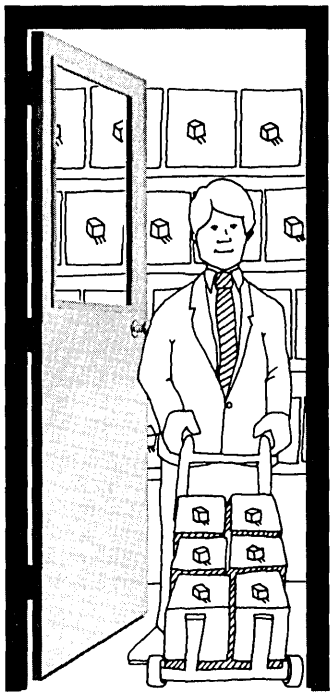
Plan Material Requirements. IMAGE/1000 also provides the power for a full material requirement planning system. Once bills-of-material and inventory level have been stored in a data base, the HP 1000 can compute net material requirements from a production schedule, interactively from an HP 2645 or in batch mode.



Process Customer Orders. An HP 1000 with IMAGE/1000 provides a common integrated database, making current information available to all departments for control of customer orders. Using QUERY, an English-like inquiry language, clerks can quickly locate open orders, input changes or add new information.



Generate Management Reports. QUERY also makes it easy to generate special management reports on customer order or production status. No special programming skills are needed to extract information from an interrelated IMAGE data base.

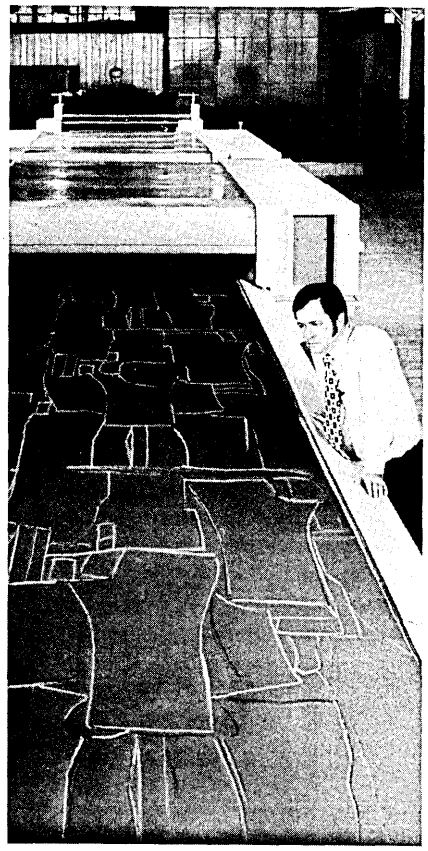


To find out more about how HP 1000 Computer Systems can improve products, productivity and profits, circle B on the attached reply card.

"A MINI IS NOT JUST A SMALL BIG COMPUTER"

Hughes Aircraft Company's Industrial Products Division, Carlsbad, California, realizes, as production control expert George W. Plossl wrote, "manufacturing control is the last frontier for profits." Large dollar savings can result from small improvements in manufacturing control. For that reason Industrial Products Division installed a Hewlett-Packard 21MX minicomputer with IMAGE Data Base Management software to handle manufacturing information control.

Jack McNamee, data processing manager for the Division, says, "we confined our search for computerized control to on-line, interactive systems that are user oriented, and that require a minimal data processing staff and no programmers. To ensure that the information was timely and immediately available, we want CRT display terminals strategically placed throughout the plant. We wanted as few printed reports as possible.



Manufacturers of a broad line of automated Lasercutters designed for the apparel industry, Hughes Aircraft Co. saves time and cost since installing a Hewlett-Packard minicomputer and ASK manufacturing software.

"We researched carefully," McNamee says, "and found that the Hewlett-Packard 21MX minicomputer offered the advantages of low cost, short delivery time, reliability, prompt service and easy upgrading."

In the search for a company to provide the needed software, McNamee found ASK Computer Services, Inc., in Los Altos, California. ASK specializes in computerized manufacturing management systems and their MANMAN (MANufacturing MANagement) software runs on the HP 21MX with IMAGE. MANMAN is an on-line, interactive, multi-user program providing inventory control, bill of materials processing, purchasing and receiving, work in process, and material requirements planning.

According to Sandra Kurtzig, president of ASK, "The 21MX and IMAGE represent the latest technology in data base management at a price that allows a company to dedicate a computer resource to a specific application. Not many people are aware just how powerful a minicomputer is. The 21MX, with 64K to 608K bytes of memory, disc storage, and speed, is ideally suited for manufacturing management applications. A mini is not just a small 'big' computer, but a unique tool all by itself."

As the Hughes division put the MANMAN system on the line, McNamee found that it disciplined the manufacturing environment. The software system has built-in edits to automatically check for errors and to assist in maintaining data integrity. For example, these edits eliminate duplicate entries into the data base and immediately reject transactions against invalid parts, assemblies, purchase orders, etc. As a result, accurate entries must be made.

The system's user orientation simplifies data entry. For instance, when parts are withdrawn from stock for work orders, a clerk need only enter the work order number. The computer will automatically make the necessary on-hand inventory adjustments for all parts on the current bill of materials for that work order. The IMAGE/QUERY system can pull information not ordinarily compiled. For example, finding all vendors of a particular part or all customers for a piece of equipment.

When the system was first installed, the plan was to fully implement MANMAN for each of the Division's five product lines one at a time. The first task was to provide complete inventory control for the production equipment line. Because of the immediate visibility into the inventory of that line, and the resulting financial control, management requested that inventory for all product lines be computerized before implementing the additional system functions. Currently, the entire MANMAN software package is in use.

The savings so far in manpower alone have been substantial. Prior to computerization, it took three full-time people to enter stock room transactions. Because of paper work back logs, it sometimes took up to three weeks for transactions to be posted. With MANMAN on the HP 21MX, it now takes only one person two to three hours a day to enter stock transactions and inventory is always current. The computerized system has eliminated redundant record keeping, reduced stock record keeping time by 90 percent, and maintained a cyclic inventory based on usage dollars throughout the year (eliminating overtime for inventories). The accounting department, which used to receive bundles of transaction slips for balancing and entry into the general ledger, now receives a complete and balanced register at the end of each day.

Says McNamee. "We certainly have a more disciplined production system now, and tremendously more accurate records. I know that we have a better handle on expense control and we expect improvement in customer order delivery. The computer handles the manual tasks and frees our people to concentrate on their other responsibilities."

McNamee is pleased with both IMAGE on the 21MX and MANMAN. "ASK has integrated the latest in functional technology with the latest in systems technology. The combination of Hewlett-Packard and ASK software gave us immediate implementation and operational leverage without a long development cycle. We can concentrate on manufacturing, our specialty, rather than on computers and programming."

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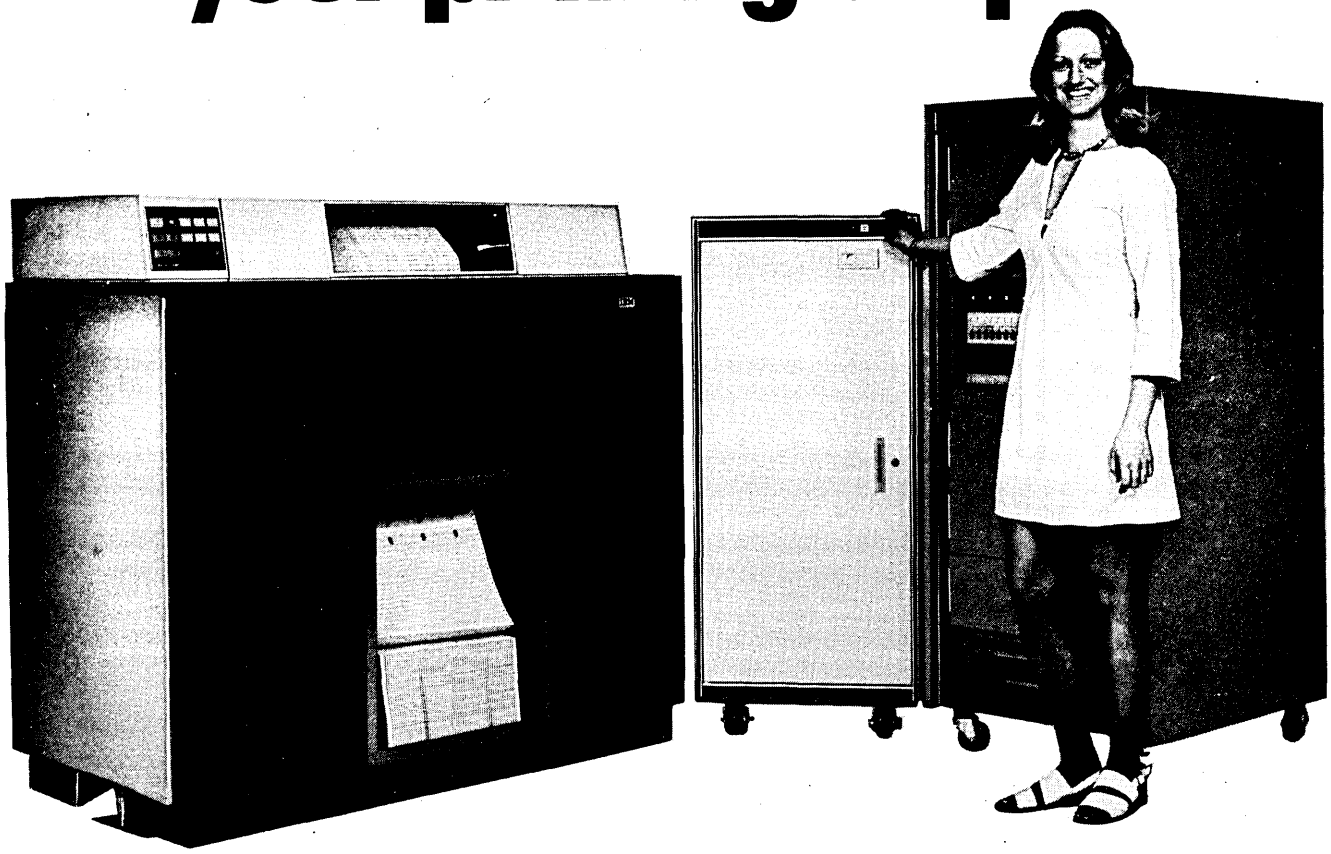

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CONTROL DATA CORPORATION

BOOK SUPPLEMENT

1976 has been a vintage year for books on data processing. Some of the best of the crop have been gathered for this special feature in the belief that good books, unlike some fine wines, should be enjoyed immediately after harvesting.

New Standard for Programming

Software Tools
by Brian W. Kernighan and P. J. Plauger
Addison-Wesley, 1976
338 pp. $8.95

With their second book, Kernighan and Plauger have established themselves among the leading teachers-in-print of how to write good programs. The first volume, *The Elements of Programming Style* (McGraw-Hill, 1974), presented the rules of programming by example. It was a high risk undertaking because the authors used a number of previously published (and presumably correct) programs by well-known people and proceeded to show how they could be improved. They not only succeeded without apparent error but they drew useful guidelines from each example.

The current volume continues the pattern—also with high risk. This time the authors teach programming by actually building programs that the reader will find useful. Again they do it without errors and even offer to provide machine-readable copies of their examples through the publisher, Addison-Wesley. One must admire them for their thoroughness, meticulous proofreading, and just plain guts.

On the more important plane of reader value, Kernighan and Plauger must also be praised. They have accomplished something that has been needed for a long time. They actually explain *how* to write programs. A student can learn to write programs that work from this book.

That kind of capability has never been conveyed by the usual books or courses about programming. We are used to learning how to write FORTRAN, COBOL, or PL/1 statements. Somehow we are expected to have the inherent ability to arrange the statements so as to solve problems. It is not taught. In a similar vein, we are taught algorithms that solve certain problems, but, for efficiency's sake or perhaps for the sheer elegance of it, the algorithms are presented in mathematical notations. If they are reduced to programs, there is seldom any effort to give input, output, or error-handling routines.

As a result, the typical student programmer has to figure out for himself what the task of programming is all about. Smart, talented programmers learn through experience. Many programmers never learn; throughout their careers they remain careful, competent coders who never quite "create" a program. Kernighan and Plauger are members of a very small segment of the smart, talented group who not only understand programming but also take the time and have the ability to teach what they know to others.

They have accomplished something that has been needed for a long time. They actually explain how to write programs.

Under the circumstances, *Software Tools* is a little misleading as the title of this volume. It is certainly about tools but, to my mind, that is secondary. The lessons contained in the text about "good programming" are the real meat of the book. The lessons are drawn from the development of a set of tools that the authors build from scratch. At each step, they make use of previous results, gradually creating a set of text-manipulating tools suitable for processing the text of the book itself. They wisely choose examples suitable for interactive use because such tools have to be tailored for an individual; thus, the reader can try out each example without making a project out of it. The examples and exercises are purposely short and simple to make them practical for classroom use.

As a consequence, there are no tools of the type used by large companies or government agencies which take hundreds of people-years to build.

Assuming the reader has some high level programming experience, the text uses a structured language, RATFOR, based on FORTRAN. This permits all the examples to exhibit the elements of programming style promoted by the authors and the other leaders of structured programming technology. However, the reader is not hit over the head with technology. The principles are there in plain language and easy-to-read programs. The authors show how to do the fundamental operations of searching, sorting, and arithmetic (the latter pretty much limited to counting and comparing). They apply these operations to a simple character stream and build up processes that handle words, lines, sentences, files. By the time they are done, they have defined a simple but sophisticated text-editing application program. The reader will understand the text-editing program and will, as well, understand a great deal about top-down design and implementation, structured programming, defensive coding, efficient program testing, and other good programming techniques.

Software Tools is a very good book destined to be a standard in software engineering education.

—Joel D. Aron

With more than 20 years with IBM, Mr. Aron is now senior advisor to the director of systems engineering for IBM Europe in Paris. He is an editor of Addison-Wesley's Systems Programming Series which is about to publish Part II of his book, "The Program Development Process."

For Managers to Novices

Handbook of Data Processing Administration, Operations, and Procedures
by S. R. Mixon
Amacom, 135 W. 50th St., New York, N. Y. 10020 (1976)
395 pp. $24.95

First, in my opinion, this is not a handbook of data processing administration, operations, and procedures. Its scope just does not cover the subjects and material implied by the title. The book *is* a reasonable handling of the subject matter of computer applications development, standards, and doc-

umentation. With that out of the way, we can proceed to examine the contents of the book.

Mr. Mixon takes us through a detailed (sometimes too detailed) step-by-step process of how to design, control, write, and document a computer based system. At times he presents outstanding concepts, makes brilliant observations, and presents data useful to the novice and expert alike. At other times, he seems to be mired in the details of precise reporting formats, form design, headings, exact "how-to's" of status reporting, and more. I would suggest careful reading and study of some sections and the complete skipping of others. Of course, some readers might be interested in knowing exactly what format programmers should use to report hours expended on a project, how it should be key-punched, and how it should be formatted on a report (but not many).

The author examines project management principles, their application to computer projects, and the techniques of utilizing those concepts. I find this area of the book outstanding. The involvement of users is emphasized, terms are exceedingly well defined, and useful techniques are well described. Anyone associated with project management can benefit by the materials presented. This section alone may make the book an asset well worth its price.

Next, the author moves into system design, including the system study, design of input forms and output reports, data element dictionaries, controls, data base design, programming, and testing. Again terms are well defined, although the material seems to lack some of the brilliance of the prior section. There are a number of areas in this portion that are interesting and usable as reference material, such as check-digit computation, a description of the processing capability of various I/O devices, an evaluation of file organization techniques, and a reasonably good test procedure check list.

> The project management principles section alone may make the book an asset well worth its price.

Mr. Mixon then approaches documentation and recommends standards in this area. There are good concepts presented, descriptions of automated documentation packages, and presentations of user, program, and operations documentation. There is a considerable amount of detail that is of interest only to those who don't currently have any idea of what system documentation is all about.

The remainder of the book is a group of appendix-like chapters on flow-charting (including definitions of each symbol), documentation forms, a few standards for ANS COBOL, and a sample of a COBOL program. There is a reference value to some of this material (if you don't have a flowchart template with descriptive cover), but most of it appears to be used to fill the book to reasonable size.

I believe portions of the book would be interesting to executives and management associated with computer applications, of reference value to practicing systems designers and programmers, and invaluable to novices and those desiring to establish an adequate documentation and control system. Although the book comes across as "one man's opinion," it is worth reading (and keeping) for those who have an interest in the areas addressed.

—Eugene Greenroyd

Mr. Greenroyd is director of operating systems and technology at Rockwell International Information Systems Center. He is responsible for the technical hardware and software direction for the Rockwell International Corp.

From Access Methods to Konrad Zuse

Encyclopedia of Computer Science

Anthony Ralston & C. L. Meek, eds.
Petrocelli/Charter, New York, 1976
1,523 pp. $60

It is enough to make some of the older pundits feel old when we realize that this bicentennial year marks the publication of a full-blown encyclopedia of computer science. Purists may query whether computing is actually a science, and, being a traditionalist myself, I have always rather liked the spelling "encyclopaedia," but, nonetheless, the book is among us.

And an impressive book it is. Surely the publishers of anything so prestige-laden must have been immersed in heavy decisions about the number of volumes in which to couch it. It has appeared in one. This massive volume, looking excellent on the bookshelf, is, however, most uncomfortable to read in bed.

The editors, Anthony Ralston of the State Univ. of New York at Buffalo, and Chester L. Meek of Andco, Inc., have been assisted by a heavyweight editorial board made up of academicians with the single exception of Eric A. Weiss of the Sun Oil Co. The contributors are legion. From Ackley to Zobrist, from Memphis to St. Jo, from Tinker to Evers to Chance, their names fill a full two-and-a-half pages in the front of the book. And these various contributors are recognized by having their full names inserted at the end of each article personally generated. This is in contrast to the practice of older, stuffier such references in which the authors are brushed off with initials only, in 2-point type.

In his Editor's forward, Mr. Ralston defines the purpose of an encyclopedia as that of a reference work for the layman or nonspecialist. This purpose he interprets as citing the need for coverage in breadth as opposed to comprehensiveness in depth. Such a goal is a reasonable one. This book exceeds it in places, offering considerable depth as well as breadth in some topics.

> . . . an excellent first buy, even if the aspirant must borrow the money to buy it.

As one who approaches the status of an ancient in matters computered, I blush to admit that I learned a number of things from the book, and refreshed the lore store of others, conveniently forgotten. As an encyclopedia should be, this book is comprehensive. It meets the goal of its editors.

Back in the dim past of 1961, I had the honor, with Walter F. Bauer and Daniel L. Gerlough, to write an article in the January issue of the *IRE Proceedings* (from the Inst. of Radio Engineers). That article was entitled "Advanced Computer Applications." Virtually every one of the then "far out" applications we touched upon is included in this encyclopedia among the things routinely done.

Particularly impressive in this new work is the rather nice balance struck between the theoretically esoteric and the soiled-hand pragmatic. There is ample content of each. The reader who "solves" the problem by stating the model, and the one who finds the only value in checked-out output, should both be happy with this book.

In a note following the Preface, Mr. Ralston asks his readers to indicate how future editions might be improved by addition of subjects, etc. While the book is well-printed and designed, we do not find typesetting under computer control included as a specific article. Yet it forms the basis of a considerable industry today.

According to some seers, word processing systems are among the big deals

of the future. Yet there is no article on word processors in the encyclopedia. Their attributes can be sorted out, in part, from other articles such as the one on text editing.

Of information on programming there is ample supply. In fact, for the novice intending to carve out a shining career in programming, this book is an excellent buy, even if the aspirant must borrow the money to buy it. The section (unsigned) on programming linguistics is beautiful reading. Authors such as Dolotta, Halpern, Zionts, Flynn, Holt, Mittman, Pollack, Sterling, and Sammet lead us through the various articles on programming with brevity, skill, and lucidity.

> . . . rather nice balance struck between the theoretically esoteric and the soiled-hand pragmatic. There is ample content of each.

Nor is hardware neglected. Ample pictures and diagrams give us the view of innards and outtards of modern-day peripherals. We are told almost more than we really wanted to know about memory. Analog and hybrid machines are covered, but their still-born little brother, the DDA (Digital Differential Analyzer), gets only two paragraphs. The logic designer will find his art summarized and defined in a number of articles. Its modern translation into standing reality is well described in the article on computer circuitry by Yau and Ho.

It is not too surprising that computer science has done its bit (no pun) to enhance the vocabulary of our language. Fred Gruenberger, a noted senior and observant citizen, seems to have taken charge of the vocabulary-building parts of the book. I find it a great honor that he gives me credit for coining the term "Kludge" (spelled variously in sundry dialects). But kludges were around well before 1962, and were, I believe, well known to hardware masochists of the time. Further, I would argue with Gruenberger's definition of "Glitch," which he describes as a small error of any kind, equivalent to a bug. No more exact is Martin's definition in his monumental compilation of human foibles, which is, "An inherent, built-in, organic fallibility in a design or a plan or an equipment or in any human contrivance" (Thomas L. Martin, Jr., *Malice in Blunderland,* McGraw-Hill, 1973, p. 3). For the precise-minded, neither definition will do. Many of us have organic fallibilities. A "Glitch," precisely speaking, is a momentary, unexplained, disruptive step function, rather akin to the breaking of wind at high mass.

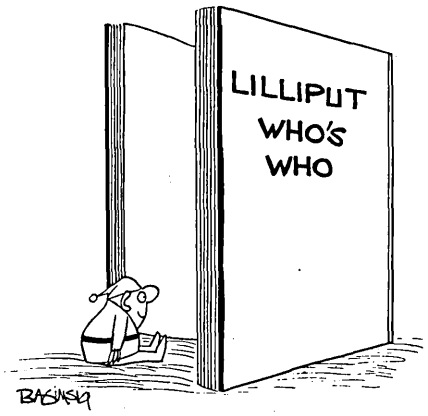
To one who considers computer science to be "a young" field, it is a trifle disquieting to find biographies in this work. Further, some of the biographees are actually dead. While wishing peaceful rest to the souls of our departed brethren, we may be forgiven for locking the bathroom door to inspect the grey hairs or the bald spot. Those biographed in this book are all people of giant stature, and surely worthy of such commemoration. One may hope, though, that some day in a more perfect world there will be enhanced criteria as to whom is to be remembered for what. One searches in vain, for example, for the biography of J. B. Rea.

Application articles abound in this encyclopedia, and it ought to serve as an excellent reference for anyone beginning a search of the literature in any such particular endeavor. The major fields covered include business, engineering, education (in computers), medicine, and many subfields and specialties among these. Oddly enough, there is no specific article on computers in banking, though MICR devices are covered under descriptions of peripherals.

Later editions will, hopefully, eliminate some of the minor muddles found in this first effort. For instance, the diagrams of the flip-flop and the BCD-complementing gate array are interchanged (figures 2 and 3 on page 811), giving the serious student of logic design some pause for confused thought. On page 812, the legend R = 1 is missing from the diagram of the third state of the flip-flop, but probably we may trust that some useful signal may come from this input, and so on in other places the critic may gleefully find.

But in spite of such burbles on the placid surface of encyclopedic tranquility, the effort is needed and useful, and well-executed. This book fulfills a need for just such a book as it is.

Like most encyclopediae, it changes



the subject rather frequently. Some sections provide a useful cure for insomnia. But these are general failings of any such compilation or multi-authored reference.

It is to be hoped that this work will be with us for some time in ever-improved versions. It is a worthy effort, well done, and to be commended.

—Jackson W. Granholm

"An ancient in matters computered," Mr. Granholm's dp experience goes back to programming on the IBM 602A and 605. He has consulted for various electronics firms, and is a Datamation contributor of long standing.

Let's Hear It For Structured COBOL

A Simplified Guide to Structured COBOL Programming

by Daniel D. McCracken
Wiley & Sons, 1976
358 pp. $9.95

Learning to Program in Structured COBOL

Edward Yourdon, Chris Gane, & Trish Sarson
Yourdon Inc., 1133 Ave. of the Americas, New York, N.Y. 10036 (1976)
252 pp. $16.50

In a recent DATAMATION Forum ("Let's Hear it For COBOL," May p. 240), Dan McCracken said, "COBOL is a lot better for structured programming than some folks seem to think." These two books go a long way toward proving this point. Together they contain 577 pages of text and numerous complete sample programs. They represent the first of what will undoubtedly be a flood of books offering to teach the beginner structured program design and COBOL simultaneously.

Dan McCracken has been writing programming language texts for a long time. All have been excellent and this one is no exception. In this book, his objectives are to teach the COBOL language, the writing of COBOL programs, and program design techniques. He succeeds admirably on the first two counts, but not as well on the last.

Each chapter is built around a sample program containing just the right number of features to fuel the discussion. Each is "structured"; the GO TO statement is not discussed until page

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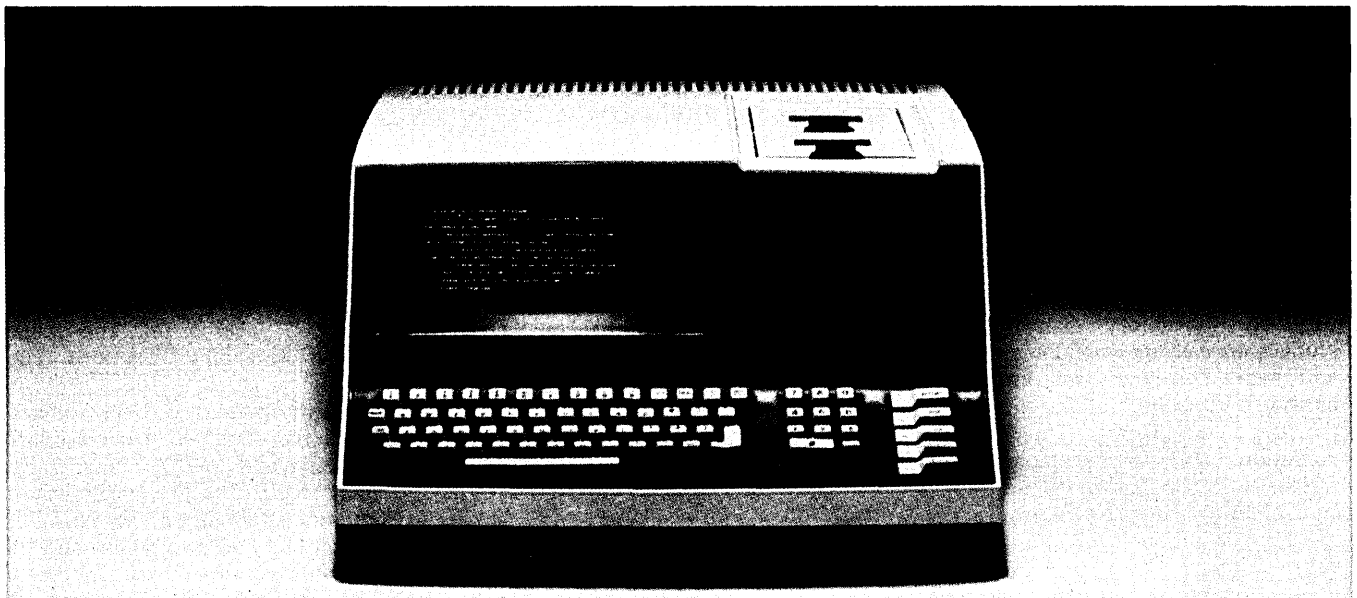

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268, and only appears once in a sample program.

The book is full of good advice on language usage, potential pitfalls, and design considerations. McCracken is a careful and clever teacher and he has organized his material so that the reader continually assimilates new facts, but is seldom forced to learn long lists of rules (of which COBOL has many). His combination of the sample programs, text, review questions (all with answers), and problems (about half-answered) should provide any novice with a good working knowledge of COBOL.

The book is less successful in its presentation of program design techniques. McCracken teaches program design by exhibiting well structured sample programs rather than by examining the techniques one can use to discover program structure. In Chapter 8, he covers a design step by step through seven expansions, but he never discusses the source of the basic structure of the program. He presents few explicit design tactics and uses only flowcharts and, less frequently, pseudocode as design aids. Although it may have some value as a teaching aid, flowcharting is a bad habit all too easy for the novice to adopt, especially when encouraged by an exercise which asks the reader to "prepare pseudocode corresponding to the following flowchart" (p. 141, question 15).

Both books can be useful to the novice— if used in sequence.

Who should read this book?

- Anyone who wants to learn basic COBOL programming. This book will teach the basics as well as or better than any text available.
- Anyone interested in how to write a superior programming language textbook.
- Instructors of COBOL who appreciate a carefully thought out instructional sequence.

The Yourdon *et al* book is the first of two volumes (the second is due in mid-1976), so the COBOL covered here is basic, but enough to write interesting programs with. It is "intended for people with no previous knowledge of computers," either "for self study or as the text for an industrial or college course." To aid instructors, an appendix contains lesson plans for 30 three-hour sessions.

The book begins with a brief introduction to computers (11 pages) by way of a sample program to print mailing labels. From here the pace quickens considerably. By page 26, we have been introduced to MOVE, IF and PERFORM together with their Shneiderman Chart representations (I. Nassi and B. Shneiderman "Flowchart Techniques for Structured Programming," *Sigplan Notices*, Vol. 8, No. 8 [August 1973]). By page 68 we have gone through a complete design sequence using a program graph, a structure chart with data-flow notation, pseudocode, and Shneiderman Charts.

By now, the novice may be quite confused unless he has the services of a good instructor. Fortunately, the rest of the book is slower paced, but a great deal of material is covered in the 222 pages of text (exclusive of appendices, etc.).

Each chapter ends with a sample program using the material covered in that chapter. Frequent questions (and answers) are interspersed with instructional text, and two review quizzes (with answers in an appendix) appear early in the book.

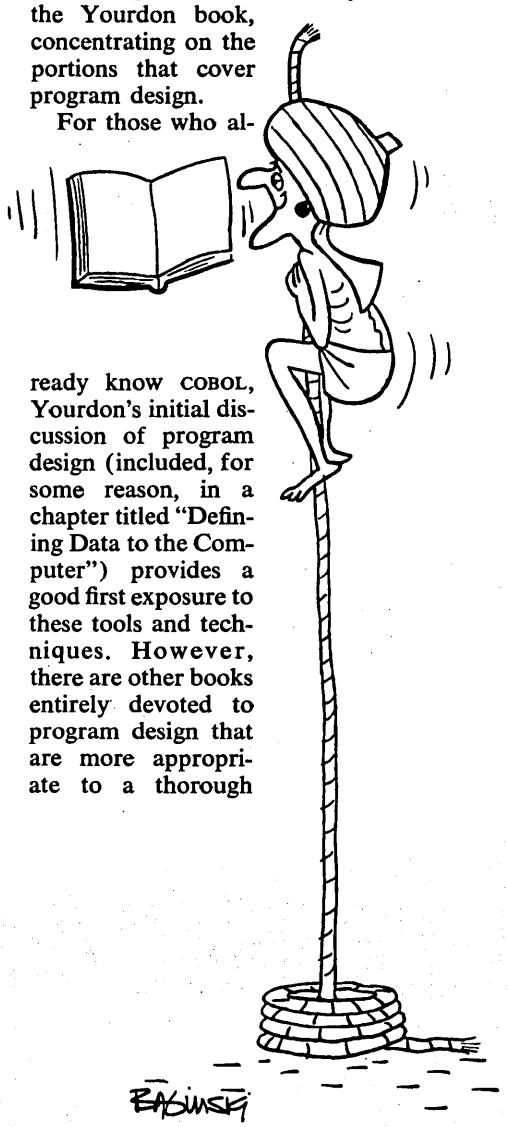
For a beginning text, the book is very strong on design tools and techniques. It is nice to see decision tables used; Volume Two promises a further discussion of them. Flowcharts are entirely absent; rather, the more appropriate Shneiderman Charts are used to explain the structured figures. The sample programs are all well structured and GO TO-less. (The GO TO is relegated to Volume Two.)

Unfortunately, the book is probably too difficult for an untutored novice. It presents complex ideas too soon. For example, modularization and the passing of data between modules are discussed on page 60, but the associated sample program is packaged as a single compile unit without explicit passing of data. Later discussions of program structure omit mention of data flow, where it would have been more appropriate. Other prematurely discussed items include data-name qualification (discussed, then rejected on p. 16), and COMPUTE and arithmetic expressions (p. 79).

Of the two, McCracken's is the better COBOL text. He presents his material at a slower pace, using complete sample programs to introduce new material and to support its discussion. The Yourdon *et al* presentation, by contrast, often seems hurried. It relies on small, out-of-context examples since sample programs are placed at the ends of chapters. A beginner stands a reasonable chance of learning COBOL unassisted from McCracken; he will need help to steer through the Yourdon book.

On the other hand, Yourdon's book does a better job of teaching program design. McCracken's book relies on the student's exposure to a series of well-designed programs to teach design. This may teach an appreciation of good program structure, but a beginner needs more ground rules before he can reproduce the work of his teacher. Yourdon presents a set of good design tools and uses them to coach the student through several designs of increasing difficulty.

Because the books differ so in their strong points, they can both be useful to the novice—if used in sequence. By reading McCracken's book first, the novice can gain a good basic knowledge of COBOL and an appreciation of good design. Then he is ready to read the Yourdon book, concentrating on the portions that cover program design.



For those who already know COBOL, Yourdon's initial discussion of program design (included, for some reason, in a chapter titled "Defining Data to the Computer") provides a good first exposure to these tools and techniques. However, there are other books entirely devoted to program design that are more appropriate to a thorough study of that subject, for example, Michael Jackson's *Principles of Program Design* (Academic Press, 1975), Glenford Myers' *Reliable Software Through Composite Design* (Petrocelli/Charter, 1975), and Ed Yourdon's and Larry Constantine's *Structured Design* (Yourdon Inc., 1975).

—Harry T. Hicks, Jr.
Mr. Hicks is manager of standards at Fireman's Fund Insurance Companies. He was formerly director, Consulting Services at Information Management Inc., and prior to that, was with Computer Usage Co. and Boeing.

(Continued on page 127)

SUPPLEMENT

Data Bases and "Back-end" Processors

Principles of Data Base Management

by James Martin
Prentice-Hall, 1976
352 pp. $18.50

This is Martin's eleventh book in the Prentice-Hall series in automatic computation. Martin is accused, quite justifiably, of heavily borrowing from his earlier works in publishing new books. However, there is hardly anyone around who has written more extensively or more authoritatively on dp-related subjects, and so he certainly can be excused if he borrows from his earlier works.

Martin has written two books specifically addressed to Data Base concepts. The other one is *Computer Data Base Organization* (more on this book later). This reviewer has attempted to read most published works on data base that have appeared over the last five to eight years. This current *Principles* book, and the earlier one by Martin, are the two best texts available for the reader who wishes an authoritative, overall view of the subjects comprising the field of data base management.

Principles of Data Base Management is highlighted by the following:

1. Clear writing style throughout.
2. Polished production by the publisher.
3. Good and plentiful diagrams (this is so rare in books that have been produced with less investment).

The result is a book that is a necessary foundation for one who wishes to be called a data base expert; and an absolute must for any dp reference library.

Principles starts off with 65 pages devoted to an introduction. This part could more properly be called the "Management Point of View," since it presents a rationale for data base. Basic definitions are formed, file devices are presented, and a comprehensive argument is built up as to why data base management may provide a superior approach for the third-generation system planner. In all fairness, it should be commented that the message is best received by someone with at least a few years of dp experien e under his belt.

Part II of the book is concerned with data base organization concepts. It is here that a thorough and clear presentation of the schema and subschema concepts are presented. Tree and network structures are presented (Martin calls networks "plex structures" since he feels the term "network" is overused in telecommunications. It's an indication of Martin's power that he is attempting to formulate a new vocabulary, at least as far as one word is concerned. It is also a reflection of the diversity of the field, however, that the term "plex" has not achieved any significant usage). The plex or network structure is compared and contrasted with the hierarchy.

Relational data bases get an entire chapter of 16-some pages. This is probably adequate, given that there is no current relational data base implementation that has achieved any market success. A short section is presented on basic file addressing concepts, including sequential searches, index sequential searches, random hashing searches, etc. To the author's credit, he also discusses the concept of distributed data bases, a field which has been largely ignored in the literature, while a number of actual implementations of distributed data bases have appeared.

Part III of the book gets more into the software required to run a data

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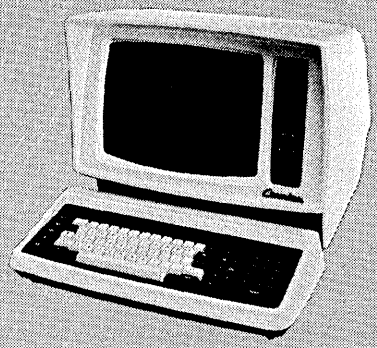

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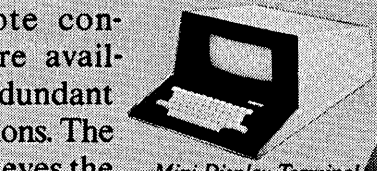

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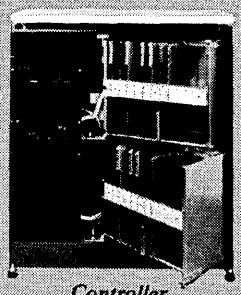

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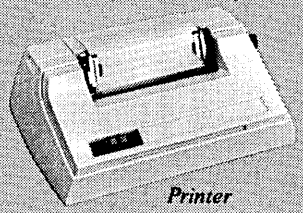

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base. Languages such as the Device Media Control Language, the Schema Language, the Subschema Language are defined and discussed in adequate depth. The construction and use of data dictionaries, and the CODASYL data description language, are analyzed. IBM's DL/1(IMS) is presented, as is a discussion of query languages.

Part IV is called "Management Considerations," and important topics are covered including the function of the data base administrator and how security can be achieved. Very important, an excellent 14-page glossary is provided.

Far too few books in dp have as much attention shown to their production as this one has. For example, at the beginning of the book a 2-page index of basic concepts is presented; in back, both the 14-page glossary and a reference list (not so useful—it could be made more so by short comments under each of the references), and, of course, the necessary index.

For many people and for graduate level courses in particular, the 558 page earlier book is a better choice than *Principles* because almost everything presented in the latter is also in the former. In addition, the earlier book offers a longer and more intensive look at physical organizations of data, as well as suggested class questions. Many of the graphs in the two books are identical. I'm of the opinion that the earlier book therefore is better suited as a reference book, but unfortunately it suffers from not having a glossary, which is a fine addition to the *Principles* book. Also, the management-oriented first part of the *Principles* book does a more concise and better job of pitching the advantages of the data base approach to management types.

All in all, Martin has come up with another excellent and positive contribution.

—George Schussel

Dr. Schussel is vice-president of Information Systems for the American Mutual Insurance Companies in Wakefield, Massachusetts. He is also the course director of AMR International's Data Base Design course.

Commercial Data Management Processor Study

Cullinane Corp., 20 William St., Wellesley, Mass. 02181 (1975)
77 pp. $500

This report is mistitled. It should be called, *The First and Only Primer on Back-end Processors and Their Suitability for Data Base Management.* For several years, kibbitzers on data base management have been discussing the desirability and feasibility of implementing a back-end processor in a manner analagous to the way front-end processors have been used for telecommunications. It is now well accepted that the use of a dedicated minicomputer processor to handle communications functions is a superior way to implement on-line systems. Analagously it could be that offloading data base management onto a back-end processor could present unique advantages. This report starts to answer that question. It was prepared as a result of a collaborative study funded by the Cullinane Corp. (whose IDMS data base management system has been

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implemented on PDP-11 minicomputers) and various government agencies.

The report is well written, easy to understand, and thoroughly professional, although it may not satisfy the serious implementer's desire for more detail. Advantages of back-end processing are listed as: improved performance, less host main memory requirements, ease of upgrading, easier data base recovery, and enhanced data base security. The disadvantages are the cost of the back-end hardware processor, potential problems of a multi-vendor environment, translation problems involved in multiple character sets among the various cpu's, hardware requirements of inter cpu communications, and the need to learn a new architecture. Various network configurations are proposed and defined, and a software architecture for distribution of the various functions in data base is defined.

> . . . in back-end processing, this report is the only reference available.

In addition, as a plus, the results of the rather thorough evaluation of minicomputers for back-end processing, are presented. A scheme for analyzing the minicomputers is presented; and, in particular, the PDP-11/70, the Interdata 8/32, SEL 32/55, and Modcomp IV/25 are compared at length (as is the IBM 370/158).

If you're interested in back-end processing, this report is the only reference available. This fact, plus the clarity and professionalism of the writing will make it worth the rather steep price to a number of people.

—George Schussel

SOFTWARE ENGINEERING: Concepts and Techniques

J. M. Buxton, Peter Naur, and Brian Randell, eds.
Petrocelli/Charter, New York, 1976
306 pp. $14.95

Consider a single volume with the following remarks:

(Dijkstra) "The dissemination of knowledge is of obvious value—the massive dissemination of error-loaded software is frightening."

(McClure) "They judge a programmer by the amount of code he produces. This is guaranteed to produce insipid code—code which does the right thing but is twice as long as necessary."

(Smith) "If you look down the PERT-chart you discover that all the nodes on it until the last one produce nothing but paper. It is unfortunately true that in my organization people confuse the menu with the meal."

(Buxton) "I know of very few programming establishments in which the supervisor is capable of reading code—some present company excepted."

(Galler) "When the hardware doesn't work, the user doesn't pay—why should he have to pay for non-working software?"

(Kinslow) "Personally, after 18 years in the business I would like, just once, to be able to do the same thing again. Just once to try an evolutionary step instead of a confounded revolutionary one."

(Dijkstra) "A Dutch definition of a university professor is someone who casts false pearls before real swine."

This is but a tiny, random sample from the fondly-remembered, NATO-sponsored Software Engineering Conferences, Garmish in 1968 and Rome in 1969. One could easily pull out just as many equally witty and insightful remarks just by looking at some other pages; the spice and flavor are everywhere.

It has taken far too long to get these proceedings into a single, permanent volume. Tattered paper copies have long since disappeared into that mysterious limbo to which all important documents eventually find their way. The original participants, now widely

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Most important, the ECLIPSE computer has a communications ability that lets you interface to your big computer. For example, when talking to an IBM system the ECLIPSE can emulate 3780/2780 and HASP procedures. Or just be itself.

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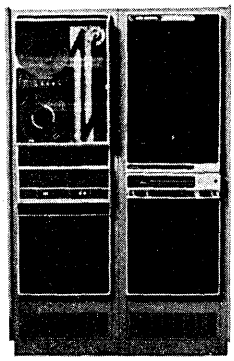

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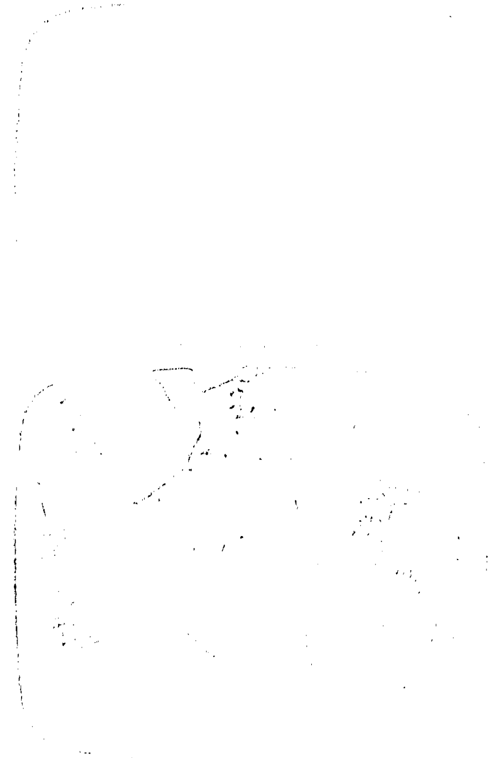

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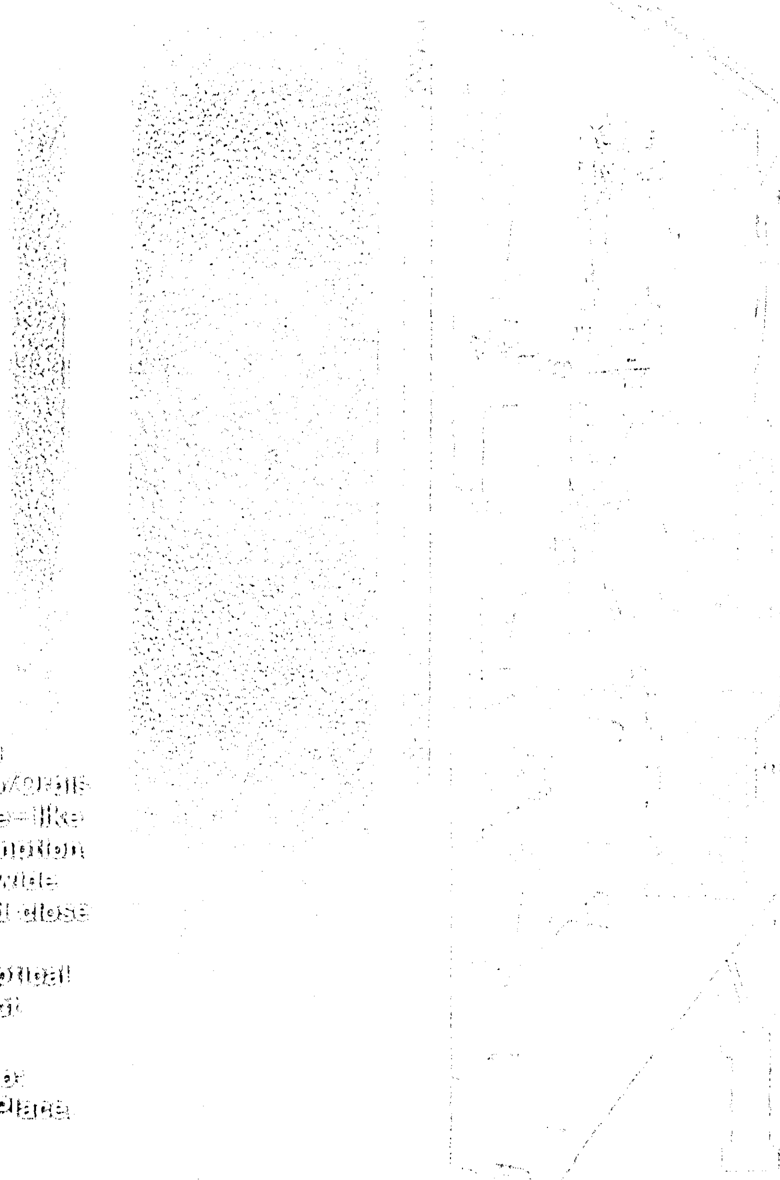

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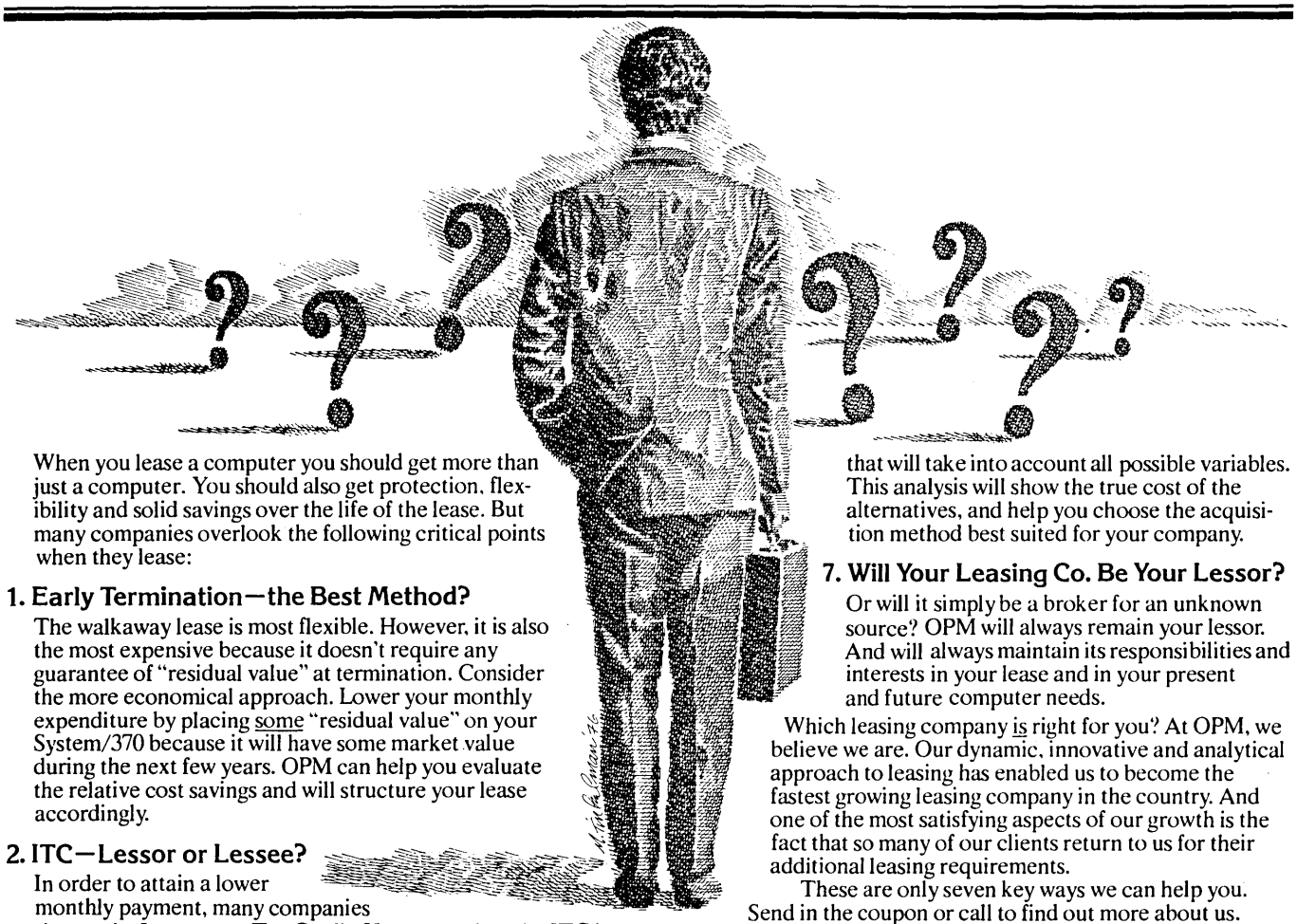
S/370 Computer Leasing: 7 Ways to Avoid Costly Mistakes



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2. ITC—Lessor or Lessee?

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3. Future Upgrade Provisions?

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Itel Announces The Ultimate Peripheral: The 360/370 CPU

by Michael Cashman

Can this be Christmas? These counterparts to IBM systems are less expensive, have higher performance, use 45% fewer circuits, run 10% cooler, draw only 45% as much power, use 75% as much space . . . .

Isn't this an interesting industry? Here we are, fully a dozen years after the IBM 360 announcement—much longer than anybody thought we'd have to wait for a new generation of systems as different from the 360 as the 360 was from IBM's old 7000 series—and "look-alike" 370s start popping out of the sands of California's "Silicon Valley." And, what is more, the chances are very good that the efforts will *succeed.* Indeed, the Amdahl effort is well on its way, and the Itel announcement of six models of Advanced Systems is an even stronger attack on IBM's installed base than was the Amdahl effort. Developments like these must cause the planners in RCA's long-defunct computer effort to wonder where they went wrong.

There are, of course, major fundamental reasons why the California 370s will, or are, succeeding where RCA's machines could not. First, RCA's two major mistakes were in not offering software compatible systems (all claims to the contrary by the marketing staff notwithstanding) and at not enough of a price difference to make enough customers switch brands.

Second, technology, principally in semiconductor manufacturing techniques and microprogrammed computer architectures, was not as highly developed as it is today.

Third, there's the matter of IBM's admission that FS, the designation for the 370 successor project, "is no longer operative" within IBM. This told users that maybe nothing really new was coming down the pike for awhile, and it told potential competitors, such as Amdahl and Itel that the "window"—the period of time when 360s and 370s would stay in the field in good target numbers—was longer than had been imagined.

RICHARD LUSSIER
President of Itel's Data Products Group is captain of boldest assault to date on IBM's installed computer base

It's almost as if IBM user reluctance to move to the FS series, where software compatibility was going to be a problem, so stabilized IBM as to give Amdahl and Itel very good shots at its installed base. And it might be a good long time before IBM announces anything that doesn't say 370 on it or doesn't adhere to the basic architectures of the 370, for all signs point to the fact that there was no back-up, no alternative product line to backstop FS.

Add to this the fact that Itel estimates IBM now owns less than half of its large scale base, and the result is that IBM seemingly can't be assured that a user will go along with any new announcements that disrupt his operations. Price cuts and improved reliability or function are always acceptable, but the possibility of reliving 1964 is not. The final element in the atmosphere, of the Itel announcement, and perhaps the most important, is that the conception that only IBM could build 360s and 370s turned into misconception during the last 12 months because of the Amdahl effort.

Six models

Compared with the timing of the Itel announcement, and the fact that the peripherals and systems leasing giant ($700 million portfolio) actually took the fateful step, the products are just what Itel thinks you'd expect them to be. There are six models, three single processor systems, and three multiprocessors, designated the AS/4, AS/4 MP, AS/5-1, AS/5-1 MP, AS/5-3, and AS/5-3 MP. Their order in terms of computing power is somewhat different, however, and Itel's claims of how the systems compare to products in the 370 line are shown in the accompanying table. Since the AS/4 competes so favorably against the 145 and 148, it's almost certain that the timing of this announcement was prompted by IBM's recent announcement of the latter.

With users thinking change, maybe they'll think changing vendors com-

pletely. The important thing for users to keep in mind is that the machines can be as functionally equivalent to the IBM counterparts as they want, says Itel, though there are some interesting differences in the Advanced Systems' hardware that allow them to do other things if they choose to.

For example, while MVS isn't really practical for 145s or 148s (or for *any* machine some users say), due to the amount of memory required and the relatively slow cpu's, Itel says you can run it on the AS/4. That's because the AS/4's design is similar to the AS/5, meaning that where the IBM machines are fetching four or eight bytes on the 145/148 models every 540/405nsec, respectively, the AS/4 is pulling a straight 16 bytes every 1035nsec. The AS/4 also has one more useable channel than the 145/148, and the AS/4 MP has seven additional channels.

There are other differences, too. Maximum memory sizes on the AS/4 and AS/4 MP are four and eight megabytes, respectively, two to four times the IBM maximum complement. A crt console, light pen, and 180cps printer are standard on all the new Itel systems. The biggest models in the line, the AS/5-1 MP and AS/5-3 MP can have up to 16 megabytes of storage. All systems can be upgraded in customers' shops.

Software details

Itel queried IBM back in May to obtain its official position regarding the availability of software for potential AS customers, and the answer was a good one for users. All software, program products, and documentation is available to users (if they do not already have them) at the established prices. It's as if IBM were saying "Sure, here take it!"

Itel will use the same sales force to push the new product (contrary to Wall Street rumors that the company had staffed up big for the new push, and each salesman would be expected to sell 2-3 systems/year). Itel claims it has 500 field engineers to support the systems, with maintenance running about the same as IBM's. "Our people cost about the same, or more than IBM's," says Itel Data Products Group President Richard Lussier. The target audience is huge and includes approximately 6,000 users of 370 model 145s, 155s, 158s, and 165s alone, not counting die-hard 360 users. With orders in-house for seven systems for six customers before announcement, it doesn't look as if Itel will have trouble satisfying the agreement to purchase at least 12 systems a year from the manufacturer, National Semiconductor Corp. to keep up its exclusive world-wide marketing rights. Itel has ordered 25 systems, and National currently has the capacity to build six per month.

More deals at Itel

Itel is a marketing organization and a good part of its success has been due to the "deals" it could make users by buying, until now, from IBM and putting the same equipment in the field for longer lease periods—and lower prices. These package deals also will be used with the new equipment. For example, while IBM gets $44,725 for a two megabyte 158-1 on a four-year lease (MLC), you can get the equivalent machine from Itel on a four-year conditional sale for $42,707, or for $30,435 on a seven-year conditional sale, with both Itel deals being financed at 11% interest.

Purchase price looks even better, with the AS/5 selling for approximately 65% of IBM's price for the 158-1. As good a difference as the 35% on purchase is, Itel officials indicate that there's even more room to deal should IBM start trimming prices on its machines. And the Itel customer gets the ownership of the machine at the end of the respective lease period.

Competition

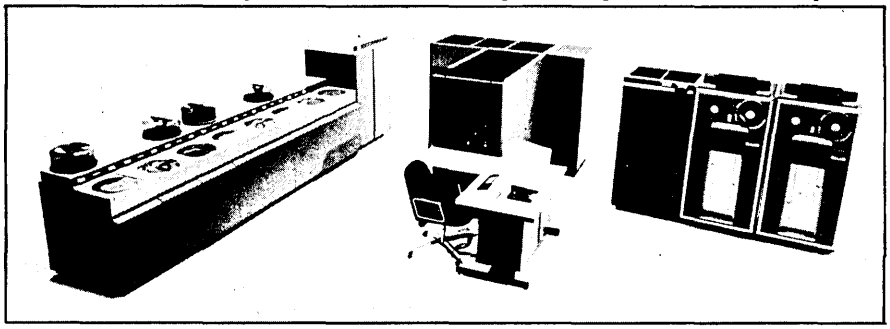
"We sure don't want to lose [any customers we convert from IBM equipment] over to Amdahl 470s" says Lussier. "There will have to be something in the works for our people." If not, there's the possibility that an IBM customer could trade in his 135 for the rumored upcoming announcement out of CDC of a 370/145 equivalent, switch to Itel for a 158, and then to Amdahl for a 168-class machine. Other mainframe manufacturers, principally Univac and Honeywell, can't be appreciating all the attention the IBM name and installation base is getting from other vendors, even if it is against its traditional arch enemy.

Clearly, IBM's response to the Itel announcement will be all important, and the Gray Giant isn't defenseless yet. There must be some room for smaller margins on the equipment of any company that makes $1 billion a year in profits, and a price battle is shaping up.

Additionally, it is known that there is an advanced 158 model called the 370/158 APS sitting in the wings for announcement (IBM always seems to have something ready to announce—which is good strategy).

Rumor has it that there really is a 370/178 after all, which could be used to move 370/165 and 370/168 customers out of Itel's grasp—and gain some time for some top-level decision making. Imagine all this taking place in full view of the Justice Dept.'s antitrust trial—if anybody's awake over there. Maybe one user we know will get his wish: IBM will win the case and the *government* be broken into smaller pieces.

So it all comes down to a battle of wits for the user's dollar, a game IBM enjoys and plays well. What the strategy will be for the unique arrangement forged by Itel and National Semiconductor to go after the breadbasket of IBM's installed base should be interesting. Though a cold winter may be coming to White Plains, home of IBM's Data Processing Div., it should be warmer than usual in the strategy planning sessions. ✲



SOPHISTICATION of microprogramming techniques makes it possible to build a machine that looks very similar to an IBM 370 on the outside, looks remarkably unlike a 370 on the inside, but runs the same software as the IBM systems. "It's no coincidence that the Itel Advanced Systems models will sport the same colors as IBM offers," says Itel Data Products Group President Richard Lussier, but unlike IBM's offer, "you can get a system in any color you want."

COMPARISON OF
PERFORMANCE RATINGS
BETWEEN THE
ADVANCED SYSTEM AND COMPARABLE IBM SYSTEMS

Advanced System Models	Performance Compared to IBM Models					
	145	148	158-1	158-3	158-1 MP	158-3 MP
AS/4	2.0x	1.4x				
AS/5-1	2.6x	1.9x	Equal			
AS/5-3	2.8x	2.1x	1.1x	Equal		
AS/4 MP	3.3x	2.3x	1.3x	1.2x		
AS/5-1 MP	4.2x	3.1x	1.7x	1.6x	Equal	
AS/5-3 MP	4.6x	3.4x	1.9x	1.7x	1.1x	Equal

Source: Itel Corp

Communications

First Hearings on Bell-Inspired Bill

An opponent remains skeptical over Bell's motives for pushing reform act even after hearing testimony.

"The head-on clash between monopoly and competition in telecommunications foreshadows all other communications issues in Washington." The first skirmish in this "head-on clash" that Thomas J. Houser, new director of the White House Office of Telecommunications Policy, so dramatically refers to is over. The battle lines, carefully drawn up before the arbitrating House Communications Subcommittee, are firmly set. But the war, brewing for years between AT&T and its feisty competitors in the terminal and private line markets, has only just begun.

The subcommittee hearings, cautiously classed as "exploratory" on "Competition in the Domestic Telecommunications Industry," were designed to take a preliminary and superficial swipe at some of the underlying communications policy issues raised by the Consumer Communications Reform Act of 1976, more familiarly known as the "Bell bill."

The bill, introduced last March, bears AT&T's unmistakable stamp, having been written by a coalition of telephone industry representatives in Washington. In the planning and drafting stages since June 1975, the measure has won considerable Congressional support with over 200 sponsors—about 180 from the House and 20 from the Senate.

While several versions of the bill have been introduced, the original measure offered by Rep. Teno Roncalio (D-Wyo.) has served as the benchmark. Under this bill, all competition in long distance services would be cut off, allowing AT&T or another carrier to take over their competing rivals. The legislation would also strip the Federal Communications Commission of its jurisdictional power over interconnection of terminal and station equipment, transferring that supervisory role to the states.

Put together at the last minute, the three-day hearings on the bill were held (in the nick-of-time) just before Congressional adjournment at the end of September, prompting one disgruntled Congressman to grumble, "I can't think of a worse week for these hearings to begin."

But begin they did, with subcommittee chairman Lionel Van Deerlin (D-Cal.) graciously welcoming the standing room-only audience "to the third act of a continuing drama." Setting the tone for the hearings, the subcommittee head noted that "in light of the results of an exhaustive inquiry by the FCC, those arguing for restraints on competition must accept the burden of proof."

This burden of proof argument, placed squarely on AT&T's shoulders, was reiterated by subcommittee members during the course of the three-day hearing. However, out of the nine subcommittee members, only three showed up with any regularity. Those stalwart subcommittee regulars included chairman Van Deerlin, Rep. Timothy E. Wirth (D-Col.) and Rep. Louis Frey Jr. (R-Fla.). Some of the Bell boosters even decided to stay away from all the action. Rep. Goodloe E. Byron (D-Md.), one of the numerous House sponsors of the Bell legislation, put in a hasty 15-minute appearance on the first day and then disappeared. And another Bell bill sponsor, Rep. Charles J. Carney (D-Oh.), didn't attend the hearing at all.

This poor attendance by Bell backers on the subcommittee led one Congressional source to comment, "Obviously, you would have to look to the bill's sponsors on the subcommittee as the supporters of the legislation and the fact that they didn't think enough of the legislation even to be there says something. It's rather clear otherwise," he adds, "that there's nobody else on the subcommittee at this point who wants to support the legislation."

Rep. Wirth has been extremely outspoken in his attacks on the telephone industry's "special interest" legislation. A spokesman for Wirth confirmed that the Colorado Congressman was still very skeptical of Bell's motives in pushing the legislation. "Even after the hearings," the spokesman revealed, "Tim believes the burden of proof on AT&T has not been met."

PETER F. McCLOSKEY
CBEMA president says a greedy Bell wants control of terminal market

FCC policy will hurt service

In his leadoff testimony on the first day, AT&T board chairman John D. deButts vainly tried to rally support for remedial telecommunications legislation. "I am not here," he assured the subcommittee, "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."

Denouncing the "FCC's brand of selective competition," deButts claimed that these policies are "undermining the telephone companies' ability to keep service as widely affordable as it is now." A continuation of these policies, he warned, will "leave us no alternative but to press for a massive cost-restructuring of our rates."

DeButts also picked up on some of AT&T's other familiar competitive complaints. The infusion of competition in the intercity private line field by the "so-called specialized common carriers" and the interconnection of terminal and other ancillary gear to the switched network, he charged, "seriously threatens the technical integrity of the network as a whole and our ability to plan." These developments, he added, have already "produced wasteful duplication of facilities" and created "difficult and expensive" accommodation problems.

Real problem is IBM

But despite deButts' contentions to the contrary, AT&T's real problems, according to industry insiders, do not stem from the competition or technical harm these rivals may or may not cause. Rep. John M. Murphy (D-NY.), says the real thorn in Bell's side is IBM. Testifying at the second day of hearings, Murphy argued that "while the Bell System talks about MCI and other small entrants seeking to provide specialized services, what it is really worried about is that somewhere down the road a company like IBM, with billions of dollars at its disposal, will take advantage of the blurred interface between data processing and data communications to provide services that the Bell System thinks belong to it."

MCI senior vice president Kenneth A. Cox sees the bill as "an unprecedented grab for monopoly power over a critically important industry." The former FCC commissioner told the subcommittee flatly that, despite Bell's claims, the measure was clearly anticompetitive. "Their whole objective would fail," he stressed, "if the bill did not eliminate competition in both the terminal and specialized communications markets. The most constructive thing your subcommittee could do," he advised, "would be to make a finding that this legislative proposal is without merit and should not receive further attention."

Following up Cox' remarks to the subcommittee, MCI chairman William G. McGowan criticized AT&T's Congressional campaign which he claimed "was mounted on an unparalleled scale." All of this frenetic activity "represented outright abuse of AT&T's right to petition Congress," he charged.

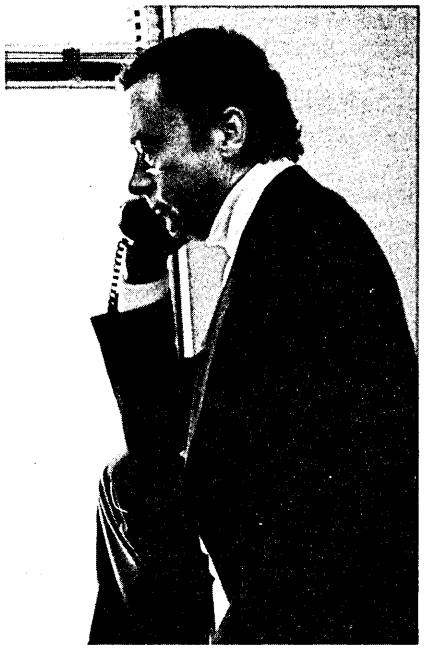
By continuing to deliberate on the Bell legislation, McGowan added, Congress will be giving AT&T a reason to claim its proposals are "under serious consideration, and this in turn can do great damage by confusing and intimidating prospective investors, potential competitors, customers, equipment suppliers, employees and even regulators." But even more dire consequences could result from the bill's enactment, he noted.

If the bill is passed, he warned, Congress "will have conferred upon the world's largest concentration of private capital a statutory monopoly over all U.S. telecommunications—one which it does not have today and never has had —and you will have given Bell a stranglehold on the public in perpetuity."

Worries about terminal market

Likewise, Peter F. McCloskey, president of the Computer and Business Equipment Manufacturers Assn., worries that the bill will enable a greedy Bell to capture control of the terminal equipment market. "Carriers supporting the Bell bills," he told the subcommittee, "are not satisfied with a large percentage of the projected terminal equipment growth. They want even more, even if this means crippling existing, working competitive markets.

"The provisions of the bills with respect to customer premise or terminal equipment," he continued, "do not simply 'reaffirm' the present provisions of the Communications Act. Instead they would change those provisions decidedly, drastically and adversely to the public interest."



WILLIAM G. McGOWAN
MCI chairman warns of Bell stranglehold on the public

After three exhaustive days of hearings, the House Communications Subcommittee had received 1,300 pages of written testimony. Extra submissions are expected to add another 1,000 pages to that staggering total. Subcommittee staffers, faced with the grueling task of sorting through all the conflicting facts and figures, began going over the mountains of material as Congress prepared to adjourn. The final report, which will summarize and analyze this material, is expected to be ready by early next year.

Revamp Communications Act

Meanwhile, subcommittee chairman Van Deerlin joined ranking minority member Frey in calling for a "basement to attic revamping" of the 1934 Communications Act. In a joint statement the two subcommittee leaders stressed the "need to go back and take a look at the whole basis of regulation to see where Congress could improve things by starting anew."

Subcommittee economist Andrew Margeson says that this "starting anew" in the 95th Congress entails "a vigorous search for as many alternative policies as possible. There are few issues of more importance," he emphasizes, "because this is at the nut cracking stage."

The subcommittee is expected to remain intact with basically the same membership base next year. The in-depth review of the Communications Act will be the first order of business on the subcommittee's agenda. This overhaul is likely to take a while, according to Congressional sources.

Right now, the subcommittee is getting ready to solicit advice from various agencies and other interested parties on possible changes that could be made to revise and update the act. "Just the sorting out of those recommendations," one Congressional aide noted, "could take months. And there will also be extensive hearings. So it would probably be late in the 95th Congress before legislation could move through the full committee and onto the floor," he predicted. Final enactment, he added, is not expected before 1978.

Senate group observing hearings

Over on the Senate side, the Senate Communications Subcommittee has been closely monitoring the House hearings. Before adjournment, Sen. Howard H. Baker Jr. (R-Tenn.) reiterated his earlier proposal for an independent Commerce Committee study. Sen. Vance Hartke (D-Ind), who is expected to take over the leadership of the influential subcommittee, had joined Baker in calling for the review last June. A similar plan was advanced in the House by Rep. Murphy but subcommittee members Van Deerlin and Frey don't seem to favor it.

Hartke, touted by Bell as a key supporter of its legislative initiative, has promised to "keep an open mind" on the matter. Subcommittee staffer Jim Graf is confident Hartke will keep his promise, but he worries about the complexity of the issues the subcommittee will be facing. "This bill raises a whole host of issues both on the surface and below the surface that are very, very

complicated. Unfortunately," he laments, "statistics are not available in the necessary form to make the kind of judgments that these issues require.

"Until you can get those kind of facts, it's pretty hard to get down to that bottomline issue which is what will be the ultimate effect of the FCC's competitive policies on residential rates."

AT&T's deButts, in telling his woeful story to Congress, has urged the legislators to put an immediate moratorium on the commission's competitive experiments "until their long-term consequences have been fully explored." Joining forces with the Bell clan, General Telephone & Electronics Corp. board chairman Theodore F. Brophy also called for a suspension of the FCC's pro-competitive policies.

JOHN M. EGER
Former OTP chief thinks proposed bill is a "red herring"

Enter USITA

While it's unlikely that the telephone industry will be successful in getting this moratorium, they are looking forward to other victories at the "grass roots" level next year. According to an inside report from the Legislative Committee of the United States Independent Telephone Association (USITA), "legislative committees have been formed in each of the 50 states to coordinate efforts to secure sponsorship of the legislation, launch educational and media programs and develop grass roots support." These legislative groups, the report notes, were set up through "the active cooperation" of the major holding companies with Washington offices and Bell System representatives.

At the beginning of last year, USITA began distributing a 28-½ minute color film called "Assignment: Service" which the association claims is aimed at describing "the service-earnings relationship." According to another report from USITA's public relations committee, this film "is achieving a splendid record both in television and organizational showings. High school audiences," the report says, "form the largest single category, helping assure that the industry's message is reaching the next generation of voters and civic leaders."

Concentrating on the Congressional campaign, USITA, which is coordinating most of AT&T's lobbying efforts, plans to continue rallying support in Congress for the Bell bill. The Legislative Committee report says this about next year's Congressional crusade: "Although we can be proud of accomplishments this year, the 95th Congress opening next January will present a new challenge. Many who have supported our legisla-

MAJOR ANTITRUST LITIGATION PENDING AGAINST AT&T

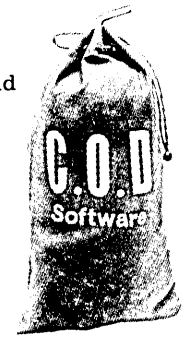
PLANTIFF	*COMPLAINT*	*RELIEF REQUESTED*		*FILED*	*STATUS*
MCI	Violations of Sherman I & II	Injunctive Relief Restoration of Competitive conditions	Treble damages	3/74	Pre-trial Discovery
U.S.	Violations of Sherman II	Equitable Relief Divestiture		11/74	Awaiting determination of jurisdictional questions
Jarvis Co., Inc., et al	Violations of Sherman I & II with respect to Key Telephone terminal equipment market	Cessation of anti-competitive practices	$900 million damages	11/74	Pre-trial Discovery
Milgo-ICC	Antitrust counterclaim against Western Electric for Patent misuse including the requirement for a connecting arrangement	Equitable Relief	$45 million damages	12/74 AT&T named third party 6/76	Pre-trial Discovery
Phonetele, Inc.	Violations of Sherman I & II Tying arrangements	Injunctive Relief	$90 million damages	8/75	Pre-trial Discovery
North Eastern Telephone	Violations of Sherman I & II with respect to business terminal equipment market	Injunctive Relief	$3 million damages	10/75	Pre-trial Discovery
Morse Alarm Equipment Producers	Violations of Sherman I & II	Injunctive Relief	$45 million damages	10/75	Pre-trial Discovery
Litton	Violations of Sherman II with respect to telephone equipment market	Injunctive Relief	$333 million damages	6/76	Pre-trial Discovery
Sound, Inc.	Violations of Sherman I & II	Injunctive Relief	$2.5 million damages	6/76	AT&T has responded
Datran/Wyly	Violations of Sherman I & II with respect to digital data transmission market. Deceptive and predatory marketing practices.	Injunctive Relief	$285 million damages	8/76	AT&T has responded.

SOURCE: Computer & Communications Industry Assn.

Eleven compelling arguments for choosing a computerized personnel/payroll system from InSci

Compelling argument number one

InSci guarantees to get your system up and running fast. C.O.D. software can leave you holding the bag—not only for installation, but communicating the system's capabilities and potential to your personnel and payroll people. InSci installs it to your satisfaction—and then makes sure that the system is used to its fullest.



Compelling argument number two

We have satisfied Users. It is imperative that you buy a system that is in actual operation. Talk to users of our system. Visit the site and witness the system in action. Let their success guide you in your decision.

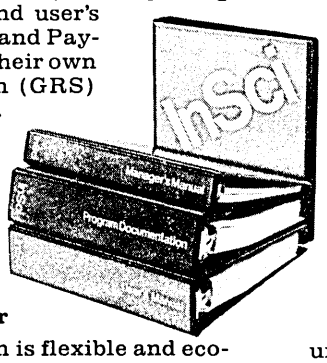
Miller High Life — The Champagne of Bars

Johns-Manville

ITT Grinnell

Compelling argument number three

InSci Systems are user-oriented. Every InSci package comes with full documentation and user's manuals that allow the Personnel and Payroll Departments to be masters of their own fate. Even our retrieval system (GRS) understands and speaks English. And, because of our experience in hundreds of installations in all kinds of companies, you are assured of an extraordinary level of competence in training. When we leave, you'll be in total control.



Compelling argument number four

The InSci Human Resource System is flexible and economical. It can grow with you. You are looking at the most flexible system available. This system provides the capability you need to support payroll and handle all of your personnel-related functions, including compliance with EEO, ERISA, and OSHA legislation, manpower planning, management development, salary and benefits administration, and health and safety programs.

Compelling argument number five

If you don't have a computer—or don't want to use yours—use ours! Manual handling of personnel/payroll information is inherently error-prone, and sometimes even dangerous! Contact our Systems Service Division. With or without a computer you need a Personnel/Payroll System from InSci.

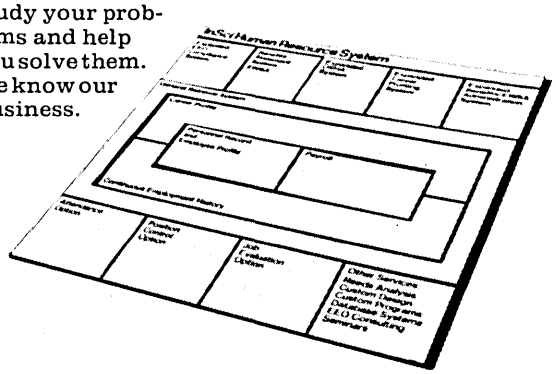
Compelling argument number six

We keep informed—and keep you informed. We hold seminars and conferences to let you know what's happening and what's going to happen. At our Annual User's Conference you'll pick up valuable ideas on better ways to use your system. Management problems, EEO, ERISA, OSHA and other vital issues don't sneak up on you. (Right now we're keeping abreast of the Privacy issue—so you won't be caught unaware.)

InSci Information Science Incorporated

Compelling argument number seven

The background and experience of our personnel is outstanding. InSci has been designing systems for more than ten years in all types of environments—you don't have to "start from the beginning" with us. We'll study your problems and help you solve them. We know our business.



Compelling argument number eight

We stay on top of EEO, ERISA, OSHA, Privacy and other legislation companies can no longer ignore. Our systems are designed to handle the extraordinary amount of record keeping and reporting necessary for compliance. Your legal headaches in these areas can be a thing of the past.

Compelling argument number nine

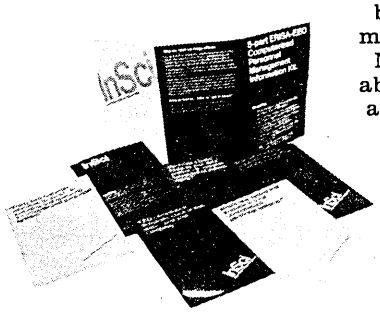
InSci is a dynamic, financially secure company. Because of its corporate connection with CPC, one of the world's largest multi-national corporations, InSci enjoys an enviable security unique in the industry. Add to this, the remarkable growth InSci has experienced in the last eleven years—and you know you're dealing with a WINNER.

Compelling argument number ten

The value of our HRS is greater than the price. We will be sure that you get the system that meets your current needs at the best possible price. Then, as your needs grow, we will help you to expand your system as it becomes necessary.

Compelling argument number eleven

InSci looks ahead and stays ahead. This is a growing company of professionals who have tremendous pride in what they have accomplished and, more importantly—an insatiable desire to get better. We look forward to meeting you in person.



Meanwhile, to learn more about ERISA, EEO, Privacy and other issues vital to management—send for our 5-Part Personnel Management Information Kit—free. It will tell you even more reasons why you should buy a personnel system from InSci.

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4204 Gardendale
San Antonio, Texas 78229
512-690-0110

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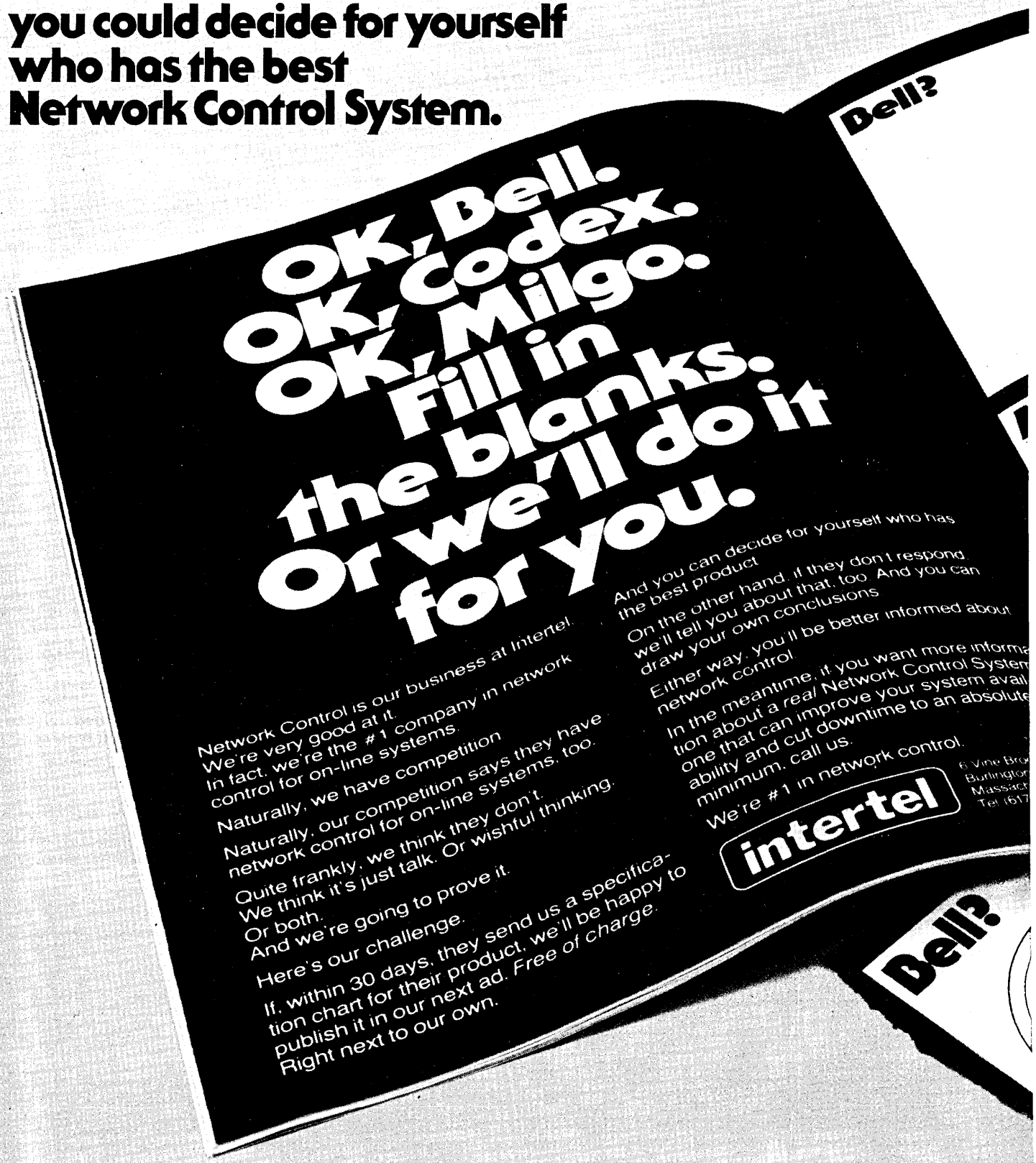
We ran this ad so you could decide for yourself who has the best Network Control System.



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First System Installed 1973
Systems Installed More than 100
Configuration Works with any on-line system
DIAGNOSTICS
Diagnose line, modem, terminal trouble Yes
At all speeds, 1200 baud-9600 bps Yes
Simultaneous with data transfer Yes
In networks with multiplexers, concentrators Yes
English language display Yes
Real-Time line level monitor No
Remote site assistance required No
Meters, oscilloscopes required
RESTORAL
Bypass line failures Yes
All automatic at remote sites Yes
Dial backup at all speeds Yes
1200 baud-9600 bps Yes
On-line spare modem
OTHER FEATURES
Secondary Channel, simultaneous with data Yes
Port Sharing Yes
Modem Sharing Yes
Bridging, analog and digital Yes
Circle 31 on Reader Service Card
Milgo?
NO REPLY
Codex?
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tive effort will not return to Congress . . . Between now and January we have the task of soliciting new support from the members returning and additional support from newly elected members of Congress. Our success in continuing an intensive grass roots program will determine how quickly the legislation will receive attention and comprehensive hearings in the 95th Congress."

There can be no doubt that Bell and its telephone industry allies are out to win. DeButts, in answer to a pointed question from Rep. Wirth during the subcommittee hearings, said he was "pleased with the (legislative) effort to date" and had "no timetable" for enactment. He also admitted, under heavy grilling from Wirth, that AT&T had spent $600,000 for lobbying last year and he claimed that no Bell employee was working full time on the legislative effort.

A spokesman for Wirth indicated that the Congressman was not entirely pleased with deButts' responses, but he added, "the first report under the FCC's accounting order (due Oct. 25) should help clarify things."

John Eger, former acting director of the Office of Telecommunications Policy, speculates that all this brooding over the Bell bill and the money AT&T is pouring into it may be meaningless in the long run. An outspoken critic of the legislation, Eger claims the measure may be "a red herring. All the while we're fighting this one piece of legislation or maybe another piece of legislation to come, AT&T is out there building little Dataspeed 40/4s and slowly getting the FCC to redefine data processing to throw a bigger regulatory umbrella over what used to be a gray area. They can have everything that way. They can't lose."

—Linda Flato

Trade Secrets

Trade Secrets Issue To Be Scrutinized

In the spring of 1972, a former high ranking official of the Federal Bureau of Investigation lunched with another man at the Holiday Inn near the Bayshore and Lawrence Expressway in San Jose, Calif.

At the meeting, the former FBI official, Courtney A. Evans, was introduced to a former IBM technical employee and before the two men parted that day, Evans had given the technical man an envelope containing $200 in small bills. The two men had reached an understanding that the technical man would attempt to gather information about any possible theft of IBM documents or parts relating to IBM's 3340, or Winchester, disc drive technology. Evans was on assignment for IBM.

While the two men agree about the above details and about many details of that encounter and of a later meeting, they differ in legal documents on many other key elements.

They differ on the subject of money, for instance.

The technical man, Alonzo Arthur Wilson, who had worked for IBM for 15 years, maintains that big money was discussed—with the implication that both men could be recipients of big money. In a deposition taken last year and obtained recently by DATAMATION, Wilson said of Evans:

"He made the comment that he had been hired (by IBM) on the basis of performance, that there was much money to be made if he was successful in his attempt . . ."

In his deposition, Wilson also agreed with a statement that he told Evans he would probably need $1 million to attempt to determine whether Forro Precision, Inc., Woodland Hills, Calif., had Winchester material in its possession. Much of the documentation of the incident has been generated in litigation between IBM and Forro.

At any rate, Evans' version was different. He said:

"My proposal to Mr. Wilson was that he follow up on a telephone call that he had indicating that Winchester documents and parts were available on the premises of a supplier . . .

"I proposed that, in accordance with his (Wilson's) feeling that it could be done, that he make a contact during the course of a regularly scheduled visit to Southern California the next week and determine whether or not he could obtain any evidence that stolen Winchester documents or parts were located at this particular vendor . . .

"No promises were made to Mr. Wilson. I did volunteer to meet his expenses that he would undergo in connection with this trip."

Aggressive on trade secrets

The meeting between the former FBI agent and the former IBMer was just one in a series of incidents involving the alleged misappropriation of trade secrets of IBM's disc technology that have been surfacing in various court cases. Documents generated from a brace of legal cases involving IBM reveal that while IBM has been aggressive in charging misappropriation of its trade secrets, few of those charged have been found guilty. Thus far at least. In fact, some IBM competitors like Memorex and California Computer Products, have charged that IBM uses the trade secret issue for harassment. In addition, IBM's aggressive pursuit of the trade secret issue has caused some problems for the computer colossus.

The key is the very definition of a computer industry trade secret. IBM seeks a broad definition of a trade secret, a sweeping definition that would encompass a wide range of its products and interfaces. IBM, for instance, maintains that its interfacing specifications between cpu's and peripherals are trade secrets while automobile manufacturers do not believe that connection specifications between wheels and tires are trade secrets.

Many IBM competitors maintain that IBM, extremely secretive to begin with, seeks to classify material as trade secrets that properly belong in the public domain. The competitors argue that IBM is the de facto setter of standards in the industry and that these standards are public standards and not trade secrets.

IBM has established strict security measures at its facilities in recent years and in spite of this, the firm charges that much of what it regards as its classified and trade secret material has been pirated away and ends up in the hands of competitors. In the most celebrated case to date, Telex was found guilty of misappropriating IBM trade secrets and in the process, of causing more than $18 million in damages to IBM.

Whatever the outcome of the continuing IBM trade secret issue, one thing is sure: IBM has been aggressively pursuing competitors with the issue.

All about Evans

Courtney Evans, already noted, has said he was hired by IBM's general counsel Nicholas Katzenbach in 1970. Evans served as an outside advisor to IBM and one of his assignments was to examine the theft of trade secret information at IBM's San Jose Development Laboratory.

Evans had served in the FBI for nearly 25 years, retiring in 1964 as assistant director of the agency. While Evans was at the FBI he worked as liaison between FBI director J. Edgar Hoover and the top echelon at the Justice Dept. which included Katzenbach, a Deputy Attorney General who later went on to become U.S. Attorney General.

In his deposition, Evans said he reported to Katzenbach "on some occasions" on the work he was performing for IBM.

Another key figure in the San Jose matter was Jack D. Kuehler, who had served as director of IBM's San Jose and Menlo Park Development Laboratories. Legal filings indicate that Kuehler introduced Evans to Alonzo Wilson who

had once worked for Keuhler. Kuehler also provided the cash that Evans gave to Wilson.

No material on Winchester

Nothing apparently ever came of the so-called "Wilson affair" and Wilson, now employed at Memorex, which is locked in a legal battle with IBM, says he told Evans he was convinced that Forro had no illegal Winchester material.

By now, however, Evans was moving in other areas. Although it is still not clear precisely what he uncovered, Evans apparently felt he had some evidence of what he believed was trade secret theft. He called an old acquaintance at the Justice Dept., Assistant Atty. Gen. Henry Peterson of the Criminal Div., and the two men—Evans says they were on a first name basis—discussed the issue.

A high level IBM memo written at this time may give some hint of Evans thinking. In the memo, a top IBM security executive states that he "reviewed some of the vendor involvements that appear in the Memorex suit depositions with Courtney Evans, former assistant director of the FBI, now with the Miller, Cassidy, and Evans law firm in Washington, to determine if he feels there are grounds to pursue some of the vendors for criminal possession of stolen property. He will go to San Jose this Friday for additional information, but his initial take is that we will contact the Fraud Div. of the Dept. of Justice . . ."

Evans presented a document to the Justice Dept.'s Petersen entitled "Synopsis of Allegations Pertaining to the Theft of IBM Proprietary Information."

At one point in his deposition, Evans said he told Petersen in a telephone conversation that his clients had information relating to "possible violation of federal criminal statutes."

Not its policy

In the end, however, Petersen apparently decided not to take any action and Evans said that Petersen told him that "in general that the policy of the Department was not to institute prosecutive action in those cases where the facts have been substantially disclosed publicly through one means or another."

Generally, a company is required to take effective steps to protect against the dissemination of what it regards as trade secrets. Once the material becomes public, a firm can lose the right to claim it as trade secret information.

As for the documents that Evans gave to Petersen, IBM attempted to withhold the documents and Evans' testimony on his meeting with Petersen on the grounds that Evans, an attorney, was protected because of an attorney-client relationship with IBM. Attorneys opposing IBM in the West Coast cases argued that Evans was simply performing investigative work for IBM.

The Federal District Court Judge who is presiding over the West Coast cases against IBM, Judge Ray McNichols, did not accept the IBM argument, however. He ruled that Evans must produce a copy of the documents he gave Petersen and that he must testify about his meeting with Petersen.

"In my judgment," said Judge McNichols," Evans was about as far from being a private citizen who was outraged in reporting something to the government—he was a hired fink who was there to do that kind of a job . . ."

At any rate, the whole issue of computer industry trade secrets will be examined in close detail as the West Coast cases unravel. The case involving Courtney Evans can be expected to be examined in court testimony, but more important, the whole question of just what constitutes a trade secret will certainly be raised and perhaps even answered.

—W. David Gardner

Credit Checking

An Unsophisticated Computer Crime

Mini-skirted but demure, looking very much like Sally Struthers in her Gloria Bunker role, a young, unemployed Anaheim, Calif., clerk testified in a little girl voice to actions that led to the conviction of six men on counts of conspiring to alter the poor personal credit ratings of individuals whose records were kept by the Credit Data Div. of TRW Inc.

The records were stored in a computer. Was it a computer crime? It was ballyhooed in the popular press as such. But listening to Kathleen Bennett, late of TRW tell it, it came off as something less.

For one thing, Kathleen is hardly a computer expert. She was an unindicted co-conspirator in the fraud case, tried in a Los Angeles federal court. But she was the one who did the real work.

A TRW vice president, C. Lee Jensen, described her job as "quality control clerk." She was a part of the Consumer Relations Dept. formed in the late '60s when the Fair Credit Reporting Act was passed, permitting credit applicants access to their files.

When a credit applicant disputes his record, Jensen explained in court, the disputed items are discussed with the company which supplied the information. Sometimes this is done by phone, he said, and sometimes by mail. "Some companies don't want to handle this on the phone and we know who they are." When it is handled by mail, TRW waits 10 days for an answer. If there is none, the disputed item is removed from the person's record. If the supplier of the information contends he was correct, the credit applicant is entitled to have his version of the particular incident entered into his record. It was Kathleen Bennett's job, Jensen testified, to verify that the necessary changes in a given record had been made.

If the record wasn't correct, she would mark changes on a computer printout and, as she put it, "give it to people who would give it to the computer." She explained the "sophisticated" code she used—circling an item meant it should be deleted, 12 meant an item had been paid satisfactorily, a U meant new information and so on.

Kathleen joined TRW in January 1972 in the data entry department. She went to Consumer Relations in March of 1972. She testified to having gotten something going for herself on the side in 1973.

That was when she started altering records for money. She would obtain printouts of records of people whose credit needed "cleaning" and would change them just as she would those records where proper changes had not been made. She would initial each changed printout.

An attorney for one of the six defendants in the Los Angeles trial asked Jensen if Kathleen had a supervisor who would initial her changes. At that time, Jensen said, she was the only one with her kind of job and there was no one initialing her changes. Presumably changes have been made.

"At that time," quipped the questioning attorney, "there was nobody guarding the dike."

The trial lasted four days and included testimony from a number of people whose credit records had allegedly been altered. The six convicted admitted that they had caused credit ratings to be fixed but denied the conspiracy charges. In fact, most of them denied even knowing each other.

The so-called ringleader, Philip Kostoff, 31, was the only one who admitted knowing all of the others and the only one known to and knowing Kathleen Bennett.

Bennett said she met Philip Kostoff in mid-1974. She said he had heard of her altering credit records for an air conditioning firm he worked for and called her to ask for a meeting. They met and she agreed to alter records for him, she said.

"Did you tell him how you did it," an attorney asked.

"Yes," she said. She added that she knew which bad debts were the best to cancel because she knew which companies destroyed records after short

periods of time.

Assistant U.S. Attorney Joel Levine referred to the other five convicted men as "finders." They all had jobs that brought them into regular contact with people who needed credit changes. "They would divide the fee," he said.

Bennett testified that she'd altered some 100 records at Kostoff's behest. She said she'd been promised between $50 and $100 per change, depending upon the complexity, but that she'd only received a total of $1,000. She did say Kostoff had given her a color television set for Christmas and a cigarette lighter on another occasion.

The people who testified that their records had been altered included a doctor, a law student, two accountants, a real estate salesman, an auto salesman and a businessman.

Convicted with Kostoff were his brother, Paul Kostoff, 35; Ronald C. Rossi, 41; John R. Dubos, 41; Kenneth L. Stevenson, 39; and Sean Shanahan, 35. All have indicated they will appeal their convictions. None was a computer expert.

During the trial, Levine made it a point several times to let it be known to the jury that "TRW is not on trial here." Some of the defense lawyers seemed to want to put TRW on trial but federal judge Manual Real was having none of it.

When one tried to bring out the fact in questioning Jensen, that the Federal Trade Commission, separate from this case, is investigating TRW Credit Data to determine whether the credit bureau is taking responsible precautions to ensure the accuracy of its files as required by the Fair Credit Reporting Act, Levine quickly objected and the judge, just as quickly sustained the objection.

The six convicted were scheduled to be sentenced Nov. 8. They face a maximum of five years in prison and a $10,000 fine on the charge of conspiracy and two years in prison and a $5,000 fine for each count of causing false reports to be issued.

Kathleen Bennett, when last heard from, was alive and well and living in Anaheim.

—Edith Myers

Retailing

POS: Retailers Are Getting There

The promises for point-of-sale (POS) of the early '70s haven't been attained yet but some companies are close and the future is clear.

This promise was made by Otto Becker, Arthur Andersen & Co. at the National Retail Merchants Assn.'s (NRMA) Annual EDP & Datacommunications Conference last month in Phoenix. "We haven't significantly changed the number of registers as was promised in 1971," said Becker, "nor have we increased selling area personnel productivity or achieved much in people savings. Those, by and large, are future benefits not yet realized."

The big benefits to date from POS, he said, have come off the selling floor. "Sales reporting costs are way down. Credit has been greatly impacted. Speed-ups in billing are generating cash."

He added that the accumulation of volumes of data at the detail level has made it necessary to upgrade cpu's, offsetting some of the savings.

What is clear for the future is that point-of-sale is here to stay and is spreading. Becker spoke at a session titled "Point of Sale: an Evaluation of the Current Status." It attracted a crowd too big for the room in which it was held but people stayed, shoulder to shoulder in the packed room and five and six deep into the hall, straining to hear.

Record attendance

The conference itself had a record paid attendance of some 800. Larry Abzug, NRMA's new executive director, explained that 650 were expected at the time the site was selected.

Les Chick, Touche Ross & Co., Inc., said at the status session that his company makes a habit of asking stores why POS. "The predominant answer is, we're opening new stores. We're not going to buy traditional cash registers. It's an investment in the future."

Gene Wycoff, Arthur Andersen & Co., talked about the future in a session on "Advanced POS Applications." He focused on what he sees as four basic trends: bigger minis in-store; inquiry via registers; more in-store printers; and more in-store crt's.

The trend toward bigger minis in-store, he said, will mean more in-store computing power, more power at the registers, and a greater possibility for distributed processing. He said inquiry via registers will lead to more functions at the point-of-sale, reduction of the central staff, heavier store training requirements, and electronic cash register obsolescence.

The importance of involving people in retail systems was mentioned time and again during the conference. First to bring it up was conference keynoter Donald V. Seibert, chairman, J. C. Penney Co., Inc.

From the ranks

"People make effective systems happen," said Seibert, the rare chairman of a large retail chain to have come up through data processing. "The system must belong to the user. No system is effective unless the user really wants it to work."

Toward this end, he said, Penney's uses systems advisory groups made up of users, systems people and top management people.

A systems approach, Seibert said, is not a computer approach but a productivity approach. "The only purpose of systems is to help people and people are becoming more knowledgeable and more demanding every day. We must prepare people to accept our systems. Systems people are in fact business people in the mainstream of retailing."

In a session on "Developing Customer Profiles" three speakers noted that they work closely with their stores' advertising and sales promotion departments to determine what these profiles should be.

John Danahy of G. Fox Co. said his department worked with advertising to identify merchandise groups. They have identified 76 different direct mail groups based on past purchase history and these can be stratified by $10 increments if the store wants to reduce the size of a mailing. If it wants to increase the size, Danahy said, we have a supplemental geographic mailing. "We've plugged in occupied housing data from the census."

Fights mail costs

John Silton, Neiman Marcus, said refining mailing lists based on past purchase history and response to mailings history has helped Neiman Marcus face up to mailing costs which he said have increased 25% in the last three years. In the spring of 1976, he said, with 13% less mail than in the same period in 1974, they had a 12.2% response compared to 10.9% in '75 and 9.3% in '74.

Jerry Montgomery, J. C. Penney Co., wondered from the audience if any session's speakers were following the activities of the federal Privacy Protection Study Commission. The answer was no. Montgomery recommended they do this and also that they track privacy legislation at both federal and state levels. "It could affect everything you're doing."

Privacy was one of the concerns of Carol Tucker Foreman, executive director of the Consumer Federation of America. Foreman said she's all for technology but insisted that technology be "applied in a way consistent with human needs."

She said what she's seen so far of point-of-sale in department stores shows her that it costs the consumer time. "We've taken one step backward.

By the time a clerk finishes keying in a purchase 1 figure he's keyed in his life history, my life history and maybe the store's too."

She would like some guarantee that savings resulting from POS would be passed on to consumers as well as to stockholders and employees "but they're better organized."

Funny little wands

Foreman admitted she had little first hand contact with the technology involved in POS "except for the time that Bob Capone (of J. C. Penney Co.) came into my office with his funny little wands."

To R. L. Bartlett of Touche Ross & Co., the technology of POS is his daily bread. He consults to the retail industry on all aspects of dp. He talked to the NRMA conference on "The Philosophy of Distributed Computing."

He said IBM and NCR are on "the leading edge" of what retailers are doing in distributed processing "but all the players have a product line for distributed processing, each with its own communications protocol." He wondered if there would ever be an industry standard protocol.

"X25 (a protocol standard proposed by the Consultative Committee for International Telephone and Telegraph—CCITT) is being kicked around but personally I don't think it'll fly in terms of private networks. I can see X25 coming in if public networks can come up with it."

He said retailers are working with both hierarchical and ring networks in their distributed processing. "The purists like ring networks. There's no central control and no rigid up and down routing. Each computer has access to data of all others." Montgomery Ward, he said, is working on a ring network.

SNA is hierarchical

IBM's Systems Network Architecture (SNA) is hierarchical, he said. IBM's retail store system is controlled by a System 370. It includes a front end processor and a store controller which essentially is a store and forward device which can be used as a mini.

He looks forward to a time when there will be "real processing at the terminal" and called NCR's new 2151 terminal, introduced during the conference, "the leading edge" toward this end.

The 2151 is a self-contained, totally software-driven retail terminal which gives retailers the ability to instruct the system to do whatever he wishes.

NCR's 2151 RETAIL TERMINAL: It's programmable and, according to one consultant, the "leading edge" of a trend toward more processing at the terminal level.

D. J. McCarthy, NCR's vice-president, Domestic Retail Systems Marketing, said the 2151, like a mainframe computer, "has its own powerful processor and uses a type of memory that can be easily programmed or changed."

The 2151 is a successor to NCR's interactive 280 terminals but stores with 280s will be able to use the new terminal in their systems without disrupting present operations, McCarthy said.

The 2151 was probably the most exciting new product introduced at the conference but there were others. General Instrument Corp.'s Unitote/Regitel Div. introduced the 420A computer-controlled terminal with a 16 character full alphanumeric display and a 23 key interactive keyboard, and the 425, an intelligent terminal with full standalone capability.

TRW's "almost new"

TRW attracted a lot of attention with its almost new (announced last May, June p. 166) 2001 retail POS system.

IBM used the conference as an occasion to announce enhancements for its systems for front end checkout. They include item look-up, faster change making, and an optional flexible keyboard and will be available in March 1977.

Many of the retailers at the show were complaining that vendors were offering them more than they really need. "What about the little guys," asked one during the status of POS session.

"What a lot of them have done," said Arthur Andersen's Becker, "is buy electronic cash registers from Japan."

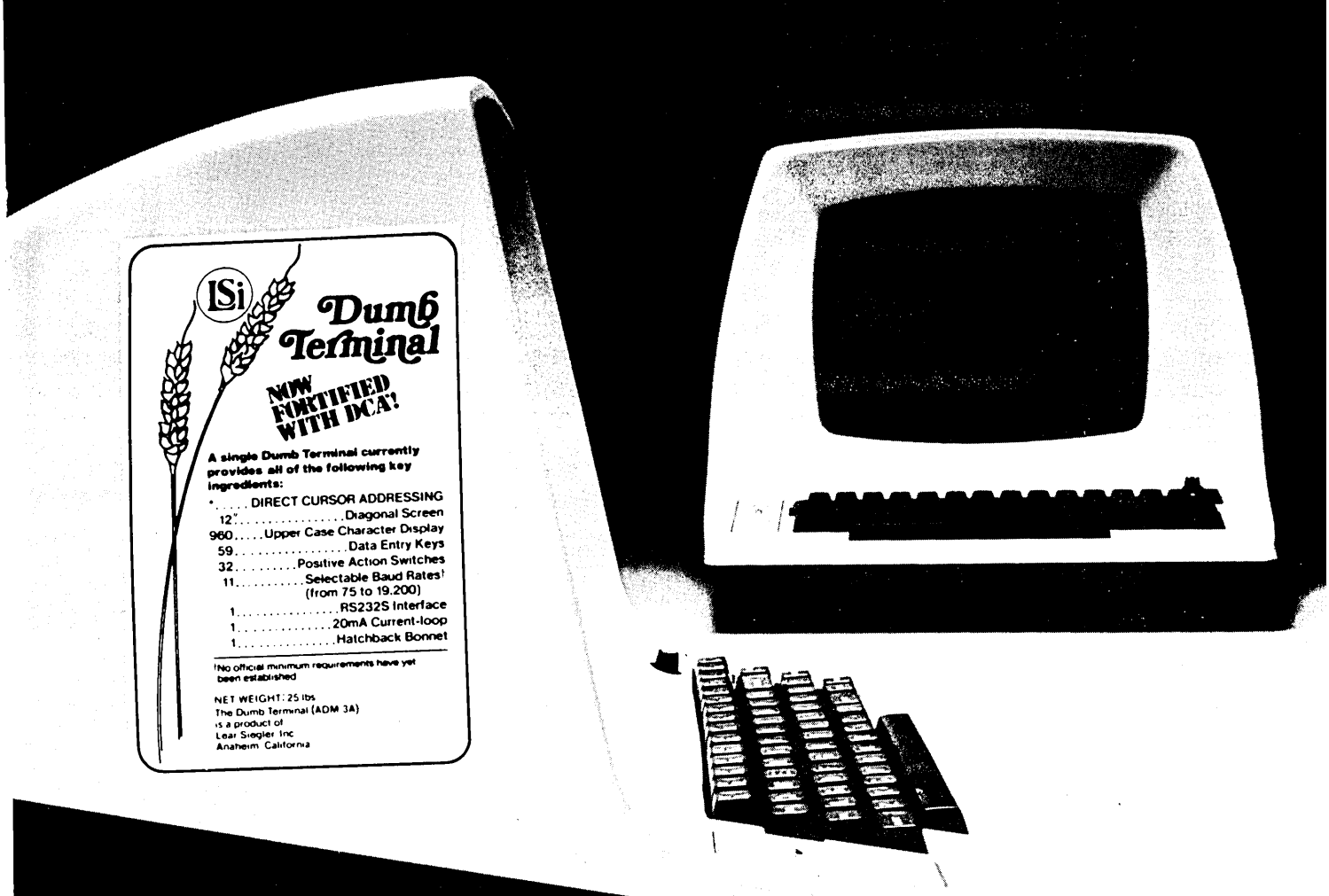
Another solution was offered by Charles Haycraft of MSI Data Corp. who told of two stores who are using his company's portable data entry devices as POS systems "recording POS information when they have the time."

Utilities as an alternative

Becker talked about utilities as an alternative. "The idea of a utility appealed to me tremendously in the early '70s. Some have been marginally successful and there are a couple in Chapter XI. It's a little bit early. It takes a lot of fortitude and a lot of capital to make it fly."

Joe Lev, Cresap, McCormick, Paget & Co., in the status session, suggested eight questions a company considering going to POS should ask itself. 1. Has the company agreed on an objective for its POS systems? 2. Are the present systems installed compatible with the POS environment? 3. What's the most effective POS system for your company? 4. What features are desired? 5. What costs will be incurred and what are the capabilities required? 6. What human resources will be needed to support the system? 7. What will be the benefits? 8. How long will it take?

"Answering these questions," Lev said,



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CIRCLE 22 ON READER CARD

"is ten percent of the total effort of implementing POS."

And how would you cost this? This was the topic of Cecil Myers and Emilio Fontana of Sweda in a session on "Economic Justification of POS." They conveyed the impression that POS is hard to justify on a cost basis.

Myers said a viable method for evaluating POS has not yet been developed. He said there are two ways of looking at this—cost effective evaluation and cost benefit evaluation. Cost effective, said Myers, is easier because it assumes outputs are fixed. "Cost benefit removes the constraints of fixed outputs but benefits are harder to come by."

The case of "Big Store"

Fontana described a cost justification prediction Sweda had done for a chain he called "Big Store." They considered savings in 1971 in people, keypunch volume, machines and ticket conversion. Equipment was installed for "Big Store" in 1972. Four years later, Fontana said, Sweda found it was off on its estimated savings by a factor of five. The Sweda estimate was low.

The problems for U.S. retailers who are implementing POS are obviously numerous. As Penney's Seibert put it, "Nothing in retailing is easy except losing your shirt."

Possibly some of the retailers attending the NRMA conference took some comfort from a luncheon speech given by I.A.J. Anderson of the John Lewis Partnership of the United Kingdom. The Partnership operates a number of department store chains as well as a supermarket chain called Waitrose.

The company has been interested in data processing since 1960 when it started using an IBM service bureau for stockholder dividend payments. It got into POS in 1968 with Sweda equipment and had its first full store installation with Pitney Bowes Alpex in 1973. This was switched in 1974 to NCR. Now they have a number of NCR and IBM installations.

But along the way they had to deal with things like the switch to decimalization on Feb. 15, 1971. "We put an embargo on systems development for six months either side of the switch." Then, when England joined the European Economic Community, tax levels were changed creating more problems for POS implementers. Last but not least was the switch from Imperial to Metric. But, there'll always be an England and it looks like POS is there too.

—Edith Myers

Not Quite Universal But It's Coming

Universal Vendor Marking (UVM), the department stores' version of the grocery industry's Universal Product Code (UPC), is still a long way from being universal but retailers, suppliers to retailers, and equipment vendors are beginning to take it seriously.

The National Retail Merchants Association adopted OCR-A as its standard for UVM more than two years ago. It still hasn't taken hold but reports from last month's National Retail Merchants Assn.'s Annual EDP & Datacommunications Conference indicate its time may be coming soon.

And more than that. Vendors of point-of-sale equipment to retailers, sniffing the wind, have unanimously endorsed the idea by adding wanding attachments to their equipment. Almost all showed wand attachments with their retail terminals at the NRMA conference.

Recognition Products, major supplier of all the scanning wands, was tucked away in a remote corner in the NRMA exhibit area but this didn't bother a booth staffer. "Our wands are in all the other exhibits too," he said. This wasn't quite true but almost. At the Recognition exhibit a wand was hooked up to a Singer POS terminal. Strange? Not to the staffer. There are still a lot of them out there. But they're TRW now.

Bill Friel, J. C. Penney Co., head of an NRMA UVM Product and Research task force, said the addition of wanding capability by all the major systems vendors indicates "UVM has come of age over the past three years."

He said one of the things his task force is doing is developing a catalog of equipment, service and systems for creating, attaching and reading UVM tickets which will be published this December.

Cooperative venture watched

Dave Carrington of Foley's department stores reported on the results of a much watched pilot, a cooperative venture of Federated Department Stores (Foley's parent firm), NCR, and Levi Strauss. Levi Strauss is marking corduroy and denim jeans for Foley's with the NRMA's recommended OCR-A marking. These are being sold and wanded at seven selling locations. First delivery of marked jeans was last April 12. Scanning began July 17 and was underway at all locations by Aug. 10.

Carrington said more than 50,000 tickets have been scanned so far and "preliminary results are exciting." The print quality, he said, is "excellent and a sampling indicates that fewer than one percent of the OCR-A tickets have contained data errors." He said wand reading at the point-of-sale is 50% faster than keying and much more accurate.

Customer acceptance, Carrington said, "ranges from apathy to enthusiasm and excitement." He told of a boy of about 13" who came through a scanning department with his mother and said, "Gee look Mom." The mother, he said, was the other extreme. "That's nothing. Toys R Us has been doing that for years."

He said the reactions of the sales people have been good. "Most of them are excited. They like the idea of having more of the right merchandise on the shelves."

The project has been successful so far, he said, in spite of the fact that "we were opening a new store in the middle of this." One thing the store learned, he noted, was the importance of communicating the values and importance of scanning to the sales force. They do this by means of videotape training programs. "Any problems we had were outside of OCR-A."

Barbie from Mattel

Show and tell was part of the UVM presentation of Fred Helm of Mattel toys. He'd brought Barbie with him. It was a prototype Barbie marked with the OCR-A code. He said Mattel hopes to have "a significant number of our products marked with OCR-A by the end of 1977. "The better you do your inventory control," he told retailers, "the better we can do our sales forecasting."

"My goal by the end of 1979," he said, "is to have more than 80% of our products marked with OCR-A." He said the packaged goods industry has been doing a lot of homework and has learned such things as the fact that if there's a blister over a UVM mark, it still is scannable. He called upon retailers, suppliers of printing equipment, and suppliers of scanning equipment to "give us simple equipment and simple specifications."

Joe Miller, director of Universal Vendor Marking for the NRMA said that 54% of the merchandise categories handled by retailers already are marked by suppliers with some printed form of stock keeping unit (SKU) information. He feels this could, as easily as not, be printed in OCR-A. He said his group within NRMA is working with 56 vendor trade associations. Five, he said, have "established committees to interface with us." He said 15 are involved in developing size codes and more than 100 have had considerable direct contact with his committees.

"They're (the suppliers) waiting for retailers."

Miller said his group also has reinstituted negotiations and activities with the

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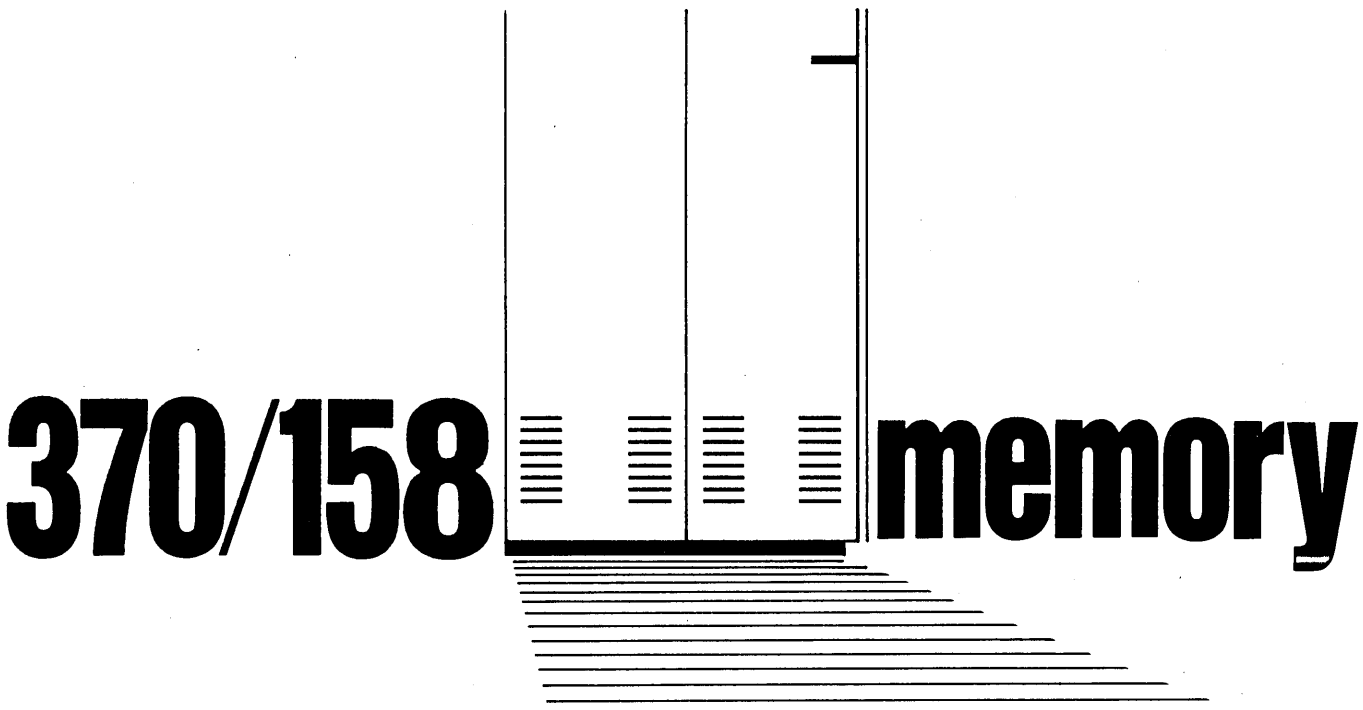

CIRCLE 10 ON READER CARD

food industry toward establishing a compatible bridge between the UPC and OCR-A.

Waiting for retailers

W. D. Power, Touche Ross & Co. echoed Miller's feeling that the suppliers are waiting for retailers, a feeling that has been repeatedly voiced since the NRMA's adoption of OCR-A as its recommended marking standard. "Equipment suppliers and merchandise vendors are on the fence," said Powers, "because there is not a clear commitment by retailers yet. They don't want to embark on an ambitious program yet."

Carol Tucker Foreman, executive director of the Consumer Federation of America, had something nice to say about OCR-A at the conference. "You're one step ahead of the supermarkets," she told the retailers. She was referring to the hassle over the non-readability of the UPC bar code and the removal of item price marking in some instances. "At least OCR-A is human readable." ✲

Litigation

Shades of Telex? No, Says Catamore

Industry-wide feeling that "IBM won again" is not shared by its ex-customer, Catamore Enterprises Inc. Last month, Catamore filed a petition for rehearing of an appeals court judgment that called for a new trial in its case against IBM.

Sept. 30, the U.S. Court of Appeals for the First Circuit decided that a jury verdict—that IBM had to pay the Rhode Island jewelry manufacturer $11.4 million in compensatory damages (Aug. '75, p. 57)—had to be set aside. The appeals court called for a retrial based on its finding of error in the instructions to the jury made by presiding Judge Raymond J. Pettine. The original trial lasted 57 days topped off by nine days of jury deliberation.

Catamore's chief lawyer, Thomas Christo, and his staff worked 14 days to dissect and rebut the appellate decision. "This court blames Judge Pettine for what IBM did," says the Catamore petition for rehearing. It further alleges mistake after mistake on the part of the appellate judges and implies they couldn't have read the testimony and appeals briefs in their entirety. It states that the error said to have been made by Judge Pettine involved verbiage that IBM itself contributed to the instructions.

Catamore further claims that the appeals court violated the Seventh Amendment by coming to its own decisions on certain conflicting testimony—decisions that only the jury can make: "The Seventh Amendment says that 'no fact tried by jury, shall be otherwise reexamined in any Court of the United States, than according to the rules of the Common Law.' "

While petitions for rehearing are seldom granted, the Catamore lawyers are hoping the assertion of constitutional violation alone will lead to some kind of reconsideration. If the Appeals court denies it, Christo says that the issue will be taken to the Supreme Court. If all fails, a new trial will begin. It's not over yet.

What's at stake

What is at stake for Catamore is compensation for the damages to its business that allegedly resulted from an unsuccessful four-year effort with IBM to automate its business. It threw out the IBM system in 1972, was sued by IBM for back rent, and countersued for fraud, negligence, and breach of contract and warranty. In 1975, a six-member jury delivered a unanimous decision on the basis of compensatory damages. Punitive damages were not cited, and the precise charges that figured in the verdict were not spelled out, as is the cus-

tom in jury verdicts. IBM then appealed.

Just what did the Appeals court decide for and against in its judgment? First of all, it concurred with the admission into the case of oral agreements on the provision of a software system. In an industry in which software has predominently been contracted for orally, this point is vital. Christo said the precedential value of the Catamore case in this regard remains.

The Appeals court did not make a ruling on the damages accruing from negligence, fraud, and misrepresentation. It did note that IBM's objection in appeal to negligence claims was not made in trial, so could not be ruled on belatedly. Also, it did not rule out fraud findings in a new trial.

The appellate judges did decide that Judge Pettine erred when he allowed the jury to "find that both the SES (Systems Engineering Services) agreement was valid and that IBM was liable to Catamore for having breached their oral agreements." This is a problem users often face with a computer vendor in or out of court. What was promised orally often differs with what was committed to in writing and the written word generally supersedes oral promises.

In the Catamore case, the jewelry maker and IBM committed to oral agreements in 1968 and in 1970, and to a Systems Engineering Services agreement in 1969. All concerned software systems for production control and other applications. In almost no instance did IBM and Catamore agree on the services and software these contracts actually covered. Catamore thought that the 1968 oral agreement provided for a turnkey production control system including programming. IBM witnesses said, not so, just system design.

Result of unbundling

The SES agreement, which entered the scene as the result of unbundling in 1969, was another bone of contention. IBM witnesses said it covered "new work." Catamore thought that it covered the 10% of the work that IBM said remained to be done from the oral agreement, and that its cost would approximate the 3% rental reduction due to unbundling. (Catamore introduced the element of fraud here since it alleges it subsequently found that the work was not 90% complete when it entered into the SES agreement and was induced to enter it under false pretenses.)

In IBM's written SES agreement, as is common with many contracts, a statement says that it supersedes all previous agreements, written or oral, and its liability is for one year after any accrual for cause of legal action. IBM put forth the claim that the SES agreement wiped out any oral agreement and further that its liability period had expired by the time Catamore sued. According to the petitions, the irony is that at the time IBM pushed this notion, its own witnesses said the contract was for "new work," and seemingly separated it from the oral agreement.

"What we have here," the petition points out, is conflicting evidence and testimony. The Appeals court however, decided to believe a little bit of both. It opted for Catamore's contention that IBM was to provide a turnkey system, and therefore, for IBM's contention that the SES agreement superseded the oral agreement. Hence, says the Appeals court, Judge Pettine should not have allowed the jury to "find that both the SES agreement was valid and that IBM was liable to Catamore for having breached the oral agreements."

The Catamore petition screams loud and long that the Appeals court had no right to make any such decision. With conflicting evidence, the jury had to decide what was valid, and according to the Seventh Amendment, "no fact tried by jury, shall be otherwise reexamined in any court of the United States . . ."

The other major assertion of the petition is that IBM was responsible for the errors Judge Pettine is supposed to have made in his instructions to the jury. IBM's own request and additions to those instructions were used by the judge verbatim. Below is the petition's comparison of what the Appeals court said was

in error and what IBM requested that caused those errors.

1. Appeals court: "Here we think the judge improperly permitted the jury to conclude that the SES agreement, if not voided by fraud, had no effect on Catamore's claims of breach of the 1968 and 1970 (oral) contracts . . ."

IBM's *Requested Instructions to the Jury,* April 28, 1975: "Conversely, if you find that the subject matter of the alleged oral contract was sufficiently differentiated from the subject matter of the SES agreement, so that the latter was not intended as a substitute for the former, then you may consider such oral agreement in determining whether and to what extent IBM is liable to Catamore for breach of contract based on its alleged failure to furnish Catamore with a totally integrated computer system . . ."

2. Appeals court: ". . . the district court erred in permitting the jury to find both that the SES agreement was valid and that IBM was liable to Catamore for having breached the two oral agreements."

IBM addition to the Court's Proposed Charge: June 3, 1975: "In addition you may award Catamore damages for prospective lost profits if you find . . . (5) that such lost profits did not result from any transaction within the scope of either the Machine Services Agreement or the SES Agreement, if you find those agreements to be valid and binding . . ."

Says Catamore, "Of course, at the close of the charge, IBM did not object to that portion of the charge for which it was responsible in the first place . . . in its opinion, this court has dismissed the negligence 'issue' belatedly raised by IBM on appeal because IBM failed to take the steps required to preserve its substantive objections . . . and yet two pages later this court sets forth another ground for vacating the verdict upon which IBM not only did not 'take the steps required' to preserve its objection, but which IBM actually invited and urged."

The petition does not stop there, going on to show numerous misstatements of fact in the appellate opinion. While noting the fine reputation of this court, Christo feels that their "errors" were probably caused by the sheer volume of the testimony and briefs. "Judges basically don't have the temperament or the time to devote to fully appreciating the significance of all facts in a data processing case."

If no higher court appreciates the assertions of the Catamore petition, it's back to the courtroom. Christo is thankful that many of the long arguments in the first trial would not have to be fought again in a retrial. Instead of the 56 days, the next battle could require a mere 35 days, he said.

In the meantime, other user vs. vendor suits sit on Christo's back burner. The Catamore setback has had a bad psychological effect on other users who are mustering courage to fight similar battles. But the "imprimatur" given oral agreements in this case, plus the fact that there was no reversal as in the Telex-IBM case, is "very significant." A reinstatement of the "bottom line" result for Catamore would be even more significant.

—Angeline Pantages

Memories

"A Commitment to End Users"

Electronic Memories & Magnetics Corp. will be the largest lessor of add-on memories for IBM mainframes when its acquisition of Cambridge Memories Inc.'s lease base is completed late this year.

The Los Angeles based firm acquired the CMI lease base from a group of banks headed by the First National

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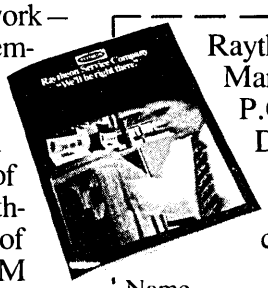

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CIRCLE 57 ON READER CARD

Bank of Boston which called loans toward which Cambridge had pledged the base, valued at $13 million, early this summer.

Tony Coppola, director of sales for EM&M also will have a new subsidiary, EM&M's Systems Equipment Div., said the acquisition is based on royalties. He said Telex had been approached by the First National Bank of Boston with "another kind of deal" because Telex was a customer of the bank and that "other firms had made offers" but he feels EM&M was the natural for the acquisition. "We're the only ones who could upgrade that customer base. Third party leasing companies who didn't even know we were considering the acquisition were calling us to find out what we could do."

Coppola said the Cambridge base, added to what EM&M already has, will give them from 900 to 1,000 add-on memory units on lease. When the acquisition is complete, EM&M also will have a new subsidiary, EM&M Systems, which will control the Cambridge lease base and will encompass EM&M's System's Equipment Div. which also is kind of new.

The company in early July restructured what had been its Computer Products Div. Three operations within the division were given divisional status. One was the Systems Equipment operation. The other two were Peripherals and Media operations. With the restructuring, the Computer Products Div. became the Computer Products Group.

Renaming and new status for the Systems Equipment Div. coincided with some personnel changes. Coppola rejoined EM&M after an eight month absence. Richard Bravo, who had been division general manager, resigned and went into real estate. Ed Farris, vice president, Computer Products Group, "for the near term" assumed Bravo's responsibilities.

Coppola, who said he really wasn't sure why he left EM&M in the first place after five years with the firm, said he returned because "of the commitment of the people to support the end user product line and a commitment to provide add-on memories for IBM's total product line including such non-mainstream cpu's as the 155."

168 add-on

EM&M's latest product announcement was for a multi-memory/168 processor storage system for the IBM 370/168 computer. Initial deliveries will begin in the fourth quarter of this year. Coppola said the 168 add-on is designed for cpu memory capacities of up to eight megabytes on a single processor and 16-bytes on a multiprocessor. It is completely compatible and attachable to all 168 models.

He said EM&M is offering deferred maintenance which permits an operator to detect any memory failure via lighted display on the memory panel, and correct the failed memory block by flicking a switch. This, he said, automatically removes the block from the system and restores storage address continuity. "Operation can be continued until the system is conveniently available for repair."

The 168 add-on uses EM&M's 4K static NMOS RAMS produced by a subsidiary, SEMI, in Phoenix. Coppola said EM&M and IBM are the only ones with static technology and producing a 4K static chip. "We had been selling the technology to Cambridge," he said.

Because of this chip, Coppola believes that EM&M through SEMI has the best chance of coming to market with an add-on for the 148. It's because of the static chip's speed, he explained. "Nothing else is fast enough."

Coppola also said he was happy he's heard "rumors that IBM is going to increase the speed of the 370/158. If that happens, because of the static chip,

we're the only ones (of the add-on memory makers) who could adjust."

Coppola feels EM&M has been too quiet about its accomplishments of late. "We were a part of the Viking Mars mission with memory and we're on a lot of airplanes and how many people know about that?" He said Martin Marietta, prime contractor for Viking, gave EM&M a supplier award.

The company, which had a loss of $2,244,000 in 1975, had a good first six months this year. Net income was $5,476,000 on sales of $22,372,000. ✲

EFTS

EFT: Opposition And Progress

In remarks made to an American Bankers Assn. Senior Operations Management Seminar in Phoenix, NCR chairman William Anderson compared the evolution of electronic funds transfer (EFT) to an unfolding drama which involves the sometimes-conflicting interests of several principal actors including financial institutions, retail stores, consumers and government.

All of the actors are extremely vocal.

At the Annual EDP & Datacommunications Conference of the National Retail Merchants Assn. in Phoenix, Carol Tucker Foreman, executive director of the Consumer Federation of America told retailers that she fears EFT more than point-of-sale and sees less potential benefit for consumers from EFT.

The things she worries about, she said, are loss of control, privacy, loss of ability to play the float and potential

WILLIAM ANDERSON
EFT—an unfolding drama

loss of proof of payment and the ability to stop payment. She also is concerned about resolution of computer errors and would like to see guidelines developed where an EFT system involves both banks and retailers as to where the accountability lies.

Del Olson, assistant corporate controller, Dayton Hudson, spelled out a retailer's position at the same conference. "Financial institutions are developing their programs with not enough recognition that retailing should be a partner," he said. "Our POS is sacrosanct. We have no intention of relinquishing control. The cornerstone is the POS terminal. To banking this is a tool. To us it is far more than the simple recording of a monetary exchange."

Bankers must understand

He pointed out that "bank systems are based on magnetic card technology which is not compatible with our OCR technology. We do not want to impair our POS equipment with costly modification. Bankers must understand."

EFT, said Olson, "can only succeed with our cooperation. Retailers should insist that there not be any encroachment on our proprietary interests."

He urged retailers to oppose any regulation or legislation mandating sharing, to oppose legislation restricting activity, to support open access to credit and "to talk to our banker friends on an eyeball to eyeball basis. We can't sit back and wait for the financial community to come to us. We have to go to them."

Role of the government

In his ABA talk, Anderson said a question mark in the unfolding EFT drama

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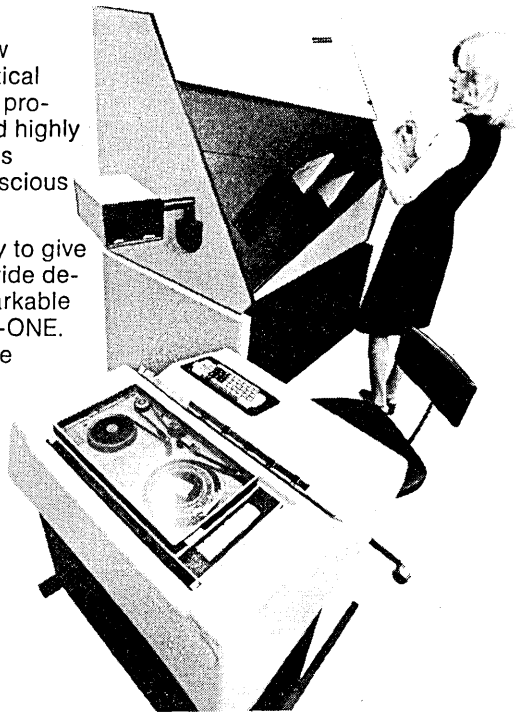

CIRCLE 65 ON READER CARD

is the role of government. He said future government action will probably be shaped by two principal objectives:

"The first will be to insure that the consumer shares in the benefits of EFT; the second will be to stimulate greater competition among all institutions that provide financial services."

At the NRMA conference, George White, Jr., vice president, The Chase Manhattan Bank, dismissed consumer concern with the argument that they don't have to use EFT if they don't want to. "Just because we have helicopters we don't all have to use them to commute to work."

In Chicago last month, two EFT leaders, Continental Illinois National Bank & Trust Co. and First National Bank of Chicago, reacted to a refusal by The Supreme Court to hear their EFT case in which a Federal Appeals Court had ruled their unmanned teller terminals constitute branch banking and therefore are illegal in Illinois.

First National senior vice-president, James A. Cassin was disappointed but noted "on the positive side, the action once and for all puts the issue of electronic banking squarely before the lawmakers at the federal, state, and city levels."

William D. Plechaty, senior vice president of Continental said the Supreme Court's refusal to review the lower court decision "represents an inconvenience to the many consumers who already have enthusiastically adopted and accepted these more convenient banking locations. At Continental, this affects the customers who conducted more than 4,500 transactions last month at our facilities at Two Illinois Center and the Chicago and North Western Station—the only two Continental units affected by the court's decision."

He said Continental will close these two facilities when ordered to do so. "We also will continue to raise this important issue on the state and national legislative levels."

New actor

And, while the Comptroller of the Currency still looks on customer-bank communications terminals (CBCT) as branches, a new actor in the EFT drama, Micor, a wholly owned subsidiary of Ramada Inns, has signed a contract with the Nebraska Electronic Funds Transfer Service (NETS) to install a network of such terminals, which has the approval of the comptroller and the Justice Dept.

In this case, explained Tom Castleberry, president of Micor, the terminals will be shared by some 300 of the 400 commercial banks in the state and consequently cannot be considered branches. Micor's primary activity is in hotel reservations.

In New York, The Equitable Life Assurance Society of the United States, the nation's third largest insurer and a leader in the electronic preauthorization of payments, is trying to muster support for a proposed giro project using the New York Automated Clearing House.

The giro approach would permit a customer of a number of corporations to pay one bill or several bills at once by instructing his bank to pay the billing corporation. The instructions could be given to the bank in a number of ways including telephone order or plastic card. After receiving the consumer's instructions, the bank would debit the customer's account and direct a credit through the ACH to the corporation's bank account.

Raymond C. McCron, vice president and treasurer of Equitable, said interest in the project has been expressed by such large billers as Consolidated Edison Co., Public Service Electric & Gas of New Jersey, American Telephone and Telegraph Co., and Metropolitan Life Insurance Corp.

NCR's Anderson summed up the EFT

situation nicely in Phoenix. "The real question today is not whether EFT will become a major payments medium, but rather how major it will become and how rapidly it will develop." ✲

Applications

Computer Aids French Skipper

A small computer kept permanent watch for veteran French skipper Alain Colas aboard the world's largest racing yacht this summer during the 1976 Observer Single-Handed Transatlantic Race (OSTAR). Colas, who won the quadrennial race in 1972, placed second this year to fellow-Frenchman Eric Tabarly, also a previous OSTAR winner, who skippered the 73-foot *Pen Duick VI.*

Colas encountered severe storms during the 25-day voyage from Plymouth, England, to Newport, R.I., and lost time in Newfoundland when sails on the 236-foot *Club Mediterranee*—larger by more than 100 feet than any other boat in the race—had to be replaced.

Although Colas' ship is as large as many freighters, and would normally require a crew of six, Colas said he "most likely" could have managed a single-handed transatlantic crossing without the aid of a computer. "But I would not have been able to sail as safely, or as efficiently," he added, explaining that the on-board computer saved him both time and considerable effort during the crossing.

Colas used a Wang 2200 computer with 16K words of memory, manufactured by Wang Laboratories, Inc., Tewksbury, Mass. The computer system included a crt display, a keyboard and a Wang model 2231 printer which provided Colas with weather reports received in Morse code via the ship's radio and decoded by the computer. Software for the system, developed by Compagnie Internationale Service L'Informatique (C.I.S.I.), of Paris, was stored on a standard-size cassette tape.

Monitored 14 instruments

Twenty-four hours each day during Colas' single-handed, transatlantic crossing, the Wang computer gathered data on the ship's progress from 14 different instruments. Colas programmed maximum and minimal limits on the instrument readings, and the computer sounded an alarm whenever any of those limits was exceeded.

The shipboard computer system allowed Colas to set limits on the *Club Mediterranee's* course; it monitored any seepage of hydrogen, or propane from tanks in the ship's galley; it sounded an alarm whenever Colas came within the range of another ship's radar; and by warning of any overcharge from the wind vane—one of the ship's three power sources—would alert Colas if his batteries were running low.

Colas pointed out that the radar detection feature of the *Club Mediterranee's* computer system was significant since OSTAR officials had prohibited the use of active radar during the race. "C.I.S.I. developed equipment which could react when another radar would have caught me in its range," Colas explained. The Wang equipment was checking that this device was working well.

The sequence of data collection was determined by the software. A particular sequence of instrument readings was selected by sending a sequence of binary codes through a model 2250 interface to the rack. These readings were received on the 2252 interface, evaluated by the program, and displayed on the crt. The

sending sequence varied in accordance with the on/off status of each instrument and whether or not an alarm was to be sounded in connection with the reading.

One of the sensing devices monitored by the computer was a water thermometer located in the ship's hull. Another was a hygrometer located on the third mast to measure percentage of atmospheric humidity.

ALAIN COLAS aboard the 236-foot, four-masted racing yacht, Club Mediterranee, which he sailed alone from Plymouth, England, to Newport, Rhode Island in fifth running of Observer Singlehanded Transatlantic Race last summer. Wang computer gathered data on ship's progress from 14 different instruments and decoded weather information transmitted in Morse code.

On the Newfoundland to Newport leg of his journey, Colas wanted to stay out of the Gulf Stream which was against him and to keep in the colder waters of the Labrador current. "So I set the computer to raise an alarm whenever I would sail into waters above ten and a half degrees C," Colas said.

Fog warnings

"Knowing the humidity helps a lot to forecast when fog will be settling," he continued. "As a matter of fact, on several occasions I was told 'bip, bip, bip, bip,' that fog was settling in while I was asleep, getting some rest, and when fog sets in, you'd better not be asleep. You have to get up and put your fog lights and sound the fog siren, listen for shipping sirens and keep a good lookout."

Fogged in completely much of the time on the Newfoundland to Newport leg, he set an alarm on the humidity sensor so that it would sound below a reading of 92 percent. The alarm meant the weather was about to clear up for a short period and Colas quickly would grab his sextant and sight for a reading. He said the Wang system also included a software program that could assist him in optimizing the ship's speed.

Other system software developed for Colas by C.I.S.I. included a program for calculating sextant sights—each of which he said normally would have taken him at least ten minutes—and a program which allowed him to take the earth's curvature into account in charting his course.

Colas said he had not previously sailed with a computer on board, and, in fact, had had no previous computer experience. He said he became familiar with the workings of the Wang computer within only a few hours.

"C.I.S.I. chose the Wang computer because of its compact size, its reliability, and the easy access to its working for someone who was not in the computer field," Colas said. He noted that the computer operated successfully throughout his 25-day voyage, although he carried a spare processor and desktop console.

It's not the kind of system for the low-budget weekend sailor. The cost of software and hardware adaptations comes to more than $40,000 and the computer, although on loan from Wang's facility in France, is priced at more than $24,000. And that doesn't include the cost of connecting instruments.

But for those who can afford it, Colas says a ship with a computer is just like a company with a computer. "You run a company better when you are well informed. The same applies to a ship . . . By how much, it's hard to say, but you know you're working better." ✲

BENCHMARKS

Third Quarter: IBM's revenues in the third quarter of 1976 reached a record $3.96 billion, a gain of 9.9% from $3.6 billion a year ago. Its net income in the third quarter soared 18.5% to a record $586.9 million, or $3.90 a share, from the 1975 period's $495.2 million, or $3.32 a share. The huge increase again reflected a high level of outright purchases by customers of equipment, but chairman Frank T. Cary cautioned that the fourth quarter increase over the previous year may not be so high because "of the record amount of outright purchases of data processing equipment in the final quater of 1975." The company's recent pricing actions encourage sales and long-term leases. But it also has increased maintenance fees, which will bolster the rental and service element of revenue. The company said its revenues of $7.67 billion in rental and service fees in the first nine months of this year represent a increase of 4.4%. *Control Data Corp.* said its 63% increase in third quarter earnings of $15 million were the result of a strong performance from both Commercial Credit and the computer business. Commercial Credit earned $9.5 million, a 92% gain, and the computer business earned $5.5 million, up 28% from the third quarter of 1975. *Burroughs Corp.* reported third quarter revenues of $443.2 million, against $367.7 a year ago and earnings rose to $37 million from $32 million a year ago. *Honeywell* reported third quarter revenues of $622 million, compared with $558 million a year ago and income reached $36.9 million, against $30.8 million, when extraordinary income of $1.4 million from loss carryforwards was added. The company's revenues from computer rental and service reached $130 million in the third quarter, compared with $115 million a year ago. *NCR Corp.* reported improved third quarter revenues and earnings due to improved margins resulting from the company's new product programs and continued expense-control measures. Its revenues reached $569.5 million, an increase of 9% over $521.5 a year ago. Earnings, which included a gain of $2 million from the sale of a subsidiary, Electronic Communications, Inc., rose to $25 million, a 58% increase over last year's third quarter figure of $15.8 million.

Amdahl Reports: Amdahl Corp., Sunnyvale, Calif., reported a record quarter for both sales and profits and established a wholly owned Canadian subsidiary. Eugene R. White, president, said revenues for the third quarter, ended Sept. 24, were $26,045,000, close to 100% greater than revenues for the second quarter of fiscal 1976. Net income for the three month and nine month periods was $6,898,000 or 99¢ per share, and $9,972,000 or $1.69 per share respectively. The new Canadian subsidiary, whose formation is subject to approvals from the Canadian government, will be called Amdahl Ltd. and will be headquartered in Toronto. Fredrick T. White, a former IBM regional manager and more recently senior vice president of Multiple Access Ltd., joined Amdahl to become president of the Canadian subsidiary.

New Gag Order: As the "West Coast Cases" against IBM opened this month in Los Angeles, a strange "gag order" drew comment from legal observers. The order allowed parties in the cases to designate any materials submitted in the cases as "nonpublic," meaning the materials cannot, under court order, be made public, nor can the various parties use the documents for business or competitive purposes. Which is okay, say legal observers, except that in prior cases a party in a case has had to establish that the material was privileged —that is contained proprietary business information or trade secrets—in order to keep it from public disclosure. As it stands now, in the order signed by Federal judge Ray McNichols, all a party has to do is say a document is nonpublic and it remains that way unless challenged. California Computer Products Corp.'s antitrust trial against IBM was to open Nov. 8 and be followed by the Memorex vs. IBM trial. Others involved in the West Coast cases are Sanders Associates, Forro Precision, Transamerica and Hudson Leasing Co.

Transfer Complete: Transfer to TRW Inc. of the maintenance and customer support operations of The Singer Business Machines Div.'s North American operations has been completed and TRW has begun servicing SBM customers. TRW said it offered employment to more than 2,200 employees of the Singer division as part of the completion. J. S. Webb, TRW's executive vice president for electronics, said of the completion: "The successful joining of the Singer and TRW operations gives TRW one of the broadest and most experienced customer service organizations in the electronics industry."

In at McDonald's: Courier Terminal Systems, Inc., Phoenix, which has been working since late 1975 with McDonald's Corp. on design and development of a Point of Service (POS) system for the fast food chain has been approved by McDonald's as the POS supplier for its more than 4,000 restaurants. Michael H. DeVita, Courier's POS program director, said the company expects to install approximately $2.6 million of POS equipment before the end of this year. Systems were tested in Chicago and Phoenix. Among other things, the system displays what's ordered as the counterperson keys in, in a way that can be seen by the "pickers," eliminating the need for the counterperson to holler out "one big Mac, two fries, one chocolate shake . . ."

Datapoint Acquisition: Datapoint Corp., San Antonio, Texas and Amcomp, Inc., Sunnyvale, Calif. have agreed in principle to Datapoint's acquisition. Amcomp, known until last spring as Data Disc, makes tape and disc drives for the oem market. Datapoint designs, manufactures and markets electronic equipment and systems software for use in business data processing. Datapoint chief executive officer, Harold E. O'Kelley said the acquisition was viewed favorably by Datapoint "because of the additional resource it would provide in tape and disc technology. It provides one further step in Datapoint's program for vertical integration of peripheral products." The agreement calls for a cash purchase.

Computer Services Growth: International Data Corp., which completed a survey of the computer services industry for the Association of Data Processing Services Organizations (ADAPSO), said revenues of the industry are expected to increase at an annual rate of growth of 20% through 1978. IDC said the industry experienced a slight reduction from this rate of growth during 1974 and 1975 but was growing at or above the 20% rate by the end of '75. The type of processing service providing the greatest share of revenue to the industry, the survey report said, was general business services. The IDC/ADAPSO forecast details the types of services that have the highest rate of growth (more than 25%) and those that have the lowest or declining growth rates.

Not a Time-Sharing Company: Robert Weissman, president of National CSS, Inc., told New York Security analysts that his is no longer a time-sharing company, but rather a marketing services company specializing in business information." He said American businesses are becoming decentralized and profit center oriented. "Profit center managers are demanding and are willing to pay for the delivery of specific answers to specific business problems. National CSS has been able to de-mystify computers by delivering a package of customer service to solve business problems." The changed marketplace and National CSS' response to it, he said, have caused the company's revenues and profit margins to grow at an accelerated rate. ✲

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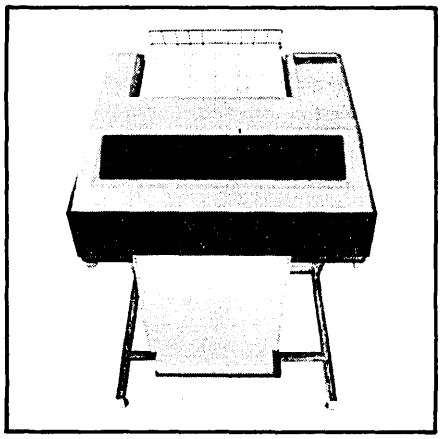

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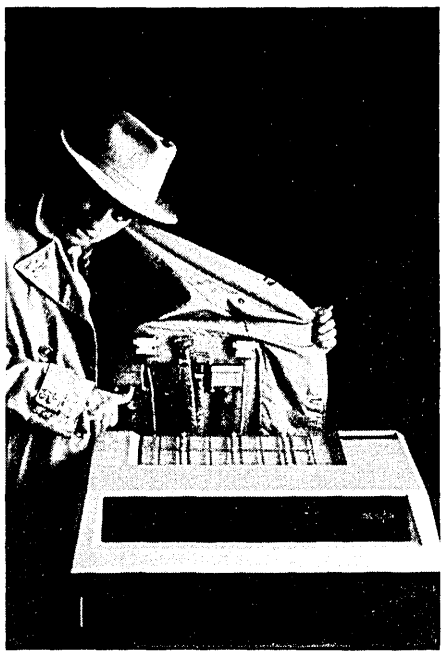
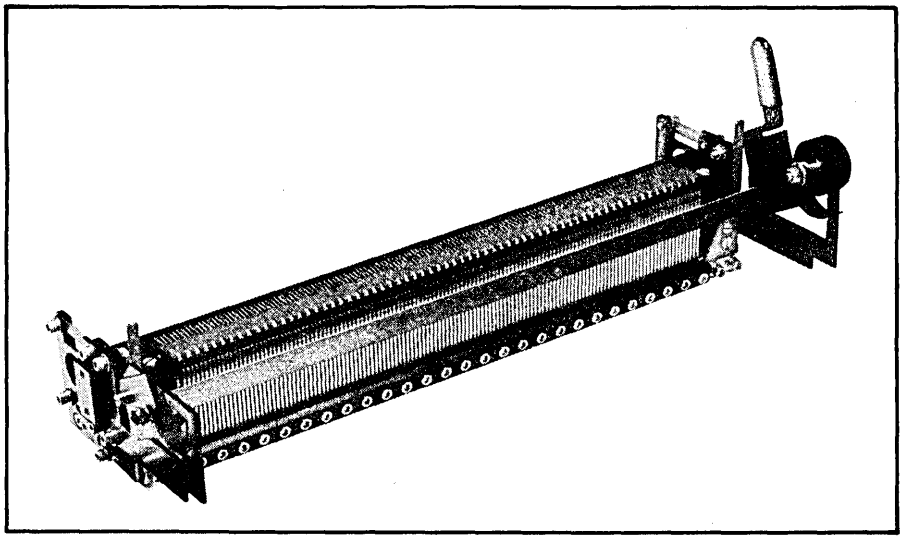


Interfaces? Lots of Them.

Whatever your mini, micro or remote terminal, the T-2200 works with it. For years, it has been running successfully with:

Data General	Prime
DEC	InterData
Hewlett-Packard	DCC
Lockheed	Intel
MicroData	. . . and many others.



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Tally's unique comb matrix printing technique is the reliability key. Belts, clutches, lubrication points are eliminated. Never any adjustments. Nothing moves if the unit isn't printing. No duty cycle limitations. No preventative maintenance except routine cleaning. A one year warranty.

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TALLY

CIRCLE 73 ON READER CARD

LOOK AHEAD

(Continued from page 18)
San Antonio. Patients recovering from the surgery there are hooked around the clock to an 1800-based system located at Mt. Sinai Hospital in New York City where, among other signs, crucial respiratory and cardiac functions are studied, something that's unavailable with cardiac monitors in general use. Doctors at Mt. Sinai say a study of 200 cases monitored under the system show a reduction in "sudden unexpected life threatening events" from 12% to 0.2% for patients recovering from cardiac surgery.

The IBM 1800 is used in lieu of more advanced equipment, because the software, developed jointly eight years ago in San Francisco by Dr. John J. Osborne of the Pacific Medical Center and IBM, is too expensive to convert.

TENNIS ANYONE?

Wonder Woman playing chess with Superman via computer could become a nightly phenomenon when Computer Recreations, Cliffwood, N. J. opens its "game parlor" to the public. Scott Guthery, president, said "we're targeting for Dec. 1, but I imagine it'll be Jan. 1. The system was up and running with two ports last month in "a friendly user mode. We're trying to shake ourselves and it down."

Computer Recreations was formed to bring a wide selection of games into subscribers' homes through a special home terminal resembling a typewriter with a cradle for a telephone head set and connected to a home tv set. When a player dials in over Computer Recreations WATS line, he enters the "game parlor." He can log in under his own name or an alias. "People are more free using aliases," said Guthery. "If you lose at chess as Wonder Woman," there's no ego hit. He compared it to the CB radio phenomenon and its aliases.

Twenty people are using the system in the "friendly user mode." Guthery said 10 of these are "putterers" and the other 10 "are trying to develop a department store." He says he's trying to encourage development of new games via "the department store concept." This involves developing a group of related games which the developer could offer on the CR system, charging whatever he wished over the 99¢ per hour the company expects to charge. Heart of the system is a PDP-11/03 in the living room of Guthery's apartment. Hours of play are 7 p.m. to midnight Monday through Friday and 2 p.m. to midnight Saturday and Sunday. Games now available include chess, golf, Monopoly, football, space war, solitaire, and blackjack. When Guthery's not running CR, he's a computer scientist at Bell Labs.

CORE PATENT ISSUE NOT DEAD YET

Just when it appeared the issues raised in the MIT versus NCR litigation (September, '75, p. 108) were put to bed, there is some feeling the case is not entirely dead. The issues, centering primarily around early core memory patents, may be examined in the California Computer Products vs. IBM case. Jay Forrester, of MIT, who holds key core patents, has been called to give a deposition in the CalComp-IBM case.

RUMORS AND RAW RANDOM DATA

Burroughs-1700 users awaiting the new B-1800 must hold their breaths for awhile. Burroughs is reportedly convinced IBM is announcing new models 118 and 128 with drastic price cuts and the new Burroughs machine won't be priced until the IBM equipment sees the light of day...IBM's ballyhooed Peachtree mini may also be offered by the firm's Data Processing Div. as well as General Systems Div....We hear MSI Data Corp. will introduce a new data entry device sometime this month to be called Source 2200. It will be capable of two-way communications and will scan Codabar as well as OCR-A...The CMC Div. of Pertec Computer Corp. is readying a "Dream" (for Data Retrieval, Entry And Management) for imminent introduction. It's labeled XL 40 and is earmarked for distributed environments...Wall Street computer analysts have been in the doldrums for several months but at least they'll get a chance next spring to examine their favorite industry in a happy setting, the Greenbrier at White Sulphur Springs, West Va. The Computer and Communications Industry Assn. is planning a large industry meeting featuring an industry report to be prepared by Professor Anthony G. Oettinger of Harvard Univ.

THE ONLY DISK DRIVES THAT DON'T NEED CLEAN AIR TO BREATHE.

Each Trident disk drive has its own enclosed air filtration system. No other removable-pack disk drives do.

This means you can use a Trident just about anywhere. In a warehouse. Or a factory. Even in a smoke-filled room.

This kind of flexibility is just one reason Trident is the choice of growing businesses everywhere.

You find Tridents on the job in department stores—taking care of inventory control right at the point of sale.

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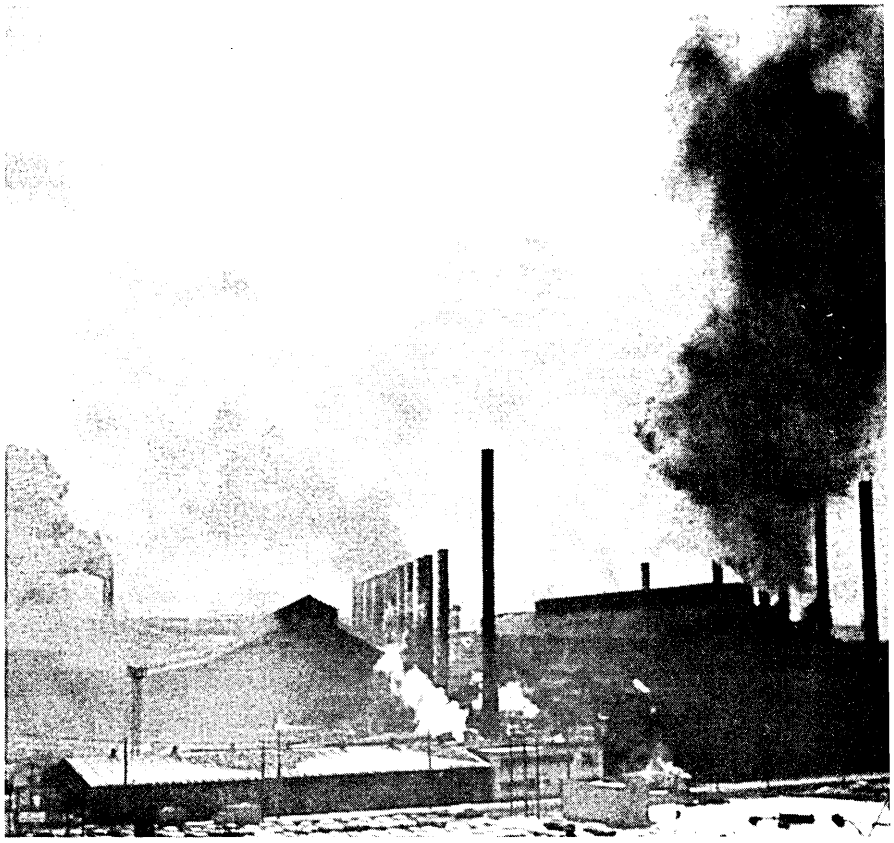
And Tridents are the continuing choice of the nation's leading OEMs.



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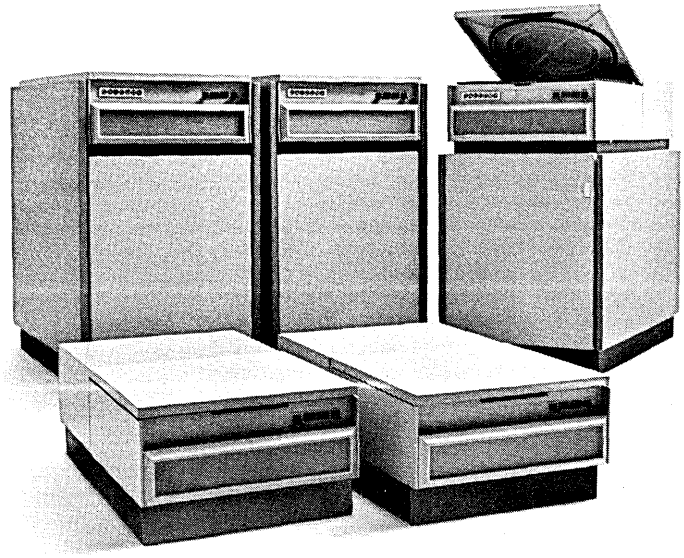


CIRCLE 79 ON READER CARD

hardware

Off-line

IBM's portable computer, the 5100, has joined the exhaustive investigation for the cause of the malady that struck American Legionnaires staying at, or visiting the Bellevue-Stratford Hotel in Philadelphia during July. Using questionnaires filled out by survivors of the disease the 5100, together with other systems at the National Center for Disease Control in Atlanta, is busy looking for significant statistical relationships among which patients visited which hospitality rooms and at what times, what they drank, etc. These answers are being compared to questionnaires filled out by attendees who did not become ill. In the rough, early stages of the processing, a statistical correlation of .05, meaning that there is only one chance in 20 that coincidence is involved, is pointing the finger at one of the 13 hospitality suites at the convention.

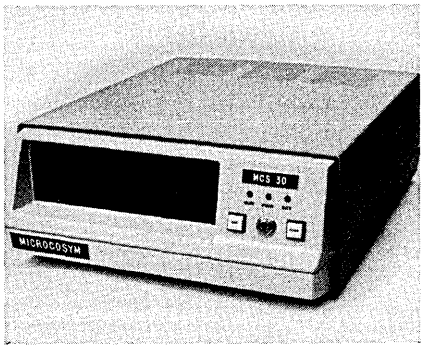
To scientists working at the NASA Goddard Space Flight Center in Greenbelt, Md., the word microscope means something quite different than the usual optical instrument. MicroSCOPE is the name of a microprocessor-based computer that will be on-board the High Energy Astronomy Observatory when it is launced in April. The "scope" portion of MicroSCOPE stands for Small Complementary metal oxide semiconductor Onboard Processor for Experiments.

An unlikely source for something that will likely be a boon to many readers is the Lancer Book Co., 1052 Park Ave., Fort Lupton, Colo. It has developed a process for re-inking Qume, Diablo, Burroughs, and some other data terminals' cloth ribbons. With new ribbons costing from $3-7, the vendor is only asking $1.25 to $2.25 per cartridge. Multiplied by four re-inkings, users might be able to save as much as $20 over the life of the ribbon.

The hobbyist computer market--which many expect to exceed the value of the hobbyist photography market--has a new source. It's Lear Siegler, Anaheim, Calif., which is offering a kit version of its ADM-3 "dumb crt terminal" for $875. An assembled version costs $1,280.

Honeywell Communications

The MCS 30 is a microprocessor controlled communications front-end designed for use with Honeywell 6000 and Series 60 Level 66 systems. Said to be totally compatible with both the hardware and software of these systems, the MCS 30 provides remote access from low-speed terminals to time-sharing, transaction processing, and other direct access programs. The standard unit includes RS-232 compatible interfaces for eight low-speed, asynchronous lines (110-300 baud),



with automatic baud rate detection. Built-in routines are standard and can be accessed remotely. Optional features include additional eight-line modules to a maximum of 32, and expanded memory in 8K or 16K increments to a maximum of 64K bytes. A read-only memory option for program storage eliminates bootloading of the system. A standard eight-line system rents for $720/month including maintenance on a one-year contract. MICROCOSYM, INC., Peoria, Ariz.

FOR DATA CIRCLE 226 ON READER CARD

Travel Agency System

Raytheon has developed a variation of its PTS 1200 system for use in travel agencies, both large and small. Called RAYTRAV, the minicomputer-controlled system provides the travel agent with a

PARS (passenger airline reservation system) airline terminal environment capable of receiving passenger itinerary and accounting data from the air carrier's host, while operating simultaneously with a local travel agency application program. Up to 16 video terminals can be supported. Used locally, the system can perform accounting, ticket printing, customer list maintenance, invoice and itinerary printing, sales analysis, and accounts receivables/payables applications. Two 2.5 megabyte disc cartridge drives contain the accounting records, and two printers, one serial and the other a line printer are used to generate hardcopy. The software, provided under a license agreement with Office Computer Corp., of Cambridge, Mass., stores information on customer account and department codes; passenger name or names with accounting data for each; complete itinerary including arrival times, meal service and fare ladder; hotel booking data including room type, dates of stay, rate and deposit; car booking data including type, dates of usage, rate, pickup and drop points; other services such as tour packages, sightseeing, phone charges, visa fees, messenger charges; special billing or delivery addresses; and credit card number. Raytheon both installs and trains the agency on the uses of RAYTRAV nationwide. First installations are scheduled for February. The first enhancement, scheduled for approximately three months later, will allow terminal communication to RAYTRAV from an unlimited distance from the central agency. Pricing hasn't been pinned down yet, but a typical installation will lease for approximately $2K/month on a one-year contract and include all the software, the controller, 4-6 video/keyboard stations, one printer and the two discs, and include maintenance. Installation and training are separately priced. RAYTHEON DATA SYSTEMS, Norwood, Mass.

FOR DATA CIRCLE 227 ON READER CARD

Matrix Printer

The T-1602 is a 160 cps bi-directional printer that features an internal microprocessor that is kept busy calculating the shortest distance between the character just printed and the next one. This helps throughput when the character to be printed is indented on the next line: the print head simply reports to that position without having to completely return to the beginning of the line. Simple, but it takes a microprocessor to do it. The bi-directional unit prints a 7 x 7 matrix font and slews at 8.5 ips. An original plus four carbon copies can be generated on

They made The Intelligent Choice.

Liggett Group

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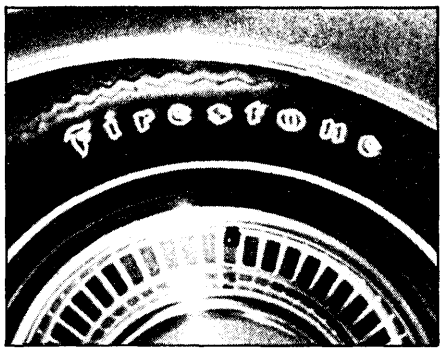
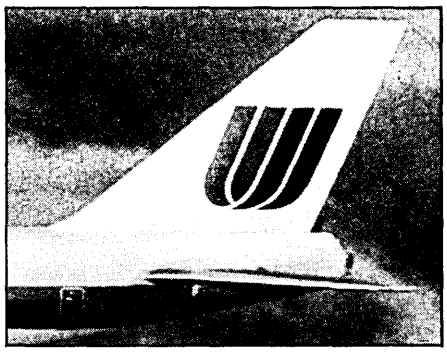
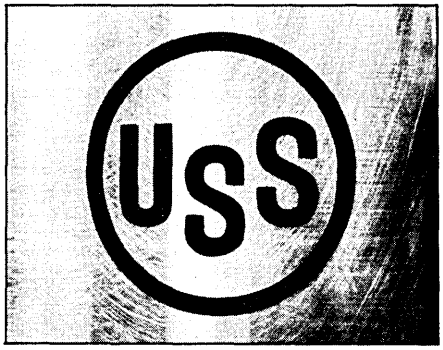


ANCHOR HOCKING



WORTHINGTON



Heinz

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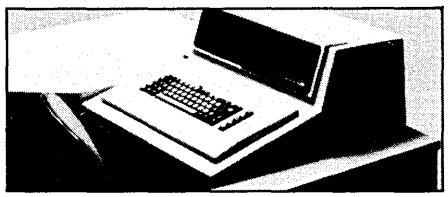

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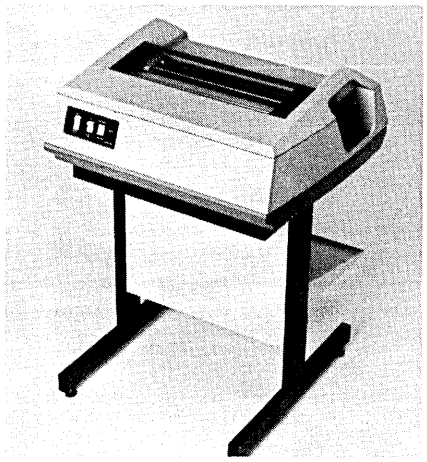
CIRCLE 27 ON READER CARD



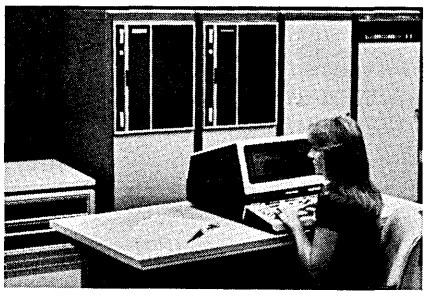
form widths from 4-15 inches. Additional features include a snap-in ribbon cartridge, dual tractor engagement above and below the print line, and digitally controlled print head advancement. It's an oem item priced at $3,115 in single units. TALLY CORP., Kent, Wash.

FOR DATA CIRCLE 228 ON READER CARD

APL Computing

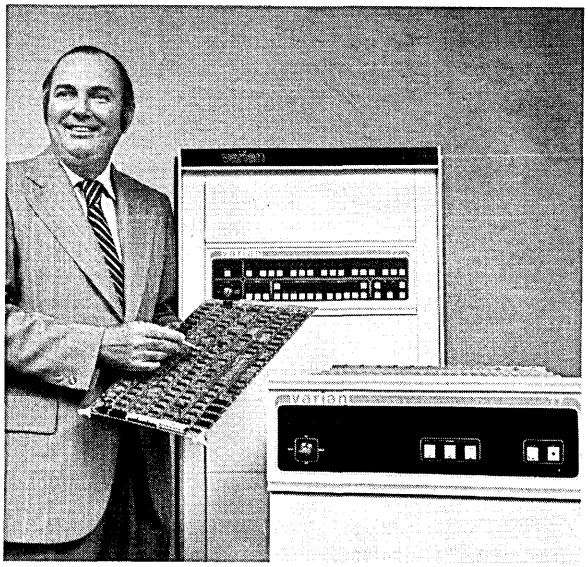
If you're in charge of a bunch of users who are clamoring for APL programming capability, it's now available on the Hewlett-Packard 3000 Series II cpu's. For around $200K, a complete system capable of supporting 12 simultaneous users in a multiprogramming environment can be supplied.

One of the nicer aspects of HP's implementation of APL is that the workspaces are virtual and are effectively limited only by the on-line disc storage available. APL/300 is implemented as an incremental compiler and not as an interpreter, meaning that compiled code is preserved and used over again without recompiling, as long as tests for appropriations are met. APL/3000's editor is a full text editor as well as a function editor, with English-like commands. The user isn't restricted to APL on the system; any of HP's other languages can also be resident on the system.



To make the system really work, a new crt terminal has been introduced. The 2641A can be switched from APL

product spotlight



Varian Data Machines President Donal B. Duncan is shown with the three members of the new V77 series of minicomputers that he hopes will garner an even larger share of the scientific, mini networking, and real-time markets.

Scientific Minis

Varian has always enjoyed a good reputation in the small-scale scientific computing market, one which doesn't receive anywhere near the press that the commercial market does. With the announcement of the V77 family of three minis, Varian is not only shoring up its defenses against primary competitor Hewlett-Packard, but is also moving away from totally turnkey problem solutions ("where we lost our shirt in estimating contract costs" says VDM president Donal Duncan) and putting more emphasis into its already impressive engineering. The attempt is to provide customers with the best "tools" to use in solving their own application problems.

The V77-200 is a single board computer for the oem market. It features eight operational 16-bit registers, 8-, 16-, and 32-bit arithmetic, hardware multiply/divide, a real-time clock, automatic bootstrap loader, tty or crt interface, memory controller for up to 32K 16-bit words, I/O bus with 300K words, and a memory interface to its larger sibling, the V77-400. Optional features include an operator's console, integral power supply, chassis, memory board, etc. The 660 nsec cycle time yields add, jump and increment times of 1.32 usec, and 7 usec multiply. The 200 is priced at $1,200; $7,600 with 32K words of MOS memory, dropping to $4,500 each in orders of 50.

The V77-400 is a superset of the 200's features and adds, as standard, memory control for up to 256K 16-bit words of storage, power fail/restart, logic parity, and memory protection. The option list differs, too. Add to the 200's list memory mapping for up to 1024K words of storage, a writeable control store for up to 1K 32-bit words, a memory interface to the V77-600, memory parity, and data save. A 32K model 400 goes for $11,100.

Things really get interesting at the V77-600 level. Add to the 200's features dual memory buses for dual port memory access, a programmer's console, and optionally a floating-point processor, and 1K of sub 100 nsec cache memory. The writeable control store uses 64-bit microinstruction formats and sports a 190 nsec cycle time to permit simultaneous parallel operations. Pricing of 600s starts at $16,500 with 64K words of MOS memory.

It is in the way that the various cpu's can be hooked up, or tiered, that promises some interesting configurations, and current users have a head start since all current Varian V76 series software is compatible. For example, a number of model 200s can report over a DMA link to a model 400 which can have a string of up to eight timing and control boards handling memory modules, (and even sharing memory), and disc units. This would allow sophisticated processing of different simultaneously incoming data in a real-time data analysis application. And there's no reason why the model 400—or several of them—can't be reporting upstairs, and receiving orders from, a model 600. Deliveries are slated for January for the new systems. VARIAN DATA MACHINES, Irvine, Calif.

FOR DATA CIRCLE 225 ON READER CARD

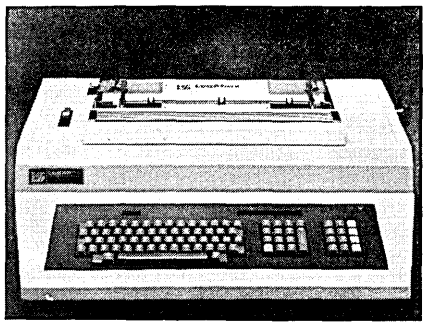
to ASCII operation and offers a full 128-character APL set and a 64-character APL overstrike set, and even a 64 character upper-case Roman set that can be expanded to 128 characters (including lower-case) as an option. Eight user keys on the 2641A are user programmable and can be set up to issue a string of as many as 80 characters, or to trigger one or more control sequences stored in the terminal, such as a complete log-on sequence at the touch of one keystroke. The terminal also contains two of the scaled-down 3M-type cartridges that HP helped develop. Up to 12K bytes of semiconductor storage is available for the 2641A terminal.

Current 3000 II users can get the APL software/firmware support for $15K. The 2641A APL crt terminal with 4K bytes of memory is $4,100; with cartridge transports it's priced at $5,700. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 229 ON READER CARD

High-Speed Terminal

One of the reasons the LX1010 high-speed serial printing terminal is being evaluated by such blue chip companies as Lockheed, TRW, Union Oil and McDonnell Douglas is the incorporation of a microprocessor in its innards that does *not* get involved with the actual printing being done. Instead, the microprocessor allows the manufacturer to promise prospective customers freedom from being locked into a particular communications protocol. For example, when customers ask whether the LX1010 can communicate with IBM's mysterious SDLC protocol, the



vendor can answer "you tell us what SDLC means in your communications environment, and we'll set the terminals up to communicate in that manner." The approach seems to be working. One minute the LX1010 be used as a private line polled device, emulating a 2740 Mod II, and the next minute it can emulate a 2741, with or without APL.

Synchronous or asynchronous data at rates ranging from 75 to 4,800 bps is accommodated in full-duplex, half-duplex, or echoplex modes. The standard print speed is 180 cps, with an optional speed of 140 cps if you don't need the 180. A nine-needle matrix print head is used which permits underscoring of information, extended print spacing, italicized printing, etc. The keyboard is programmable, permitting users to lay out the standard 53 alphabetical and numeric/symbolic keys anywhere they wish (Dvorak keyboard users take note!) A standard 10-key cluster is used for data entry, and a set of 12 function keys eliminates repetitive typing in selected data entry operations. The 1010 can also perform graphics. The terminal sells for approximately $6K, or rents for about $200/month, including maintenance. Initial deliveries are underway. LOGABAX, U.S. DIVISION, Los Angeles, Calif.

FOR DATA CIRCLE 230 ON READER CARD

Digital Cassette

3M evidently figures that since cassette usage is dying about as fast as that of paper tape (and paper tape *isn't* dying), maybe they should offer a cassette updated with a better oxide material to users. The new Scotch brand No. 834 cassette is said to exceed the National Bureau of Standards reference and standard tape benchmarks by 20%. Higher signal output increases a cassette drive's reliability by reducing lost signals and resulting lost data, the developers point out. Some additional thinking has gone into the design of the case, too. For example, a patented pillowed slip sheet is used to allow the tape pack to ride on a smooth concave surface rather than on a crease. Thus, torque characteristics are more uniformly maintained for extended tape life and reduced debris generation. Optional ANSI standard "write enable" plugs or handy sliding doors to prevent tape clobbering are also featured. In quantities ranging from 10-100, the No. 834 cassette is priced between $6-7. 3M COMPANY, St. Paul, Minn.

FOR DATA CIRCLE 232 ON READER CARD

Distributed Processing

This company has focused its attention for the last 14 years on the problems of manufacturing automated control systems for large ships, later diversifying into automated systems for refineries, chemical plants, utilities, and pipeline applications. Its first commercial dp product is called Outpost 7, an intelligent terminal incorporating a crt display, microprocessor, keyboard, cartridge drive and RS-232 communications interface. Communication is serial ASCII (EBCDIC optional) at selectable baud rates of 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud. The operating modes are conversational (character at a time), message (line at

a time), page (full screen), and multi-page (multiple screens.) Character delete/insert/overwrite; partial rewind to last record or specified record number; and variable length records characterize the editing/format features. A printer interface for 40 column units is optional. The memory inside the Outpost 7 is expandable from 8-64K bytes in 4K byte increments.

The Outpost 7 will be primarily marketed in the New Orleans, Houston, Dallas, and Los Angeles area, with typical systems priced around $5K. The marketing arm is called Eclectic Rentals, Inc., a Tano subsidiary. TANO CORP., Metairie, La.

FOR DATA CIRCLE 231 ON READER CARD

Printer

The RDS/LA180 is a modified version of the DECprinter, featuring an RS-232 interface with 512 or 1024 character buffer and polling capability for network applications. The terminal also performs block transmission and error correction. The price is $3,735. RANDAL DATA SYSTEMS, Torrance, Calif.

FOR DATA CIRCLE 233 ON READER CARD

PDP-11 Add-on Memory

Here's another source of add-on memory for the ubiquitous DEC PDP-11. The ARM-1170 is available in 128K byte increments and can be expanded up to the PDP-11/70's limit of 4 megabytes. The memory is offered as a transparent alternative to or replacement for the MJII memories used in the PDP-11/70. Two- and four-way interleaving is provided by the ARM-1170; four-way interleaving reduces the effective cycle time to 350 nsec, compared to the hardware's true spec of 800 nsec, or the 1 usec of the stock DEC memory. One megabyte, which occupies 22.75 inches inside the PDP-11/70's cabinet, is priced at $48,500. AMPEX CORP., El Segundo, Calif.

FOR DATA CIRCLE 234 ON READER CARD

Multiplexor

The Timeline 290 Miniplexer is a synchronous time division multiplexor that should be of particular use to current users of Bell 209 data sets. The

hardware

290 makes it possible for the 209 user to switch to DDS (where available) and gain all digital transmission without losing the bandsplitting features of the 209. The Miniplexer can also be used for bandsplitting on conventional facilities. The 290 will split a 2400, 4800, or 9600 baud line, DDS or conventional, into two, three, or four separate channels. Inputs can be any mix of DDS and conventional at speeds of 600, 1200, 2400, and 7200 bps. Input speeds are switch selectable. Diagnostics are built-in. The Miniplexer is priced at $1,500, and you'll need one for each end of the link. INFOTRON SYSTEMS CORP., Pennsauken, N.J.

FOR DATA CIRCLE 235 ON READER CARD

PDP-11 Disc Controller

This peripherals manufacturer has developed a microprocessor-based controller that interfaces up to eight drives (a total of 20 megabytes) to any PDP-11 minicomputer. DEC offers one, too, but it's claimed that, at $2,900, the 4091 (E) is a full $2K less than DEC's, or nearly half price. PROM resident routines perform status control, interface formatting, and error checking functions. The PROM is also responsible for all seek, read and write functions, read and write checks, control and drive reset, write lock, and hardware poll. The manufacturer may have found a way to solve the "bus hogging" condition of conventional disc controllers: the 4091 (E) uses First-In-First-Out (FIFO) data registers for temporary storage. If a higher priority peripheral interrupts a data transfer, the microprocessor continues to write from or read into the buffers, thus freeing the cpu for other tasks. The manufacturer can also supply a complete disc system for the PDP-11. DATUM INC., Anaheim, Calif.

FOR DATA CIRCLE 236 ON READER CARD

One Megabaud Communication

The CCI-4000 is a coaxial cable interface unit is intended for computer to computer or computer to peripheral communication at any bit rate up to 1 megabaud. Computer to peripheral connections are provided in the form of plug-in peripheral point boards, allowing use with crt displays, keyboards, cassette units, printers, data collection terminals, card readers, and punches. The transmission distance can be as far as 40,000 feet without repeaters. The transmission mode is asynchronous half-duplex. Full-duplex mode can be obtained by using twin cables and two additional cards in the CCI-4000 at each end. Prices start at $2,840. COMPUTROL CORP., Bethel, Conn.

FOR DATA CIRCLE 237 ON READER CARD

Industrial Terminals

With terminals like the CONCEPT III and CONCEPT IV, one should be able to implement a fairly comprehensive shop floor/manufacturing data acquisition system—maybe even microprocessor controlled—at a reasonable price. The primary difference between the model numbers on the CONCEPTS is that the III is a desk-top unit and the IV is housed in a wall or rack mounted NEMA-12 enclosure. The terminal features a 16-character alphanumeric display, 12 numeric and special character keys, shift, clear and enter buttons.

Communication is accomplished in full-duplex, asynchronous current loop or modem interface at four baud rates ranging between 110 and 1200. Options include a 22-column badge/80-column punched card reader; 16 additional alphanumeric display characters; up to 16 function keys; a full alphanumeric keyboard; time clock display; audible display, audible alarm; and 32-character buffer. Prices start at $1,350, single quantity. Customizing is offered, depending on requirements. INDOCOMP INC., Royal Oak, Mich.

FOR DATA CIRCLE 238 ON READER CARD

Hardcopy Terminals

Three more variations are offered of the Carousel printer that was introduced by Interdata early last year. The printer developers have been split off to better do their own thing (under the new name below), with the models 310, 320, and 350 one of the first results. The emphasis is on easy forms handling for two of the models, with the third destined for duty as a computer console.

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hardware

The 310 features a single platen, and provides 4,800 points/inch^2 plotting capability. The forms feed can vary from a pin-driven tractor accessory for standard perforated paper, to a front insertion feeder for handling multi-carbon business forms, even forms with varying length sheets. The print speed is 30 cps. The 310 is priced at $2,995.

The 320 is intended for applications where an ASR teletype device might be replaced by a higher performance unit. The 320 operates at 120 cps and has both paper tape and plotting capability. As in the other terminals, the keyboard contains the full 128 character upper/lower ASCII set plus special symbols, and a space compression feature that automatically converts multiple spacing codes into faster tab operations in excess of 45 cps. The 320 is priced at approximately $3,495.

The 350 includes a split platen and the ability to accommodate two paper-handling devices simultaneously, such as a journal tape spooler with a front forms insertion device for handling ledger cards. The ledger card and the tape can be printed and advanced independently of each other, under operator or computer control. Split platens are available in 6/12-, 12/6-, 9/9-, and 0/18-inch configurations. The 350 is priced at $3,995. PERKIN-ELMER DATA SYSTEMS, Randolph, N.J.

FOR DATA CIRCLE 240 ON READER CARD

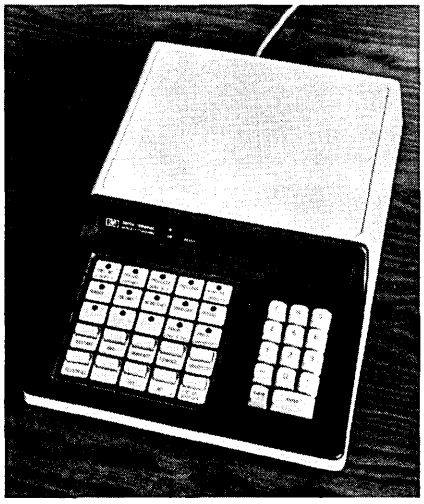
Interdata Disc Controller

The TDC803 was developed to allow Interdata oem customers to interface one of the CalComp series of Trident disc units onto the system. Thus a 50 megabyte disc system is available for something under $8K, which seems like a real bargain. The controller features hardware checksum calculation. Up to four controllers and 16 drives can be supported without any software modifications; in multiple controller systems each controller has the same device address. Single-drive cables, supporting software, and documentation are included in the single quantity price of $1,900. Each controller is warrantied for five years; all integrated circuits are burned in, and the pc boards use all-gold contacts. MINICOMPUTER TECHNOLOGY, Mountain View, Calif.

FOR DATA CIRCLE 239 ON READER CARD

Numeric Data Entry

The 3070A and 3071A numeric data entry terminals represent a whole new product line for Hewlett-Packard. They're intended for industrial and commercial applications where operators with little or no experience in working with computers need to be prompted. The difference in the model numbers signifies that the 3070A is for use with HP's 2100 and 21MX computers, while the 3071A works with most other cpu's. Both models are designed



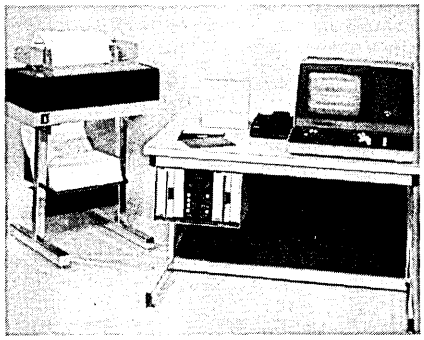
to be tailored to users' applications, have numeric-only keyboards for entering data, and 16-digit displays. The principal market for the terminals is thought to be oem designers of systems for manufacturing, inventory control, shipping/receiving, as well as commercial application in banks, insurance

companies, and similar businesses. As many as 56 3070A terminals can be connected to HP's new 1000 system via a single twisted pair cable. The 3070A is priced at $1,308 in quantities of 10, and the 3071A slightly lower at $1,143 in the same quantity. Deliveries begin this month. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 241 ON READER CARD

Microprocessor Development

The DMS is a complete hardware/software tool for developing software packages to implement on the popular Motorola 6800 microprocessor. Included is a model 7002A dual drive



DynaTermDisk, 8K of random access memory expandable to 64K, a virtual memory editor, and two RS-232C ports for interfacing a terminal and line printer. The standard software includes a file management system having one file director per diskette. File names can be up to 12 characters long, optionally preceded by a diskette drive unit number. An absolute assembler and symbolic debugging package is also included. Symbolic tracing is provided in both the local and global sense. Utilities available include an I/O data formatting package and a 12-digit floating point math package. Application packages include mailing list preparation and data entry/verification routines. The DMS Microcomputer System sells for $4,995. DYNALOGIC CORP., LTD., Ottawa, Canada.

FOR DATA CIRCLE 242 ON READER CARD

8080 Floating Point

The External Processing Unit (EPU) plugs directly into microprocessor systems based on the Intel 8080 chip, which includes offerings by Altair and Imsai. The EPU handles add, subtract, multiply, divide, I/O conversion, load store, and error handling procedures. Additional ROMS can be added for performing sine, cosine, tangent, decimal and natural logs and antilogs, arc-tangent, square-root, and constants. The execution times are somewhat less than the equivalent 8080 software, but what counts is the fact that not as much of that precious commodity called storage is required for the computations. The EPU comes in kit form and is priced at $350. LINKER/WOLF, Beverly Hills, Calif.

FOR DATA CIRCLE 243 ON READER CARD

Computer Alarm

If 70% of the work force is to be computer dependent by 1985 (and that's what the U.S. Government General Accounting Office tells us), then some work has to be done so that when all the computers go down, we won't have an unemployment rate higher than during the Great Depression. This manufacturer offers a simple solution: rather than rigging up duplicate computers, simply install an alarm that torments the operator into taking corrective action. (This assumes that we still have computer operators in another 10 years.)

It is true that operators tend to wear a lot of hats, particularly in smaller organizations, and the Sentry/360 alarm can apprise him of an idle situation on the cpu that he can easily correct. The Sentry/360 attaches to all IBM 360 and 370 equipment and ranges in price from $1-3K. CRU, Cleveland, Ohio.

FOR DATA CIRCLE 245 ON READER CARD ✲

software & services

Updates

Informatics Inc. regularly surveys the approximately 1,000 users of its MARK IV programming system. This year the company was kind enough to share the results of the survey with us, and there are some interesting little tidbits in the results. Informatics must be doing something right with its users--it achieved a 43 percent return on the questionnaires, which is extremely high.

The number of installations planning to operate in an on-line telecommunications mode increased from 60 percent in 1973 to 96 percent at the end of 1975 (when the survey was taken). Most users felt that data base technology had made a significant impact on their data base operations and felt that the change to data base processing was far more significant than just an exchange of one access method for another. The top five data base applications, worldwide, were personnel, inventory control, management information, order entry/billing, and programs classified as ad hoc retrieval/-reporting. 91 percent of the respondents with data base applications use outside data base management products, the rest use in-house developed methods.

Chalk one up for Honeywell: With the battle shaping up in many installations over the philosophy of whether to go "relational" or stay with the traditional "network" approach, Honeywell has announced that its Multics Data Base Manager (MDBM) is now available commercially, and MDBM supports both approaches.

Hundreds of microcomputer programs are now available for Intel Corp.'s microcomputer line--from the old 4004 and 4040 4-bit chips to the newer 8008 and 8080 models through a new and expanded user's library. INSITE (INtel Software Index and Technology Exchange) contains over 300 programs for the machines, complete with listings up to three pages long. A one year membership in the library is free to persons who contribute acceptable programs. A prepaid "handling" fee of $15 is charged for each tape. New members will receive five free source tapes of their choice when registering. Among the programs are two BASIC compilers, one for paper tape based systems, the other for disc systems, that operate on the 8080A micro.

Data Entry/Management

Data General has announced a new model in its Eclipse line of 16-bit minis called the Eclipse C/330, the C standing for Commercial. As impressive as the new hardware is (up to 512K bytes of memory—the original limit on the IBM 360/65), it's a clever little package called Idea (for interactive data entry and access) that will probably make the system really move. The intent is to provide a facility for easy creation and maintenance of data entry/access and data base inquiry/response programs in multiterminal, transaction-driven applications. The Idea software consists of a screen format generator for free-form format design, a compiler for specifying field processing, and an on-line multiterminal monitor for controlling up to 16 crt terminals. The Idea compiler allows users to specify how data fields defined with the screen format generator are to be processed. The compiler contains more than 40 English-like processing instructions, including add, subtract, multiply, divide, move, compare, branch on condition, I/O, and file handling, giving the program access to the INFOS data base-oriented file management system. You can also get ANSI-74 COBOL and RPG II on the new system. All 16 terminals can be working on the same, or different, applications simultaneously. A 16 terminal system with the new Eclipse C/330 cpu and 384K bytes of core memory, two 92 megabyte disc drives, a magnetic tape subsystem, 600 1pm printer, communications chassis and multiplexors, terminal printer, 16 crt terminals, the operating system (RDOS), INFOS, Idea, COBOL, RPG II, and remote job entry support is priced at $230K. DATA GENERAL CORP., Southboro, Mass.

FOR DATA CIRCLE 217 ON READER CARD

Intelligent CICS Dumps

With more and more applications being implemented under IBM's Customer Information and Control System (CICS), this vendor has developed a faster means of finding out "what went wrong" when the CICS portion of the system crashes. This should help both production and test environments. The tool is a dump, but not one that just dumps out hexadecimal memory representations, but goes several steps further in interpreting control blocks, bit masks, identifying the control program in which the ABEND occurred, providing sorted trace tables by task, and providing interpreted tract table entries, such as "Storage Control Getmain issued at C23104 by task 0101 for 100 bytes acquired at E4320." The program is automatically implemented when the ABEND occurs. Reports are generated on the system local printer. The CICS Dump Analyzer is another of those packages that would seem to pay for itself even if only used several times a month considering its rental price of $165/month ($175 for vs versions.) COMMERCIAL SOFTWARE, INC., New York, N.Y.

FOR DATA CIRCLE 218 ON READER CARD

Text Editing

The addition of "proximity searching" to the INQUIRE data base management system turns it into quite another type of product—resembling, as much as anything on the market, the much lamented (by the U.S. Justice Dept.) magnificent document indexing system that Control Data developed to manage its suit against IBM several years ago, before the suit was settled out of court.

As one might expect, the first uses for the proximity searching option will be among lawyers, and the system was just recently shown to the Federal Bar Association. What it allows one to do is search for strings of words or phrases buried in untold documents, trial transcripts, depositions, memoranda, abstracts, etc. An English-like command language allows one for example to "find all the instances of a witness saying: 'You've got to be out of your mind!' " Users can locate documents that contain one or more words within the same field or same sentence, within a specified number of words or sentences of each other, and in a specified order. The contents of both text fields and other fixed or variable fields, as well as optionally assigned index terms, can be searched by the same command, and, once the desired documents have been located, the user has full control over formatting and printing the entire document or any portion of it.

INQUIRE and the proximity searching option operate under any IBM system equipped with CICS or TSO, and both crt and hardcopy terminals are supported. INQUIRE is priced starting at $39,500; a comprehensive text processing package, of which proximity searching is a part is $16,500. The new feature alone is priced at $9,500. INFODATA SYSTEMS INC., Falls Church, Va.

FOR DATA CIRCLE 219 ON READER CARD

Montgomery Ward Wraps up Audit Package with MARK IV®

By Don Trinite, EDP Audit Manager
Montgomery Ward & Company
Chicago, Illinois

"MARK IV is the only tool we use for mechanized auditing – it's that versatile.

"Its use is nationwide, covering the home office, all five regions involving 9 catalog houses, 475 retail stores, 20 credit service and operating centers, our national service center and about 110,000 employees.

"We've used it for everything from credit reporting to freight claims analysis. We audit payroll with it, retail merchandising work, analysis of customer order status, stock records, retirement/profit sharing, managers' compensation, analysis of deferred income on service contract sales, catalog work – there are some 54 audit analysis procedures right now, and more on the way.

"Our savings in time and effort are substantial. Before we got MARK IV in 1971, our summary of activities involved 100 different manual reports. MARK IV now lets us do the job with seven.

"A typical program has master files, cycle-to-date files (which contain the transactions) and suspense files. In credit, for example, we determine what would be exception-type data that an auditor should investigate – a listing of accounts with balances of X number of dollars or that are one month delinquent, or both. We list these in account-number sequence for the cycle being audited. With just one pass of the files we create 16 exception-type reports, which are sent to field auditors when they're going to audit one of our credit service centers.

"We handle payroll system audits the same way. When we receive a request, we submit the job with a cataloged request as a remote test. The output comes to us, and we relay it to the field.

"When our outside auditors asked internal audit to verify accrued vacation cost reserve, we used MARK IV for parallel testing and simulation. They wanted this as an independent verification of the payroll system. Now we can quickly and easily tell, by location, which of our 110,000 employees gets how many weeks – and how much it's going to cost.

"Our future plans for MARK IV call for complete audits of locations which are on mechanized systems. For example, we'll set up an EDP auditor and a field auditor team to put together an audit program for metro warehouses.

"We've come to expect this kind of forward mobility with MARK IV, but ease of programming is what I like best. It makes all the other good things better."

MARK IV SYSTEMS

WHAT IS MARK IV?

MARK IV is the most versatile and widely used software product in the world for application implementation, data management and information processing. Six powerful models (prices start at $12,000) are in daily use on IBM 360/370, Univac 70/90, Siemens 4004 and Amdahl 470 equipment at 1,000 sites in 42 countries. Programs in MARK IV require only about 1/10 the statements of Cobol. Users say no other system offers the power, flexibility and simplicity of MARK IV.

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software & services

Simulation Language

The Advanced Continuous Simulation Language (ACSL but pronounced "axle") is designed for modeling the behavior of continuous systems described by time dependent, non-linear differential equations or transfer functions. Typical applications include control system design, missile and aircraft simulation, or fluid flow/heat transfer analyses. The developers have had considerable success marketing ACSL to the U.S. Government (Dept. of Commerce, White Sands Missile Range, and the Naval Air Defense Center) and think that there should be even more potential users in the private sector.

The basic structure of ACSL follows the 1967 SCS Committee on Continuous Simulation Languages specification, but with the addition of a run-time interpreter that allows on-line interaction with the model. Integration of the differential equations is selectable between a number of algorithms of different order and of variable or fixed step size. Gear's implicit integration algorithm is included for fast solution of stiff systems. Standard simulation operators are provided such as variable time delay, dead zone, backlash, or quantization. Any system or user defined FORTRAN function or subroutine can be used to allow access to local library routines. Printer plot output is standard, but line plots can be obtained in place of, or at the same time, providing you have a CalComp or Houston Instruments plotter. On-line plots can be obtained through Tektronix or Zeta Research terminals. ACSL can run on CDC 6000/7000 series machines, Univac 1108s, IBM 360/370s, and SEL 3255 machines. ACSL is priced at $9,500. MITCHELL AND GAUTHIER ASSOCIATES, Concord, Mass.

FOR DATA CIRCLE 220 ON READER CARD

Microcomputer Software

One of the few problems that microcomputer users have suffered with has been the lack of a resident compiler for building software packages. That's all changed now—at least if you own one of the "industry standard" microcomputers, the 8080, SBC 80, and other 8080A chip-based systems manufactured by Intel. PL/M, "which looks like PL/1 from about five feet away" according to an Intel source, is similar to PL/1 but is not a subset of it, even though the control structures are the same. The high level language can now be compiled into relocatable object code modules, and the modules joined together to form software systems. A floppy disc and 64K words (8-bit)

software spotlight

Programming Method

One of the heavyweights of the European interest in structured programming techniques, Michael Jackson, has come up with a new programming methodology that is said to supersede structured design and IBM's improved programming technology techniques. The new methodology has been tried out on more than 500 companies in Europe and is now being taught in the U.S. The emphasis in Jackson's method is an intensive analysis of the requirement specification data. The methodology is said to then enforce precise, one-to-one correspondence between the problem data structure and the final program structure. Program designs are independent of hardware and programming languages. Rules are provided for coding in COBOL, PL/1 and other high and low level languages.

The course takes two weeks time and is available in most major U.S. cities, at the vendor's offices, and can also be taught on-site. The cost of training varies from around $800 per person for 15 programmers to less than $100 per head for large staffs. INFOTECH INTERNATIONAL, Pasadena, Calif.

FOR DATA CIRCLE 216 ON READER CARD

words are required to support the PL/M resident compiler. It's priced at $975.

Included with the compiler is a new diskette-based operating system called ISIS-II. ISIS-II contains a macro assembler, linker, locater, and library manager. A text editor with string search, substitution, insertion and deletion commands is included. ISIS-II interfaces with the System Monitor which contains diagnostic aids and peripheral driver routines. INTEL CORP., Santa Clara, Calif.

FOR DATA CIRCLE 221 ON READER CARD

Microprocessor Compiler

This company managed to announce a resident compiler for the Intel 8080 microprocessor system before Intel did, but this one is for a subset of FORTRAN and it's called FORT/80. The great advantage of having a resident compiler is not having to rely on relatively expensive outside time-sharing services for developing programs. Currently only single- and double-byte integer arithmetic is supported, but an IBM-standard floating-point package should be available by the time you're reading this. You'll need 16K of memory, I/O drivers for console and listing devices, and $750. The software is supplied in your choice of diskette, paper tape, or PROM form. A reference and a user's manual is included. UNIFIED TECHNOLOGIES INC., Islington, Ontario, Canada.

FOR DATA CIRCLE 223 ON READER CARD

Library Retrieval

Perhaps the Jet Propulsion Laboratory, which played such a major part in the fabulously successful Mars missions earlier this year, also knows a thing or two about information retrieval in a library. The system they developed is now available for accessing books and documents by a number of data elements: subject, title, authors/editors, source, contract number, or report numbers. The Library Information Retrieval System (LIRS) can also report a library's holdings in terms of these elements. The system also retrieves bibliographic citations on specific subjects by using a logical search. To reduce processing time, the preceding year's data is retired to a history file at the end of each calendar year. Updates of the current year's records are provided on a monthly basis. The program is set up for running on a 370/158 under OS/VS2, and the maximum amount of memory required is 150K bytes. Seven tape drives and a disc storage unit are also required, but we've never seen a 158 without them. The batch mode program is priced at $610; documentation is an additional $16. COSMIC, University of Georgia, Athens, Ga.

FOR DATA CIRCLE 222 ON READER CARD

Intelligent OS Dumps

MINIDUMP 3, available to IBM 360/370 users of OS and OS/VS (MFT, MVT, VS1, SVS, and MVS), is a general-purpose ABEND processor incorporating "intelligent" program dump coding. MINIDUMP 3 produces a continuum of dumps on a completion code basis ranging from no dump at all to a complete dump of storage, and a one page report on the immediate cause of program failure and a summary of conditions at termination. Each dump can either include or exclude the following components: a formatted display of the I/O control blocks for each open data set; a formatted display of the DL/1 call structure and of IMS control blocks; the system control blocks; all or part of the active user load module; the user subpools 0-127 and 251/252; the areas around the program status word address or pointed to by the last (actual or attempted) instruction; the areas around a wider range of addresses, including areas pointed to by the registers; and all or part of the system nucleus, formatted. Including documentation, MINIDUMP 3 is priced at $2,460 for OS systems, $2,920 for VS systems, with an additional $940 charge for the IMS debug option. DATA SERVICES CORP. OF AMERICA, Arlington, Va.

FOR DATA CIRCLE 224 ON READER CARD

letters

(Continued from page 8)

affected parties, to inhibit the latter as much as possible.

The micro and mini explosion is about to burst. Let's hope it blows away some of the guff from the central computer utilities.

PAUL SCHICK
University of Wisconsin
Madison, Wisconsin

Some "wicked" questions

Several analogies to "wicked" aspects of software design came to mind from Peters' and Tripp's article ("Is Software Design 'Wicked'?" May, p. 127). These analogies generated some questions:

1. There is no intrinsic stopping rule in the evaluation of a position in checkers or chess; could the evaluation strategies used in chess and checker playing programs be applied to software design?

2. Were a software evaluation function to be expressed mathematically, it would probably be a hypersurface with numerous saddle points, plus a few local minima and maxima. I suppose that methods exist to find a global maximum if one exists, or to discover that it doesn't; could any of the strategies used in such methods help in evaluation of a design?

3. The problem of decomposing an activity into functions is the same as designing a classification system; what strategies (if any) are used in such a process?

4. The authors' description of the design process as "iterative" is slightly inaccurate; "recursive" is better. My vague question is, then: Could any of the strategies used in programs with recursively called routines be applied to the software design process, especially their stopping rules?

MATHEW B. BARKLEY, JR.
Software Associates
Houston, Texas

Codasyl-type DBMS

In the recent DATAMATION review of data base management system technology (April) and in a published letter from Mr. Harvey Duhon (July, p. 8), the impression is given (or stated explicitly in Mr. Duhon's case) that IDMS, marketed by Cullinane Corp. is a CODASYL-type DBMS, "and as such is the only DBMS of its kind running on IBM hardware." We at the Univ. of Florida have developed a CODASYL-compatible system entirely in machine-independent ANS COBOL which has been running on IBM equipment as well as numerous other main-frames for more than six months. Because this CODASYL-type DBMS is expressly designed to be transportable, it represents a significant advance in freeing the user from hardware dependence. AIM (Automated Information Management) system is currently available from and supported by the Univ. of Florida.

MICHAEL J. SMITH
Assistant Professor
Department of Computer and Information Sciences
University of Florida
Gainesville, Florida

Perversions in language

It is probably too late to halt yet another perversion of natural language (English) of which the computing industry has been all too guilty. However, this misuse grates more than any before it.

Advertisements advise us "The Diskette—a Fantastic Recording Media!"—perhaps more fantastic than we realize when a singular diskette becomes plural media. Media is the plural of medium, and the diskette *is* a fine recording medium.

VAN WHITIS
Manager, Software Development
BNR Inc.
Palo Alto, California ❁

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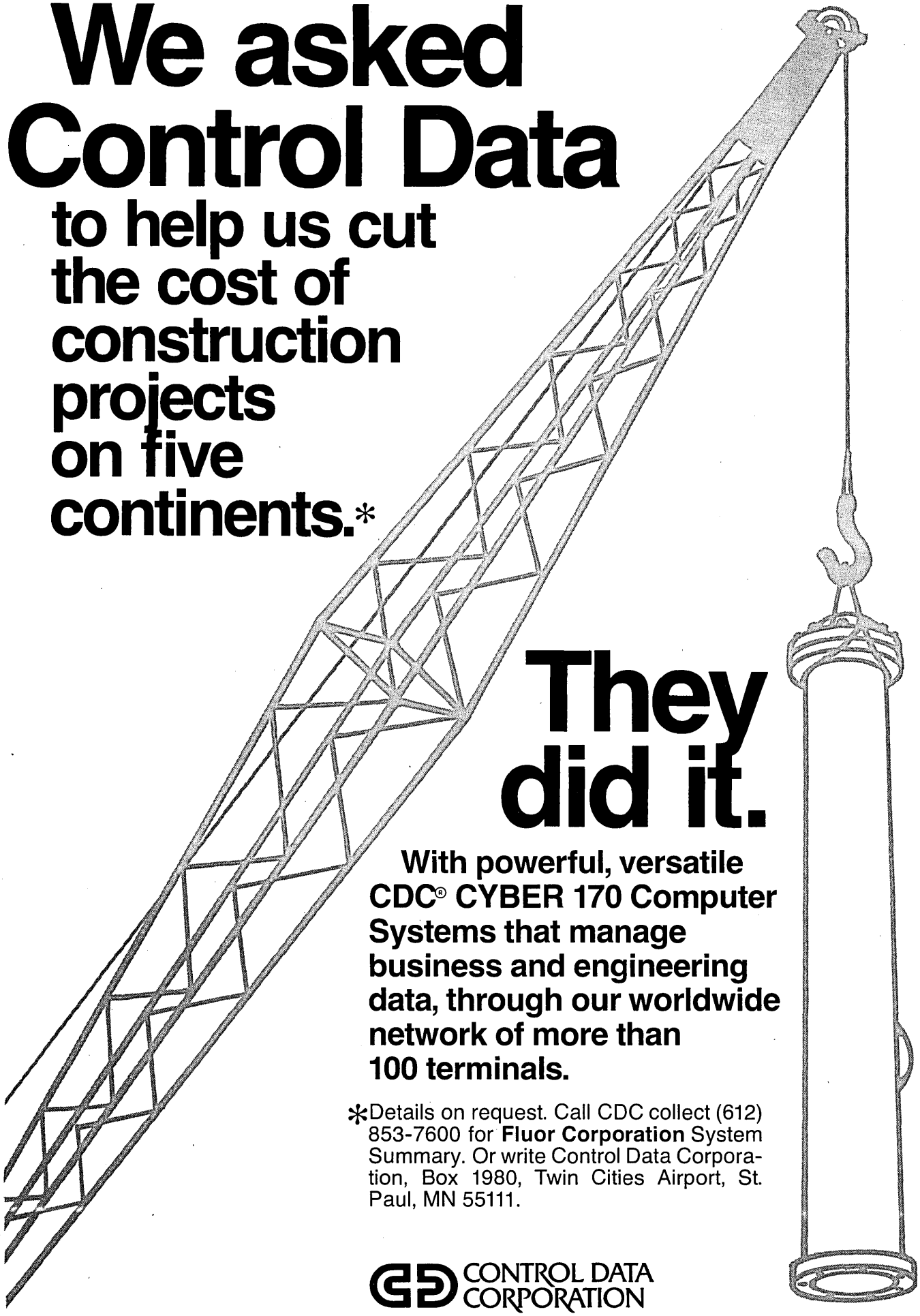

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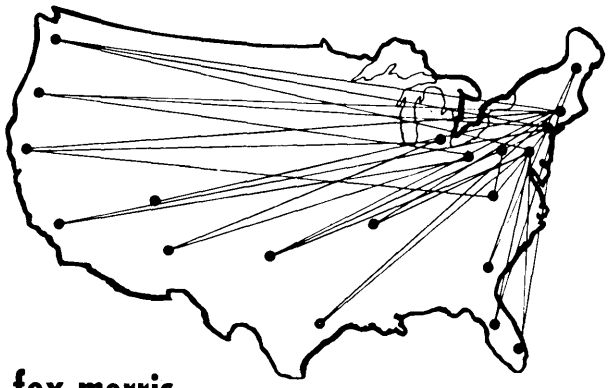

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What To Do With That Obsolete Computer Center You're Running

So now what do you do? One vendor is pushing his "FORTRAN machine," another his "megamini," yet another a standalone data base management system. All are tugging at the sleeves of your customers and saying, "why are you putting up with that unavailable, unreliable, unresponsive expensive central facility, with operators who make mistakes, when you can have your own machine, available when you need it, run the way you want, and save money to boot?" Sure you can fight back, get higher management to forbid it, tell scare stories about bad software and maintenance problems, bribe favored users with lower rates or less savory inducements, but eventually you had better find something truly cost effective to do with your multimillion dollar white elephant.

Look at your options. You could arrange an orderly phaseout of your central shop, help your users transfer to independent minis or to some surviving central facility, and find another way to earn a living. Or you might continue business as usual; some centers are bound to survive. Most likely you will see a gradual erosion of your customer base. If neither course—giving up, or gritting your teeth and staying put—appeals to you, you must pick a direction.

Consider one extreme. You might take the advice of some quantum chemists, and adjust your pricing to hold the number crunchers. In this scheme compute-bound jobs would be charged for just the cost of the cpu, not for peripherals, operators, etc. Don't do it. This may keep the number crunchers from straying, but ultimately it would produce a severe revenue squeeze. On most machines, service to small jobs and interactive work requires good cpu access. Low rates for compute-bound jobs would very likely encourage heavy cpu loading, reducing response to other jobs and pushing out customers who are supporting the peripherals and operators.

Better to orient your shop towards the small user, to provide him with services and facilities which are not easy to buy from an equipment vendor. Forget the large number crunchers. They don't really need you for straight computing. Someone spending $100K per year in your shop can easily afford all the computing he needs in a "mini," plus an operator and time-critical maintenance. Instead of chasing him, provide unique data bases, ultrahigh quality peripherals, stable response, hand-holding, documentation, and tender loving care. These are things your small users are not likely ever to be able to provide for themselves. Such users may be messy to serve, but they validly justify your staff, and can even justify expansion. For example, consider the following:

Media conversion. Provide local and remote support for as many peripherals and media as possible, with simple copy

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commands and sensible defaults. Despite everyone's pious hopes for standardization, the variety of incompatible data storage media is still increasing. Paper tape, cassettes, floppies, magtapes, an infinite variety of discs, punch cards, mark-sense cards, MICR, and OCR all coexist. Your services will then be of value to a wide range of users, including a lot of those strayed mini-owners who cannot afford to buy one of everything.

But take care that *your* "one of everything" is of the highest quality and scrupulously maintained. While a user will lovingly coax his own cranky paper tape reader along, he will hate you if yours so much as burns.

Small scale data storage. Make small scale data storage cheap. Most centers provide discounts to users who store very large quantities of data on system storage. But in a system that chains file blocks, as long as directory blocks are charged as part of the files, small files actually cost less than large files. They cause fewer problems with disc fragmentation, overflow of dump tapes, automatic retrieval from tape, and deadlocks. Indeed, a user who needs only a few tens of thousands of characters of file space to run is nearly invisible to others sharing the facility, while one requiring half a disc to run can bring the system to a screeching halt if only 49% is available.

A center that discourages large user files and charges low prices for small files might just manage to compete with current minicomputer disc prices. In addition to attracting users who wish to store programs to run on your own cpu, you will attract users who wish to store programs for their own minis for remote loading. Naturally, this should be augmented by providing libraries of system and applications software for minis on your discs.

Data bases. While discouraging large files for single users, you should do everything to encourage large, shared data bases and program libraries. A stable data base, under the control of your center, does not have to conflict with the creation of small files by your users; and it is a rare user who can afford to maintain a major data base for his private use.

Pick a few fields represented in your current user community, and provide, say, bibliographic searches, patent files, and citation indices directed towards their interests. You can recover the cost of the file space by subscription fees and/or cpu use surcharges. The existence of such bases will encourage more cpu use by your current users and attract new users.

Hand-holding. Be the experts. Some users can probably handle your machine better than your staff, but most users have better things to do with their time than browse through computer manuals. Let as many of your line people as possible advise users on how to use computers effectively, even on how to use their own minis effectively. Don't try to make money from this activity directly. It is essentially a form of advertising, to be handled as an overhead item.

But the returns on such activity can do more for your center than almost anything else. It is good for staff morale as well as user morale; it encourages the highest staff training levels; it brings problems to light very early; and it may even make your users think your center is worth supporting, even if it is obsolete.

—**Herbert J. Bernstein**

Mr. Bernstein is a programmer in the chemistry department of Brookhaven National Laboratory, Upton, Long Island, New York.

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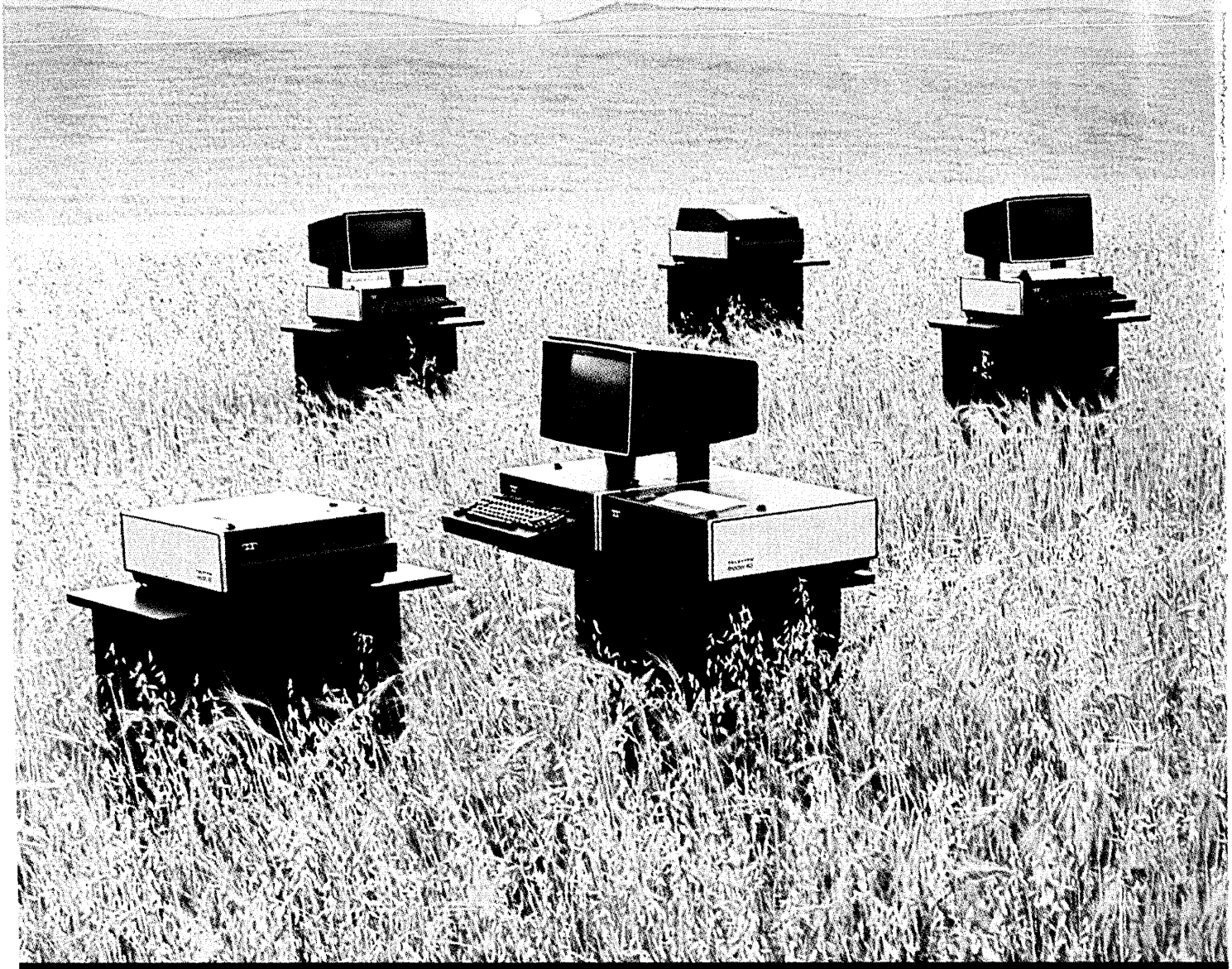

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