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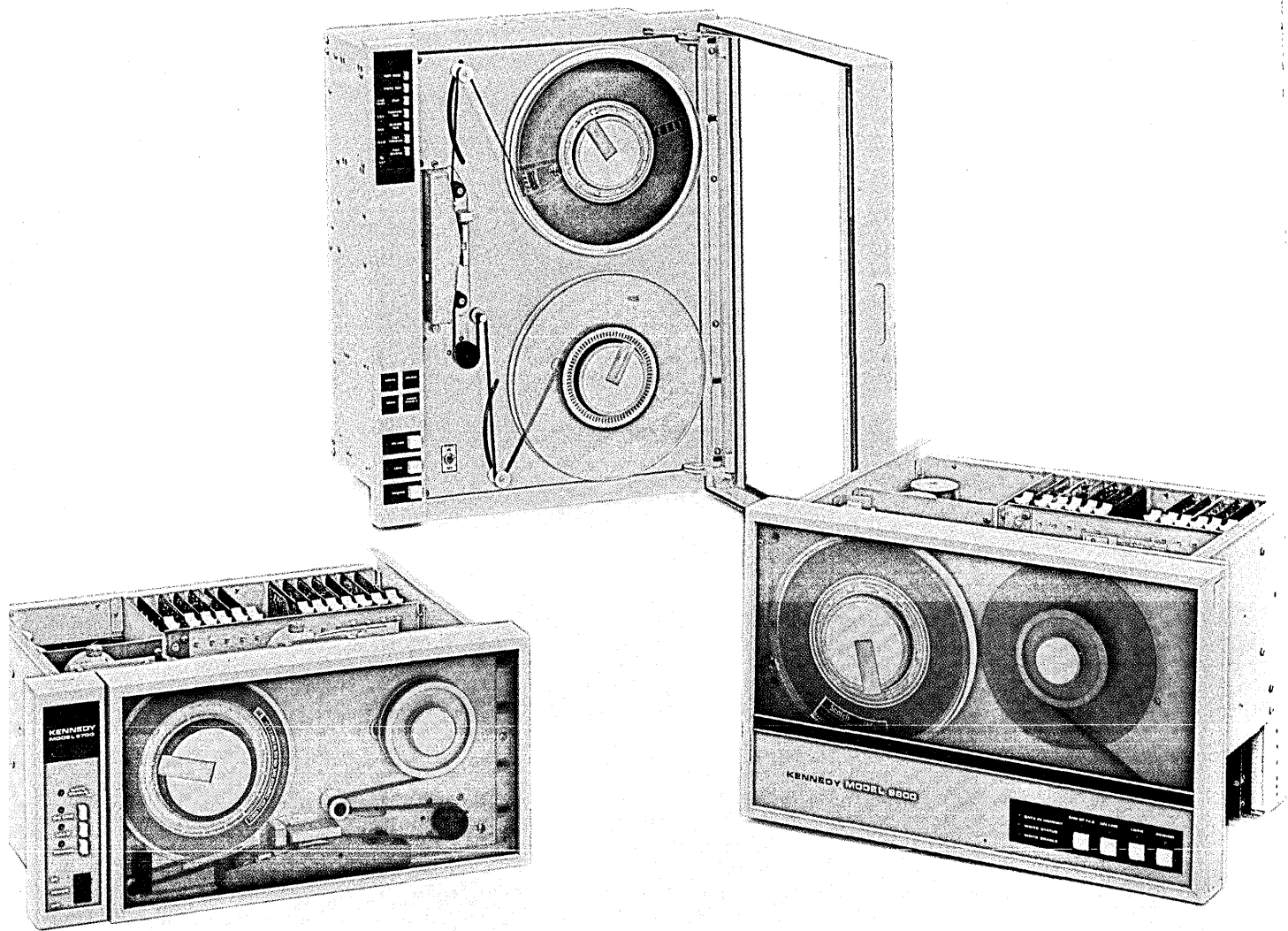
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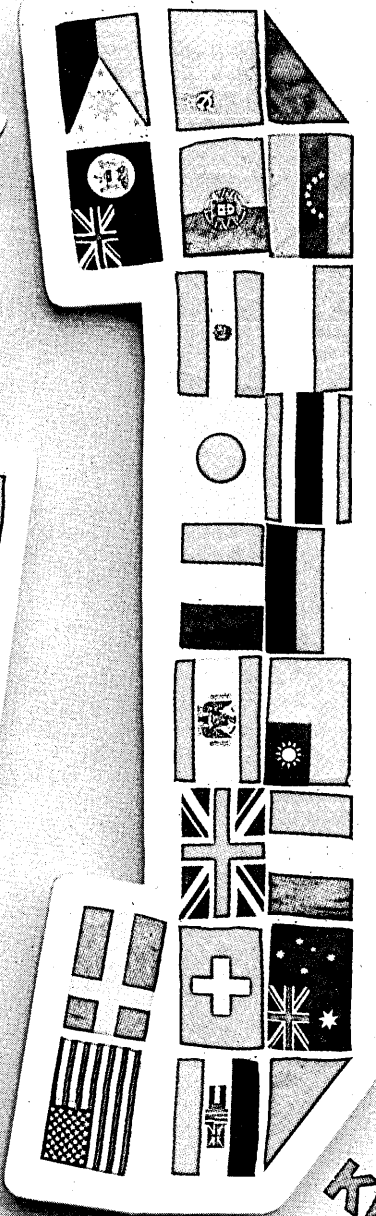
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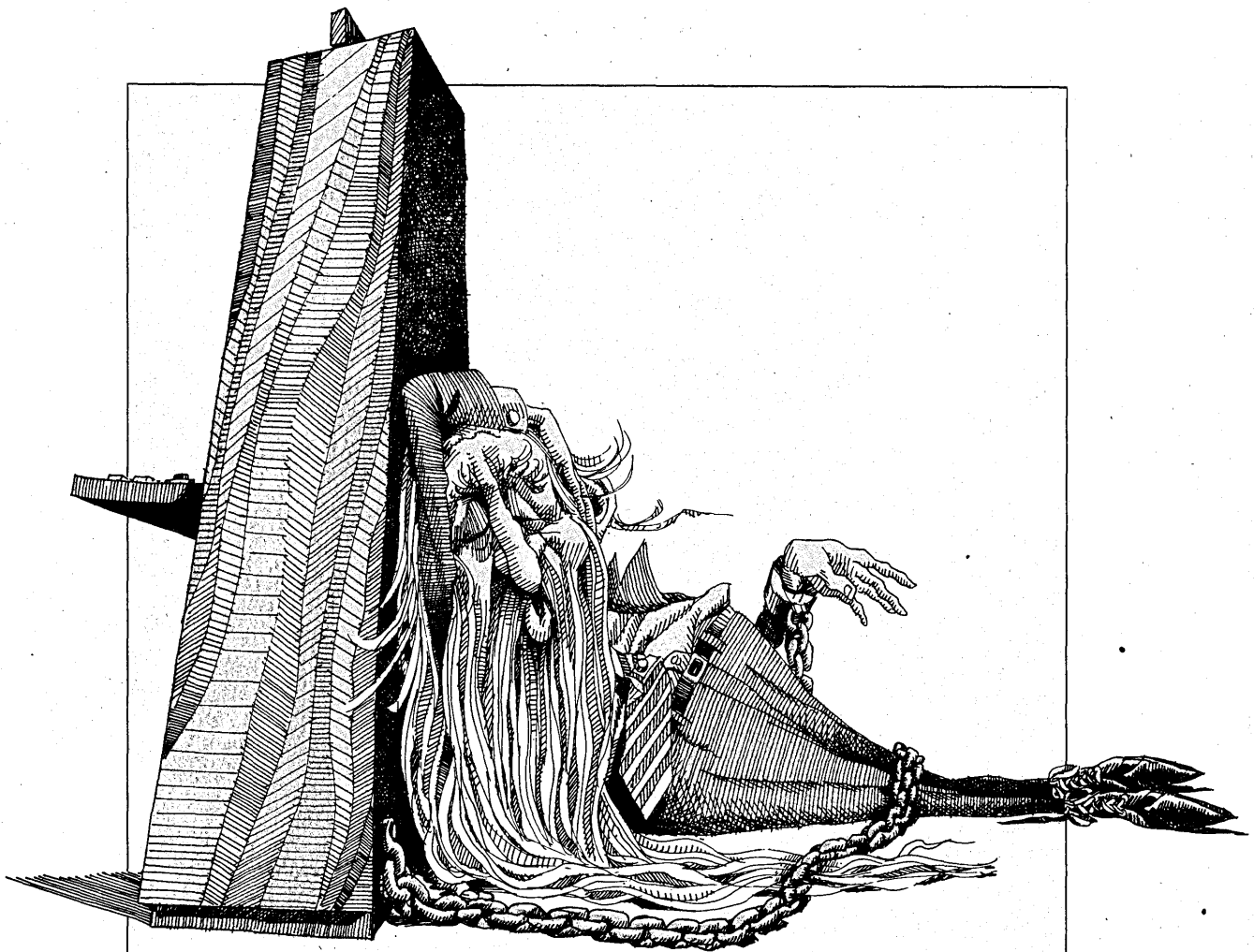
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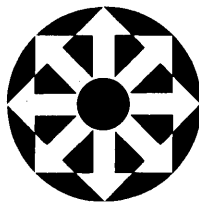
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VOLUME 22 NUMBER 6

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JUNE 1976

FEATURES

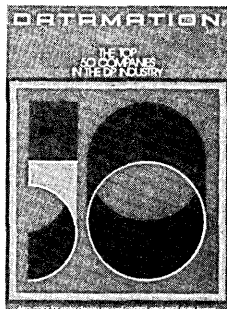
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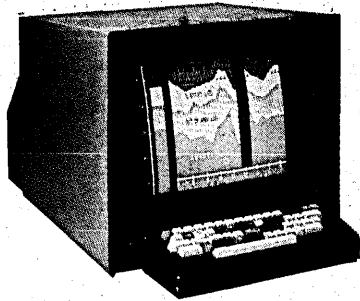
preneur has come into his own, bringing computing power to the mom and pop shops of America. Will his numbers increase, or are there hard times ahead?

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- LOOK includes facilities to dynamically correct system imbalances which result in reduced throughput.

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- CPU Utilization
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- Paging Activity (VS only)
- Wait Conditions
- Job/Device Associations
- Control Block Information
- Core Usage

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- Core Fragmentation
- Exclusive use of data sets
- Waiting for shared DASD
- Lost I/O Interrupts

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- Invisible Problem Identification—"See" hidden aspects of a system's operation which may be the unsuspected problem source.
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JOB	STEP	TOTAL PAGES	LT FIX BLW V=R	LT FIX ABV V=R
PRODJOB1	STEP4	90	00	00
PAGEABLE	LINKPACK	80	00	08
TESTJOB2	STEP1	20	00	00
XJOB	LNK	12	00	00
*NUC 30	SOA 16	LSOA 8	LRG AVL V=R 30	OF 30

*PAGES IN/SEC 45 PAGES OUT/SEC 40

THRASHING DIAGNOSIS

JOB	STEP	% USING CPU	% WAITING FOR CPU	% WAITING FOR I/O OR WORK	PRIORITY
PRODJOB1	STEP3	92%	00%	08%	10
OPERATNG	SYSTEM	06%	00%	94%	15
TESTJOB	STEP1	02%	96%	02%	03
XJOB	COBSTEP	00%	100%	00%	06

*THE CPU IS BUSY 100% OF THE TIME

HIGH-PRIORITY, CPU-BOUND JOB DIAGNOSIS

CHN/UNIT	TOT BSY	VOL	JOB	STEP	FILE	BSY	CYL	CWT	
*CHN	1	32%							
CHN	2	15%							
*DSK	152	50%	DISK03	PRODJOB1	STEP5	INFILE	22%	160	05%
				PRODJOB1	STEP5	OUTFILE	12%		
				TESTJOB2	STEP1	SYSUT3	10%		
				XJOB	GO	LIBFILE	06%		
DSK	233	20%	DISK04	PRODJOB1	STEP5	MASTFILE			
DSK	130	10%	SYSRES	OPERATNG	SYSTEM			02%	

DEVICE CONTENTION DIAGNOSIS

SYSDSN	TEST.LIB	
*TESTJOB3	STEP1	-OLD
INIT1	PRODJOB2	-SHR
INIT2	TESTJOB4	-SHR
INIT3	PRODJOB3	-SHR
INIT4	XJOB	-SHR

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letters

Memories are made of this

As a member of the group which developed IBM's first commercial core memories, I was fascinated by your story ("The Fight for Core Memory Patents," March, p. 162) concerning the MIT/IBM patent negotiations and their uneasy partnership in the SAGE program. There is another, little known, aspect of those events which I believe your readers will find interesting, if only because of its ironic twist.

Among the SAGE-MIT "men who spent more time at Poughkeepsie" was a young engineer who had come up with the concept of a magnetic switch for address selection for core memories. Although this was part of his thesis at MIT before the start of his SAGE work, it was patented by MIT and was part of the package licensed by IBM. Thus, he also shared in the settlement described in your March article.

This "Anti-Coincident Magnetic Matrix Switch," (its awkward patent title), was incorporated into IBM's early core memory machines, the 704, and its business partner, the 705. The result was a fourfold reduction in high powered, multi-tube address select drivers—simplifying circuitry, reducing size, power and heat dissipating requirements, and greatly enhancing reliability—in all, a significant factor in the success of these systems. The inventor was only consulted briefly and informally at his Poughkeepsie office, although the switch was known by his name, internally within IBM. However, in the published descriptions of the IBM memories, its patronymic was forgotten. Indeed, the secret was so well kept that he says he only learned that his brain child was ever implemented just four months ago!

The rest is history. The IBM 700 series went on to the technical and monetary fame so well described by Richard McLaughlin in his article, "The IBM 704: 36-Bit Floating-Point Money-Maker" (August 1975, p. 45). And the inventor? Soon after, he left MIT's Lincoln Labs and went on to smaller and better things, founding a company now on an apparent collision course with IBM itself. I wonder what DEC's Ken Olsen now thinks of his almost unknown, but important contribution to "the most profitable program in IBM's history."

ROBERT L. WARD
Consultant
Acton, Massachusetts

Artificial intelligence and human reason

Joseph Weizenbaum's *Computer Power and Human Reason* brings to computer science a new method of proof—calling ideas obscene. Daniel McCracken in his review of the book (April, p. 27) approvingly quotes, "The very asking of the question, 'What does a judge . . . know that we cannot tell a computer?' is a monstrous obscenity. That it has to be put in print at all, even for the purpose of exposing its morbidity, is a sign of the madness of our times."

However, when Weizenbaum complains that coupling an animal's visual system and brain to a computer is "simply obscene . . . [an idea] whose very contemplation ought to give rise to feelings of disgust in every civilized person," McCracken, who sees some good in the idea, mildly says he wishes Weizenbaum would elaborate his objections. This seems inconsistent, because both of them call ideas obscene precisely when they don't wish to elaborate their objections. It's a bad sign of our times that this style meets no objections from reviewers—not to mention editors.

I am sorry Weizenbaum has made McCracken hate us at the AI Labs enough to imagine us gnashing our teeth, but this is not why I write now. My problem is that Weizenbaum "quotes" me twice from oral debates, McCracken repeats *both* "quotes," and I can't confirm either one. The first doesn't bother me because I do believe we will eventually be able to tell a computer what a judge knows. It won't be soon, and we may not want to use computers as judges, but my opinion on the scientific issue (and I trust those of DATAMATION's readers) will not be influenced by the silly charge of having obscene ideas.

The other quotation, "*The only reason we have not yet succeeded in simulating every aspect of the real world is that we have been lacking a sufficiently powerful logical calculus,*" is allegedly from the BBC debate with Lighthill; but no one can find it on either the videotape or the audiotape. . . . We do need powerful logical calculi, and a description of the common sense world using these calculi, because full simulation is usually impossible. . . . We use the law of conservation of energy even when we know the precise laws of motion—and even more when we don't. I thought perhaps I had misspoken in rapid dialog, but it just isn't on the tape.

Maybe I shouldn't complain about having my research misrepresented; such distinctions may be mere pedantry to a practical professor who can say, "*Scientists who continue to prattle on about 'knowledge for its own sake' in*

order to exploit that slogan for their self-serving ends, have detached science and knowledge from any contact with the real world."

Let McCracken beware lest his next book be banned in Poughkeepsie for obscene COBOL programs.

Yours for precision in language.

JOHN MCCARTHY
Professor of Computer Science
and Director
Artificial Intelligence Laboratory
Stanford University
Stanford, California

Daniel McCracken's review . . . is very disturbing, not because of any criticism of artificial intelligence, but because of the anti-intellectual spirit manifest in some of Weizenbaum's remarks. I fail to see how a statement like "The very asking of the question, 'what does a judge . . . know that we cannot tell a computer' is a monstrous obscenity" is *any* different from the bigotry that attacked Darwin's speculations on evolution as obscene and branded Galileo's theories about the planets as heretical.

For all I know, Weizenbaum and McCracken may be right in stating that we cannot fully understand humans as information processing devices, although it is unclear just why this limitation should apply to some of the specific questions (such as differences in the right and left brain hemispheres) mentioned in the review. But, surely, it cannot be immoral to make the attempt, or to ask just where the limits lie.

In his review, McCracken states, "In some places, more explanation of the reasoning would be welcome." It might have been more accurate to say that in some places, logical reasoning is missing. What we have instead is a mixture of emotion charged words and circular reasoning, which boils down to the simple assertion that some things are immoral because they are immoral, and one shouldn't think thoughts that encourage immorality. Thus, the proposal (mentioned in the review) that animal visual systems be coupled to computers is dismissed as "an attack on life itself." Similarly, Colby's suggestion that computers be used as psychotherapists is rejected, not because it won't work—although a case might be made that it cannot—but because it is "immoral." It is not entirely clear just why a tool that helps someone in deep emotional distress is such an evil thing, especially if having the tool allows persons to be helped who otherwise could not be.

Unlike McCracken, I do not believe that these are minor quibbles. On the

letters

contrary, it is this characteristic of Weizenbaum's argument that constitutes the major weakness of his book. It is certainly true that computers (or anything else) should not be applied for immoral ends. But it is exactly in situations where such value judgments must be made that clear reasoning is most necessary, and where the use of epithets instead of explanation is most dangerous.

One of the chief prizes of our intellectual heritage is the concept of free inquiry. Bitter experience has taught that such inquiry does not flourish in an atmosphere where a question can be called "obscene." It is part of the "madness of our times" that intellectual debate is carried on in an atmosphere of increasing verbal inflation. It is this, more than anything else, that threatens to lead to "a shriveling of the concepts of freedom, dignity, and—yes—even grandeur and sanctity of spirit" which McCracken so fears.

RUSSELL H. TAYLOR
*Artificial Intelligence Laboratory
Stanford University
Stanford, California*

Professor Weizenbaum responds: I confess that I am unable to give reasons to explain why I find the idea of disembodiment the brain and the eyes of a cat, keeping them artificially "alive," and using them as visual receptors of a computing system, obscene. If simple human decency allows nothing to be taken for granted, then I retreat before the onslaught of my critics.

There are some things I, however, do take for granted. One of these is that a machine of the sort here in question (and that my critics can apparently view with equanimity) would appear to me to be a monster from which I would turn with disgust and revulsion. I have in mind also the teaching urged on us by some leaders of the AI community that there is nothing unique about the human species, that, in fact, the embrace of the illusion of human uniqueness amounts to a kind of species prejudice, and is unworthy of enlightened intellectuals. If we find nothing abhorrent in the use of artificially sustained, disembodied animal brains as computing components, and if there is nothing that uniquely distinguishes the human species from animal species, then—need I spell out where that idea leads?

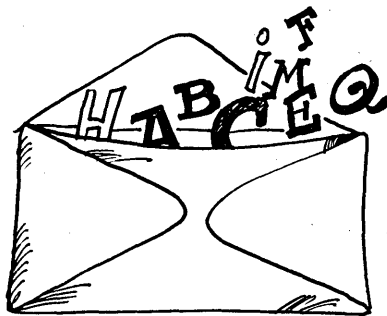
With respect to the question "what do judges know that we cannot tell computers," let me make the following analogy: Consider the question "what has art contributed to human welfare?" Were that question asked in order to define a theme for a curriculum of study, then I would applaud its asking. If, however, the question is asked rhetorically, i.e., were it really an assertion that art had contributed nothing to human welfare, and if, moreover, that assertion were made as part of an argument that artists

ought to be declared social parasites, then I would find the question obscene. I agree, certainly, that there is a form of the question "what do judges know that we cannot tell computers" that raises substantive questions about the limits of computation. These are the very questions to which the bulk of my book is addressed. But the way John McCarthy asked me that question at the Stanford AI conference in 1973 clearly indicated that the question was not a question at all, but an assertion that all human knowledge is reducible to computable form. This diminishing of the human being I find offensive. I apologize for not having made this point sufficiently clear in the book.

I admit to an error with respect to the quotation John McCarthy could not find on the BBC videotape from which I had said I acquired it. On that tape, Prof. McCarthy says only "... the general formulation of what the world is like has not been accomplished ... part of this is due to a defect in our current systems of mathematical logic." My attribution should have been to a discussion following a showing of the tape. I apologize for the error. Even though my original citation made it clear that the statement in question was made in the context of a debate, I regret that I may have lent undue weight to what was in fact spoken in the course of a fast paced argument, and which, given more tranquil circumstances, Prof. McCarthy would surely have qualified.

I stand by my statement that "scientists who continue to prattle on about 'knowledge for its own sake' in order to exploit that slogan for their self-serving ends, have detached science and knowledge from any contact with the real world." I call attention, however, to the boldfaced clause. Let those "scientists" whom the shoe fits wear it.

Finally, I see John McCarthy's gratuitous escalation of McCracken's innocent use of the teeth-grashing metaphor to an implication of "hate" as precisely the kind of inflation of language that Russell Taylor rightly deplores.



... and Mr. McCracken replies also: These letters are directed primarily at Professor Weizenbaum, but I wish to respond to the question of what is harmful in using a computer as psychiatrist if troubled people are helped by it.

The problem is that there is a fundamental deception of the patient who thinks he is getting therapy when actually he is in effect conversing with a random number generator. That it is in part self-deception does not alter the doctor's complicity, if he does nothing to correct the patient's misunderstanding.

Once a doctor comes to believe that it is permissible to systematically lie

to his patients "for their benefit," then there are no limits, medically or morally. Psychosurgery then becomes all right or potent experimental drugs administered without informed consent, or uses of a computer that assume there is no important difference between a man and a machine. The doctor has become the supreme arbiter, responsible to no one, of what is "good" for the patient. The patient has no participation in the decisions affecting his future, no rights, no dignity. The elitist outlook is unmistakable, and, to me, frightening.

Remember that Weizenbaum's basic question was this: What can be the view of human nature by a doctor who is willing to deal with people in such ways? What has the use of the computer, even though it is "only a tool," done to the doctor's perception of what it means to be human?

Evidently this kind of question does not interest the Artificial Intelligence people, if we may judge by the emphasis on such less substantial issues as the choice of words to be used in debating. The question must be asked, nonetheless.

And thank you, John, for plugging my new COBOL book.

Computer abortion

In the April issue, a guest editorial entitled "The Great Data Famine" by Art Buchwald appears on page 45. In the last two lines of his satire, he humorously refers to the Vatican's computer blessing for computer abortions.

I would expect to find ridicule of the Catholic Church's teachings in Mr. Buchwald's newspaper column. I would not expect an industrial or scientific publication as DATAMATION to become an avenue of religious intolerance and bigotry.

I think it is completely inappropriate for you or your guest editors to vent their prejudices under the cover of "April foolishness." This demonstrated insensitivity on your part represents an effrontery to the American Catholic community.

ANTHONY F. NORCIO
*Coordinator, Academic Services
Computer Center
The Catholic University of America
Washington, D.C.*

Regrettably Mr. Norcio took offense at our guest editorial when none was intended.

HIPO at Ward's

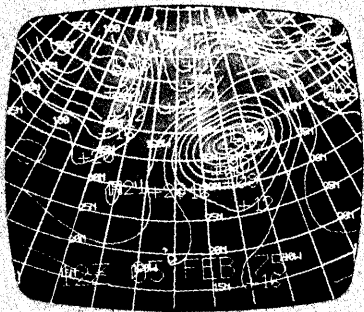
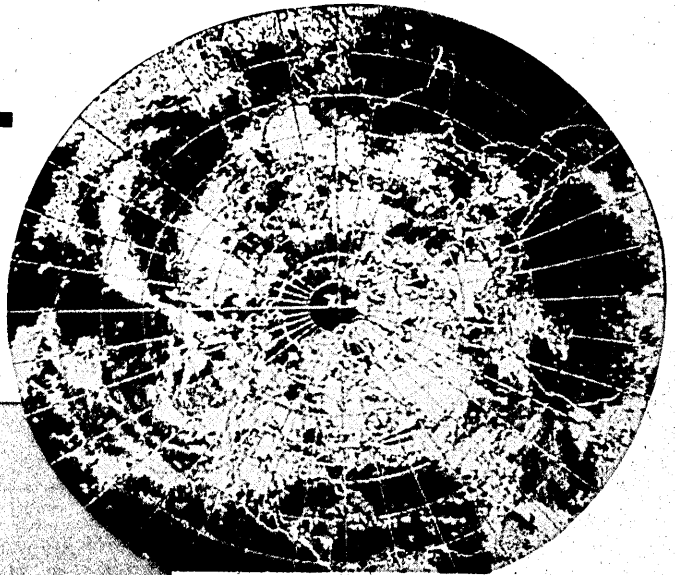
Enjoyed reading Martha Jones' article about HIPO's and Improved Programming Technologies (March, p. 112). We've had the same experiences and success using HIPO's at Ward's. We even had the same comments from the user that he could understand the system before it was installed.

Our approach was a little bit more structured than Mrs. Jones in that we used design HIPO's for the business functions and then developed detailed HIPO's for program specs. The user was

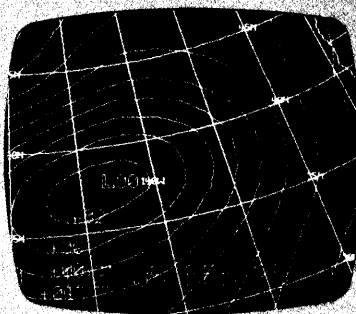
(Continued on page 187)

Genisco Displays.

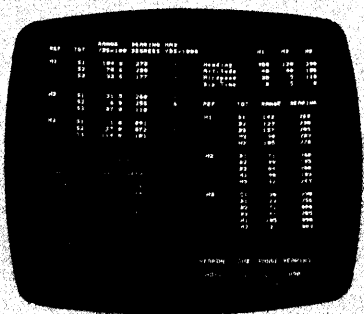
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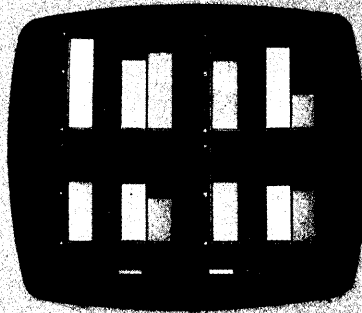
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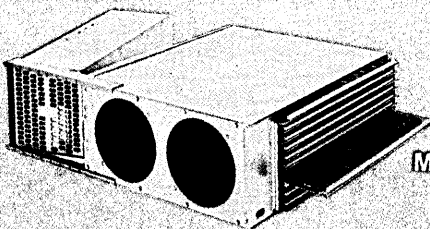
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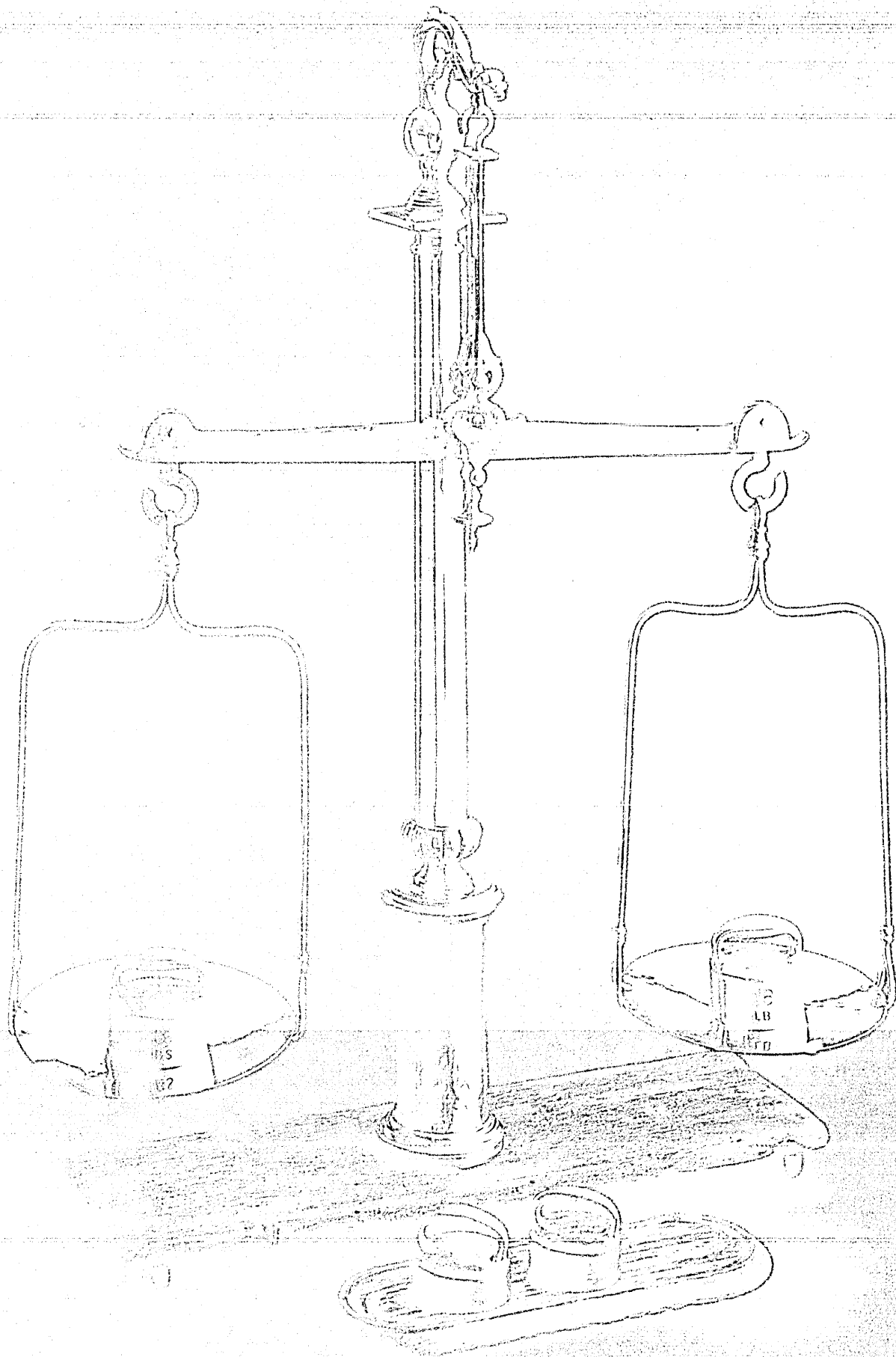
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Let's see how the SEL 32 Hardware balances with the SEL 32 Software.

On the hardware side of the scale, we'd like to say a few brief words about obsolescence, throughput, and I/O.

The SEL 32 Mini's powerful CPU architecture is proof against obsolescence. Want to upgrade? Just change a board or two.

Throughput? The SEL Bus is capable of transferring data and commands at a continuous throughput of 26 megabytes per second. Based on a 150 nanosecond clock, this has established the industry standard for bus speed.

Lastly, I/O. The SEL 32 is the only 32-bit mini that employs micro-programmable, independent processor-based I/O, so it doesn't have to steal cycles.

That's all quite nice, but so far, it's just iron. Let's take a look at the other side of the scale: software.

You understand the impact of unreliable software. The SEL 32 software has seen over five years of enhancement and action, so you can be sure it's bug-free, seasoned, and headache-proof.

But there's more to software than a super track record.

The nucleus of our software is provided by a powerful, disc-based Real Time Monitor ... a true multi-programming operating system capable of handling up to 255 concurrently executing tasks.

One of those tasks, the new SEL Terminal Support Subsystem, allows up to 16 CRT operators to develop programs, debug, or activate tasks ... concurrently. Result? Increased flexibility.

Another SEL software bonus is our highly optimizing FORTRAN IV Compiler, which reduces the amount of memory and execution time required for a program. In addition to its full ANSI-standard capabilities, several extensions are available which enhance its real-time applications even further.

There's more, of course, such as RJE terminal support, graphics software, a BASIC compiler, and additional operating systems.

Consider, then, this combination: Flexible, reliable software, based on our powerful RTM; and dynamic hardware, with Independent I/O, record-shattering bus speed, and totally upgradeable CPU, which absolutely defies obsolescence.

This is how the SEL 32 keeps its balance... to help you keep yours. (And for as little as \$18,000, it's been known to help balance some corporate budgets, too.)

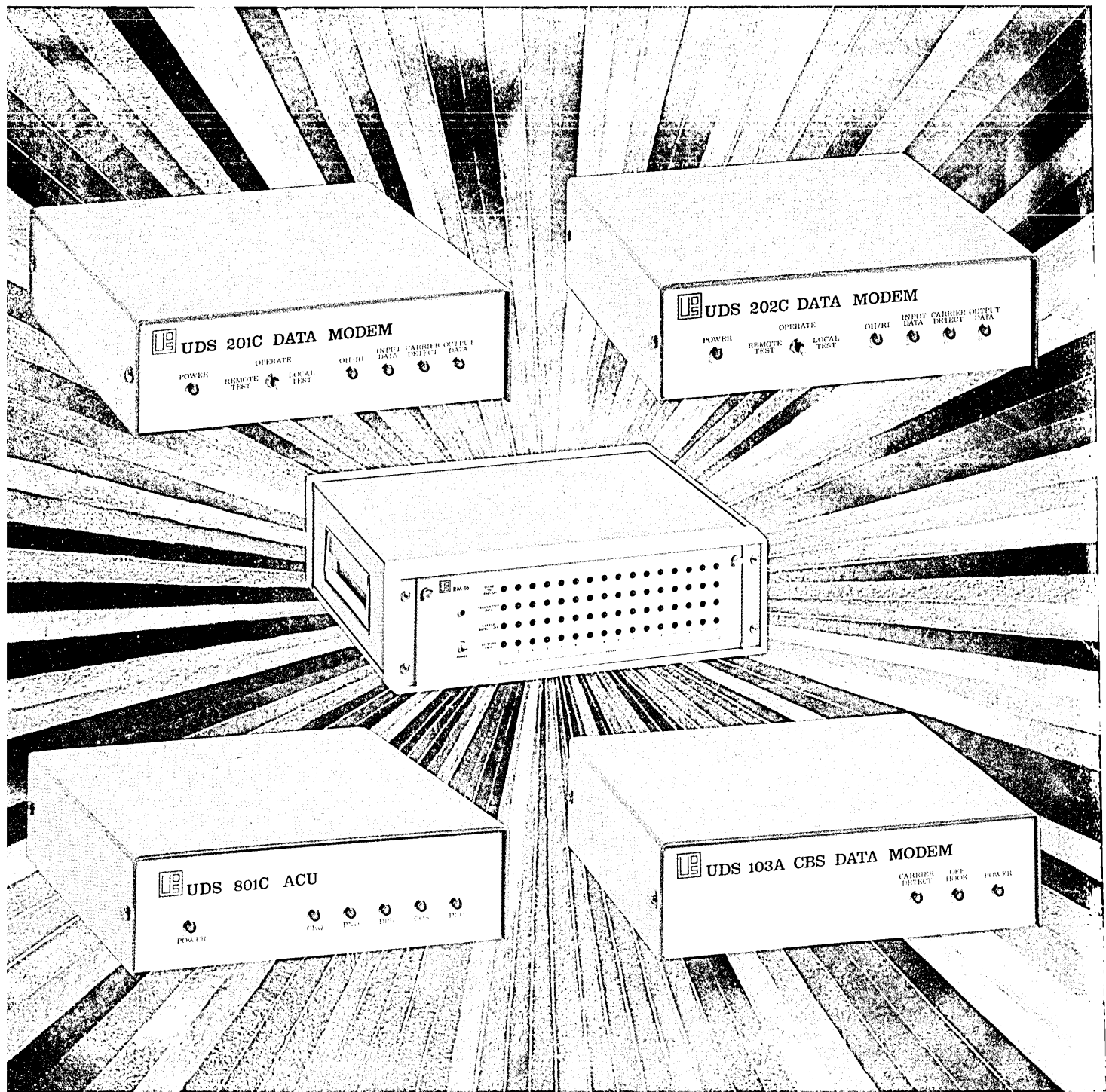
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Destination: Toronto

Each June at college graduation time, the top aspiring circuit designers head for Silicon Valley to the semiconductor manufacturers near San Francisco. Novice minicomputer architects go to the Boston area. And a smaller elite known as the "APL freaks" make the trek to Toronto.

The destination is I.P. Sharp Associates, Inc., a software and time-sharing company that has built an international name for itself in APL.



IAN P. SHARP

"... I said that last year and ..."

"The APL nuts seek us out," says Ian P. Sharp, president. "Not long ago, for instance, we had a guy wander in here from New Mexico wanting to work for us. He was good and we hired him."

Others who sought out the firm and were hired on were three children of Kenneth E. Iverson, the former Harvard teacher who developed APL (A Programming Language). Iverson is now at IBM where the firm said recently that all of its divisions rely on the software language in one way or another.

Sharp Associates is something of an anomaly for a Canadian computer company—the firm is highly profitable and is growing rapidly. Most of the good news at the firm is directly trace-

able to APL and its growing use in the commercial market. The language, of course, has always been strong in the scientific marketplace.

Ian Sharp says his firm will permanently look upon APL as its mainstay ("It's a limitless language.") His company uses APL and the company's own communications network primarily for applications in corporate planning, and in financial, economic and econometric data bases.

"We have a continuing development program in APL," says Sharp. "We have 11 people working full time in systems development just doing basic software and programming improvements."

Sharp has tied his services together with a minicomputer-based packet switching network. With offices scattered around North America and local dial hookups to support the Sharp offices, the firm can claim relatively wide coverage. The company, which has some 200 employees, also has offices in London and Amsterdam.

Sharp says that most of his firm's European business comes from the company's North American customer base, and he sees increasing opportunities for his European business as Europeans become more sophisticated in computer usage. This year, he expects to do about 40% of his business in Canada with that percentage continuing to decline as the company increases its U.S. and European base.

One interesting aspect of the Sharp operation is that the firm has been able to cut back on hardware costs as software and time-sharing services have

been refined. "We've thrown out the two 370/145s we had," notes Sharp, "and the two 360/75s we replaced them with cost us less than one 145."

Sharp concedes that his firm's competitive advantage increases because the time-sharing network tends to "lock customers in." However, he notes that the company's APL batch service has an offering in which customers pay only for the service they actually use at a reduced cpu time rate of 20 cents per unit and the \$8/hour connect charges are eliminated. IBM's 5100 with its APL capability has been something of a boon for Sharp's business in that some customers do their order entry on site, edit the job on the 5100 and finally assemble it on Sharp's network.

Irish-born Sharp got into APL gradually. Trained at England's Cambridge Univ. in operations research—which the wry Sharp refers to as "management science fiction"—he came to Canada in 1960 seeking work. "I couldn't get a job in operations research in Canada because nobody ever heard of it," he recalls. "So I had to call myself a programmer."

In 1964, Sharp Associates was founded and the company was financed internally on a shoestring to the point that its annual business is about \$10 million and growing very rapidly. Last year, the firm's growth rate was 60%.

Can Sharp Associates continue that rapid rate of growth, Ian Sharp was asked.

"I doubt it," he says, and, after a pause adds: "But I said that last year, and we grew 60%."

"There's No Other Industry..."

Kim Kelley, 31, started out his business life selling leather goods.

Now he's selling big computers. He's the new Industry Manager, State and Local Government for Amdahl Corp. He joined Amdahl Corp., headquartered in Sunnyvale, Calif., after six and one-half years of selling computers for Honeywell, much of the time to state and local governments and to universities. Kelley works out of Amdahl's midwest regional office in Chicago.

He feels there's a good market for Amdahl computers in state and local governments because of the financial investments of these groups in IBM software (Amdahl machines are fully IBM compatible) and stringent budget requirements.

A native of Davenport, Iowa, Kelley attended the University of Iowa and Long Beach City College. He came to California from Iowa because "I wanted to see the ocean and I loved it."

But he returned to Iowa to "marry my childhood sweetheart, corny as that sounds," and was selling leather goods

in Peoria, Ill. when a friend of his, a sales manager for Honeywell, got him into computers.

"Initially I wasn't comfortable. I had



KIM C. KELLEY

"concepts are more important"

International Computing Symposium 1975

edited by E. GELENBE, *Belgium*,
and D. POTIER, *France*.

1975. 276 pages
US \$ 27.50/Dfl. 75.00

This volume contains the proceedings of an international symposium organized by the European Chapters of the Association for Computing Machinery, held in Antibes, France, June 1975. It presents an up-to-date picture of the current state of computing, with an emphasis on recent developments and research.

SESSIONS: 1. General. 2. Numerical Analysis. 3. Programming Languages I. 4. Theoretical Computer Science I. 5. Computer System Models and Performance I. 6. Terminal Systems. 7. Programming Languages II. 8. System Design. 9. Measurement. 10. Theoretical Computer Science II. 11. Computer System Models and Performance II.

Minicomputer Software

edited by J. R. BELL and C. G. BELL,
Digital Equipment Corporation, U.S.A.

1976. 346 pages
US \$ 27.50/Dfl. 75.00

Minicomputers are the most rapidly proliferating types of computing equipment and minicomputer software is the key to success in applying minicomputers. This book contains the proceedings of the first IFIP Working Conference on Software for Minicomputers, September 1975. Eight papers by leading experts, provide a wealth of information on the design and application of minicomputer software while in-depth panel discussions offer a stimulating interchange of viewpoints and insights, by teachers, users and software designers. Each section of the book is self-contained so that the reader may concentrate on those parts of direct interest and value to himself.

Integrated Automation Practice

by L. PUN, *France*, J. ARACIL, *Spain*,
and J.-L. ABATUT, *France*.

1975. 380 pages
US \$ 31.95/Dfl. 80.00

The aim of the book is twofold. Firstly, using fourteen practical examples involving basic operations of adaptation, one-level adaptations and multi-level adaptations, it sets out to show how today's automation problems can be formulated. Secondly, the methods and means of solving these sub-problems (theoretical and technological) are described in twenty appendices.

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PEOPLE

no math background. But I soon found out that concepts are much more important in the computer business than multiplication tables.

Seven months ago, while still with Honeywell, Kelley decided to change jobs, to move into another industry. He did a lot of interviewing. "I decided there is no other industry with the exciting challenges of the computer industry." He stayed.

He joined Amdahl last March 15.

War is War...

It's a far cry from war games to data base management and data communications... maybe.

Not for Kenneth A. Parker, president of Computer Information Management Company, Dallas based marketer of both data base management and data communications services.

Parker, as a West Point cadet in the '50s, was a star in war games. Maybe what he did then helps what he's doing now.

Computer Information Management Co. started out as a custom "house."



KENNETH A. PARKER

From war games to more of the same???

Parker teamed up with fellow IBM-alumnus Chuck McCoy to make the big switch to data base management and data communications. McCoy and Parker founded CIM in 1968.

"We had a very important product feature that was not being explained or exploited," said Parker. "Datacom (a CIM software product) is the only data base system on the market where both data base and data communications elements are designed and implemented by the same group of pro-

fessionals." This group is led by McCoy.

"The uncommon ease of interface is a factor we hadn't been letting prospects know about," Parker added. "Once we started to focus on this major use advantage, our sales took off."

CIM was acquired by Insyte Corp. in September 1974. Houston-based Insyte had an active data services division and felt, says Parker, that CIM would benefit from a combined customer base.

CIM launched a "business-oriented" advertising campaign in mid-'75 stressing specific user benefits from Datacom in terms of dollar or personnel savings, rather than the industry's traditional "technical" explanation of the db system itself, Parker said. "As soon as we put the product on a recognizable cost effective basis that corporate financial, administrative and dp executives could identify," he said, "our inquiry response went through the ceiling."

Parker recently expanded his corporate sales staff and appointed a new national sales manager "to give CIM more time to organize our marketing effort on a more structured basis."

Parker said he also plans to introduce Datacom abroad in mid-1976. "Many of our multinational customers have indicated an interest in having us talk to their European and mid-east managers. We see the international market contributing substantially to corporate revenue before 1980."

In New Posts

E. JAMES TIBBS was appointed corporate vice president and director of Logicon, Inc.'s Process Systems Div., in Fairfax, Va. . . . GEORGE SENKO was named president of A. H. Systems, Inc., Chatsworth, Calif. . . . CHARLES P. COVINGTON was named director of customer support services in the Americas Domestic Operations of Sperry Univac . . . ERIC H. DUGROO was elected an assistant secretary of the Hartford Insurance Group, Hartford, Conn. He will be responsible for the installation, support and maintenance of software and hardware for the company's data center . . . Qantel Corp., Hayward, Calif., appointed BERTIL D. NORDIN executive vice president . . . DAVID H. ARNOLD was named vice president and general manager of University Computing Corp.'s Commercial Div. . . . STEPHEN M. MICHELL is the new vice president and center manager of National Sharedata Corp., the Western Union Teleprocessing Div. . . . RICHARD W. BURDICK was elected president and chief executive officer of the Leader Corp., a banking industry-oriented subsidiary of Boeing Computer Services . *

Tektronix Graphics now has a mind of its own.

The 4051 BASIC Graphic Computing System: Off-line computing and editing: On-line processing in any language.

Introducing an intelligent solution to your time-sharing budget crunch. The 4051 can pay for itself in one year's time-sharing savings or less. Its built-in 8K of workspace (expandable to 32K), mag tape storage, and complete editing capability can take you off-line and take a huge bite out of connect-time charges. Out of CPU time. Out of storage costs.

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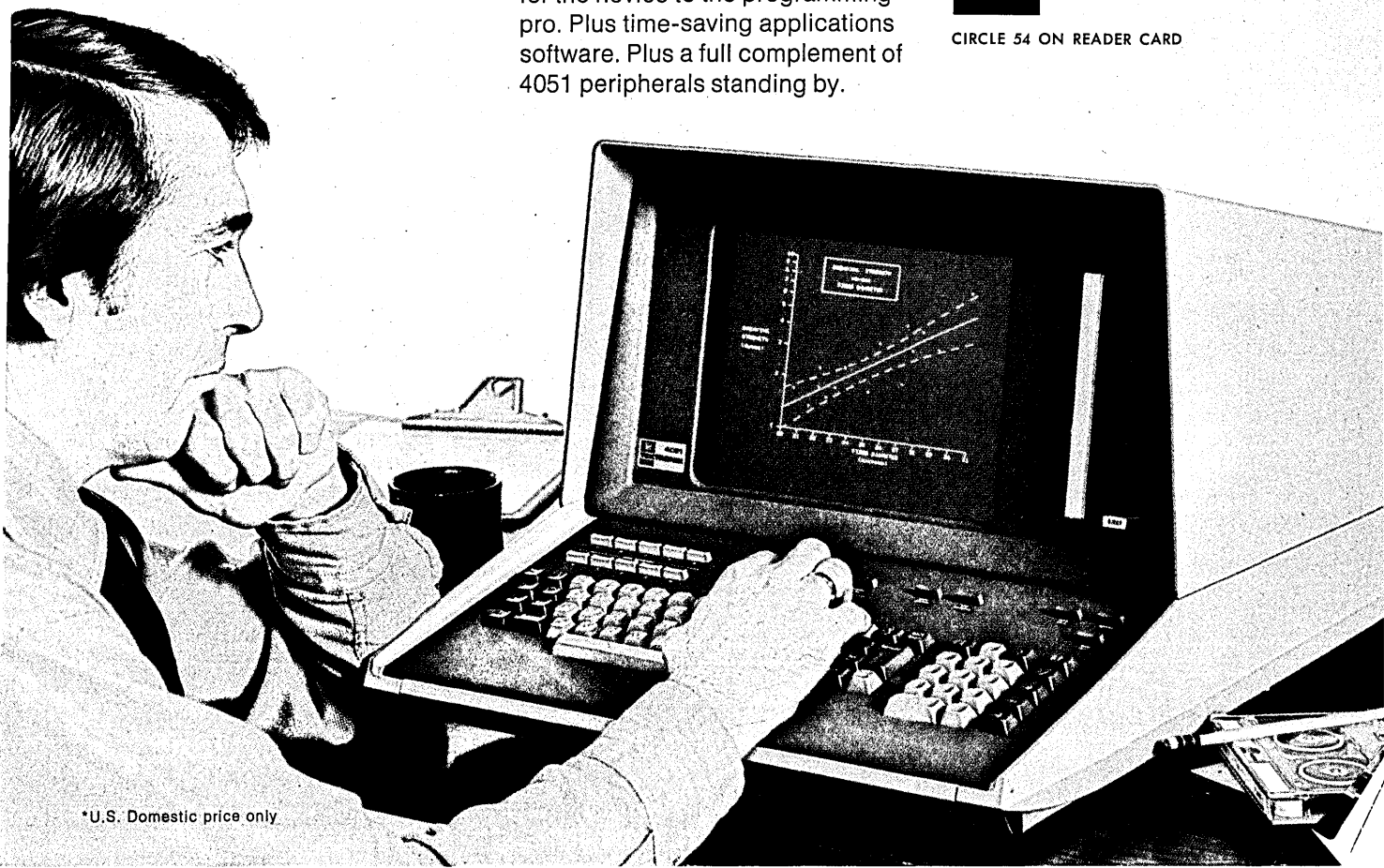
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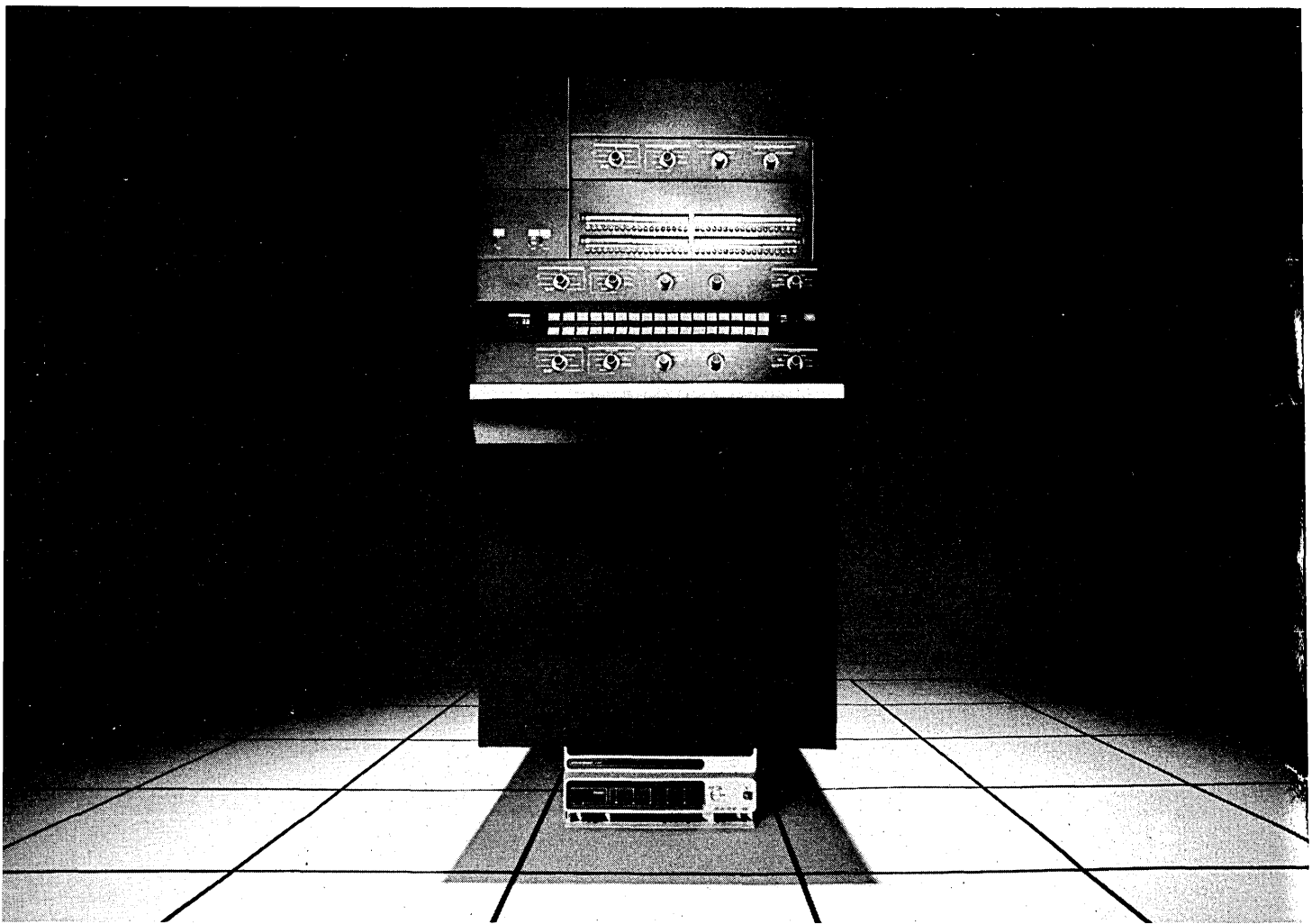


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And since we didn't take any shortcuts, this COBOL gives you the full power of the language. So there's no need to retrain your programmers.

In fact, this COBOL has things no other COBOL has. Our extensive data management facility called INFOS, for example. It makes for easy manipulation of data bases, ranging from simple ISAM files to complex data structures.

This COBOL also interfaces to our Communications Access Manager software. So you can handle multiple terminals in simple data entry/inquiry applications directly from a COBOL program.

And because the ECLIPSE C/300 COBOL is a complete language system, it has extensive development aids you can't get on any other small computer. An interactive debugger with COBOL-like verbs such as COMPUTE and DISPLAY, for example. And free format input of source programs from any terminal. All of which helps you get your programs up and running sooner.

And this COBOL takes advantage of the C/300's instruction set that's tailor-made for commercial applications. Which keeps both your programmers and your programs efficient.

And the ECLIPSE C/300 COBOL runs under our mature Real-time Disc Operating System. So you can concentrate on your software instead of ours.

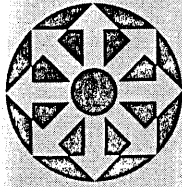
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LOOK AHEAD

DATAMATION'S TOP 50 COMPUTER VENDORS

The nation's top 50 computer vendors sold \$22.2 billion worth of equipment in 1975 throughout the world--\$12.739 billion (or 57.3%) in the U.S. and \$9.502 billion (or 42.7%) outside the U.S.

Datamation's listing of the 50 leading computer companies shows that sales of peripherals and terminals accounted for 40% of the volume at \$8.9 billion. Value of computer mainframes delivered in 1975 is \$5.7 billion, or 26%. Revenues from software and services reached \$4 billion, or 18%; supplies and accessories \$1.9 billion, or 9%; and minicomputers \$1.6 billion, or 7%. It's the first such report (page 48), so comparative figures aren't available.

The first six ranking companies are all mainframers (IBM, Burroughs, Honeywell, Sperry Rand, Control Data and NCR) and they account for 78% of the business. The top minicomputer maker, ranked 6th, is Digital Equipment, followed by Hewlett-Packard. Memorex is the largest peripherals manufacturer in terms of volume of sales.

IBM CONFRONTS INDEPENDENTS WITH 35% PRICE CUT

In its first major counter offensive against the independent 370 memory add-on business, IBM has slashed prices on memories for the 115, 125, 158 and 168 models of its 370 line. Impacted are some 13 companies who sell to the market either on an oem or end user basis. The new IBM prices are 35% lower for the 158 and 168 and about 31% lower for 115 and 125 add-on memories. The company left the price of add-on memory for the 145 untouched.

John Clark, president of Itel Corp.'s Computer Products Div., says the new IBM prices still leave plenty of umbrella space, although his company contemplates making a further price cut of 5-10% from its present level of \$110,000 per megabyte of add-on memory. IBM's price has been cut to \$170,000 per megabyte from \$263,000.

Intel Corp.'s Memory Systems group, which has just introduced its in-7168 add-on memory, said it was studying the IBM move. The in-7168, with two installations at present, brings that company's total for the 370 line to 202, excluding another 160 installed on an oem basis. It's an indication of the huge size of the market that IBM has decided to confront with its price reductions.

DATAPoint MAKES ITS OWN "PERFECT PRINTER"

Datapoint's new microprocessor-controlled matrix printer isn't pie in the sky: more than 50 units of the printer have been chugging away in Datapoint's San Antonio factory and a few have even been delivered to customers for testing. The 132-column, 80 cps printer has a story behind the story of its design. Datapoint engineers, intent on finding "the perfect printer," toured all the printer factories in the world. They didn't find what they wanted so they designed the 9232, which should be selling in single units for less than \$4,000. The printer has a dual tractor option that allows the machine to print two separate forms simultaneously.

Datapoint isn't the only firm with a novel new printer. IBM is readying its highly touted jet ink printer for a debut--possibly with a new word processing machine.

BACK TO THE DRAWING BOARDS

When Gerald Siegal, president of Data Entry Systems, El Segundo, Calif. looked into punched card voting, he decided hanging chad was a major problem. So, he developed what he calls "the powered stylus. No matter how little pressure you use it's a sure thing to get the chad out." The California State Election Device Commission approved it. Dan Martin of Martin & Chapman, a Long Beach, Calif., firm that runs municipal elections for small cities, liked it so much he tried it out in an election in Whittier, Calif., in April. Some 15-20 of the styluses were used in five or six precincts.

They didn't work. When the polls opened at 7 a.m. they were working but they began malfunctioning around 10 a.m. and by 11 a.m. all were down. "We had to round up some conventional styluses quickly," said Martin who confessed to being "very disappointed. We felt they would prove beneficial to elderly people." He stills thinks "the idea is great" and if Data Entry Systems "can fix the spring or the gear or whatever" he'll try the styluses again.

HONEYWELL GETS \$7 MILLION CITIBANK MINI ORDER

The computer industry has always had its Hamlet in Honeywell's minicomputer operation,

LOOK AHEAD

which has never seemed to have been able to figure out whether it should be or not be. Well, the operation has been handed a fat order from no less than Citibank's innovative dp operation. The order is said to be in the \$7 million range and calls for Level 6 machines. The difficulty for Honeywell now at Citibank is that some of its older dp mainframes are slated to be removed from the operation. The mini order will help mitigate that pain.

THREE RESIGN AT U.S. OPERATION OF ICL

ICL's fledgling U.S. operation has been hurt by the resignation of three key persons: Peter Weill, U.S. president and general manager of North and South America; David Crocombe, long-time v.p. of marketing; and Ron Fisher, controller. (The latter two have gone to TRW.) Operating here for the last 21 months, ICL has sold 15 small business 2903s in the New York area. While neither ICL nor Weill would comment at writing, sources claimed the problem is ICL's continued indecisiveness about its commitment to the U.S. market. It hasn't opened offices or customer centers outside New York, and certainly U.K. corporate executives haven't publicly appeared on these shores since 1974 to make any assurances. Englishman Peter Gyngell replaces Weill, and word has it that he'll continue the search for a joint venture partner, begun in 1974.

GROSCH AND McCracken TO HEAD ACM

Old pals, Dr. Herbert R. J. Grosch and Daniel McCracken, the new president and vice president of the 30,000-member Association for Computing Machinery, were holed up May 20 in Grosch's Sunnyside home going over reports on the association's publication plans. Grosch advocates a newsy, "vital, edited publication of interest and value to all members, modeled roughly after Scientific American or the IEEE Spectrum." McCracken may have other plans. Grosch says, nevertheless, "we're all willing to take a new look" at the way the ACM is run.

Although he was vice president, and thus in line for the presidential post, Grosch was aced out as a nominee for president "because Jean Sammet (the present president) didn't think I'd work hard enough." He said that four years ago the ACM was near bankruptcy and the then president Anthony Ralston pulled it out and when Jean Sammet came along, "she couldn't bear to let it go," meaning turn it back over to the 30-person staff. Grosch thinks it's time to do that, and to concentrate on more long-range subjects as "licensing, certification, portable pensions, compensation standards, malpractice protection, ethical codes and enforcement."

Both Grosch, who got 40% of the vote, and McCracken, who got 60%, were nominated by petition, not by the official nominating committee. G. G. Dodd of General Motors Research Laboratories, was elected secretary. It should be an interesting year when they take over next July 1.

RALSTON WON'T RUN FOR SECOND AFIPS TERM

The chairman of the ACM nominating committee that turned down Grosch--Dr. Anthony Ralston of City Univ. of New York in Buffalo--won't run for reelection as AFIPS president, although he had been nominated. The successors will be chosen from Ed Palmer, former president of the Data Processing Management Assn. and Prof. Theodore J. Williams of Purdue, representing the Instrument Society of America.

Although Ralston won't comment, it's understood he was miffed at the nominating committee's selection of Palmer to run against him. Traditionally, a first-year president is given the opportunity to run unopposed for a second term. After Palmer's nomination, a group of AFIPS members entered the name of Williams to oppose Palmer at the June 12 election.

Ralston's forced ouster followed a battle over the way Ralston handled the funding of a feasibility study for an AFIPS publication that would be similar in content to the Scientific American. Everybody wants to look like the Scientific American, it seems, at least in the world of professional societies.

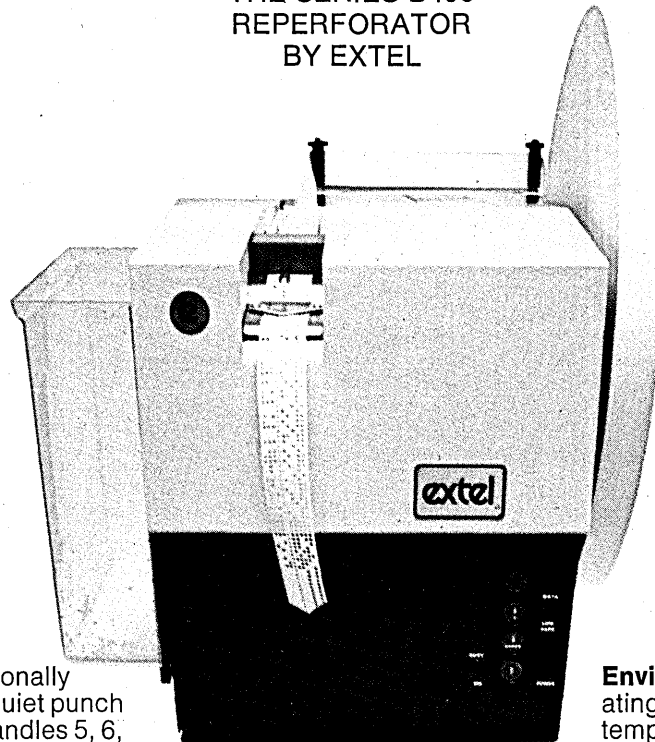
MUDDY WATERS

The status of customer-bank communication terminals (CBCTs) continues fuzzy but Comptroller of the Currency James E. Smith, whose office's ruling that the terminals don't constitute branches, has promised operation guidelines. He said the guidelines "will be based on what our office has found as the best operating practices in terms of consumer protection and the most sophisticated knowledge available in terms of

(Continued on page 168)

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they not only talk to your CPU, but to each other.

And that means flexibility.

Should the requirements of one location change, our systems can change with them. You can switch terminal models without changing programs, or even retraining operators.

The Model 340.

For smaller office situations that call for data entry, you'll find our Model 340 the low-cost intelligent answer.

No matter which of its hundreds of applications you use it for—like order entry, payroll and accounts payable—you're assured of virtually error-free data every time. Because operator errors are pointed out immediately for on-the-spot correction.

And, its 8k bytes of programmable memory and capabilities like customized field validation, conditional data entry and arithmetic operations, mean the Model 340 goes even further in providing for needs you might not even have anticipated when you first got it.

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If you need the advantages of random accessibility, look into the Model 350. The 500,000 "fill-in-the-blanks" characters on its exclusive dual flexible disks let you store customer, product/price and salesman files right at the source.

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Just key in a customer number and you get all the pertinent data: name, address and billing information. That means reduced key-strokes, improved accuracy and big savings.

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When you need more than just data entry, look into our new Sycor 440. With a disk storage capacity of up to 10 million characters and the use of up to eight separate terminals, you can do data entry and inquiry/response concurrent with background processing.

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CIRCLE 60 ON READER CARD

calendar

JUNE

3rd Biennial International CODATA Conference, June 28-July 1, Boulder. The sponsoring group, Committee on Data for Science and Technology, aims to promote data compilation and evaluation, and to improve the quality and usefulness of data collections. Papers on methodology and techniques will be presented. Fee: \$40. Contact: Dr. H. van Olphen, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

3rd Symposium on Machine Processing of Remotely Sensed Data, June 29-July 1, West Lafayette, Ind. Central themes of this meeting are theory, implementation and application techniques. Research results, new technological developments and existing processing techniques will be discussed. Fee: \$65. Contact: Prof. Philip H. Swain, Purdue Univ., West Lafayette, Ind. 47907 (317) 749-2052.

JULY

Summer Computer Simulation Conference, July 12-14, Washington, D.C. The program will emphasize the conference theme, "Progress in Simulation." Sponsors are AICHE, AIAA, AMS, ISA, SCI, and SHARE. Fees: \$75, members and participants; \$90, nonmembers. Contact: Paul Bohm, Johns Hopkins Univ., 11100 Johns Hopkins Rd., Laurel, Md. 20810 (301) 953-7100.

3rd Annual Conference on Computer Graphics, Interactive Techniques and Image Processing, July 14-16, Philadelphia. Sponsored by ACM/SIGGRAPH, this conference will present papers and panel discussions on current developments and research in theory, hardware, software, and applications of these special topics. A workshop on July 12 and 13 precedes the conference, and will feature several specialized discussions, including animation and pattern recognition. Fees: workshop and conference, \$50 each, member; \$60 each, nonmember; after June 30 the fee for each will be \$70. Contact: SIGGRAPH 76, Dept. of Decision Sciences, Univ. of Pennsylvania, Philadelphia, Pa. 19174, (215) 243-6067.

"Software," July 19-21, Washington, D.C. This conference for government and industry representatives will present a survey of current technology and applications. Fees: \$295; teams, \$195. Contact: Dept. PR, AIE Seminars, P.O. Box 25116, Los Angeles, Calif. 90025, (213) 826-7572.

3rd Int'l. Colloquium on Automata, Languages and Programming, July 20-23, Edinburgh, Scotland. Presentations will include formal languages and automata theory, analysis and complexity of algorithms, mathematical and formal reasoning, semantics of programming languages and data bases. Contact: C. A. Mackinder, Organizing Secretary, Computer Science Dept., Edinburgh Univ., Edinburgh, Scotland.

AUGUST

3rd Int'l. Conference on Computer Communication, Aug. 3-6, Toronto. Sponsored by the International Council for Computer Communication (ICCC), and hosted by the Trans Canada Telephone System, the meeting will be attended by more than 1,000 communication system specialists and users of communications services. The iccc-76 theme is "Advancement Through Resource Sharing." Fees: \$75 before July 1, \$85 after. Contact: iccc-76, P.O. Box 365, Station A, Ottawa, Canada K1N 8V3.

Symposium on the Simulation of Computer Systems, Aug. 10-12, Boulder. Cosponsored by the Assn. for Computing Machinery and the National Bureau of Standards, this meeting will feature papers on system design and modeling, program design and testing, selection, configuration, and optimization. Tutorial and workshop sessions will be featured. Fee: \$60, member; \$75, nonmember. Contact: sscs, Stephen Schobel, Bureau of Census, Room 3107, FOB-4, Washington, D.C. 20233, (301) 763-7746.

8th Annual Meeting, National Assn. for State Information Systems, Aug. 16-18, Hershey, Pa. General topics of discussion will be the growth of the dp manager, security and privacy, computer performance evaluation, and use of minicomputers. Contact: Carl Vorlander, NASIS, P.O. Box 11910, Lexington, Ky. 40511.

Int'l Conference on Parallel Processing, Aug. 24-27, Detroit. This conference is cosponsored by the IEEE Computer Society and Wayne State Univ. Presentations will describe recent advances on all aspects of parallel/distributed processing. Included will be parallel/distributed logic circuits, processor-memory interconnections, computer networks, modeling and simulation techniques, operating systems, and various application studies. Fee: \$40. Contact: Dr. Charles S. Elliott, College of Engrg., Wayne State Univ., Detroit, Michigan 48202, (313) 577-3812.

Int'l. Optical Computing Conference, Aug. 31-Sept. 2, Capri. Scientists and engineers will attend this meeting in Italy sponsored by the IEEE Computer Society. Papers will be given on optical pattern, character, and object recognition techniques; imaging and image transformations, and real-time and near-real-time light modulations. Fee: advance, \$65, member; \$80, nonmember; add \$10 at the door. Contact: Optical Computing, P.O. Box 639, Silver Spring, Md. 20901.

SEPTEMBER

Computers and Peripheral Equipment, Sept. 6-10, Singapore. This exhibit by U.S. companies, many of them in the minicomputer field, will be held at the U.S. Regional Trade Center in Singapore. Participants will also conduct seminars or other presentations. The exhibit coincides with the Southeast Asia Computer Conference on computer technology, data base management, and data communications, expected to attract over 400 delegates from 15 Asian nations. Contact: Robert M. McLaughlin, Office of Int'l. Marketing, U.S. Dept. of Commerce, (202) 377-2471.

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.

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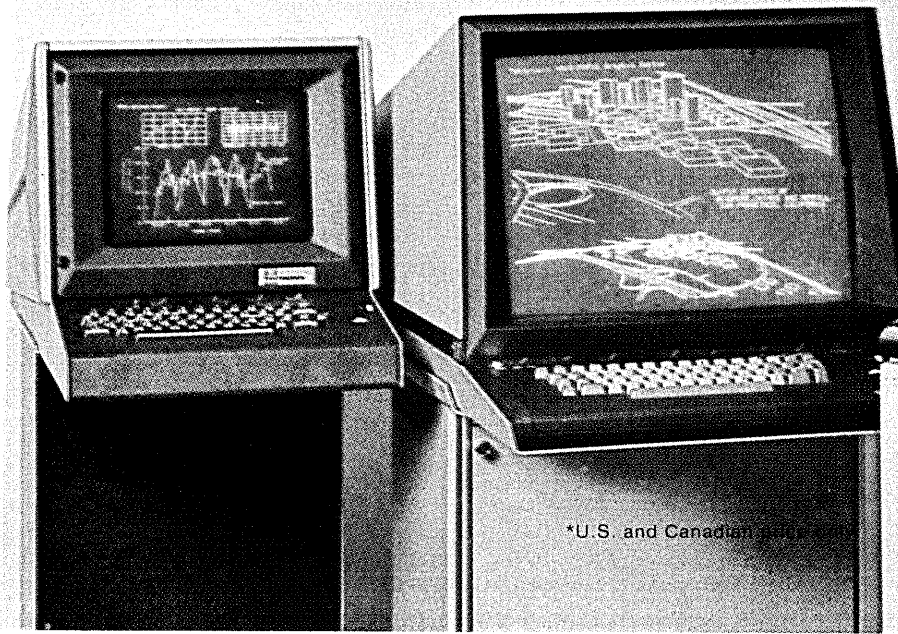
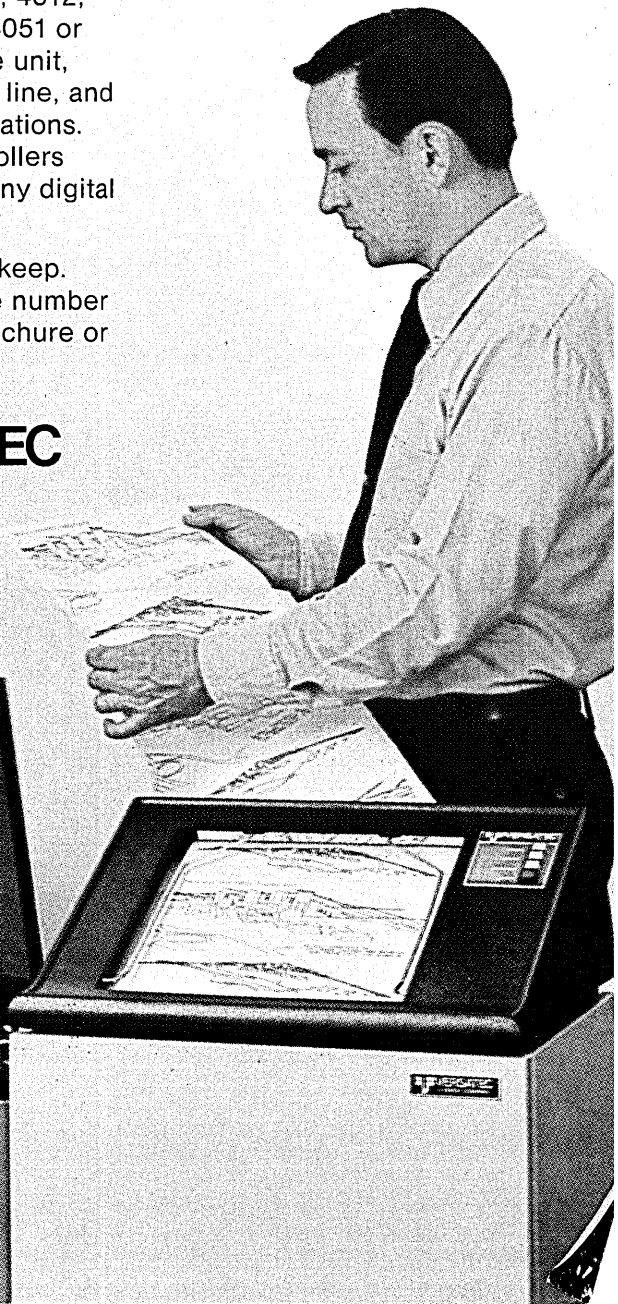
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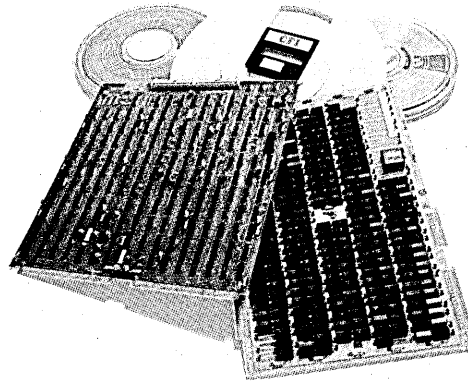
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- Harris Communications** Slash 4, Slash 7 (Datacraft) • HP 21MX, 2100, 2114, 2116 • IBM 1130 • Interdata 716, 832 •
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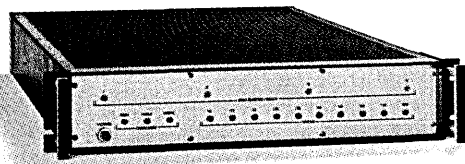
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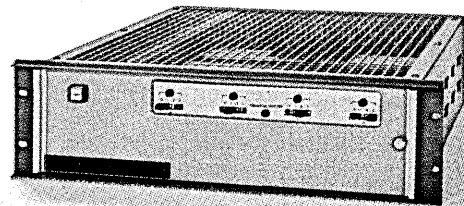


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books

Theory of Data Bases

by Bo Sundgren
Petrocelli/Charter, New York, 1975
244 pp. \$19.95

Information Systems Architecture
by Borje Langefors and Bo Sundgren
Petrocelli/Charter, New York, 1975
366 pp. \$19.95

These books are quite different from the normal fare presented to the computer practitioner.

Theory of Data Bases is a book of definitions, theories, and first extensions of those theories as they apply to the concept of data bases. It proposes an alternative and somewhat more general concept for a theoretical underpinning of data base than that proposed by Codd's and other relational models. The relational approach stresses a process, while Sundgren's book describes an overall theory of definition which could apply to any data base and process of access.

Rigorous definitions are given for such frequently informally used terms as "data," "information," "memory," "file," etc. Fundamental concepts of data are described in terms of objects, properties, object relations, and time. "Infological" is the term used to describe the formal statement of the external properties of any data base.

Information Systems Architecture can be considered a companion book to *Theory of Data Bases*. It offers less basic definitions, and ties many of the concepts presented in *Theory of Data Bases* to file concepts. Some relationships are established to specific hardware devices, and an explanation of how to tie data base concepts to real-world systems terms such as sequential, random, batch, channels, disc, etc., is presented. Some of the various file types are presented and described through algebraic notation.

Professors Langefors' and Sundgren's work is far better known in Europe than in the U.S.; publication of a review in DATAMATION may serve to change that. But it is doubtful that *Theory of Data Bases* would be of interest, or even understandable, to the typical data base practitioner. A moderate amount of mathematical nota-

tion is used on both books. The notation itself is fairly standard, but would be strange to anyone who has not had at least one graduate level course in set theoretic concepts. The books would be of interest to theoreticians who want to understand how to build a rigorous definition of information technology by using the techniques and notations developed by mathematicians.

These books may be the best theoretical foundation for Information Systems concepts yet, but whoever wishes to partake of their knowledge must be prepared to spend a lengthy time reading these materials to master the concepts within.

—George Schussel

Dr. Schussel is vice-president of Information Systems for the American Mutual Insurance Companies in Wakefield, Massachusetts. For the last several years, he has also been the course director of AMR International's Data Base Design course.

An Introduction to Structured Programming in COBOL
(Installation Management Series,
Manual No. GC20-1776, 1975)
Obtainable from nearest IBM branch office
48 pp. \$2 (subject to change)

This manual, different from usual IBM manuals, is well written, easy to understand, and reasonably priced. If one wants to know the basic concepts of the subject, it is well worth the time to read it.

A minor drawback is that structured programming is treated as a "Programming Style." Such a narrow view may cause misunderstanding and is certainly not very helpful if one wants to introduce structured programming in most established programming departments. For real world practitioners, the natural reaction to another programming style is, "Who cares about the style; we are here to make things work on time and produce results, not to make things pretty." Since this IBM manual is labeled as part of the *Installation Management* series, it seems attention should be paid to potential resistance to changes.

The manual gives a very brief reference to some of the associated programming productivity aids, i.e., top-down program development, hierarchy plus input-process-output (HIPO), structured walkthrough, development support library, and chief programmer team.

It then proceeds to describe basic elements of structured programming and briefly touches on the GO TO issue. It does not totally discard GO TO state-

ments from COBOL programs; it allows use of the GO TO under the rationale "There are uncommon situations where the use of GO TO's may improve readability." However, the manual only presented multiple levels of nested IF statements, without any de-nested IF examples. This is quite contrary to the real situation because the de-nested IF often makes complicated COBOL programs easier to read and maintain, versus nested IF construction. De-nested IF construction probably is the most compelling reason to allow the limited use of GO TO statement in COBOL.

The remaining portion of the manual is devoted to an oversimplified COBOL program. One of the benefits of this is to show beginning COBOL programmers, students, and casual readers how to apply some basics of structured programming on COBOL, but it provides very little help to the practitioner, because the real problem is how to structure large systems of programs rather than to structure a single program. As an introductory manual, however, it may be appropriate to treat the subject lightly.

—Honien Liu

Mr. Liu is manager of computerized systems technology at Pacific Gas and Electric Company, San Francisco.

World Information Systems
by E. D. and R. P. Gibson
Xerox Univ. Microfilms, Ann Arbor,
Mich. 48106 (1975)
250 pp. \$19.50

Try as I would I could *not* find a single good thing to say about *World Information Systems*; in my view, books like this should never be published.

The badness of the book is compounded of three elements: the social and political biases of the authors; atrociously poor writing; and the "scholarship" of the work, which is at best questionable. I shall substantiate these charges with excerpts from the book itself.

The biases of the authors are obtrusive. Of course, they warn you that this will be the case! "... this book has been written to supply an outside, impartial opinion [sic] of what information systems was [sic] yesterday, is today, and will possibly be tomorrow, with special emphasis on what Developing Nations, particularly, should [sic] be doing about it, if they want to join the ranks of modern, industrialized nations offering their citizens a better way of life" (p. iv). Then consider this: "We believe that the computer revolution, coupled with new technological developments, is the best, surest, and fastest road to such betterment." (p. v).

Did you know that Brazil is a dp application? So say Gibson and Gibson: "Probably the best dp application in a developing country we have ob-



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Data Entry Intelligent Features:

- Data keyed to built-in cassette storage after editing for batch transmission.
- Convenient data entry keyboard (similar to IBM 029 keypunch) with numeric cluster.
- Dup, skip, tab, and special programmed function keys.
- Printer may be off during data entry. Software programs control on/off function for error alert and field prompts.
- Cost-cutting editing power for double key verification of critical fields, checks for length and type of characters, and range checks.
- Pre-processing power for numeric computation and automatic input of fixed field data.

can be polled at night while your terminals are unattended. For example, TI's Model 700 TPS Terminal Polling System with mag tape output is available.

This affordable intelligence includes cassette drives and instant hard copy with printer off/on under program control, for fast, efficient data entry keying. Optional forms printer interface and built-in modems are available.

One other thing.

All *Silent 700* data terminals are backed by TI's worldwide force of service engineers and applications analysts. People who gained their experience in support of thousands of *Silent 700* terminals and Model 900 series minicomputers now in use around the world.

For more information, contact your nearest TI office. Or write Texas Instruments Incorporated, P.O. Box 1444, M/S 784, Houston, Texas 77001. Or call (713) 494-5115, extension 2126.



TEXAS INSTRUMENTS
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*Trademark of Texas Instruments

TRUMENTS.

source data

served is Brazil. While it [referent?] does have a few horrible examples [of what?], the overall drive, confidence, interest, and downright capitalistic approach to data processing has resulted in some of the best installations found in any developing country" (p. 33).

More of the authors' personal views and incredible English: "The increasing unwillingness [of whom?] to hold students to high standards of achievement, to permit discrimination [the increasing unwillingness . . . to permit discrimination?] for one reason or another, to back a government that gives 'me' what I want while denying the same right [what right?] to others, and similar trends [trends?] make us wonder whether this gift of the gods (computer ability) is not going to be used against us and not for us" (p. 46). I am left wordless by such views.

Table V (p. 41) is labeled "Comparative world computer increase, 1960-1972*." The footnote pointed to by the asterisk reads "All figures indicate only 'some' [sic] of the actual figures. We are sure there are some countries we did not know about, and we obtained figures in some years but not others." There is otherwise no in-

dication of the sources of the data used to compile the table. If that were not enough, text preceding the table cautions you: "[We have used] the best figures we could gather, making personal choices between two, three, or four sets of available figures. . . . Some . . . figures are averages we collected by personal interview [with whom?]. Where several other sources [what are they?] agreed on a different figure, it was used." I trust, given all this warning, you will be shocked to learn that, in 1972, according to the authors, there were 150,463 computers in the world—not 150,462 or 150,464, but 150,463.

I have written at length because this is such a *bad* book. I believe its authors—and other similarly inclined or qualified persons—should be discouraged from publishing works of this kind. I invite your help to get that message across: accept my recommendations that (1) under no circumstances should you buy a copy of the book; and (2) if you already own a copy of the book, you should demand that the seller refund its purchase price.

—Robert M. Gordon

Mr. Gordon is director of the Computing Services Centre at Victoria Univ. of Wellington, Wellington, New Zealand. Previously he held a similar position at the Irvine campus of the Univ. of California.

facing techniques common to all microprocessors. Detailed descriptions are given of microprocessor families such as Intel 4004/4040 and 8008/8080; Motorola M6800; Rockwell PPS-4 and PPS-8; and the DEC PDP-11 minicomputer and LSI-11 microcomputer. Illustrations, examples, and references are included.

Systems Analysis & Design for Management
by Paul Gross and Robert D. Smith
Dun-Donnelley Publ. Corp.,
666 Fifth Ave., New York, N.Y.
10019 (1976)
468 pp. \$15

This well-designed volume has as its thesis that "Information systems must be designed with the participation of management . . . the ultimate consumers of the end products of the systems." Thus, this non-technical guide concentrates its system design approach on the behavioral patterns and technology level of the user. Numerous examples from government, hospital, educational, retail and manufacturing organizations are included.

Computer Graphics: Techniques and Applications
R. D. Parslow, R. W. Prowse, and R. Elliot Green, eds.
Plenum Publ. Co., 227 W. 17th St.,
New York, New York 10011 (1975)
233 pp. \$6.95 (paperback)

This first soft cover edition uses material from the International Computer Graphics Symposium held at Brunel Univ., Uxbridge, England, in 1968, along with additions and amendments that update the information. The four-part treatment discusses systems, equipment, and software; applications and installations; a special session for the technologist; and computer graphics hardware.

Computers in Education
O. Lecarme and R. Lewis, eds.
North-Holland Publ. Co.,
Amsterdam, The Netherlands, and
New York (1975)
1,025 pp. \$83.50

The 190 papers contained in this volume are the proceedings of the 2nd IFIP World Conference on "Computers in Education," held in Marseilles in September 1975, and reflect the progress and change since the first conference, held in 1970 in Amsterdam. Sample topics among the dozens of chapter headings include education for management, teaching programming, theoretical aspects of computer assisted instruction, learning with data bases, and the use of computers in teaching various academic subjects.

The Best of Creative Computing (Vol. 1)
David H. Ahl, ed.
Creative Computing Press, P.O. Box 789-M, Morristown, N.J. 07960 (1976)
328 pp. \$8.95 plus 75¢ postage, (paperback)

This volume consists of material which originally appeared in the first six is-

BOOK BRIEFS . . .

Privacy, Security, and the Information Processing Industry
Assn. for Computing Machinery
P.O. Box 12105, Church St. Station,
New York, N.Y. 10249 (1976)
200 pp. \$12 (paperback);
\$9, ACM members)

This report, prepared by the Ombudsman Committee on Privacy of the Los Angeles chapter of ACM, was designed to cover the administrative, technological and legal considerations of computer security and the privacy question. Although the presentation and content vary in quality, the section on legal considerations exposes the problems and the dilemma well, and is probably the book's most valuable contribution to discussions of this topic. A code of "Fair Information Practices" is more useful than many previously published ones, and the appendix includes the proposed "Comprehensive Right to Privacy" bill, the Privacy Act of 1974, and a glossary. Views expressed in this publication do not represent the official position of the ACM or the ACM publications board, says a disclaimer.

Systems Programming: Concepts of Operating and Data Base Systems
by David K. Hsiao
Addison-Wesley, Reading, Mass.
01867 (1975)
328 pp. \$16.95

General concepts and prevailing theories in systems programming are orga-

nized into six chapters dealing with one or more important topics. Included are assembly languages and assembly systems; I/O operations and I/O control systems; off-line and on-line batch processing systems; multiprogramming; virtual memory systems; and data base management systems. A knowledge of a programming language and computer organization are required for most effective use of this book.

Components of Computers
by F. F. Mazda
Electrochemical Publications Ltd.,
29 Barns St., Ayr, Scotland
KA7 1XB (1976)
100 pp. \$28.50

This introduction to component technology used in computers traces the growth of digital, analog, and special purpose computers, and the latest developments in digital devices, integrated circuits, magnetic components, optical devices, operational amplifiers, and analog components. An extensive bibliography containing 3,000 references enables the reader to research selected subjects presented here.

Microprocessors & Microcomputers
by Bruno Soucek
Wiley & Sons, 1976
607 pp. \$23

A valuable reference for engineers and computer scientists, this book seems to be a comprehensive presentation of application, programming, and inter-

The Private Eye.

It solves the mystery of data communications networks.

The new Codex 6000 Series Intelligent Network Processor.

The Codex 6000 has a unique, multiple-micro-processor system architecture that combines the best features of time division multiplexers and computer-based concentrators.

The Codex 6000 slips into your network without a hitch: it's completely transparent to network protocol, terminal mix, system configuration or existing control facilities. Yet no customized programming is necessary.

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and data compression - outputs more traditional TDMs by factors as high as four to one, with less node-to-node delay. Error-free data is assured by a full-duplex internal ARQ protocol.

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A great case to work on for better network planning, growth and management.

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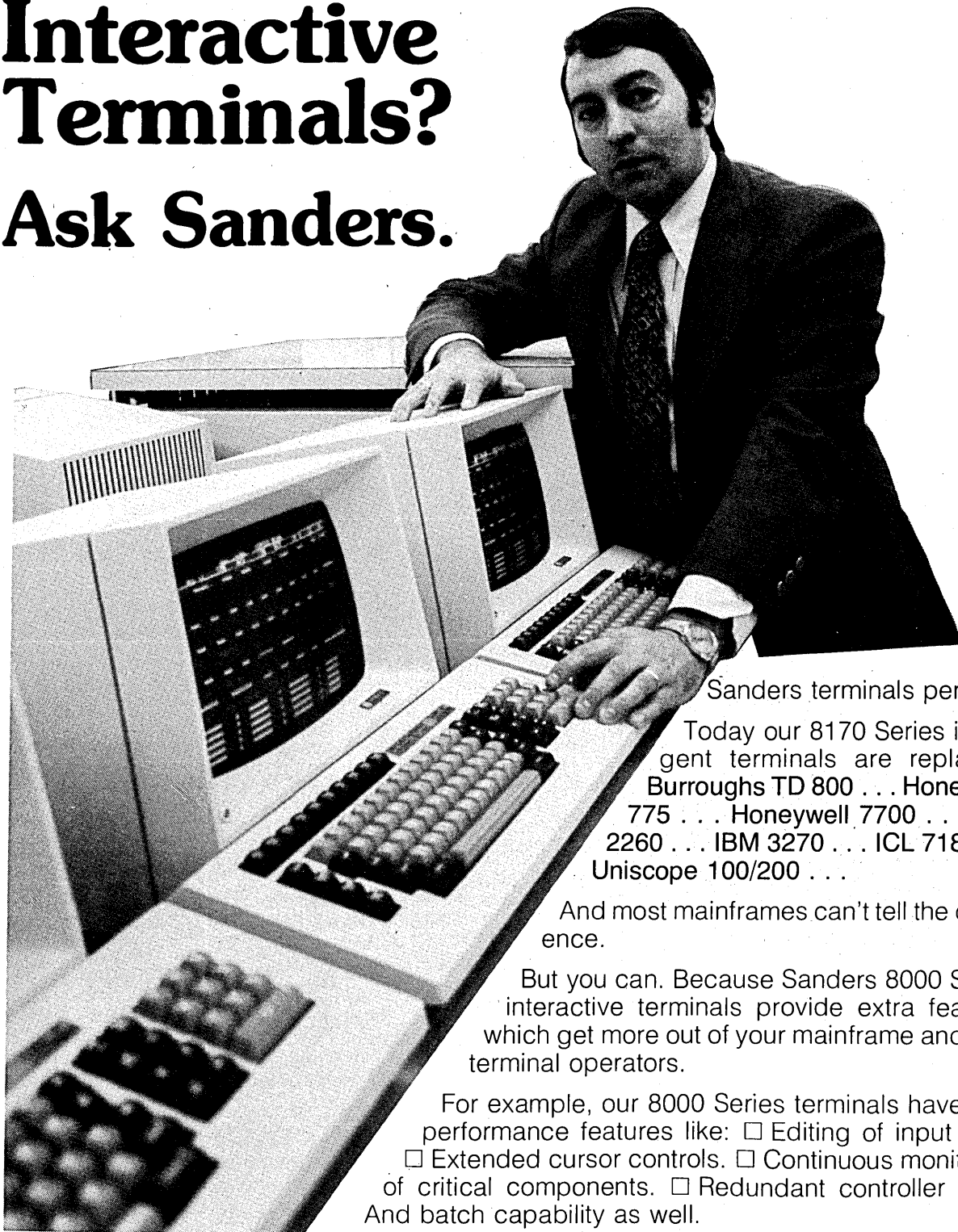
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sues of Creative Computing magazine, which specializes in articles, stories, games, activities, puzzles, computer art, and a "dose of foolishness" in each bimonthly issue. The 8½ × 11 format has permitted reprints of interesting and popular selections, including the Super Star Trek game and Mr. Spock's computer image.

Microprogrammable Computer Architectures
by Alan B. Salisbury
American Elsevier Publ. Co., Inc., 52
Vanderbilt Ave., New York, N.Y.
10017 (1976)
161 pp. \$13.50 (\$8.75 paperback)

This book serves as an introduction to microprogrammable computers, which it defines as machines with writable control store intended for general purpose microprogramming. (This is in contrast to microprogrammed machines with read-only memories designed for a specific machine language and architecture with a limited specific use.) Numerous case studies are included, with descriptions of the Microdata 3200, Burroughs B1700, Control Data 5600, Digital Scientific META 4, and others. The volume is particularly useful as a reference or supplemental text.

Elementary Computer-Assisted Statistics
by Frank Scalzo and Rowland Hughes
Petrocelli/Charter, 1975
345 pp. \$12.95

This introductory text presents pre-packaged computer programs, written in BASIC, as tools to solve problems in elementary statistics. There are 14 programs covering descriptive statistics, inferential statistics, and probability; each one has an instruction sheet, flowchart, and coding in BASIC. Numerous examples are given, and helpful appendices are included.



Data Base Management
"Data Base Management: An Overview," is a 54-page paper by Randall Rustin, a vice president of Chase Manhattan Bank, on current approaches to data base management. A highly condensed tutorial, the paper distills many concepts of importance. The nine sections are: general approaches to data/information handling; overview of data management; data models; data description, manipulation, and man-

agement; data independence; data storage description; data structures and their storage structure representation; physical organization considerations; and data integrity, security, and privacy. All in all, this paper seems a good way to obtain background information on DBMS free of charge. ADAMSON CONSULTING, New York, N.Y.
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Small Business Computers
More than 230 small business computers—40 of them analyzed in depth—are discussed in the 275-page *Auerbach Guide to Small Business Computers*. Evaluation and selection guide-

lines, current price information, individual product reports, specification charts, configuration guides, and hardware and software evaluations are provided. Price: \$29.95. AUERBACH PUBLISHERS INC., 6560 N. Park Drive, Pennsauken, N.J. 08109.

State Technology Systems
The 1975-76 edition of the NASIS annual report, *Information Systems Technology in State Government*, contains facts on state information systems from the 50 states and the Canadian Province of Quebec. Hardware inventory, personnel breakdowns, state plans

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and standards, funding and expenditures, and security and privacy are just a few of the detailed tables and information included. New this year are tables on off-line peripheral equipment by state agency, and an application matrix which simplifies use of the applications inventory. The final appendix is prime contacts for state information systems. Price: \$17.50 (10% discount for 20 or more). NATIONAL ASSN. FOR STATE INFORMATION SYSTEMS, P.O. Box 11910, Lexington, Ky. 40511.

Packet Switching

A major share of future data communications business will be packet switching, and benefits to the U.S. computer community will include lower tariffs and a higher quality of service. So says the 400-page report, *Packet Switching Services and the Data Communications User*, a detailed study of the objectives and problems of this new technical development, which is soon to appear also in Canada, France, the U.K., and "probably Japan." The interface problem between the user computer and the network, standardized packages for operators such as Telenet, costs, and other topics are discussed. Price: \$180. OVUM LTD., 14 Penn Road, London N7 9RD, England.

Datapro Newsletters

A copy of the monthly, 4-page *Datapro OfficeNews*, which covers developments in office systems and business equipments, is offered free. News is provided on word processing, dictation machines, copiers, calculators, and facsimile and communications equipment. Annual subscription: \$42.

MiniNews is another Datapro monthly newsletter; this one covers the latest changes and applications of micro/minicomputers. Commentary and perspective on developments in the industry as well as the specifics of the minis, microprocessors, and special software are provided. Annual subscription: \$42. DATAPRO RESEARCH CORP., Delran, N.J.

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Point-of-Sale

Sales of POS equipment in 1975 reached 307,000 units for a total of \$572 million. Cumulative sales through 1980 will be more than 2 million units for a value of \$4.6 billion. An analysis of this strongly growing industry is found in the 56-page report, *The Point-of-Sale Industry*, which cov-

ers products and development of the industry, the market, cost justification, competition, etc. The focus is on electronic cash registers and electronic point-of-sale terminals. Price: \$495. CREATIVE STRATEGIES INC., San Jose, Calif.

FOR DATA CIRCLE 213 ON READER CARD

MVS

The success of IBM's Multiple Virtual Storage (MVS) operating system in curing the ills of vs depends principally on the strengths of the System Resource Manager (SRM). SRM is a dynamic job scheduler and resource allocator, and an Auerbach report analyzes SRM's chances for success or failure. Covered also are other MVS performance boosters, including Virtual I/O, logical channel balancing, JES 2 and 3, and independent scheduler work areas. Price: \$25. AUERBACH PUBLISHERS INC., 6560 N. Park Drive, Pennsauken, N.J. 08109.

Computer Bibliography

Over 300 books on computers were published in 1975, an increase of 50% over 1974, and these are entered into the ninth edition of the *Annual Bibliography of Computer Oriented Books*, which contains more than 1,000 entries. Other than a few classics, titles published prior to 1970 have been deleted. Two new categories added to the previous 51 are data base (with 19 entries) and structured programming (with 7 entries). Price: \$4 (\$5 if invoice required). COMPUTING NEWSLETTER, Box 7345, Colorado Springs, Co. 80933.

Microprocessor Handbooks

A 96-page handbook on this vendor's "Pace" (Processing and Control Element) single-chip, 16-bit microprocessor describes both the cpu and the complement of hardware and software items comprising the system. Another 65-page handbook does the same for the single-chip B-bit "sc/MP" (Simple-to-use, Cost-effective, MicroProcessor). Both publications contain numerous tables and illustrations. Price: \$3 each. NATIONAL SEMICONDUCTOR CORP., 2900 Semiconductor Drive, Santa Clara, Calif. 95051.

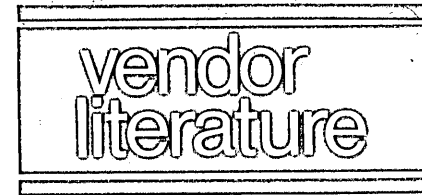
Electronic Office

The 230-page report, *Communicating Word Processors*, reviews the development of the market for electronic typewriters which can be used both for text editing and communications. Sending a letter directly to the receiver's typewriter over telephone lines, eliminating the need for envelopes, is one of the uses discussed. The market for such

processors is expected to quadruple within two years. Price: \$795. INTERNATIONAL RESOURCE DEVELOPMENT, INC., 46 Main St., New Canaan, Conn. 06840.

Intel Catalog

The 1976 Data Catalog of this vendor's microcomputer and memory products is available. Twelve sections cover RAMS, ROMS, serial memories, memory support circuits, memory systems, development systems, software, time keeping circuits, and three microcomputer systems; MCS-80, MCS-40, and Series 3000. Price: \$2. Marketing Services, INTEL CORP., 3065 Bowers Ave., Santa Clara, Calif. 95050.



Data Communications

The first U.S. carrier to provide computer/terminal communications on a packet switched basis (in operation since August 1975), describes its network in an illustrated, 12-page booklet. The economies and flexibility that can be realized from a nationwide public network is compared to the maintaining of dedicated facilities. A primer of packet switching, an overview of the network, and terminal and host access are among the items discussed. TELENET COMMUNICATIONS CORP., Washington, D.C.

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Varian Software

A 6-page brochure, *Varian Software Systems*, describes this vendor's software capability. VORTEX, a real time operating system, and subsystems under it are presented. Among others are TOTAL (for data base management), VTAM (for data communications), PRONTO (for transaction processing control), HASP (for remote job entry), TSS (for multi-user editing), and time-shared BASIC. Language processors (FORTRAN, COBOL, RPG II, DASMAR, and MIDAS), and system utilities are also discussed. VARIAN DATA MACHINES, Irvine, Calif.

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International Shipping Info Service

Among the services of Lloyd's Register of Shipping—an independent, non-commercial classification society in the U.K. with over 1,700 engineers, naval
(Continued on page 128)

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the most incredible
advancement
in data entry
ever offered.

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UPC  SPC

Ultraphase by makes every portable

Nothing else reads Universal Product Code (UPC), contains non-volatile memory, and is hand-held — no wires or cords. Ultraphase makes data entry simpler, faster, and more accurate than any other system.

USES:

Order Entry
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Receiving
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Etc.

It's deceptively small.

It's a solid state microcomputer that fits in your hand and weighs about 26 ounces. Because it has advanced circuitry and only one moving part, ULTRAPHASE is the most reliable data entry system yet. It is totally portable and has a shock mounted optical probe, a LED display, a 16-position keyboard, and removable Memory Packs. All in a virtually indestructible Lexan case.

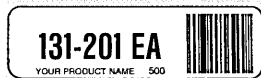
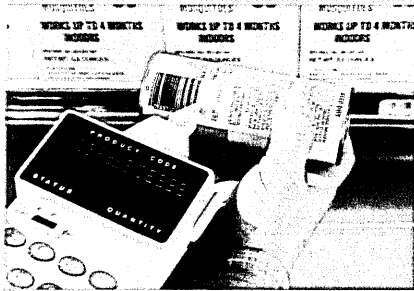
It reads.

You simply whisk the optical probe across a UPC bar-coded product, shelf label, or shipping label. ULTRAPHASE reads bar codes in virtually every color and can read the code backwards or forwards. If you want shelf labels, they can be bar-coded to your existing product numbers, eliminating the need to recode your inventory. And the labels can contain item, price, date



Bergen Brunswig data entry terminal obsolete.

or other descriptive information in addition to the bar code.



Warehouse label



Retail label

If interprets as it reads.

It automatically recognizes both types of UPC (A or E) then reads and calculates the check digit for verification. ULTRAPHASE interprets the bar codes and translates them into digits. The item numbers appear — bright and large — on the LED display as fast as the probe reads the code. If an error is detected, an "E" flashes in the status position and an alarm sounds. When everything is correct, an "A" for "Accepted" appears. The scanning is done without turning on a switch. ULTRAPHASE has no power on/off switches for any procedure. It turns itself on when needed, off when finished.

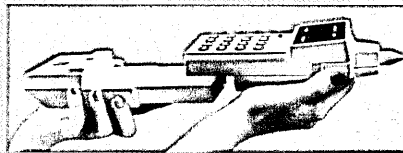
If remembers.

After the bar code is read, you enter the quantity and ULTRAPHASE remembers both. All entries appear on the display for visual verification and are stored in the removable Memory Pack. At any time, stored information can be recalled and displayed since ULTRAPHASE remembers exactly where each entry is. You can review the entire contents of the memory, or may search for a

specific item or group of items. ULTRAPHASE keeps track of the unused memory and informs you on request. Current memory capacities 4000 (4K) and 8000 (8K) characters are available and interchangeable.

Its memory is unlimited.

Because ULTRAPHASE stores its data in removable Memory Packs, it has unlimited capacity. You have all the advantages of solid state technology with the flexibilities offered by cassette. Essentially, the ULTRAPHASE Memory Pack is a "solid state cartridge." Each Memory Pack contains an eight-hour charge and when inserted into the service module, activates the recharge



cycle. The Memory Pack always remembers the next available location for data storage, even if the Pack has been removed and subsequently reinserted. Because ULTRAPHASE has removable 8-hour Memory Packs, the terminal can be used 24-hours a day. In addition to being portable, it can be used as a work station, utilizing a common 110-volt AC electric outlet.

If speaks.

When you are ready to forward information to a processing center, you simply slide out the lightweight Pack and insert it into the service module. Dial the center, press the transmit button and your information is sent at 120 characters per second. Transmission status is monitored and indicated on the service module.

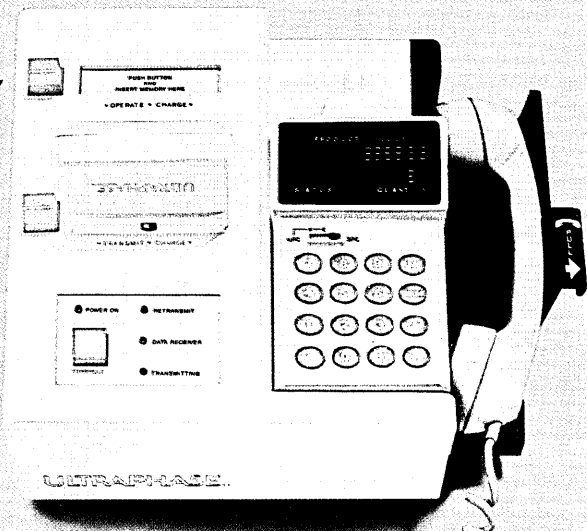
It protects.

It has the ability to stop errors before they happen. It monitors the state of its rechargeable power source continuously. When it nears an unacceptable operating range, ULTRAPHASE turns on an audible alarm and refuses to take further input. All this automatically. It also lets the operator know when the Memory Pack is nearing capacity. Just prior to the end of memory, it sounds an alarm and flashes "F" for "Full" on the LED display. Finally ULTRAPHASE offers protection against accidental erasure. Since there is no on/off switch, memory can be erased only by a positive action.

ULTRAPHASE is now available in limited quantities. For information please write or call Ronald W. Zolkiewicz, Vice President of Marketing, (213) 549-4040.

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Bergen Brunswig DataService Co., a division, has developed electronic order entry, turnover and profitability reporting programs, as well as price sticker, shelf label and Micro-fiche programs for business.

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As a result, OPM can show you how long a lease you need, and the best method of Early Termination. If sub-leasing or utilizing a used computer might be right for you, we'll tell you so. And if our analysis shows that you should buy instead of lease, we'll tell you so.

OPM can design a lease on the spot.

Perhaps the most impressive aspect of OPM's analysis is where it is done.

Our representatives are knowledgeable enough and have the authority to construct, negotiate and approve the lease agreement on the spot.

Then, instead of having the agreement kick around

in the legal departments, OPM brings its attorneys to yours.

This allows the agreement to be signed and implemented quickly.

This ability to analyze thoroughly and act efficiently has helped OPM, in its six years of existence, grow to service 1,800 clients. And the majority of the business comes from Fortune 500 companies.

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Announcing the biggest breakthrough ever in core storage.

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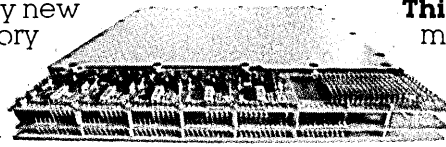
Because now you have the best of two worlds. The capacity of disc. With the high speed and reliability of main memory. At an amazingly economical price.

The big breakthrough came when we found a way to slash the cost-per-bit of core by condensing a massive 256K bytes of memory into a single memory plane. In a single MEMORY+ device, anywhere from one to sixteen of these memory modules go together for a total capacity of 4 megabytes.

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Think of it as a giant extension to main memory. It's both word and block addressable, and it swaps data so fast it appears to be a part of main memory itself.

Think of it as a way to beat the sluggish speed of fixed head disc. With its core memory access time, and transfer rates as high as five megabytes per second.



The MODCOMP 256K-byte memory module that made it all possible.

Think of it as a shared memory in multi-processor systems. Two MODCOMP computers can be processing the same data at memory speeds, without tying up main memory.

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Think of it as a direct data path to main memory for external data, used as a high-speed buffer.

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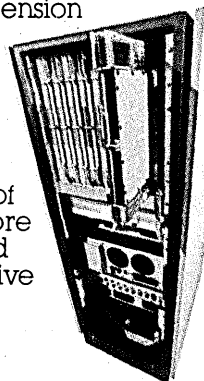
And because of its modular design, you buy only the capacity you need now. As you need more, add more plug-in modules.

It's simple. It works. And it's available. Now.

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Modular Computer Systems, 1650 West McNab Road, Ft. Lauderdale, FL 33309. Phone (305) 974-1380. European Headquarters: Export House, Woking, Surrey, England. Phone (04862) 71471

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Four MEMORY+ devices give this MODCOMP computer an external core storage capacity of 16 megabytes, operating at main memory speeds.

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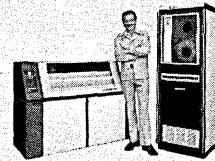
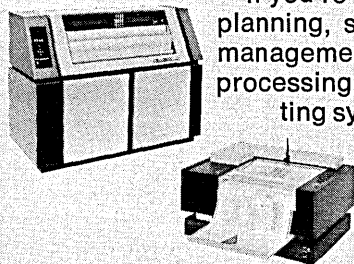
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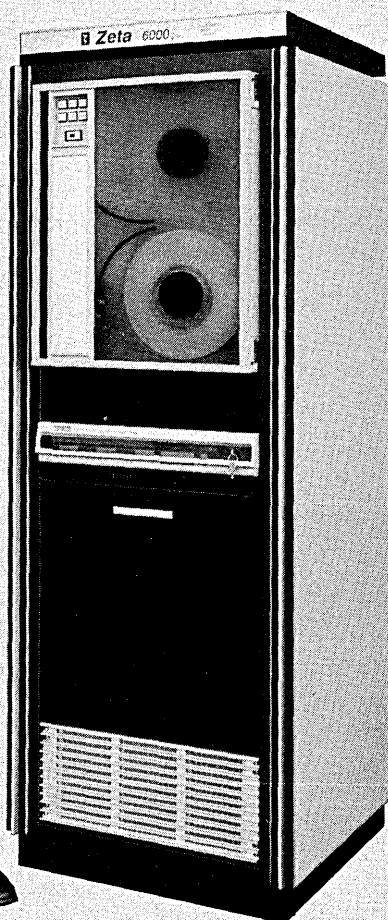
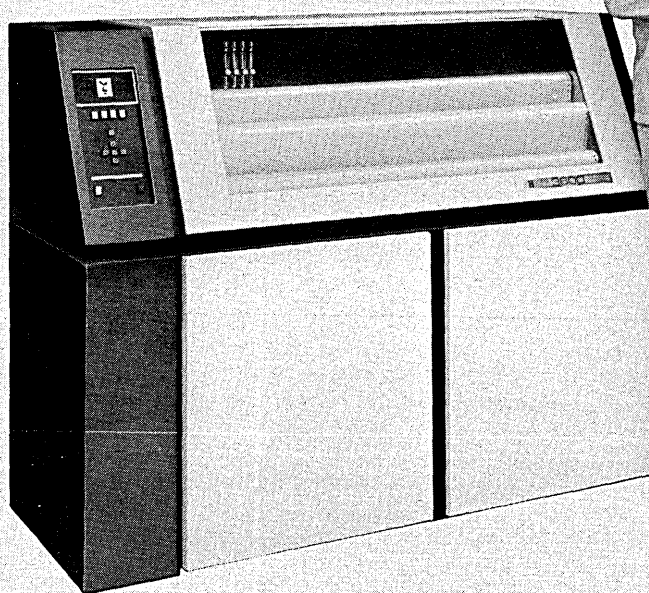
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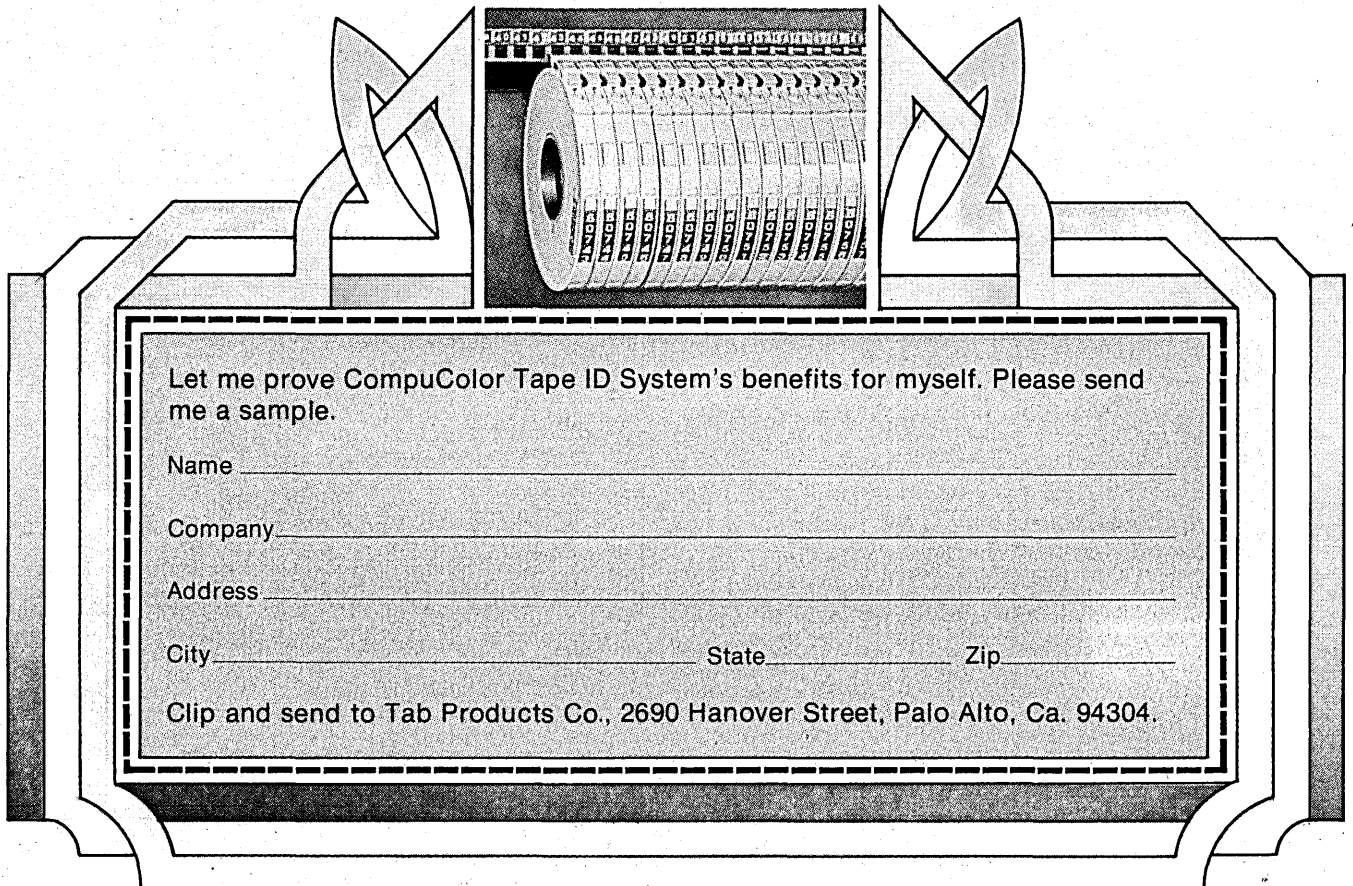
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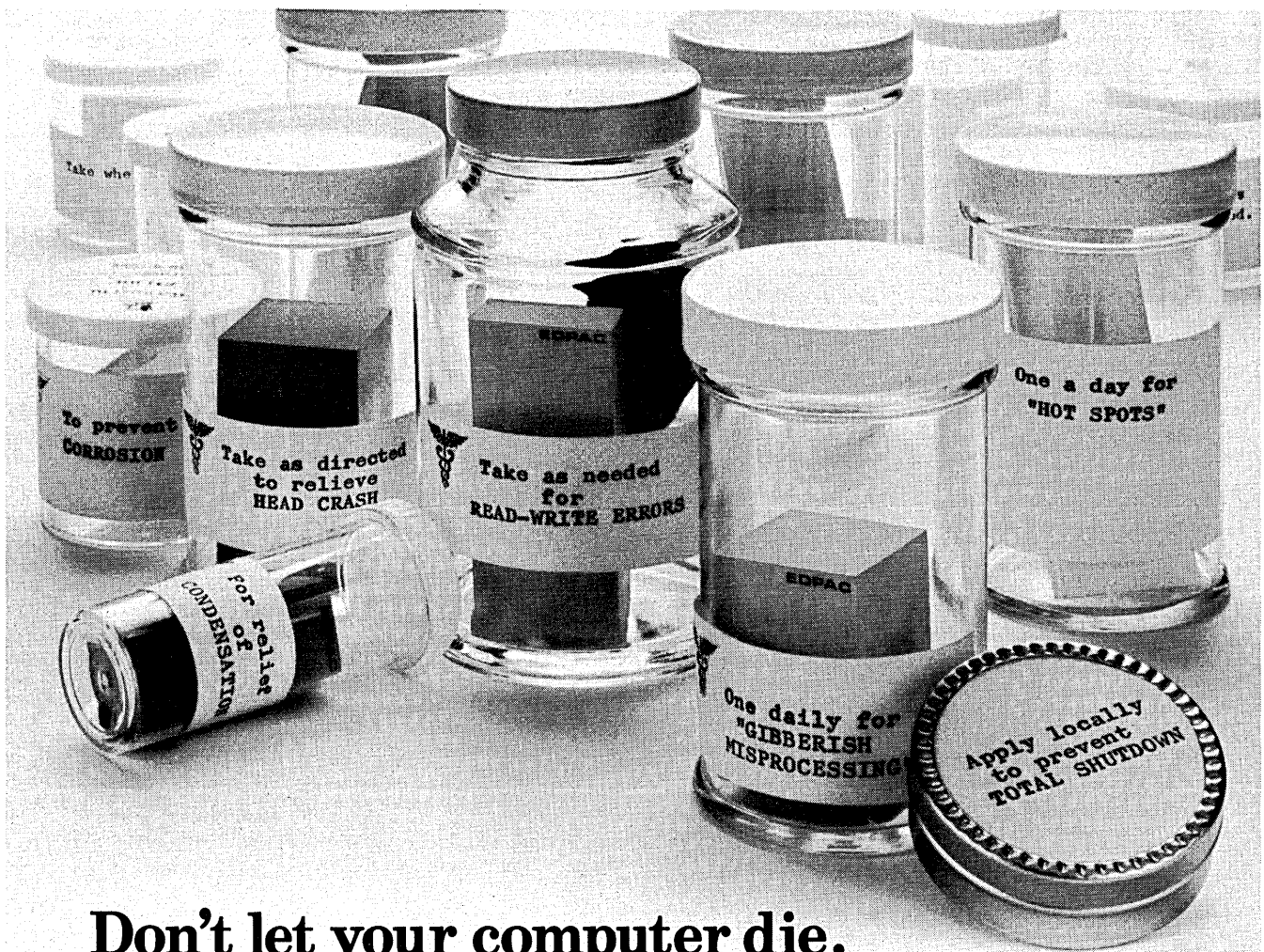
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Rx

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Company _____

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EDPAC

D-66

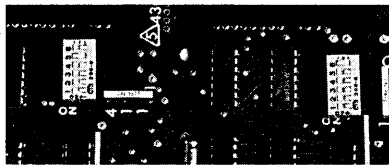
Old Cuthbert Rd. at Deer Rd.
Cherry Hill, New Jersey 08034

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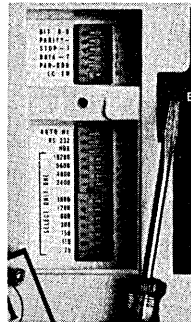
All the people who bought our DUMB TERMINAL (the ADM-3) because of its low \$995* unit price didn't really expect a lot. But they hadn't counted on the 32 switches. Switches that let you turn the DUMB TERMINAL into a pretty clever animal.

Take the 20 switches under the LSI name plate, for example. Among them, 11 communication rate positive action switches that let you select bauds from 19200 to 75. Also an RS232 interface extension port switch. It allows you to connect the DUMB TERMINAL to all kinds of clever devices — to recorders, printers and smarter terminals. And switches for odd-even parity. Optional upper and lower case (the complete set of 128 USASCII characters) — plus a lot more.

Inside on the PC board, 12 more switches. More positive action types that instruct the DUMB TERMINAL how to behave. And for all those who bought the 24-line optional display, there's a switch to change over from the standard 12-line format. So instead of showing 960 standard characters in 12 rows, you have the option of displaying 1920



The 32 Switches
The 12 switches in the rear, on the PC board.



The 20 switches under the front name plate.

characters in 24 rows of 80 letters. And there are still more switches that make your terminal a cinch to operate.

Now people aren't sure what turns them on: the low price, the 32 switches, or the DUMB TERMINAL's standard features. Features like a full 12" diagonal screen.

59 data entry keys, arranged like on a typewriter. Compatibility with all popular computers. Simple, quiet operation. An optional numeric key pad. And fast data throughput. All features that make this terminal a perfect video replacement for the old teletypewriter.

The fact is, people keep finding more and more jobs for our DUMB TERMINAL. Because they can do anything within reason — with just a little switching and training. And that's why the DUMB TERMINAL really turns out to be a smart buy. Which may be the biggest switch of them all.

For full information, write: Lear Siegler, Inc., E. I. D. / Data Products, 714 N. Brookhurst St., Anaheim, CA 92803; Tel. (714) 774-1010.



**DUMB TERMINAL.
SMART BUY.**

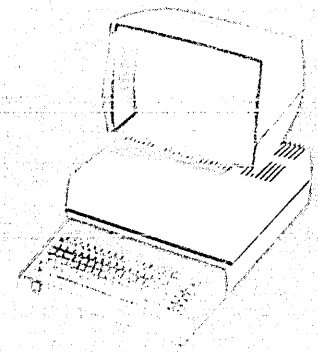


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provides uniform readability
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and built to meet specifically
for the 40+ terminal's
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ensure positive
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Special circuitry
allows one-line changes
to key method and
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Dependable solid state switch
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Editor's Readout

John L. Kirkley, Editor

The Coming Shakeout

It was just like old times. Bounding out from his ten-foot, curtain draped booth, the president of the company stopped us in the aisle, pointed enthusiastically to his hand-lettered felt pen signs, and breathlessly told us why his computer system could bring new joy and happiness into our business life.

After a few minutes of conversation, we also found out that he was not only the company's Chief Executive Officer, but also the salesman, writer of the software, keeper of the books, and maker of the coffee.

No, this wasn't a Joint Computer Conference in the mid-sixties; it was the annual Southern California Business Show which recently met in Los Angeles.

Unlike those early JCC enthusiasts, this entrepreneur is not peddling a system he had finished breadboarding just two days before the show. He's a new breed of cat: a member of a rapidly growing fraternity of small, independent systems firms specializing in turnkey minicomputer business systems. They call themselves "oem's" because they buy hardware from the mini manufacturers at oem discount prices. Their target is the small businessman in a specific vertical market. Their specialty is applications software. It's a lucrative business. And a growing one.

The mini makers like the arrangement. For their own sales force they reserve multiple purchases by big companies and the sale of medium and large scale systems. The low end of their business oriented mini line is sold to the oem who in turn goes after that vast, almost virgin (if there is such a thing) territory of entry-level users. "Not even Big Daddy himself," said one manufacturer, in a not-so-oblique reference to IBM, "has the resources to provide the kind of hand-holding this entry-level market needs."

The oem's like the arrangement too. One-time software buffs or consultants turned entrepreneur, they have been able to enter a potentially lucrative market with a minimal capital investment. With the cost of computer power plummeting, new prospects are on every block.

But despite the excitement generated when a new and potentially huge market begins to take shape, all is not beer and skittles. Voiced by almost every oem we talked to was that word so feared in our still young and often erratic industry. That word is "shakeout."

No one really knows how many oem's there are across the country—one guess was 1,000 but its maker admits to being wildly speculative. An oem'er at the show estimated about 100 of his ilk were located in Southern California. "This market will only support about ten decent sized houses," he said dourly. "The small, the undercapitalized, will go."

Shakeout proponents are claiming that many oem's are financially unstable, have no marketing plans, and are ill-equipped to manage a business, no matter how impressive their ability to write code. And it takes money—big money—to continue development of effective software packages, especially real-time and data base management systems . . . \$800,000 to \$1 million was one estimate. Another point—once the oem has saturated the potential customers in his geographic area, he must look to greener pastures. Again, expansion costs money, money the smaller oem's just don't have.

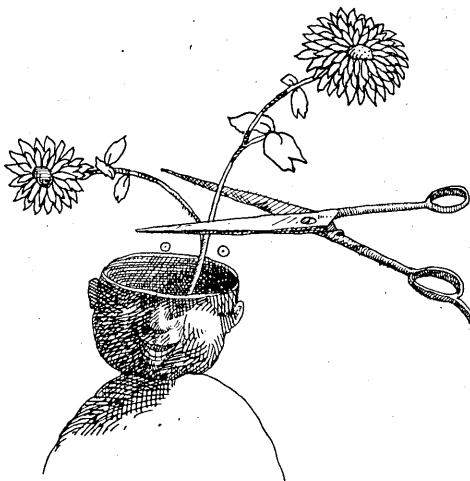
"Overly pessimistic," say others. This is a brand new market; we've just begun to scratch the surface. There's plenty of room for everyone and more besides. Furthermore the manufacturers are carefully screening prospective oem's. Financial credibility, market plans and forecasts, management ability, . . . all are scrutinized, weeding out the unfit. And once underway, it's in the oem's best interest to make a clean, on-time installation and to leave behind a satisfied customer; he knows that most of his new business will be by referral. Except for normal attrition, these firms are in business to stay—no shakeout is in the offing.

As so often happens, the unseen and unheard party in this fast-paced financial game is the end user . . . in this case the many mom and pop shops who are getting their first taste of computing. If a shakeout happens, their first taste may be sour indeed. And that would not be in the best interests of the manufacturers, the oem's, the users, and our industry in general.

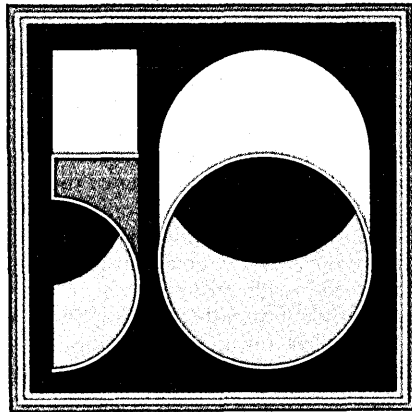
If the small business computer manufacturers continue to screen their oem's carefully; if the small businessman is canny and cautious in his first experience with the world of computing; if the oem's plan for the long haul . . . next year's small business shows may be even more exuberant.

More booths, more felt tip signs, more young, hustling Chief Executive Officers hailing you in the aisle. Maybe even some twenty-foot booths. Or that sure sign of a market segment that is really hitting its stride—pretty models in miniskirts.

We'll see.



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The Top 50 Companies in the Data Processing Industry

by Oscar H. Rothenbuecher

The industry comprises two nearly equal segments, IBM and the 49 others.

While becoming a part of every other business, data processing has become big business in its own right. As this analysis will show, revenue from dp products and services now accounts for nearly \$23 billion annually.

This feature briefly describes the business data of the 50 largest companies in the data processing industry, ranked on the basis of their dp related revenue derived from general purpose computers, minicomputers, peripherals and terminals, media and supplies, software and services. Simple communication of data, without attendant processing of some sort, was not considered to be part of the dp industry for the purposes of this analysis; therefore AT&T's data communications revenues are not included although Wylly Corp. revenues from Datran are.

As the curve in Fig. 1 illustrates, the cumulative 1975 revenues for the top 50 companies was something over \$22.2 billion. The curve also shows the high degree of concentration of revenue in the largest companies. Half of the total revenue accrued to the industry leader, IBM, whose dp revenue (reported as 77% of its corporate total) amounts to over \$11.1 billion. Further, the first seven companies have virtually all the general purpose system

revenue, about 75% of the minicomputer and peripheral equipment revenue, and about 60% of the services revenue.

Though no firms offering only services or peripherals are in the top seven, some such companies have attained relatively high ranking, proving that it is no longer necessary to manufacture computers to have a large data processing business.

The estimated net income of these 50 firms was about \$2 billion in 1975, disregarding some relatively small reported losses. Three quarters of this was earned by IBM. In fact, the income which IBM reports from "other" non-product sources alone (principally interest) is \$360 million, more than the combined incomes of the next six largest computer manufacturers.

The Top 50 tabulation

The tabulation shows selected data about the top 50 firms, listed in descending order of dp revenue for fiscal '75. In cases where two companies' dp revenues are estimated to be about the

The information presented in this article was compiled as a result of a study conducted for Datamation by Arthur D. Little, Inc. staff under the supervision of Mr. Rothenbuecher.

same, the firms are listed alphabetically. In those instances where no definite data were available, an estimate was made; such estimates are identified by the letter "E." (See tables, pp. 52-53.)

The left half of each tabulation line relates directly to the dp activities of the company. Since companies with activities in several businesses generally do not break out individual revenue sources in their consolidated statements, the data mainly reflect Arthur D. Little, Inc. estimates.

Further information on the businesses of these firms is included in the company business profiles. Bar charts in these profiles provide estimates for the percentage of 1975 dp revenue derived from five product and service categories (whether from sales, rentals, or some other arrangement). The five categories are:

- *Mainframes* — general purpose computers and memory (excluding peripherals and terminals)
- *Minicomputers*—all end user and oem minicomputer systems, exclusive of detachable peripherals
- *Peripherals and terminals* — all units shipped as part of systems or separately, including data entry equipment and add-on memory
- *Media and supplies*—media such

as disc packs, magnetic tapes, carbon ribbons, and incidental forms (but no major forms manufacturers are included)

- *Software and services* — software products, plus all types of time sales, maintenance, training, and customer assistance provided for a fee.

Disclaimer

The information reported in this feature is based on data provided in annual reports and other publications of the companies covered, *Moody's, Standard and Poor's*, Value Line financial services, and trade publications. While these estimates represent the best efforts of Arthur D. Little, Inc. and DATAMATION on the basis of available information, we cannot in any way guarantee completeness or accuracy. While our estimates were shown to the companies in all cases and were often improved by company sources, many companies preferred not to comment or to provide the details desired.

Due to the peculiarities of reporting cycles and policies of companies covered, inconsistencies and inaccuracies may have developed. Contributing to these are the following facts:

- The fiscal year by which companies report is not always identical to the calendar year, leading to differences in reporting periods, final adjustment considerations, and the like. Where this is the case, comparison of results for fiscal 1975 as presented by one company with those presented by another company for a fiscal 1975 of a different period may lead to some inequities.

- Identification of dp revenues and breakdowns of product class contributions are often not made available, or counts and definitions may vary from the mode which we selected.

- Double counting of oem-supplied products such as minicomputers, peripherals and terminals has probably occurred, because revenues of the originating manufacturer and the

assembling vendor are both likely to include them. The inflating effect of this factor is probably only of minor impact in the context of total industry revenues. *

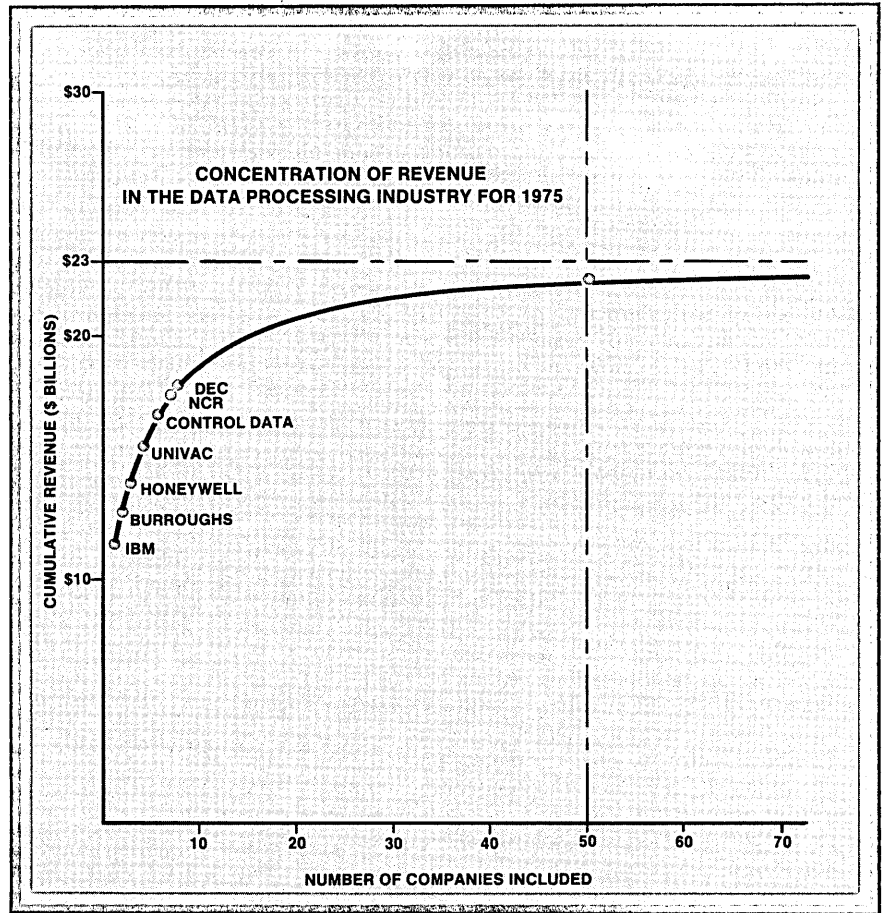


Fig. 1. The total data processing related revenue of the top 50 companies in the dp industry is approximately \$22.2 billion. Firms included in the 50 range from IBM (with roughly half the total revenues at \$11.1 billion) to Decision Data (with \$40 million, about 1/3 of 1% of IBM's amount).

The distribution of revenue in the industry is such that if all the 1975 revenues of all the companies under \$40 million were included, the curve would probably not rise by more than \$1 billion.

BUSINESS PROFILES (IN ORDER OF INDUSTRY RANKING)

International Business Machines Corporation
 Old Orchard Road, Armonk, NY 10504 (914) 765-1900

We estimate that \$11,116,000,000 of IBM's total revenues for 1975 came from sales, rental, and services of dp equipment and systems. (Slightly more than half of that originated in World Trade Operations outside the U.S.)

The worldwide revenue generated by general purpose computers and their attached peripherals and terminals amounts to more than 75% of that \$11 billion-plus figure. While minicomputers appear in increasing numbers in the company's small business systems as well as in terminal controllers, etc. their relatively small value results in a revenue total near the 4% level. Revenues from media, such as disc packs, tapes and other supplies, are estimated to contribute about 10%, services and software about the same.

Revenues from sales increased only 6% over 1974, reflecting the reduced shipment volume which is considered normal at this point in IBM's product cycle. Revenues from rentals and services rose by more than 17% over the previ-

ous year, due in part to additions to installed systems, but also to increases in rental and service charges.

Mainframes	Minicomputers	Peripherals & Terminals	Media & Supplies	Software & Services
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Percentage of data processing business attributable to main product and service categories.

Burroughs Corporation
 Burroughs Place, Detroit, MI 48232 (313) 972-7442

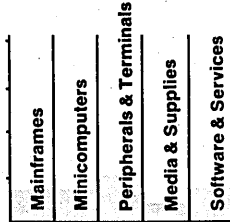
An estimated \$1,447,000,000 of Burroughs' 1975 revenues were derived from dp related activities, the second largest volume in the industry. Only about 20% of this amount is attributed to general purpose computers. Terminals and peripherals are estimated to contribute about 30%, media

and supplies 10%, services and software nearly 20%.

The remaining 20% of the dp related revenue comes from minicomputers in small business systems and terminal configurations, in which Burroughs has acquired a strong position. Further, its recent announcement of the B730 small computer series and promised new products indicate the company intends to compete even more intensely in small business systems.

Roughly 41% of Burroughs's dp business is done outside the states.

Percentage of data processing business attributable to main product and service categories.



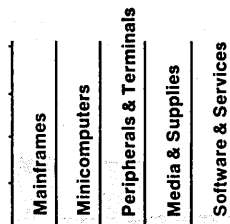
Honeywell Incorporated
Honeywell Plaza, Minneapolis, MN 55408
(612) 870-5200

Honeywell Information Systems contributed almost half of the 1975 corporate revenue. With dp revenues of \$1,324,000,000 the firm holds the number three industry position.

Somewhat over half of the dp revenue was produced in Honeywell's foreign operations. A major portion of that originated with the French-based affiliate Cie. Honeywell Bull, which last year was merged with CII (Cie. Internationale pour L'Informatique) to create a new company with a French majority interest. French government subsidies to the new company and a favored position in that government's procurement may result in an improved market position for CII-CHB.

The major contribution to dp revenues (40%) came from general purpose computer systems. Minicomputers amounted to only 6% of the volume, but the announcement of the Level 6 minicomputer family and the TC 2000 indicate that HIS will place more emphasis on this product class. Peripherals and terminals are estimated to contribute near 38%, media, and software and services 8% each.

Percentage of data processing business attributable to main product and service categories.

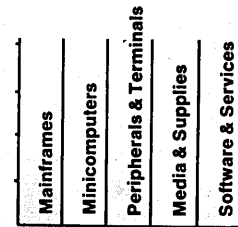


Sperry Rand Corporation
1290 Avenue of the Americas, New York, NY 10019
(212) 956-3273

In its fiscal 1975 (which ended in March 1975) Sperry's Univac division contributed \$1,295,000,000 to total corporate revenues, representing a dp growth of about 15%. About 42% of this originated in foreign activities. (If revenues were reported for calendar 1975 Univac might occupy a higher position.)

Computers, peripherals and terminals contributed about 75% of Univac's dp revenues, with a major portion of that based on the wide acceptance of the large scale 1100 computer systems; a strong government business also contributes substantially. Revenues from services and software are estimated to contribute nearly 20%, supplies less than 5% of the total.

Percentage of data processing business attributable to main product and service categories.



Control Data Corporation
P.O. Box 0
Minneapolis, MN 55440 (612) 853-8100

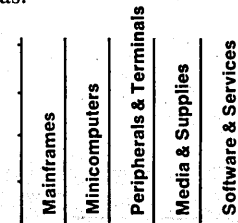
Control Data's total revenues in 1975 showed an increase of 13% over the previous year's level. \$1,218,000,000 (98%) of the volume originates from dp related activities, which also include spare parts, instruments and controls, and aerospace operations, placing CDC in the number five position in the industry.

The company reports that 36% of its revenues originate with systems, in which it includes peripherals and terminals used with its own mainframes, minicomputers used in communications handling, etc. We redistributed these product contents by our best estimates to the appropriate classes. As a result, service emerges as the main contributor to CDC's revenues.

Second largest are the peripherals and terminals used both in the corporation's own product line and sold in the oem market. Joint ventures, such as Magnetic Peripherals Inc. (formed with Honeywell) and Computer Peripherals Inc. (with NCR and International Computers Ltd.) can be expected to improve CDC's position in this field. They may also increase CDC's foreign revenue base, which at present accounts only for one-third of the total volume.

While the firm in the past did not provide hardware offerings catering specifically to the small business user, it announced in March the Cyber 18 line, a family of small computers with which it intends to compete in the intelligent terminals and small systems areas.

Percentage of data processing business attributable to main product and service categories.



NCR Corporation
Main & K Streets, Dayton, OH 45479 (513) 449-2000

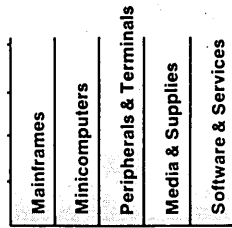
In 1975, \$960 million, close to half of NCR's total revenue came from data processing systems. Over the last several years the company has concentrated its activities on specific industries such as financial institutions and retail firms. It has become the world's largest manufacturer of retail systems and can be expected to reinforce this position further since Singer, its key competitor, has left the field.

As we see it, general purpose computers make up approximately 15% NCR's dp revenue volume, minicomputers another 23%, and peripherals and terminals account for more than 33% of the volume. Supplies are in the 7% range, while the service contribution (especially due to growing data center activities) is at the 22% level. Our estimates of the business volume differ from the revenue distribution reported by NCR because of differences in definition.

NCR has completed its conversion from mechanical devices to the electronic product families, and with its models 299 and 399 has gained a strong position in the small business machines market in which further growth is expected. The company has also recently announced a new

general purpose computer line, "Criterion." (See page 137.)
Roughly half of the company's business is done overseas.

Percentage of data processing business attributable to main product and service categories.

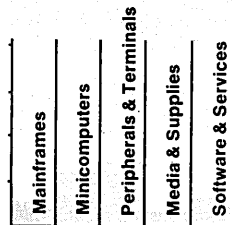


Digital Equipment Corporation
146 Main Street, Maynard, MA 01754 (617) 646-8600

In 1975, Digital Equipment continued its growth with revenues of \$534 million, nearly 40% of which was derived from foreign operations.

While the minicomputer (on which DEC's business was founded) continues as the key product and produces almost 30% of the total volume, mainframe computers of the DECSYSTEM-10 class have grown in importance and are estimated to account for around 12%. This category can be expected to gain further as the somewhat smaller DECSYSTEM-20 achieves high volume shipment levels. Peripherals and terminals combined are estimated to contribute about 37%, media and other supplies near 6%, and services including software sales about 15% of revenue.

Percentage of data processing business attributable to main product and service categories.

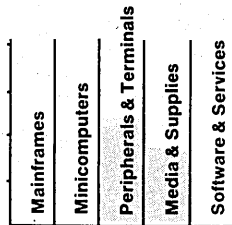


Memorex Corporation
San Tomas at Central Expressway
Santa Clara, CA 95052 (408) 987-1000

Memorex's 1975 revenue, derived practically exclusively from computer peripheral products such as disc storage systems and related media, grew by almost 18% over the previous year to \$264 million. With a net income of \$18 million, it produced a substantial profit after several years of sustained losses. Peripheral products and terminals provided about 60% of the revenue, and 40% resulted from media sales.

About 40% of the firm's revenue is attributed to foreign operations.

Percentage of data processing business attributable to main product and service categories.



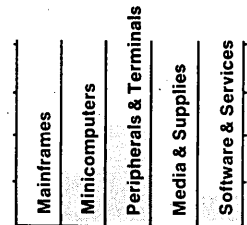
Hewlett-Packard Company
1501 Page Mill Road, Palo Alto, CA 94304
(415) 493-1501

While the growth of sales of H-P calculator products slowed somewhat in 1975 due to increased competition and reduced price levels, its minicomputer business increased in importance. Though it holds third place in the number of installed minicomputers, it is in second position by total value of systems in use. This is due to the high average value of the H-P minicomputers.

We estimate that H-P's revenues have risen to 25% of the

corporate total, or \$250 million, with 40% originating abroad. About 28% of the dp volume originates in minicomputers, 56% in related peripherals and terminals, and about 16% in services.

Percentage of data processing business attributable to main product and service categories.

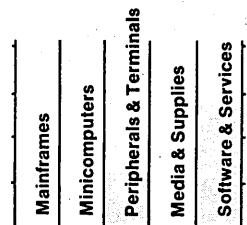


TRW Incorporated
23555 Euclid Avenue, Cleveland, OH 44117
(216) 383-2332

The volume of TRW's dp related business has reached substantial proportions mainly through its emphasis on holding a leading position in credit authorization and reporting services. TRW indicates its intent to expand its credit reporting services further in 1976. In 1975 the company entered the market for point-of-sale systems, subsequently strengthening its position by taking over the maintenance and support for Singer customers when that company discontinued its activities in this field.

Indications for 1975 are that TRW's dp revenues have grown to the \$250 million level. About 70% of that amount is attributed to services, the other 30% mostly to terminals. Fully 90% of TRW's dp revenues come from domestic operations.

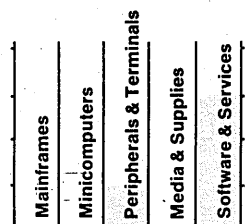
Percentage of data processing business attributable to main product and service categories.



General Electric Company
3135 Easton Turnpike, Fairfield, CT 06431
(203) 373-2211

The data processing related activities of General Electric are in its time-sharing computer service network operation and in the production and marketing of its Terminet terminals. The time-sharing services have been growing in excess of 20% per year, and are estimated to have reached the \$150 million level in 1975. The Terminet product line is estimated to contribute about \$50 million of revenue, for a combined total of \$200 million (80% of which was done in the U.S.)

Percentage of data processing business attributable to main product and service categories.



3M Company
3M Center, St. Paul, MN 55101 (612) 733-1110

The dp related products produced and marketed by 3M are mostly a variety of magnetic recording materials: magnetic tapes, disc packs, cassettes and, most recently, a magnetic tape cartridge. We estimate that the combined dp revenue produced by these products is in the range of 6% of corporate total revenue or about \$180 million, of which 80% were obtained domestically. (Continued on page 54)

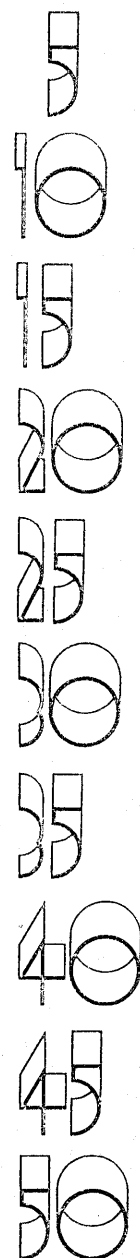
THE TOP 50 COMPANIES IN THE DP INDUSTRY

Estimates for 1975

RANK	COMPANY	DP REVENUES \$M	DP REVENUES (% of total revenues)	U.S. DP REVENUES (% of total dp revenues)
1	International Business Machines	11,116	77%	50%
2	Burroughs	1,447	85%	59%
3	Honeywell	1,324	48%	46%
4	Sperry Rand	1,295	43%	58%
5	Control Data	1,218	98%	67%
6	NCR	960	44%	50%
7	Digital Equipment	534	100%	61%
8	Memorex	264	100%	60%
9	Hewlett-Packard	250	25%	60%
10	TRW	250	10%	90%
11	General Electric	200	1.5%	80%
12	3M	180	6%	80%
13	Computer Sciences	177	100%	92%
14	Mohawk Data Sciences	170	100%	46%
15	McDonnell Douglas	160	5%	100%
16	Itel	147	72%	90%
17	Automatic Data Processing	143	92%	95%
18	Bunker Ramo	120	42%	95%
19	Electronic Data Systems	119	100%	100%
20	CalComp	116	95%	70%
21	Ampex	109	45%	55%
22	Data General	108	100%	61%
23	Pertec	105	100%	70%
24	Data 100	96	100%	69%
25	Management Assistance	94	100%	61%
26	Storage Technology	92	100%	75%
27	Dataproducts	84	88%	76%
28	Harris	80	17%	90%
29	Xerox	80	2%	90%
30	Teletype	78	50%	90%
31	Telex	75	71%	90%
32	General Instrument	71	17%	68%
33	Electronic Memories & Magnetics	70	71%	80%
34	Greyhound Computer	61	100%	82%
35	GTE	60	1%	100%
36	Raytheon	60	3%	80%
37	Texas Instruments	60	4%	90%
38	Wyly	60	90%	66%
39	Recognition Equipment	59	100%	100%
40	Inforex	57	100%	44%
41	General Automation	56	100%	71%
42	Tymshare	56	100%	85%
43	Sycor	55	100%	50%
44	Boeing	50	1.4%	100%
45	Wang Laboratories	50	65%	53%
46	Tektronix	49	15%	60%
47	Datapoint	47	100%	52%
48	Varian Associates	47	15%	95%
49	Centronics Data Computer	42	100%	66%
50	Decision Data Computer	40	100%	75%

Reported Data

1973 TOTAL REVENUES \$M	1974 TOTAL REVENUES \$M	1975 TOTAL REVENUES \$M	1975 NET INCOME OR (LOSS) \$M	NUMBER OF EMPLOYEES	RANK
10,993	12,675	14,437	1,990	284,647	1
1,284	1,533	1,702	164	51,671	2
2,390	2,626	2,778	78	86,250	3
2,229	2,613	3,040	131	92,950	4
948	1,101	1,246	13	42,800	5
1,816	1,979	2,166	72	72,000	6
265	422	534	46	19,000	7
177	218	264	18	5,364	8
661	884	981	84	30,200	9
2,165	2,486	2,586	104	82,757	10
11,575	13,413	13,400	580	404,000	11
2,545	2,937	3,127	267	83,600	12
120	147	177	4	7,500	13
143	169	170	(22)	4,200	14
3,003	3,075	3,255	86	70,700	15
108	143	204	11	2,000	16
90	112	155	14	5,400	17
291	314	289	(14)	10,600	18
109	114	119	15	3,660	19
80	129	123	(12)	3,250	20
257	272	242	6	10,400	21
53	83	108	13	3,280	22
27	33	105E	2E	900	23
43	70	96	6	2,620	24
67	77	94	6	2,440	25
57	75	92E	6E	2,000	26
60	76	95	6	3,000	27
384	437	479	1	13,200	28
2,990	3,576	4,053	244	101,380	29
N.A.	N.A.	157E	N.A.	3,200E	30
68	90	106	1	2,000	31
319	426	420	12	22,300	32
106	111	98E	(.5)E	4,900	33
46	52	61	.7	850	34
5,105	5,661	5,948	365	187,000	35
1,590	1,929	2,245	71	54,410	36
1,287	1,572	1,368	62	65,524	37
80	89	66	(52)	2,000	38
42	43	59	2	1,800	39
38	52	57	1.5	1,573	40
30	61	56	(4)	1,700	41
35	46	56	5	1,200	42
32	40	55	5	1,200	43
3,335	3,731	3,719	76	74,800	44
47	64	76	3	2,350	45
203	271	337	26	12,664	46
19	34	47	5	1,300	47
241	293	310	8	10,400	48
24	42	42	7	750	49
18	41	40E	(.2)E	950	50

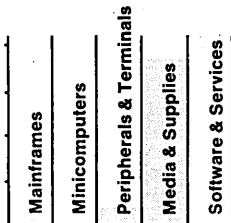


E estimated figure

NA not available

* Pertec's 1975 revenue estimate includes CMC revenues

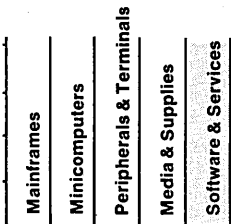
Percentage of data processing business attributable to main product and service categories.



Computer Sciences Corporation
650 N. Sepulveda Boulevard, El Segundo, CA 90245
(213) 678-0311

Computer Sciences Corporation (the largest dp service organization) achieved a revenue level of \$177 million in fiscal 1975. Contract services grew by 12%, and the INFONET operation by 65% over the previous year! With the growth of both continuing, CSC expects its revenues for 1976 to exceed \$200 million, with an accompanying strong increase in profit.

Percentage of data processing business attributable to main product and service categories.

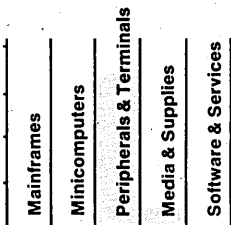


Mohawk Data Sciences Corporation
1599 Littleton Road, Parsippany, NJ 07054
(201) 540-9080

Mohawk's activities, concentrating in data entry devices, remote job entry terminals and small data processing devices, experienced slowed growth and resulting losses during recent years and early fiscal 1975. During the remainder of 1975, efforts to eliminate some of the weaker products led to a further reduction in sales, to the level of \$170 million. The slimming of the product line appears to have checked the losses, and enhancements to the product line may result in profits during the 1975 fiscal year.

Perhaps unexpectedly, more than half of Mohawk's dp business is done out of the country.

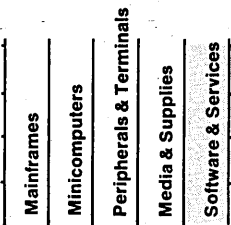
Percentage of data processing business attributable to main product and service categories.



McDonnell Douglas Corporation
P.O. Box 516, St. Louis, MO 61366 (314) 232-0232

McDonnell Douglas Automation, a wholly owned subsidiary of McDonnell Douglas Corporation, provides a variety of computer services. Recognizing early the importance which industry specialization can have in this field, McAuto has actively pursued such areas as automotive dealership services and services to hospitals. We estimate the revenue which McAuto contributes to the corporate total to be in the 5% range, or about \$160 million.

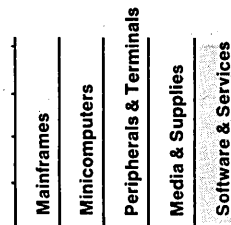
Percentage of data processing business attributable to main product and service categories.



ITEL Corporation
One Embarcadero Center, San Francisco, CA 94111
(415) 983-0000

Almost three-quarters of ITEL's revenue, roughly \$147 million worth, is derived from dp related services. These consist mostly of leasing of IBM computers and related peripherals, the latter generally made by manufacturers other than IBM. During 1975, ITEL completed the phase-out of its IBM 360 leasing activities. Its continuing computer leasing activities concentrate on the IBM 370 line and associated peripherals. A variety of network oriented data services, such as the on-line banking service launched during one year, show growth potential.

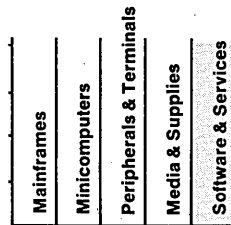
Percentage of data processing business attributable to main product and service categories.



Automatic Data Processing, Incorporated
405 Route 3, Clifton, NJ 07015 (201) 472-1000

ADP has consistently been one of the most successful participants in the data services field. It gained a nationwide reputation with its batch-mode payroll service. Consistent expansion into other similar services has led to a steady growth in revenue, and ADP has expanded significantly into on-line interactive services. Its recent acquisition of Cyphernetics is indicative of its commitment to a wider scope of interactive remote services, and is a stepping stone to expanding its operations in the international market. Total dp revenues for 1975 are estimated at \$143 million.

Percentage of data processing business attributable to main product and service categories.

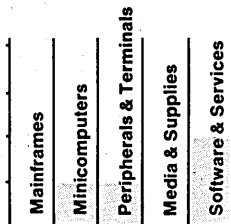


Bunker Ramo Corporation
9000 Commerce Drive, Oak Brook, IL 60521
(312) 986-2700

Bunker Ramo's \$120 million dp business is in information services and terminals. The information services are primarily for financial institutions, providing subscribing organizations with trading information on securities and commodities on various exchanges. In addition, the company owned and operated for the National Association of Securities Dealers an automatic quotation system for over-the-counter securities. In a recent agreement with the association, it agreed to sell the system to the association and continue to operate it for another four years.

Bunker Ramo's terminal line emphasizes teller systems for savings banks. While the firm previously also offered point-of-sale terminals for supermarkets, it decided at the end of 1975 to withdraw from this field and direct its resources toward areas in which it sees the promise of better returns. The net loss for 1975 amounted to \$14 million.

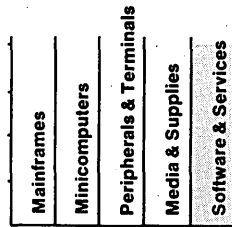
Percentage of data processing business attributable to main product and service categories.



Electronic Data Systems Corporation
 1300 EDS Center, Exchange Park, Dallas, TX 75201
 (214) 358-3171

EDS has operated data processing services on a facilities management basis for a variety of organizations, especially in the health care, insurance and financial industries. With its growth slowed in the last two years, holding revenue to \$119 million in 1975, EDS is exploring new opportunities in the processing of social security payments.

Percentage of data processing business attributable to main product and service categories.



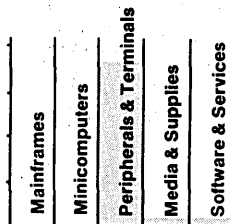
California Computer Products, Incorporated
 2411 West La Palma Avenue, Anaheim, CA 92801
 (714) 821-2011

Fiscal 1975 was a difficult year for CalComp. While revenues from disc and tape memory products to end users rose slightly, and plotting equipment showed an increase of 18% over the previous year, the decline of oem sales of disc and tape products resulted in the first decrease in revenue in 10 years bringing the firm's dp revenues to \$116 million. A substantial loss was significantly increased by product decisions which required additional write-offs. CalComp withdrew from the add-on random access memory market and stopped the development of high density (6250 bpi) tape drives, feeling that the resources thus freed can be more profitably utilized in accelerated development in the disc area.

Improvements in operations late in calendar 1975 produced a turnaround interpreted by CalComp as indicating a stabilized position.

About 30% of the company's business is foreign.

Percentage of data processing business attributable to main product and service categories.

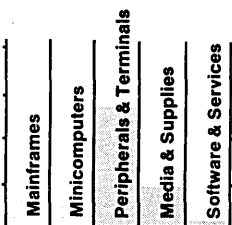


Ampex Corporation
 401 Broadway, Redwood City, CA 94063 (415) 367-4456

Ampex produces and markets a variety of magnetic storage products for computer systems, a business which brought it an estimated \$109 million in 1975. The slowing demand for magnetic tape drives has affected sales growth, as did the increasing competition in disc drives. Ampex was an early proponent of mass storage systems with its Terabit device, but sales of this product have not been at a compensating level.

Almost half of its revenue is from non-U.S. sources.

Percentage of data processing business attributable to main product and service categories.



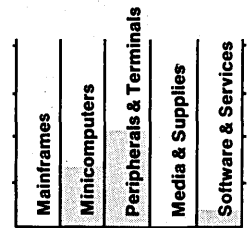
Data General Corporation
 Route 9, Southboro, MA 01722 (617) 485-9100

Data General continued in its strong growth in 1975, increasing its revenue by 30% over the previous year's level to \$108 million. Almost 40% of this was derived from foreign operations.

A larger and more powerful line of minicomputers, the Eclipse, was introduced during the year to serve customers with a need for computing power exceeding that of DG's previous models. The firm sees in the response to this new product line an opportunity to penetrate new end user markets.

Minicomputer shipments are estimated to contribute somewhat over 33% of the revenue, peripherals and terminals about 55%, and service and software sales 10%.

Percentage of data processing business attributable to main product and service categories.

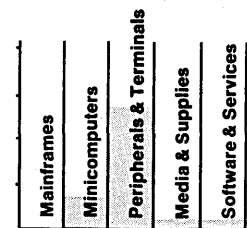


Pertec Corporation
 101 Continental Boulevard #435, El Segundo, CA 90245
 (213) 640-1540

Pertec has consistently expanded its sales of peripheral equipment and terminals, largely for oem use in minicomputer-based key-to-disc data entry systems. Pertec's main oem customer for these systems is Univac. Foreign sales provided 30% of total revenues, with negotiations reportedly under way to gain additional distribution agreements.

Pertec recently completed its acquisition of Computer Machinery Corporation, which manufactures and markets data entry systems, remote batch terminals and off-line printing systems. Total revenues for Pertec including the 1975 contribution of CMC would be at the \$105 million level. Other data reported in the tables do not include CMC's contribution.

Percentage of data processing business attributable to main product and service categories.

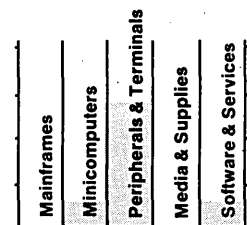


Data 100 Corporation
 6110 Blue Circle Drive, Minneapolis, MN 55435
 (612) 941-6500

Data 100 provides a variety of terminals, especially for remote batch operations in the IBM environment. Over 70% of Data 100's \$96 million revenues are attributed to terminal and peripheral sales, approximately 15% to the mini-computer content, and a like amount to services.

Nearly one third of the revenue now originates in foreign operations.

Percentage of data processing business attributable to main product and service categories.



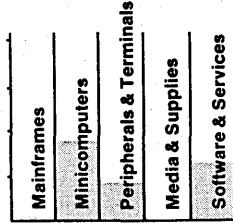
Management Assistance Incorporated
 300 East 44th Street, New York, NY 10017
 (212) 557-8310

MAI continued its penetration of the small business systems market in 1975 through expansion of the activities of its subsidiaries, bringing its revenue to \$94 million. More than 2,000 BASIC/FOUR systems have been manufactured, of which in excess of 50% went to foreign customers (as did nearly 40% of all its dp business)

Increasing efforts are also being made to expand MAI's position in the terminal market with Genesis One Computer Corporation offering its GS-77 product as a plug-to-plug competitive alternative to IBM offerings.

The Sorbus, Inc. subsidiary is the largest independent data processing maintenance service organization, actively expanding its base of operations by gaining service agreements with an increasing number of manufacturers.

Percentage of data processing business attributable to main product and service categories.

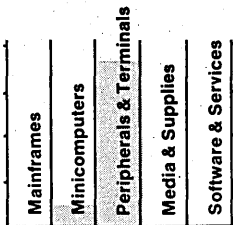


Storage Technology Corporation
 2270 South 88th Street, Louisville, CO 80027
 (303) 666-6581

STC produces and markets magnetic storage subsystems for computers, a business which brought it \$92 million last year. It acquired a strong position in plug-to-plug compatible tape drives for IBM users. As the demand shifted toward disc storage devices, STC responded with appropriate product offerings and is expanding its market share in this product class. The Series 8000 large capacity disc storage system, introduced in 1973, featuring fixed media, has gained in market acceptability since IBM announced fixed media disc devices last year.

The recent acquisition of Ultimacc signals STC's intent to move into the small business computer field.

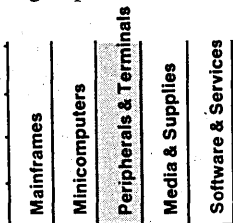
Percentage of data processing business attributable to main product and service categories.



Dataproducts Corporation
 6219 Desoto Avenue, Woodland Hills, CA 91364
 (213) 887-8000

Data Products' main product line is line printers, which it supplies to the oem market. It also holds a strong position as a supplier of core memories, for which growing sales are reported in the European market. Nearly one quarter of its \$84 million revenue is attributed to foreign operations.

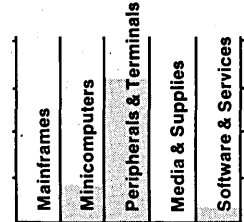
Percentage of data processing business attributable to main product and service categories.



Harris Corporation
 55 Public Square, Cleveland, OH 44113 (216) 861-7900

In 1975, the revenues Harris received from the sale of commercial electronic products grew faster than the corporate total (the low level of net income was due to a write-off taken on some discontinued operations). We estimate that the volume of dp related electronic products sold by Harris (including minicomputer systems for text composition systems, terminals and software packages) amounted to \$80 million. About 15% of that is attributed to minicomputers, 80% to terminals and peripherals, and about 5% to software and services.

Percentage of data processing business attributable to main product and service categories.



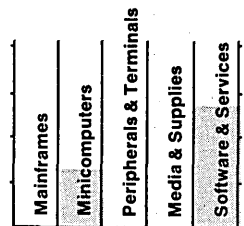
Xerox Corporation
 Stamford, CT 06904 (203) 329-8711

In 1975 Xerox Corporation decided to withdraw from the general purpose computer business after five years of sustained losses. However, it is continuing in the manufacturing and marketing of serial printers, high-speed non-impact xerographic printers for data processing systems, and computer disc drives.

Its acquisitions in 1975 of Daconics, a maker of word processing systems, and of Versatec, a manufacturer of electrostatic printers and plotters, are indicative of Xerox' intent to continue activities in dp related areas which offer the potential of acceptable returns. This intent is also reflected in Xerox' growing efforts to offer computer services to business organizations and public agencies.

We estimate that revenues from these activities amounted to \$80 million (only 2% of the corporate total), with 33% attributed to peripherals and terminals and about 67% to services.

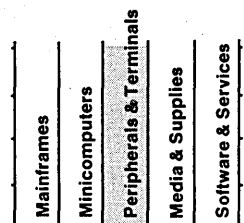
Percentage of data processing business attributable to main product and service categories.



Teletype Corporation
 5555-Touhy Avenue, Skokie, IL 60076 (312) 982-2000

A wholly owned subsidiary of Western Electric Company, Teletype produces and markets teletypewriters and data terminals. A large portion of its teletypewriter products are used in the general communications field; we estimate that about half of Teletype's revenues, or \$78 million, relate to the dp market. Teletype is expected to be an aggressive competitor for an increasingly diverse variety of end-user terminal markets.

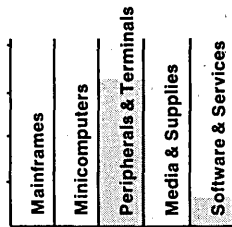
Percentage of data processing business attributable to main product and service categories.



Telex Corporation
P.O. Box 1526, Tulsa, OK 74101 (918) 627-2333

Telex' dp product line comprises magnetic tape drives, disc drives, and printer mechanisms, mainly for the IBM-oriented user environment. The reduced user interest in tape drives and the increasingly competitive situation in the market for disc storage devices have impacted the growth of Telex' revenues in recent years, holding its dp revenues to \$75 million.

Percentage of data processing business attributable to main product and service categories.

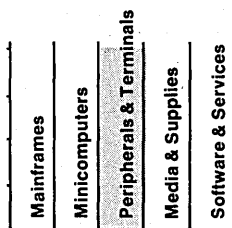


General Instrument Corporation
1775 Broadway, New York, NY 10019 (212) 541-8200

Dp products manufactured and marketed by General Instruments contribute about 17% (\$71 million) to total corporate revenue. Growth of revenue has leveled in 1975; this is attributed to the economic situation reducing demand for the company's products.

Revenues from sources outside the U.S. are estimated at 32%.

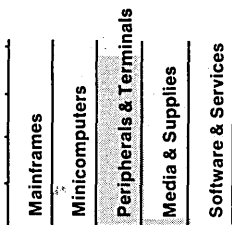
Percentage of data processing business attributable to main product and service categories.



Electronic Memories & Magnetics Corporation
1880 Century Park East, Los Angeles, CA 90067
(213) 556-2323

About 71% of EMM's revenues are from memory products, specifically core memories and magnetic disc packs compatible with similar products made by IBM and some other computer manufacturers. With the technology of memories shifting to semiconductor circuitry, a decline in demand for core replacement memory has occurred which is reflected in the reduced 1975 dp revenue level of \$70 million.

Percentage of data processing business attributable to main product and service categories.



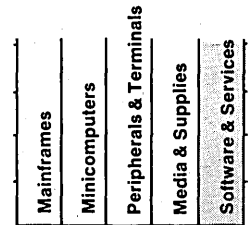
Greyhound Computer Corporation
Greyhound Tower, Phoenix, AZ 85077 (602) 248-5713

With the economic situation causing many computer users to cut costs in 1975, Greyhound Computer Corporation could expand its volume in computer leasing. The medium and small systems market grew, but price declines for larger systems created a more intensely competitive situation which reduced the profits.

Greyhound is complementing its computer leasing operations with increasing activity in data processing services, especially for the medical and banking industries. Revenues

produced by data services are near 20% of the \$61 million total.

Percentage of data processing business attributable to main product and service categories.

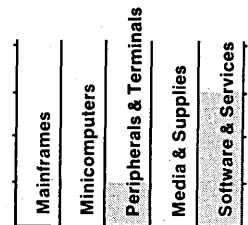


GTE Corporation
One Stamford Forum, Stamford, CT 06904
(203) 357-2000

The dp activities of GTE Information Services consist mostly of computer-based data services for the financial community, concerned with trading activities on major stock and commodity exchanges. Total revenue produced is estimated to be about \$60 million, with 75% originating from services and 25% from terminals.

Note that dp business is only a tiny fraction of GTE's interests, approximately 1%.

Percentage of data processing business attributable to main product and service categories.

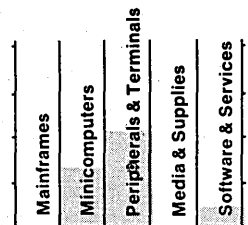


Raytheon Company
141 Spring Street, Lexington, MA 02173 (617) 862-6600

Raytheon's activities directed to the dp end user have been mainly in display terminals, specifically in airline reservation systems. We estimate its dp revenue volume to be in the \$60 million range, with 55% originating in terminals and peripherals, about 35% in minicomputers, and the remainder in service and software activities.

Dp related revenues constitute only 3% of the company's business.

Percentage of data processing business attributable to main product and service categories.

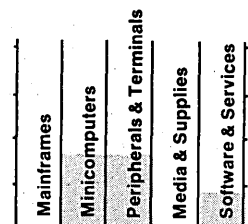


Texas Instruments, Incorporated
13500 North Central Expressway, Dallas, TX 75222
(214) 238-2011

Revenues derived by Texas Instruments from the sale of terminals and minicomputer systems have grown to the \$60 million level, but still represent only 4% of total revenues. More than 80% of this volume is attributed to minicomputer, terminal and peripheral hardware, and about 20% to services and software.

The majority of these sales were to the domestic user population, with a possible 10% contributed by foreign operations.

Percentage of data processing business attributable to main product and service categories.

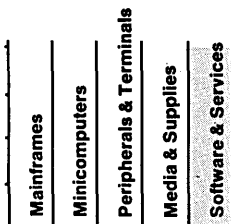


Wyly Corporation
P.O. Box 6228, Dallas, TX 75222 (214) 637-5181

In fiscal 1975, Wyly Corporation continued its efforts to become a data processing and data communications company. Its Datran subsidiary was in the early operation and continuing development stage and had no significant revenues, strongly contributing to the firm's \$52 million loss. The bulk of Wyly's \$60 million revenues derived from data processing services.

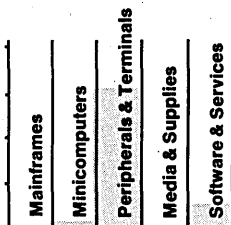
Domestic revenues account for 66% of total dp revenues.

Percentage of data processing business attributable to main product and service categories.


Recognition Equipment, Incorporated
P.O. Box 22307, Dallas, TX 75222 (214) 438-8611

REI, as one of the leading manufacturers of optical character recognition systems, is showing continuing growth of revenues, attributed mostly to its check processing products. More than 75% of its \$59 million revenue originates with its peripheral and terminal products, 5% with the minicomputer content of the product line and the remaining 15% with service.

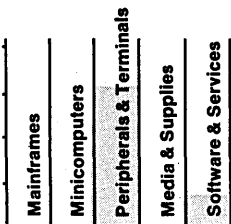
Percentage of data processing business attributable to main product and service categories.


Inforex, Incorporated
21 North Avenue, Burlington, MA 01803 (617) 272-6470

The company's main product line, clustered key data entry systems, have gained increasing acceptance in both domestic and foreign markets. About 25% of its \$57 million revenue is attributed to the minicomputer content of the product, 67% to the terminal and peripheral portion, with the remainder coming from service and software.

Foreign sales contributed in excess of 56% to the total!

Percentage of data processing business attributable to main product and service categories.

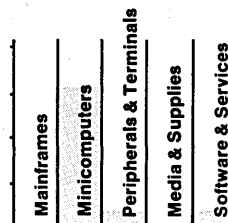

General Automation, Incorporated
1055 South East Street, Anaheim, CA 92805 (714) 778-4800

In fiscal 1975, total revenues gained by this manufacturer of minicomputer systems for process control, data management, and communications handling were slightly down from the previous year level to \$56 million. A loss was incurred, due in part to an inventory write-off.

Recent operations are reported improved, resulting in a turnaround from the earlier loss situation to a small profit in the quarter ending January 31.

Nearly 30% of GA's revenues are from foreign sources.

Percentage of data processing business attributable to main product and service categories.

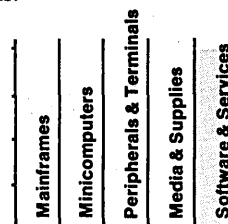

Tymshare, Incorporated
10340 Bubb Road, Cupertino, CA 94014 (408) 257-6550

Offering a variety of data processing services throughout the United States and Europe, Tymshare's activities in 1975 continued to expand to \$56 million. It continued in its program of acquisitions (of Leasco Response and Quelex Data Systems), and broadened its operational base in Europe through CEGOS-Tymshare UK, a joint venture with Unilever in the U.K.

The spectrum of its more than 4,000 customers has shifted increasingly toward the business market, which now makes up more than 75% of the total!

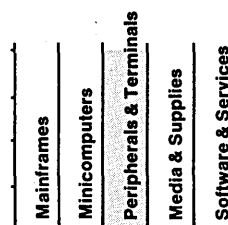
About 15% of Tymshare's revenues is estimated to originate with its international operations.

Percentage of data processing business attributable to main product and service categories.


Sycor, Incorporated
100 Phoenix Drive, Ann Arbor, MI 48104 (313) 971-0900

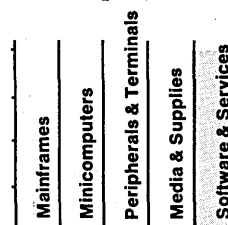
Sycor is showing continuing success in the manufacture and marketing of intelligent on-line data entry terminals, remote batch terminals, and related peripherals. Revenue growth in fiscal 1975 was 37% over the previous year. With continuing favorable user reception to its products, Sycor's sales advanced to \$55 million, fully half of which came from foreign sources.

Percentage of data processing business attributable to main product and service categories.


Boeing Company
P.O. Box 708, Dover, NJ 07801 (201) 361-2121

Boeing Computer Services provides a variety of computing services through a nationwide network of computers and telecommunications lines. While its revenue is miniscule as a portion of Boeing's corporate total, at an estimated \$50 million it is of respectable size in the computer service industry.

Percentage of data processing business attributable to main product and service categories.

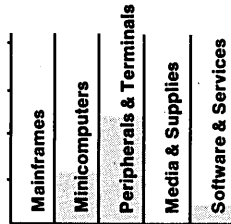


Wang Laboratories, Incorporated
 836 North Street, Tewksbury, MA 01876
 (617) 851-4111

During 1975, Wang actively continued its marketing of low-cost interactive computing products to a wide variety of users. The introduction of the new Wang Computer Systems (wcs) for the small business user in April of 1975 resulted in more than 1,500 orders in the first year.

Roughly 30% of Wang's \$50 million revenues are attributed to the sale of minicomputers, about 60% to peripherals and terminals, and the remainder of about 10% to software and services.

Percentage of data processing business attributable to main product and service categories.

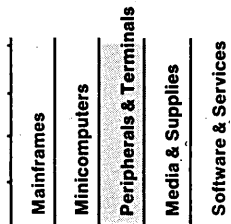


Tektronix, Incorporated
 P.O. Box 500, Beaverton, OR 97077 (503) 644-0161

For several years Tektronix (believed to be the world's largest manufacturer of cathode ray oscilloscopes) expanded its activities in low cost graphic terminals. As a result, information display products in the 1975 fiscal year contributed \$49 million to the corporate revenue, or nearly 15%. Forty percent of this amount originated from international markets.

Tektronix' product introductions in 1975 included a new low cost graphic terminal and a microprocessor-based graphic computing system from which it expects further growth.

Percentage of data processing business attributable to main product and service categories.

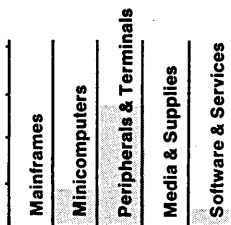


Datapoint Corporation
 8400 Datapoint Drive, San Antonio, TX 78284
 (512) 690-7000

An early supplier of intelligent terminal configurations for distributed data processing systems, Datapoint has shown remarkable growth over the last three years. Revenues of \$47 million originate about half from the U.S. and half from international sales. Approximately two-thirds of the domestic sales are to end users, the remainder to oem customers.

Sales of terminals and peripherals make up about 70% of Datapoint's revenues. About 20% is in standalone processors. The remainder is from services.

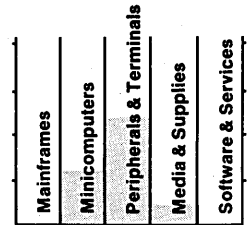
Percentage of data processing business attributable to main product and service categories.



Varian Associates
 611 Hansen Way, Palo Alto, CA 94303 (415) 493-4000

Varian's dp related activities center around small scale systems for data communications, industrial control, law enforcement, and medical research and therapy. They contribute about 15% of total corporate revenue, or about \$47 million. Roughly 60% are attributable to peripherals and terminals, 30% to the minicomputer portion of the systems, and the remainder to services.

Percentage of data processing business attributable to main product and service categories.

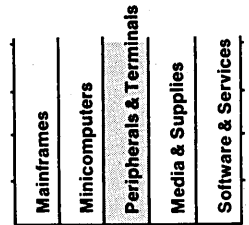


Centronics Data Computer Corporation
 One Wall Street, Hudson, NH 03051 (603) 833-0111

Centronics has achieved a leading position as an oem supplier of matrix impact printers to many vendors of mini-computer systems. Reduced inventory levels of its customers as a result of the difficult economic situation had their effects on revenues, which at \$42 million did not exceed the previous year's level.

One third of Centronics' revenues originate from overseas sales.

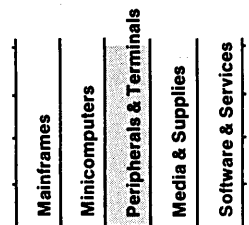
Percentage of data processing business attributable to main product and service categories.



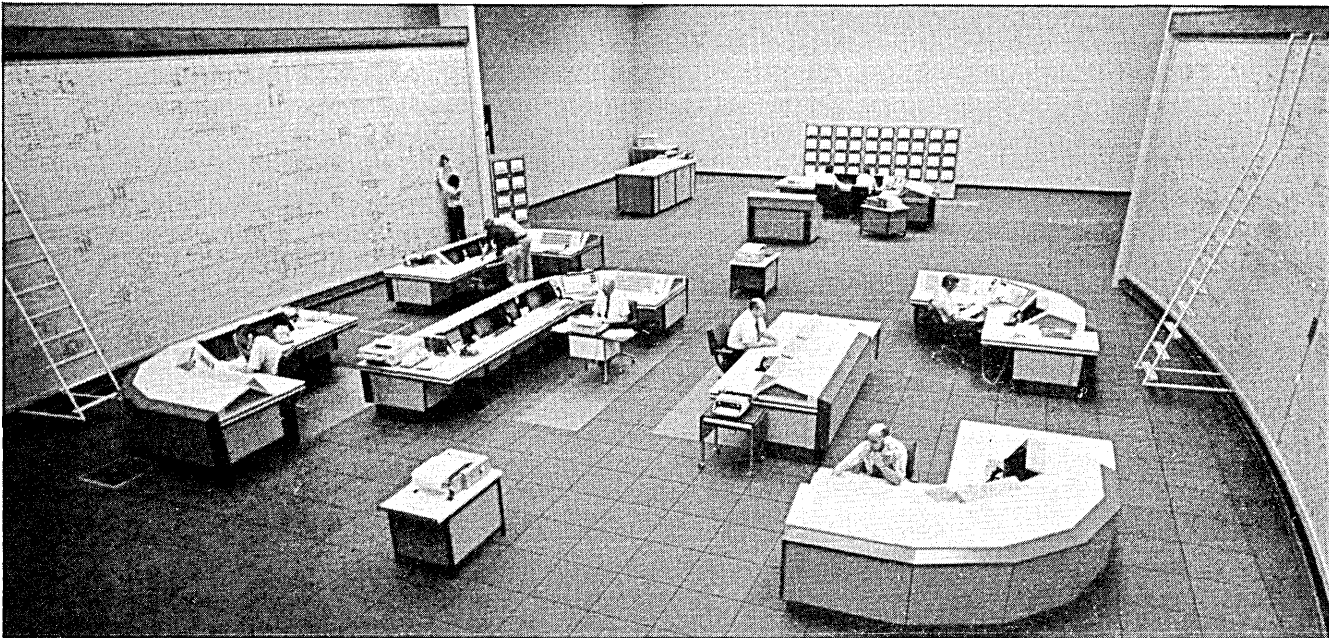
Decision Data Computer Corporation
 100 Witmer Road, Horsham, PA 19044 (215) 674-3300

Of the company's line of mostly card-oriented computer peripheral equipment, almost 50% of the total output was sold to Burroughs Corporation, about 20% to third party leasing companies, the remainder going to other oem manufacturers and to end users. Reduced shipment activities in computer systems apparently affected Decision Data's revenues. Revenues for the first nine months of the company's fiscal year led us to believe that the total may not exceed the previous year's level, being held to about \$40 million for a very slight net loss.

Percentage of data processing business attributable to main product and service categories.



Mr. Rothenbuecher is a senior staff member of Arthur D. Little, Inc.'s Information Systems Planning and Management Group. He has been with the dp industry for more than 20 years. Presently he is doing applications development, operations audit, product development, and marketing research for domestic and overseas clients.



The Bonneville Power Administration provides a power transmission grid for electricity generated in the Pacific Northwest, a territory of 300,000 square miles. The dispatchers must deal with thousands of variables in making their decisions to switch

power, to energize lines, or to drop some of the facilities for maintenance. An imaginative use of color displays makes it easier for them to find the information they need for their decisions.

Color Coding Decision Data

by Frank Orem

The basic problem was displaying thousands of data points, collected and managed by a cluster of 15 computers, clearly enough for a dispatcher to use in making split-second decisions.

Pretend for a moment, in spite of the temperature, that it's winter. Four days ago, in the Sea of Japan, a storm was born. At the same time, in the Canadian arctic, chilled air was piling up. Now, the storm has grown to a disturbance covering 80,000 square miles, bearing down upon the coast of British Columbia. From the east, the arctic mass has broken out and is racing southward to beat the incoming storm. The prize: a few hours of dominion over the Pacific Northwest.

As the combatants move together, the battlefield is set. The fronts will slug it out across a 700 mile line marked by the 10,000 foot peaks of the Cascade Mountain Range. Skirmishes will be fought in the passes and valleys.

Below the shaping battle, in a dozen and a half locations in the Pacific Northwest, dispatchers of electric power contemplate the outcome. They know that the storm can destroy their transmission lines by avalanche, icing, washout, or wind.

They know that thermostats in about 1½ million homes will respond

to changes in outside temperature. They know that a single degree in temperature change causes a 180,000 kilowatt load change—and that temperatures can change ten degrees/hour.

The dispatchers must plan their operations in the face of these uncertainties. They must decide how much power to buy from utilities as far away as Southern California. They must have immediate plans to reroute hundreds of megawatts in case a transmission line goes down, and mobilize crews to make repairs. They consider literally hundreds of other factors within a massive system.

The problems the storm can cause for the Bonneville Power Authority are massive ones, problems which can affect six million people over a 300,000 square mile area. To help handle the problems, Bonneville has developed a 15-cpu data acquisition and control system, supporting color crt consoles through specialized display software. The computer system is complicated and sophisticated, however its primary functions are not to react to the problems or to the storm, but to provide

current information to the dispatchers who must react to them. In the end, the decisions and responsibilities rest with a few key individuals.

From Goshen to Hungry Horse

The "system" with which the Bonneville dispatcher deals is immense. It directly includes the electrical network of 340 substations and 12,000 miles of high-voltage lines. But, in another sense, it encompasses much more: it includes the factors which determine generation capacity of 31 hydroelectric plants, load, and interchange of power among adjacent utilities. Weather strongly influences both the demand for electricity and generation capacity. It can destroy transmission capacity, sometimes even predictably by high winds or icing. Thus, weather too is part of the "system."

The generating plants and the Columbia River itself, although not directly under Bonneville's control, are part of the system. Water inflow is dependent on weather (both short and long term), but decisions regarding storage or release are made by the Army Corps

of Engineers or Bureau of Reclamation to serve the requirements of flood control, navigation, irrigation, fishing and recreation, or by other generating utilities for power or storage. The water released, in turn, helps determine hour-by-hour generating capacity.

The system must also include the major transmission facilities of Bonneville's neighboring utilities: they act as parallel lines which, if taken out of service, may cause overloading on Bonneville's lines.

And there's yet more "system." Within the substations, power plants and control centers is a variety of automatic control equipment, the operation of which is often guided by dispatchers. For example, Bonneville and its neighboring utilities each have automatic generation controls which match electrical power generation to load, each interacting with the other across the region's electrical networks.

The Bonneville dispatcher has a unique responsibility. He manages nearly half of the region's generation. His transmission network provides the security of reserve capacity to his neighboring utilities while it is whole. If it falters, it will surely disrupt operations for each of those utilities, with costly effects.

The dispatcher's job is multifaceted. He deals with planning for equipment maintenance outages over a several week period, hourly scheduling of generation and accounting for actual exchanges with neighboring utilities, directing switching for planned outages and restoration, coordinating voltage adjustments, continually controlling generation to match load, and analyzing apparent disturbances in the power system.

The majority of his job is routine—most of the time, the power system runs itself. The dispatcher's special worth is his ability to anticipate and respond to problems. The information used by him is, like the system itself, immense. To begin with, the Bonneville transmission network is described by some ten thousand measurements—such quantities as circuit breaker and disconnecting switch status, transformer tap settings, bus voltage, real and reactive line flows, and a hodgepodge of alarm conditions (ranging from an open door in a substation to critical transformer temperatures).

Then, the generation system is described adequately for dispatching purposes by perhaps five hundred measurements, including total generation, generator status, river flow, and water levels. Short-term plans for generation, interchange, control, and switching are represented by another thousand elements. As a further complication, weather conditions and precipitation

for the region could not be well represented by fewer than a thousand quantities, including temperature, humidity, wind direction, and solar radiation from at least a hundred locations.

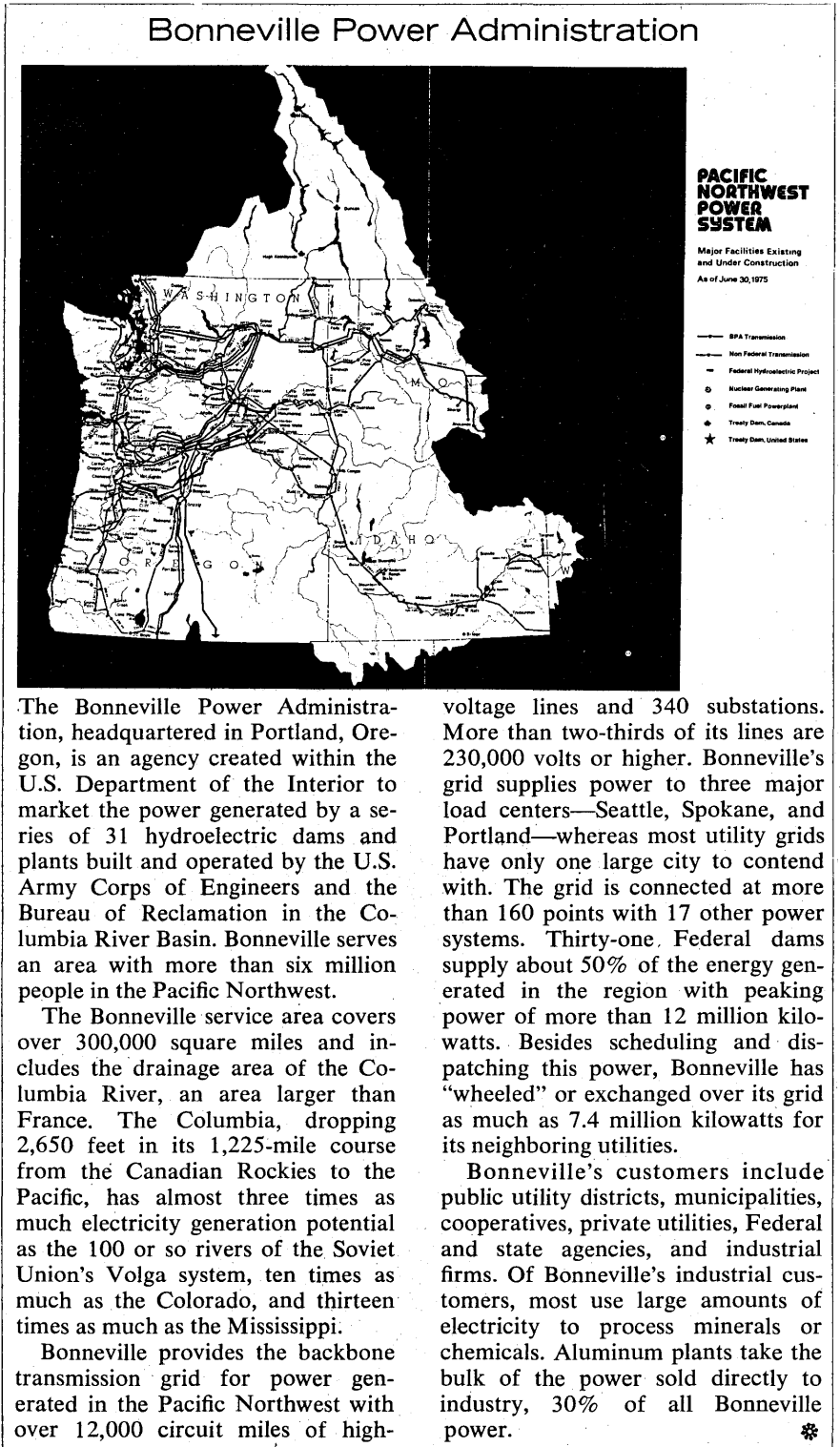
The pulse is digital

A massive control and management problem exists by virtue of the growth of Bonneville's and other utilities' systems. The growth was in turn forced by increasing power demands. These problems are met by a complex computer configuration for data acquisition,

control and information display.

Bonneville has developed the computer system over several years, and now has more than a year's operating experience with several computer-based data acquisition and control systems.

The heart of the Dittmer System Control Center is an array of 15 computers (Fig. 1) comprising several distinct operations that continually interface one another. The major system at Dittmer is the Real-time Operation, Dispatch and Scheduling (RODS) sys-



voltage lines and 340 substations. More than two-thirds of its lines are 230,000 volts or higher. Bonneville's grid supplies power to three major load centers—Seattle, Spokane, and Portland—whereas most utility grids have only one large city to contend with. The grid is connected at more than 160 points with 17 other power systems. Thirty-one Federal dams supply about 50% of the energy generated in the region with peaking power of more than 12 million kilowatts. Besides scheduling and dispatching this power, Bonneville has "wheeled" or exchanged over its grid as much as 7.4 million kilowatts for its neighboring utilities.

Bonneville's customers include public utility districts, municipalities, cooperatives, private utilities, Federal and state agencies, and industrial firms. Of Bonneville's industrial customers, most use large amounts of electricity to process minerals or chemicals. Aluminum plants take the bulk of the power sold directly to industry, 30% of all Bonneville power. *

COLOR CODING

tem, while the Supervisory Control and Data Acquisition (SCADA) systems and others address specific data acquisition requirements.

The RODS system is a five-computer complex consisting of two Digital Equipment Corp. PDP-10s and three PDP-11s. By switching, a primary or on-line system using one model 10 and two 11s may be configured. The remaining two computers (which are available as spares) are used for program development.

The two PDP-11s on the primary system act as smart controllers for a variety of devices, relieving the PDP-10s of much routine activity. One 11 interfaces to all the data acquisition systems described above. The other controls traffic to 19 display consoles.

The interfaces between RODS and the dispatchers are the consoles in the photograph on page 60. The crts are 19

inch, 48 x 72 character grids with a 96 character set, seven colors, and hardware blink. For dual-crt consoles, the keyboard and cursor may be manually switched to either crt. Push-button back lighting in either steady or blink is computer controlled.

The crts provide the dispatchers with over 400 operational graphic and text displays along with comprehensive lists and indices. This information aids him in making decisions in four general areas: automatic generation control, power system display, power generation scheduling, and security monitoring.

1. Automatic generation control: The basic process for generation control is straightforward. A control error is computed from scheduled and actual power interchange and frequency error (deviation from 60 cycles). Plants are requested to move to a computed generation level which reduces the control error. All that is done once a second. But it isn't that easy. Things go wrong.

Often.

Suppose a telemetry link goes down; the power transfer is still taking place. The computer senses the open link and simultaneously sounds an audible alarm, flashes an alarm condition on the crt, types an alarm message and suspends automatic generation control.

Guided by an alarm message. The dispatcher calls up the proper interchange summary (Fig. 2) and views the last known value (estimate) of power being interchanged. If experience indicates that this estimate is correct, he can return AGC to control using this value.

Since the telemetry link has gone down, it may have been degrading over

10,000 Data Points

In the past, control over the Bonneville power network was effected by decentralized switching of supervised substations and manual logging of events and operation actions, on-line analog computer processing, reports by phone and substation and utility personnel, and off-line digital computer processing.

The computer-based data acquisition systems now used are primarily for dispatcher support. All of them pass their data upward to the dispatch support computer.

Supervisory Control and Data Acquisition: The three SCADA systems provide the bulk of power system data. There is (or will be) one SCADA system for each control center. Among them, they reach into the most important 147 of Bonneville's 340 substations, sampling about half of those 10,000 measurements on a three-second cycle. In addition, they provide a crt-based interface to supervisory operators. The SCADAs display a diagram of each of their stations complete with current equipment status and power flow values. They scan flows and voltages for over-limit conditions, send alarms to the operator, and log alarms and status changes. They accept operator commands to actuate circuit breakers and transformer tap changers, send them to the substations, and verify proper operation. Each of the SCADAs communicates radially to its substations across Bonneville's microwave system.

Automatic Generation Control data: The Bonneville network joins with its neighboring networks at about 160 points. At each point, power interchange is metered and that value is transmitted to the control center as an analog value. All are sampled once per second for use in computing control signals to power plants.

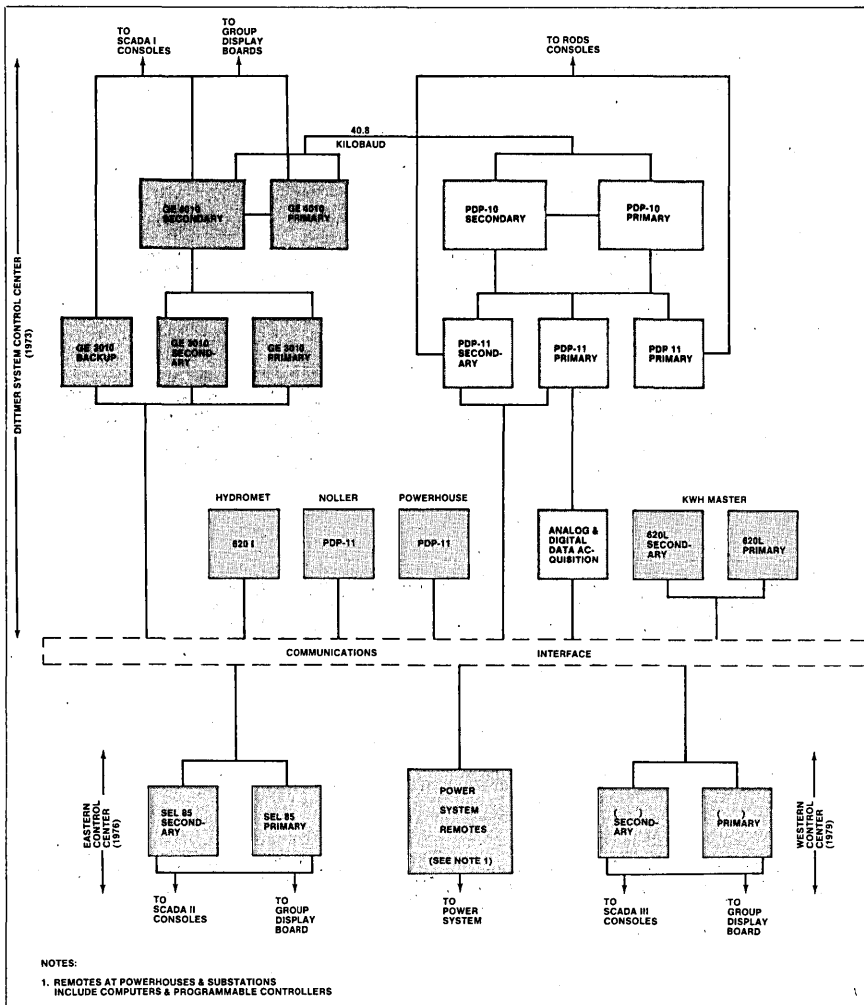


Fig. 1. The configuration at Bonneville Power Administration includes 15 computers of various manufacture. Five are in the Supervisory Control and Data Acquisition system, SCADA, which does the bulk of the data acquisition and is also used in supervising 147 of BPA's substations (upper left). Five more are in RODS, the Real-time Operations, Dispatch and Scheduling system, through which the dispatchers operate (upper right). Specialized data acquisition tasks take up five more (center). In addition, regional control centers will have four.

a period so that the last known value is in error. If the dispatcher decides that the estimate may be incorrect, he calls up a display of the interchange value trend (Fig. 3) over the past ten minutes or the past hour.

From these data, the dispatcher enters a new estimate using the ten-key keyboard. The AGC is put back on control using this value. Periodically the dispatcher reviews the status list and interchange summary to see if telemetry has returned to reliable operation.

So the process is planned to handle this and many other exigencies.

2. *Power system display:* There are nearly four thousand items of network

Every Few Seconds

Kilowatt Hour data: This system parallels the AGC system, reaching out to watt-hour, or energy, meters at the interchange points. Its minicomputer master (a Varian 620) brings in energy interchange readings hourly and passes the values to RODS where they are used to check the quality of generation control.

Hydrometeorologic data: Every hour this minicomputer master samples 80 field locations from the West Coast to Montana and receives temperature, precipitation, and other "hydromet" data and passes it to RODS. There it is available for some dispatcher alarms (wind or icing), stream flow forecasting (precipitation, temperature), and load forecasting (temperature, wind).

Power House Communications Controller: In parallel with Bonneville's automation program, both the Corps of Engineers and the Bureau of Reclamation are upgrading their plant control to computer-based systems. Both have responsibilities such as flood control which require real-time data. Bonneville is sharing data acquisition facilities which will give access to generator status, water levels, and a variety of quantities on updates of a few minutes, which are essential for optimal generation scheduling. Bonneville operates the message switching to pass these data among (eventually) 23 Federal plants and the three Federal agencies.

Data sharing: A generalized file exchange function is implemented to exchange power scheduling data with neighboring operating entities. The present two links are by low speed, dial-up lines. There will probably be considerable expansion of this type of link, with eventual conversion to dedicated links for power system operation as well as communicating scheduled data. *

data (e.g., status flows) which are pertinent to the dispatcher's job. These data must be made available in a conspicuous form and order. Since the data describe a network, a natural presentation is by placing the data on crt diagrams of the network schematic (Fig. 4). This works pretty well. The diagrams are of two levels: an area view showing 15 to 20 substations with their connecting lines (in/out of service shown by color) and power flows; a detailed equipment diagram of each substation, likewise with status and values. RODS gives further support to dispatchers by logging events, managing assorted power system records, and handling maintenance tagging (physical interlocks and visual warnings to prevent inadvertent equipment energization).

3. *Generation scheduling:* The discussion to this point has tacitly included scheduling as part of the dispatch function. Actually, although it is integral to Bonneville's operation, it is a large, distinct, and unique function. Utilities in other regions usually consider incremental cost of fuel to determine optimal allocation of generation among thermal plants; in essence they have complete control of both energy and physical plant resources. Bonneville's schedulers, on the other hand, must plan, on an hourly and over long-term basis, the flow of three million gallons of water per second through more than 30 hydroelectric power plants. The water has other competing uses in navigation, irrigation, fish and recreation. Relying heavily upon the computer, schedulers glean all but a few percent of the available energy from the falling water.

4. *Security monitoring:* The power network is designed to carry maximum generation to load centers as long as all equipment is in service. But planned maintenance work and an occasional accident remove some equipment, placing heavier flows upon the remaining network. A dispatcher decides what equipment may be removed or perhaps should be restored to service quickly. The security monitoring function guides him in this with a number of displays. RODS computes line flows for hypothesized network configurations and identifies overloadings which would be encountered.

Overall, RODS is a very busy computer system, handling a range of task priorities. There are over 150 programs, mostly on disc (several service programs are, of course, resident). Some, especially those for interpreting and executing console command sequences, are loaded and executed within 300 msec. Others, such as scheduling and security monitoring applications, may grind on for several minutes. The PDP-10 software will manage up to 40 such jobs simultaneously.

Nearly all programs are organized around the display. The display package of RODS contains the best engineered and most interesting software in the control center. The package interprets all the inputs and produces all the outputs for the 19 consoles. Inputs come from push buttons, 10-key units, crt cursor (with X-Y position), and the crt image itself. Outputs are push-button backlights, complete crt pictures, and cursor position.

Depending on the console command, the package may handle the function in its entirety. Or, it may give



Fig. 2. The interchange summary lists current values for power interchanges with 13 utilities, and the detail of interchange points for one (in this case, Grandview).

COLOR CODING

control to a disc-resident service program. In this latter case, the program stores crt data, computes new values and returns them to the data base. Finally, it requests the display package to paint a new crt frame in a specified format and to release the console for further input.

Definitions for input procedures and outputs are built by an off-line processor from specifications written in a special display language. These specifications correspond to the external specifications for RODS. The language

permits a programmer to define multi-step input sequences from any of the input devices. The completion of a sequence may be defined to result in call-up of another display, storage of crt areas or 10-key strings, or execution of a named program referred to as a command point processor. For crt output, the programmer may define constant graphics with variable color, alphabetic or numeric values from data base (with optional cyclic updating), substation diagrams with status, flows, and tags, and graphic trending. The data base references are by symbolic name to common tables on disc files or in memory so that elements can be

moved without forcing recoding.

Command point processors are generally small programs written in FORTRAN. From 20 to 200 lines of code, they usually perform data checking or actions requiring decisions. References to universally available data (COMMON) are written in symbolic form by a preprocessor. This preprocessor uses the same data base definition as used by the off-line processor for display specifications. Thus the two are automatically linked.

By no means does this package represent the ultimate in console service software. An immediately obvious refinement is adding to the specification language logic for input actions (e.g., decision tables) to reduce the need for the special command point processor. However, the use of a display format and procedure specification language is firmly rooted and will continue to grow.

Epilog

As the battle of the fronts builds up, RODS aids the dispatchers in planning contingencies. They can display area weather reports to observe the build-up of the storm. From experience with the system they know which transmission towers are in avalanche areas and which lines may be subject to heavy icing. Viewing network diagrams allows them to ascertain alternates for the jeopardized lines. They may then call up specific security monitoring reports to determine existing loads and calculate loads should the lines go down.

To meet increased load caused by falling temperatures, the dispatchers review generation schedules. They may request additional generators be placed in reserve—rotating but not supplying power until needed. Thus using RODS, they meet the challenge of the storm, and their customers continue to take them for granted—which was their goal all along. *

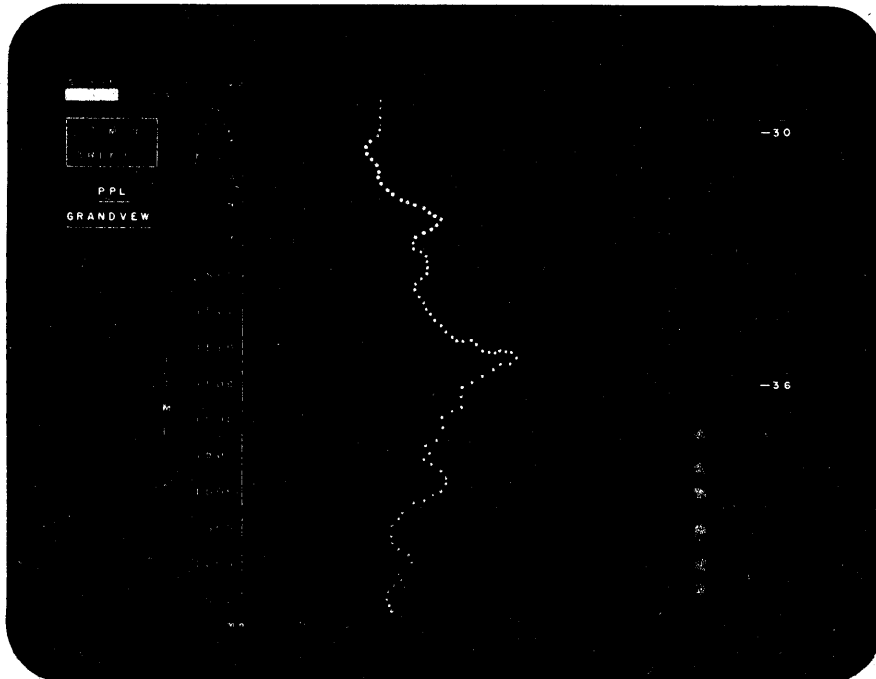


Fig. 3. The interchange trend diagram displays recent interchange values. The upper portion is updated every second.

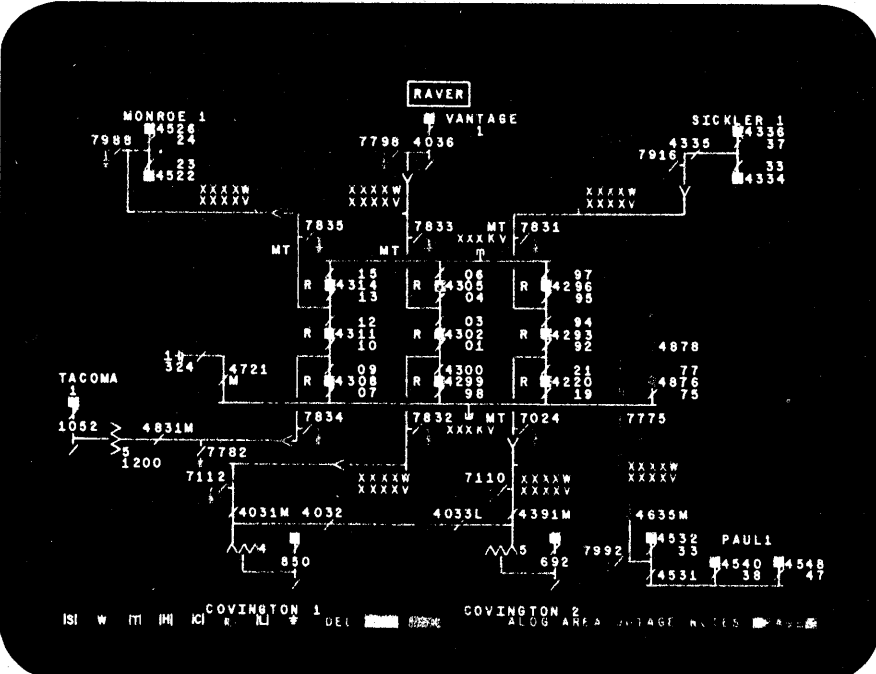
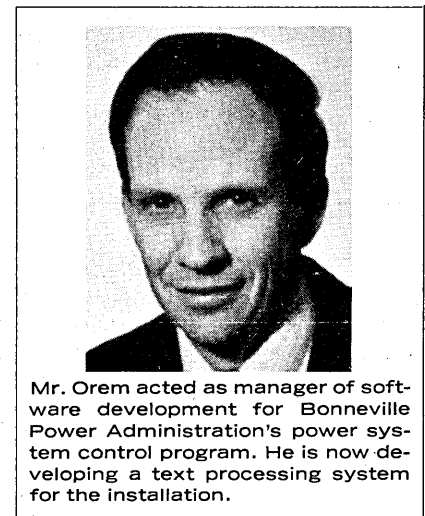


Fig. 4. The substation diagrams show status of lines (energized lines are in red) and switching devices. Line flows, in megawatts, and bus voltages are updated cyclically.



Mr. Orem acted as manager of software development for Bonneville Power Administration's power system control program. He is now developing a text processing system for the installation.

HEWLETT-PACKARD

COMPUTER ADVANCES

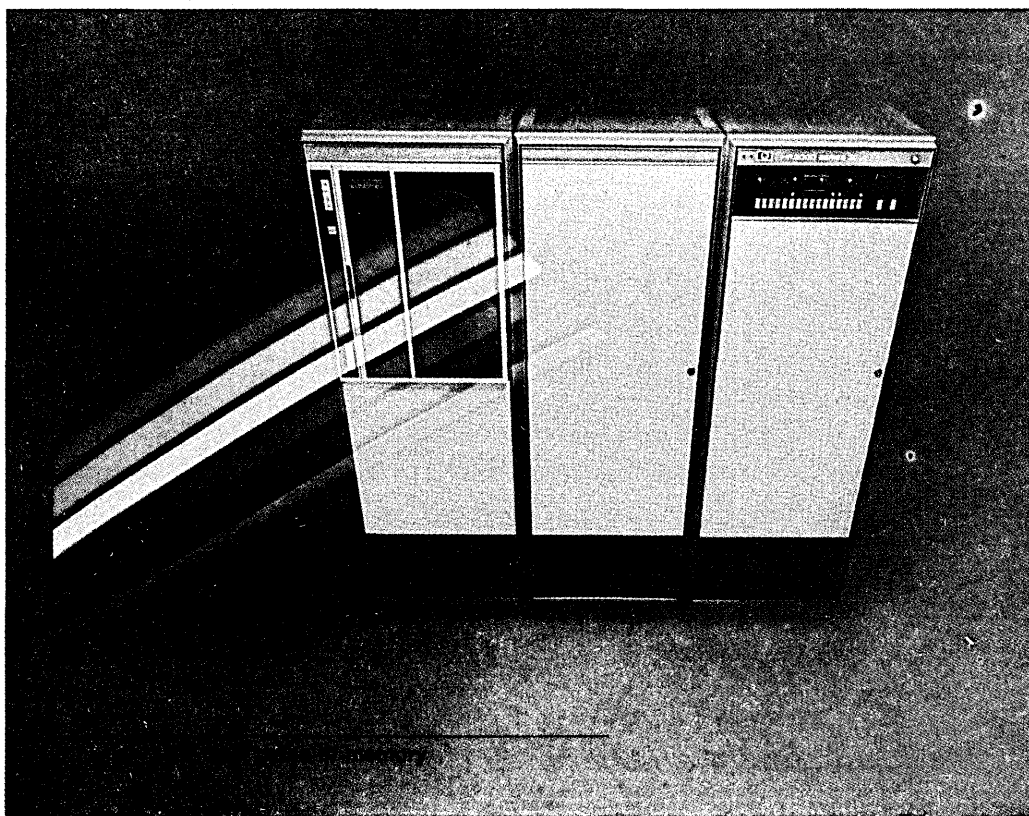
Many business firms, governmental agencies, scientific/engineering groups, and educational institutions found their data processing needs could be met only by large systems priced outside their budget. Not any more.

The Hewlett-Packard 3000 Series II now makes large system capabilities affordable. Advances like con-

current batch and interactive terminal processing, Firmware-Assisted Software, Fault Control Memory, sophisticated data base management, virtual memory, full system security, job accounting, processing in five languages and data processing done locally or remotely via teleprocessing mean you can have all the performance you need in a new general purpose computer.

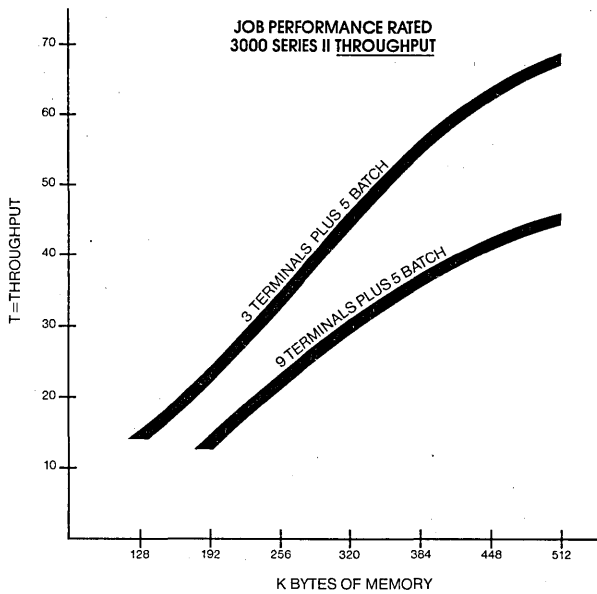
The price is within the affordable range of \$110,000 to \$300,000* and the HP-3000 Series II has the standards of performance, reliability, and quality inherent in the Hewlett-Packard name. If you plan to install a computer or upgrade your present system, you owe it to yourself to get all the facts. Read on▶

*U.S. domestic prices FOB California.



HEWLETT-PACKARD ANNOUNCES THE HP-3000 SERIES II

HEWLETT-PACKARD SERIES II IS JOB PERFORMANCE RATED



BUSINESS DP MIX	
3 & 9 INTERACTIVE USERS	5 BATCH USERS
<ul style="list-style-type: none"> • COBOL program development of 3359 lines of code at .3 Char/Sec. rate repeatedly. 	<ul style="list-style-type: none"> • 85 statement RPG compile and execute 2 key SORT on 17 records, 292 statement RPG compile, execute and print 750 line report. • Disc to disc copy of 3359 source records. • SORT 80byte, 10,000 record file on 3 keys. • COBOL compile of 3359 statement program. • IMAGE data base management program in 700 statement COBOL program updating and deleting in random order each record of a 500 record data base.

Evaluating a multi-programming interactive computer system is perplexing. Available benchmarks for stand alone, sequential batch machines do not apply to an on-line multi-programming system. This causes a real problem.

The design of the HP3000 Series II brought with it an opportunity to address that problem. To simplify a prospect's task of evaluation, the HP3000 Series II performance has been measured. Both the throughput and response times for Series II Systems have been quantified. The Series II is "job performance rated."

A test performance simulator helped the Series II design engineers optimize system parameters. From these simulations evolved the idea to job performance rate the HP3000 Series II for both terminal response time and system throughput.

Accurate measurements of the response time of the Series II were obtained from a hardware simulator driven by an HP2100 mini-computer. Together with special software, it has the

ability to simulate any number and variety of interactive user inputs to the Series II, to measure the amount of time for a response to a terminal and then to log the data. To closely approximate the real world, the simulation was designed to include user typing time, and to statistically generate random "think" time.

Next, job mixes were defined typical of Series II data processing, scientific, and timesharing environments. The scientific mix used an assortment of FORTRAN and BASIC programs run in both batch and interactive mode. The data processing mix utilized a variety of RPG and COBOL programs and compilations, file sorts and data base manipulations.

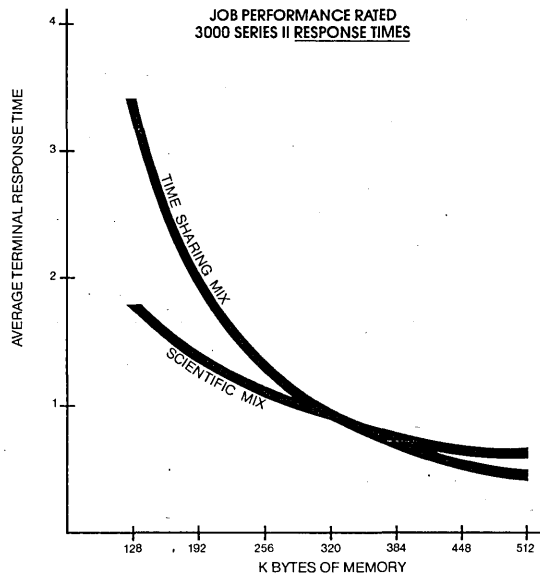
Then, each job mix was actually run on standard non-optimized Series II Models of varying memory sizes. Each job mix was run first for one hour with the addition of three interactive users, and then for another hour with nine interactive users. At the end of each hour, batch job completions were counted and the terminal response

times were averaged.

A throughput factor (T) was defined based upon the number of job completions, and normalized to a unit job. This expression of the value of work done by the entire system in one hour, was plotted on a graph. Another graph of average interactive terminal response time was plotted.

The job mix descriptions, although typical, can not represent every possible application. But together with the ratings of job throughput and response, the job mixes and ratings define what the HP3000 Series II can do in a series of environments. Job performance rating is an attempt to address the problem of measuring interactive multi-programming machines. Hewlett-Packard offers the results of this job performance rating technique to help prospects evaluate whether the HP3000 Series II capabilities match their computing needs. For more information check C on the response card to receive your copy of "Performance Summary." [HP]

TIMESHARING MIX	
13 INTERACTIVE USERS	2 BATCH USERS
Enter BASIC interpreter, Retrieve prestored BASIC program from disc, Modify the program, List parts of it, Execute the program feeding it 4 data records, Repeat preceding three lines, Name the program, Save the program, Exit the BASIC interpreter. Repeat.	<ul style="list-style-type: none"> • A 4000 line BASIC compiled program generating a disc file and printing a 500 line report. • Above job executed under BASIC interpreter.
SCIENTIFIC MIX	
6 INTERACTIVE USERS	4 BATCH USERS
<ul style="list-style-type: none"> • 3 FORTRAN program development. • 3 BASIC interpreter program development. 	<ul style="list-style-type: none"> • 4000 statement BASIC program compile, execute and print a 500 line report. • 1360 statement FORTRAN compile, execute and print of a 29 page report. • A 4000 line BASIC compiled program generating a disc file and printing a 500 line report. • Above job executed under BASIC interpreter.



INNOVATIONS IN MEMORY TECHNOLOGY

Memory With A Memory

The Series II features new \$84 per kilobyte semiconductor memory. To ensure memory reliability, the process of isolating memory errors is ongoing throughout the life of each Series II system.

Experience has shown that failures in semiconductor memory typically occur early in the life cycle. Consequently, pre-production RAMS are subjected to extensive "burn-ins" and computerized testing. Further oven tests monitored by computer are conducted on chips mounted on circuit boards and built into computers.

Testing for memory faults continues even after the system is installed at a customer site. A significant characteristic of the HP3000 Series II memory is its ability to correct single bit errors. Five checking bits not only determine when an error occurs in any 21-bit word (16-data bits, and 5-error correcting bits) but also locate and correct the failing bit. Fault correcting memory is not new in the computer industry, but a memory with defective chips is inherently less reliable, so the Series II memory remembers its faults. Information necessary to locate error prone chips is recorded in a logging RAM. Approximately once per hour, the information is automatically written to a disc file by the Series II operating system. A program can be run at any time to list a report identifying each chip that has failed and indicating the number of times a failure has occurred. With this information in hand, the HP customer engineer can simply replace faulty chips during routine maintenance.

The entire Fault Control process occurs without loss of memory speed, and, as the memory self-corrects, without urgency. Defective chips can be replaced at leisure. This unique Fault Control memory with error logging is innovative in the computer industry. The HP3000 Series II introduces memory with a memory.

Use of dynamic MOS semiconductor memory results in costs savings that are passed on to the customer. A core 32K byte memory board for the 3000CX cost \$10,000. The new Series II 64K byte semi-conductor memory module with 18 pin 4K RAMS costs only \$5,400. Series II memory brings twice the density at approximately one-half the price.


Series II memory is large, expandable to 512 bytes; and fast. Memory access time is 350 nanoseconds. Semi-conductor memory is volatile, so a standard sixty minute battery supply supports the memory during brown-outs and power failures.

Memory With A Manager

The Series II uses high-speed discs to augment main memory in an efficient scheme known as virtual memory. A Memory Allocation Manager (MAM) controls needed transfers or "swaps" of programs and data between disc and main memory.

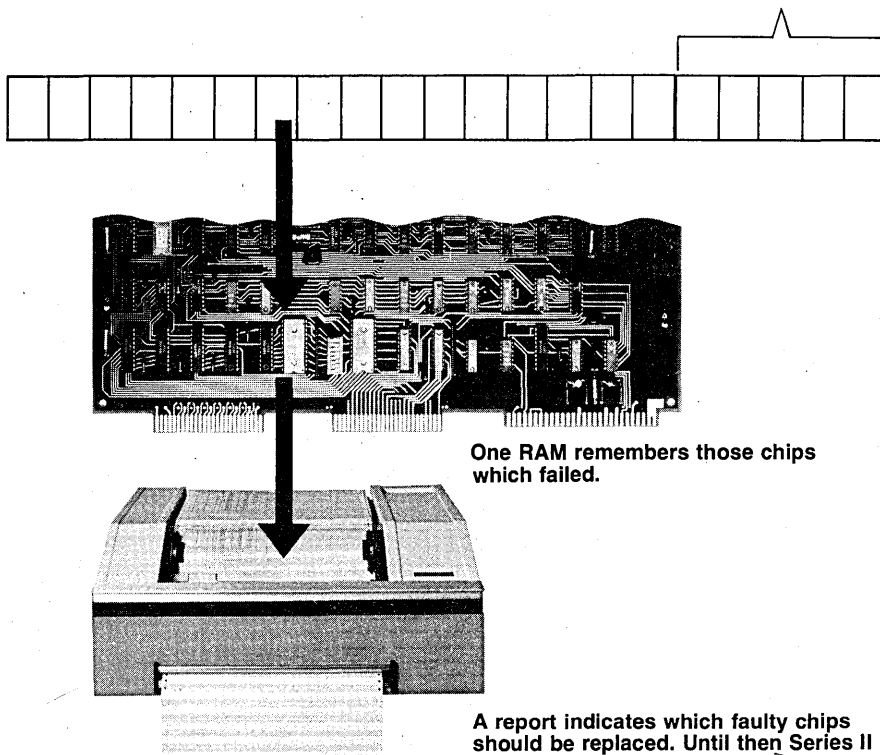
The fundamental unit of virtual memory transfer is a variable length segment of logically related information. In a virtual memory system, efficiency is gained when needed segments are ready in main memory and do not require a time consuming swap from disc. Implementation of a new algorithm used by MAM maximizes this efficiency. The "Segment Frequency Algorithm" (SFA) keeps a running history of segment use in main memory. Only segments whose past history indicates a high percentage of reuse remain in main memory. Each program is given just enough main memory to run efficiently.

Memory checkerboarding is reduced by MAM. The Memory Allocation Manager finds needed memory space by careful relocation of a segment if it separates two "free" areas. This technique (known as the "Local Compression Algorithm") creates free space, and discourages fragmentation of main memory.

To receive a technical summary of the Series II check B on the reply card. 

Fault Control Memory

Five bits check and correct the 3000 Series II semi-conductor memory.



A report indicates which faulty chips should be replaced. Until then Series II Fault Control memory keeps on correcting with no loss of memory speed.

HEWLETT-PACKARD 3000 SERIES II FEATURES FIRMWARE ASSISTED SOFTWARE


In the 3000 Series II, Hewlett-Packard has gone beyond implementing the base instruction set of the CPU in microcode. Parts of the operating system that normally would be software have been microcoded. We like to refer to these as "Firmware-Assisted Software".

These operating system functions, if executed in non-firmware-assisted software, would be characterized by lengthy program sequences. In their Series II microcoded form, the single composite instruction executes in a few cycles of the microprogrammed CPU. Microcoding means high-processing speeds and a high result/instruction ratio.

One example of such time savings is the "IXIT" instruction. "IXIT's" most common usage is to determine if the scheduler's existing job queue and priorities need to be reexamined as the result of an I/O interrupt. If a reprioritizing is indicated, "IXIT" activates the dormant "Dispatcher." When executed in software form, this procedure took 155 microseconds. Now, in its Firmware-Assisted Software form, execution-time is 24 microseconds or six and one half times faster. One single firmware instruction replaced approximately 30 software instructions.


Firmware-Assisted Software functions for the HP3000 Series II include repetitive operations like sub-

program linkage, string processing, buffer transfers, and such integral functions as the "Dispatcher" or scheduler.

Heart of the Hewlett-Packard 3000 Series II is a 32-bit, pipelined, microprogrammed processor with a cycle time of 175 nanoseconds. This microprogrammed processor supports 209 instructions. Eighteen of these standard instructions are extended, precision floating-point and decimal operations. The microcode instructions and Firmware-Assisted Software occupy 4K microprogramming words. The HP3000 Series II has a total of 10K words of control store available accommodating an additional 6K for future growth. 



THE SPEEDY DISPATCHER

"Firmware-Assisted Software" is the key to the Series II ability to support up to 63 interactive users. With so many users bidding for CPU attention at the same time, the role of the "Dispatcher" or scheduler is critical to the successful operation of the Series II on-line multi-programming system. The Dispatcher switches CPU resources from one competing user to another. The more immediate the switching, the less system overhead diminishes available user time. Firmware-Assisted Software allows the Dispatcher to switch in only 750 microseconds. 


The most frequently used software code required by the operating system has been designed into the HP3000 Series II micro-programmed processor. The result is speed and efficiency.

For more information check B on the reply card.

ONE SECOND IN THE LIFE OF A SERIES II


To explore the internal intricacies of a concurrent batch and interactive system, we tracked MPE II, the powerful multi-programming operating system of the Series II, for one second. MPE II dynamically allocates resources such as main memory, processing time, and peripheral devices to each user as needed.


The state-of-the-art "working set" memory manager, employs a "Segment Frequency Algorithm" (SFA) to optimize main virtual memory use. In this second, jobs similar to the data processing mix described earlier are handled by MPE II. Just to keep the processors active, three more interactive users were added for a total job mix of four-batch and six-interactive users.

 The second starts off with the all important Dispatcher checking its internal queue of ready users. First on the list is an interactive user in the EDITOR subsystem working through program modifications. With the three-milliseconds of CPU time, our busy editor modifies COBOL source code. The modified lines are quickly transferred back out to disc, to prepare space for the next set of lines to be modified. The system's separate I/O processor handled this data movement at the same time the CPU continued with the next activity. Time Check: 3 Milliseconds.


The CPU can't ignore the


energetic Spooler one millisecond longer. The Spooler's role in life is to keep track and prioritize those who need non-shareable devices like mag tapes and printers. The Spooler has been handling an earlier request to print out a listing. It sets up another 16 lines in main memory ready to begin automatic printing. Time Check: 34 Milliseconds.


 No rest for the hustling line printer. Another interactive COBOL user has decided to take a hard-copy version of his program home to study in peace and quiet. However, some system code necessary to perform this operation isn't in main memory and there's no space. The CPU needs the aid of the Memory Allocation Manager (MAM). MAM is responsible for making virtual memory a reality. In this instance, MAM performs two functions: First it determines those segments of memory that have fallen into disuse and are available as free space. Next, it uses the Local Compression Algorithm to consolidate selected free memory spaces into one contiguous area. Now MAM can swap the needed code in from disc to main memory and complete the request. Time Check: 50 Milliseconds.

 Meanwhile, the first interactive COBOL user is still modifying source. Some of the code he's using is identical to that used by other interactive users on the system. The

Series II cleverly stores code (program instructions) and data (program variables) separately in main memory so that such identical code segments can be shared. This is a great way to save memory space. A few more lines are modified. Time Check: 66 Milliseconds.

 A batch user requests data to be moved from disc file to a working space in main memory while the separate I/O processor handles this data transfer. Time Check: 71 Milliseconds.

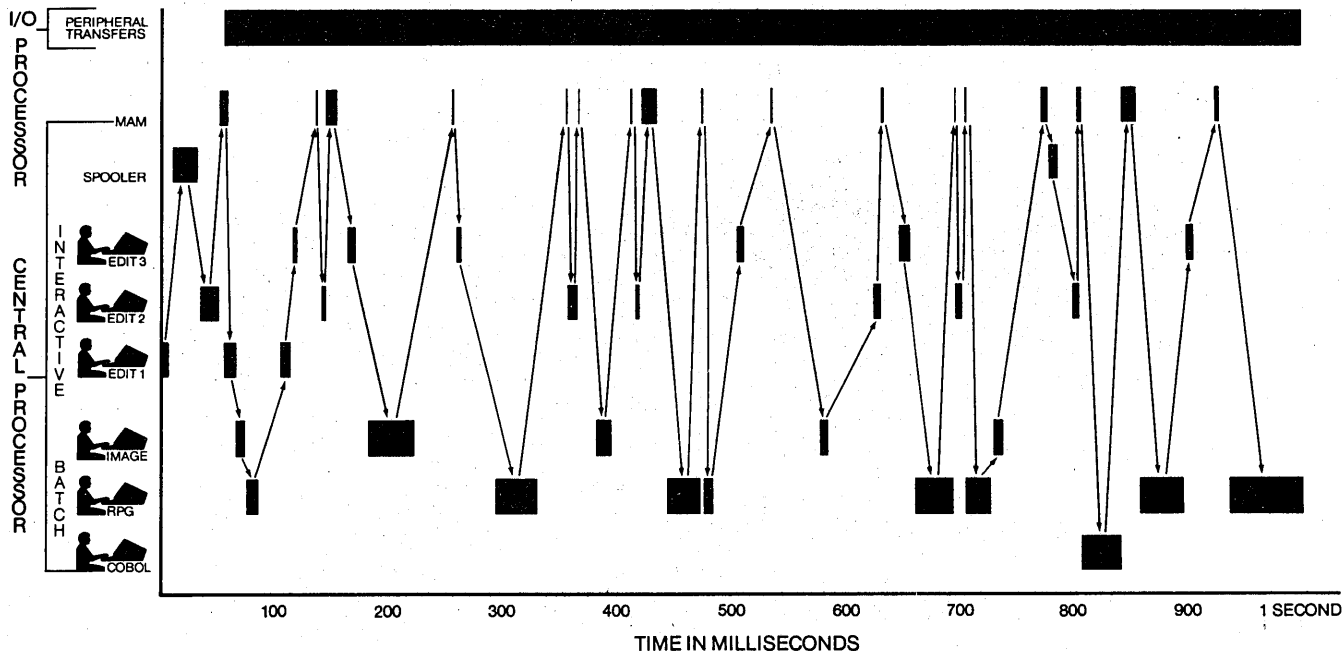
 Simultaneously the CPU is given to an RPG compile which requests another data transfer. Time Check: 84 Milliseconds.

 Remember our first COBOL user? With this swatch of CPU time, he completes his modifications and is prompted by the EDITOR for another command. Time Check: 112 Milliseconds.

And so on for the rest of the busy second. Each user gets CPU action for a slice of time. You probably noticed that only six of the 10 users had CPU attention. The Dispatcher determined that this specific load factor achieved the most efficient CPU use.

The total amount of work accomplished during this one second was 2,280,000 micro instructions in the central processor, 14 file accesses, seven input swaps, and five output swaps.

ONE SECOND IN THE LIFE OF A 3000 SERIES II.



Rapid switching of system resources, and concurrent CPU and I/O processor activity mean each user feels she/he has the total power of the HP3000 Series II on command. In this second from the life of a standard Series II, system overhead took only 12.5 percent. For more information check B on the reply card.

USER TESTED PERFORMANCE

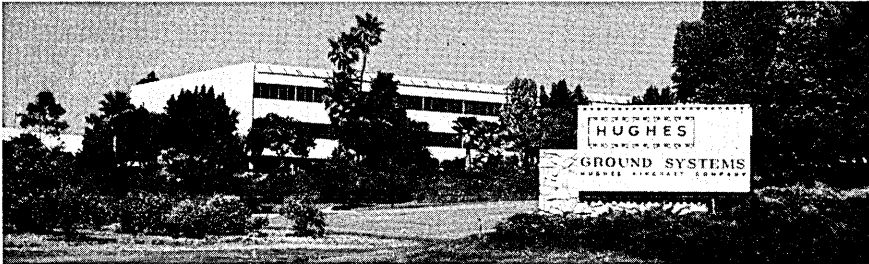
Longs Drug Stores and Hughes accelerate Data Processing with 3000 Series II

Hughes Aircraft Company's activities today span more than 80 major areas and include more than 550 products.

Hughes' Ground Systems Group typifies the technical sophistication and advances inherent in the Hughes' approach. New demands for computerization are continuous and

labor data.

Hughes estimates that 80 percent or better of their manufacturing processes will be automated. Hughes anticipates throughput yields of double to triple today's standards. Key to that kind of performance is a consistently reliable and versatile general purpose computer like the 3000 Series II.



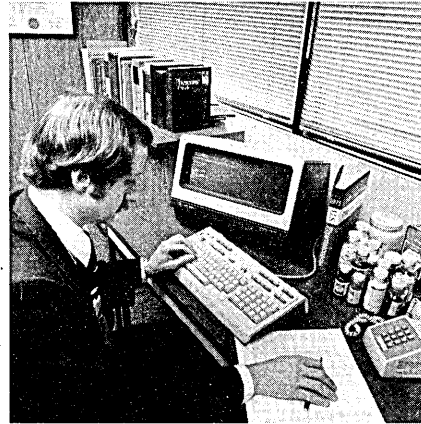
With the HP 3000 Series II, Hughes expands its ability to perform three functions: manufacturing business processing, and computer aided manufacturing and testing.

diverse, making computer system flexibility essential. Hughes' Ground Systems Group's Manufacturing Division chose an HP 3000 as a machine that fit manufacturing business processing, as well as computerizing of manufacturing and testing processes of all their products. The 3000CX has the ability to serve these three functions simultaneously. Hughes' varied demands on the system created a perfect 3000 Series II test site. The new Series II, delivered on March 19, 1976 was operational within a day according to James Jones, Project Head in Computer-Aided-Test Systems (CAT).

CAT and Computer Aided Manufacturing (CAM) are in the development stage now. With over 4000 hours of programming work on the old 3000, Hughes was concerned about conversion to the new system, but these programs were simply transferred using the RESTORE utility. A few special cases did need to be compiled. Conversion was as simple as loading a mag tape.

Commenting on performance, Jones observed that the Series II was able to process a typical request from one of six test station satellites three times faster than HP's 3000CX. This same network also interfaces with two IBM 370's at the Corporate headquarters for processing financial and

Longs Drug Stores have experienced fast growth and expanding computerization for the past ten years. Sales of the retail drug chain, headquartered in Walnut Creek, California, grew at a compounded rate of 22 percent reaching \$410 million in the last fiscal year through 92 stores located in California and Hawaii. The result: a burgeoning increase in data processing work load, which Longs has chosen to meet with mini-computers rather than with the traditional large mainframes.



The HP 3000 Series II was operational at Longs Drugs Data Processing Center four hours after it came off the truck.

Longs has used a Hewlett-Packard 3000CX system as its main computer since 1974. Most data files are structured by HP's IMAGE Data Base System and are processed either with COBOL programs or IMAGE'S QUERY language. Batch processing is usually done during the night shifts with interactive terminal work assigned top priority during the day. Very heavy system use made Longs ideal for field testing of the new HP 3000 Series II.

According to Bill Gates, Longs Data Processing Manager, "We fully expected to encounter many problems with our Series II test system. After all, a main purpose of field testing is to discover any remaining bugs in the hardware or software. However, we found the system to be very reliable and stable from the beginning. As HP systems are factory integrated and tested prior to customer shipments, the Customer Engineers had it operational four hours after it came off the truck."

Longs performed many comparison tests between their HP 3000CX and the Series II, and now uses the new system for most of their production and development. According to Gates, the test results are significant: "We found the Series II executes our batch jobs 30 percent faster. We have also seen increased speed with our COBOL compilations. For example, three of these compiles take 98 minutes on the HP 3000CX. On the Series II, the execution time is only 37 minutes. Terminal response time has also shortened noticeably. The effect of additional main memory is that more terminal users and batch jobs may be added without degrading system performance.

"We have been using our test system very heavily", says Gates, "and have discovered only one software problem of any consequence, a bug in the printer spooling system's procedure to recover from a line printer paper jam. While this problem was being corrected by HP, we printed all special forms on our old system. This was an easy task since the two systems are fully software compatible."

Longs Drugs is convinced that at announcement the Series II is a solid, reliable system that sets a new standard for the industry. [HP]

HEWLETT  PACKARD

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1501 Page Mill Road, Palo Alto, California 94304

Project Planning and Control

by William S. Donelson

Reversing the usual process—by developing a user manual first rather than last—can ensure well-defined project objectives; a little math can determine what meeting those objectives will cost in time and money.

Management information system projects generally have two distinguishing characteristics: 1) they are late, and 2) there is usually a significant cost overrun. There may be other related problems such as improper definition, inadequate scope, poor design, poor programming, inadequate testing, cryptic documentation, and incomplete implementation. Attention to the two main characteristics should also shed some light on these.

There are, of course, many successful implementations of systems which have proven well worth their cost. The difference between the successful and unsuccessful systems may well lie in the manner in which the projects were managed. With better MIS project management tools, virtually all dp system implementations can be successful and cost effective.

Return on investment

If we look at a dp system as a purchased product (which it really is), what do we expect for our money? We might be tempted to say: profound problem definition, creative design, well-engineered execution, etc. But these items are conceptual attributes, not products. Just like any other purchase of goods and services, we are looking for a tangible product and effective service which performs as advertised and has a set of instructions telling us how to use it. We are buying a "bill of material" combination of product and service which may be defined as follows:

1. *A number of modules or programs* which permit data entry, detectable error identification and reentry, file maintenance, analysis, and reporting. These modules should work correctly.

2. *Implementation and operating tools*, including module linking "job control" decks, data base creation or conversion utilities, data backup and

retention utilities, and job control decks for periodic operation.

3. *Instructions for use*, including a user manual with illustrated samples and step-by-step procedures for data preparation, error correction, and report utilization; and an operating manual for installation, data entry, and periodic operation.

4. *Technical documentation* for the systems analyst and programmer (and interested user) to aid in understanding the system.

5. *Training or educational service* to enable users, systems, programming and operations personnel to make optimum use of the system.

Summing up, when we buy a system we are buying programs, JCL, and documentation, and we expect some training services to enable us to implement and use them.

If we are purchasing a "package" from an outside vendor, we have in mind performance and economy requirements, and the price we can afford. Our task is matching the capability of various alternatives to our requirements at a given cost. We generally compromise in one or more areas, or we end up making modifications to meet our requirements.

If we are developing a package in-house (hopefully, because the capability cannot be purchased), the big difference is that we must state objectives and define requirements which must be converted into specifications. We then employ people with the technological capability to develop and deliver the product, hopefully in accordance with specification, at the proper due date, and at an agreed-upon price.

The goals are the same, for purchasing or developing systems, but there is an advantage in purchasing—the buyer gets to examine all the parts and then make his decision. In developing an in-house system, the parts won't be there to examine unless

some careful planning and carrying out is done. There's no magic to this; in fact, in-house development can be reduced to a six part recipe: producing a user manual, planning a framework for project control, estimating, scheduling, project control, and analysis of variance from estimates.

The user manual, it turns out, is very important to do first rather than last.

Part one: the user manual

The critical issues are stating objectives, defining and establishing specifications, and these are not trivial tasks! In virtually every area of enterprise; these items are conceived mentally and manifested on paper (text and drawings). For project oriented (as opposed to mass produced product) businesses, in only a few instances is it financially feasible to provide a tangible working prototype or model prior to development of the real thing. The finished product must be constructed from "paper" ideas and, all too often, both the quantity and quality of this "paper" is insufficient to determine the adequacy of design and to predict the success or failure of the outcome. In fact, too many systems definitions and specifications exist only orally and are not reduced to paper until after programming or implementation has started, if ever.

Would you buy a million dollar computer without reading its specifications and principles of operation manuals? The obvious answer is "no." Then why buy a dp system without demanding the same privileges? You don't have to.

To the user, the "system" is synonymous with the outputs (reports, crt screens, audio response, graphics, etc.) and inputs. The user should determine his reporting requirements and provide specifications with the aid of (not through delegation to) a systems an-

PLANNING

alyst, using concrete objectives as a guideline. The systems analyst must then determine the data base requirement to support this reporting capability, and the user should participate aggressively in this data base definition activity. Finally, both the systems analyst and the user must determine the inputs, sources and timing of data needed to support the data base, and the reporting capability. The user must then be willing to bear the burden and expense of providing the input to gain the benefit of the output.

In many cases, the provider of the input resides in another department or division, and interdepartmental or interdivisional cooperation will be required to carry out the plan successfully. Keeping in mind that each functional area has its own objectives, incentives, and motivations which may conflict with those of other functional areas, this element of cooperation is a crucial matter.

As a result of having defined the outputs, data base and inputs (which are the "first cut" at requirements definition and specifications), we should be in a good position to construct a user manual with the following sections:

1. *Annotated sample reports* which are mocked up by writing proposed report formats on data entry sheets, keypunching, and listing the data with conventional dp utilities to produce realistic report facsimiles. (The key-punch approach is recommended over typing because changes are easier to make.) The annotation should cover the name, purpose, source, content, sequence, distribution, frequency and disposition of the report.

2. *Preliminary data base layouts* showing master file and detail record layouts and data base structure (list, hierarchy, network, sequential, etc.).

3. *Preliminary input layouts*, and procedures for entry including source of data, applicable edit rules and balancing procedures, error correction and reentry procedures with illustrated samples.

4. *Proposed coding structure tables* which identify and define the meaning of codes to be used by the user (customer type code, credit limit code, inventory ordering rule code, etc.). Even if the codes have not been defined at this point, there should be pages indicating that codes will be developed to represent data elements so that the users can clearly identify what will be required of them.

5. *A preliminary system flowchart* of input, processing and reporting modules and flows. This chart should depict

interfaces to existing and planned systems and should be supported by a narrative explaining interface plans and anticipated problems, production schedule changes, etc.

6. *A system narrative* stating the requirements, scope, objectives, description, benefits, capability and limitations of the system (10 to 15 pages).

For a typical commercial system (receivables, materials requirements planning, general ledger), this manual will be about 100 pages and can be constructed fairly quickly if it is made a prerequisite to systems development (and this is a top management consideration). It may take 90 to 120 man-days to complete the user manual at a cost of \$5,000-\$15,000, but keep in mind that the whole project may cost \$75,000-\$150,000 or more and at the point this preliminary user manual is completed, no program specifications have been written, no programming has commenced, no computer test time has been consumed, no implementation has proceeded, and therefore, no costly mistakes have been made.

The manual must show on paper what the system will do, how it will work, who must support it and in what capacity, who will specifically benefit from it and how the total organization will benefit from it. Every participant in the system will have the opportunity to see what they are buying, to determine if the merchandise is good, and to propose (or insist upon) design modifications to better meet their requirements before they get locked into an inflexible system.

Part two: a framework

By identifying the object of planning, more than half the project planning battle is won. If a system is a set of programs, JCL, documentation (user reference material and procedures) and training, a project is nothing other than the framework in which the system is commissioned, defined, constructed and implemented. This framework is conceived and animated by people. Thus, the planning of a project is the planning of the framework within which the project will gain its iden-

tity, planning which addresses the following issues:

1. *Problem Definition.* Who wants the system (the user), why do they want the system (suspected problem), what do they want the system to do (scope), and how will the system benefit them (objectives).

2. *Project Organization.* Who will authorize the project (management), who will manage the project (project manager or steering committee), and who will participate in the project (project team consisting of users, MIS personnel and dp personnel).

3. *Problem Analysis.* What is the real problem and what is the cause? Can the problem be eliminated or mitigated, or do we have to construct a system to handle it? (A lot of "make work" systems could stop here because there is no real problem).

4. *System Definition.* The environment, inputs, data base, flows, rules and procedures which will solve the problem. This should manifest itself in the form of a user manual as defined earlier.

5. *System Review and Approval.* The formal process of reviewing the requirements and specifications against proposed capability to ensure a good match. The focal point is the user manual and the project turning point is here. The project can proceed with review and approval by all functional area managers affected by the system and final authorization by top management; it can go back to any prior step for rework; or it can, as scrap, be terminated. If a positive decision is not made within a reasonable time, usually the project will continue into detail design and programming stages without approval and authorization until a cost, time, design, or some other obstacle is encountered. This may be the reason for a high project failure rate—the system never gets completed for lack of cooperation, or never gets implemented because of lack of consent by required contributors.

6. *Detail Design.* Program specifications relating to processing of inputs, maintenance of files and production of reports.

Module Class	STATEMENTS* PER MODULE		PROGRAMMING RATE (Statements per hour)		COMPUTER TEST HOURS PER MODULE
	Mean	Standard Deviation	Mean	Standard Deviation	
1. Data definition	62	52	16	N/A	.7
2. One-time utility	177	92	30	N/A	3.2
3. Conversion utility	449	179	24	N/A	8.9
4. General utility	260	120	5	4.5	8.1
5. Data base interface "bridge"	450	150	10	1.8	19.0
6. Edits	1715	415	16	4.2	11.3
7. Updates	1278	528	20	7.8	27.0
8. Processing	1186	108	8	1.4	6.1
9. Major extracts	530	29	15	3.9	4.6
10. Minor extracts	186	76	7	3.0	19.7
11. Major reports	907	436	8	2.5	5.0
12. Minor reports	260	95	9	5.1	

(N/A = Not Available)
*does not include COPIED data definition statements.

Table 1. Programming and testing estimates for new applications developed in COBOL in a batch processing IBM 360/40 environment.

7. *Programming and Testing.* The conversion of the ideas on paper into the bill of deliverable products. Along with this should go a high degree of project management, project control, and revision of documentation.

8. *Training and Implementation.* The delivery of the product and performance of related services.

9. *Post-Implementation Review.* The formal process measuring how well the capabilities of the product and service matched the requirements, and the subsequent fine tuning of the system to accomplish a good match.

Project planning has only these two essential ingredients: a framework for conduct, and a user manual for manifestation. Without these, it is not possible to estimate, schedule and control the project and to analyze the deviation from the plan. Items 4 and 5 provide the proper background for project estimation, scheduling and control. Items 6, 7 and 8 are the proving ground for the estimation, scheduling and control and Item 9 provides the opportunity for analysis of variance from plan.

Part three: estimating

The preliminary user manual provides the focal point for project estimation. The quantifiable components for estimating are the numbers of each functional type of module or program which will be required to construct the system, and by this time we should have an accurate forecast of the number of each type due to the preliminary system flowchart in the manual. A typical commercial system has at least 12 categories of functional components:

1. *Data definition books.* File, record and transaction layouts which are stored in a library and copied into programs as required.

2. *One-time utilities.* Programs to create files, generate test data, simulate processing, and test called subroutines.

3. *Conversion utilities.* Programs to convert or reformat data files and transactions from existing systems to the new system format.

4. *General purpose utilities.* Modules to perform repeated functions which are used by different control modules (date conversions, table lookups, calculations, etc.).

5. *Data base interface utility.* Here I am advocating the use of a "bridge" between application programs and most data base management systems to provide a higher degree of data independence, to assure physical integrity of the data base (by auditing adds, deletes and updates), and to provide file content and utilization statistics. This bridge relates functional entry points (open, close, read, write, explode, implode, etc.) for application

modules to technique-oriented entry points and commands supplied by data base management packages (MRAN, CDIR, ADD-M, DELVD, GET UNIQUE, etc.).

6. *Edit modules.* Programs which assure the logical integrity of data entered into the system and which provide error listings or alerts. (One module per transaction type or family of transactions is assumed.)

7. *Update modules.* Programs which update the data base. (This function may be performed within the same module as the editing function, but it is, nevertheless, a separate function which produces audit trails or activity reports.)

8. *Processing modules.* Programs which do extensive calculations, analyses, and manipulations of data, resulting in possible additional file maintenance.

9. *Major data base extracts.* Programs which select data from the data base for subsequent (or simultaneous) analysis and reporting.

10. *Minor data base extracts.* Same as Item 9, but less complex.

11. *Major Reports.* Programs which report the results of major extracts and processing and which are complex in nature (multiple levels of control breaks and totals, sophisticated row and column formatting, and possibly further access to the data base.)

12. *Minor Reports.* Same as Item 11, but simple in structure. (Note that the project manager who tightly controls the data definition books and data base interface utility will produce a well constructed system in terms of architecture and adaptability to change. Also, if the file maintenance function is strictly confined to file maintenance modules, there will be less latitude for the occurrence of difficulty to locate system bugs.)

For typical commercial application systems, each class or type of module has a mean number of statements per module (and standard deviation), and also has a measurable programming rate in terms of mean and standard deviation of numbers of statements per hour. Computer test requirements are also a quantifiable by module type. Comprehensive study by the author has revealed the statistics in Table 1, based upon new applications development using COBOL in a batch processing IBM 360/40 environment. (For system modifications, as opposed to new systems development, other languages, on-line processing, or other hardware, different statistics will have to be compiled. These statistics will no doubt vary somewhat by installation due to differences in methods, standards, and personnel experience levels, and each installation should adjust these statistics to account for these differences. As explained later, the

analysis of variance technique will be instrumental in providing the basis for refinement of these statistics.)

System analysis and design hours are approximately 110% of programming hours for an entire project, assuming that this function has responsibility for project management, analysis, design, user manual preparation, program specification writing, program quality control, test results analysis, user training, system implementation (as opposed to program implementation and operations support, which is typically done by lead programmers), and post implementation review. COBOL programs may be keyed and verified at the rate of 125 statements per hour, assuming an average of 32 characters per statement (if more characters per statement are coded, the number of statements per module should decrease, and the total keystrokes per module class should remain fairly constant).

By determining the number of modules in each class, it becomes feasible to forecast systems analysis and design hours, programming hours, keypunch hours and computer test hours. Knowing the cost per hour of these resources (approximations are \$20/hour for systems analysis and design, \$15/hour for programming, \$9/hour for keypunch and \$50/hour for computer time—although computer chargeout rates can vary substantially), it is possible to estimate project costs as follows:

Total Cost =

$$\sum_{i=1}^{12} M_i \left[\left(\frac{(S_i + a_i \sigma_i) (1.1 R_s + R_p)}{(P_i + \beta_i \sigma_p)} \right) + \left(\frac{(S_i + a_i \sigma_i) R_k}{125} \right) + T_i R_c \right]$$

Where i = module class or type

M = number of modules per class (from planner's estimate)

S = mean number of statements per module per class (from Table 1)

σ_S = standard deviation of S (from Table 1)

a = selected multiple of σ_S (from planner's estimate)

P = programming statements per hour (from Table 1)

σ_P = standard deviation of P (from Table 1)

β = selected multiple of σ_P (from planner's estimate)

T = mean number of computer test hours per module per class (from Table 1)

R_s = hourly charge for systems analysis and design

R_p = hourly charge for programming

R_k = hourly charge for keypunch

R_c = hourly charge for computer test time

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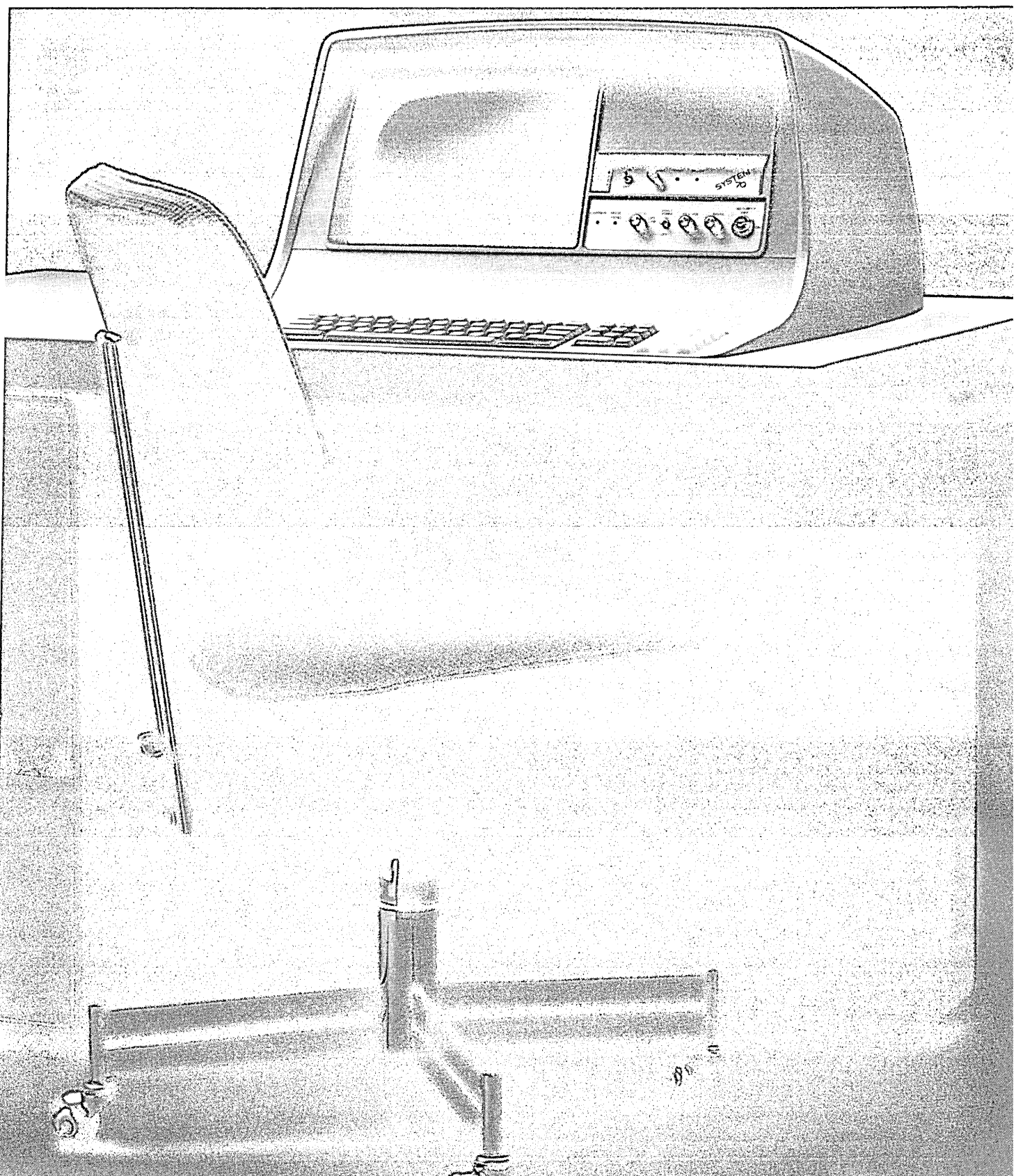
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This cost algorithm and set of statistics address the costs of project development through implementation and post implementation review which accrue within the MIS/DP department.

(Note that this estimation technique is very much akin to building construction cost estimating, a primary tool of which is cost per square foot.)

The specific costs associated with user participation during development have been purposely omitted from the cost estimation algorithm for various reasons (the author believes this type of cost must be estimated on an incremental cost basis or on an opportunity cost basis). However, the total hours of user involvement are believed to be about 50 to 100% of total systems analysis and design hours, and can run even higher in some cases. Also, clerical effort required for one-time data conversion can be very substantial, but is rather easily estimated.

Part four: scheduling

Once a project estimate is established in terms of man-hours and dollars, we are in a position to establish a master project schedule. Analysis of prior projects has revealed the distribution of resource consumption over project duration (again, these statistics

Required hours by resource by phase ÷ (# personnel allocated × 123).

We may also wish to establish a constraint on computer test time utilization in any one month based upon a reasonable limit per programmer (say, 20 hours/month) or based upon a total availability of x hours/month. This can be converted into minimum elapsed months per phase as follows:

Computer hours required in each phase ÷ (# programmers allocated to phase × 20)

or,

Computer hours required in each phase ÷ x .

In most cases, we can assume infinite capacity for keypunching because of the number of outside service bureaus available and the relatively minor cost of this resource (1-3% of project total).

We then take the largest elapsed months figure (systems analyst, programmer or computer) in each phase as one would establish a critical path with PERT analysis. The sum of the largest figures from each phase represents the minimum total project duration. Design review time (two to four weeks or longer) should be allowed between analysis and detail design, and several months should be allowed

bug-free status.) This technique of allowing minor bugs to accumulate minimizes the disruption caused by frequent changes, some of which cause additional problems.

From the project master schedule, it is possible to establish a detail schedule for each activity and each participant. In doing this, timing, sequence, and resource availability problems will appear which did not appear at the master or macro-schedule level, and the planner can make schedule adjustments to handle them. When the final detail schedule is summed back up to a macro level, the overall duration of the project may change ± 15% or more from the first iteration of the master schedule.

This top-to-bottom and bottom-back-to-top approach preserves the principle that the whole is equal to the sum of its parts, and we end up with detail schedules for each activity and each participant. This detail will be useful for project control.

Part five: project control

Project control implies and requires a controllable situation and a means of accountability to measure progress against the plan. If every person records hours worked against one project control number, the project is automatically out of control because there is no "individual" accountability. Therefore, a participant code or name must be assigned to every participant and a subproject code or name to every activity, so that actual progress against plan can be recorded at the micro level. In this manner, overall progress of the project can be measured, problem areas can be identified or predicted, and action can be taken in advance to prevent an out-of-control activity from resulting in disruption. To measure progress, however, to-date actual progress versus plan is not sufficient. If the plan calls for 100 hours to complete an activity, and 60 hours have been consumed to-date, we cannot assume that the activity is 60% complete. An independent estimate of percentage of completion of each activity by each participant is needed. With the "percent complete" known at the activity level, dividing actual hours to date (times 100) by percent complete yields a *projected actual*. If the summation of projected actuals adversely affects the project estimate and schedule for the current phase to an unrecoverable degree, alternative plans should be established and cleared with management. A revised schedule and budget generally results, being strangely characteristic of building construction and product development projects.

The estimation of percent completion at the detail activity level is a tenuous task, as the person who is

Resource	PROJECT PHASE				
	Systems Analysis	Detail Design	Programming And Test	Training And Implementation	Post Implementation Review
Systems analysts	24%	26%	30%	13%	7%
Programmers	0%	16%	55%	24%	5%
Keypunch	0%	0%	90%	10%	0%
Computer	0%	0%	68%	30%	2%

Table 2. Estimated resource consumption over the life of a project (again using batch COBOL on an IBM 360/40).

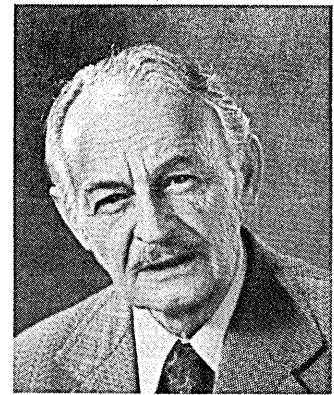
may require some refinement by the reader in order to be applicable to their specific environment) shown in Table 2.

If each project phase is treated as a separate entity and the rule is made that subsequent phases cannot be initiated until the current phase is completed, then we can establish a master schedule for each phase. The estimated hours for each resource are multiplied by the percent of resource consumed in each phase, yielding resource hours per phase. A safe assumption is that a project participant can contribute a maximum of 123 productive hours per calendar month (2087 hours/year-80 hours holiday-80 hours sick leave-80 hours vacation ÷ 12 months/year × 0.8 productivity factor). If the project personnel are 100% allocated to the project, we can compute minimum elapsed months for each phase of systems analyst and programmer utilization as follows:

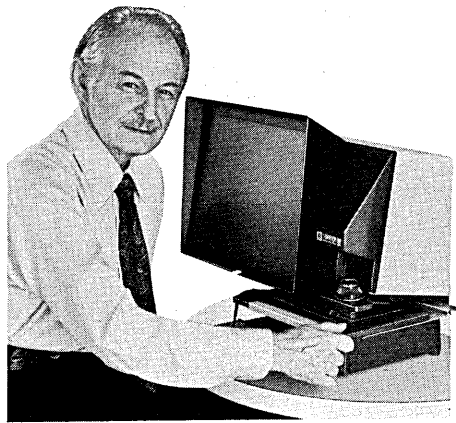
between implementation and post-implementation review to establish a system performance record (keep in mind, the system is operational at the end of implementation, but the project should continue until fine tuning of the system is completed).

In the elapsed time between implementation and post-implementation review, problems should be noted; however, attempts to correct minor problems should be discouraged and only major disruptive system, programming, and operational problems should be fixed immediately. In this manner, the level of program and system bugs builds up to a meaningful work load which is most efficiently handled at one time, the time being when 95% of all problems have been detected. This is usually three to four months after implementation, provided that the system operates on a minimum weekly basis. (Systems whose cycles are monthly or longer rarely achieve

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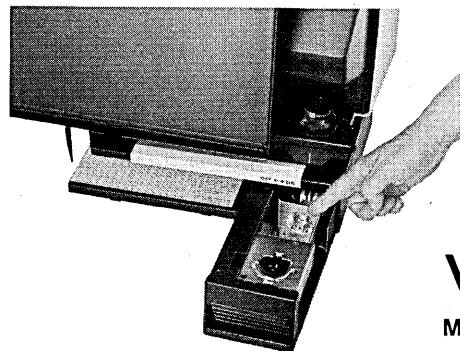


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Research and Development
Microform Products Div.
Realist, Inc.



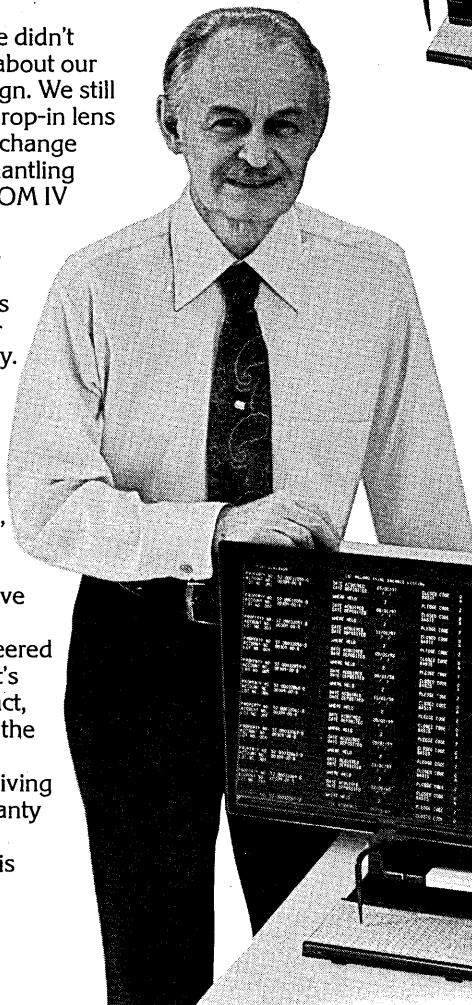
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doing the detail work has a sub-conscious desire to report good news to the project administrator in order to appear to be where he is expected to be. Typically, dp personnel report 25% completion when they start an activity, 50% completion when they are really 25% complete, 75% completion when they are really 50% complete, and 95% complete for the remaining duration until they are really 100% complete. A well thought out antilogarithmic function combined with independent estimates of hours to complete lagging activities will smooth this reporting problem. For individual performers who consistently operate within expectations, detail progress review may not be necessary. These people know their capabilities and limitations, and will advise the project manager of anticipated problems. (They also are the type who will take work home and do it when necessary to prevent project disruption and avoid personal embarrassment, so one may never know they had a problem.) For inconsistent performers, a regularly scheduled progress review meeting should be held.

The percentage completion reporting method is not free of major pitfalls, however. In fact, the method is a highly subjective exercise. In the early stages of a project, it is difficult to distinguish between 5% completion and 10% completion, yet the resultant projection can vary 100% based on which number is chosen. Thus, for perhaps the first half of a project, this method is at best unreliable and may cause project control alarms to sound needlessly.

Project milestone reporting is perhaps a more suitable alternative. Using this method, each task or sub-project is divided into scheduled elementary steps (for example: flow-charting, coding, first compile, first unit test, first volume test, final test, etc.), and the completion of each step is reported on a master project schedule. If the master schedule is established using a PERT or critical path technique, it is possible to measure the overall impact on the master schedule caused by schedule variances of individual tasks. This places much more emphasis on getting tasks done on time and focuses attention on critical areas which are running behind schedule.

The ideal method of project control would be based on a marriage of the two techniques. If cumulative percent time distributions were established over all phases of each typical subproject, milestone reporting of each would automatically yield an associated percentage of completion, thereby giving

a project manager both current status and an estimate to completion. There is much room for creativity and applied research in the discipline of project control.

Part six: analysis of variance

The purpose for analysis of variance from plan is to identify specific factors which caused project cost and schedule under- and overruns (mostly the latter), and to help us do a better job of estimating, scheduling and control of the next project. To illustrate the concept, let's take a specific example. The hours and cost estimation technique shows that programming cost is a function of four factors:

$$\begin{aligned} & \text{Number of programs} \times \text{Statements} \\ & \quad \text{per program} \div \\ & \text{Statement coding rate per hour} \times \\ & \text{Hourly cost of programmers} \end{aligned}$$

The programming estimation technique employs two standards: statements per program and statement coding rate per hour. The numbers embodied in these standards may be questioned. However, these standards are a starting point, and positive decision rules can improve them to the point where they work for a particular environment, staff, language, and computer.

Let us make the following representations:

$$\begin{aligned} P &= \text{number of planned programs} \\ \Delta P &= \text{actual number of programs} - P \\ S &= \text{standard statements per program} \\ \Delta S &= \text{actual statements per program} - S \\ H &= \text{standard hours per coded statement (reciprocal of statements per hour)} \\ \Delta H &= \text{actual hours per statement} - H \\ R &= \text{planned hourly cost} \\ \Delta R &= \text{actual hourly cost} - R \end{aligned}$$

Our initial cost plan is $P \times S \times H \times R$. The actual cost will be $(P + \Delta P) \times (S + \Delta S) \times (H + \Delta H) \times (R + \Delta R)$ which expands into 16 compound factors. We are interested in five of the compound factors, and we allocate the other 11 using standard cost accounting methods. The five factors of interest are:

$$\begin{aligned} \text{A. The original plan:} & \quad P \times S \times H \times R \\ \text{B. Change due to } \Delta P: & \quad \Delta P \times S \times H \times R \\ \text{C. Change due to } \Delta S: & \quad P \times \Delta S \times H \times R \\ \text{D. Change due to } \Delta H: & \quad P \times S \times \Delta H \times R \\ \text{E. Change due to } \Delta R: & \quad P \times S \times H \times \Delta R \end{aligned}$$

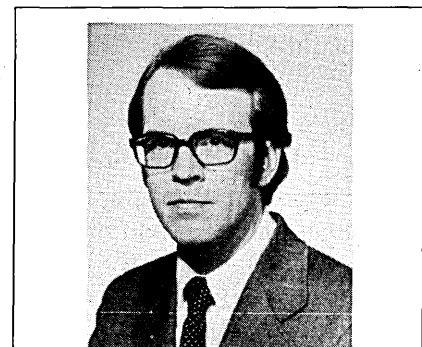
We are now prepared to explain actual results which deviate from plan in a meaningful and analytical manner. If the number of programs changed, we should have known early in design phase, and, although our original master plan should never be changed, we

can have a working plan which gets revised by upper management consent. If the hourly cost rates changed, we should have known about that in advance and called this to the attention of upper management. The only remaining elements to explain are C and D. If there was a significant variance either way (say, more than $\pm 10\%$) due to ΔS , an analysis should be made of the programs in question to explain the variance in terms of the manner in which the programs were written. If the programs are acceptable, and the relationship $-0.1 < (\text{Item C} \div \text{Item A}) < 0.1$ does not hold, a change in the "S" standard may be appropriate for future use. If the programs are not acceptable, project control administration or programming standards may have been inadequate. If there was more than $\pm 10\%$ variance in the plan due to ΔH , a performance review should be held on an exception basis with those doing the work to explain the variance. If these people's performance is judged to be acceptable, and the relationship $-0.1 < (\text{Item D} \div \text{Item A}) < 0.1$ does not hold, a change in the "H" standard may be advisable. If the performance was judged to be substandard, project control administration may have been inadequate or personnel recruitment and development practices may be poor.

The analysis of variance and subsequent review provide an explanation for variance from plan and suggest areas for improvement in future projects.

Voila!

There is no substitute for managerial capability, good judgment and a conservative approach in planning, estimating, scheduling and controlling a project, but these quantitative methods can significantly reduce errors in estimating and scheduling MIS projects, and can lead to improved planning and control. *



Mr. Donelson is corporate manager —MIS quality assurance for the Harris Corp., Cleveland. His 15 years in dp include previous service with Glidden, General Electric, and his own consulting practice.

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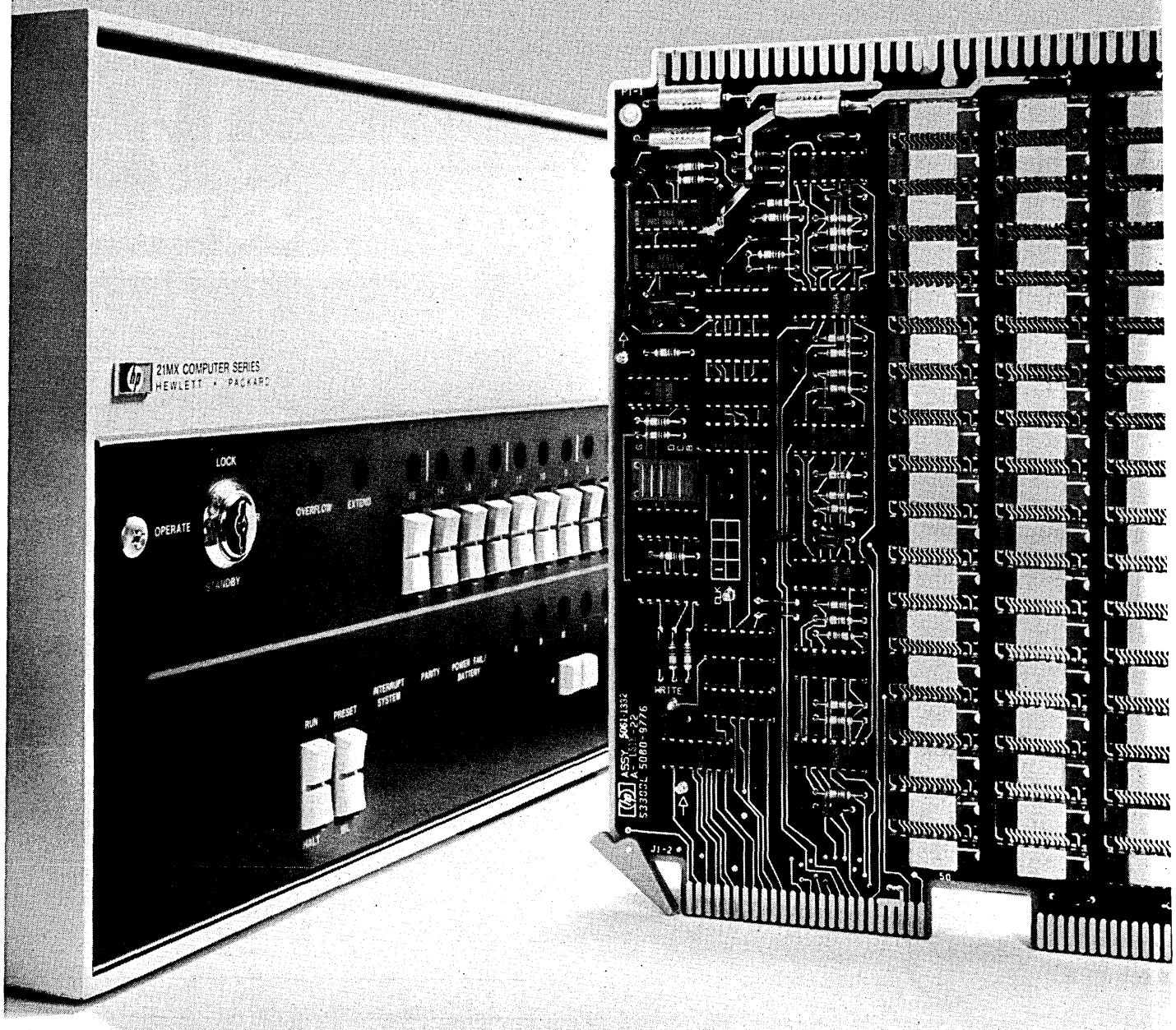
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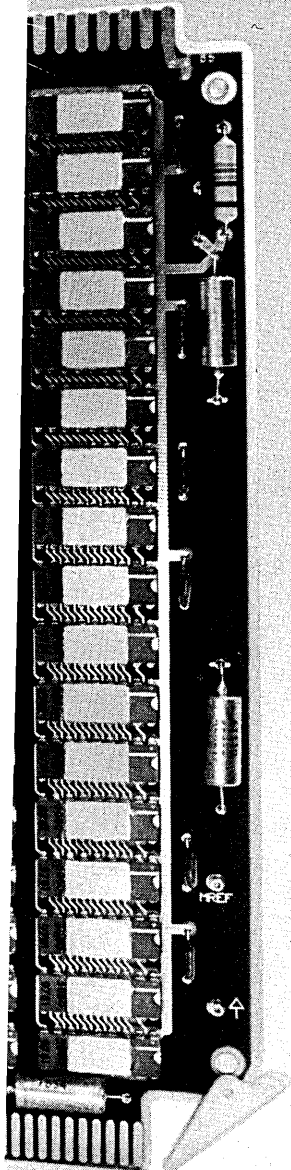
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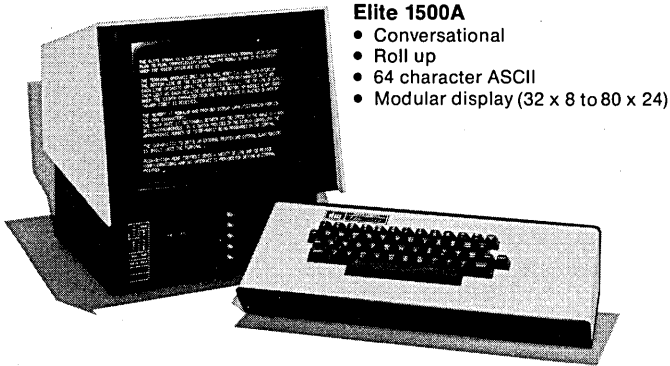


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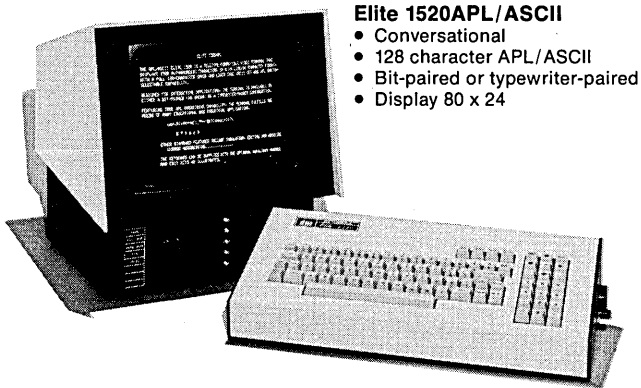
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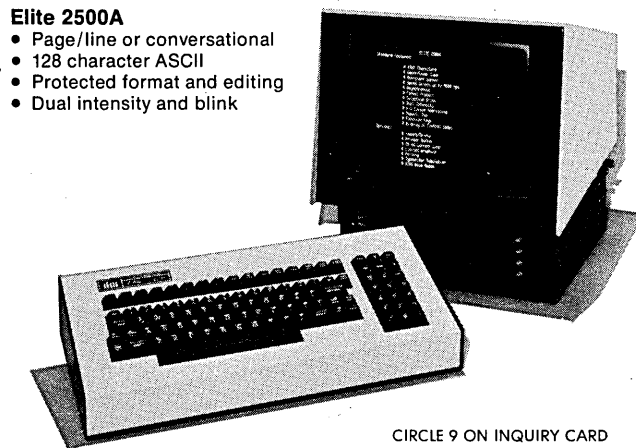
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The Chief Programmer Team Administrator

by Lawrence H. Cooke, Jr.

Adding some of the chief programmer's duties to those of the librarian helps make the entire team more effective.

Have you ever wondered how Mankind determined which mushrooms were edible and which were poisonous? That was long ago, but the problem must have been one of selecting "volunteers" for the tasting assignment. Much the same situation exists in smaller dp organizations (smaller, say, than IBM) regarding chief programmer teams. In principle, the programming staff is enthusiastic about the team concept—that is, so long as someone else is the librarian.

The chief programmer/librarian team was introduced by IBM to the rest of the industry in 1972. It was used very successfully on the New York Times text retrieval project. In conjunction with structured programming, top-down design, and the development support library (DSL), the chief programmer/librarian team produced a prodigious amount of accurate, efficient code. The productivity ratio of this approach over prior methods where everyone "did his thing" independently were on the order of five-fold! The news of the chief programmer/librarian team's potential spread rapidly as dp managers began to imagine how a five-fold ability to meet deadlines might help them out.

The team members

The chief programmer/librarian team on the New York Times project was headed by two very experienced and well-respected professionals, Terry Baker and Harlan Mills. The team was structured around a skilled senior technical manager who *codes*, and an equally skilled backup manager who is able to take over the project leadership should the chief programmer become incapacitated, get promoted, move, leave the company, or whatever. The chief programmer is highly skilled technically and takes the most difficult, the most centrally important tasks unto himself. In the "top-down" approach, these key tasks are on the critical path of the project.

Working right next to him is the backup programmer, who both understudies and complements the chief programmer. The backup programmer performs tasks that are only slightly less complex, and which are only slightly off the critical path. He relieves the chief programmer of some of the routine interaction with other programmer members of the project.

All the other team members can be considerably junior to the two top members of the project. They code the less complex modules, modules not on the critical path, and modules which are not as vital to the success of the project.

Although the development support library is crucial to the success of the chief programmer team, the responsibility for it is placed way down at the bottom of the hierarchy. The librarian is given the least attention of all the team members. However, the librarian performs the central clearing functions for all work submitted by the development staff to be funneled through the computer. This is not a purely clerical job, for a certain amount of judgment is needed. The librarian is expected to be aware of interactions where one programmer's work may be duplicated or negated by another's. He (or she) maintains all systems documentation and retains the latest copies of all computer listings and other components of the DSL. The New York Times project was a large, complex assignment. There were many individuals and many alternative skill levels available from which to select the best person to perform the librarian duties.

Once created, the librarian's role has become somewhat flexible. Some organizations may direct him to make physical keypunch changes, while other organizations may instruct each programmer to make coding changes and submit jobs to the librarian for confirmation and checking only. If the team is not large—let's say smaller than six programmers in all—then the librarian

may be a junior member of the programming team himself. He may spend up to half his time coding his own work, while the other half is occupied by performing the clearing and checking duties for the rest of the staff. Large teams would require that he spend all his time in reviewing computer results, checking incoming programmer work, filing, and performing duties of a "gofer."

The librarian problem

There is nothing in the librarian job to make it attractive to a programmer. For a short time, a very junior person could learn a great deal from working closely with a team of luminaries; it would be interesting briefly to be at the hub of activity. But there is nothing of technical interest to make the librarian job one of growth to other assignments. It must be considered hardship duty for whoever is assigned to it.

Assigning the librarian duty to non-technical office personnel may be a possible alternative, but then all technical continuity on the project is lost. The librarian can no longer function as a clearing house of information. The team value of the chief programmer/librarian is lost if the librarian function requires only file clerk capability. The chief programmer draws no more synergistic power from the librarian in this case than a general would in strategy planning from an orderly.

A further drawback of the clerical solution for smaller companies is that when projects are small, the dp manager does not have enough extra people to assign a "clerk-librarian" to every three to six programmers. Perhaps the smallest team that would warrant a full-time clerk would be a staff of eight to ten programmers. Most smaller companies are unable to construct teams of this size to work on a single project.

For a dp professional—one who is capable of contributing to the chief programmer/librarian team—to accept the job of librarian has been, in the

CHIEF PROGRAMMER

writer's experience, like inviting an individual to sample a new, unclassified mushroom. No rational appeal works to convince him to do it.

In order to overcome the reluctance of candidates to accept the role of librarian, the dp manager must enrich the job. While being a librarian is a completely honorable profession in the context of library science, within the dp community it is totally unacceptable to programmers. It implies a skill level that is below what a programmer would accept for long. It implies the same demotion for a programmer that being transferred to operations or key-punch implies. This negative connotation of the term "librarian" is so pervasive that the use of it in the context of the chief programmer team should be avoided.

In the process of enriching the job, a totally neutral term without negative connotations must be sought and applied honestly to managing the development support library function. To enrich the job has a cost, but, as we shall see, the cost is a modest one compared with the benefits resulting from job enrichment.

To overcome the negative connotations, I propose the term "project administrator" to replace that of "librarian." By calling the individual an administrator, I do not mean a mere title swap. The job would be substantially different; it would be more active. The administrator would centralize all documentation, including all the code, which is substantially what the librarian now does. However, in addition, he would (after negotiation with the chief programmer) have authority to indicate to team members certain directives. For example, he could indicate that some of the code be structured in a particular way, or that particular naming and linking conventions be used. He would be responsible for preventing redundant work. He would initiate review cycles with users, auditors, etc. He would, in short, take over some of the duties of the chief programmer.

It is obvious that the administrator must be a trained programmer. At Midlantic Bank, we see this in fact as a senior level position, one which requires the services of a qualified senior programmer. This means in addition that the administrator would not, as some librarians do, make coding changes for team members from slips of yellow paper; nor would he keypunch or go for coffee for the rest of the staff. Instead, each project member would prepare his own work, check it first, and then review it with the administrator, who in his turn reads the code and en-

forces the changes he requires for smooth project integration.

Using an administrator frees the chief programmer to perform the same technical role he would perform in the original context. His ability to set policy is likewise unimpaired. An administrator, in his turn, works within the general policy guidelines of the technical manager, yet retains an enriched, challenging, and satisfying job.

The chief programmer controls the project, sets policy, codes, and performs nearly all the duties as in the original concept. If there is a change in emphasis, it is that he can now rely more on the administrator for the coordination function which fell formerly to the backup programmer.

The backup programmer's duties are likewise changed only nominally. He can devote more of his time to technical assignments, and can assist the chief programmer more in the critical areas of coding.

One cost is obvious. Staffing with an administrator who is a senior level programmer is a more expensive solution than staffing with a candidate who is more or less a clerk. However, you can now find candidates for administrator among programmers where formerly volunteers for the job of librarian were as scarce as hens' teeth. A low cost solution that cannot be implemented offers no savings to the company.

The administrator offers the benefits of intelligent, consistent planning to the project team. It is this aspect of the function (not the salary differential) that was discovered on the New York Times project to have the productivity boost. Centralization of the DSL was thought to be the most crucial aspect of teamwork in the New York Times project; it was even more important than the backup programmer notion for the smooth and steady running of the project. Further, the project administrator provides more thoughtful coordination and control the closer he approaches the skill level of the chief programmer himself.

I am not completely happy with the term "administrator." Perhaps it sounds too bureaucratic. Perhaps "coordinator" or "facilitator" would be better. However, I am far happier with the results of converting to that concept, whatever it is called. Skilled, valuable staff members at Midlantic Bank have undertaken the function willingly. We currently have two chief programmer team projects, one a check processing system, the other an automated teller machine system.

Initially the senior members of the technical staff who took the positions as project administrators on these two projects had their apprehensions. However they like the idea of developing the concept of project administrator as

well as having a more active participation in the project. They find the work interesting and challenging. The first project is currently entering into the heavy coding phase; the second is now being wrapped up. Although the jury is still out—and there may still be some apprehension about how this particular stint as project administrator will affect career paths—the results so far are excellent. Project direction has moved away from everyone "doing his thing" towards the chief programmer team objective of technical excellence with centralized control. And as far as the career path for project administrator is concerned, we see no reason why it could not be one of the possible stages for progress as programmers—at the senior level.

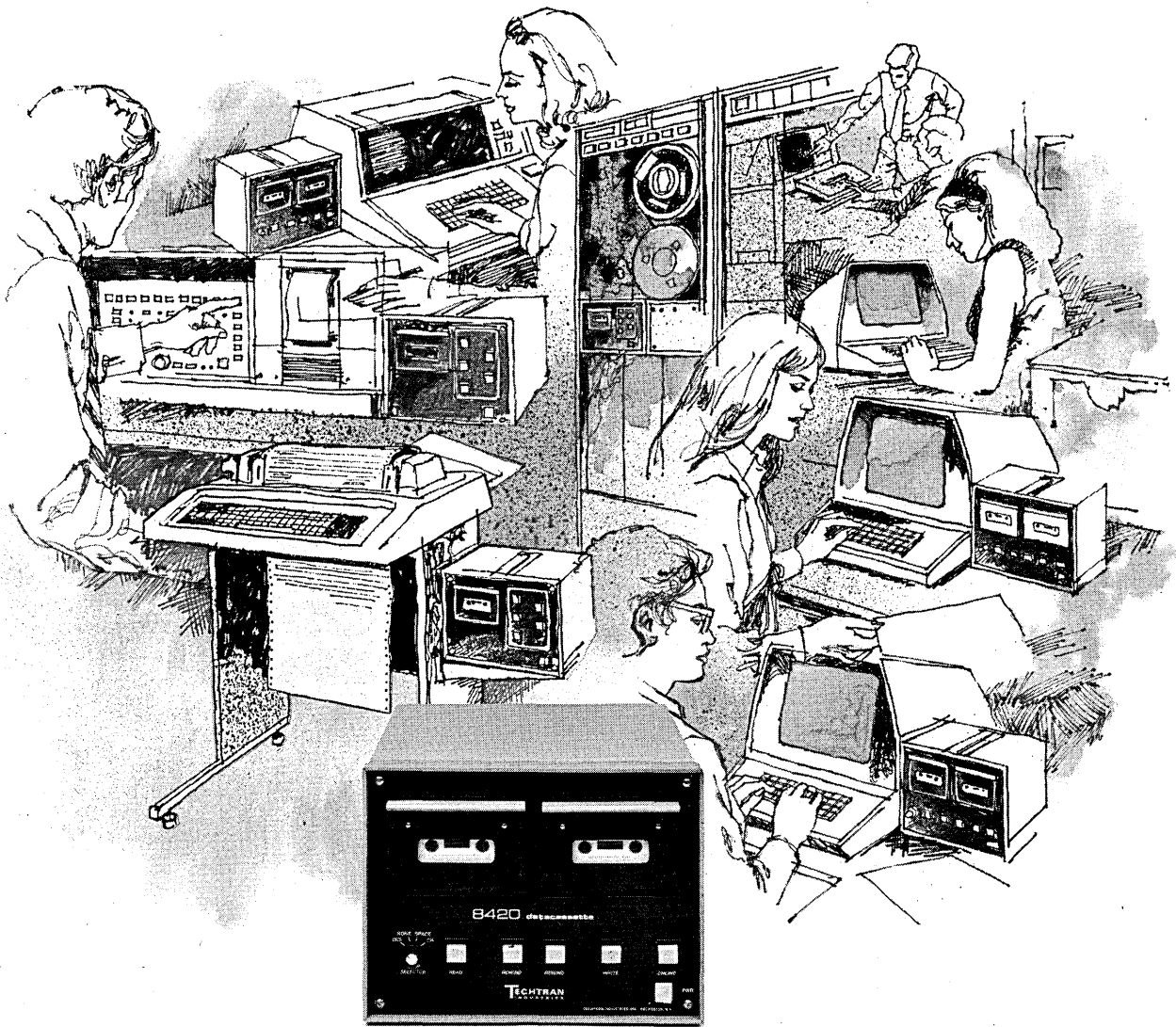
It is too soon in the game to quantify how much of the five-fold productivity opportunity we've achieved by this move. Time and experience will either prove the concept or thrust it onto the junk heap with other well-intentioned plans. But I'd like to report some additional results achieved already:

In using the former "librarian" terminology, I have noticed, in my own organization and in every organization I've talked with, a built-in, sexist bias in the use of the librarian role. "Let's make Sally the librarian." "Gertrude would be a splendid candidate for librarian." "Let's make Louie the librarian, so he'll quit." These are sample remarks people offer, not always consciously aware of the bias.

Well, no one at Midlantic Bank thinks the administrator is a demeaning job, nor is there any sexist bias. Those who have taken the position have found it a challenging one. The function has contributed to productivity. You can't ask more than that from a notion that has yet to be tried in other organizations. Is it a toadstool or is it a good mushroom? We've survived our first nibble. *



Mr. Cooke is assistant vice president and manager of systems and programming at Midlantic National Bank, West Orange, N.J. He was formerly with the Federal Reserve Bank of New York and with IBM.



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The Computer Manager's Guide

by D. F. Stevens

Some particularly imaginative managers have even persuaded users that interrupts serve their best interests.

The successful computer center manager is the one who achieves and maintains a state of constant resource saturation, despite fluctuations in the workload, and who provides a careful statistical demonstration of extreme efficiency of operation. The techniques for the former are rather well known and widely practiced; nevertheless, for the sake of completeness a brief summary is included below. Certain aspects of the latter are also widely practiced, but not in any systematic way, and generally in ignorance of their true worth. It is my hope that this Guide will provide a foundation for the orderly development of this hitherto rather random enterprise.

Achieving saturation

Much nonsense has been written attempting to define saturation in terms of utilization of various components of the system. Saturation is really quite a simple concept. When the system is presented with more work than it can accomplish before the next lot arrives, it is momentarily saturated; when this situation persists, it is fully saturated. Thus the key to achieving saturation is evident: either present the system with more work to do, or reduce the amount of work the system can process. I will examine each of these two master strategies in turn, but first a few words about a simple expedient which, in fact, contributes to both.

Even the most unconcerned computer center manager can achieve premature saturation if he uses the manufacturer's software with the manufacturer's defaults. (Careless tinkering with the options has been known, in a few cases, to actually decrease the level of saturation; it's best to leave well enough alone.) The saturation effect is proportional to the square of the number of programmers on the software development team; and thus, unless you have a very large staff, you are better off not attempting to beat the manufacturer at his own job.

The manufacturer's software succeeds because it uses all of the individual techniques outlined below; but it generally fails to utilize them to the

fullest, thus leaving considerable scope for the computer center manager. The careful manager realizes, however, that not all techniques are suitable for all centers, and will select only those which fit the areas of inexpertise of his user community.

Providing more work

Saturating a system by providing more work is independent of the true workload; it must be done either by increasing overhead (i.e., providing hidden work) or increasing the redundancy index, I_r , defined as follows:

$$I_r = \frac{\text{total job submissions}}{\text{useful job submissions}}$$

One must be careful not to let the overhead increase too rapidly, however, lest it become visible. The preferred way of increasing overhead is to provide additional management — a nice parallel exists here between computer system organizations and human organizations — increased use of vs; more rapid polling of terminals; more frequent garbage collection. *Note that these are all undertaken in the name of better service!* Another way is to provide a high-overhead substitute for a low-overhead task, such as rewind-and-read-forward instead of direct position for backspace; copy-to-dummy-file instead of skip. The enterprising manager can extend this list almost indefinitely.

There are three general mechanisms which can be invoked to increase the redundancy index: the correct-but-useless job, the abort, and the interrupt.

Correct-but-useless jobs flourish in the presence of suggestively incomplete documentation and subtly incompatible systems. They arise from a desire to find out what really happens in such-and-such a case; their beauty is that each user tends to run the whole set for himself (he learns to trust no one), often several times, especially if the system changes frequently. Thus one carefully phrased allusion in the users' guide can create hundreds of redundant jobs over the years.

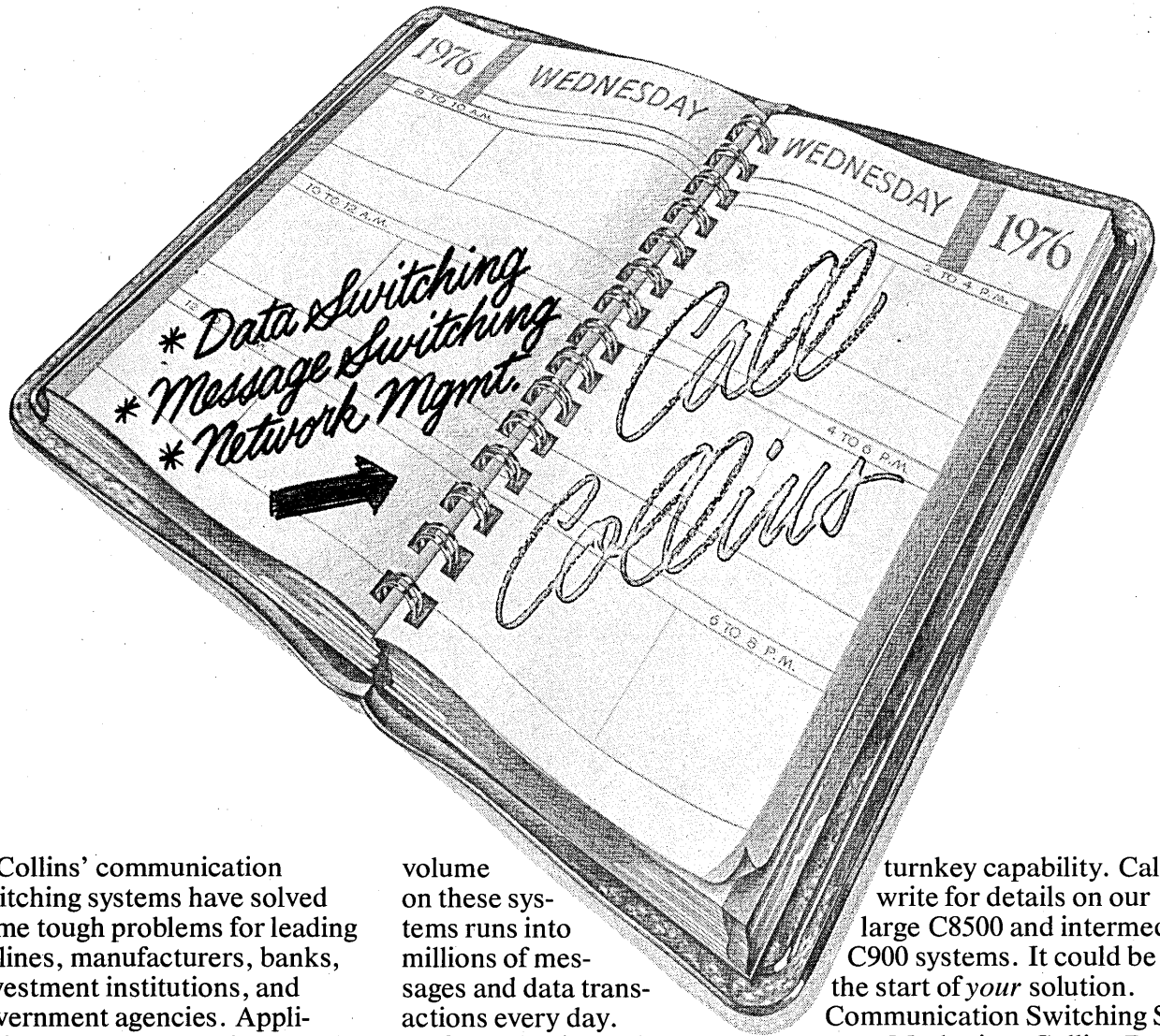
Another source of correct-but-useless jobs, and also of aborts, is error-

intensive syntax. The use of a single name for several possibly contradictory purposes in different control statements is quite helpful here (e.g., R for Read, Ring, Rewind, no-Rewind), as is the use of different names for the same purpose. The astute manager will insist upon positional calling sequences instead of keywords, especially for utilities with many arguments; and where keywords are unavoidable he will select them either for their non-mnemonic qualities or to maximize the likelihood of keypunch errors. (A useful point to remember is that the number of errors is inversely proportional to the intelligibility of the text and directly proportional to the number of strokes; thus the optimum parameter name is long, but either meaningless or ambiguous, and almost identical to one with a very different purpose.)

The various job limitation parameters (those which establish the maximum amount of a given resource which may be devoted to a job) are readily exploited via subtle system changes which force existing jobs over a particularly tightly controlled limit. (Increasing the default buffer size without a corresponding increase in the default job size, say.) Unfortunately the cumulative effect of many such changes is to inspire the affected user to investigate the system; therefore the wise manager will carefully orchestrate successive changes to avoid catching the same segment of the user community too often.

The interrupt is a blunt instrument; it is effective, but only some particularly creative managers have succeeded in persuading users that interrupts serve their best interests. The main benefits of the interrupt, of course, is that it reduces the time available for the completion of the work; of that aspect, more in the next section. The unscheduled interrupt also increases the redundancy index significantly, as each interrupt causes the total number of job submissions to increase by n (where n is the average number of jobs active at once) with no increase in job submissions. If interrupts occur frequently enough, long jobs must be restructured

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MANAGER'S GUIDE

into a series of short ones, to finish at all, thus providing a modicum of increased overhead as well as the increase in the number of jobs.

Reducing system capacity

Interrupts are also the most effective way to reduce the capacity of the system. Short of resorting to outright sabotage (a risky business), the manager has little opportunity to influence the number of unscheduled interruptions, but the current state of most systems is such that no such intervention is necessary. The manager, however, is in full control over the number and timing of the *scheduled* interrupts. Again, it is best if these occur "in the interests of the user." The more common reasons are preventive maintenance and operating system development and testing. Some enterprising managers have also introduced *separate* interruptions for reconfiguration, for system cleanup, or to avoid confusion during shift changes.

In the interests of more precise management, a successful manager keeps all interrupts dedicated to a single purpose, and to avoid extended periods of downtime he makes them noncontiguous, thus reaping the benefits of separate rundown times for each. This, together with a suitably fussy restart procedure, can guarantee an hour of non-productive time per interrupt in addition to the time required to perform the work for which the interrupt was requested. A one-hour PM shot plus two one-hour system shots per day thus provides a manager with instant 25% "saturation," even in the absence of *all* work!

Other ways of reducing the capacity of a system *do* exist, but they tend to pale into insignificance compared to the creative scheduling of interrupts. They have one advantage, however: they are rather technical, and thus beyond the comprehension of many users. The most fruitful areas of adjustment are the resource allocation modules, including the cpu scheduler. Among the more useful techniques are under-allocating devices, overloading channels; selecting allocation unit (page, sector) sizes for minimum use; mismatching buffer sizes with allocation unit sizes; round-robin cpu scheduling. In most of these areas, you will find the manufacturer's suggestions quite satisfactory; the perfectionist may be able to gain another 5-10%, but only with the exercise of great ingenuity. He could, in general, do better by scheduling a couple of additional interrupts per week.

Statistical support

The simple attainment of saturation

is thus seen to be within the reach of even the mediocre manager, and the mediocre manager will seize it forthwith, with no thought for the consequences. The prudent manager, however, knowing that saturation leads to user frustration, takes continuous pains to ensure that user anger, when it erupts, will not be directed at him. The prudent manager provides a steady stream of statistical reports which demonstrate the exceptional efficiency and effectiveness of the center.

How can he guarantee that these reports will be so favorable? By selecting the proper indices and defining them very carefully. Thus one does not speak of "usable time," but of "availability;" nor of "expected duration of service," but of "mean time to failure;" nor of "efficiency" itself, but of "utilization;" nor even of "system utilization," but of "cpu (or some other single component) utilization."

You will note that the first three pairs sound synonymous, and are so taken by much of the computing community; therein lies the strength of this technique.

Availability

"Availability," as the term most often employed, is a triumph of creative definition. It appears to mean "the (percentage of) time the system is available to the user;" something in the 90-95% range thus sounds extremely impressive. In fact (and this is the beauty of the definition) *it means just that*; it is only in the underlying assumption (percentage of *what?*) that appearance surpasses reality. The uninitiated assume percentage of total real time; the manager (who creates the report) assumes percentage of not-unavailable time. The manager is also in full control of the definition of unavailable time (scheduled downtime), and can by careful attention to detail produce some quite remarkable results.

To see how this works in practice, consider a fully managed site with PM from 0800-0900, system time 1030-1130 (with rundown beginning at 1000) and a shift change interrupt at 1600 (with a consequent shut-down of input at 1500). Let us assume there is a half hour unscheduled interrupt at noon, and that all starts and restarts require twenty minutes. (See Table 1). A user trying to submit jobs during that shift would be able to do so 37.5% of the time (of the eight hours, two were lost to scheduled interrupts, one to restarts, one-and-a-half to rundown, and a half for the unscheduled interrupt); "availability," on the other hand was a respectable 91.7% (five-and-a-half hours out of six). This particular site runs a closed shop — the users in fact hand in their jobs over the counter, and thus do not personally experience any interruption in service — this is perhaps

a wise precaution in such a fully managed operation.

0800-0900 Preventive Maintenance
0900-1030 Production Time
(Note: Start rundown at 1000)

1030-1130 System Time
1130-1600 Production Time
(Note: Start rundown at 1500)

1200-1230 Down to replace CQ module
(All starts and restarts require 20 minutes.)

Table 1

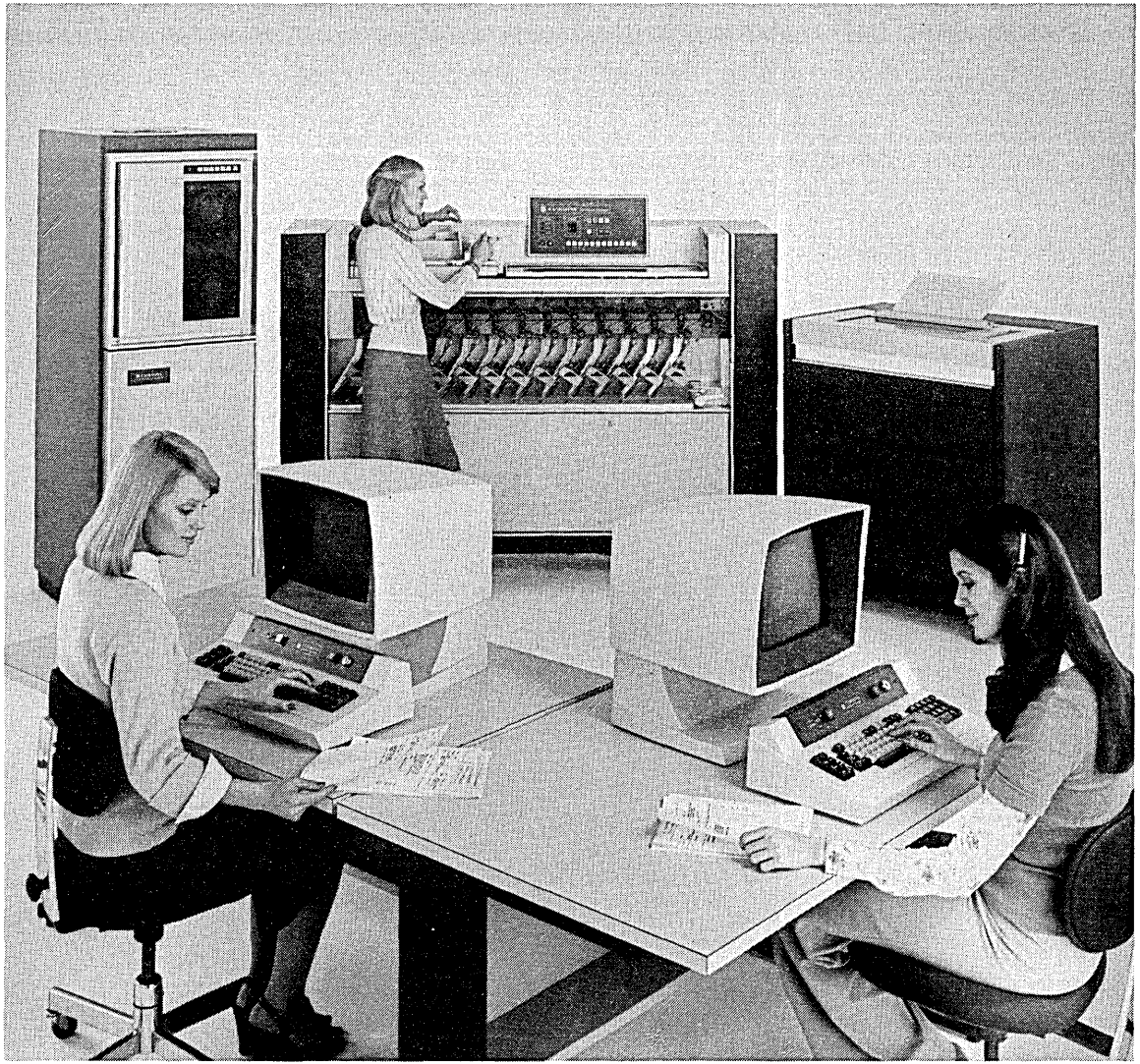
Mean Time to Failure

The concept of mean time to failure (MTF) has been around for a long time in engineering circles. It expresses the duration of continuous operation which may be expected of a system or component before an interruption caused by failure. It is defined as the sum of the lengths of each service period, from start until interruption, divided by the number of such periods; in practice it is calculated by dividing the total "service time" by the number of interruptions.

Mean time to failure is never used in practice. It has become the custom in the computing business to generalize upon MTF in a disarmingly trivial way to derive MTBI. MTBI is an undefined concept. Translated as "mean time between interrupts," it is calculated by dividing the total "service time" ("available" time) by the number of *unscheduled* interruptions (since a scheduled shut-down can't very well be considered an interruption, can it?). Table 1 can be used to illustrate the relationship between MTBI and its quasi-synonym, "expected duration of service." During the sample shift there were three service fragments defined by the manager (0900-1030, 1130-1200, and 1230-1600), for a total "available time" of 5.5 hours with but one (unscheduled) interrupt. MTBI equalled 5.5 hours. The service fragments, as defined by a user, however, did not begin until 20 minutes later in each instance (since no service is possible during restart); this gives an "expected duration of service" of 1.5 hours.

Utilization

The Manager is on safest ground when it comes to "utilization." Throughout the literature of computing one finds the terms "utilization" and "efficiency" used interchangeably. Perhaps the early writers were honestly confused. One hopes the more recent ones understand, and are capitalizing upon tradition. But one suspects that they are acting ritualistically (as in the case of MTBI), without comprehending the underlying truths. Perhaps this brief exposition will open their eyes and, indeed, suggest ways to extend this



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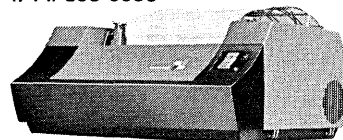
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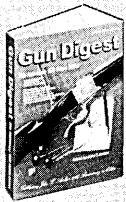
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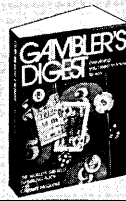
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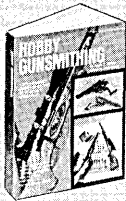
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MANAGER'S GUIDE

false analogy still further.

"Efficiency," as applied to mechanical systems, expresses the actual output of the system as a percentage of the theoretical maximum output. It came into currency with respect to computing systems as "cpu efficiency" when the cpu was either working on the user's program (there was only one user and no operating system) or waiting for an I/O operation to finish. At that time efficiency was nearly synonymous with "cpu utilization." The world is different now, but the terms have remained interchangeable to this day.

Thus the manager need not rely upon the user to misinterpret the data. Standard computing practice allows him to report cpu utilization as "efficiency." This confusion has been reduced somewhat in recent years by the tendency of the hardware to keep its own records concerning the beneficiary of current cpu activity; however, one can argue that work done in "supervisor" state eventually benefits someone. And this argument is, strictly speaking, true since that which doesn't benefit a user benefits the computer manufacturer.

Two for the future

The successful manager anticipates the concerns of his user community and is prepared to minister unto them as soon as they become evident. Two new ones are beginning to emerge: Throughput and Turnaround. The first one is rather less of an immediate worry as no installation-independent measure of throughput has been accepted by the computing community. The usual measure is jobs-per-day, and any manager worth his salt can develop a number of stimuli to persuade users to break large jobs into little ones. One which has been quite successful, as a matter of fact, is the provision of better turnaround for small jobs.

Turnaround itself is rather difficult to manipulate, so the manager must concentrate upon careful reporting. A useful concept is to omit time spent in output queues from the turnaround consideration (after all, the job is done). Another is the creation and submission of many small, high-priority jobs by the computer center staff.

If you find these last two paragraphs to be relatively unhelpful, you must realize that the problems they address are relatively new, and we have no long tradition or experience to guide us. Nevertheless, I am confident that today's managers will meet this challenge as successfully as their predecessors met earlier ones, and that it will continue to be the case that saturation can be achieved and efficiency demonstrated independently of workload. *

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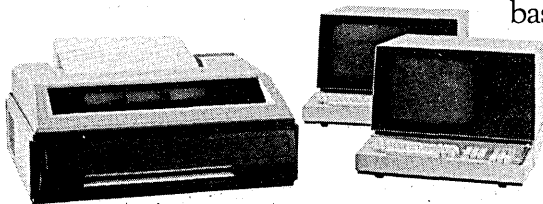
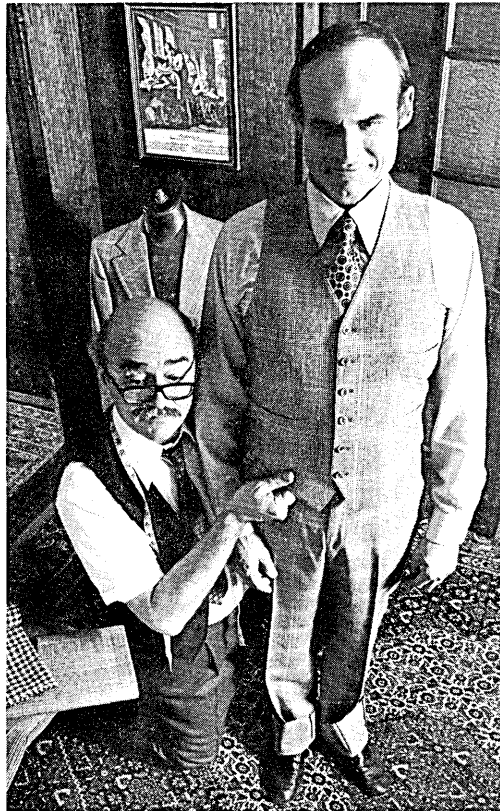
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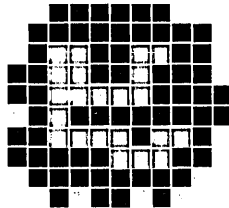
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Putting A Data Base On A Mini

by Gary Floam

Minis are small, cheap, have limited word size, tend to be isolated, etc. How do these characteristics affect the problem?

Five characteristics of data bases are especially important when considering putting one on a minicomputer. Data bases tend to involve mass storage, to be devoted to one application, to be on-line, to be isolated (this is not invariably true), and to be fairly complex. Presented here are some thoughts about what to watch out for in putting one of these things on a minicomputer.

One thing about programming on a minicomputer is sometimes overlooked. For programs of the same complexity, it costs as much to program on a mini as on a mainframe. At best, a line of FORTRAN is a line of FORTRAN, no matter on what machine, and assembler languages are again much the same, more or less. So product development done entirely in FORTRAN and assembler is the same on any computer. But on a mini, assembler and FORTRAN are about all you get. Sometimes there is COBOL or BASIC, but not always; and these are usually subsets of the language as they are understood on a mainframe. PL/1 is out of the question, so character shuffling or bit arranging, when necessary, has to be done in assembler. Though this point is sort of obvious, it is often overlooked: moving data around, operation per operation, is no bargain on a mini, as far as program development is concerned.

Mini characteristics

Minis, of course, are small. They are also cheap. There are a lot to choose from, and with minis, we do not tend to be locked into existing hardware the way we are with mainframe projects. If you're in an IBM shop and a project comes along that will take 10% of the computer's capacity, no one will suggest buying a CDC just for that job; you're going to put it on the IBM. But when a mini project comes up, and it's proposed that a couple of minis are needed in the field, people often let their imaginations run wild.

Minis are often isolated. If the minicomputer you're involved with is in a switching center working on some

project, the nearest other computer might be the minicomputer in the next room involved with another project—effectively out of your universe. You have to think of isolation.

Minicomputers tend to have small word sizes. This is only a tendency. It used to be the definition of a minicomputer, but nothing is absolute in our business.

Another characteristic of minis is their often rather nifty hardware. All the inventions one hears about are implemented on some mini somewhere.

It turns out that each of these characteristics has an effect when trying to install a data base on a minicomputer, and surprisingly, each one of them makes the job harder.

Effects of characteristics

Yes, minicomputers are small. IBM's IMS takes about 100K 32-bit words. Well, that's often all the space one has on a mini. And besides, in addition to whatever data base system you're considering, you might want to have some operating system, a touch of applications software, whatever. So you are running into machine boundaries. The last job on an average minicomputer project is making the project fit the machine.

A natural corollary of this problem is that one should make the data management system, as well as any other software for a mini, as small as possible. Of course even on a Virtual Machine/168, one wouldn't make software larger than necessary just for the heck of it, but on a minicomputer this becomes more critical.

Any project development must be built around three opposites: program size, execution time, and project development time. To decrease any one pole, one has to increase at least one of the others. Execution time is often decreed as part of the project definition, and there is usually not too much slack in this area for a trade off between this pole and one of the others. So the only two opposites that can be traded off are

development time and program size. Therefore, it is worthwhile to take time to make a program small.

Another corollary is not to overbuild the system, or, in other words, keep it friendly. The standard procedure on a large mainframe is for one program module to assume that anything fed to it by another program module makes no sense at all. As data is passed from one module to another, it is checked and verified, and rechecked and reverified. This kind of defensive programming has its place (say when designing an operating system, and not knowing what might be coming at it) but when the entire project is under one project management, this gets to be excessive. On minis we often can't afford the cost of this kind of effort where nothing can be assumed favorable about another module—even if the same programmer wrote both. So keep it friendly.

Also don't build bells and whistles onto a data base system which aren't necessary. Don't design the ideal data base system with ideal data base features no one will use. Don't design yourself into a corner.

Again, minicomputers are cheap. Although one would hardly think so, this can be quite a disadvantage. Not only are minicomputers cheap, but the people who own them tend to be poor. Large companies that bought their first computers years ago, may now be getting interested in minicomputers, but the biggest customer base is the candy store kind of customer who can just barely afford one, and who may have someone coming in part time to do BASIC programming for him. If this is so, what are the effects?

Well, it is a fact of human nature that people would rather sell to the rich than the poor. Hence, there's much less software available for minicomputers compared to what's available for larger mainframes. One can buy seven or eight data base systems for the IBM 370 that are on a par with IMS, but there are only two or three available for mini-

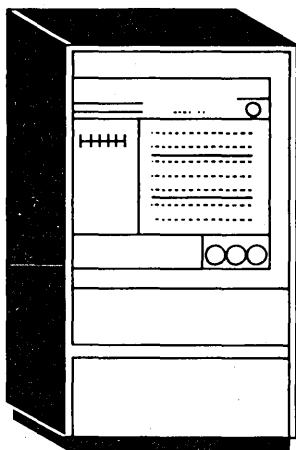
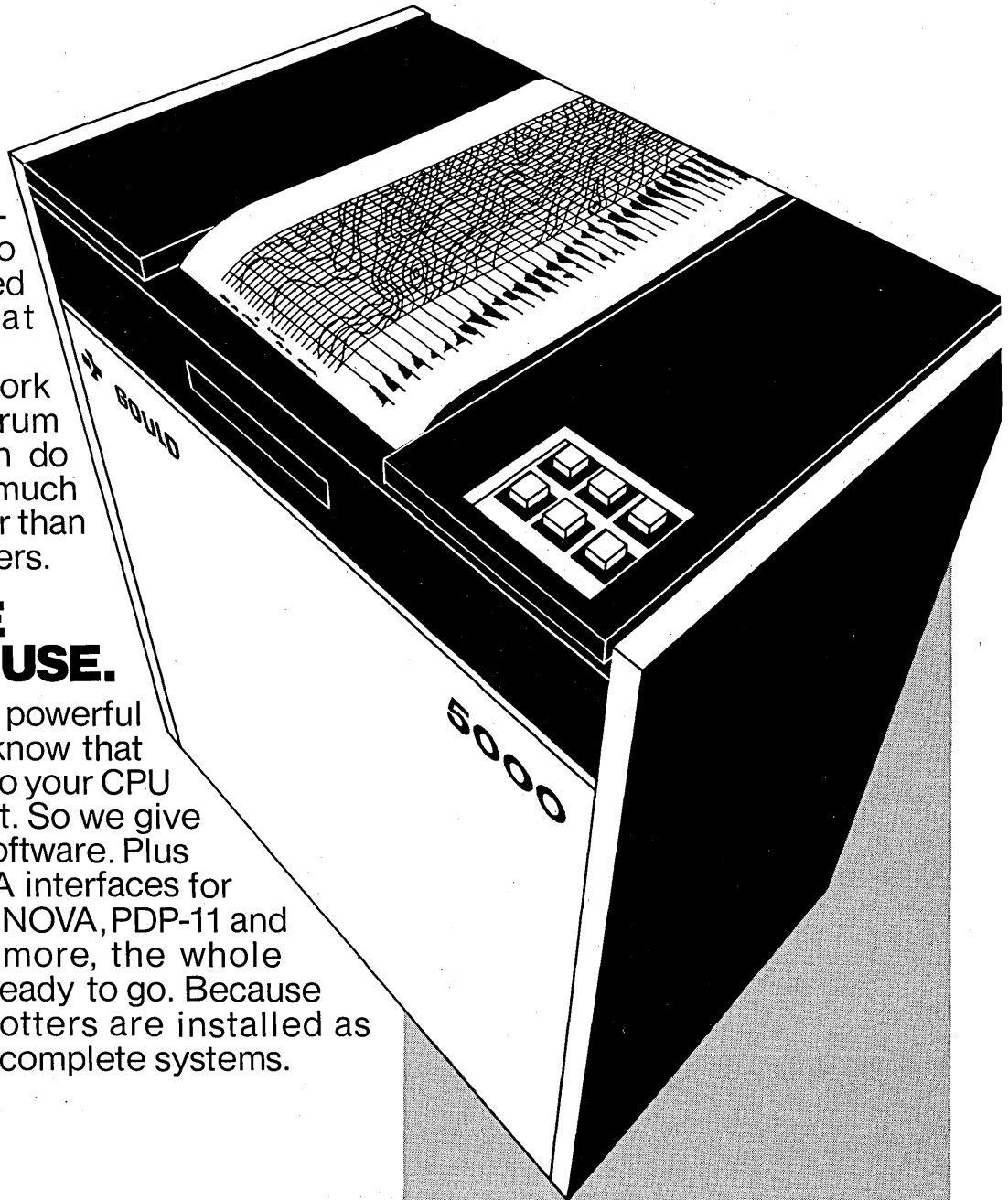
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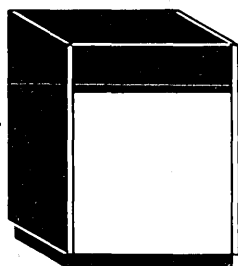
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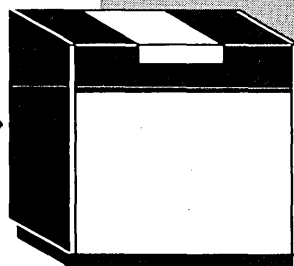
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DATA BASE ON A MINI

computers—and this is for as many minicomputers.

There are fewer products of all kinds for minicomputer users. This means that users are more often forced to build rather than to buy. There are fewer firms that can provide consultants on a short-term basis, and in general, one feels more alone working around minicomputers. Also, vendors who are selling a cheap product to poor customers, are less apt to spend millions of dollars on their system software. The user is rather a lot on his own.

Next, minicomputers generally have some really nifty hardware concepts. There are ingenious instruction sets and hardware stacks, and clever ways of handling interrupts, and many, many wonderful things. As a matter of fact, minicomputer companies are often so fond of their hardware that it is often all they want to talk about. IBM seems to be run by its salesman; Univac, by electric shaver people; and minicomputer companies, by their hardware people. So don't expect too much in the way of an operating system, nor much in the way of an understanding of commercial problems. DEC, the largest vendor of minicomputers, does not even provide an index sequential system as part of its standard file handler.

There is a good selection of minis to choose from. While this is good in a lot of ways, it tends to reduce further the chances of purchasing software; and for a given machine and operating system, there are fewer other users to swap programs and war stories with. It is harder to find people who know your computer, and it will take longer for new people to come on board, since although they might have good minicomputer experience, it is on another machine. The next project might very well be on a different machine. All this makes the project development a little bit harder.

Isolation—and word size

Minicomputers tend to be isolated. They are found in the oddest places, far removed from large computer centers and trained staffs—and this has several ramifications. If anything goes wrong, the first people who will try to set things right are likely not to know very much about computers. Recovery procedures have to be over-designed, compared with a comparable project on a computer center mainframe. The on-site documentation has to be written to a higher standard, as the system designers or maintenance programmers cannot take an elevator downstairs to look at what's going wrong.

To as large an extent as possible,

isolated minicomputer systems should be self-healing, or at the very least, self-diagnosing. And when a mini system is installed in a dozen different locations, this becomes even more important. Even a flying maintenance squad can only be in one place at a time. Restart procedures, reconfigurations of the system, fallback procedures, or anything that's allowed on-site have to be absolutely cookbook and foolproof—a great deal more so than for projects on centralized mainframes.

There is another aspect to having an isolated system. In a large mainframe shop with many projects, the difference between 0.95 disc packs and 1.05 disc packs is one-tenth of a disc pack. On an isolated minicomputer system, the difference is one whole disc pack. On the other hand, the difference between 2½ disc packs and three disc packs is zero. Storage space can no longer be considered a continuous quantity, but rather, it has to come in discrete lumps. Likewise, if a project needs three tape drives at any given time, it needs three tape drives all the time. Sometimes it takes some clever scheduling and forethought to allow a system to do everything it has to with a minimum number of I/O devices.

And there is one last consideration that is of special concern to minicomputer projects. This is the small word size. This does not apply to all minicomputers, nor all the time, but there is a tendency because of the small word size for minis to have a small address space within a program. Not all the time, but sometimes. If you have a 16-bit word, and only 16 bits for addressing, you can only address 64K of memory, and that's all. This does not affect how large total memory is in a computer, but it does affect how large any one program can be.

This situation causes problems of the type that can come up well after a project is installed. It happens that as a project proves successful, and more and more work is put into it, certain internal tables will have to expand. But chances are that some of the programs are already pretty close to the maximum program size, so something is going to bump. Something is not going to work as more data is put on the mini. Of course these are the kind of problems that can be anticipated and prevented by proper design and planning, but on occasion they are not foreseen.

What to do

What should one keep in mind when faced with putting a data base project on a minicomputer? One good tactic is to stall. More products are coming on to the market every month, so every month the job gets easier. But of course, if everyone stalled, there would be no new products on the market ever.

Failing that, one should think small. Programs should be kept small. A higher level language might sometimes have to be passed up because the code generated by the compiler might be too verbose to fit onto the installation. Program size should be one of the design considerations, and core rationing might have to be applied to each and every job in a project.

Be thrifty, especially with disc storage, and don't plan the project so tightly that an extra two tracks of on-line storage will push you up to another disc pack.

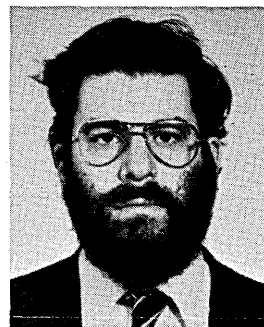
Think friendly. You can't afford to have each program foolproof against every other program's mistakes.

And keep everything that could involve an operator, especially exceptional things like restarts, fallback configurations, and reconfiguring the system, as simple as absolutely possible.

Putting data bases on minicomputers is a new business, and pioneers are often found with arrows in their backs. While there are currently very few data base systems on the market, more are planned. IDMS and TOTAL are scheduled for sometime this year, and more are sure to follow. Vendors are starting to think about operating systems in a serious way, and they are also starting to talk about business applications.

While vendors might have a long way to go, at least they are beginning to talk about their machines in a way that would interest business shops. Minis are getting bigger with each announcement, and even the proprietors of candy stores are finding out that money spent on applications software can be money well spent.

In short, people who are doing data base projects on minis are about in the same boat that 360 programmers were 10 to 11 years ago. The path right now is bumpy, but it must lead somewhere. *



Mr. Floam says he learned about data bases at Bell Telephone Labs in Piscataway, N.J. After coming to Canada "on a whim," he learned about minicomputers "with a gun pointed at my head." His specialty is in data base without reference to the size of the computer involved.

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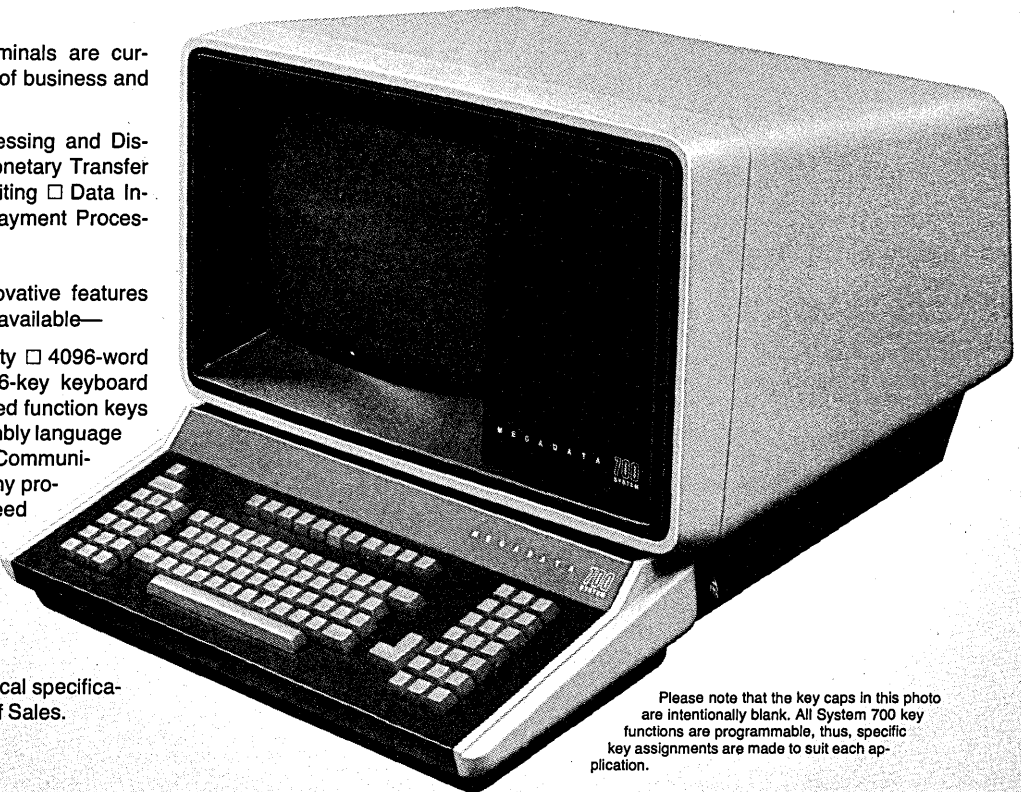
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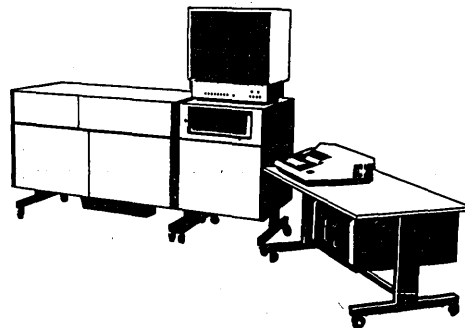
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Structured Programming in Cobol

by Jan L. Mize

By modifying the use of certain COBOL constructs, readable, flexible, and easily maintained programs can be achieved.

There is a need for a set of rules or standards for COBOL that would result in deriving most, if not all, of the benefits of structured programming. A drastic modification to the COBOL language, as suggested by some, is not a prerequisite for these benefits. As it exists today, the COBOL language provides sufficient control structures and constructs to allow implementation of structured program design principles.

Since COBOL's native habitat is a business environment with recurring processing cycles and evolving systems requirements, it demands, perhaps more than other languages, an orderly structure and rigid standards for readability, maintainability, and flexibility. It is difficult to instill in the beginning COBOL programmer an appreciation for these characteristics in his own programs; such appreciation for absolute clarity often comes months (or years) later when the programmer returns to review his own programs or those written by others.

Developing programs with the characteristics of readability, maintainability, and flexibility should be the primary objective of COBOL program design. This is not to imply that considerations of machine efficiency should be ignored, but rather that such considerations should take place within the constraints of an orderly, well-structured program design. There is little incremental cost associated with the structuring, and the degradation in execution speed is minimal. Even if structuring did cause a significant de-

gradation in machine performance, improvements in other areas, especially in flexibility, would still make it the preferred design. Macroefficiency, in the form of flexibility, is obtained with little, if any, compromise in microefficiency (machine efficiency).

A set of standards useful in deriving the advantages of structured programming for COBOL, while not seriously altering standard COBOL techniques, is suggested here. Imposing specific standards and guidelines for structuring the DATA DIVISION and PROCEDURE DIVISION of COBOL programs will help programmers write more orderly and understandable programs, and need not inhibit creativity. Nor does this approach require a complete relearning process by experienced COBOL programmers, although their discretion in some areas will be limited.

Program design objectives

One overall objective of structured programs is to allow difficulties in understanding them to increase linearly rather than geometrically with increasing length of the program. This is achieved by requiring that logic modules *not* be interrelated with all other modules; otherwise a combinatorial growth in understanding difficulty would result.

This objective leads to a single-entry, single-exit, independent module structure. Desirable flexibility and responsiveness are gained through this structure. Programs are more easily tested and debugged. They are easier

to maintain and modify. And there are advantages both for the initial program design and for the writing effort.

In the initial design phase, the functional logic of a module ("black box") may be divided into subfunctions without affecting the module's interface with the rest of the logic modules. This subdividing and the resulting more detailed functional definition continues until all definitions are detailed enough for the coding level. This is the top-down approach to program development. In the maintenance and modification effort, a module may be replaced by a more efficient module for the same function, or by a modified function module—again without changing its interface with the rest of the logic modules. All this, of course, requires independence among the modules.

PROCEDURE DIVISION

The primary objective of the PROCEDURE DIVISION portion of a COBOL program is to present the processing statements in such a manner that they are easily understood by a new programmer, or by the original programmer later in time. Readily understood statements also make debugging, maintenance, and modification easier. This objective can be satisfied with relative ease within the existing COBOL language by applying certain standards to the programming effort. It is not intended that rigid structured programming concepts be imposed for their

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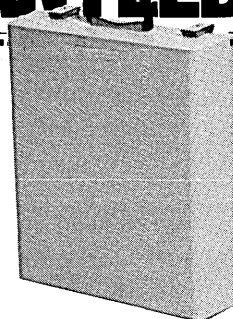
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STRUCTURED PROGRAMMING IN COBOL

own sake, but rather to carry over advantages offered by such concepts into COBOL. Efficiency considerations also apply within such design objectives.

In order to provide specific means for meeting this objective, the following standards are suggested:

1. All coding logic should be developed in a top-down manner using PERFORM statements to control execution of the levels of detail. All forms of PERFORM statements are allowed.

2. GO TO's should be allowed only to transfer within a logic module which is restricted to a single paragraph plus an exit, if needed. Specifically, a GO TO can only transfer control to the beginning of the paragraph containing it, or to the common exit of that paragraph. Since the transfer to the beginning of a paragraph will occur only within a conditional statement—otherwise the statements following it in the paragraph could never be executed—it represents a variation of the formal DO-WHILE construct. The alternative to allowing this backward branch would be switches to communicate with a higher level controlling paragraph for the DO-WHILE operation. One form appears as explicit as the other; the preference here is to eliminate flags and switches wherever possible. Allowing this backward branch of the GO TO will significantly reduce the need for nested IF's and PERFORM's.

3. Modules should be functional in nature with one, or at most, a few logically related logical operations. The scope of a module should be small enough that its logic might be readily grasped at one time.

4. Modules, insofar as possible, should be made logically independent of each other. Any switches or flags may be tested only in the mainline logic, never in a subordinate logic module.

5. All conditional statements should use indentation to show the range of the true and false conditions. This will also highlight misplaced periods.

6. Nested IF's should not be permitted. Although they are sometimes very convenient, generally they are detrimental to easy understanding and modification. If nested IF's are permitted, the levels of nesting should be restricted. Three levels would more than suffice for the type of programs that are written in COBOL.

7. Only one statement should be written per line.

8. All paragraph-names and data-names should be descriptive. Data-names carry a two character prefix in-

dicating the 01 record containing them. Paragraph-names carry a three digit prefix indicating the page location of the paragraph-name on original coding sheets. This would allow one to immediately determine the vicinity of the physical location in the program of the referenced paragraph-name.

9. For efficiency and readability, all tables should be accessed through the use of indices rather than subscripts, using the SEARCH or SEARCH ALL verbs where possible.

DATA DIVISION

Certain conventions may be adopted to improve the readability of the DATA DIVISION component of the COBOL program, and the efficiency of program execution. The conventions discussed here assume a variable word-length computer with a packed decimal instruction set.

The recommended conventions are:

1. All record formats to go to the printer are laid out separately in WORKING-STORAGE. This allows preformatted heading, detail, and total lines where only the variable data in the line must be inserted before writing the line. Doing this improves readability since the lines are shown completely in WORKING-STORAGE, and the efficiency of program execution can be improved by minimizing the need for blanking out areas and formatting them at execution time.

2. *Data-name convention:* All data-names must be descriptive of the data contained and carry a two character prefix to identify the record (level 01) containing them. This is true in both the FILE SECTION and the WORKING-STORAGE SECTION. For example,

```
01 MASTER-REC
02 MR-EMPLOYEE-NO
   PIC X(9).
02 MR-LAST-NAME
   PIC X(20).
   ETC.
```

The convention improves the readability of the DATA DIVISION. It facilitates the location of the data-name, and avoids errors and confusion on similarly named fields.

3. *Numeric field conventions:*

a. Only fields used in arithmetic operations will be defined as PIC 9's fields. All other fields will be defined as PIC X's fields, so that compares on these fields will be handled as character compares rather than decimal compares. This convention has the advantage of preventing data checks from occurring needlessly on compares of numeric fields.

b. All numeric fields used as counters and accumulators will be placed under one 01 record in WORKING-STORAGE. The following rules ensure efficient arithmetic operations:

(1) Assign a USAGE of COMP-3 to

this 01 level, so that all fields may be used directly in arithmetic operations. Otherwise, packing and unpacking will be required with each arithmetic operation.

(2) Sign all PICTURE's, even if the field can contain only positive values. Otherwise, the sign must be stripped off every time a value is stored there.

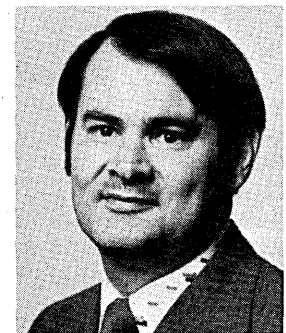
(3) Make all fields an odd number of digits to provide byte boundary alignment.

(4) Insofar as possible, specify the same number of decimal (fractional) positions for all items used in conjunction with one another (arithmetic or compare operations) to eliminate the need for instructions to align decimal points.

Conclusion

The standards and conventions proposed here provide a means of deriving the benefits of structured programming within the existing COBOL language. Used properly in program design, the top-down independent module approach should produce COBOL programs that have fewer bugs in the initial program, are easier to test and debug, and can easily be modified with minimal impact to the other logic modules. The standards discussed here conform generally to the nature of the COBOL language and do not try to force onto it constructs that are not natural to the language.

A fair warning to the reader: strict adherence to *formal* structured programming logic constructs in COBOL, on the other hand, will not always produce the desired results. As a matter of fact, such adherence, with its forced structure and nesting, may at times result in logic that is less understandable and less flexible when applied to complex programs. But all in all, the benefits provided by the standards proposed here would certainly seem worthwhile for a large portion of COBOL programming. *



Dr. Mize is both assistant professor of information systems at Georgia State Univ. and a consultant. In the dp field since 1961, he was previously with IBM and Lockheed-Georgia Co.



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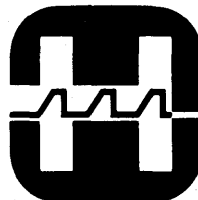
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How Many Directions is Top-Down?

by Dennis P. Geller

Top-down design is more a way of looking at a problem than a rigid method for implementing a solution.

"Where's the top?" "Which way is down?" Beginning to use a technique like top-down design and implementation is a little like climbing a mountain in the fog using unproved equipment.

With the top-down approach, there are the problems of learning new techniques and adapting them within the existing framework of an organization. The top-down approach is a successful technique—it does work—but a number of other techniques, probably including ones presently used in most installations, also work. Given the time it takes for people to become comfortable in their use of *any* of the new programming methodologies, is it really worth dropping the techniques now being used in favor of going top-down?

There is, in fact, no conflict. True, breaking into the top-down approach will take time, but it need not involve throwing out those techniques which are already helping to develop correct and modifiable code. The top-down approach has suffered from the same false myth that has plagued the acceptance of other "structured" techniques. Just as there is no fixed set of rules for producing structured code—no program that can be bought from a software house which measures how structured the code is on a scale of zero to ten—there also is really no such thing as "pure" top-down. Top-down should really be considered as a strategy, not a single universally applicable technique. There are many techniques, and many problems, which fit easily with the top-down philosophy, and each such technique gives rise to a different top-down method.

Advantages

Let's review. Top-down essentially means proceeding by refinement. At each level, the function to be performed is defined and then expressed in terms of functional units at a lower level, continuing the process until the

level is reached at which one can write directly in the source language. (Of course, a number of techniques have been suggested for developing these functional statements at each level; each serves as a tactic within the top-down strategy.) This approach can be applied at any stage of the programming process—design, coding, or testing—but one of its real strengths is the way that it lets the stages be combined. For example, once a certain module has been defined, it can be put directly into code and tested.

The functional parts which comprise the module will eventually be subroutines, paragraphs to be PERFORMed, or macros—and for these, subroutines (or paragraphs or macros) called *stubs* can be substituted. The stub has the same name as the object it substitutes for, but doesn't perform the actual function it represents. What it does do is provide sufficiently similar input-output behavior to fool the module which references it. This lets one test the module in operation first by itself, and then plugged into the rest of the system as developed so far. One advantage of this *phased* approach is that at every point there is a partial system which works; it shows the analyst and programmer (and the customer) a pretty good picture of what the final system will do, and serves as a test-bed for the next module to be completed. A second advantage is that if problems in the design are discovered during implementation, the work of developing a two-volume design document has not yet been done, and therefore does not have to be completely scrapped.

There are other advantages as well: don't be misled into believing that this brief review is a complete description of top-down. The top-down approach is much more adaptive than we may have indicated. For example, top-down neophytes commonly ask, "But what happens if I don't really know enough about the system even to get started

top-down?" Top-down certainly allows for, in fact encourages and gives support to, doing the research necessary to make an intelligent start.

Allowing for changes

Let's dig a little deeper into the top-down philosophy. One of the factors which led to its development and acceptance is the simple fact that the requirements of systems usually change before the project is finished. The customer gets a new idea, the machine architects substitute paper tape drives for card readers at the last minute, the IRS demands a different form for reporting withholding tax. Change is inevitable, but it doesn't have to ruin the project (or the product). In the same way that a project schedule must provide for employee turnover, sickness, unplanned vacations, and even the coming of spring, a project can be planned to adapt to changes. The top-down approach allows planning for—and with—changes by postponing development of the most volatile system components until they become as stable as they ever will.

But what if the function of the system is the thing that's likely to change. This isn't as ridiculous as it sounds. Suppose for example that the project is the development of a command language interpreter for a file system. A top-down approach which is often successful in such projects involves orienting the top parts of the structure to the structure of the command language. But suppose that the language is likely to change, perhaps because the customer has started a study of how well programmers like the language as currently designed. Clearly, a different "top" must be found. It might well be the bottom. Much of the top-down philosophy still applies: there is such a thing as doing top-down bottom up. We might start with low level routines, exercising them through test harnesses (which work like upside-down stubs)

TOP-DOWN

and then build up to higher levels, using the already tested bottoms beneath them and test harnesses above them.

This technique has many of the benefits of the "pure" top-down approach. One which it does lack is refinement: going bottom-up loses the logical progression which top-down provides. However, if the bottom is the only stable part, bottom-up is better than staring at the walls. In less extreme cases, though, one of the top-down variants may prove to be more beneficial than strict bottom-up (or strict top-down).

The top-down approach is especially helpful in letting us isolate critical parts of the problem, whether they are part of the function of the system, such as an algorithm which must be especially efficient, or part of the environment. One environmental factor, the inevitability of change, is already controlled by top-down. Other versions of the top-down approach are intended additionally to address other critical factors.

For example, it might be the case that the system being built must be extremely reliable. Here a simple variant of top-down techniques can be extremely successful in helping to structure the testing. First construct the system in the usual top-down manner,

testing each module alone, and then as part of the system with stubs. Even though stubs are only pale substitutes for the modules they represent, they usually are successful in system testing.

But, for extra reliability, rip the system apart and start the testing all over, bottom-up. Take the lowest level routines and exercise them with test harnesses. Then, as if the top-down testing had never happened, build up from the bottom, encapsulating each stage in a test harness until you reach the top with the system put back together. In this way each module has its interfaces tested in two different directions, and any problems not caught by the first testing phase are likely to be caught by the second. Of course when necessary, the same procedure can be used with the phased design and implementation going bottom-up and the secondary testing going top-down.

Speed techniques

Another common criterion is development speed. Rushing through system development is certainly not the choice way to get correct programs, but there are times when there is no alternative. There have been two related techniques proposed for such situations, both relying on the fact that interactive programming can be faster than batch, without necessarily sacrificing quality. (Both approaches have also relied on the use of APL, although

it is likely that any quick, and easy interactive language would work as well.) The first technique is essentially what engineers call "breadboarding"—building up a working model. Here one proceeds top-down in the development phase, but does the development in APL rather than in the target source language. When the system is complete, it is translated to the target language.

This seems like a lot of extra work, but has had surprisingly good results. Increases in system development time by a factor of 50 have been reported. Of course, the technique doesn't work very well if the APL code is just another version of Egyptian hieroglyphics. The APL code must be written in a fairly structured manner to be easily translatable. An advantage of APL is that, having to control structures of its own, it is easily adaptable to mimic those provided by the target language. It is also easy to simulate the special built-in functions provided by the target language.

An added benefit of this approach is that doing the project in two different languages may expose the problem to a much more language-independent scrutiny, with corresponding gains in understanding, and hence ultimately in performance. Naturally, if the completed APL system is kept around after the project is finished, it serves as a test-bed for further modifications.

A second technique also takes advantage of the ease of working interactively, and especially of the ease of debugging. This variant of the bread-board approach has one working in both the target language and APL (or some other powerful on-line system) at the same time. When a module has been coded, it is immediately translated into APL (again, this requires good code structure on both sides) and tested both in isolation and plugged into the part of the APL system already tested. Most, in fact probably all, logic errors will be found, and found faster, with the APL version; the changes can be made and then translated back into the source code. (It is worth noting that stubbing is generally much easier in APL than in any other language.)

Of course, we would test the source version fully anyway, but even with full testing there will be little if any time-consuming batch debugging. This technique also, at the end, provides both a working APL version to develop modifications on, and the richer understanding gained by dual language development.

A number of problems do not really develop smoothly by refinement from top to bottom. Often, there is a smooth flow until about $\frac{2}{3}$ the way down, and then the problem changes form radically. As an example, consider the command language interpreter mentioned



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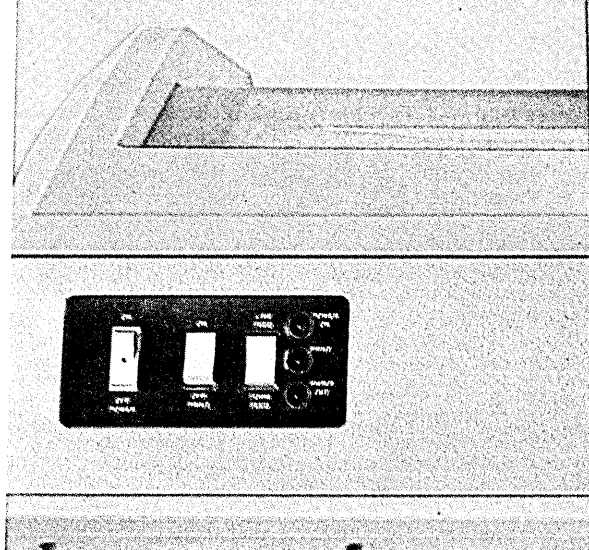
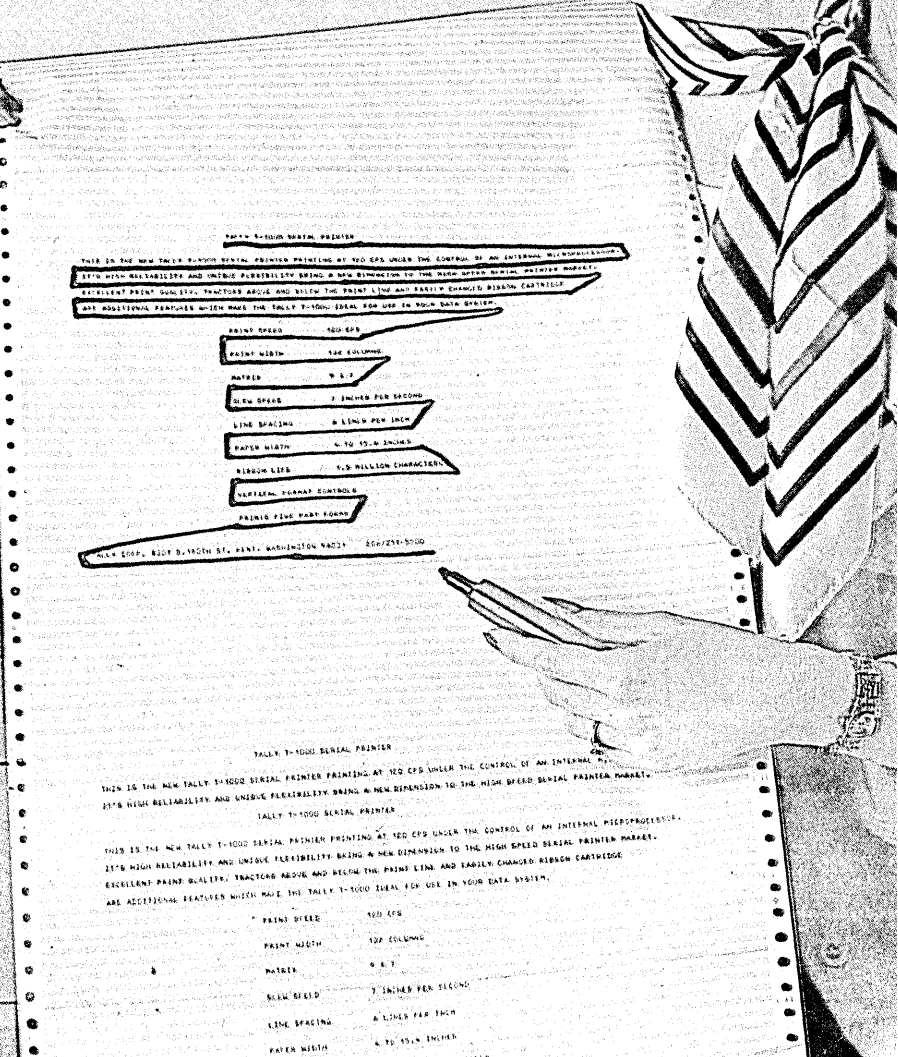
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earlier. The problem has one form from the top until the basic file operations are reached, and quite a different one as the details of the file manipulations are developed. What might be most appropriate in such a case is to have two top-down projects going, possibly at the same time. One project would be to develop the virtual machine upon which the command language interpreter will rest. That is, what would be developed is the code which implements the sorts of requests that the language will make of the system. The other project involves working down from the top, implementing the language interpreter, but aiming towards the virtual machine developed in the other project. This sort of break at a virtual machine level provides a good deal of flexibility, depending on one's knowledge of the system.

If one is pretty sure what the virtual machine will look like, he can start by developing that. The language interpreter can wait if its structure is unsure or if some experimenting is needed before ascertaining that the virtual machine is designed properly; or the development can go on concurrently.

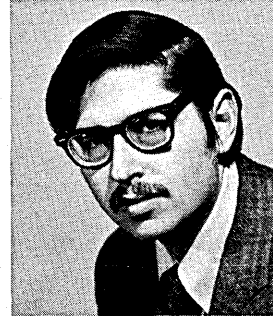
On the other hand, if the language itself is clearly defined, start there, but

possibly let a few people on the team try to develop some prototype virtual machines to get a better understanding of the problems involved at that level. This approach may require some minor refinements of the interpreter, as it may need modifications at its lowest levels to fit the structure of the virtual machine. However, proceeding in this manner will keep such modifications minor, and they will not have major effects on the whole system.

As already noted, going top-down provides a partially functional system at all times. But one gets vertical function with the lower levels stubbed, and that isn't always sufficient. For some projects it would be more convenient to have partial function in the horizontal direction—a little bit working at each level. This can be achieved by a top-down version implementation. Here a few functions are isolated, and a prototype or version developed, again working top-down. This can be especially helpful in making size and timing (and development) estimates for the complete system. Then, starting with this version, one can move diagonally: as new features are added, one is moving horizontally, but since levels are still expanded by refinement, one is also moving top-down.

These are a few useful variants of top-down. There are many more: some

may be created by combining the ones already discussed, some may come naturally from a consideration of the quirks of individual problems. If the basic principles are kept in mind—phased design and implementation, use of independent functionally defined modules, proceeding by refinement, isolating sections which are volatile or otherwise critical—one should be free to experiment safely with top-down variations. *



Dr. Geller is a senior analyst for Massachusetts Computer Associates, and is also associated with Ethnotech, Inc. and Yourdon, Inc. He is the author (with Daniel Freedman) of "Structured Programming in APL" (Winthrop Publishers, 1976), and (with Gerald Weinberg, Tom Plum, and Naomi Kleid) of the film series on "Structured Programming" produced by Edutronics, Inc.

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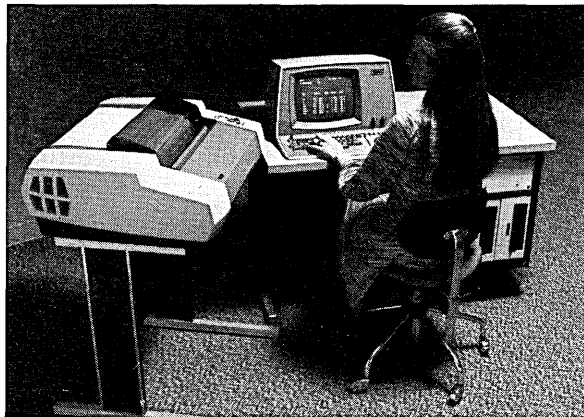
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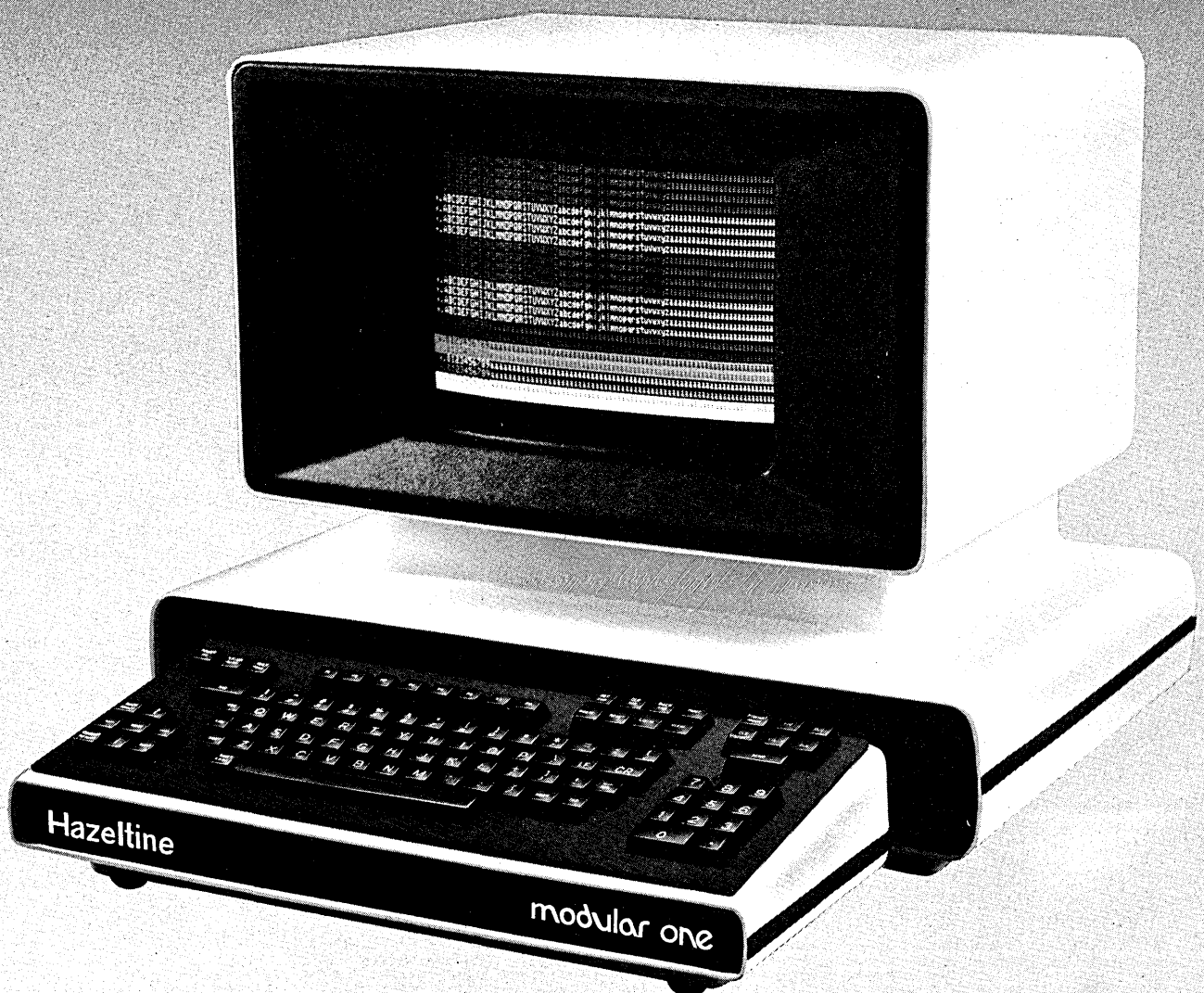
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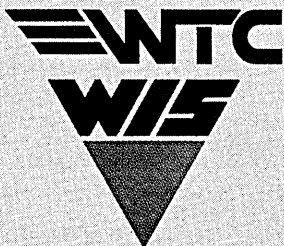
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Problems and Predictions for Communications Processing

Expenditures for data communications will overtake those for data processing by around 1978, and by about 1980, AT&T's revenues from data communications will exceed those from voice communications.

These were two of the points made by Edward A. Collyer, the telephone company's product manager for data network services, at a conference on "Federal Government Data Systems, 1976-1978," sponsored by the American Institute of Industrial Engineers in Washington, D.C. this past April. Collyer, who said his projections were based on recent AT&T studies, also shed additional light on Bell's thinking regarding a "communications processing service."

He emphasized that the company, at the moment, has made no final decision about offering such a service, but indicated that one is likely within the next few years. When questioned, he said the timing would depend at least partly on "how fast users migrate to the new digital networks."

Collyer also said it's technically possible for Bell's ESS switches to support "communications processing" but he doesn't know whether it's "economically feasible."

"Communications processing," as Bell defines it, includes formatting of bits for display as lines of crt characters, frame and field editing for these and other terminals, speed conversion, error control, polling, and several other functions. Communications processing, the telephone company contends, represents one of three elements of data communications. The other two are "transmission"—the movement of bits over a communication channel—and "media conversion," the transformation of human-readable input into bits as well as the reverse conversion of the bits into human-readable output. The main difference between communications processing and data processing, claims Bell, is that dp changes the meaning of the bits while cp doesn't.

Collyer presented the figures shown in Table 1, projecting total user expenditures for transmission, media conversion, and communications processing over the next 10 years. They are also based on AT&T studies. The totals indicate that what Collyer calls the phone company's "potential market" was worth \$5.5 billion at the end of 1975, and is expected to be \$12 billion at the end of 1980, and \$22.5 billion at the end of 1985.

In his remarks about a "possible"

communications processing service which "could be" marketed by a carrier, Collyer said the offering should:

- include store-and-forward capability;
- provide partitioning into sub-net-

	1975	1980	1985
Transmission	\$1.7 billion	\$3.2 billion	\$ 5.5 billion
Communications Processing	\$1.7	\$3.5	\$ 7.0
Media Conversion	\$2.1	\$5.3	\$10.0

Table 1

works dedicated to individual users or user groups;

- interface with all existing types of terminals, communication speeds, and modes, as well as with independent networks and the telephone company's dial-up system;
- offer multiplexed host connections, abbreviated and broadcast addressing;
- include design, maintenance, and administrative support—e.g. traffic, facilities-utilization, and other reports.

Asked where such a network service might be offered first, Collyer said the likeliest applications include those involving on-line service bureau time-sharing, other types of on-line inquiry-response, and jobs requiring a lot of message switching.

The competition

Data communication consultant Lynn Hopewell, another speaker at the conference, contended that Datran and MCI aren't likely to survive but the new value-added carriers—like Telenet—have much brighter prospects.

His basic point was that Datran and MCI "are offering no essentially new services," and are competing with Mother Bell on a price basis. "There is no reason to believe that the Bell System, if pricing is based on cost, cannot deliver basic transmission services as cheaply or cheaper than any other organization." Investors are aware of this, he added, and so Datran and MCI will have increasing difficulty finding the money they need to continue operating. ITT and Southern Pacific Communications, since they're less dependent on outside money, have a better chance of survival, Hopewell added.

The value-added carriers (VAC's) are in the best competitive position, he indicated. "Since they do not build capital intensive transmission facilities, their capital requirements are much lower than the other scc's (specialized common carriers). Additionally, they are offering a completely new service

concept directly tailored to the user's need to move data."

The scc's "have assumed that the telephone companies' artificially-high pricing of private line data services . . . was more-or-less permanent," he ex-

plained. "They underestimated the ability of the telephone companies to adjust, and the impact of the adjustment on their own market share and viability."

Future datacom technology was discussed extensively at the meeting.

Hopewell believes communication satellites promise a big reduction in transmission costs, but he said these benefits are still a couple of years off



H. Matting

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IN CONGR

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PROBLEMS

because techniques for coping with satellite transmission delay and for sharing circuits efficiently—i.e. through demand-assigned, multiple-access (DAMA) switching—will take that long to be implemented on a widespread basis. He thought the implementation of a standard packet communications protocol (see May, p. 187) would also be a stimulant because it will simplify communication between dissimilar types and makes of terminals. In addition, the structure of the new protocol, which segregates the components of a datacom network into discrete layers, will limit the "ripple effect" produced by modifying a particular hardware or software component.

Another stimulant to use of packet networks was mentioned by Dr. Lawrence G. Roberts, president of Telenet Corp., when he described how they permit individual transactions—credit card sales, for example—to be individually and automatically routed to the final processing point. Now, he explained, this data has to be collected and sorted by computers at some intermediate point. Packet technology, by combining sorting and transmission, enables the user to eliminate a substantial expense, he said.

Another speaker, R. L. Sharma, a senior technical staff member at Collins Radio, predicted that by 1985, "we should have an affordable intelligent terminal built around the ubiquitous telephone, consisting of microprocessors and associative memory, and capable of electronic mail, banking transactions, mathematical computations, call-holding and call-forwarding." He also thought packet radio will become an important data communication device by then, along with CATV.

Collins is working on an experimental packet radio system, under a Dept. of Defense contract, which is about to be installed and tested, he reported. The basic architecture can consist of either small, handheld or larger mobile terminals with a range of about 15 miles, which can communicate with terrestrial and/or satellite networks through unmanned repeaters that transmit up to 30 miles. "Data exchange, digitized and packetized voice communication, scientific data processing, and bank fund transfers are all possible" through such a network, he explained.

Much of Sharma's talk, and that of Frederic G. Withington, a senior consultant at Arthur D. Little and a *DATAMATION* contributing editor, concerned future system architecture. Sharma pointed out that most existing networks are centralized and it is in the interest of the telephone companies to

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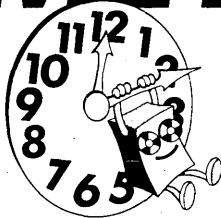
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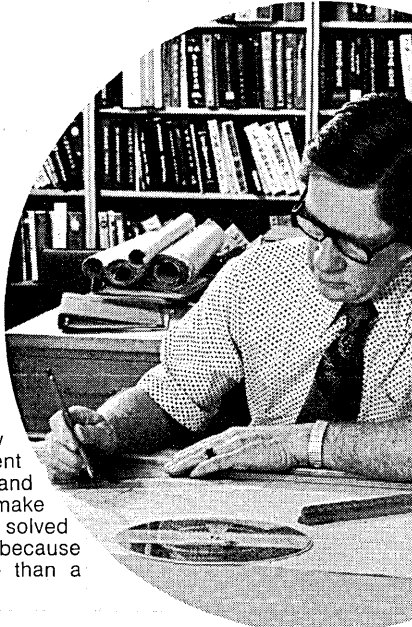
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CIRCLE 127 ON READER CARD

PROBLEMS

perpetuate this centralization. As he put it: "Telephone companies will continue to install more and more logic at the central offices . . . where they can control . . . it." He cited AT&T's recent statements about possibly offering its value-added "communications processing service" as an example of this approach. The phone company has indicated that if the service is offered, the logic to support it will be incorporated into the electronic switching systems (ESS's) now being installed at Bell central offices.

But Sharma indicated that market forces will create pressure for distributed, hierarchical datacom networks.

One such force is the user's demand for a service he can customize to meet his own requirements; an intelligent terminal that encompasses as many value-added functions as possible represents the logical way to satisfy this need.

Another force is the emergence of a new type of vendor—represented by the independent value-added carrier—who operates between the telephone network and the user, markets a service that competes with offerings like "communications processing," and therefore shares the user's interest in decentralizing flow-control, speed- and code-conversion, formatting, editing, and related network functions.

Sharma and Withington agreed that by the 1980s, these forces, plus the declining cost of memory and logic circuits will produce complex switching nodes composed of specialized minicomputers dedicated to specific functions such as processing, communication line control, local and remote concentration, and I/O device handling. Depending on the size of the network, there will be a hierarchy of nodes, and the resources within each will be shared by a number of users through terminals which have at least some local computing capability.

"After a user has installed one of these computer networks, it will no longer be possible to distinguish individual systems clearly by either boundary or size," said Withington. "There will be many modules, some collected into centers and some geographically dispersed, but all interconnected. The user will no longer be able to replace the entire network with a catastrophic upheaval. However, it should be easy to replace, or add, a module as long as it is compatible with the system software, which is completely responsible for the user's interaction with the network and which has become the computer industry's most important product."

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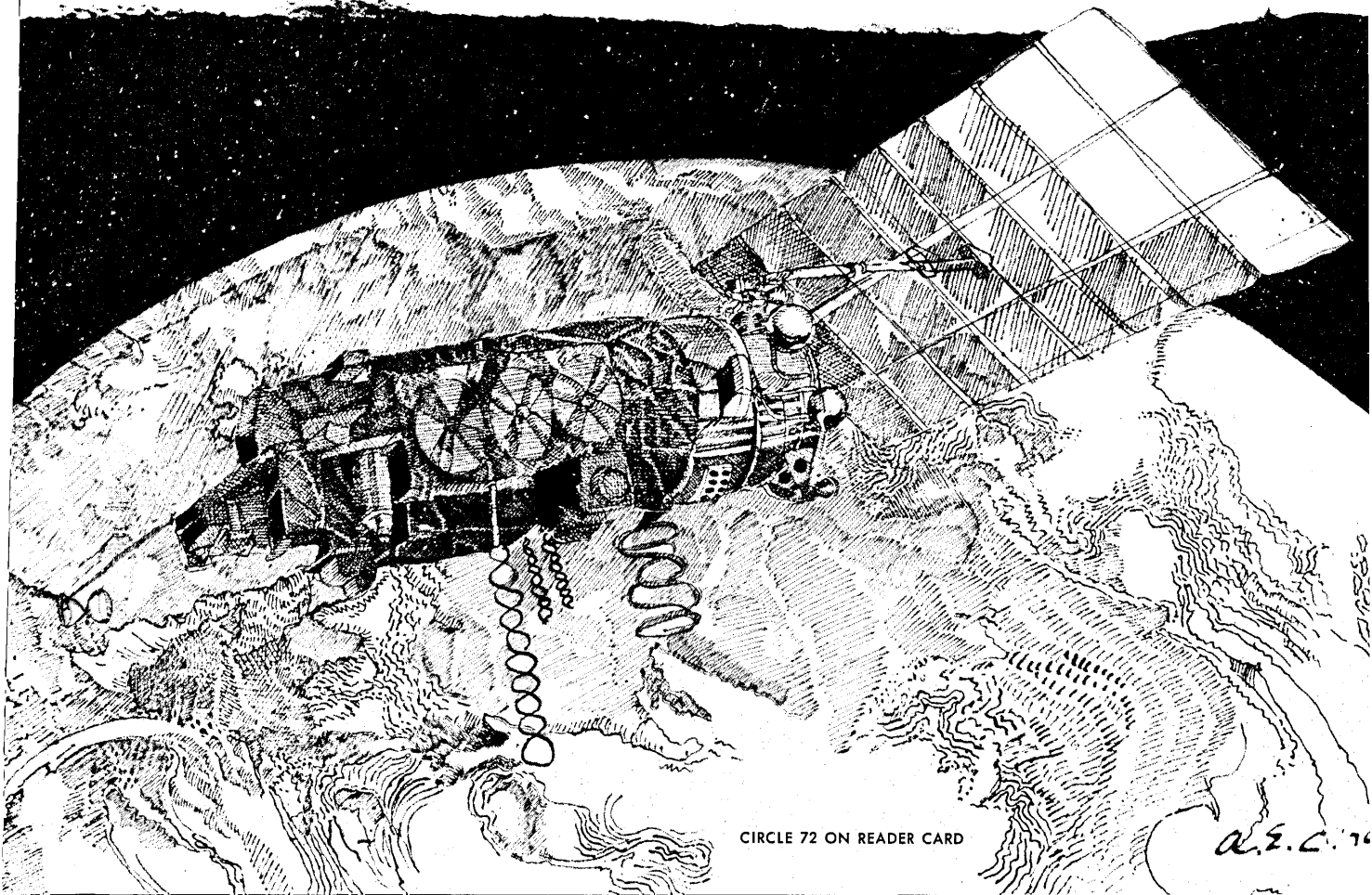
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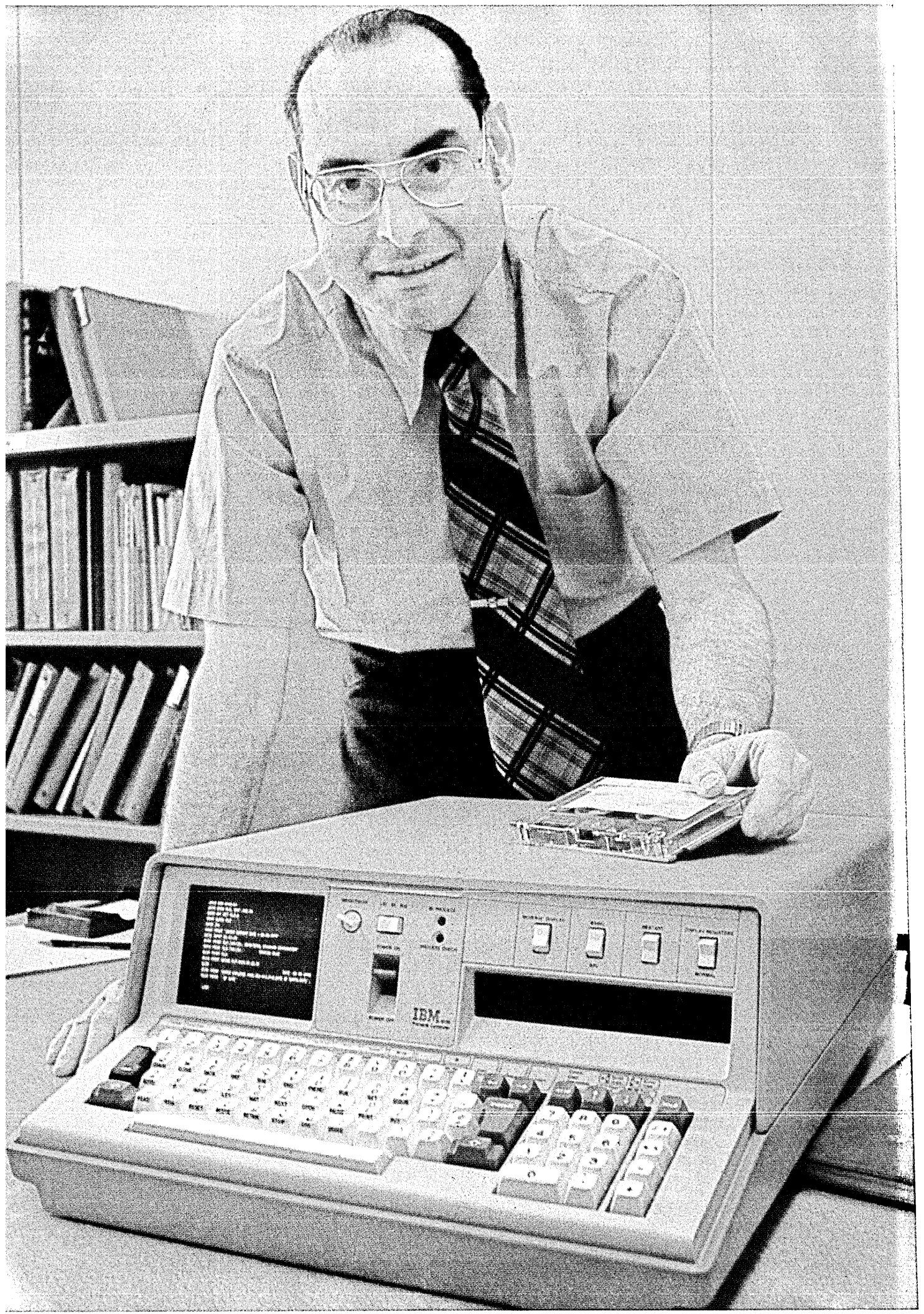
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CIRCLE 102 ON READER CARD

Computers, Law, and Language

You really ought to quit writing notes and memos to each other, and to yourselves, and rely more on verbal communications and memory. If your company should become involved in a lawsuit—say, with one of your dp suppliers—those written internal communications can be retrieved by your opponents, much to the detriment of your case. To see the truth in this, one need only look at the government's current antitrust action against IBM and the latter's internal documents that have become an embarrassing part of the public record.

"I think data processing is particularly prone to this problem because there is a tendency to want to document everything and record what's going on," says attorney Richard L. Bernacchi. He advises against such written communications. "It's a practice that can be particularly troublesome to a lawyer who is trying to litigate the case."

Bernacchi, of the firm of Irell & Manella in Los Angeles, tells of a client who discussed the handling of litigation in a closed meeting where minutes were kept. Those minutes were accessed by the other side during the discovery phase, and the trial strategy thus disclosed.

The attorney was on a panel that discussed problems in litigation at the first West Coast conference of the Computer Law Assn., held in April in San Francisco. Some 150 registrants showed up for the day-and-a-half conference, most of them lawyers and law students but many from computer user organizations and a few vendors, as well.

Problems with the dp language received a good deal of airing at the meeting. Bernacchi said that because people have a different understanding of the meaning of the same dp terms, it's important that an attorney talk to a number of different people to get their versions of an event. Despite the lack of standard definitions, he added, people tend to assume that other peoples' understanding of a term is the same as their own.

Co-panelist George T. Caplan, of the same firm, commented also on the complexity of technical terms. "The most simple concepts in the industry are difficult to present to a judge or jury," he said. "The language problems cannot be underemphasized."

The subject was highlighted by Gerald H. Larsen of Unicorn Systems

Co., who noted both the lack of a standard definition for terms and also the fact that the language is in a constant state of flux. As a reference source for attorneys, he recommended the "IFIP Guide to Concepts and Terms in Data Processing," published in 1971 by the North-Holland Publishing Co., but available in the U.S. from AFIPS. Larsen suggested that lawyers and people in dp foster some group that will develop a definitional and communicative document of industry terms.

An earlier panel discussed the intricacies of contracting for a dp system from a hardware vendor and software from a separate supplier. Among other problems considered were vendor incentives. Roy N. Freed of Pollock, O'Connor and Jacobs in Boston said he was generally opposed to any provisions for incentives for early completion of work or for early delivery. From the customer's point of view, he said, it is better to negotiate a fair agreement without mentioning incentives. He explained that incentives can be mentioned in a contract only if the customer stands to gain appreciably by the early completion of a product or by a level of performance much higher than usual. Otherwise, he warned, the customer receives only regular performance for his extra dollars.

Freed favored acceptance testing and performance criteria as parts of contracts, but warned attorneys to get into the definitions of these things early in the process. He said it is time-consuming and expensive to come up with these specifications. "I feel objectively that, many times, working at that nerve wracking and expensive activity . . . can be beneficial to suppliers in that it causes the users to identify what they intend to do with the system, what they expect to get from it, and thereby limits the expectations of the users and the exposure of the supplier." A supplier's salesman tends to promise the world, in his sales presentation, and the user couldn't possibly get delivery of such capability.

In a question-answer portion that followed, the panel also discussed the incorporation of provisions that allow the user to insist the supplier replace a part that continually fails. Someone mentioned the analogy of the auto repair shop, which led Freed to quip: "Computer users should not be treated like car owners."

—Edward K. Yasaki

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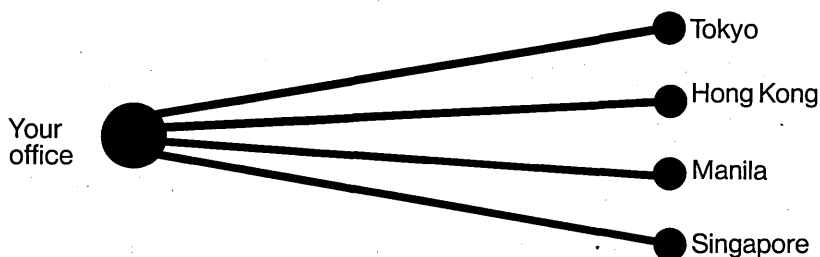
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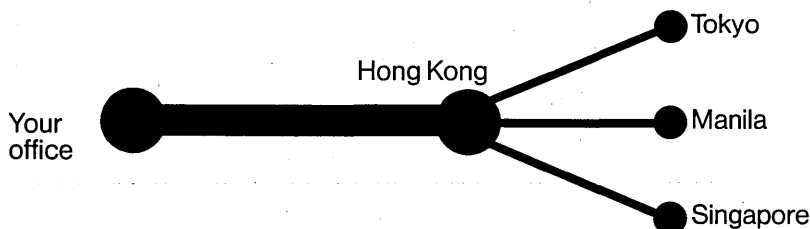
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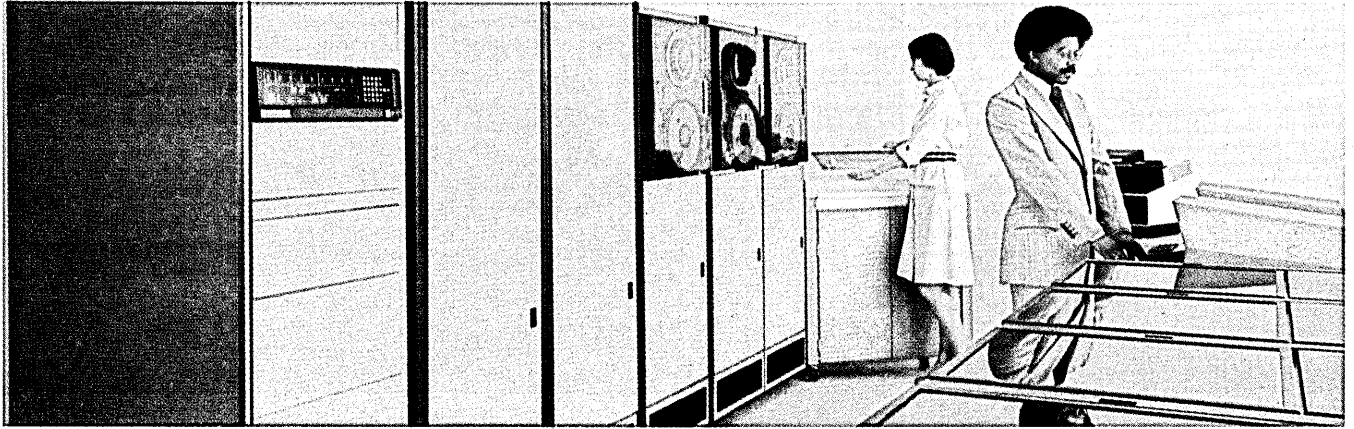
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Cable & Wireless, International Commercial Dept., Mercury House, Theobalds Road, London WC1X 8RX. Tel: 01-242 4433. Telex: 23181.
U.S. Office: Cable & Wireless (NYK) Inc., Graybar Building, Suite 2020, 420 Lexington Av., New York 10017. Tel: 212-889-9020. Télex: 12094.

INTERDATA 8/32 MEGAMINI LIFE SUPPORT



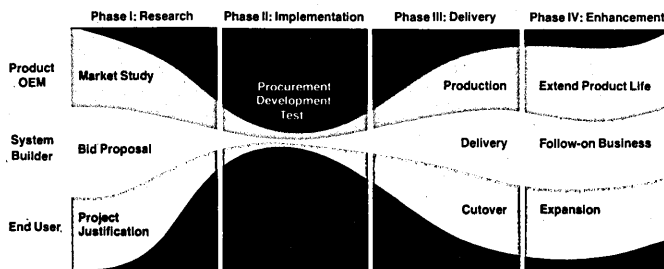
Risk-free computer buying—with power to spare.

You're looking for a computer system so powerful, it takes you over any snags that could cost you extra.

That's why Interdata builds the powerful 8/32 Megamini with 32-bit hardware performance and direct addressing capability of up to one million bytes. With unique software packages that are powerful, flexible and easy-to-use. With Megamini Life Support that means you'll never have to take a risk with:

On-time Delivery. Interdata guarantees on-time delivery of your Megamini. In fact, we've already shipped hundreds of 32-bit computers from production that are completely operational.

Hardware Back-up. Interdata hardware means 32 registers, each 32 bits wide. Fast single- and double-precision arithmetic. Optional, writable control store. And big computer peripherals. It also means that we support you long after your system is operational.



Interdata's computer products and services exist for one reason—to satisfy our customers: The Product OEM, the System Builder and the End User. Each of these computer buyers has a Computer Life Cycle with four specific Phases—Research, Implementation, Delivery and Enhancement. Interdata responds to customer needs during each Phase with Computer Life Support.

Software To Do the Job. Megamini's software optimizes its hardware and gives you a solid systems environment. It includes program development tools like BASIC II, FORTRAN, MACRO CAL and COBOL. And the versatile real-time OS/32 MT (Multi-Tasking) operating system. Megamini software helps you build simple solutions to your toughest applications problems.

No Surprises. Our customer requirement analysis insures that you never have to add more people than you planned on. Or more hardware than you scheduled.

Megamini Life Support. From the moment you decide on Interdata, until you are completely operational, Megamini's capabilities are carefully spelled out. The Interdata/Perkin-Elmer name stands squarely behind every promise with the viability of a \$300 million corporation. With Interdata and the Megamini, you're guaranteed power to spare.

Gentlemen:

Send me more about Megamini power.

My needs are:

___ Immediate ___ 6 Months ___ 1 Year ___ For Reference Only

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone () _____

INTERDATA®

Interdata, Inc.
Subsidiary of Perkin-Elmer
Oceanport, N.J. 07757 201-229-4040

source data

(Continued from page 34)

architects, metallurgists, and other professionals around the world—are computer facilities and a wide range of technical and engineering systems and programs available to help other organizations obtain shipping information, solutions to engineering problems, and presentation of such information and solutions effectively. Charges are on a “cost plus” basis. A 24-page booklet describes the programs, services, and hardware which now include remote job entry and conversational terminals, and graph plotters. LLOYD'S REGISTER OF SHIPPING, 71 Fenchurch St., London EC3M 4BS, England.

Safety Supplies

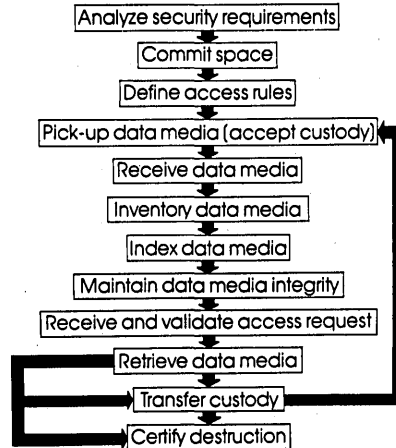
First aid kits, masks, danger and other signs, disposable gloves, safety lights, fire extinguishers, and so on are listed in the 72-page, illustrated catalog of safety supplies. Over 1,000 items are listed which should help organizations meet OSHA regulations. The vendor claims that more than 90% of the items can be shipped with 24 hours. INTEREX CORP., Natick, Mass.

FOR COPY CIRCLE 218 ON READER CARD

Information Security

The 12-page *Information Security Primer* discusses the guidelines for organization of an optimum information security system for data media. Traditional records storage facilities for protection of vital records and data media

INFORMATION SECURITY SYSTEM Flow Chart



are compared to this vendor's Data-guard system, which protects computer tapes and discs, microfilm, and other vital records. BONDED SERVICES, New York, N.Y.

FOR COPY CIRCLE 215 ON READER CARD

Plotting Software

A number of software packages representing this vendor's fully integrated, compatible line of electrostatic plotting software, are described in a 12-page brochure. It is claimed that the Versa-plot software, version 6, reduces core requirements by 20%, triples programming speed, and provides compatible programming among various operating systems and electrostatic printer/plotter models. VERSATEC, Santa Clara, Calif. 95051.

FOR COPY CIRCLE 220 ON READER CARD

Peripherals

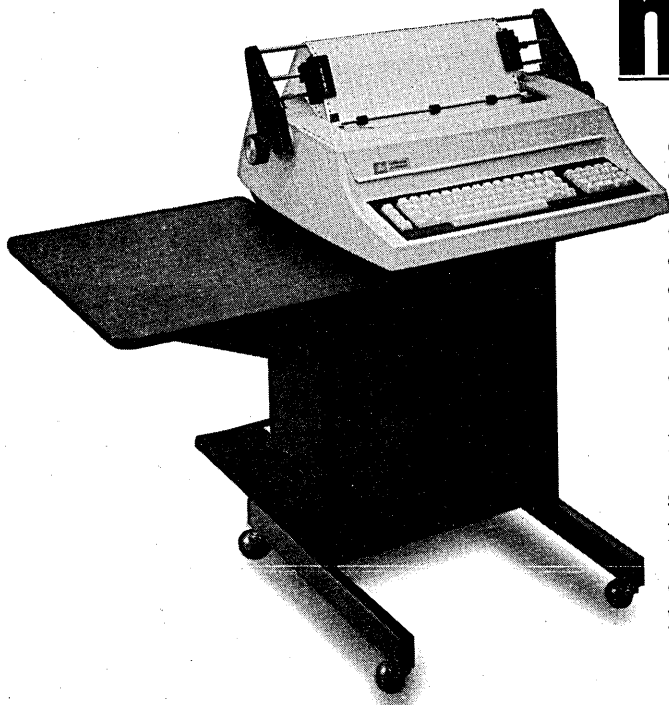
A 10-page illustrated brochure describes this vendor's line of peripheral equipment. Information on this Swedish company's manufacturing facilities and the scope of its products are also included. FACIT-ADDO, INC., Greenwich, Ct.

FOR COPY CIRCLE 221 ON READER CARD

Systems and Consulting

The systems, consulting, and educational services of this vendor are outlined in a brochure. Among those described are *TeleSystems Journal* (a publication with articles such as "How to Choose Data Communications Software," "Managing Real-Time Systems," etc.), STOP (Storage Protection

Let's talk about a brand new Terminal



Here it is! The new AJ 832. This new printer terminal combines high speed with versatility, reliability, and operating convenience. There are plenty of features as well, for example:

- A 256-character buffer memory
- ASCII, EBCD, and Correspondence Codes in one
- 30 or 45 cps throughput
- 17 key numeric pad with programmable function keys
- High speed plotting and plotting software, too
- APL keyboard

There are many options available, too, such as pin feed platen or forms tractor, side shelves, and fan-fold paper trays.

We have a nationwide sales and service organization to stand behind every new AJ 832, and you have the choice of purchase or lease (month-to-month if you wish).

We'd like to talk about everything this new AJ 832 has to offer. We'll start by sending you our brochure. Why don't you circle the number or call us direct.



**ANDERSON
JACOBSON**

1065 Morse Avenue • Sunnyvale, CA 94086 • (408) 734-4030

CIRCLE 104 ON READER CARD

Sometimes there's just no room for error.



It's no different in the computer room.

Perfect performance has never been more important than it is today.

At densities up to 6250 CPI, even the smallest error can compound tremendously because of masking by the GCR format. Ask your Graham product technology man to explain.

While higher densities may help you reduce your library size, the smaller the library the better the tape should be.

Since you could be needing fewer reels of tape now, you can easily afford Epoch 4.

If you want to get more throughput, get Epoch 4.



**GRAHAM
MAGNETICS**

Graham, Texas 76046

CIRCLE 70 ON READER CARD



source data

and Debugging System), FILE (for users of IBM's Customer Information Control System), PADS (Performance Analysis Display System), and particular reference cards. ON-LINE SOFTWARE INTERNATIONAL, Hackensack, N.J.
FOR COPY CIRCLE 217 ON READER CARD

Terminal System

The ICC 40+ Data Display System is described in a multicolored, illustrated brochure, which includes a section on

telecommunications business applications available with the terminal. Features and technical specifications, as well as two models of compatible printers, are included. INTERNATIONAL COMMUNICATIONS CORP., Miami, Florida.

FOR COPY CIRCLE 222 ON READER CARD

Disc Test System

The Siemens DT-334 Disc Test System for certification of oxide-coated magnetic "Winchester" type discs is described in an 8-page brochure. Illustrations and specifications are included. SIEMENS CORP., Cherry Hill, N.J.

FOR COPY CIRCLE 223 ON READER CARD

Numerical Control

This vendor's numerical control tape preparation and communication system, the NC-9, is described in an illustrated, 4-page brochure. The system is designed for off-line editing and on-line computer assist. Applications are outlined, and the printer, the punch/reader module, and other features are detailed. INTERNATIONAL COMPUTER PRODUCTS, INC., Dallas, Texas.

FOR COPY CIRCLE 219 ON READER CARD

COURSES

Computer Network Seminar

A new institute has scheduled Leonard Kleinrock, author of *Queueing Systems*, to conduct a 3-day seminar on computer network design. The seminar will be held in Dallas (July 19-21), Washington, D.C. (Aug. 9-11), and Los Angeles (Aug. 30-Sept. 1). Price: \$485 (includes text, luncheons, and refreshments). TECHNOLOGY TRANSFER INST., P.O. Box 35247, Los Angeles, Calif. 90035.

Reliability and Maintainability

A one-week course for managers, engineers, and administrators in implementing reliability and maintainability programs will be held in Los Angeles (July 19-23) and Annapolis (Oct. 18-22). Price: \$475 in Los Angeles and \$425 in Annapolis (company headquarters). ARINC RESEARCH CORP., 2551 Riva Road, Annapolis, Md. 21401.

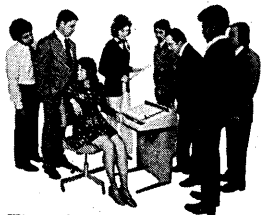
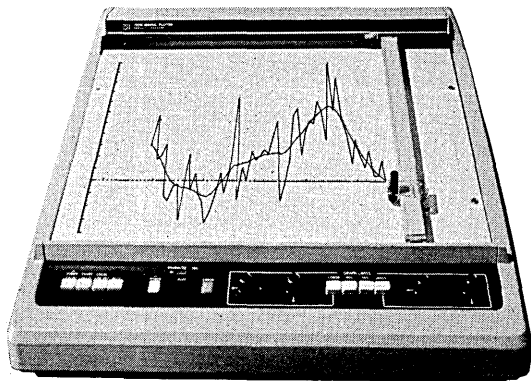
Data Base

Three 3-day courses in as many cities concerning aspects of data base are scheduled. *Management of the Data Base Commitment*, designed for executives and managers, and *Technical Introduction to Data Base Packages*, which includes a "hands on" workshop on five packages: IMS, TOTAL, IDMS, S2000, and ADABAS, are scheduled for New York (June 22-24), Chicago (July 20-22) and San Francisco (Aug. 3-5). *The Minicomputer DBMS* [see the article by Gary Floam on this topic in this issue] will be held in New York (July 27-29) and Chicago (Aug. 17-19). Price: \$375 per seminar (includes luncheons and workbook materials). PERFORMANCE DEVELOPMENT CORP., 32 Scotch Road, Trenton, N.J. 08628.

Summer Institute

Care to study *Structured Programming* from Harlan Mills and William McKeeman? This and other two-week courses, *Operating Systems, Compiler*

Let us show you the drawing power of HP's computer plotters.



Our Graphic Plotters always draw a crowd when they start to work. Everyone around is quick to notice how the plotter reduces stacks of computer data into meaningful charts and graphs.

The plotters work wonders for electronic and mechanical designers. And sales managers, financial people, researchers, chemists or anyone else who uses data from a computer, time-share terminal or computer-operated measurement system.

With a minimum of software, they let you have graphics for engineering, research, marketing and financial problems. On any size paper up to 11 x 17 inches (28 x 43 cm). In red, blue, green or black.

And prices start at just \$3750 (domestic USA price).

For more information on why HP's Graphic Plotters are a top drawing item, write: Hewlett-Packard, 16399 West Bernardo Drive, San Diego, CA 92127. If you wish, you can have a live demonstration just for the asking. Then draw your own conclusions.

11607

**HP Graphic Plotters. Built for times
when a fine line separates success from failure.**

HEWLETT  PACKARD

Sales and service from 172 offices in 65 countries.

CIRCLE 112 ON READER CARD

New Hytype Terminal for OEM's!

Fine print quality, graphics versatility and high speed tabbing.

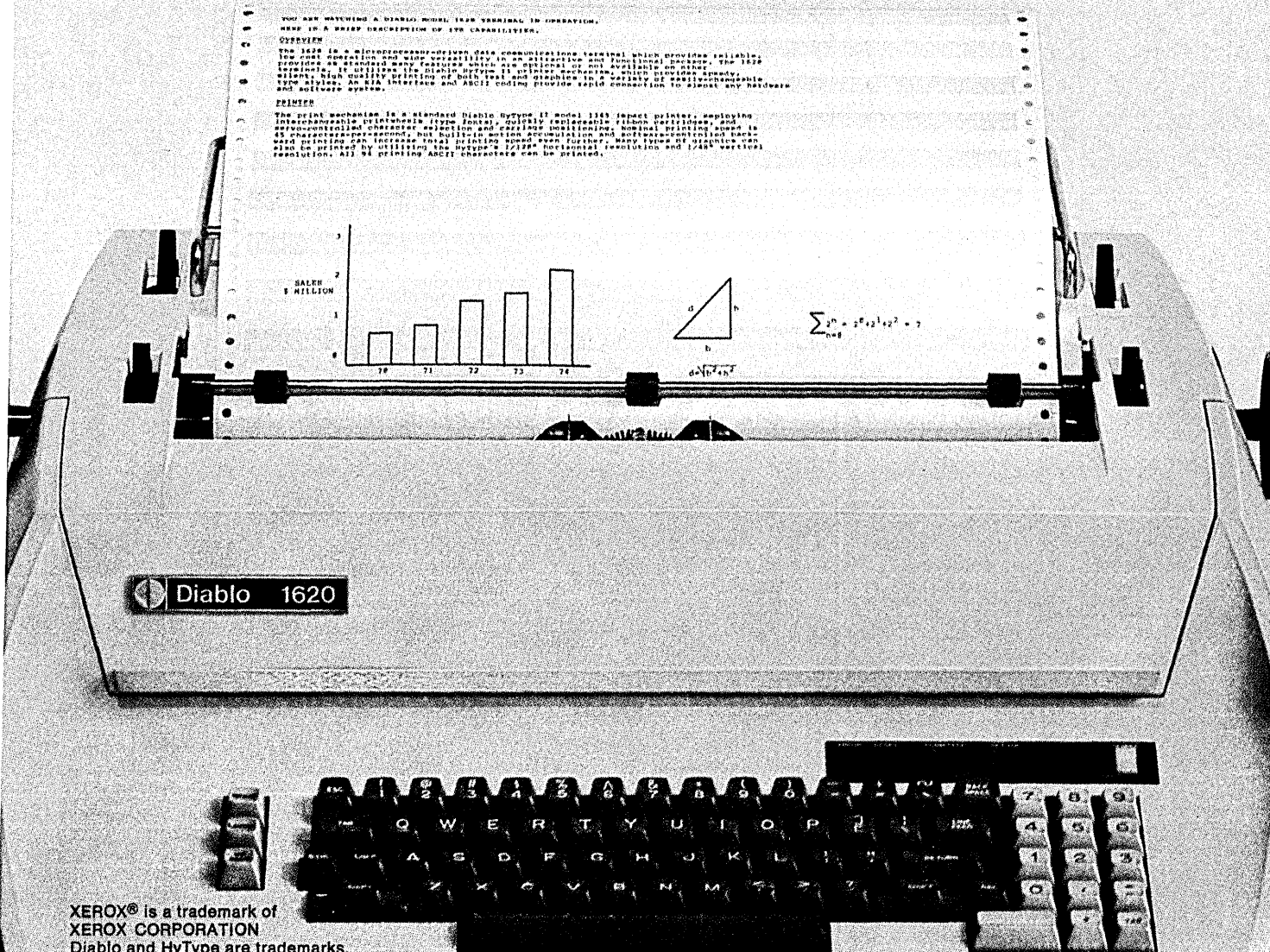
We call it HyTerm and we've given it all the proven HyType reliability and maintenance ease. HyTerm is controlled by a microprocessor for speed, efficiency and versatility. It utilizes the new Diablo HyType II Printer mechanism noted for its typewriter print quality and speed. HyTerm is interface compatible to RS-232C and communicates in standard ASCII code. Both Receive Only (RO) and Send/Receive (KSR) models are available. All logic and circuitry, microprocessor, memory, and power supply are contained within the cover. Printer flexibility is maintained so software can initiate the mechanism's unique graphics performance, and its inherent high-speed horizontal and vertical tabbing and backwards printing capabilities.

Other features: control panel and switches, audible alarm, variable format control, escape-code functions, full ASCII character set, keyboard overflow buffer, 158 character print buffer, and data error detection. Numeric pad, pin feed platen, and form tractor feed options are available. For complete specifications and features, write Diablo Systems, Inc., 24500 Industrial Blvd., Hayward, California 94545, or Diablo Systems, S.A., Avenue de Fre 263, 1180 Brussels, Belgium.



Diablo Systems, Incorporated
A Xerox Company

CIRCLE 25 ON READER CARD



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Diablo and HyType are trademarks.

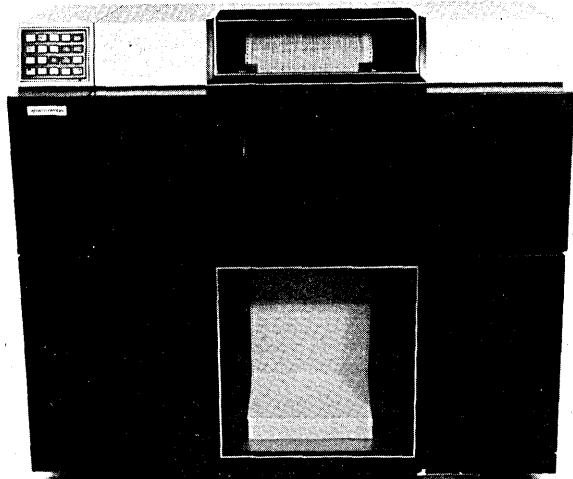
DOCUMATION'S PRINTER/READER/PUNCH: YOUR IBM 360/370 WILL THINK IT'S IBM. THE PRICE PERFORMANCE RATIO WILL TELL YOU IT'S DOCUMATION.

Documation just introduced a new Printer/Reader/Punch Subsystem you should introduce to your IBM System 360 (Models 22 through 85 and 195) or 370 (Models 115 through 195).

When you replace your IBM 2540 Reader Punch and IBM 3211 or 1403 Printer with Documation's new Printer/Reader/Punch Subsystem, your main frame won't notice the difference.

But there are some very significant differences *you* will notice. Starting with the fact that Documation's Subsystem can be tailored to give you as much function as you need.

You can take your choice of two printer models — our DOC 2250 (printing 2250 lpm with a 48 character set) or our



DOC 2250 OR DOC 1800

DOC 1800 (printing 1800 lpm). Either model can appear to your system as either an IBM 3211 or 1403. With some extra advantages thrown in.

Operating in the 3211 mode, the DOC 2250 prints 10% faster than the 3211. That's advantage #1. Advantage #2 is price. The DOC 2250 costs less than half as much as the 3211. Advantage #3 is space. The DOC 2250's integrated microprocessor controller eliminates the need for a separate controller. And because the DOC 2250 has built-in, comprehensive microdiagnostics, maintenance can be done off-line without tying up the host system.

The DOC 2250 also offers: buffered vertical format control including indexing and line spacing; fully-buffered print line; operator-changeable character arrays; a 432-position Universal Character Set Buffer (UCSB) that allows any character set to be used; up to 6-part forms; high-speed paper slew up to 100 inches per second; power cover; power stacker.

The DOC 1800 offers all the features of the DOC 2250, but at a reduced printing speed. And a reduced price.

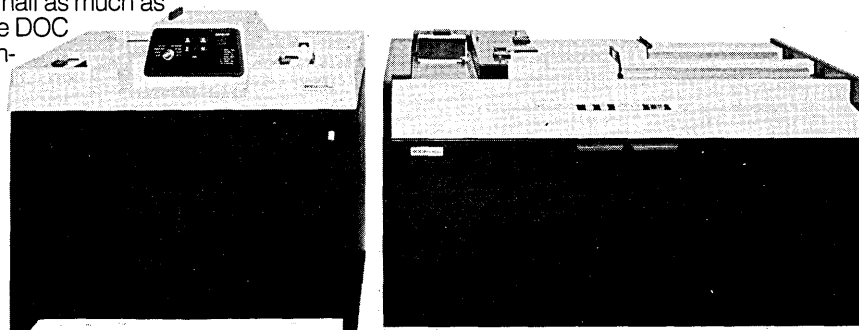
The 1403 compatibility feature allows both models to operate in the 1403 mode. This feature includes: paper tape loop; operator selection of line spacing (6-8 lines per inch); dualing; manual indexing with rotary dial; use of 1403 UCSB feature or other standard non-UCSB character arrays. Your CPU will think it's working with a 1403. You'll know you're getting a 2250 or 1800 lpm printer for just about the cost of an 1100 lpm printer.

The read/punch side of the Subsystem (the PC 6000 Reader and the PC 50 Punch) recognizes the same command set as the IBM 2540. All data and control signals transferred between the host and the PC 50 and PC 6000 pass through a subsystem microprocessor controller built into the PC 6000. Utilizing Documation's own patented rifle-air pick and stack system, the PC 6000 reads 1000 cards per minute and stacks them in one of two stackers. The input hopper holds 6000 cards and can be loaded on the fly. Stacker 1 card capacity is 5500; Stacker 2 holds 3500 cards. PC 6000 options include 51 Column Card Read, Optical Mark Read and Read Column Eliminate.

The PC 50 Punch Model 3 punches a minimum of 50 cards per minute; Model 4 punches 100 cpm. The PC 50's microprocessor controller enables it to detect and correct punch errors automatically without operator or host system intervention. With the Pre-Read feature Model 3 reads 300 cards per minute, Model 4 reads 400 cards per minute. Other PC 50 options include a 51 Column Card read/punch feature, an interpret feature, a second input hopper to enable off-line reproduction of card decks; a Read Column Eliminate feature and Optical Mark Read. Off-line, the PC 50 will gang-punch, gang-punch and interpret, reproduce, reproduce and interpret, or just interpret — eliminating the need for extra pieces of equipment to perform these off-line functions.

The ruggedness and reliability of Documation equipment in the field is legendary. What that means to you is less downtime. Documation equipment has proven itself so reliable in fact, that card-handling equipment users ranked Documation their #1 preference in 1975 media surveys. The reason? All Documation products are designed in-house. Then all parts and machines are fabricated in our own sophisticated precision manufacturing facility, giving Documation a unique control over product quality and reliability.

Documation provides sales and service in major metropolitan areas. Documation's service is as reliable as Documation's equipment. When your Documation equipment needs maintenance, we don't want you to have to wait for us. So



PC 50 PC 6000

we have a service team of Documation-trained field engineers waiting for your call. Documation's maintenance contract provides maintenance and parts 24 hours a day, 7 days a week.

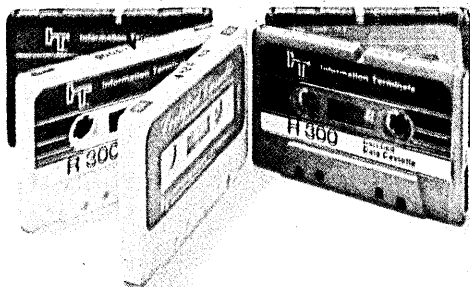
You have an IBM 360 or 370. We have the Printer/Reader/Punch that offers the most cost-efficient subsystem available. Let's get together. For more details, call or write Mr. Roy Ostrander, Vice President, Box 1240, Melbourne, Florida 32901. Phone (305) 724-1111.

DOCUMATION INCORPORATED

Try pricing out the cost of lost data.

Then you'll know why over half the certified digital cassettes in use throughout the world today are made by Information Terminals.

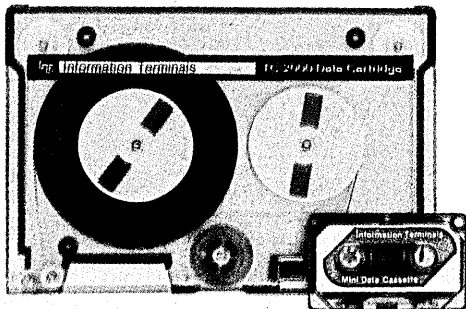
A dropped bit could mean only a misspelled name. It could also mean a check a hundred or a thousand times too big, a carload shipment sent to the wrong destination, or a fleeting moment in time lost forever!



100% Certified.
You can be sure with ITC.

To help protect you, your company and your projects against such losses, ITC tests its computer grade information storage media 100% *after assembly*.

This means every ITC computer grade digital cassette, floppy disk, FLIPPY™ disk, 1/4-inch Data Cartridge and Mini-Cassette is checked for perfect mechanical and recording operation before it leaves our hands. 100% Certified. You're sure with ITC.

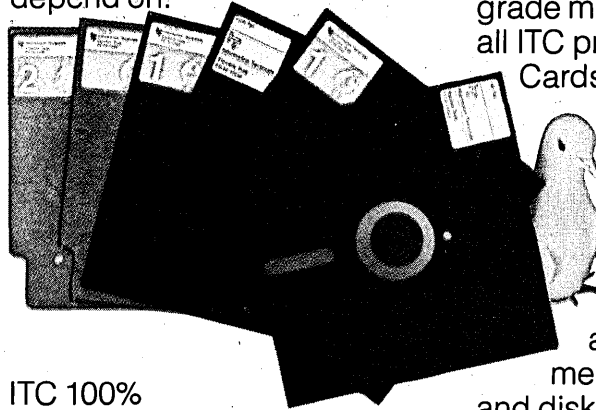


A medium for every message.

ITC 100% CERTIFIED DIGITAL CASSETTES. Five Series, to fit just about every system and environmental requirement, from computer room or business office to desert, jungle or frigid mountain top.

ITC 100% CERTIFIED FLOPPY AND FLIPPY™ DISKS. One-sided floppies and two-sided FLIPPIES™.

No matter what or who's diskettes you've been using, there's a 100% Certified ITC disk you can depend on.



ITC 100% CERTIFIED 1/4-INCH DATA CARTRIDGES. ITC's new 1/4" Data Cartridges, with exclusive new features for new levels of performance and reliability.

ITC 100% CERTIFIED MINI-CASSETTES. A unique new approach to data storage in hand-held and desktop digital devices. ITC's MI-50 Mini-Cassette

packs 50 feet of data capture in a package smaller than a box of pocket matches.

ITC MAGNETIC CARDS FOR WORD PROCESSING SYSTEMS.

High quality products for the Office,



from the leading producer of 100% Certified computer grade magnetic media. Like all ITC products, our Mag Cards feature consistently high performance from one shipment to the next.

Write for Information on ITC computer grade and word processing media, and our cassette and diskette testing and alignment equipment. Or call your nearest ITC distributor or representative.

Information Terminals
323 Soquel Way
Sunnyvale, California 94086
Telephone (408) 245-4400

In Europe:
Information Terminals SA
Case Postale 296
1215 Geneva
Switzerland

source data

Construction (a one-week course), *Using Microcomputers*, *Computer Graphics*, *Principles of Data Base Management Systems*, and *Simulation Using GPSS*, are scheduled for the sixth annual Institute in Computer Science to be held at the Univ. of Calif. in Santa Cruz this July and August. Price for a two-week course: \$510, including text, course materials, and computer time. Four quarter units are optional. (Price for the one-week course: \$375, and 2 quarter units optional.) Enrollment is limited in all

COURSES. UNIVERSITY OF CALIFORNIA EXTENSION, Santa Cruz, Calif. 95064.

Course Series

Four 3-day courses are scheduled for several cities this summer. *Practical Leadership of DP Projects*, "designed for the individual . . . charged with the responsibility of planning and leading computer systems 'professionals' in the design and development of information systems products," will be held in Chicago (July 12-14), San Francisco (Aug. 30-Sept. 1), and Washington, D.C. (Sept. 27-29). *Applied Data Communications Design* is scheduled for San Diego (July 19-21), Washing-

ton, D.C. (Aug. 25-27), and New York (Sept. 15-17). *Distributed Mini-computer Networks* will take place in Denver (July 14-16), New York (Aug. 4-6), and Washington, D.C. (Sept. 8-10). And *Minicomputer Systems* will be held in Chicago (July 7-9), Washington, D.C. (Aug. 23-25), and Boston (Sept. 8-10). Price: \$445 (\$395 if prepaid). INST. FOR PROFESSIONAL EDUCATION, INC., Ste. 601, 1901 N. Fort Myer Drive, Arlington, Va. 22209.

periodicals

Computer Networks

To provide a forum for the presentation and discussion of computer networks, their applications, and the technical, economic, social, legal, and regulatory questions raised by these new systems, a new bimonthly journal, *Computer Networks*, has been founded. All forms of distributed computation and information systems will be covered, with emphasis on studies and experience addressing practical aspects of networking. Philip H. Enslow Jr. of the School of Information and Computer Science, Georgia Inst. of Technology, is editor-in-chief; the first issue appeared in February 1976. Special subscription rate: \$25. NORTH-HOLLAND PUBLISHING CO., P.O. Box 211, Amsterdam, The Netherlands. *

For a Friend Assigned to a Maintenance Group

The fellow who designed it
Is working far away;
The spec's not been updated
For many a livelong day.
The guy who implemented it is
Promoted up the line;
And some of the enhancements
Didn't match to the design.
They haven't kept the flowcharts,
The manual's a mess,
And most of what you need to know,
You'll simply have to guess.

We do not know the reason,
Why the bugs pour in like rain,
But don't just stand here gaping!
Get out there and MAINTAIN!

—David H. H. Diamond

The robotical judge all could trust—
a congenital stranger to lust,
and impervious to
lips of red, eyes of blue,
he was always implacably just.

—Gloria Maxson

Who went back to school to help you manage your productivity?

Cobol Optimization

Structured programming

IMS INFORMATION MANAGEMENT SYSTEM

BCS did. Several years ago. And we learned that education is the first step towards increasing productivity. Since then, we've been teaching our customers all we know and they're reaping the benefits. Take COBOL Optimization for example. Our three day course, taught in a workshop atmosphere, introduces new structural designs, not codes. Result: experienced programmers have trimmed their run time an average of 13%. Some reached 50%. We also teach programs in IMS. The best management decisions are usually the most informed decisions, so it's important for you to create and maintain an information base that is complete, current and easily accessible. We've been develop-

ing and using large, on-line data bases for several years, so we teach from experience. How about structured programming? We go further. Systematic Software Development and Maintenance (SSDM) helps you increase productivity in system design, coding and maintenance by combining top-down design with structured programming. It enables your dp staff to formulate a set of well-defined procedures for developing systems. We've been using SSDM for three years, and have found it helps produce more reliable software at a lower cost — and it's also easier to maintain. Ask us for details. Call BCS Education and Training at (206) 655-6575 now, or mail the coupon.

BCS BOEING COMPUTER SERVICES INC.

Education & Training Division
PO. Box 24346
Seattle, WA 98124

Please send me:

- BCS Education & Training Brochure
- Complete Schedule of Classes

Name _____

Title _____

Firm _____

Address _____

Phone _____

City, State, Zip _____

Boeing Computer Services. You already know us.

CIRCLE 101 ON READER CARD

PUBLIC UTILITIES NEED TERMINALS THAT ARE MORE THAN JUST UTILITARIAN. THE WORD IS RAYTHEON.

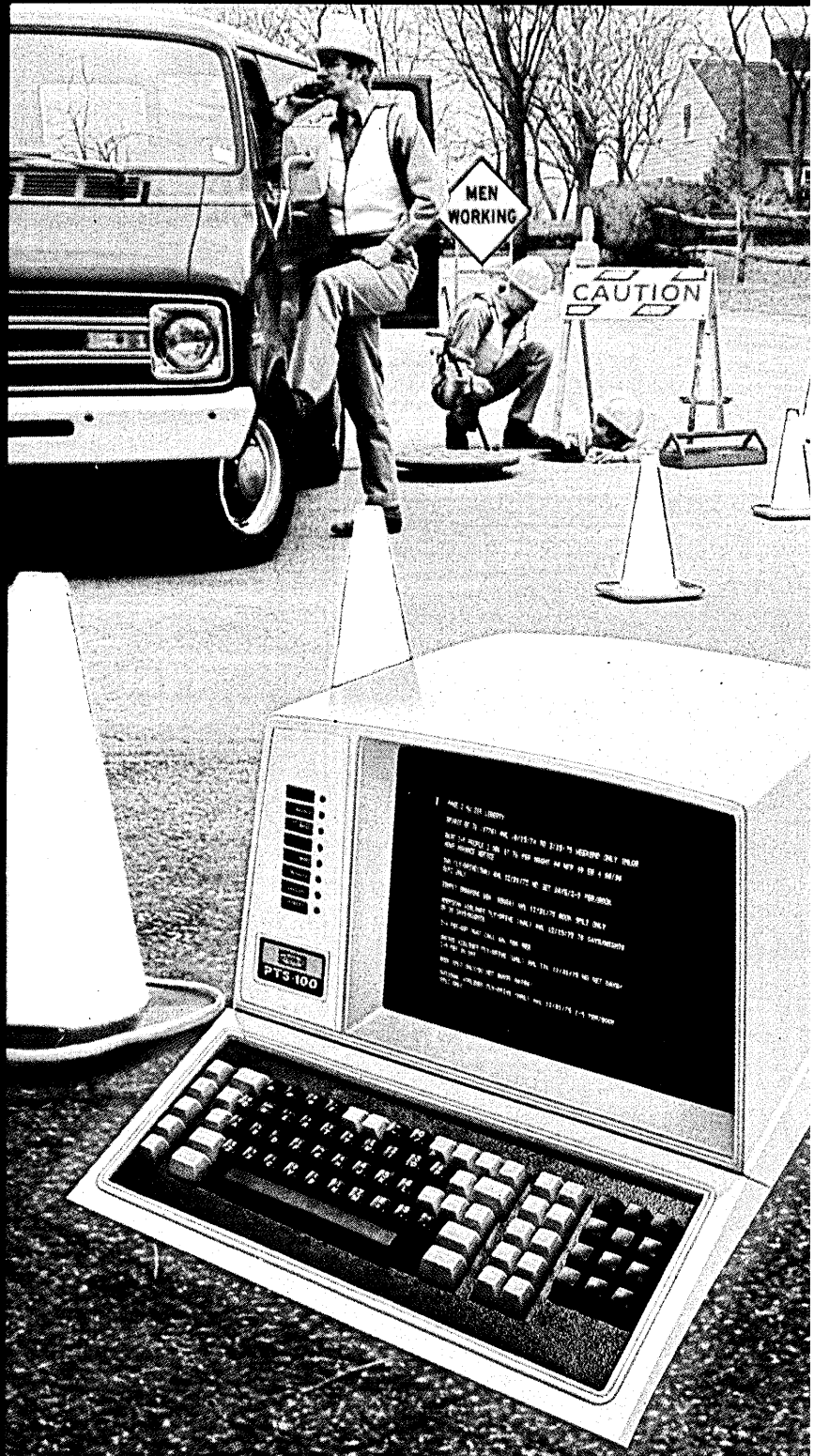
Raytheon PTS-100 terminal displays help utility companies cope with all kinds of daily detail — service orders, meter maintenance, repair and transportation records, inventories, billing, payrolls and other financial matters.

What's more, they can process such data right at any remote site, so central computers can be used more effectively and line costs can be controlled.

Raytheon's terminals are economical, fast and versatile.

- They're direct replacement equipment for 2260, 3270, U-100 or VIP-7700 display systems.
- They're competitively priced and offer extended-lease plans.
- They're available with high-speed character or line printers and card readers.
- They control local printing; no okay is needed from the host computer.
- They offer local format storage.
- They're intelligent — so you can design your own applications and modify them easily.

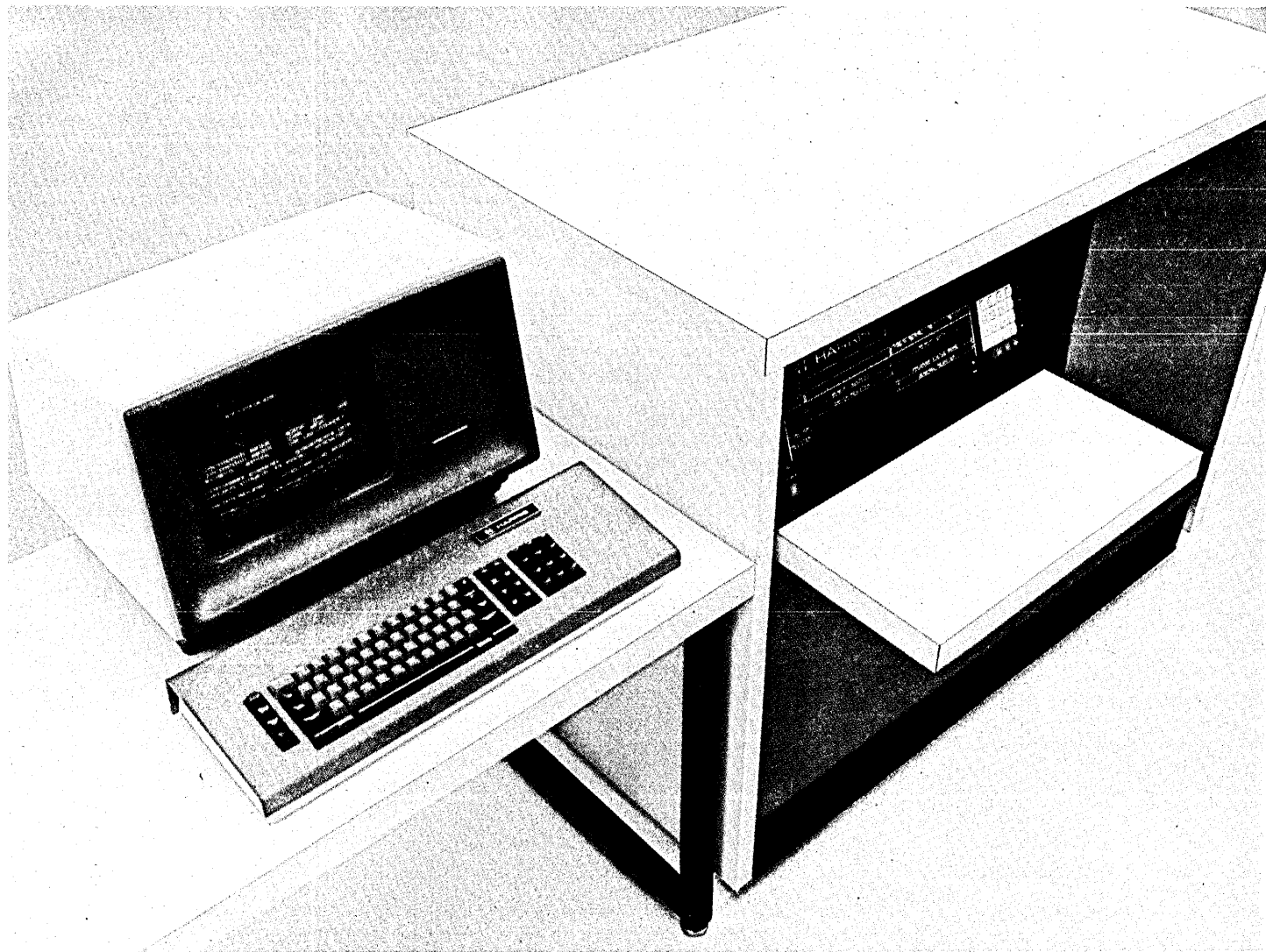
For the complete word, and a demonstration, write Raytheon Data Systems, Marketing Dept., 1415 Boston-Providence Turnpike, Norwood, MA 02062 — or call 617-762-6700. (Outside Massachusetts, call 800-225-9874 toll-free.) When you build better information processing systems... **theWord gets around.**



INTELLIGENT TERMINALS. MINICOMPUTERS AND TELECOMMUNICATIONS SYSTEMS

RAYTHEON DATA SYSTEMS

RAYTHEON



First we gave you the HARRIS 1600 with a mainframe-type operating system for money-saving remote communications. Now there's more!

Distributed processing. That's what's happening with the Harris 1600 Remote Communications Processor.

We already had a good thing going with the 1600's multi-emulation capability . . . and you've had one going with the resulting savings in hardware and reduced line costs. But we promised even more savings to come: the ability to distribute your central data base through local processing of data at the remote site.

We're keeping this promise. With our new disc-based ECOS (Extended Communications Operating System) you can perform functions such as data entry, remote batch, file manipulation, media conversion and local batch processing *concurrently*.

We're also announcing Key Entry Processing (KEP), a new hardware/software system that permits you to perform both local and remote data entry, file update and file manipulation operations on the 1600. You can pre-process and edit data at the 1600 through our new Model 1675 CRT key entry station, reducing the load on your host processor and helping trim line costs.

Plus, to support KEP we're offering a new language (REGAL) which helps our 1600 solve a wide variety of business-oriented data manipulation problems. Through REGAL, you can create your own key-entry programs for

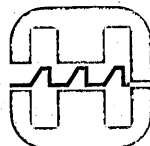
source data entry, file manipulation and file update — all with surprising ease.

Additionally, executing under ECOS, our local batch processing capability will enable you to perform applications programs at the local 1600 site written in COBOL.

When will all this be available? Harris is already delivering ECOS based systems with local batch processing. Delivery of KEP systems will begin in July.

Keep your good thing going by specifying distributed processing from Harris. You'll find the performance and flexibility you've been waiting for, at a price per function that's more cost effective than anyone else can offer!

For more information, contact Harris Corporation, Data Communications Division, 11262 Indian Trail, P. O. Box 44076, Dallas, Texas 75234, (214) 620-4400.



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

Criterion: "Standard of Measurement"

by Edith Myers, Associate Editor

First new computer line in eight years bows at NCR users conference. Six others have been certified. First to benchmark machine says, "I'm happy. My management's happy."

NCR chairman and president William S. Anderson may have been taking personal credit for the company's first new computer line offering in eight years.

At the first showing of the new line, dubbed Criterion (see Product Spotlight, p. 172), at an NCR users meeting in Atlanta in late April he called the new system "in many ways the culmination of all the changes which have been carried out at NCR in the past four years." Anderson became president of NCR just about four years earlier—in May 1972.

The Criterion, first new computer from NCR since it introduced the Century series in March of 1968, was named by Anderson. Originally it was to have been called Century 2 but Anderson chose Criterion for the word's dictionary definition: "standard of measurement." Project manager for the series, Jim Carroll, told the user group meeting that this meaning is meant to apply to "measurement of productivity in information processing."

The announcement of the new series was timely and three pronged. The user group showing was the first, followed closely by showings at a press conference at NCR's Dayton headquarters and at West Germany's Hanover Fair. All just enough ahead of this month's National Computer Conference to keep center stage.

No surprise

Users at the Atlanta meeting were not particularly surprised by the announcement. Many had already been pitched on the new system and one installation already was operational. They were surprised at an accompanying announcement, that NCR would be selling Criterion software AND Century software on an unbundled basis beginning May 1. Ray Smith, assistant vice president, product programs, told users this new policy is part of NCR's "total commitment to total solutions."

"It's unfair for every customer to pay the same price. With unbundling each customer pays for only what he needs. He can choose only those software elements he needs." He added the obvious. "It has become necessary to realize a return on software investment."

Smith said present Century users can upgrade existing applications software they had been using on site prior to May



WILLIAM S. ANDERSON
The culmination of four years . . .

1, at no charge. Century programs can run on the Criterion.

The Criterion Series makes extensive use of firmware—stored on floppy disc and read into the dedicated instruction storage segment of memory—to implement the firm's approach to reliability, availability and serviceability and to configure a virtual machine capability. Under the real storage operating system, firmware is used to make the Criterion a virtual machine which can run Century software without recompiling.

Under the new unbundling policy, the only exception was the real storage operating system. There will be no charge for the real storage firmware or for batch, on-line or multiprogramming executives.

New OS next year

A touted feature of the Criterion series which will not be available until the middle of next year, is a virtual storage operating system called Virtual

Resource Executive (VRX) which NCR says will greatly simplify the job of reconfiguring a network and developing on-line programs.

Down the road

Also in the works but with less definite timetable, is a successor to the Criterion series. Anderson said Advanced Systems Laboratory, a joint venture of NCR and Control Data Corp. is working on this. He said work was in a "very early stage" and declined to predict when a product might be ready for market.

The plan is, he said, for NCR to develop the low end of the new line, and for CDC to develop the larger models.

Smith told the user group meeting that seven Criterion systems had been certified prior to the announcement. In addition to the one shown at the meeting, the one in Dayton demonstrated at the press conference, the one shown at the Hanover Fair, and the pilot system which is at Dart Warehouse Corp. in Los Angeles, there are three others ready for delivery to customer sites.

Up and running

The system demonstrated at the user group meeting was shipped to Atlanta from Rancho Bernardo where development work was done. Smith said it went into the conference hotel on a Saturday afternoon and was "up and running in less than 24 hours, including time for installation of a raised floor, air conditioning and electrical panels."

Jerry Lindee, director of management information systems for Dart Warehouse, said Dart took seven of its software systems to run at Rancho Bernardo prior to taking delivery of its own Criterion 8550 on April 5. They were scheduled to run at Rancho Bernardo from March 15-26 but the hardware didn't come up until March 18. But, said Lindee, by the evening of the 18th, "we were three days ahead of schedule on our work load." He estimates the 8550 is "at least" 25% faster than the Century 201 he had been using. Dart started running live on its Criterion April 8 with no parallel on the 201.

"I'm happy. My management is happy," Lindee told the NCR Users Group. *

Networks

Tymshare Applies For a Value-Added Network

The company apparently wasn't able to change Ma Bell's mind

"We've heard rumors that the FCC is about to restrict the use of line-sharing agreements," said Warren Prince, Tymshare, Inc.'s vice president of data services. He was explaining why his company asked the Federal Communications Commission for authority to go into the value-added carrier business.

Prince said one possibility is that the commission will forbid such firms from making a profit on the auxiliary services they provide to their joint users. Tymshare, for example, makes nothing on the circuits it shares with Tymnet joint users, but the company does earn a profit on the switching, concentrating, front-end processing and supervisory services which they use.

This may not be the whole story, however. Another source reports that he has seen a letter AT&T wrote last August, which said in effect that Tymshare could no longer qualify as a joint user but would have to become a "composite data service vendor." Such vendors, under the tariff, must be value-added carriers. "Apparently Tymshare wasn't able to change Ma Bell's mind," says our source. (December '75, p. 19.)

Another reason Tymshare is filing now may be that it suspects, or knows, that the FCC, in its forthcoming decision (expected to be in late spring or early this summer), plans to deregulate value-added carriers. Rumors to that effect have been floating around the commission's headquarters for several weeks.

In its announcement in mid-May, Tymshare said the new value-added carrier service will be provided by Tymnet, Inc., a wholly-owned subsidiary. Initially, the service will be offered in the 61 cities in which the present Tymnet system operates. Circuits will be leased from already-established carriers and the supporting hardware and software (such as switches and concentrators) will be acquired from Tymshare. By 1979, "Tymnet Value-Added Data Communi-

cations Service" is planned to be available in 105 U. S. cities.

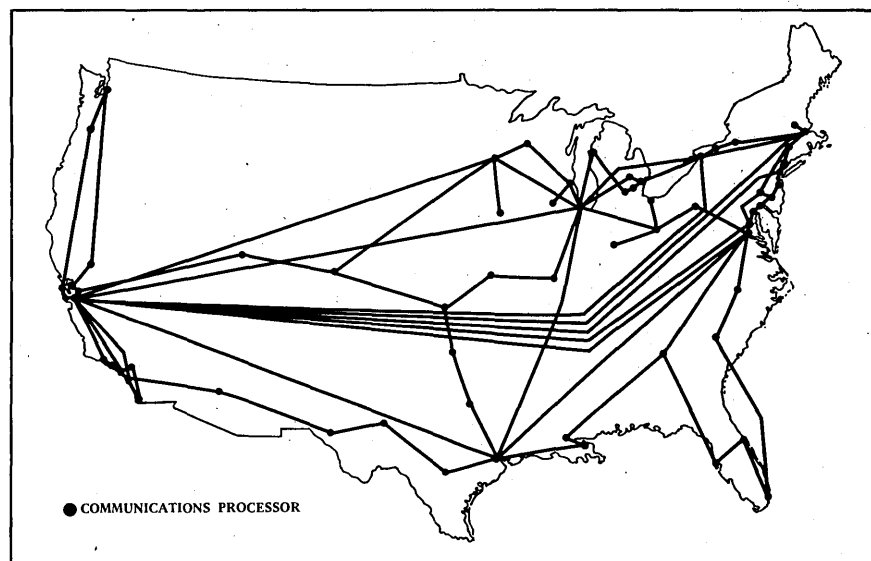
Much more efficient

Customers will access the network through leased, private, dial-up or WATS circuits. Messages will be transmitted in a packet format, but the company indicated that Tymnet's technique will be

ity to offer services in the future at any speed "which is economically and technically feasible."

Tariff lists three charges

An illustrative tariff accompanied the FCC application. Essentially, it lists three kinds of charges—for access to the network through a terminal or computer



TYMNET VALUE-ADDED NETWORK: Serves 61 U.S. cities today and by 1979 will raise capacity to 105 U.S. cities.

much more efficient than the one used by Telenet Communications Corp., the other U. S. packet carrier. Tymnet's special virtue is that it has been designed primarily for low-speed terminals and uses shorter packet headers. Thus, the ratio of data bits to the total number transmitted is higher.

The value-added features to be included in Tymnet's new service include store-and-forward service, speed and code conversion, usage and other management reports, virtual routing, and extensive security protection.

Low and medium speed transmission will be offered initially (i.e. 1200 bps and below plus 2 to 9.6 kbs). However, the Tymnet application requests author-

host processor; for usage; and for store-and-forward service.

A host processor installed on the customer's premises will cost \$2,150 a month plus a non-recurring installation charge of \$1,000. Programming is not included. The processor can support up to 30 asynchronous or 64 synchronous users.

An off-premise processor costs \$100 per single access asynchronous interface, plus \$100 for installation. A synchronous interface, used by one or two customers, costs each one \$1,400 per month plus \$1,000 for installation, and if three or four customers are connected, the charge is \$1,000 per month and \$1,000 for installation.

news in perspective

ety of attitudes among those involved with all aspects of EFT.

Bank operations and automation personnel, for instance, talk glowingly of the wondrous things EFT can do for their institutions like increasing market share and bringing in new accounts. They would like to see their institutions among the pioneers.

Senior officers, apparently, think differently. Payment Systems, Inc., as part of its Payment Systems Research Program (PSRP), late last year interviewed more than 75 senior officers at banks, thrift institutions, and regulatory agencies throughout the country. A report based on the interviews concluded that top executives believe "the chief impetus for EFTS development will be competitive pressure."

Among senior executives, the report states, "EFT services are viewed as hav-

EFTS as a threat to privacy: 28% of commercial banks feel it will and 45% think it won't. Among thrift organizations it was 32% yes and 44% no.

ing been undertaken on a defensive basis, to keep current customers, rather than on an aggressively offensive basis, in hopes of gaining new customers and increasing market share."

PSRP said the top executives feel "debit cards will emerge on a proprietary basis within individual institutions with little need for nationwide interchangeability, until local and regional customer acceptance is gained." This view, said the research firm "flies in the face of recent announcements by both National BankAmericard and Interbank of national debit cards."

BankAmericard already has introduced its blue, white and gold card called Entree, (October '75, p. 112) in selected markets. Interbank, which issues Master Charge, is planning to introduce a green and white debit card called Signet next year.

Widespread reality soon

Other conclusions of the PSRP report include: interest bearing transaction accounts will become a widespread reality over the next one to two years; automated teller machines will continue to be implemented primarily to better serve existing customers; and shared EFT systems will inevitably evolve and will have significant competitive ramifications.

PSRP said an overall impression gained from the interviews was that "there will be few big winners or big losers attributable to EFTS innovation.

Bankers may not be worried about

losing but corporate treasurers are—about losing float. Richard Speer of PSRP said corporate treasurers tend to shy away from EFT because it "originated with the financial institutions and not with the treasurers."

At a PSRP seminar on "Corporate EFT" in Atlanta last month several corporate treasurers indicated they consider themselves more skillful and knowledgeable than the bankers they deal with. Mel Gilman, director of cash management for Occidental Oil said Occidental is moving to reduce its bank relationships. He also said "if banks don't supply adequate services industry could easily build their own payments network."

Alan Hickok, Manager, Direct Deposit Administration for Xerox Corp., said if Xerox had realized the float loss it would incur with its direct deposit program (of payroll) it probably wouldn't have applied for the service. "The only reason for it is good employee relations."

And then there's the attitude of the smaller independent banks. A special committee on EFTS-EDP of the Independent Bankers Assn. of America (IBAA) surveyed its membership of which 70% are banks of \$20,000,000 or less in size serving predominantly rural-agricultural trade areas of 10,000 or fewer people.

The committee learned that "71% of our members believe they will have to provide point-of-sale service to their customers within the next five years." It also learned that 57.4% of its members currently use correspondent banks to perform data processing.

E. A. Trautz, chairman of the committee, said it views correspondent bank processing with mixed emotions. "Unlike large data processing companies, few correspondent banks have the expertise or they lack the commitment to make available the emerging electronic technology known as remote item processing."

The committee believes "it is through the utilization of remote item processing that our member banks will get not only better teleprocessing systems but will also access EFT systems at lower costs." In addition, Trautz said, "unlike the highly competitive private suppliers of data processing, correspondent banks tend to price their services on an arbitrary basis with little or no relationship to real or actual costs."

Still another survey, again conducted by Payment Systems Research Program, looked at the attitudes of marketing executives of both commercial banks and thrift institutions (including credit unions, mutual savings banks, and savings and loans).

Respondents were asked to either agree or disagree with specific statements. Some came up uncertain. The statement "My institution will probably participate in a merchant point-of-sale (POS) electronic terminal system" drew agreement from 81% of the banks and 71% of the thrifts against disagreements of 4% and 7%. Seventy-three percent of the banks and 71% of the thrifts agreed that "where EFT systems are offered, local sharing by competitive financial institutions will be widespread."

More evenly divided was opinion as to whether or not consumers will see EFTS as a threat to personal privacy. Among commercial banks, 28% feel they will and 45% think they won't. Among thrifts it was 32% yes and 44% no.

Forty-seven percent of the banks and 45% of the thrifts indicated they don't feel new laws will be needed to convince consumers that EFTS computer errors will be handled fairly. Of the opposite opinion were 29% of the banks and 33% of the thrifts.

One proposed rule which has stirred up considerable controversy is the Federal Reserve Systems' proposal to amend its Regulation J which covers check clearings, to make it applicable to automated clearings.

John Eger, acting director of The Office of Telecommunications Policy, feels the effect of the proposed amendments would be to "facilitate placement of the Federal Reserve in an operational role at the heart of a nationwide electronic funds transfer system." He said his office's position is "that such a role would

Commission organized into four committees, each of which will gather information through task forces, public hearings, and contacting outside sources.

stifle innovation in the use of computerized telecommunications and that competition would be discouraged because of the heavy economic disincentive to establish alternative systems."

Paul Armer, chairman of the American Federation of Information Processing Societies' Special Committee on Electronic Funds Transfer Systems, submitted letter comment to the Fed pointing out that while privacy and confidentiality of account information was addressed in the amended regulation, "the area was treated in a very cursory manner . . ."

Eger feels governmental operation of an EFT system "potentially represents a highly effective tool for keeping track of people and enforcing 'correct' behavior."

Such are some of the attitudes the EFT commission will encounter. Theirs shapes up as a gigantic sort job. —Edith Myers

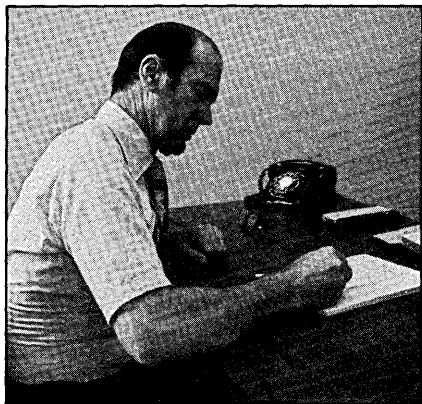
Finning Selects Minimizer for Large Order Processing and Inventory Job

The invasion of minicomputers into traditional commercial electronic data processing markets is becoming as relentless and as successful as the Viet Cong's infiltration of South Vietnam. For instance, Frederic G. Withington of the Arthur D. Little, Inc., management consulting firm estimates that the market represented by minicomputers selling in the business dp area was between \$70 and \$90 million last year and is "growing rapidly and with a tremendous surge of interest."

Thus far, the minicomputer infiltration has been primarily a guerilla warfare matter in which minis are scattered about dp installations, sniping away and taking over small segments of the larger installations.

But now the mini invasion is beginning to show signs of mounting a more frontal assault as minis here and there threaten to replace large dp mainframes outright.

One such example is occurring in Vancouver, Canada, at the Finning Tractor and Equipment Co. which is replacing its large dp mainframe with two large mini configurations in Vancouver and 25 small minis in other locations. Finning's dp manager, C. A. Harris, says



C. A. HARRIS of FINNING
Breathing easier now.

the evaluation process and the final choice were tough management exercises.

"My biggest period of concern was just before I recommended the new equipment," recalls Harris. "I knew I had done my homework, but I was still nervous. I'm breathing easier now. We've received the hardware and it's working fine and the software looks good, too."

As a distributor with about \$15 million worth of parts inventory of some 250,000 items, Finning's data processing function—primarily for order processing and inventory control—is a particularly important part of the firm's operation.

The existing equipment at the installation is centered around a Honeywell

2040A and assorted computer peripheral equipment including Consolidated Computer Keyedit stations.

Picked Data General

As its new equipment, which is intended to upgrade the dp capability at Finning as well as replace most of the existing equipment, the tractor distributor picked two Data General Eclipse C/300 commercial systems and 25 Data General Nova 2 computers. "It was," says Harris, "our desire to have one manufacturer, if possible."

The new equipment, however, wasn't a "pure" Data General buy, since archival Digital Equipment Corp. got the nod from Finning for DEC's LA-180 serial printers as input-output devices for the Novas.

Finning began the evaluation process in the spring of 1974 when the distributing firm began to see signs it would soon outgrow its Honeywell mainframe. Finning was also beginning to look ahead to the time when it could anticipate that 50 terminals would be on-line to the central installation. As always, timing was important since many of the options needed by Finning were not offered by various vendors at one time or another during the evaluation process. Many manufacturers later added options that would have been important, but these came too late. For instance, Honeywell's software conversion aids to the Honeywell Series 60 did not impress Finning in the spring of 1974. However, recent Honeywell software emulation releases look more attractive.

At any rate, Honeywell equipment was eliminated by Finning because of the problems the tractor company foresaw with upgrading. The same basic reasons—fears of expensive difficulties with software conversion—were the main reason the other dp mainframe firms were ruled out. For instance, an IBM 370/135 or 145 with CICS was considered to be an attractive alternative, but Finning felt the proposed configuration would be too costly.

One-third the price

"Actually, the job could have been done nicely by any one of the dp mainframe manufacturers," says Harris. "But they were just too expensive. We figured that a minicomputer manufacturer could do the job for about one-third the price."

Although Data General does not offer a full-blown data base management system, the mini maker's INFOS file management system is capable of handling Finning's entire company data base on the two Eclipse 100 million byte

disc storage units. The chief competitor for the Finning order, Digital Equipment Corp., did not have a data base management system at the time of evaluation. (Although DEC had not announced a data base management system at the time of this writing, the firm is expected to offer shortly a data base management system based on Cullinane's popular IDMS.)

Another key ingredient in the evaluation process, says Harris, was the fact that Finning top management took an extremely active role in the selection of the new equipment. Finning's executive vice president of finance, V. K. Sood, and executive vice president of parts and service, R. C. Biss, visited similar

Financial breakdown was something of a moving target, but Harris believes that Finning will be able to save a considerable amount in the long run.

computer installations in the U.S. to gain first hand experience.

As the evaluation came down to the final stages, and as Finning began leaning more and more towards Data General, Finning management visited a Data General user installation in North Carolina. "We also visited Data General sites around Vancouver," says Harris, "And we phoned another half dozen Data General users in the States."

Thought of front-ends only

Actually, Data General came to be considered for the job in a roundabout manner: at first, Finning thought it would simply front-end the Honeywell 2040A with a minicomputer and, as Finning dp personnel began evaluating minis, they became more and more intrigued with the idea that the entire dp operation could be handled by minicomputers. Finning then focused its attention on Data General and DEC. ("It was very close between DG and DEC," said Harris.)

Finning management was also careful to touch bases with its largest supplier, Caterpillar in Peoria, Ill., which supplies the great majority of Finning's equipment. Harris indicated that Caterpillar went along with the Finning dp plan.

The Eclipse systems—each with 256K bytes of main memory—will serve as the central system for the real-time interactive network of Novas located in remote locations across a vast and sprawling 366,000 sq. mi. of British Columbia and the Mackenzie Valley of the Northwest Territories that Finning covers. Finning operations range from the City of Victoria in a mild climate, to Inuvik deep in the Arctic Circle. The terminal systems, each to have at least two crt displays, will be connected to the central Eclipse system in Vancouver by dedicated syn-

news in perspective

chronous lines. The new system will result in greatly reduced costs for Telex, rwx and long distance calls.

Indeed, financial savings played a key part in the evaluation procedure. Since the Finning operation is constantly changing—like most rapidly growing

A key ingredient in the evaluation process was the fact that Finning top management took an extremely active role in the selection of the equipment.

businesses—the financial breakdown was something of a moving target, but dp manager Harris believes that Finning will be able to save a considerable amount of money with the new equipment in the long run.

When the new dp operation is completely implemented, Harris figures there will be a savings of \$10,000 a month by eliminating the off-line data entry system and its operators; a savings

of \$6,000 a month when Honeywell and telephone company gear is returned; and a savings of \$4,000 a month represented by eliminating the Telex and rwx lines and moving to leased lines. In addition, the company places a \$10,000-a-month figure as the savings it will realize by simply moving from the old manual order system—it normally took four days to process an invoice—to the on-line system.

The new equipment costs about \$1 million and, when that is written off over a five-year period, the monthly cost including maintenance will come to about \$27,000. That figure would be more than covered by the savings Finning expects to achieve.

“All we’re trying to do really is to get a wash,” says Harris. “The new equipment should enable us to accept our growth easily.”

Hired DG people

Finning also did something reminis-

cent of the early days of the commercial dp mainframe business: the tractor distributor hired two former Data General systems programmers. That practice was common, say, 15 years ago when IBM began installing its systems en masse.

The two systems programmers, Doug Dymont and Michael Haines, serve as a sort of insurance policy for the new installation. Dymont and Haines have been preparing sophisticated software for Finning and they hope eventually to be able to market the software to other Data General users.

“We’re modifying DG’s FORTRAN so we can use it in a commercial application,” says Dymont. “One problem with minis is that they run out of memory quickly, so we’re using virtual memory overlays.”

From a systems programming point, Dymont says one great advantage to the configuration is that there are no logical limits to the system—several Eclipses and innumerable Novas can be added to the configuration.

—W. David Gardner

Minimakers Capitalize on Transaction Processing

While most minicomputer manufacturers view their move into the commercial marketplace as a growing and attractive opportunity, they are in near unanimous agreement that the market for them is still in its embryonic stages.

“The trend is certainly in our favor,” said a spokesman at the Digital Equipment Corp., the largest of the mini manufacturers. “The minicomputer is by its very nature transaction oriented and the overall trend in computing is towards transaction processing at the expense of batch processing.”

The DEC spokesman pointed out that DEC began staking out the market a few years ago when the firm started developing commercially-oriented software enhancements for the PDP-8 and the PDP-11. One particularly significant software release was announced one and a half years ago when DEC added COBOL for the PDP-11 series. The mini manufacturer is also understood to be working hard on a new data base management system that should be attractive in the commercial marketplace.

Data General has aimed its Eclipse C/300 machine at the commercial market and has already enjoyed good customer acceptance of the offering. DG also offers a brace of software aids including COBOL and INFOS that are aimed at the dp business market.

One showcase order in the emerging market has been landed by General Automation. That minimaker is in the

process of installing more than 100 GA 16/4400s as part of a \$9 million order to the Bank of America.

“We’re finding that networking in the banking market is a big action business for us right now,” said a General Automation spokesman. “The development of SDLC protocol was a particularly important breakthrough.”

Most of GA’s configurations at the Bank of America consist of four computers that are interconnected in one module—two normally handling the networking and communications functions; and two handling data base management functions.

Like most other mini manufacturers, GA offers COBOL and the firm is finding that it is moving into areas where transaction volume by users is high.

Perhaps the most wholesale pioneering use of minis in a traditional commercial dp environment is being done by the First National City Bank of New York (Citibank).

The bank has been installing minis from a variety of mini manufacturers but one new order there from Interdata is particularly striking. Citibank’s Securities and Government Services Group has contracted to purchase eight Interdata 8/32s to give the banking unit its own dedicated data processing operation and—more important—in the process save more than \$1

million annually. The Interdata equipment will perform data processing functions that were being executed on two 370/158s.

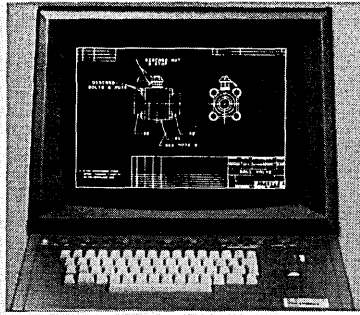
Everywhere the minis are going, users savings are a big factor in the selection of the equipment. As one observer put it succinctly: “How would you like to be a bank vice president and save more than \$1 million a year. You’d feel pretty good. And you’d look pretty good too.”

Minicomputer manufacturers have been traditionally scientific-oriented. One firm, Modular Computer Systems, was particularly so, and recognizing the gap in its organization and seeing the new rapidly developing market, Modcomp acquired a systems software house outright to help plug the gap. The acquisition was of a firm called ECS, which specializes in placing minis in commercial dp situations.

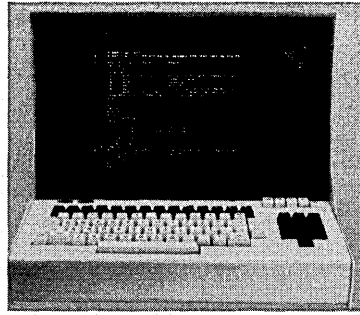
“The mini vendors still don’t have great depth,” says ECS president John Crawford. “The caveat for the user is that he must have some technical ability. It’s not a hand holding business.”

Crawford points out that the lines between minicomputers and commercial mainframes are “becoming fuzzier and fuzzier” as the vendors in both businesses move toward each market. Crawford says the biggest problem of moving from a dp mainframe to a mini is usually the high cost of software conversion. *

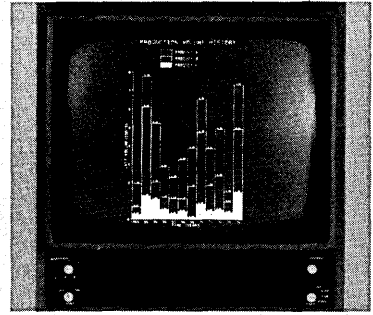
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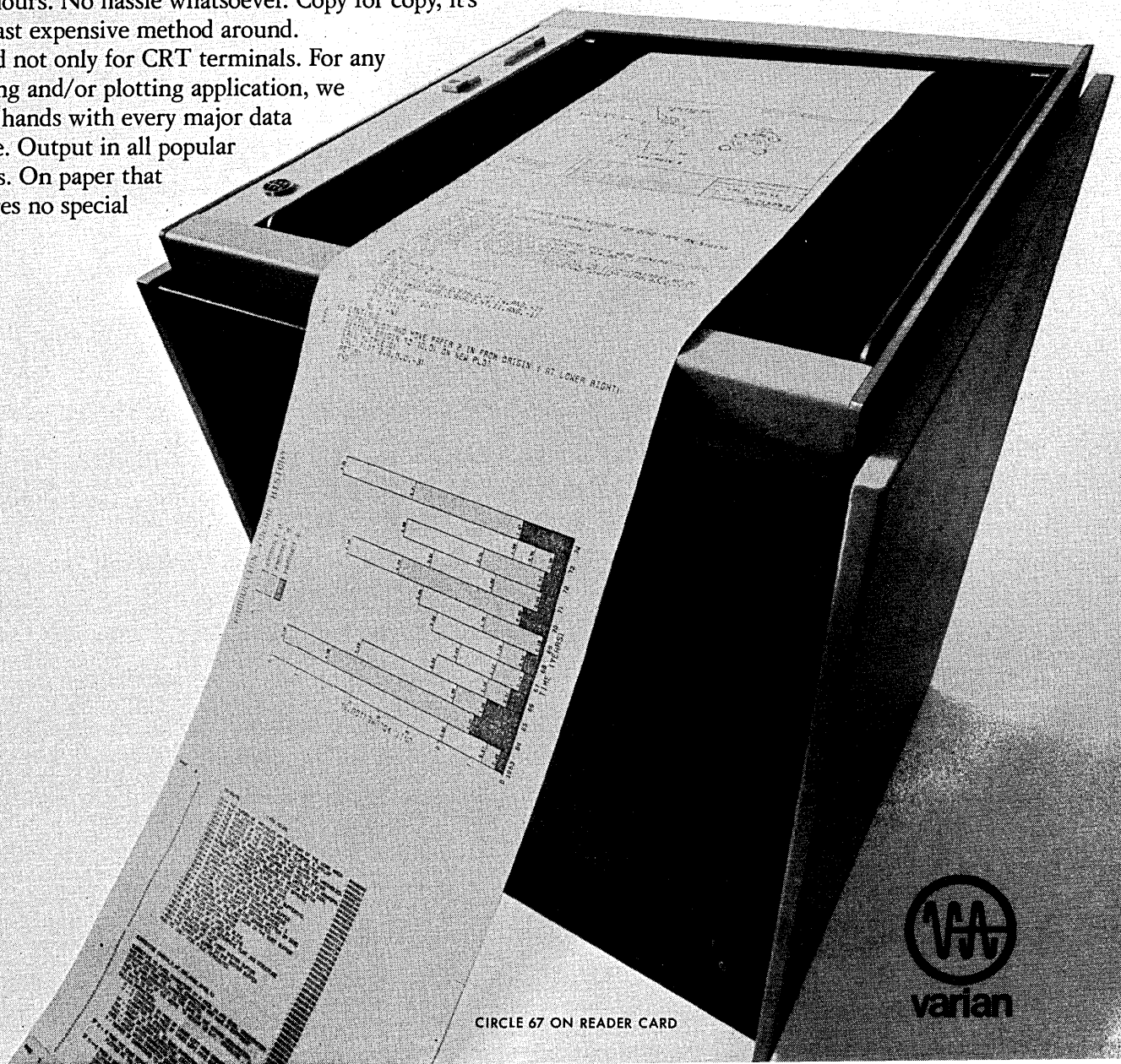
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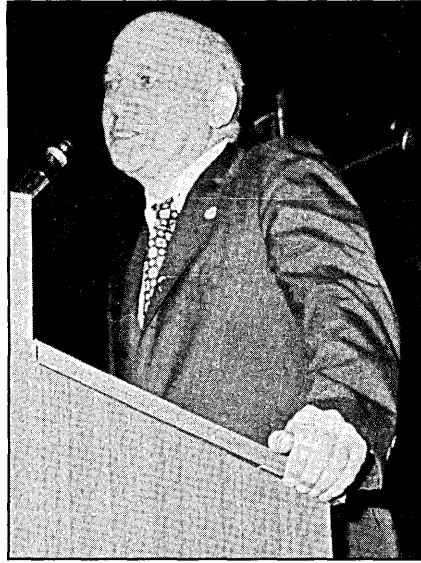
User Groups

NCR Users Hear Univac Keynoter

It's rare when a user group meeting for one mainframe vendor has as its keynote speaker a key executive from a competing vendor.

J. Presper Eckert, vice president-science advisor to the president of the Sperry Univac Div. of Sperry Rand Corp. was just that at the sixth annual international conference of NCR users, NUCON '76, in Atlanta last month. He explained it nicely.

"I came close to being from NCR," he said. Dr. Eckert, with his co-inventor of the Eniac, Dr. John W. Mauchly, founded the Eckert-Mauchly Computer Corp. in 1947. In 1950 the firm, in need of money, was looking to be acquired. "We talked to both Remington Rand and NCR. Our first offer came from Remington Rand and we accepted. Six hours later we got a better offer from NCR but we were already committed. Remington Rand became Sperry Rand and Eckert has been part of the firm's Univac operation since 1950. Univac (Universal Automatic



DR. J. PRESPER ECKERT
"I almost came from NCR."

Computer) was a project underway at Eckert-Mauchly Computer Corp. prior to its acquisition.

Eckert talked to NCR users about another early Eckert-Mauchly project, Binac, billed as the first electronic fully-self-checking computer. Development was completed in 1949. Eckert

said only two Binacs were ever built and that the patent application is still in the patent office . . . has been in the patent office longer than just about any other computer patent application. He expects action in about two months.

He talked of the "so-called good old days" when he was at the Univ. of Pennsylvania's Moore School of Electrical Engineering, where he first met Mauchly. "They were not really good old days, just a lot of hard work."

He said input/output has long been a big problem in use of computers and he doesn't think "it's improved very much." He cited memory as another "major limitation . . . maybe the greatest limitation, even with virtual storage."

A long way to go

In the I/O realm, Eckert said Univac, in its research laboratory, is working on input involving reading of fingerprints but "there are still lots of problems." He feels that many of the major problems of the early days of computing "are problems still." Computers, he said, "will have a small effect on every industry, rather than a huge effect on any one. The computer is far, far, far from being refined."

He gave his estimate of where the major ideas in computing have come from: better than 90% from the U. S.; 15% from universities; 30% from Eck-



International Congress for Data Processing (ICD) Berlin 1976

**The general theme of the Congress is:
"Benefits of Data Processing for the Individual, the Company and for the General Public"**

The favourable reaction of the experts to the 1st International Congress for Data Processing in 1974 clearly demonstrated the necessity for such a congress.

The experience gathered there will enable the 2nd ICD 1976 to take an even more practice-related course.

The Congress is arranged for the benefit of data processing management circles in industry and administration, of specialists in all areas of data and information processing, of users in industry, administration and public services and of interested parties in the fields of science and research.

During the first three days of the Congress, topical subjects will be put forward for subsequent discussion in concrete terms in a number of workshops.

The main weight of attention will be given to the following groups of subjects in order of importance: "Computers at the Work Desk", "Remote Data Transfer, Remote

Data Processing", "Measurement of Usage and Profitability", "Trends of Development in Hard- and Software" and "Compact or Large Computers".

A number of workshops will also be kept open in the programme of the ICD for subjects of special topicality, which can be determined at very short notice or ad hoc, as may be expected in such fields, for instance, as data security.

A special exhibition accompanying the Congress will provide a detailed survey of all types of technical publications on the subject of data processing.

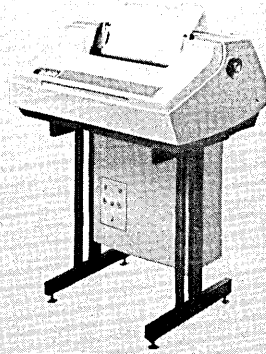
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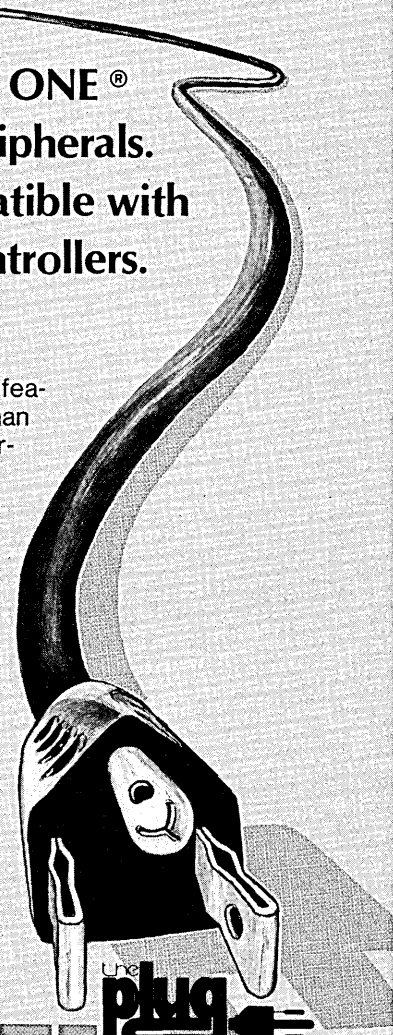
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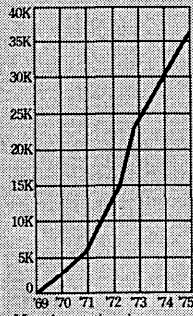
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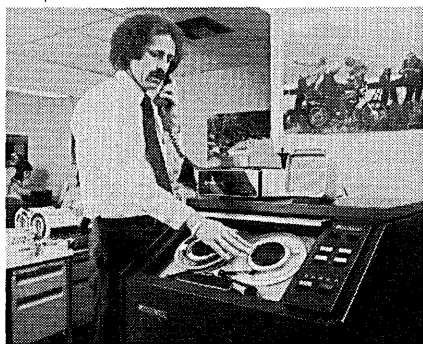
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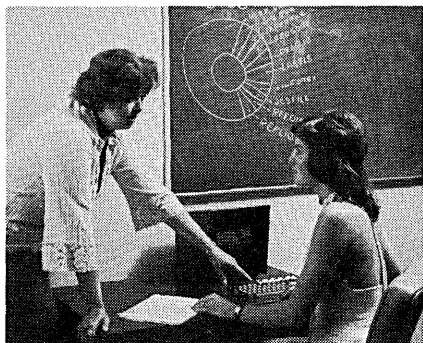
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June, 1976

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ert/Mauchly-Univac; 15% from IBM; and 40% from everyone else (presumably including NCR).

Eckert shared his idea on how the industry has and is changing. He believes in "four eras." The first, he said, was the "early" era, of growing, from 1943 to 1950, an era marked by the use of available components and systems ideas and one in which user requirements were not well-known or understood. In this era, "there were three and one-half major contributions per year." His second era, he called the era of "growing." He called this, the years from 1950 to 1960, the era in which "50% of the things we have today, happened." He said it was an era of new components and new systems ideas that were "mostly just refinements" but one marked by a high rate of five or six major ideas per year of which "only half are still with us."

Eckert's third era was one of "refining." These were the years from 1960 to 1975. "We were dependent upon the refinement of earlier ideas like time-sharing." It was an era dominated by communications and small computers, he said, and I/O was still a major problem. "There were three major ideas per year of which 1½ stayed on."

Era number four, Eckert calls the era of "maturing" and it's still with us. He dated it "from 1975 on." He said "we're starting to get more static than we like on things like mass storage and pattern recognition." He predicts no more than one really new idea per year for this era and feels that fewer than that "will stay with us."

He seemed to be saying the rate of change for the industry is slowing down.

Change at NCR

William S. Anderson, chairman and president of NCR, who was Eckert's opposite end (he was last speaker, Eckert, first) at the NCR users conference, painted a different picture for NCR as a company. "I think it's no exaggeration to say that no company in our industry has changed to a greater extent in the span of only four years," Anderson told the user group.

"Taken together, our computer and data terminal revenues contributed 75% of our total equipment revenues in 1975," he said. "This year they will provide 85 to 90% of those revenues. I believe those figures indicate, more convincingly than any words of mine, that NCR has pretty much completed the transition into a computer systems company."

Anderson said NCR "invested \$85 million last year in research and development, an all-time high. This year we

have budgeted more than \$100 million for R&D. That is twice as much as we spent for R&D in 1972."

He talked of reorganization in NCR. Two years ago the company changed from a product line marketing organization to a vocational structure. Four vocational groups were established. "In retrospect," Anderson said, "it should



NCR's RAY SMITH
Ribbon cutting chores during the cocktail hour

have been three." Soon it was obvious, he noted, that two of the four groups, retail systems and financial systems, were each producing twice as much revenue as the other two, commercial-industrial and medical-educational-government. The latter two have since been merged creating "a single organization comparable in size to each of the other two vocational groups."

No speakers

Anderson made note of the user group conference's attendance, which, at more than 800, was its largest ever. The conference's program, with 70 sessions, also set a record. All were well attended. Speaker-less luncheons seemed to be appreciated. Groups of attendees from individual companies, who split up for concurrent sessions, seemed to appreciate the opportunity to compare notes.

NCR chose the conference as the occasion for the first introduction of its new Criterion computer series (p. 137). Some conference organizers were leery of the "commercialism" of this but they made sure the introduction came at a time that didn't interfere with any of the user sessions. It took place late in the

news in perspective

afternoon of the conference's first day. Introductory talks came first followed by a ribbon cutting which took place during an NCR sponsored cocktail party. NCR demonstrators tried to extoll the Criterion's virtues over a babble from cocktail-toting users. The system even went down for a short time and one user guessed: "Someone probably spilled beer on it."

But all was not fun and games. NCR users are a serious lot when it comes to

Computers will have a small effect on every industry, rather than a huge effect on any one. The computer is far, far, far from being refined.

their jobs and the many applications sessions were livened and made more useful by question-and-answer sessions which, more often than not, had to be cut off by moderators to make room for sessions coming up in the same rooms.

In a session entitled "POS (point-of-sale) and Much More," Paul Cabra, of The Fair Inc., Beaumont, Texas told how his store built a system they call "280 flash" around a series of NCR 280 POS terminals. "Management wanted us to do everything with it (the system) but make coffee," he said. Apparently he came close. "The terminals are programmable and their use is limited only to the imagination." He said at the Fair they've qualified their terminals to handle 99 varieties of messages. They carry "pony's" on every terminal panel so the operator will have no problems knowing how to handle each kind of message. Beyond the standard point-of-sale use, The Fair's use of their 280s ranges from inventory information through payroll and employee productivity data.

Key figure in an audit

A session on "EDP Applications Audit," may have been the best attended of all at NUCON '76. Jim Winkels, EDP Audit Manager for General Mills, was the speaker. One of the key points he made was that someone who has come up through data processing, as he had, should be a key figure in a dp audit.

General Mills is made up of a multitude of separate subsidiaries and sub-subsidiaries, many of them with their own data processing organizations. Winkels said his group makes a point of letting these organizations know ahead of time when an audit is in the offing. They do both an applications review and a site review. They use interview techniques, partly using standard questionnaires, but "we try to get away from that because each case is different, each individual is different."

A session on "Interfacing with ACH (Automatic Clearing House)," presented by Mark McManus, vice president, Security Bank and Trust Co., Stroudsburg, Pa., produced more questions than it did answers. The questions came, for the most part, from representatives of small banks, who wondered how they could afford to participate. One of these questioners said he'd estimated, based on his bank's volume, it would cost \$1 per person per month to participate in an ACH. Many questioned the time involved. Security takes 45 minutes to process, via ACH, some 500 Social Security payments. David Brinkley, Security's dp manager, pointed out that this allows time for creating reports but the questioners were still wondering as the session ended.

But few attendees were wondering about the overall value of NUCON '76 as it concluded. Most already were talking about attending NUCON '77. "Know any good restaurants in St. Louis?"

—E.M.

Micrographics

Outlook is Hazy As Memory Prices Drop

In its recently-published survey of the microfilm industry, Frost & Sullivan says "the future of the microfilm industry will depend largely on how well COM (computer output microfilm) penetrates the marketplace." That question was being addressed—without any firm answers—at the National Micrographics Assn. conference and exhibit this spring in Chicago.

The Frost & Sullivan survey (182 pages, Report No. 373) showed that in the next nine years microfilm industry shipments will climb at an 18 percent annual rate to hit \$5 billion by 1985 and that COM's proportion of that market will rise to 37 percent. Coincidentally, the International Business Forms Industry (IBFI) said that 1975 was the first year of negative growth for the manifold business forms industry—a decrease of 4½ percent in product shipments from 1974's \$2.12 billion. Forms tonnage may have declined as much as 8-11%, the IBFI report said.

The report, while expecting some improvements in 1976, said the industry will experience a gradually declining growth rate as less paper and other computer output technologies cut into the continuous forms market.

Outlook is hazy

Despite all this good news—for the micrographics industry—the future is

somewhat hazy. "A few years back, if someone had asked me about the future in micrographics, I could have answered quickly, fairly certain of my ground," said D. W. McArthur, vice president of 3M Company's microfilm Products Div. "Today, however, it is a little more difficult."

McArthur said the rapidly lowering costs of computer memories and the development of scanners for digitalizing data could lead to an "era of competition between micrographics and the computer." Without forecasting the future, he said microfilm's most vital role will remain in solving the tremendous paperwork explosion by miniaturizing data by using light, laser, or electronic means to record rather than time-consuming keypunch methods or ocr (optical character recognition). "While computer memories are getting smaller and less expensive, it is still rather time-consuming to load them with the necessary data, and expensive to manufacture the memory devices as compared to the manufacturing costs of high resolution microfilm."

What is needed, McArthur said, is that the people in micrographics start to comprehend the computer, its memory and where it can be harnessed to work in the micrographics field. If the industry can learn, for instance, to take advantage of advances in the field of retrieval and display of information, it "can ride that wave for a number of years to come."

"However, if the industry fails to attract the young talent to utilize these advances, it could very well relinquish to the electronics industry the leadership in the area of data handling, and fall back to its original role of storing information for archival purposes."

Charles Askansas, president of Quantor Corp., Cupertino, Calif., disagrees with McArthur's assessment. He says hardware represents only 20% of the price of computer systems. Thus, reductions in memory is infinitesimal and certainly will be offset by rising costs of other things, especially software. Magnetic material is still more expensive than microfilm whose data density is much greater. Askansas, however, agrees with the need for both groups to study each other's needs. He's establishing a steering committee consisting of members from both industries to present seminars, position papers and lectures on subjects of interest to both.

Aid for Congressmen

The conference keynoter, Rep. Charlie Rose (D-N.C.) who is chairman of a House subcommittee on computers, told of a system using computers and micrographics to help members of Congress in the decision-making process. The Congressional Research Service of the Library of Congress has developed a file of some 200 major questions fac-

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ing members of Congress and provides such on-line data as background and policy analysis, pending legislation on the subject, a list of hearings that have been held and a chronology of events.

Computer output microfilm will allow the briefs to be updated and transferred to microfiche with copies being mailed to the home offices of congressmen and maintained on 20 microfiche cards. Rose said that trying to maintain a complete file of all 200 briefs in Washington and in two or three offices back home could be a real burden without the use of microfiche. "Each brief averages 10 or 12 pages and there are 535 members of the House and Senate, so you can see the paperwork and mailing costs involved.

"So if you hear your representatives in Congress making impressive speeches this fall on a lot of different subjects, chances are they got a little research help from microfiche." Rose said.

The NMA conference drew 10,304 persons to Chicago's McCormick Place, where the exhibit was held, and 1,900 to the Conrad Hilton hotel for the technical program. The exhibitor turnout at the exposition was 119, 10 more than in Anaheim last year, according to Jack Hess, NMA press relations manager.

That's a big show for an industry challenging the computer market. *

Communications

Products and FCC's Wiley at ICA Show

Two sub-minute facsimile machines . . . an automatic dialer attachment for a Xerox telecopier . . . an "intelligent" version of a facsimile terminal. These were among new products exhibited last month at the International Communications Assn. conference in Washington, D.C.

Also at the conference the Federal Communications Commission chairman Richard E. Wiley assailed the telephone carriers for their current efforts to "sweep away" commission-made communications policies. Wiley later discussed "remedies" that might reduce the harmful impact on the telephone carriers of competition from specialized carriers and interconnect suppliers—assuming the commission decides that such competition is real rather than rhetorical. An FCC study of possible "economic harm" from competition—Docket 20003—is underway. Wiley said the commission hopes to issue an initial decision "late this summer."

One possible remedy, he explained, is that telephone companies "might be

authorized to impose access charges for terminals interconnected with the network." (An FCC spokesman said later that Wiley was not suggesting these charges should be imposed only on independently-made terminals, because that would be "discriminatory." One possible non-discriminatory approach, the spokesman indicated, would be to let only marginally-profitable telephone carriers impose access charges.)

Other possible remedies:

—Usage-sensitive rates for intrastate service.

—"Repricing and unbundling of telephone service rates to make them more competitive with independent suppliers."

Remedial action promised

Wiley said FCC commissioners, once they have reached an initial decision in Docket 20003, will be in a position to determine whether the interconnect and specialized carrier decisions "pose special burdens on marginally profitable telephone companies." If some companies can't provide adequate service at a reasonable profit, "I believe the commission will take prompt remedial action." Wiley then added: "Accordingly, the attempt by certain large companies to oppose our policy by wrapping themselves in the banner of the small, rural entities is simply not very compelling."

But he also said that "if the public is to receive the benefits of innovation, efficiency and productivity stimulated by competition, telephone companies must be free to realize any efficiencies or economies of scale inherent in their operations. New entrants should not expect regulatory intervention to protect them from "... such market forces," Wiley pointed out. He added that "for this reason, I expect to spend most of the next several months personally reviewing the contents of Docket 18128, dealing with ratemaking principles."

New products

A digital sub-minute facsimile machine will be on the market early next year from Stewart-Warner for about \$200 a month—well below prevailing prices. A prototype was shown at the ICA show and engineering of the receiver is to be finished during the first quarter of 1977.

The transmitter weighs 12 pounds and fits easily under one arm. Using an array of 1728 photo diodes, it reportedly scans an 8½ x 11 in. page in 1.4 seconds. The scan has a resolution of 200 lines an inch horizontally and 96 or 192 lines an inch vertically.

A spokesman said the unit will consist of a separable transmitter and receiver packaged in a single unit and capable

of operating over either digital or analog circuits. Bit compression will reduce the amount of information that has to be sent. He added that a typical business letter can be transmitted between two stations in an average of 45 seconds over a standard analog dial-up circuit, and the image reproduced at the receiving end will have an average resolution of 200x200. A "dense" letter—i.e. one containing about 600 words—will require approximately 75 seconds of transmission time. Using a 56 kbs digital circuit, the new system will transmit a one-page letter in a minimum of 10 seconds and



XEROX SELF-DIALING SYSTEM: Secretary sets clock for 11 p.m. when automatic dialer will send trayload of documents at night telephone rates.

a maximum of 50 seconds, depending mainly on whether bit compression is used.

A major application of the new system involves transmission of facsimile data to a computer. The basic idea is to compress the data at the latter point, store it on a disc, have the computer automatically select the portion requested by each recipient, and then transmit only this data rather than the full document. Paper and transmission costs would be reduced, as well as the cost of the terminal installed at the receiving end of the message path—it could be a slow-speed facsimile machine or teleprinter. Two prospective customers will begin testing arrangements like this within the next few months, Stewart-Warner said.

3M machine hidden away

The 3M company announced it "has under development a facsimile unit that utilizes a digital system to achieve sub-minute transmission of (lettersize) documents." A prospective user said he saw a prototype of the equipment hidden away in an upper-floor room of the Washington, D. C., Hilton, the conference hotel.

He added that 3M told him the new system will go into production early next year, be priced at \$350 to \$400 a

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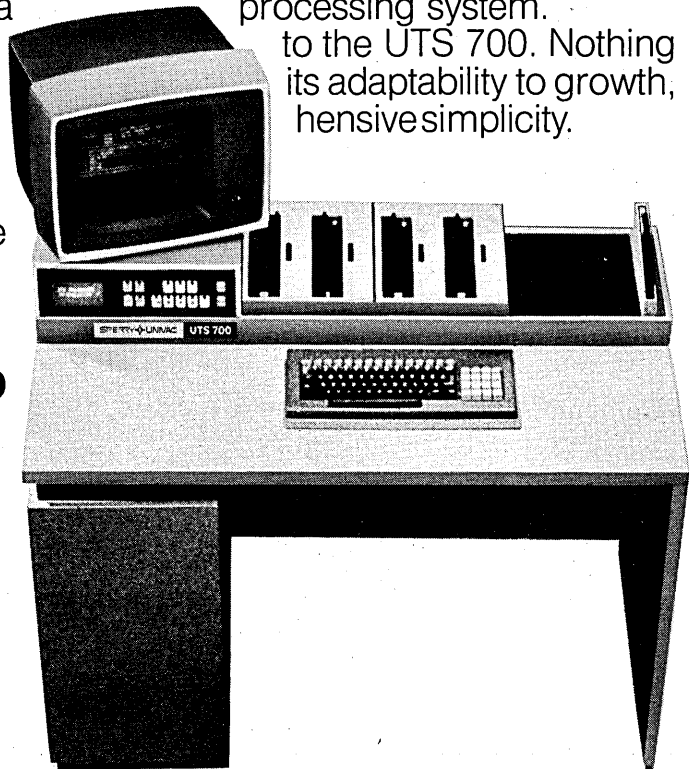
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month for a transmitter-receiver and roughly \$100 less for either unit alone. According to this source, the equipment will send a 300-word letter over an analog 4.8 kbs circuit in about 55 seconds, and in about 10 seconds over a 56 kbs wideband channel. Other features: it operates off-line as a copier; has an automatic loader holding 50 to 75 documents ranging in size from checks to legal forms and in thickness from onion skin to card stock; provides automatic dialing and polling; monitors the circuit continuously, drops transmission speed from 4800 to 2400 bps when necessary, and issues an audible alarm when no transmission is possible; offers remote on-line diagnostics.

This latter feature enables a remotely-located 3M service technician, through a telephone hookup, to exercise the terminal. Reportedly, in about 40% of the cases, he can diagnose the problem, tell the customer how to fix it, and get the terminal back into operation without a service call.

Automatic dialer

Xerox introduced an automatic dialer attachment for its Model 200 telecopier, priced at \$75 a month. The device en-

ables the machine to begin transmitting documents automatically after a delay specified by the user. Since interstate telephone rates drop sharply after 11 p.m., use of the dialer can cut communication costs substantially, said Xerox.

Up to 25 telephone numbers can be stored in the auto-dialer (they're read off cards which are mark-sense encoded by the user), and through the use of "pause cards" he directs the system to wait a specified amount of time between calls. A record of each uncompleted call is stored in the auto-dialer's memory and can be read on a gas-discharge display panel built into the unit. In case a failure occurs because the operator made an error in loading the copier, or because a circuit component failed, the panel displays a numeric code identifying specifically what went wrong.

Intelligence is added

Rapifax demonstrated an "intelligent" version of its Model 100 Fax terminal. Software has been added which enables the scanner to "discriminate between variable and redundant data" so that only the former has to be sent, the company said. The differentiation is

based on the use of different inks for the two kinds of information.

New multiplexor

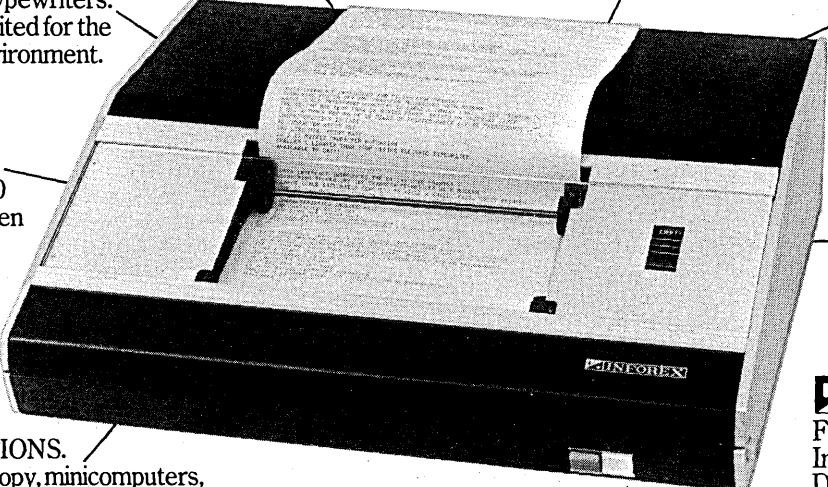
Western Union officials said they will introduce a new time-division multiplexor, the Model 4100 at the National Computer Conference in New York City June 7-10. It's the first in a new series and will be priced at \$6,800. The 4100 reportedly subdivides a channel of up to 9.6 kbs into as many as 20 asynchronous circuits. The Model 4200, scheduled for formal introduction next fall, will multiplex up to 64 asynchronous and/or synchronous circuits from a wideband trunk handling up to 56 kbs. Built-in, micro-coded circuitry will support several bit- and character-oriented communication protocols, including SDLC. A particular line will be dedicated to a particular protocol, or it can be switched from one to another either by the host or from the system control panel.

Electronic mail

Wiltek's booth was devoted mainly to the company's recently-announced "electronic mail service." EMS is based on an intelligent "electronic mail station" (base price: \$265/month), which Wiltek's Wilcom network polls periodically or on demand. The station is an upgraded version of the Wiltek teleprinter. It communicates with the net-

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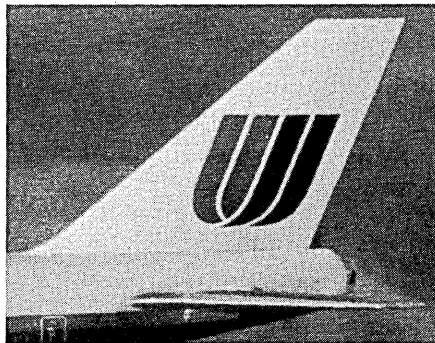
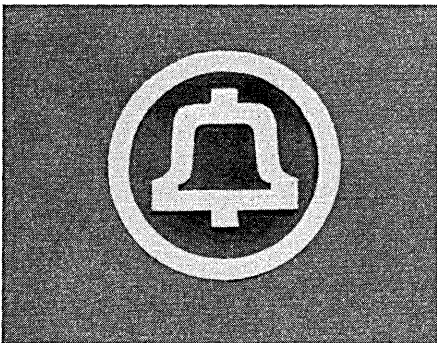
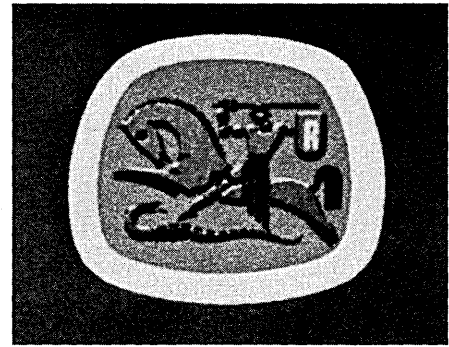
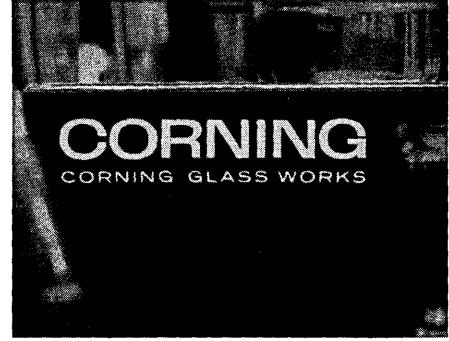
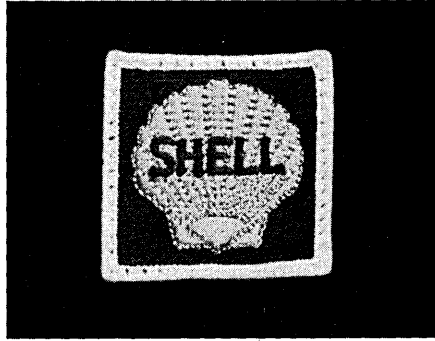
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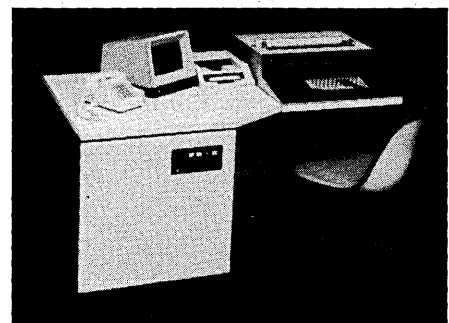
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work at 1200 baud over a dial-up line, or at higher speeds via leased circuit. The network links the station with other Wiltek terminals. Also, the station can communicate directly with Telex, TWX, and Mailgram users.

A Wiltek graph distributed at the ICA show contends that the cost/message of EMS is substantially below the cost of using mail, Telex, or TWX if a user sends 30 or messages a day. Eleven customers, including Westinghouse, Squibb, and National Distillers, will be installing electronic mail stations during the next three months, Wiltek reported.

—P.H.

Opposition Grows Against Bell Bill

A total of 64 representatives and nine senators now have introduced versions of the "Consumer Communications Reform Act"—legislation aimed at restoring the telephone carrier monopoly that existed before the Federal Communications Commission's Carterfone and Specialized Carrier decisions.

There are three versions of the bill, all of which closely follow a draft prepared by the telephone industry, often called the "Bell Bill." Meanwhile, efforts to slow a rapidly-accelerating snowball of support began taking shape at the FCC and on Capitol Hill.

In a speech at the International Communications Association conference (see accompanying story), FCC chairman Richard E. Wiley suggested the commission might endorse subsidies for marginally-profitable telephone companies. A key argument of the major telephone companies in promoting their bill has been that competition from specialized carriers and interconnect suppliers will force rural telephone companies into bankruptcy.

The House Commerce Committee's communications subcommittee issued an "agenda for oversight"—a list of the subjects upon which it intends to hold future hearings. A subcommittee staffer said the hearings may not start until next year.

"The subcommittee will treat as its first priority the rapid establishment of sound private ratemaking principles and a program insuring that they are adhered to by the carriers." The FCC common carrier bureau's recommended decision in this area "does not represent a final resolution of the issues."

The subcommittee specifically questioned the bureau's endorsement of rates based on fully-allocated costs (strenuously opposed by the telephone

carriers, and just as strenuously endorsed by the specialized carriers).

The subcommittee's review of the recommended decision "suggests" the long-run incremental cost approach—which the telephone industry favors—was rejected by the bureau "primarily because of practical problems," but the statement added that the subcommittee "wants to stress" that the recommended decision is "not an acceptable long-range policy."

Modify consent decree

An "alternative" means of "preventing predatory pricing" might include "modification of the AT&T consent decree," added the subcommittee, which then said it would "like the commission to report . . . as soon as possible on any such changes it believes would be desirable. The subcommittee suggests that this could appropriately be preceded by a formal inquiry . . ."

Security

Risk Managers Urged For Curbing Fraud

The General Accounting Office has recommended the establishment of "risk management" techniques within the federal government to handle computer frauds. A GAO report issued last month showed the government lost more than \$2 million through 69 computer-related crimes perpetrated at federal dp installations.

In many instances, the report indicated, it is almost impossible to detect, thereby making it almost impossible to determine how often it occurs.

Among the GAO's findings were 14 federal installations containing combustible magnetic tape files which were stored in computer rooms which exposed them to losses from fire. Other installations were vulnerable to flood, theft, terrorism or vandalism, the agency reported.

Describing "risk management" as an element of managerial science that is concerned with identification, measurement and control of uncertain events, the agency said it is used to make decisions regarding the costs of protecting against possible losses—primarily insurance losses. It noted that the method is recommended by the National Bureau of Standards in its publication, "Guidelines for Automatic Data Processing Physical Security and Risk Management."

Initial planning

The GAO suggested that in the initial planning for analyzing risks, consider-

While it may be "acceptable" to establish fully-distributed costs as "a point of reference . . . it may be unwise to rigidly rely on this approach during the immediate future." Instead, "the carriers should be allowed to make a case for lower rates on the grounds that they will result in a greater contribution to common costs and therefore benefit all users."

There were these other developments:

- Vance Hartke, who was the first senator to introduce the Consumer Communications Reform Act of 1976, and who will become chairman of the Senate communications subcommittee if reelected in November, soundly defeated his primary opponent, Rep. Philip Hayes.

- Hubert Humphrey, who seems likely to be Senate majority leader in the next Congress if he doesn't run for President, called for hearings on the legislation "as soon as possible."

- Datan issued a statement saying that it will be forced out of business if the bill is enacted. *

able care should be given to: estimated costs and availability of funds to perform an analysis; value of the physical installation; worth of data to the organization and to others; existing safeguards; and impact of data processing on the organization's mission or goals.

From this summary, management could then determine those risks that could be tolerated by the organization and those which require some control. Those requiring control then could be assessed according to risk avoidance; risk transfer (transferring some or all of its financial responsibility to another party through contractual agreements); risk assumption (the opposite).

Risk manager

The GAO report then suggested creating a position for a risk manager because the "system is not likely to succeed without having one knowledgeable individual responsible for decisionmaking and supervision over all technical and analytical activities in the process."

In small organizations, the position could be assumed as a collateral one by a top level management official. In a larger and complex entity, however, a separate position that is "sufficiently high" in the organization should be established for a risk manager with authority for dp security across organizational lines.

Some requisites for a top level risk management position:

- Knowledge of short and long-range goals of the organization;

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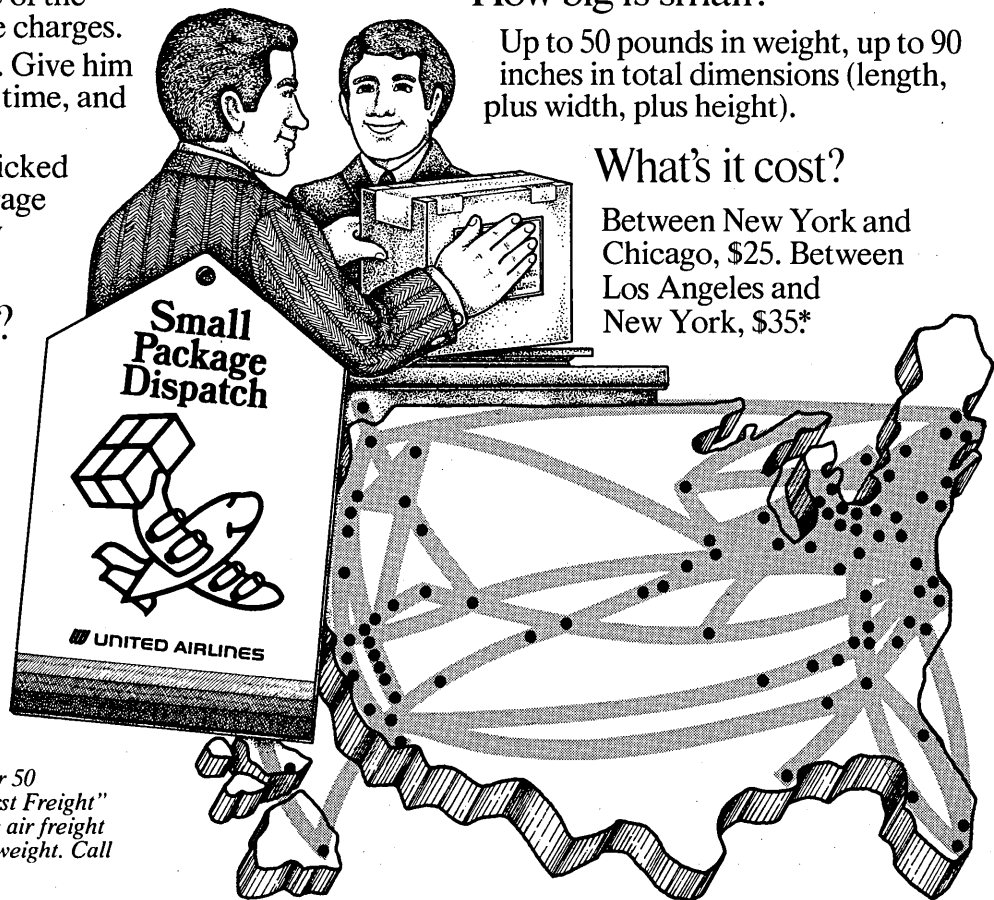
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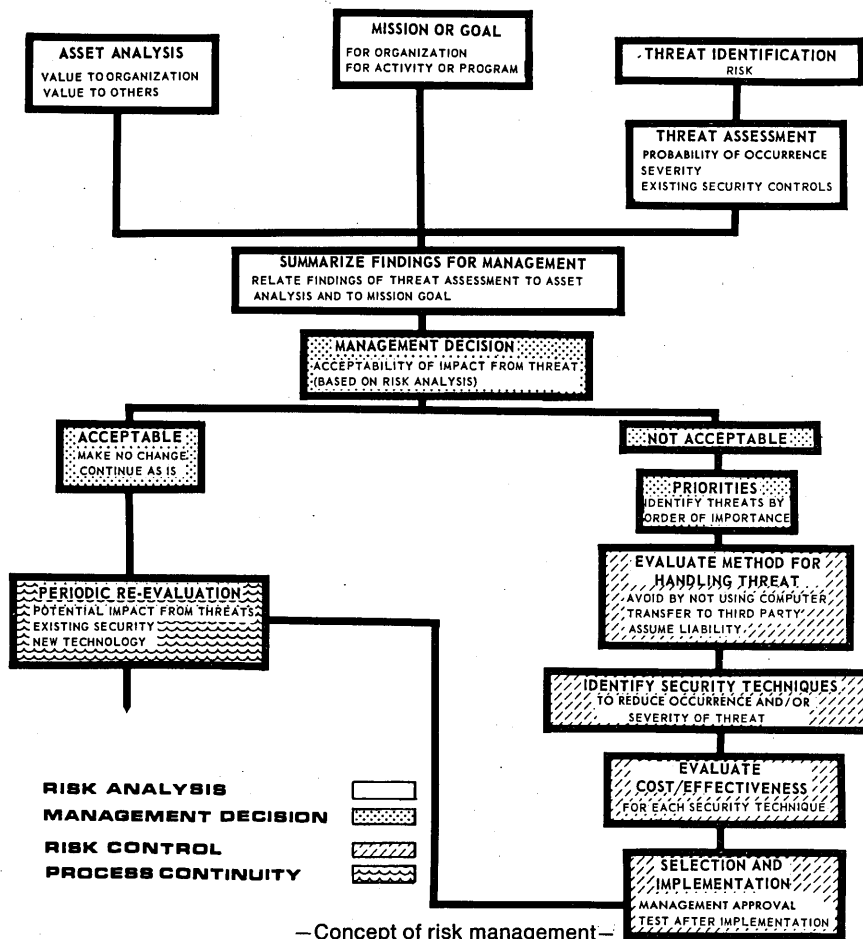
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— Concept of risk management —

- Awareness of users' security needs and priorities to establish and maintain appropriate levels of security;
- Awareness of new technology for security;
- Authority to make, or assist in making, policy decisions on security programs and procedures;

- Authority, with management approval, to implement security measures deemed feasible from a risk analysis;
- Ability to follow through periodically on security policies and practices in action, checking actual performance and results. *

Reservations

And Then There Were Three

Six years ago the hotel reservations arena was attracting computer based service firms like garbage attracts flies.

One by one, they fell by the wayside. Few remember the names of most of them—names like Reservations World, International Reservations, Telemax Corp., NARS Computer Systems, Inc.

Next month, July 23, to be precise, the last of the biggies in this field, The American Express Space Bank, will cease to operate. The Space Bank, a computer based hotel and car rental reservation system has operated since 1968.

After July 23, American Express said in its discontinuation announcement, reservation services will be maintained

solely for Mutual Computer Services, Inc., (MCS), a wholly-owned computer subsidiary of Continental Airlines, while MCS implements its own hotel reservation system for its airline customers.

Qantas Airways, now linked to Space Bank's computer, has stated its intention to continue providing hotel reservation services for its customers after July 23.

Maurice Segall, senior vice president of American Express and president of its Card and Reservations Div., said, "In 1974/75, we repositioned Space Bank principally as a service which airlines and the travel industry could use to provide hotel and car reservations. However, with the recent announcement that several major airlines would provide travel agents with a similar system of their design, and the ongoing discussions concerning industry-sponsored systems, we believe the reservations en-

vironment is in a state of flux which likely will result in functions such as those served by Space Bank being no longer viable."

For those few firms left providing travel reservations service—there are three, National Data Corp., Atlanta; Micor Inc., Phoenix; and Compass Computer Services, Huntington Beach, Calif.—this reasoning doesn't seem valid. However, none sees itself as providing exactly the functions served by Space Bank. Historically in the hotel reservations field each firm has seen itself and its service as unique.

Phone numbers game

A characteristic shared by most of the firms that bowed out was that they dealt directly with consumers. It was their phone numbers that the reservations making public called. This is not the case with the three that are left. The phone numbers used are advertised by the individual hotels as their own. In the cases of National Data and Micor the numbers reach their reservation centers. Compass doesn't have reservation centers or telephone answerers. "We think of ourselves as simply a computer utility," said Compass president, Pat Morrison.

For National Data, hotel and motel reservations are just a small part of a total business president George Thorpe describes as "the collection and dissemination of information—with an added value." The company has regional centers in Atlanta, Cherry Hill, N. J., Chicago, Reno, and Toronto, staffed by people Thorpe calls "formatters." These people answer phones and, in addition to hotel-motel reservations, handle such things as check and credit card verification, bank deposit information for all major fast food chains, and orders for merchandise. Thorpe said he plans to concentrate the reservations activity in the Toronto and Reno centers in the near future.

National Data's activity in the reservations field is linked to Mobil Oil Co. It handles all hotels and motels listed in the Mobil Oil Travel Guide which includes small chains and independent properties.

"Largest in the world"

Micor Inc. is a wholly owned subsidiary of Ramada Inns, Inc. Its reservations system is described by company president, Tom Castleberry as "the largest hotel reservations system in the world." The system was first designed for the Ramada Inns, now serves "five major chains" in the U.S. and 25 individual properties (hotels or motels).

The firm has been operating since June 1, 1974 and uses Texas Instruments 990 computers which Castleberry says "were built to our specifications" and Facit Model 4553 page printers. Castleberry is not worried about the kinds of

news in perspective

things American Express talked about in its announcement of the Space Bank closure. "There's was a PARS (an IBM developed reservation system for airlines) based system and their overhead was too high. I can control my operating costs."

Each "property" on the Micor system is equipped with a terminal which communicates with a TI data concentrator in Omaha which collects messages for subsequent transmission to the computer center in Phoenix. There messages are processed and the computer transmits a response back to the originating terminal. Reservations clerks receive the messages in the form of a printout.

Micor has expanded beyond reservations. It now offers hotels an internal room inventory system and is working on a front office management system. In late April it announced an "Inn-Power" system for reducing electric consumption and by mid-May had received 60 orders for it. Its newest offering is a "wake-up" system based on "a little mini" and a recording. It calls a hotel patron at a designated time. "If there's an answer," Castleberry said, "the system disconnects. If there isn't it will retry in ten minutes."

Like Micor, Compass has branched

out from reservations and, in mid-May, was "pretty close" to announcing an energy conservation system. President Morrison described it as "a data gathering, analytical tool." Compass is a 50-50 joint venture of Hilton Hotels and Transamerica Corp. Its system, based on two IBM 370/145s, has been up and running since January 1973. In addition to all Hilton Hotels and Inns, it serves Budget Rent-a-Car, Princess Hotels, and Auto-Train Corp., the outfit that carries both passengers and cars between Washington, D.C. and Orlando, Fla. In mid-May Morrison said Compass had "a couple of prospects that look good."

Its non-reservation services include a number of management reports and a marketing system which provides follow-up information on tours and conventions and travel agent commission tracking.

Morrison said Compass expects to handle seven million reservations this year. Like Castleberry, he isn't concerned about the things that bothered Space Bank. "We don't interface with the public. We don't have to market to the public and that's a costly part of the equation." He considers his biggest competition to be those hotels that decide to do it themselves.

He is concerned about the airlines but not about anything that's been announced so far. "Most airlines will make hotel reservations for their passengers but only in a routine way. They don't provide a sophisticated service." United Air Lines, however, has developed a system for Western International Hotels which it owns and Morrison said he's heard "rumblings" that UAL might market this package to other people.

He would have preferred United to follow the example of American Airlines which owns the Americana Hotels. These are on the Micor system.

—E.M.

Standards

Univac's Protocol Out in a Year

Sperry Rand's Univac Div. will officially announce its new link control protocol, UDLC, "within the next year," says a company spokesman. He described it as "a superset of SDLC, HDLC, and ADCCP which fixes the problems that have emerged since these protocols were announced."

In addition to UDLC, which enables only link control functions, Univac also is developing an end-to-end control

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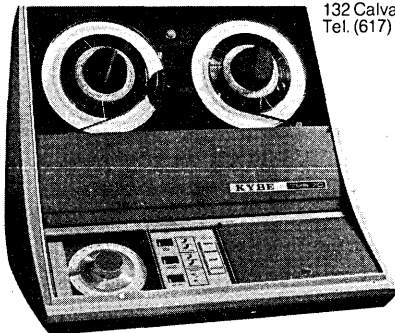
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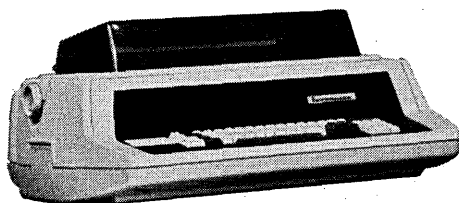
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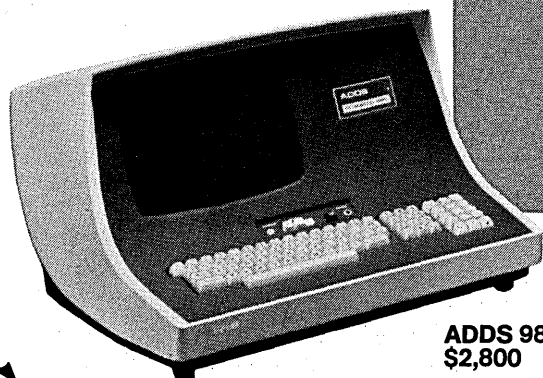
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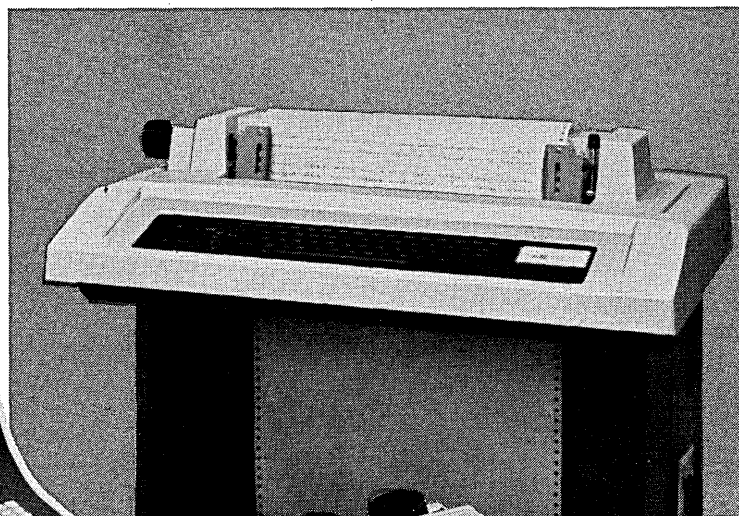
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scheme "that encompasses those functions performed by the 'handler' imbedded in VTAM and other telecommunications access methods," said the spokesman.

He indicated that this end-to-end control scheme will conform with the proposed standard recently recommended by Study Group VII of the Consultative Committee on International Telephone and Telegraphy (X25). Telenet and the Trans-Canada Telephone systems already have announced that X25 will be the protocol for their packet switched networks.

The spokesman added, however, that it hasn't yet been decided whether Univac's forthcoming announcement will be restricted to UDLC or will also include the end-to-end control scheme. The company plans to implement the new protocol across its entire line of computer front-ends, multiplexors and intelligent terminals. He also reported that Univac plans to support competing protocols in addition to UDLC. SDLC, the IBM protocol, was specifically mentioned.

Asked about other protocols, such as those developed by Burroughs and Digital Equipment Corp., he said "it all depends on the demand." *

Time-sharing

Timing of Phone Calls in California May Hurt the Time-Sharing Business

California is where it usually starts: The electronic handheld calculator, the microcomputer, topless dancing, you name it. For a change, the state has managed to lag behind some others in being charged additional message units for long-duration local phone calls. But the cutover is being made, and time-sharing users are about to be impacted.

The phone companies, miffed at all the people who make a local call to a computer and then tie up that line all day, have begun timing business calls in populous parts of the state.

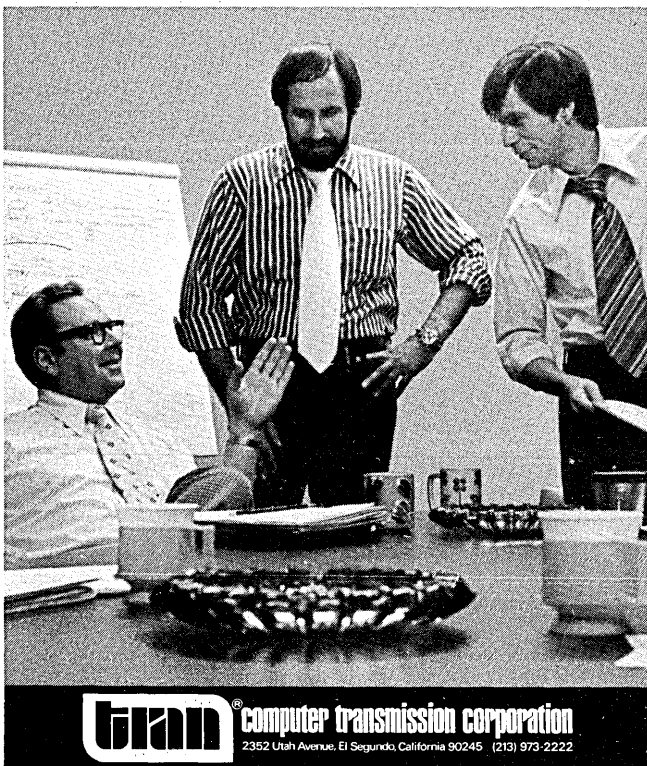
"We're presently running about \$4,700 total a month in message unit costs," says Barbara O'Brien, communications manager for Memorex Corp. The phone company estimates that under the new billing method Memorex's phone bill will increase by about \$1,000 a month. But O'Brien thinks that figure covers only voice communications and does not take into consideration the number of phones at Memorex using outside time-sharing ser-

VICES. "I do think it's going to impact us more than a thousand dollars a month," she adds.

Pacific Telephone, a Bell subsidiary serving the most populous areas of California, received authority from the state Public Utilities Commission in July of 1974 to begin implementing its so-called Single Message Rate Timing (SMRT) program in the state's five major metropolitan areas. Under this billing method, which applies to all businesses on measured service, the duration of local calls is measured and one message unit is charged for each five minutes or any fraction of it. A message unit costs five cents.

That may not stop the teenager or homemaker who ties up a line for hours on end, when this tariff is also applied to residences, as it eventually will. But it will have an effect on computer users who gain access to a computer with a local call. Thus for continuous service over local loops, it might become more economical to go to local private line

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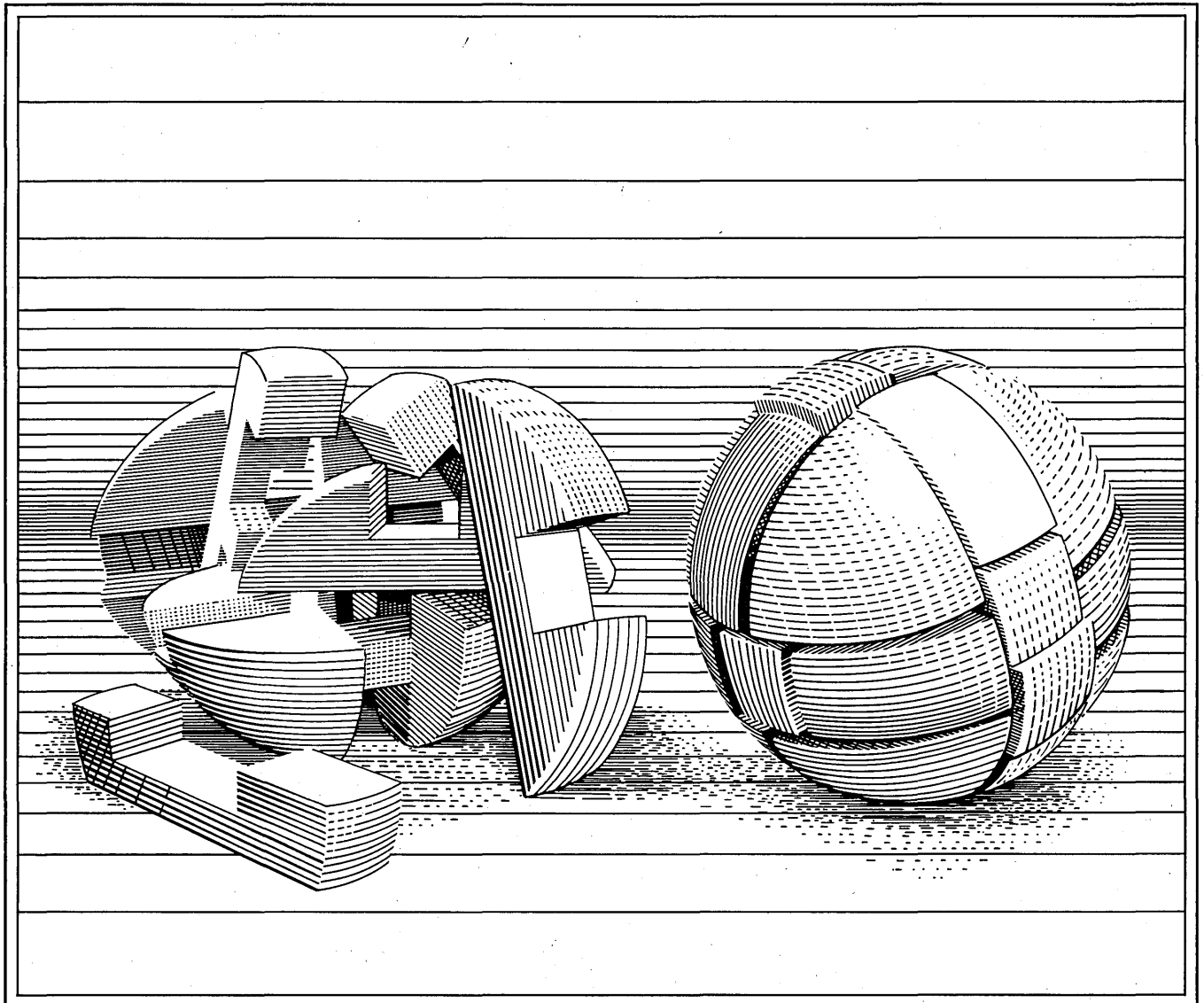
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service.

And that's precisely what's being recommended to the board of a high school district in Northern California. Educational consultant LeRoy Finkel of Menlo Park tells of a six-school district (being reduced to five) using dial-up lines whose phone bill currently is about \$315 a month. Under SMRT, what with terminals at six locations, including the district office, he projects a monthly phone bill between \$1,000 and \$1,400. He's recommending the use of multi-point leased lines, which he figures will bring the line costs down to some \$75 a month. But it requires a capital expenditure of \$15,000 for the equipment replacement.

FDM is their answer

Using frequency division multiplexing (FDM), he'll be able to run a maximum of 1800 baud on the line. It'll mean the ability simultaneously to run, say, six 30-cps terminals, or two Teletypes and one 30-cps crt terminal at one school and three more Teletypes at another school. The ability to service terminals at different locations is made possible by FDM, says a spokesman for General DataComm Industries, Wilton,

Conn. The firm is installing such systems not only for school districts but also for city and county governments.

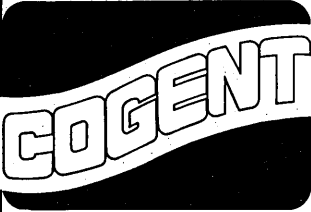
The idea of using leased lines to get around the new phone company tariff, however, does not appeal to RAIR Inc., a minicomputer-based commercial t-s service in Mountain View, Calif. This firm, now establishing additional computer centers in San Diego and in Denver, Colo., meets the needs of small, local users who gain access to the service with a local phone call. The problem is that they're limited to 32 ports, and a leased line ties up a port; if each user had a leased line, RAIR would quickly run out of ports.

Although SMRT has not been placed in effect in the area, RAIR already has felt its impact, handling a number of calls from concerned users who have learned of the impending change. "There's a lot of consternation," says Fred Valdes. The new tariff adds a surcharge of 60 cents an hour per terminal to a user's run time, which can mount up over a one-month period. The service bureau might be able to lower its rates, says Valdes, but "we run what I would consider a discount-house time-sharing service, and we really can't go very much lower."

One way around RAIR's limited number of ports is a port-sharing device, a port selector that can be visualized as a rotary switch. With it, a user who signs on is assigned to one port, but when he signs off that port can be assigned to another user.

Educational consultant Finkel says his first recommendation is to go through one's own PBX. The Palo Alto Unified School District, warned of the impending change two years ago, chose to go this route, treating each terminal as an extension line. But Finkel says his client missed an earlier chance to replace its old PBX. "Had it been replaced, we wouldn't be facing this problem," he notes. He advises that "if you don't have a PBX, maybe you ought to talk to your people about getting one." Noting that the new phone tariff makes a PBX sensible, perhaps economical for the first time, he adds, "I can see some schools that should be in a position where that may be a key to getting one."

The dollars add up very quickly under SMRT. (Martin Fletcher of Com-Quest Corp., the market research firm, notes that the tariff was initially called Single Message Unit Timing, but they didn't like the acronym.) If 10 terminals were hooked up all day over dial-up lines, that would come to \$480 a month. And that's not many terminals. Steve Robertson of Memorex observes that their users tend to stay hooked up to



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Terminal was designed with a typewriter-like keyboard with numeric pad. And communication control panel. Convenience and ease of operation are designed into the product:

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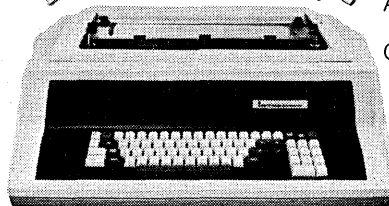
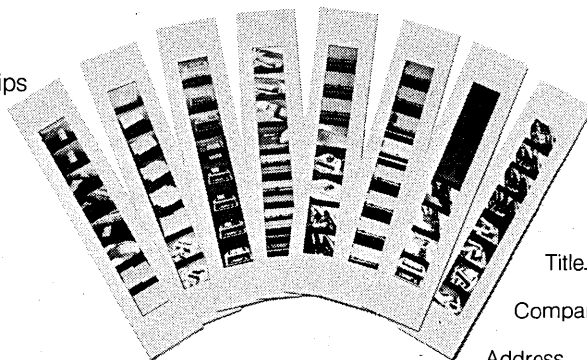
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news in perspective

outside services for hours at a time, even while they're out to lunch.

"My gut feel is that (the new tariff) is going to reduce the connect time," he says. "People are going to become aware of how much it's really costing them when they get these horrendous bills at the end of the month." He explains that the habit of staying hooked up—a widespread practice throughout the industry—is a carryover from their own internal system, which is TSO. In the past it sometimes was time-consuming to log on, so once the users got on they didn't want to lose their place in line. The firm has since remedied the bad log-on situation, but habits die hard. At outside, commercial services, he continues, the user will often encounter a busy signal during the peak midday hours, so once again he tends to stay connected after he's made a successful link.

Hillel Segal of the Assn. of Time-Sharing Users, however, takes this all in stride. "A nickel here, a dime here, isn't going to mean much," he says. "It's just another cost of doing business." He says that time-sharing services, on average, cost \$40 to \$50 an hour, including storage, cpu usage, and connect time. "The telephone costs are kind of incidental." —Edward K. Yasaki

Hobbyists

Computer Hobbyists Search for Software: Need is "Terrific"

While computer hobbyists continue to go wild over newer and cheaper hardware, an increasing number of them have reached that point where the desperate need is for software. The demand for microcomputer chips—the components of them, as well as interfaces and peripherals to attach to them—is being addressed by a growing number of vendors at the wholesale and retail levels (May, p. 201).

And the buyers, with a diligence and patience reminiscent of the pioneering days of the development of the digital computer, have been developing what might be termed applications programs—for gamesplaying, voice synthesis, and control purposes.

Among the legion of hobbyists, however, that patience may be wearing thin.

In Arvada, Colo., a suburb of Denver, a clearing house for marketable software has begun functioning in the home of Chuck and Diana Howerton, currently handling anything that sells for \$10 or less. And that with documentation.

"The need (for software) is terrific," says Diane, tending to the store while Chuck goes off to his job as a systems programmer. "And it will be never-ending, so long as people have their own systems and are not able to do this sort of programming, as it were, themselves. They will always need to have somewhere they can go to, either for new software or for answers to questions they have about it."

15-20 orders a week

The Howertons inaugurated the service in early March, experienced an early inundation of orders and inquiries and currently are receiving 15 to 20 orders a week for packages. They're disappointed only by the scarcity of software developed by users. "There's a great amount of talent out there that is not even being tapped," says Diane.

The cry for assemblers, editors, even compilers, has also resulted in a periodical devoted to free and inexpensive system software available to the hobbyist

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crowd. The first issue of *Dr. Dobbs' Journal of Tiny Basic Calisthenics & Orthodontia* appeared at the end of February followed in mid-April by the second issue. Two weeks later the third issue was mailed. By that time, some 600 subscriptions were being filled and an equal number was being sold at retail computer stores serving hobbyists around the country.

The interest is further highlighted by a version of BASIC for microcomputers earlier proposed by the publishers of the journal. It was in the spring of 1975 that the need was seen for a stripped down version of BASIC for hobbyists, one that fits in 2K bytes or less of memory and without such features as floating point arithmetic or the handling of arrays. That summer, a computer consultant named Dennis Allison wrote an article in a hobbyist's newspaper, *PCC*, published by the People's Computer Co. It stated how such a tiny BASIC could be designed in machine-independent form. In assembler language, he wrote a basic interpreter for an abstract machine and then noted that to get it to run required the writing of an interpreter for the user's specific machine. That was published in the fall of '75, by which time it came to be called Tiny BASIC.

Early this year, word on the first implementation of Tiny BASIC reached the editorial offices of *PCC*—from, of all places, Tyler, Tex. *PCC* editor Bob Al-

brecht immediately saw the need for a publication consisting of Xerox pages, to get the word out on this and anticipated implementations. Sure enough, word on similar accomplishments began arriving. The first two implementations were for the Intel 8080 micro and the third was for the Motorola 6800.

Other versions

"We understand there's a version written for the (MOS Technology) 6502," says Jim C. Warren, Jr., another consultant in Menlo Park, Calif., who took over the editorship of the new Journal.

Warren traces the coincidental development of Tiny BASIC with last year's phenomenal growth in the hobbyists market. While it is difficult to date the start of the craze, there is little doubt but that it received an enormous boost by the publication in *Popular Electronics* early last year of a story on the Altair 8800 kit by MITS, Inc. of Albuquerque.

In his simplification of this history, Warren allows three months for the readers of that article to order their kits, another three months to receive the kits through the mail and three more to build their home computer.

By the fall of last year, then, many hobbyists had a machine with no software and by the end of the year they were thirsting for information on software availability.

The first issue of the journal con-

tained six to eight pages of octal code for about a 2,700-byte first version of Tiny BASIC. Within weeks of the mailing of that issue they started receiving letters from people who got it up and running, including those who had to load it through the switch register.

Howerton tells of a 12-year-old boy in Denver who is programming in Octal. At his age, of course, he has his limitations and so he's now looking for an assembler. "I just never cease to be amazed by the market that is there and how hungry people are for game tapes and program tapes," she says. "They all want a more sophisticated version of Tiny BASIC because they've had fun with it and now they want to get to the gut level." She adds that such a version is in the pipeline but is not yet ready to be marketed.

Warren points out that hobbyists almost have to get the source code so they can do the modifications necessary for their own peculiar configurations. Everyone has a different setup, different types of peripherals, he says. Some have both a RAM and a PROM, while others have no PROM. So they must be able to get at least at the peripherals interfaces in the software. And that's what *Dr. Dobbs Journal* does: It publishes complete annotated source code. Pages after page of the stuff, apparently much to the delight of its readers.

—E.K.Y.

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News in Perspective

BENCHMARKS

Re-Established: The position of Presidential Science Adviser and the Office of Science and Technology Policy, abolished in 1973 by then-president Nixon, were re-established by a bill signed by President Ford last month. The legislation gives the new science adviser "a crucial role" in development of the federal research and development budget and policy, said Sen. Edward Kennedy, one of its sponsors. The adviser is made a member of the White House Domestic Council and an adviser to the National Security Council. As head of the new office, he will direct preparation of an annual critique of the federal investment in science and technology. He also will chair a "federal science and technology survey committee," whose main mission is to conduct a comprehensive study of federally-supported science and technology.

Debut In Japan: The Univac 90/80, yet-to-be introduced in the U. S., is on the market in Japan, competing with the IBM 370/158. The Japanese version, called the 90/800, was introduced by Nippon Univac which said it was made available in Japan first because of a more pressing need there for users of other 90 series systems to expand into larger configurations. It is the first time a Univac computer was unveiled in Japan prior to its U.S. introduction. A U.S. announcement is expected this month.

Standard Acquisition: United Telecommunications, Kansas City, Mo., and Standard Computer Corp., have agreed in principle on the acquisition of Standard by United Telecom. United will issue 227,500 shares of its common stock for the business and assets of Standard which provides time-sharing and remote computing services through its wholly owned subsidiary, Standard Information Systems, Inc., Wellesley Hills, Mass. United Telecom is a holding company which operates the United Telephone System.

Negotiations Ended: Sun Ventures, Inc., and Graham Magnetics Inc. said they have ended negotiations for a proposed acquisition of Graham by Sun which is a unit of Sun Oil Co. Both companies said legal problems caused by a suit brought against Graham by a shareholder, Dr. Forrest E. Lumpkin Jr., prevented consummation of the proposed transaction. Dr. Lumpkin charges Graham with issuing "fraudulent and misleading" statements that led people to make unwise investments in Graham.

Agreement in Boston: At Electro '76 in Boston, Mostek and Zilog announced an agreement for Mostek to second-source Zilog's Z-80 microcomputer components and for the two companies to develop memories and peripheral chips for the Z-80 family. "The agreement involves long-term financial commitments from Mostek for rights to certain Zilog technology," said Federico Faggin, Zilog president. Robert B. Palmer, vice president of the Texas-headquartered Mostek, said Mostek will concentrate on memories and Zilog on peripherals.

Cray Posts Loss: In its first financial report since it went public last March, Cray Research said it lost \$290,929 on revenues of \$14,217 in the first quarter ended March 31. Cray received \$9 million from its first public offering (May, page 17) of 600,000 shares of stock. The company said it had 824,632 shares outstanding at the end of its latest quarter.

EFT-POS Hook-Up Test: NCR will add electronic funds transfer to its Model 255 point-of-sale terminal and test it beginning in September with New York City's Chase Manhattan Bank. A yet-to-be-named food chain also will participate. Phase one of the test will consist of the entering of a customer's credit card number via the keyboard of the 255 and transmitting sales information to the bank's data base. If this proves successful, a card reader will be added to the 255.

Environmental Data: The National Oceanic and Atmospheric Administration awarded a \$5.4 million contract to System Development Corp. to develop a data processing and services subsystem for the National Environmental Satellite Service's TIROS-N Ground System. The environmental monitoring satellite will provide weather coverage over the entire world on a twice-a-day basis to the U.S. National Weather Service for use in forecasting short term weather conditions. The contract calls for the dp system to be operational by February 1978 when the first TIROS-N will be launched. Major subcontractors to SDC are Ampex Corp. which will provide a Terabit memory system and Systems Engineering Laboratories which will supply the computers.

Data Scrap: When a computer has processed its last bit, chances are it will end up in a heap at a Portland, Ore., scrap

dealer, called Data Scrap. The company buys old computers at from a penny to 15 cents a pound, has 12 persons who dismantle them, and sells the parts through various outlets, including a subsidiary, Broad Spectrum Electronics. Some go to the Taiwan scrap metal market. Peter Haney, president, said most are purchased from government owners and are of late '50 and early '60 vintage. Last year, the company invested \$70,000-\$80,000 in purchases of old computers. Haney, a former chemical engineer, formed the company six years ago and in the past 12 months has spent \$600,000 buying up old computers and other electronic devices for the scrap market.

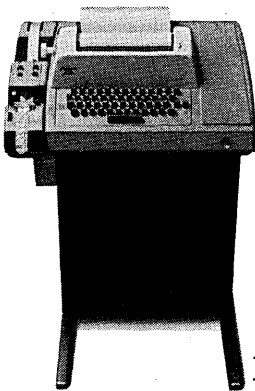
The Style of the Store: TRW, Inc. took a big plunge into the retail point-of-sale (POS) market late last month. Just 11 days after announcement of a definitive agreement under which it will take over maintenance and customer support of the Singer Business Machines customer base, it announced its new 2001 retail



POS system, a system it says is designed to fit the "style of the store." Most notable feature is a nine-inch video display for operator prompting and error checking—a first in POS. The system consists of a store level computer, a microprocessor based intelligent terminal support module, and POS terminals which offer full standalone capability on the sales floor. All programs are written in PLT 1, TRW's enhanced version of PL/1. The company said this makes it easy for the retailer to add or modify interactive programs. TRW formally announced the system May 24, and showed it for the first time May 31 at the National Retail Merchants Assn. financial executives conference in Puerto Rico. *



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LOOK AHEAD

(Continued from page 18)

equipment to protect your institutions and systems from being used fraudulently."

Smith made the promise to a group of Indiana and Illinois bankers who also were advised by Deputy Comptroller C. Westerbrook Murphy that national banks can have CBCTs in more than 40 states and "If your lawyer tells you what the status is (in a given state), and is the same as our ruling used to be, you can go ahead." The ruling that "used to be" allowed installation of the terminals within a 50 mile radius of a bank's headquarters following a 30 day advance written notice. The 50 mile limit was waived if the terminals were to be shared.

WUNDERKIND HENRY BURKHARDT ON LEAVE FROM DG

One of the wunderkinds of the computer industry, Data General's Henry Burkhardt III, is taking an extended leave of absence from the firm. Burkhardt was DG's combination trouble shooter-renaissance man, at different times heading up the mini manufacturer's software development, internal financial, and manufacturing operations. The intense but brilliant college dropout hadn't taken more than a week's vacation in eight years during which time, as one of the founders of DG, he helped propel the mini manufacturer to the front ranks of the industry. Now 31, Burkhardt is a battle tested veteran of the industry. He holds the title of vice president of long range planning at DG.

FREEDOM IS FREE AS LONG AS.....

The Freedom of Information Act has brought a lot of funny things out of the woodwork but it can be got around in some cases. The state of New York did it. The state was procuring a new computer system with Honeywell and IBM the only bidders. The state asked for a lot of top security, company proprietary information from both bidders. Both came through. Then Honeywell invoked the Freedom of Information Act and asked to see IBM's documents. Next thing, IBM found out. It did the same. The state, knowing it would take a long time to reach the courts, didn't do a thing. Honeywell got the contract.....

RUMORS AND RAW RANDOM DATA

Slippage in software development has been blamed for a delay in implementing the Society for Worldwide Interbank Financial Telecommunication (SWIFT). New date is October 1976. The message switching network will serve 300 banks in 15 countries. A similar network in the U.S., Bankwire II, successor to Bankwire I, which has been around since the '30s and had reached its saturation point in terms of the number of terminals it could handle, currently is being implemented for "limited testing"... Spike those rumors that Honeywell's computer chief Clancy Spangle wants to leave the firm. Spangle has had several fat job offers from other companies, but he's turned them down, which would indicate he's happy and well at Honeywell. Spangle is unhappy, however, that he had to leave his home by the sea in the Boston area for Minneapolis...The Computer Industry Assn. says that after a year of presenting the market definition portion of its case against IBM, the government now moves to the more exciting part of the case--alleged conduct such as bundling, fighting machines, and educational discounts. It says the government is expected to introduce a wealth of internal IBM documents which "demonstrate the company's ability to exclude competition and control prices"...The Association for Systems Management is taking a long, hard look at its members' "concepts of the profession" following its international conference in Toronto last month which drew an attendance of 1,200, a record for recent years. ASM plans an international attitude survey in which members will be asked why they joined and where they think they are going professionally...WEMA, which began in 1943 with 25 fledgling West Coast electronic firms, has grown to an organization of 750 companies in 28 states. Its directory of members, published last month, is available for \$35 (plus \$2.10 sales tax in California) from the association at P. O. Box 11036, Palo Alto, CA. 94306...Norden has established a Computer Product Center in Norwalk, Conn., to manufacture and market a mil-spec version of DEC's PDP-II. The ruggedized machine, which will be tested at Norden's sophisticated environmental testing lab, should be available in 1977. Norden is a division of United Technologies Corp.

(The first 500 are only a partial list)

not 30
days — not 90 days, but one year
chip or board level maintenance

switchable — for great
readability
results
from no fan — prevents contamination,
reduces maintenance

very low purchase
or lease prices (compare: \$51/mo.
for a 1920 character terminal)

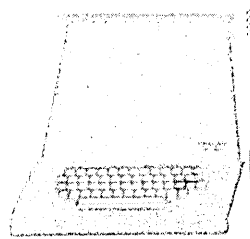
on-site
maintenance in most metropolitan areas

a look inside a Teleray
tells you right away that this is a
no-short-out unit

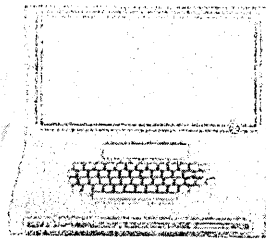
average 3 service calls per 100 terminals
per year

straight-forward
design, nothing fancy to give you trouble

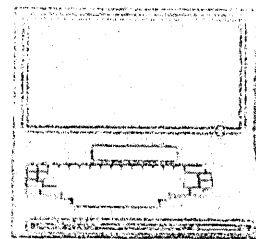
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the field (check the first 500 reasons
above)



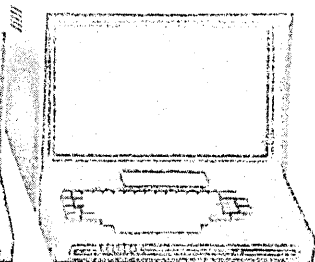
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hardware

Off-line

Magnetic media and devices for data storage have reached an engineering plateau and improvements for the near future will result from more effective testing and built-in system error correction techniques, says a man who should know. He's Michael S. Shebanow, V.P., Engineering for Pertec's Peripheral Equipment Division. Addressing an invitational computer conference earlier in the year, Shebanow foresaw no major technological advances making a significant impact on the near future. While these statements might be ominous for the magnetic recording device manufacturers, it must play right into the hands of solid state device researchers, such as bubble memory manufacturers.

It's claimed that the Vadic model VA-3400 is the industry's only full-duplex, 1200 bps modem. The manufacturer, based in Mt. View, Calif., has made arrangements to lease the products through General Electric's Instrumentation & Communications Equipment Service.

Explosive growth will mark the programmable terminal printer market from 1974 to 1980 when the number of printers installed will increase six-fold, according to International Data Corp.'s report entitled "Terminal Printer Market." According to the study, programmable terminals (both standalones and clustered systems) will increase from 47,300 installed in 1974 to 303,300 installed by 1980. The total terminal printer output was 15 billion original pages in 1975, and it's thought that this number will increase to approximately 50 billion by 1980. IDC is headquartered in Waltham, Mass.

GTCO CORP., Rockville, Md., has acquired the rights to manufacture and market Digi-Data Corp.'s series 3000 MT/ST magnetic tape readers and series 3500 magnetic reader systems.

The first IBM System/3 model 12 has started school. It's used at the Princeton University Store on the University's 230-year-old campus. The cardless system is primarily used to keep track of charge accounts, inventory control, and billing chores for the eating halls, the faculty club and student agencies on campus.

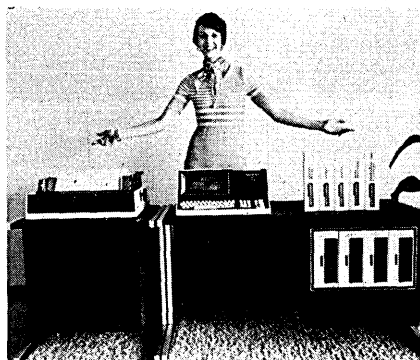
6250 bpi Tape Drives

Production is underway on this series of 6250 bpi tape drives which are offered both the oem and end user markets. Actually, two series debut, the 3400 models which feature 800 and 1600 bpi recording densities, and the more interesting 3600 dual-density transports featuring 1600 and 6250 bpi recording. Four models are available; 45, 75, 100, and 125 ips speeds yield data rates of 280, 470, and 781 KB second transfer rates, respectively. The 9-track drives have a nominal load time of five seconds, and a rewind time of 48 seconds. It's claimed that design breakthroughs have been made in features such as tape path and servos. The drives are both electronically and logically compatible to IBM offerings and are warranted to perform equal to or better than the competition in comparable environments. Prices begin just under \$10K per unit. GULLIVER TECHNOLOGY CORP., Santa Monica, Calif.

FOR DATA CIRCLE 226 ON READER CARD

Accountant's System

DATACOUNTANT is a variation of this firm's Datapoint business system expressly designed to entice independent accounts into the user ranks. The system is comprised of a Datapoint 16K mini, keyboard/video display, four floppy disc unit, each capable of storing more than 250,000 characters

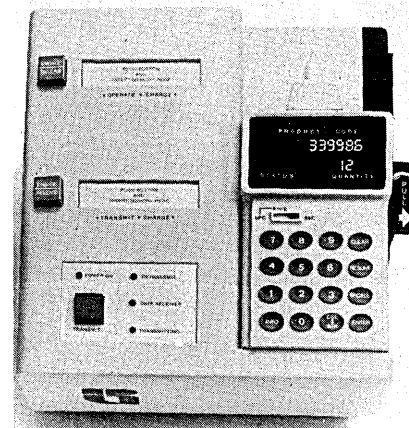


of data, and a variety of printers. These can range from relatively low-speed units to 300 lpm capability. The accounting programs are said to be designed with such a wide variety of options and formats available to the user that no programming capability is necessary for utilization. Packages include payroll, client accounting system, professional time accounting, word processing, and standard accounting. A typical three-year lease for the system runs \$627 per month after

an initial license fee of \$1,950. DATAPOINT CORP., San Antonio, Texas. FOR DATA CIRCLE 227 ON READER CARD

Order Entry

ULTRAPHASE is the name given to a portable handheld microprocessor-equipped terminal complete with built-in optical scanning probe and light-emitting diode display. The developers see the pharmacy, supermarket, hardware store, mass merchandiser, auto-



motive supply and other similar retail outlets as the principal markets for the terminal. The scanner can read the Universal Product Codes (UPC-A and UPC-E) in either direction as well as other bar codes, both black and white and color. The display has 12 digits for the product code, three for quantity, and a status code. The microprocessor can check entries to detect errors, and comes with two removable solid state memory packs capable of storing four thousand characters, or 800 line items. The data transmission rate is 120 cps. The microcomputer module, service module and two memory packs sell for \$2,950. BERGEN BRUNSWIG CORP., Los Angeles, Calif.

FOR DATA CIRCLE 228 ON READER CARD

Printwheel Mods

So you've fallen in love with your Xerox 800 ETS printer, but would like to change some of the characters on the printwheels? This firm knows how to do it (and claims to have Xerox as a customer). It probably involves using that luscious Hawaiian sand to remove the old characters and add the new ones. The charge is \$15 per character change, and the firm, which also gets into specialty and custom printwheel and single element typehead design,

For example . . . today's cost for an IBM 360 is about 25% of the current price for an add-on Memory. This does not mean that you should put your 360 out to pasture. Far from it. Your 360 is a very enhanceable CPU and Standard Memories has a better idea . . . SMART® Systems. The simple addition of the Standard SMART® compatible Core Memory can give your basic 360, regardless of Model, an entire new generation of life expectancy.

SMART® Systems is total assurance of reliability, low-cost, minimal downtime, and huge increases in computer memory within a small space. The SMART® Systems Series are a unique memory attachment that offers the user complete flexibility of configuration. You

can replace your present 360 core memory or expand its capacity to as much as 2.0 Meg-A-Bytes with a Standard Memories' SMART® System. You can actually more than double the capacity offered by IBM.

MODEL SM 300

IBM 360/30 Compatible Memory up to 512K Bytes

MODEL SM 400

IBM 360/40 Compatible Memory up to 512K Bytes

MODEL SM 440

IBM 360/44 Compatible Memory up to 1.0 Meg-A-Bytes

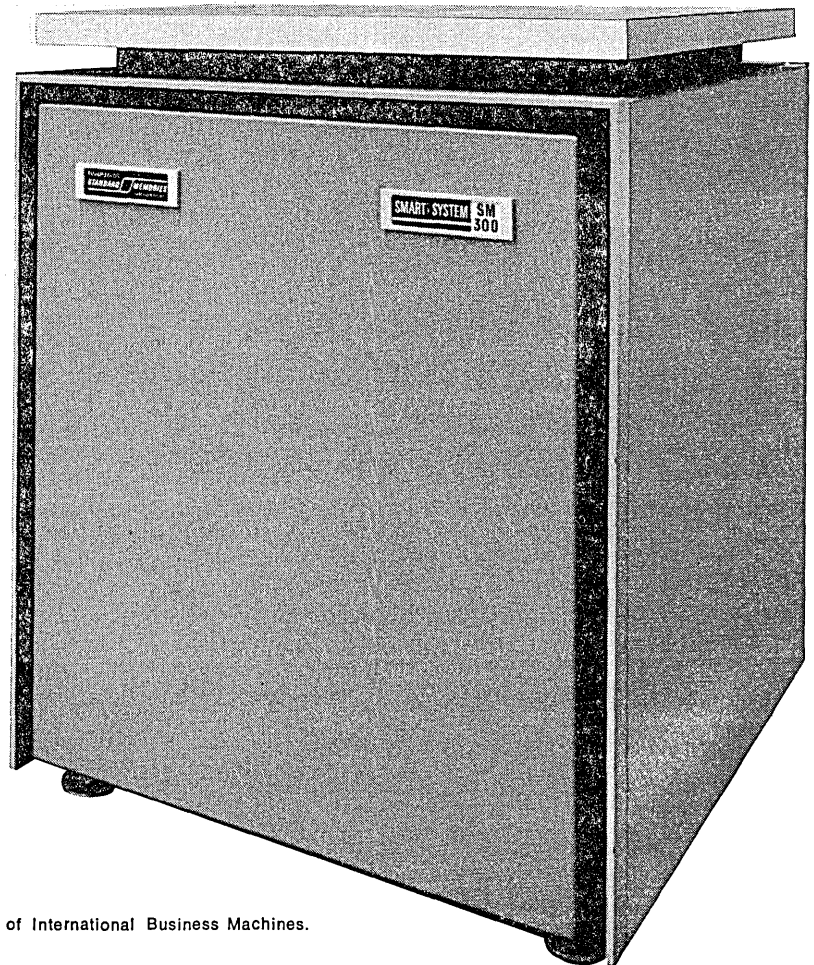
MODEL SM 500

IBM 360/50 Compatible Memory up to 2.0 Meg-A-Bytes

Call or write Herb Godfrey

STANDARD MEMORIES  AN APPLIED MAGNETICS COMPANY

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CIRCLE 90 ON READER CARD

hardware

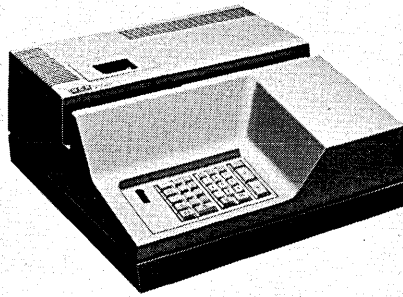
can turn them around in approximately two weeks. CAMWIL INC., Honolulu, Hawaii.

FOR DATA CIRCLE 229 ON READER CARD

Document Encoder

The 7740 utility encoder provides encoding for all fields on financial institution documents in either MICR or OCR fonts. The microprocessor-based device can be programmed by the user to specify field formats, typefaces and other variables. Each field can contain up to 16 characters, with a limit of 70 characters per line. The operator can enter any or all fields for document encoding. An automatic field-entry

feature allows an entire field to be encoded by depressing a single preprogrammed key. A second model, the 7740 proof encoder, incorporates a journal printer and four totals, including an adding machine feature. It



can be used as a utility encoder as well as in low volume proof applications. Prices for the utility encoder begin at \$2,250 and prices for the proof en-

coder begin at \$3,450. Deliveries are scheduled for September. NCR CORP., Dayton, Ohio.

FOR DATA CIRCLE 230 ON READER CARD

Crt Terminal

A 12-inch crt terminal equipped with a Bell 202-type modem is now available. The Video 100 is available as either a standalone terminal or can be obtained with a cassette buffer that allows it to operate with various modem arrangements at speeds up to 1200 baud. The display features 24 lines of 80 characters for a total of 1,920, with each character generated as a 5 x 7 dot-matrix. A one-year lease for the crt/modem combination is \$86; with automatic answer modem, \$90; and with manual or automatic answer with

product spotlight



Fourth Generation Systems

It's been a long time since NCR announced a major line of computers, and many people were thinking they probably wouldn't invest the money and make the corporate commitment to do it. They were wrong. The Criterion Series is possibly the most exciting computing announcement of the decade and shows what is possible using the latest technology in nearly every aspect of systems design.

Before the term fourth generation computing system became misunderstood to mean all-LSI designs, or IBM's 370 series, or even virtual memory computers, it meant machines that could be in effect customized to each installation's particular processing requirements. That can be done on the first two models of the Criterion Series, the 8550 and 8570. A floppy disc is used to organize the microcode of the machine into a COBOL machine, a dynamic multiprogramming system, or run in Century-compatible operation (NCR's existing large scale series). Another interesting architectural feature of the new series is a bus organization that is rather common to minicomputer systems but has never been tried in a larger system. The bus connects all the subsystems that comprise a tradi-

tional mainframe. The direct memory access capability of the highspeed devices means less that the cpu has to do. It seems like a good idea.

Deep inside the system one finds extensive use of ECL, a very fast form of circuitry that has been proven in recent years, MOS memory on 4K chips that can be expanded to a full megabyte within the confines of the mainframe's cabinet, multiple virtual storage, providing up to 16 megabytes of memory per each program (sound familiar? It should; the specs are the same as IBM's MVS operating system), and more. NCR likes to call the processor a pipeline unit, but their engineers must have had a little trouble talking to some of the CDC engineers who looked over the Criterion development. While the very fast 56 nsec processor can be fetching, interpreting, and executing instructions on its three minor cycles, this still seems to be a form of instruction overlap. There's no misunderstanding on the intent of the design, however, and that's to squeeze even more performance out of the design. The breadth of power covered by the initial offerings of the Criterion Series span from the Century 200 and go beyond the performance of the Century 300. Other hardware goodies

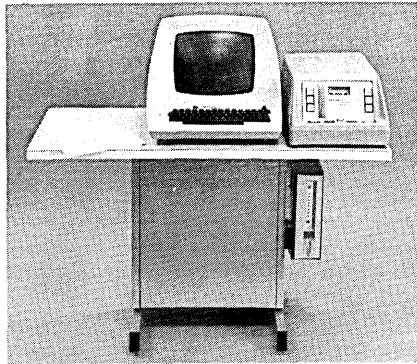
include a dedicated service processor to manager operating control and act as the diagnostic control center, remote diagnostic capability (most of the machine designers are at NCR's Rancho Bernardo facility near San Diego), and even a miniprocessor for intelligent disc interface and multiple microprocessors for the communications interface. No mention was made of multiprocessing capability, but NCR mentioned its 351 system in Japan that is a multiprocessor system. The implication was clearly that such an announcement could easily come on other models in the line still under development.

For power, it's estimated that the smaller of the two systems offers about 35% more processing power than systems such as the IBM 370 models 115 through the 370/135—and at less cost. Most application programs, files, terminals and peripherals used with Century processors can be transferred directly to the Criterion. Languages include COBOL, NEAT/3, FORTRAN, RPG, and BASIC.

Initial deliveries begin in late summer with software to run in Century series mode. The Virtual Resources Executive which should really make the system click is scheduled for release in the middle of next year. Any delays in the development could certainly diminish the system's attractiveness.

A basic Criterion 8550 equipped with 128K bytes of memory, 112 msec processor, integrated 600 cpm reader, 1200 lpm printer, and 200 megabyte disc drive rents for \$5,900/month on a five year agreement. The more powerful 8570 with 256K bytes and the 56 nsec processor, same reader/printer combination, and 300 megabytes of disc storage, rents for \$11,500/month. NCR CORP., Dayton, Ohio.

FOR DATA CIRCLE 225 ON READER CARD

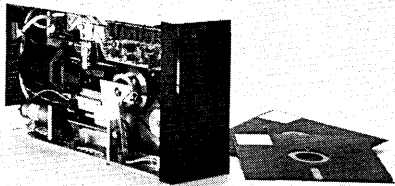


reverse channel, \$95. The pedestal is an additional \$6/month. WESTERN UNION DATA SERVICES CO., Mahwah, N.J.

FOR DATA CIRCLE 231 ON READER CARD

Diskette Drive

The model 270 dual diskette drive is one of the most sophisticated variations of the original floppy disc we've seen to date. A single 19-inch rack can hold two of the units if placed horizontally, or four if housed vertically. Fully compatible with the IBM 3740, each drive can store a total of 3.8 megabits, 1.9 million bits on each diskette. In



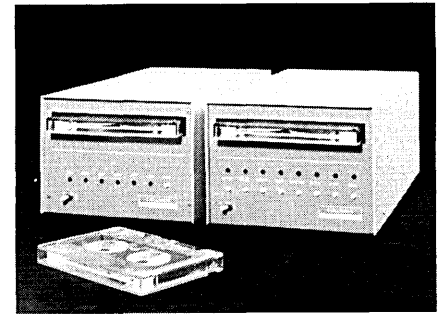
non-IBM hard or soft sectored formats the drive will store up to 6.4 megabits. And a double density option doubles this capacity. Voice coil positioning is used to help provide random average seek times of 33 msec and full stroke 76 track seeks of 100 msec. Track-to-track access is 10 msec including head settle time. Other features include ceramic heads, built-in hard sector capability, parallel or radial system interconnection, and optical index sensor. Prices are approximately \$880 in orders of 50 units. PERSCI, INC., Marina del Rey, Calif.

FOR DATA CIRCLE 232 ON READER CARD

PROM Programmer

June is traditionally prom month, and the Model VIII is ready for invitations from oem's programming mos programmable read-only memories. Programming is accomplished through a keyboard, a master ROM, or the manufacturer's RAM-PAK memory cube. Features include hexadecimal keyboard, address and data displays, mode control switches and supporting indicators, and the capability to select a special address or a data field using upper and

lower address limits. Programming or verifying initiates the automatic sequence of ILLEGAL BIT TEST—PROGRAM—VERIFY; detected errors are indicated with appropriate address and data displayed. The Model VIII is priced at \$1,700. A binary version is also available. DATA I/O CORP., Issaquah, Wash.
FOR DATA CIRCLE 234 ON READER CARD



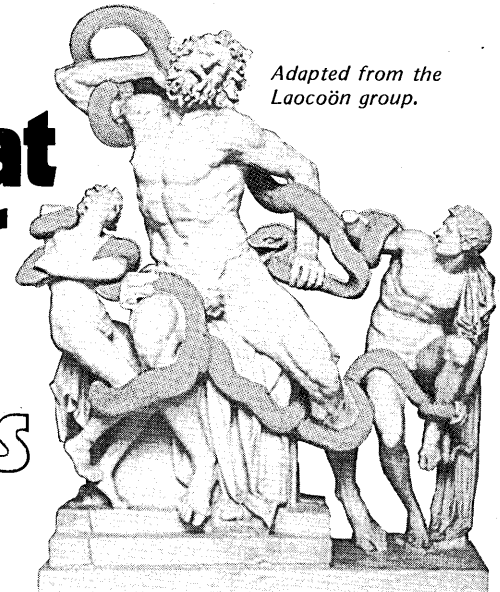
Data Cartridge Drive

The 300-S is the first product from this new peripheral manufacturer, and it enters into competition with other 3M data cartridge drive manufacturers. The unit features a dual-gap head and

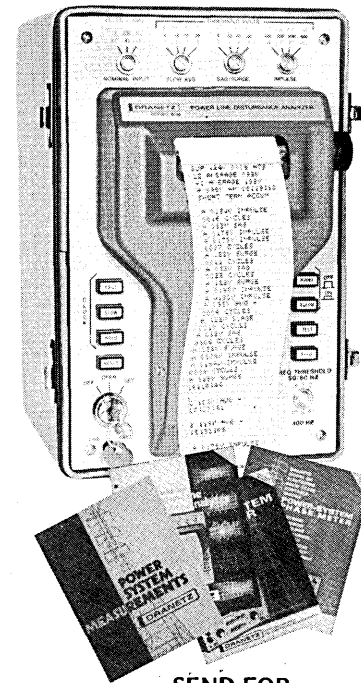
synchronous formatter for read-after-write and character redundancy checking. A parallel I/O structure is used in the formatter/controller to simplify interfacing to microprocessors

Watch that Power Line!

with this



Adapted from the Laocöon group.



A low-quality power line can tie your computer — and your EDP budget — in knots, yet look perfectly innocent . . . until you look the other way. Meanwhile, your downtime piles up, and your bottom-line bottoms out. What's more, you don't know what happened, so there's no way to prevent or cure it. Maybe you've got a clean, steady AC line — usually. But just one sag or surge, a long sneaky drift, or a single big glitch, and your data in becomes garbage out.

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CIRCLE 110 ON READER CARD

hardware

and minis. The single track (625,000 character) unit is priced at \$1,495, and a four-track, 2.5 million character model is only \$200 additional.

The buffered control unit, model 300-B is also new. It contains a dual 128-character buffer for asynchronous applications. Standard features include RS-232/tty, parallel interface, editing/-searching capabilities, remote/manual control, etc. The buffered one- and four-track models are \$1,795 and \$1,995, respectively. Delivery is within

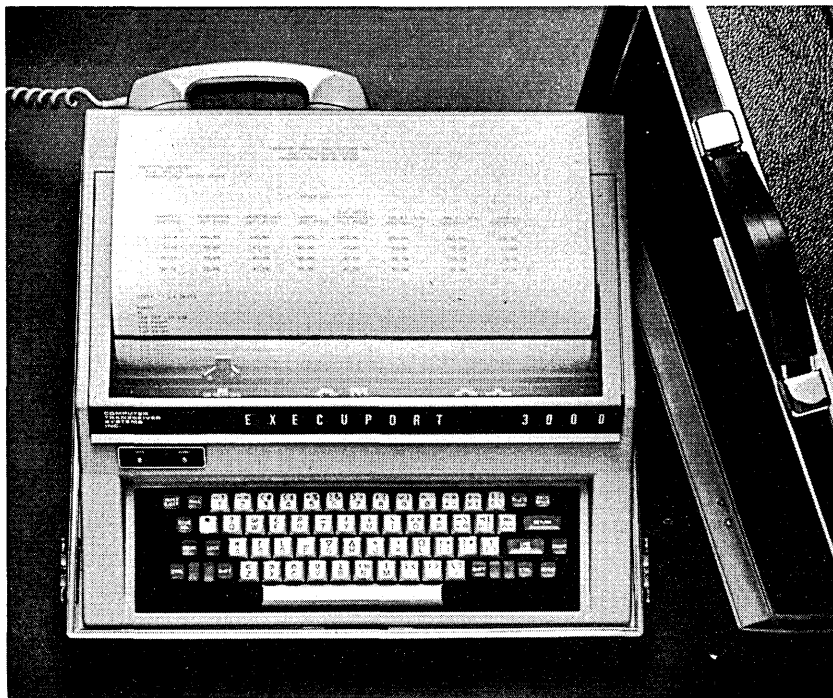
thirty days ARO. COLUMBIA DATA PRODUCTS, INC., Baltimore, Md.
FOR DATA CIRCLE 233 ON READER CARD

System/7 Data Recorders

This firm's data recorder unit, which has been so highly successful in IBM System/3 installations, can now be attached to IBM's System/7 to provide data input at speeds up to 300 cards per minute. In addition to providing important dual-file card reading and punching capabilities, the data recorder has an input reading rate over 10 times faster than the comparable IBM unit and output punching speeds

How we got a 136-column portable into our 80-column portable.*

*Optional APL Code.



Our new 136-column 3000 portable terminal has the same outside dimensions as our 80-column 300 portable. How did we do it? By completely redesigning its interior.

Result? A terminal with everything: compactness, reliability, two switchable codes, (APL/ASCII), complete plotting capabilities, 1/4-line spacing in both directions, and, of course, adjustable up to 136-column width.

Equally remarkable, it prints 30 cps, operates over regular telephone lines (with its own acoustic coupler), accepts 80- or 136-column paper rolls, and has a printer with lots of visibility (thanks to a complete facelift).

Our new 3000. Everything you wanted in an 80-column portable. Now in a 136-column portable. Complete with its own self-contained carrying case.

Now we can offer you a choice between our durable 80-column portable with APL/ASCII codes, or our new wider carriage 3000 portable. Take your pick.

Call Charles Kaplan or Shirley Newman at (201) 261-6800 for the complete story. Computer Transceiver Systems, Inc., East 66 Midland Avenue, Paramus, NJ 07652. Tony Swanson, 10471 Oakhaven Drive, Stanton, CA. 90680 (714) 827-0281. Service from 190 locations.



Distributor inquiries welcomed

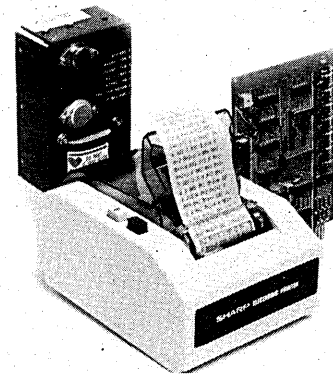
CIRCLE 94 ON READER CARD

up to 120 cpm. Other advantages include higher performance keypunching and verifying, and the availability of numerous off-line auxiliary functions including reproducing, sorting, interpreting and gangpunching. On-line data recorder rental rates, including maintenance, range from \$202 to \$236/-month depending on rental agreement. The Data Recorder with S/7 attachment can also be purchased outright for \$8,500 with monthly maintenance of \$73. DECISION DATA COMPUTER CORP., Horsham, Pa.

FOR DATA CIRCLE 236 ON READER CARD

21-column Printer

If you're looking for a little printer and can get by with only 21 columns, the CE-21AP might end your search. The non-impact unit prints at 126 characters per second and comes in kit form,



including printer, cabinet, a pc interface card containing a 64-character buffer, and a power supply. The interface is parallel by bit/serial by character ASCII. The price is \$399. HYCOM INC., Irvine, Calif.

FOR DATA CIRCLE 235 ON READER CARD

Lines on the Purchase of RCA Computer Systems Division by Univac

Our enterprise has now
gone smash;

We'll lay you off, and
give you cash;

Else, if you do not want
the sack,

Get you a job with
Univac.

—David H. H. Diamond

She had great character but no looks,
was not one that housecleans or cooks,
but he married his gray
univac for the way
she figured, and kept up his books.

—Gloria Maxson

Increase the dividends from your computer investment.

You need more performance from your computer to get more mileage from your computer investment.

Expand your 370/158 with the EMM Multimemory/158 processor storage system and get an unbeatable combination: the memory capacity you need and protection for your computer investment. You'll get benefits and features available only from EMM.

Like the reliability and performance benefits of our company's vertical integration—core and semiconductor memory components, subsystems, and systems all made by EMM. We make, sell and service our systems worldwide. And our lease plans fit your requirements.

Look at our system. It's designed to take you to 4 million bytes of memory. With the only single switch deferred maintenance feature available anywhere. Just flip a switch and you automatically reconfigure any segment of EMM & IBM memory...you're back on the air. And a configuration that allows close coupling to the cpu and results in better timing margins.

Add the circuit simplicity and reliability of our own static NMOS semiconductor device. Total IBM compatibility. Solid support. Competitive pricing. And low operating costs.

Take advantage of EMM's flexibility. With our full line of memory products, you can upgrade your memory system whenever you need to. Let your EMM salesman help you plan for bigger dividends from your 370 computer.

More users and computer manufacturers use EMM memory products than those of any other independent company.

Call your regional EMM sales office. Eastern (201) 845-0450.

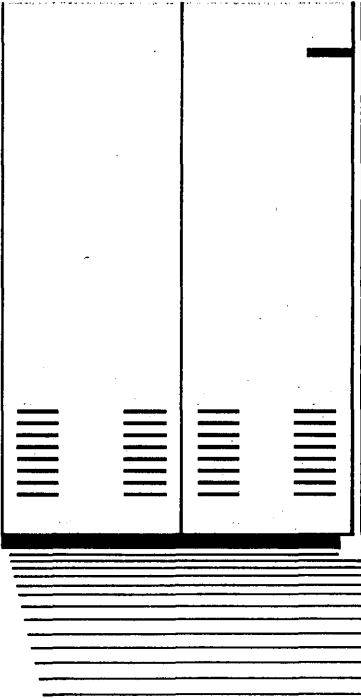
Central (312) 297-3110. Western (213) 477-3911. Federal (703) 941-2100.



COMPUTER PRODUCTS DIVISION

Electronic Memories & Magnetics Corporation

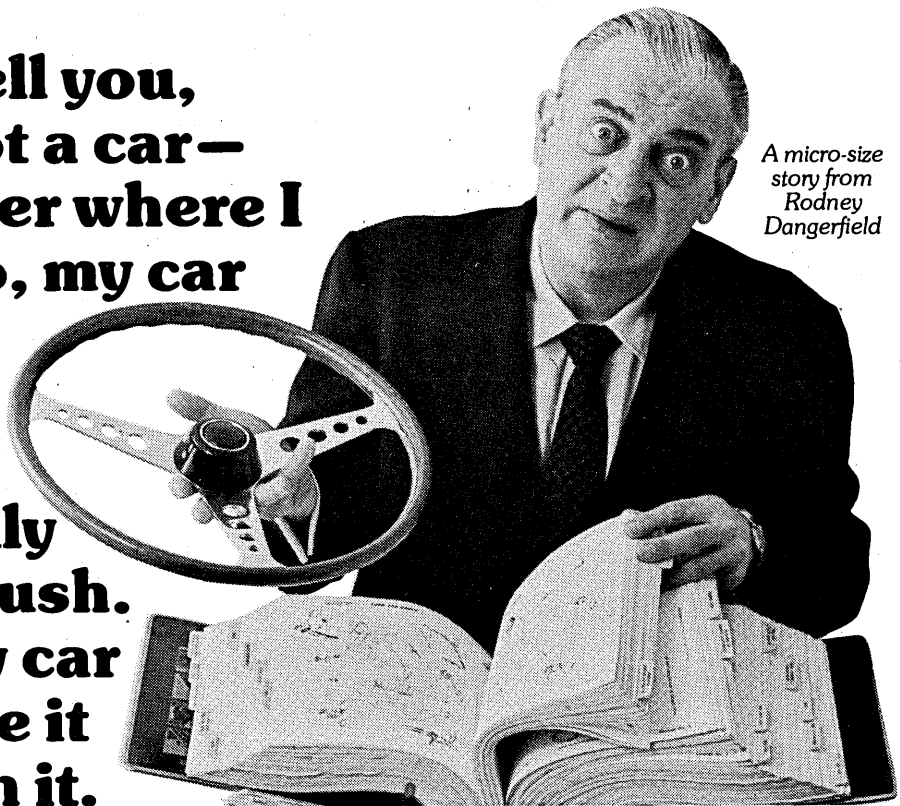
3216 West El Segundo Boulevard, Hawthorne, CA 90250



370/158 memory

The graphic features the text '370/158' in a large, bold, sans-serif font on the left, and 'memory' in a similar font on the right. Between them is a vertical rectangular frame containing four horizontal bars of varying lengths, resembling a memory stack or a data bus. Below the frame, several horizontal lines radiate outwards to the right, creating a sense of depth or motion.

**I tell you,
I got a car—
no matter where I
want to go, my car
don't want
to go there.
Every Sunday
I take my family
out for a push.
I got the only car
dogs chase it
and catch it.**

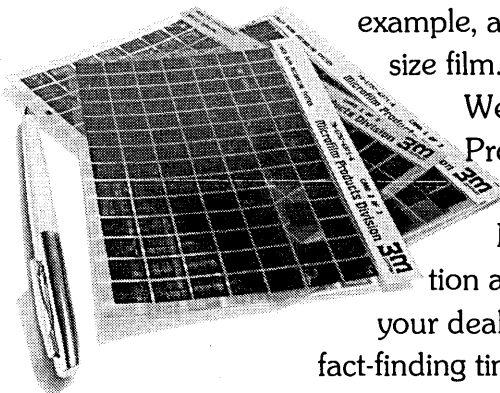


*A micro-size
story from
Rodney
Dangerfield*

But what really bothers me is Joe's Garage. With Joe, I don't get no respect at all! It takes him four days to find out which part I need. And four more days to find out where to get it! Eight days without a car! Joe don't know how to keep records. And nobody else knows how to fix my car!

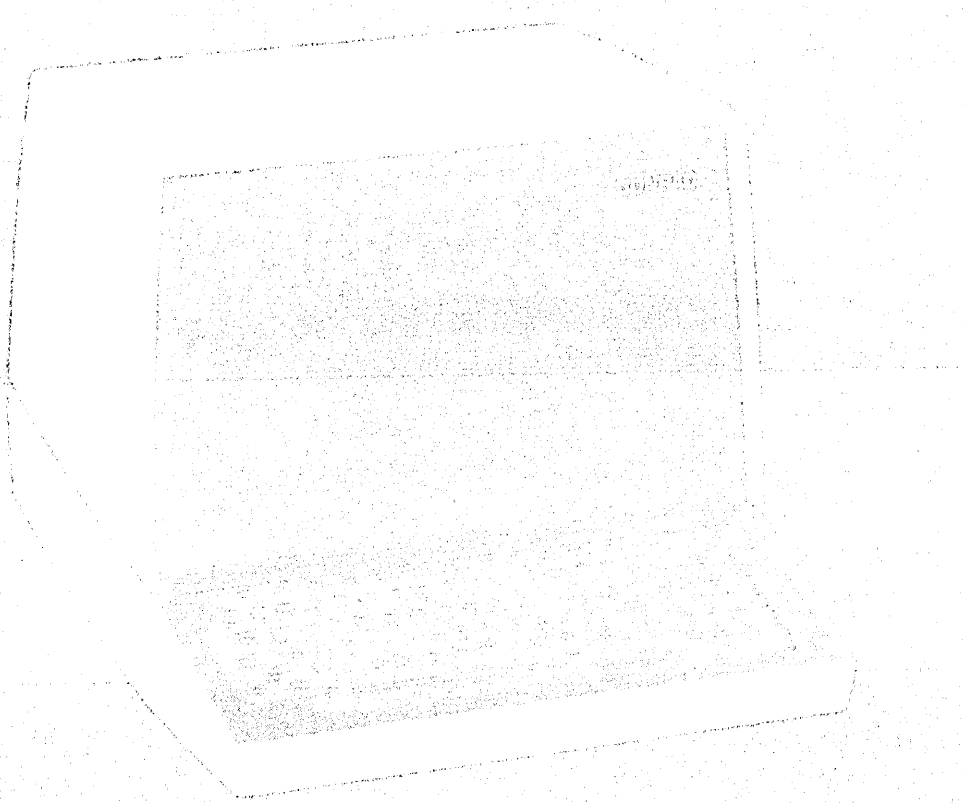
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The Power of

PowerPC



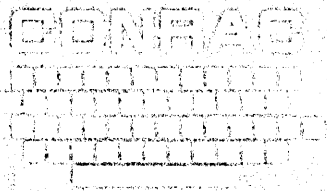
...and the Power of

ConneXion's new PowerPC-based architecture (PPC) gives you the power to design your own applications. With a 32-bit architecture, you can design your own applications or use our software. You can design your own applications or use our software. You can design your own applications or use our software.

Designed around a new 32-bit architecture, the PPC can be changed its character simply by changing resident software. This permits emulation of numerous system architectures such as TRX, Ultrabug, and the Linux architecture.

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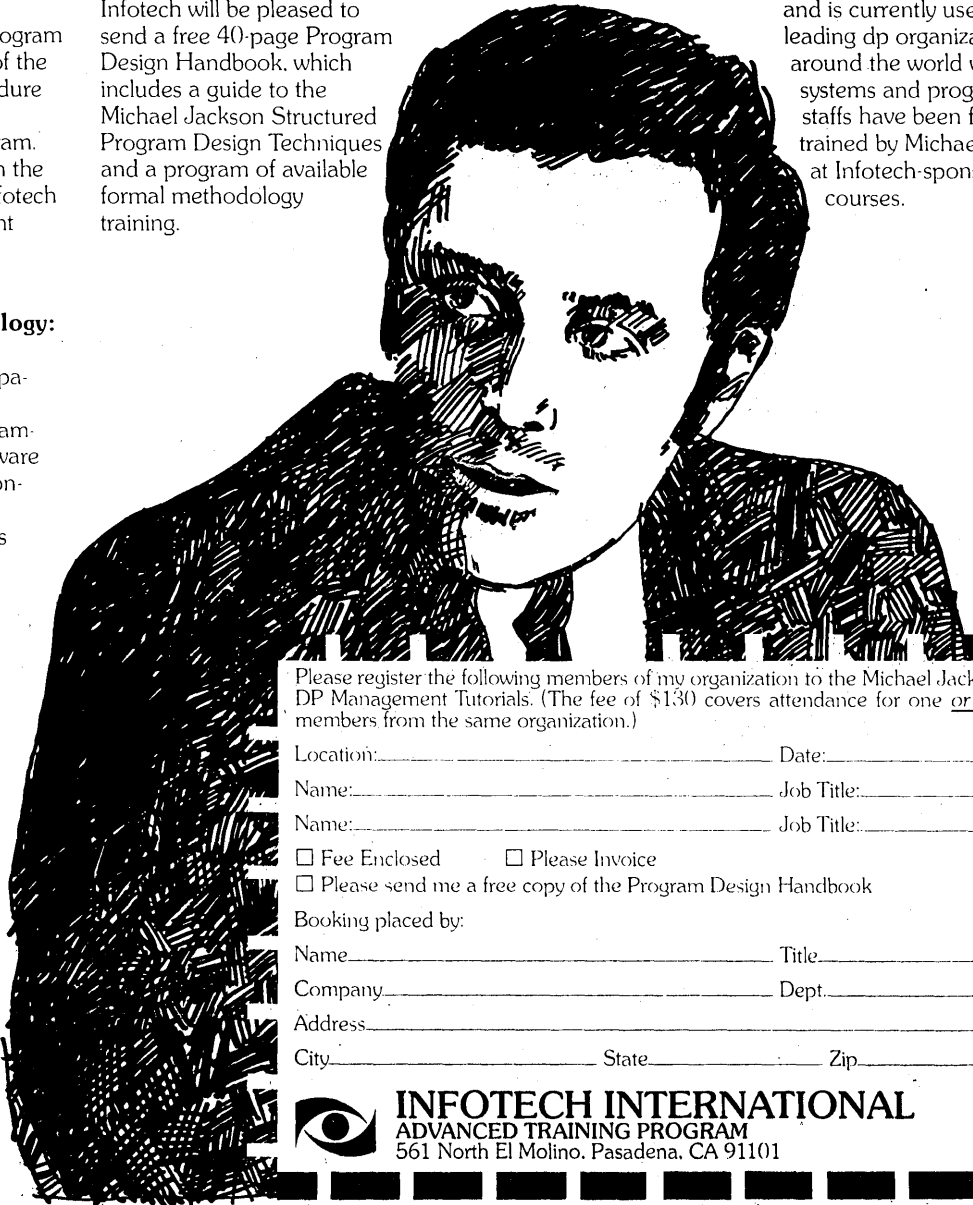
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- Immediately rejects inconsistent specifications
- Removes all design bugs before programming
- Insures correct, reliable program, minimizing maintenance and enhancement expenditures



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DOS/RS FULL is available on permanent license, or monthly rental for as low as **\$400.**

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DOS/RS BASIC I™: This software is perfect for the shop that's running one processing and one TP partition on one shift, and two processing partitions on other shifts.

Even with limited core, it permits you to share the efficiencies of multi-programming and spooling. Permanent license, or monthly rental as low as **\$160.**

POWER-I™: When it comes to cost and core, this spooling software is as miserly as they come. Yet, it's generous in features: supports one or two partitions, offers early print start and is simple to install. It's upward compatible with Power-III. Permanent license, or monthly rental as low as **\$65.**

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software & services

Updates

Her Majesty The Queen of England recently became an ARPANET user. A message transmitted by Her Majesty from the Royal Signals and Radar Establishment, Malvern, England, announced the availability of CORAL 66 high-level language capability available on a computer at the base. CORAL 66 is a language adopted by the Ministry of Defence for real-time applications and also used by industry in Britain and overseas. The U.S. Department of Defense has recently been evaluating CORAL 66 with an eye toward a standard language for its own use. As a measure of the interest in CORAL 66, Varian recently became the first U.S. manufacturer to buy the real-time compiler without commitment to a specific project.

Hitachi, Ltd., has introduced a new balancing method for determining the correction weights necessary to reduce shaft vibrations in large rotary machines such as thermal turbines and power generators. Hitachi claims this to be significant for two reasons: mass imbalances are unavoidable in the manufacturing process for such items, and previous methods for determining the correction weights required much more time and skilled labor. The new technique essentially centers around measuring bearing vibrations at various rotational speeds.

The U.S. Air Force's software library system is being credited with avoiding software duplication of effort and continual "re-inventing the wheel," say its directors. In operation at Hanscom Air Force Base in Massachusetts, the total cost of the software system responsible for keeping track of the various program abstracts came to only \$87K after an initial estimate of \$1 million.

Western Union and the U.S. Postal Service have announced a new five-year agreement for Mailgram message service. Since the service was begun in 1970, the traffic has risen to an annual total of 22,671,000 in 1975. A 50-word Mailgram message originating from a Telex or TWX terminal typically costs \$1.25; 100-word messages dictated to Western Union operators typically cost \$2.55.

Corporate Planning

Imagine being able to model the effects of a merger between your firm and one of your closest competitors, or being able to model the future financial profile of over a thousand major U.S. corporations. That, and more, can be done by utilizing the Corporate Planning Model of this financial analysis firm's data base. (The data base has been around for several years, but the new modeling capability should really make it go.) The model is useful for estimating the income statement, retained earnings account, flow of funds and balance sheet for each of 1,450 non-financial corporations, 60 industry groups and a composite of 900 industrial firms. (Sorry, aberrations, such as bribes, cannot be accounted for.) There are approximately 50 million characters of corporate history on file covering more than 20 years and 50 quarters on these firms, which is a superset of the *Fortune* 1000 index. The modeling data is updated approximately 30 times per year by the developers. A typical run on one company is around \$20, and it's claimed that the model has been used to produce capital investment studies for members of Congress. The Corporate Planning Model is currently available on Comshare, Inc.'s time-sharing service, or you can talk straight to the developers. VALUE LINE DATA SERVICES, New York, N.Y.

FOR DATA CIRCLE 202 ON READER CARD

Planning/Scheduling

An algebraic theory of scheduling is used to plan and schedule resource-limited production systems in DPS, the Dynamic Planning and Scheduling System. The system is said to differ from conventional planning and scheduling systems in that it uses a detail scheduling algorithm to determine when each operation will be performed and the specific facility that will perform it. The algorithm traces all job flows and resolves all conflicts for the use of the production system's facilities as they would occur and be resolved in the real world. Typical applications include factories, data processing centers, project-oriented production systems, and hypothesized systems. DPS is written in ANSI COBOL primarily for computers with fixed-point binary capability (360, 370 Univac 1100, etc.) but can be implemented on other computers providing they are equipped with a packed decimal computation mode. Leases range

from \$700-1500/month depending on length, which ranges from one month to five years. Memory utilization is typically 20-30 times the number of operations to be simulated on an 8-bit machine, or roughly 256K bytes for a 10K operation simulation. BERNARD GIFFLER ASSOCIATES, Warrington, Pa. FOR DATA CIRCLE 203 ON READER CARD

Distributed Data Bases

This small manufacturer has announced a new software system for its J100 VideoComputer, a desktop sized unit containing a 16-bit cpu, 16-128K bytes of memory, 1,920 character crt, keyboard and two IBM-compatible diskettes. System II is a multi-user, multitasking disc operating system that provides more than 40 separate utilities. Examples include "SYSGEN" which defines devices, the size of the system, performance characteristics, system tuning, etc., on-line bisynch communication, automatic user program loading, sort/merge, a relocatable loader, etc. The language for the J100 is an extension of Dartmouth BASIC called Data Base BASIC. One user of the system stores 300,000 600-byte records on the J100 and can find, access and display any record in less than two seconds, even with seven other terminals in use on the system, it's claimed. The software is included in the price of the system, which starts at less than \$10K. JACQUARD SYSTEMS, Santa Monica, Calif.

FOR DATA CIRCLE 204 ON READER CARD

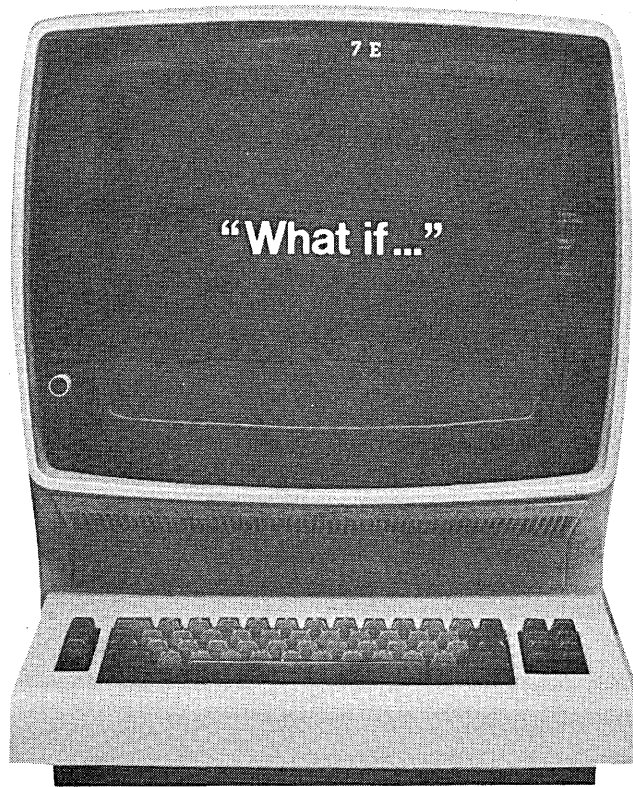
IMS Inquiry Language

IN?UIRY/ims is this vendor's answer to the lack of an on-line query facility on IBM's Information Management System, IMS. The package uses English-like statements to access the data bases, operating as a message, message batch, or batch program. The user does not have to know the physical characteristics or the detailed organization of the information stored in the data base, and it's claimed that all users, regardless of their technical orientation, can use IN?UIRY/ims. About the only prerequisite necessary to bring the package up is to have DL/1 on the system. In fact, in certain cases, you don't even need to have IMS if your files are organized in certain ways that the developers will gladly explain.

All IMS supported terminal types or their equivalent can be used to perform operations on the files that include arithmetic operations on data fields

asi/inquiry

The IMS DB/DC QUERY LANGUAGE



ASI/INQUIRY is an IMS DB/DC query language that operates completely as an interactive Message Processing Program. The design of ASI/INQUIRY is such that the *structure of the data base is transparent to the user*. Moreover, one need not have familiarity with DL/1 segment logic or the complexities of multi-pathing. Extremely rapid response time is assured.

MAJOR HIGHLIGHTS

- End-user oriented
 - Easy-to-use language
 - Requires no knowledge of IMS
 - Comprehensive diagnostic messages
- Rapid response time for even the most complex queries
- Dynamic priority scheduling to maximize system performance
- Availability of default as well as user-defined screen formatting

Since introduction in September 1975, ASI/INQUIRY has been installed in numerous firms representing every major industry.

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS DB/DC environment. It is the only system combining an easy to use language, complete user flexibility, and rapid response time in a single package. If you want to start answering "What if" immediately, call or write today for further information. *Note:* ASI/INQUIRY now supports TSO.



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and/or constants. It's claimed that IMS overhead is minimized through inquiry page and time limit specifications at the logical terminal level. INQUIRY/IMS resides in the IMS message processing region. It's priced at \$22K for a perpetual license that includes 12 months of warranty, installation, and documentation. Maintenance is 10% of the lease price per year currently. CGA COMPUTER ASSOCIATES, INC., Rosslyn, Va.

FOR DATA CIRCLE 206 ON READER CARD

Digital Communication

DATAPHONE Switched Digital Service is a new high speed communication offering from AT&T Long Lines that appears to be very good news to users who require 56 Kilobit transmission rates a few times a day between multiple points, and somewhat disconcerting news to the new generation of communications services vendors trying to gain a foothold in the field.

To illustrate the attractiveness of the tariff schedule that will be filed upon the FCC's approval to operate, consider this example. A customer with a sta-

tion in New York and another in Chicago would pay a fixed monthly charge of approximately \$670 for access lines and station arrangements. For usage, the customer pays about 12 cents for an initial 10-second period, with each additional second costing about a penny. For usage one hour a day during 22 business days per month, the usage portion of the bill would be approximately \$911 for a total of \$1,581, less tax. Comparable private line (analog)

service at 50 kbps currently costs approximately \$9,800 for the same amount of usage—or roughly six times as much.

Eighteen cities are initially slated for service under DATAPHONE Switched Digital Service, including New York, Boston, Washington, Chicago, Philadelphia, Newark, Baltimore, Pittsburgh, Cleveland, St. Louis, Detroit, Kansas City, Atlanta, Dallas, San Francisco, Los Angeles, Houston, and

software spotlight

New 360 Operating System

A totally new operating system for IBM 360 and 370 Disk Operating System users would seem to have "missed the window" for machines that have been out as long as 11 years, but this developer's research convinced him there would be a substantial market for such a system. DOS/MVT is said to be fully compatible with Release 26 of IBM's DOS and will run on any CPU having at least 192K bytes of memory. Regions, as few as three, and as many as 12, are set up by DOS users for batch processing instead of the usual fixed partition approach. The new DOS is so dif-

ferent that it is incompatible with the I/O spoolers such as IBM's POWER or the popular GRASP package, and contains its own spooler to service the higher number of partitions. As far as conversion to DOS/MVT goes, programs link edited with common self-relocation routines as well as programs link edited with the system's own relocation system can be processed. Any number of private core-image libraries can be searched in sequence to locate a program, and a new multi-path channel scheduler allows I/O devices to be connected to any number of selector channels. There are currently five sites running production under DOS/MVT we're told, and the price of \$500/month on straight rental seems reasonable. SOFTWARE PURSUITS, INC., Mill Valley, Calif.

FOR DATA CIRCLE 201 ON READER CARD

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MANAGER, Financial Systems

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CIRCLE 130 ON READER CARD

Minneapolis. (Notice the high correlation to cities with professional sports franchises: the new service should be profitable to AT&T if only used to discuss personnel trades, salary disputes, strike votes, etc.) Nine additional cities will be added to the net during 1976 if all goes well. (If Newark, N.J. gets a sports franchise during 1976, remember that you read it here first.) AT&T, New York, N.Y.

FOR DATA CIRCLE 205 ON READER CARD

Data Entry Auditing

Here's a rather unusual—and perhaps much needed—service that is just coming on the market: an audit to analyze the efficiency of a firm's data entry department. Evaluations and recommendations are made in nine major facets of the data entry function: operator performance, work flow, physical environment, organizational structure, salary policies, staffing caliber, employee policies, morale, and department operating budget. At the conclusion of the audit, companies receive a report and consultation that can enable them to identify ways in which efficiency and accuracy can be improved. The time required to conduct the audit depends upon the size of the department and the current state of documented procedures, but the requirement for a department of 25 work stations could be approximately four weeks time. The price for the service is \$4,500. ADVANCED KEYBOARDING SYSTEMS, New York, N.Y.

FOR DATA CIRCLE 207 ON READER CARD

Mini Operating System

Interdate 16-bit users are offered a multi-user operating system designed to handle both real-time and multi-terminal processing activity. RDOS is structured into variable DOS or BOSS partitions where each user can select the amount of memory required. Programs can be run in any partition with "little or no" modification, and the file structure is the same as the standard Interdata DOS. Additional commands have been incorporated to provide operator control of the multitasking environment. Multitasking capabilities exist within individual partitions. The multitasking scheduler operates with 16 priority levels, with tasks of equal priority scheduled in round robin fashion. Any Interdata machine above the Model 4 level with 16K of memory can run the new system. Included in the \$850 price is the RDOS system, a module called linker that is similar to Library Loader, an editor said to have many IBM string handling features, and a disc loader. AMERICAN BUSINESS COMPUTERS INC., Santa Rosa, Calif.

FOR DATA CIRCLE 208 ON READER CARD

Data Base Management

This major data base management system vendor has made a number of substantial enhancements to its System 2000 data base management system that could conceivably affect the make or buy decision. Version 2.7 for IBM systems features both batch and on-line processing performance improvements typically in the range of 2:1 to 4:1, it's claimed. For example, data base load I/O time at one user's site for 50,000 logical entries has improved by 208% over previous versions. A new buffer manager has dramatically reduced device dependence from the days when it was either/or 2314 or

3330-type disc units. An "extended Where-clause" allows non-key elements as well as key elements in selection criteria to qualify for immediate access, report writer, and extended PL/1 precompilers. There's also an extended procedural language interface COBOL precompiler and PL/1 precompiler.

Version 2.8, slated for September, will feature more goodies, including automatic backout/restart. Prices for System 2000 range from \$30K to more than \$100K, depending upon which modules are selected. MRI SYSTEMS CORP., Austin, Texas.

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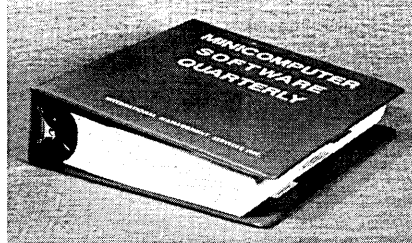
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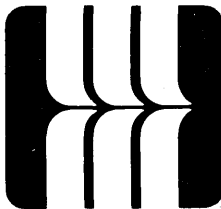
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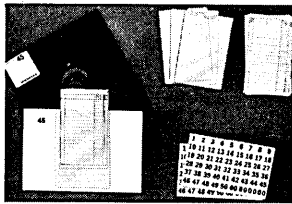
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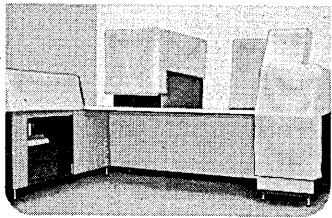
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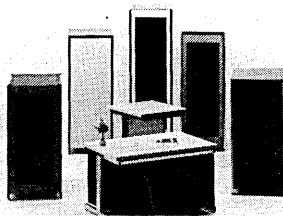
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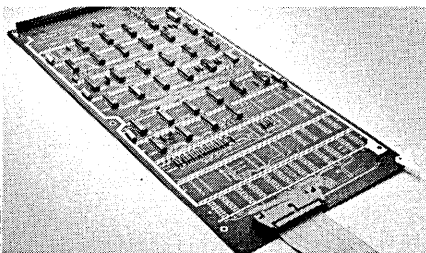


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CIRCLE 184 ON READER CARD

letters

(Continued from page 8)

not involved in program HIPO's but did review the functional business HIPO's. We found that two sets of HIPO's are best for our particular application, and they bridge the old problem of translating a business need into program requirements.

E. J. TALBOT
*Project Manager
Corporate Offices
Montgomery Ward
Chicago, Illinois*

An Wang story

You are fortunate in having David Gardner on your staff!

His article on An Wang and the invention of magnetic core memories is a jewel. (March, p. 161). My congratulations to you!

FRANK WAGNER
*Celanese Chemical Company
Corpus Christi, Texas*

Encryption algorithm key size
I read with interest your news story, "Encryption Algorithm: Key Size is the Thing," (March, p. 164) concerning the proposed National Bureau of Standards encryption algorithm. We are a consultant to a large New York bank and in this capacity, about a year ago, evaluated that algorithm. We found it unsuitable for use within our client bank and, as a result, designed and implemented for the bank an improved algorithm which, interestingly enough, utilizes the key length of 128 bits suggested in your article.

We attempted to explain to the National Bureau of Standards the reasons for our dissatisfaction with their algorithm, but their replies to our correspondence were nonresponsive and, it seemed, rather defensive—hardly the response one would expect from the National Bureau of Standards.

JOHN R. SCANTLIN
*President
Lexar Corporation
Los Angeles, California*

Seymour Jeffery, Chief of Systems and Software Division of the National Bureau of Standards in Washington, D.C., replies: A good encryption system requires a strong and publicly known algorithm and a user supplied key. A long key length does not guarantee a secure algorithm and can provide a false sense of security. An algorithm that is not sufficiently strong, even with a very long key, can be broken in a very short time on a mini-computer. A good algorithm should be of such a nature that it cannot be algorithmically tested or mathematically analyzed. Further, it must be economically infeasible to recover a key by trying exhaustively all keys.

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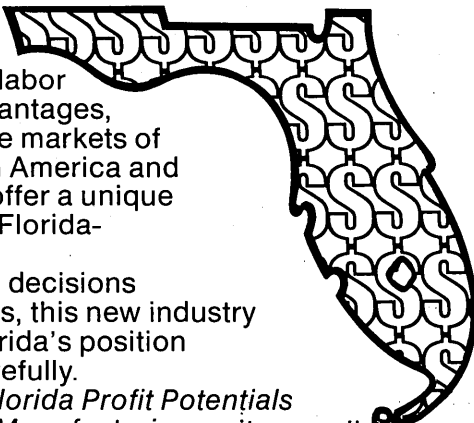
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CIRCLE 125 ON READER CARD

letters

(Continued from page 187)

phered text as a potential penetrator would desire, the NBS proposed data encryption standard would require nearly 2,300 years to derive a single key. This assumes that one block of cipher can be generated and the results compared in one μ sec. It is important to note that no commercially available computer can perform such a test of cipher generation and comparison in one μ sec.

We believe that the proposed NBS standard provides the necessary high degree of data protection. Continued analysis of the proposed standard by technical experts with unique experience in encryption technology has reinforced our position.

Alive and well

Your amusing coverage of Dick Brandon's current activities in the April issue (People, p. 13) will, I am afraid, leave DATAMATION readers with a serious misunderstanding of the recent history and present health of Brandon Applied Systems, Inc. We would like to correct this impression.

Dick Brandon did indeed watch "his creation dwindle from 300 to 20 people" in 1970-71. What the article leaves out is what happened next. In 1972, Brandon Applied Systems "acquired" the Rand Teleprocessing Corp., a transaction which gave Rand shareholders 80% of the ownership. In the next three years, revenues had increased from about \$2,000,000 to \$7,000,000 and the staff had grown to about 200 employees. We are a vigorous company, serving major clients all over the world, specializing in conversion and system development services.

Yes folks, there is a Brandon Applied Systems, alive and well and living in San Francisco.

ARNOLD D. PALLEY
Executive Vice President
Brandon Applied Systems, Inc.
San Francisco, California

Run time analysis

Bill Inmon's article, "An Example of Structured Design," (April, p. 82) contains many important ideas. The concept of active and inactive modules may also be called run time analysis of program flow. A program which provides such an analysis is available from the Honeywell users' software library. Its accession number is GES-1184.

HAROLD P. SIEGLAFF
State of Arizona
Department of Administration
Data Center
Phoenix, Arizona



Share a week of stimulating information interchange with the world's best thinkers

IFIP CONGRESS 77 and its Exhibition will mark the first return to North America in more than 12 years for this triennial gathering of information scientists. In sponsoring this important congress, the International Federation for Information Processing (IFIP) brings together developers and users of information processing techniques and technology from 35 member countries throughout the world. In the U.S., IFIP is represented by the American Federation of Information Processing Societies (AFIPS).

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To register, or for more information about registration, contact Mr. Robert Spieker, U.S. Chairman, Registration and Accommodations, Western Electric Company, 222 Broadway, New York, NY 10038.

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4. Computer Networks—Aspects of the merger of computer and telecommunications technologies.
5. Applications in Science and Engineering—Mathematical computation and the computational aspects of cybernetics and process control.
6. Computer Aided Design—The application of information processing and computer technology in design.
7. Applications in Management and Administration—Implications of recent advances for organization and administration of information processing areas.
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CALL FOR PAPERS

Papers are currently being solicited which will relate the Congress theme to broad areas of information processing. All papers should deal with the design or use of computer systems, but may concern theoretical advances, new techniques, or practical experiences. In addition the following guidelines must be observed: 1. Papers must be written in English. 2. Total length must not exceed 4,000 words. 3. Four copies of each paper must be submitted. 4. Papers must be received no later than 15 November 1976.

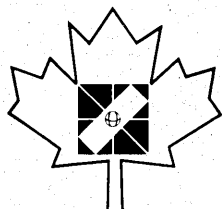
For a copy of the official "Call for Papers" brochure, with complete information on where to submit papers for each program area, write: The U.S. Committee for IFIP Congress 77, c/o The Bowery Savings Bank, 110 E. 42nd Street, New York, NY 10017.

For a pamphlet giving guidelines on preparation of papers, "Instructions and Aids for IFIP 77 Authors", write to Program Committee for IFIP Congress 77, IFIP Foundation, Paulus Potterstraat 40, Amsterdam 1007, Netherlands.

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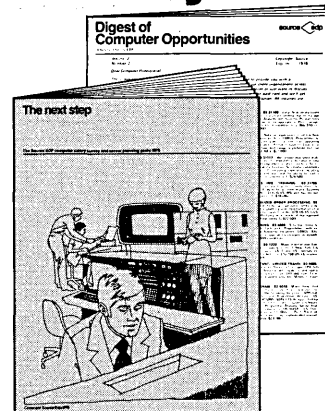
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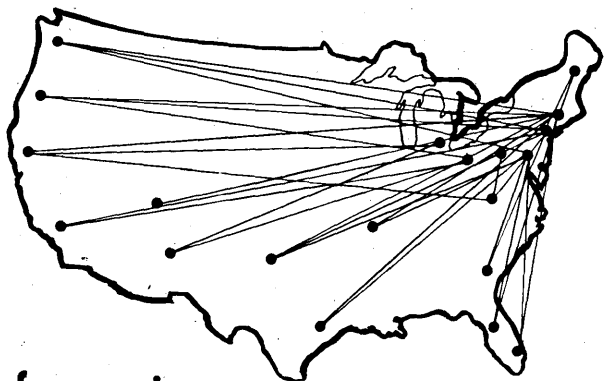
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The Best Man for the Job May Be a Woman

An American businessman, traveling in Japan, enjoyed a native luncheon of Sushi. When he discovered that he had eaten raw fish, however, he became ill.

In the man's internal confrontation between his intellect (logic) and his emotions (feelings) the battle wasn't even close. His emotions won by a country mile.

It would take many months and well spaced nibbles of Sushi before these opposing forces within him merged. In time they did get together, but it happened slowly. Deeply instilled feelings do not change overnight—not even in the face of overwhelming logic.

Logic vs. gut feelings

Today, American businessmen are caught in a similar bind in the recruiting, hiring, training, and promoting of women into management and other nontraditional areas. Logic and law dictate that ability—not sex—be the determining factor in job selection. It takes a real Neanderthal to argue otherwise during these affirmative action, class action days. Yet, while the intellect says "go," the emotions scream "no" within many of the executives who are making the decisions which control the working lives of women.

Unfortunately, many executives, whose emotions cry out for Momma to stay home and make chicken soup, can recognize neither the battle going on within themselves nor within their lower level managers. Such executives have long prided themselves on being "hard-nosed" and unemotional—prerequisites for successful management.

"The best man in this company gets the job, by God, no matter if he is a woman," said one executive, slamming his fist on his desk. Did this executive recognize that he was being both emotional and illogical? Of course not. He was using "man" in its generic context and pounding his fist for emphasis. But how would he view a woman who behaved exactly as he did?

This executive perceives himself to be a no-nonsense, firm, fair, effective captain of a tight ship. His success is measured by his company's financial success. If profits drop, the captain will ferret out the culprits and fire them. He then will logically select "the best man for the job." Emotions will have no place in this determination, this executive firmly believes.

Of course, this man—and executives like him—long ago accepted a standard for successful business conduct based on so-called masculine traits. Successful business people should be hard, tough, striving, driving, smart, competitive, cool, and hard-nosed. If women measure up to these tough

standards, they measure up. If not, they should stay home, find men to support them, have babies, and shut up.

Successful women are considered the exception, not the exceptional. Ironically, if this executive has in his company a woman who is hard, tough, driving, smart, competitive, cool, and hard-nosed, he probably dislikes her. Women who have succeeded in business traditionally have been characterized as cold, unattractive; spinsterish, masculinized people who "think like men." They are usually described as "sexless," as hard, unfeeling freaks.

Executives, like other male human beings, don't want the women in their personal lives to be cool, detached, and unemotional. They want them attached and emotional—passionate as lovers and warm and understanding as friends.

This set of values has created a "Catch 22" situation for women who are, or want to be, in management. Since being hard-nosed, logical, unemotional, and objective are considered male traits, women who fit the criteria will appear to be less feminine. This puts male executives in the position of promoting women they dislike but believe will succeed, or women they like but believe will fail.

A similar "Catch 22" situation is created for the executive himself. Since "logic" is considered a masculine trait and "emotion" a feminine one, the executive is in a bind. If he admits that his gut feelings about women play a part in his executive decisions, it impairs his self image of his own masculinity—a fearful prospect.

Women inside and outside management are questioning both the so-called male criteria for success, and the gut reactions of those who apply the criteria. If enough of these gut reactions are put together, a pattern of psychological discrimination emerges. It is not the lack of qualified women, but psychological discrimination which is the number one barrier to affirmative action for women. And the evidence that the emotions of men are blocking opportunity for women is all around us.

An article in *The Harvard Business Review*, "Sex Stereotyping in the Executive Suite," by Benson Rosen and Thomas Jerdee (March-April 1974, pp. 43-58), dramatically revealed psychological discrimination in personnel decisions even though the personnel managers involved believed they were being totally objective.

Fifteen hundred *Harvard Business Review* subscribers, who are in management, responded to a questionnaire designed to explore the decision making process in typical business situations. Half the participants received questionnaires in which a particular business situation described

male employees, while the questionnaires of the other half described female employees in the same situation. Both sets were identical except for the factor of sex.

For example, one case described a 46 year old female employee without a college degree who had been with the company for 20 years. She competed for a promotion with a 26 year old man with a college degree and with the company only two years. Half the participants received a reverse situation in which the woman became the 26 year old employee competing with a 46 year old man who had been with the company 20 years.

The "man" won out over the "woman" in both situations. The 26 year old man was chosen for the promotion because of his greater potential to the company. The 46 year old man won because of his greater experience plus his "loyalty to the company."

Among other things revealed by the survey, according to the article, were: companies try harder to keep male employees because they are more valued than females; milder disciplinary action is applied to male employees in petty rule breaking; sexual misconduct is tolerated in men more than in women; women are expected to help their husbands succeed in business but not the reverse. Family demands are perceived as far less complicating for male than for female employees—which creates an upward mobility blockage for all women, regardless of individual circumstances.

"Pure logic," impure bias

In these and other situations, promotions based on "pure logic" turned out to be pure fiction. The conclusions, as reported by the article, were that "psychological barriers to women interested in a management or professional career still exist despite recent changes in policies on the employment of women," and that in decision-making, "managers tend to fall back on traditional concepts of male and female roles."

A young man on his way up the corporate ladder faces none of this sex-based discrimination. The male boss admires in other males traits he attributes to himself—coolness under pressure, objectivity, dedication, and a dash of ice water in the veins. An older, established executive brings along his chosen protege in the accepted business system by being a "godfather" or "mentor." He protects and guides the young man's career upward with the ultimate aim of replacing himself.

The same relationship becomes complicated for women, although for women executives, this too has been a track

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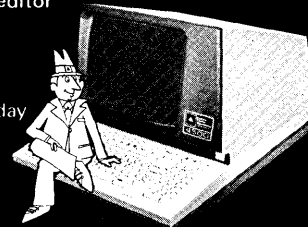
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DATAMATION

the forum

to the top.

"It worked for me for a while," said a young woman manager who is striving, smart, competitive, cool, and trying to keep from appearing hard, tough, and hard-nosed. "Then it exploded in my face when my godfather decided he wanted to go to bed with me. I knew the relationship was over either way—if I did or if I didn't. I wish I had a god-mother, but there aren't any in my company."

Regardless of the realities, many men believe that women use sex as a powerful competitive weapon in their search for success. While nobody denies that some women have slept their way to the top, using sex in business further complicates an already complicated set of male-female relationships. Women who have succeeded in business reject sex as a sane approach toward business success unanimously.

"If your objective is admission to a mental institution use sex," advised one woman executive who describes herself as having "schlepped" her way to the top instead. "I stuck around so long they had to promote me, explain me, or fire me; and it was easier to promote me," she said.

In a management awareness seminar I conducted recently, a senior vice president of a large New York bank admitted that he feels women are less intelligent than men, are too emotional to handle tough business decisions, and should be attractive in order to get ahead in the business world.

"But," he added, "I promote women in my bank on the basis of performance. I am objective. Whether it is a woman or a man makes absolutely no difference to me."

Another executive wrote down the attributes he admires in women, those he admires in men, and compared them with those he requires in his managers. For women he listed warmth, softness, devotion, attractiveness, sexuality, and intelligence. For men he listed leadership, coolness, strength, toughness, objectivity, and intelligence. The executive listed only one attribute in women that he felt important in a manager—intelligence—and he listed it last!

Whether it is a feeling that women don't belong in business, or a feeling that emotions in men are a sign of weakness, or finally, that business conduct must be ruthless—we ultimately must come to grips with two powerful forces within all men and all women: emotions and intellect. Both are at work constantly in our personal and business lives, whether we recognize it or not. When they fit together we feel comfortable. When they don't, we feel anxiety. There is a lot of anxiety in today's business world because emotions and intellect no longer fit neatly together.

Before the women's movement and anti-sex discrimination laws, emotions and intellect were kept in lockstep through the application of circular logic and a litany of misconceptions handed down through the ages: women don't want responsible jobs; women's hormones render them unfit for management; men won't work for women; women won't work for women; women haven't natural leadership qualities; a woman's place is in the home; and on and on.

Today, although they still may feel *all* these things are true or "ought" to be true, few executives attempt to argue these myths on the basis of logic. Women have proved they do want responsible jobs and do want to share in every facet of business—from the chairman's job to the computer's maintenance.

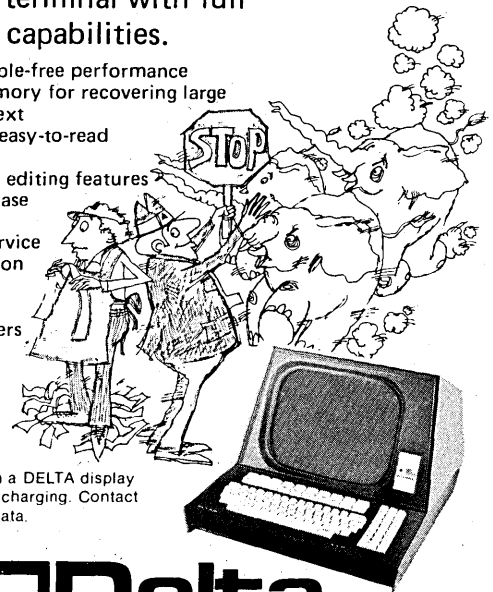
Psychological factors in promotions

The fact remains, however, that sometimes the decision to promote a woman may be a bad decision, and the decision not to promote her, a good one. The decision is not being questioned as much as the decision-maker and his motive.

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A growing number of executives are becoming aware of the impact psychological discrimination has had on the progress of women. With increasing pressure from government, the courts, and determined women employees, executives—for sound business reasons—are questioning their own gut feelings as well as those of their lower managers.

Robert L. Patrick's article, "You've Come a Long Way, Baby," which appeared as a Forum in this magazine several months ago (December '75, p. 193), was a classical example of writing by a man whose intellect told one story but whose emotions revealed another. Patrick, business consultant and contributing editor to *Datamation*, gave clear, sound, logical, helpful advice to women in the computer field: be well prepared for the job, learn the business from the logic circuitry up, compete vigorously, be dedicated, results-oriented, and expect a few hard knocks. He also pointed out that business is in business to make a profit—not for anybody's social welfare.

Patrick was probably stunned by the irate replies from women—"shrieking" as he so revealingly described them. He had failed, as they had not, to perceive his own underlying emotional message in the article. Along with his sound advice, Patrick was condescending, inaccurate, demeaning, paternalistic, and dogmatic. Up front he revealed himself to be a hard-nosed, no-nonsense man who has a difficult time saying "woman"—not uncommon. Instead of "women" he uses "gals," "girls," "ladies," and "baby," as in the title of the article.

Patrick dismisses an extremely important women's movement as a bunch of "bra burners" (a media invention which never happened). He implies in an example that the failure of one woman is the failure of all women, rather than what it is—the failure of one woman. He explained: "She had a husband and several kids, and they constituted one of her distractions and one of her afflictions." (Assuming Patrick has a wife and kids, does he consider them a distraction and an affliction?)

He suggests that this inept female will-of-the-wisp's job was taken over by a "tough sob" who got the job done—a sad commentary if applied to all men. sob's generally get the job done despite their affliction, not because of it.

Sprinkled throughout the article, Patrick leaves evidence of a man trying to pass off as logical his emotional feelings about women. Scratch the surface of his article and you'll uncover a bundle of conflicts about the changing role of "ladies."

Patrick concludes his article with this advice: "I'm not counseling a secondary role for you ladies, but your boss is more interested in getting the work done than *he* is in having his social consciousness raised" (my italics).

Getting his social consciousness raised may well be the most important item on a busy executive's agenda today. The company's survival may depend upon it. Because when a high powered executive decides the company can no longer afford managers (or consultants) who live in the past, learn nothing from their mistakes, and bring on financial disaster, *she* may decide to put the dead wood out to drift. Especially, if she is a firm, fair, striving, driving, intelligent, no-nonsense leader who sees no place in business for a hard-nosed sob who has a head to match.

—Gonnie Siegel

Ms. Siegel is a feminist management consultant, conducts seminars on women in management, and is president of Contemporary Communications, Bedford Village, New York. She has written on women's employment problems, authored a column "Changing Woman," and is former president of NOWestchester.



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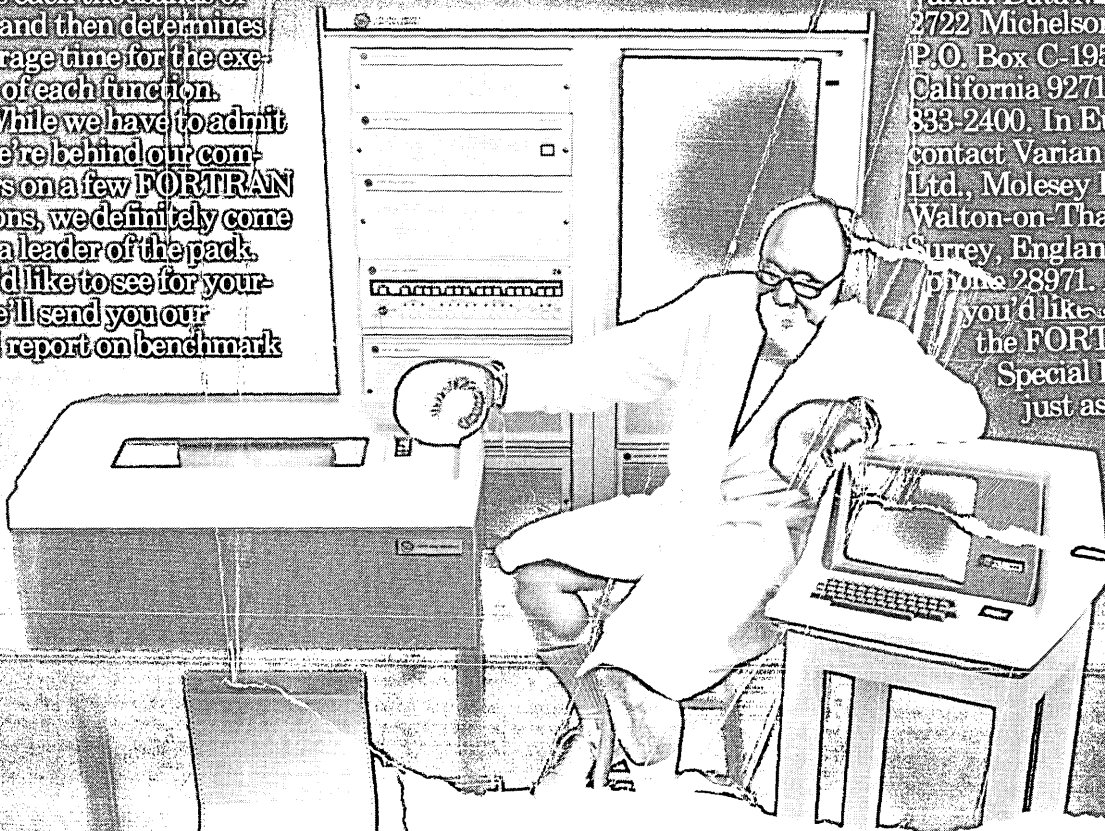
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