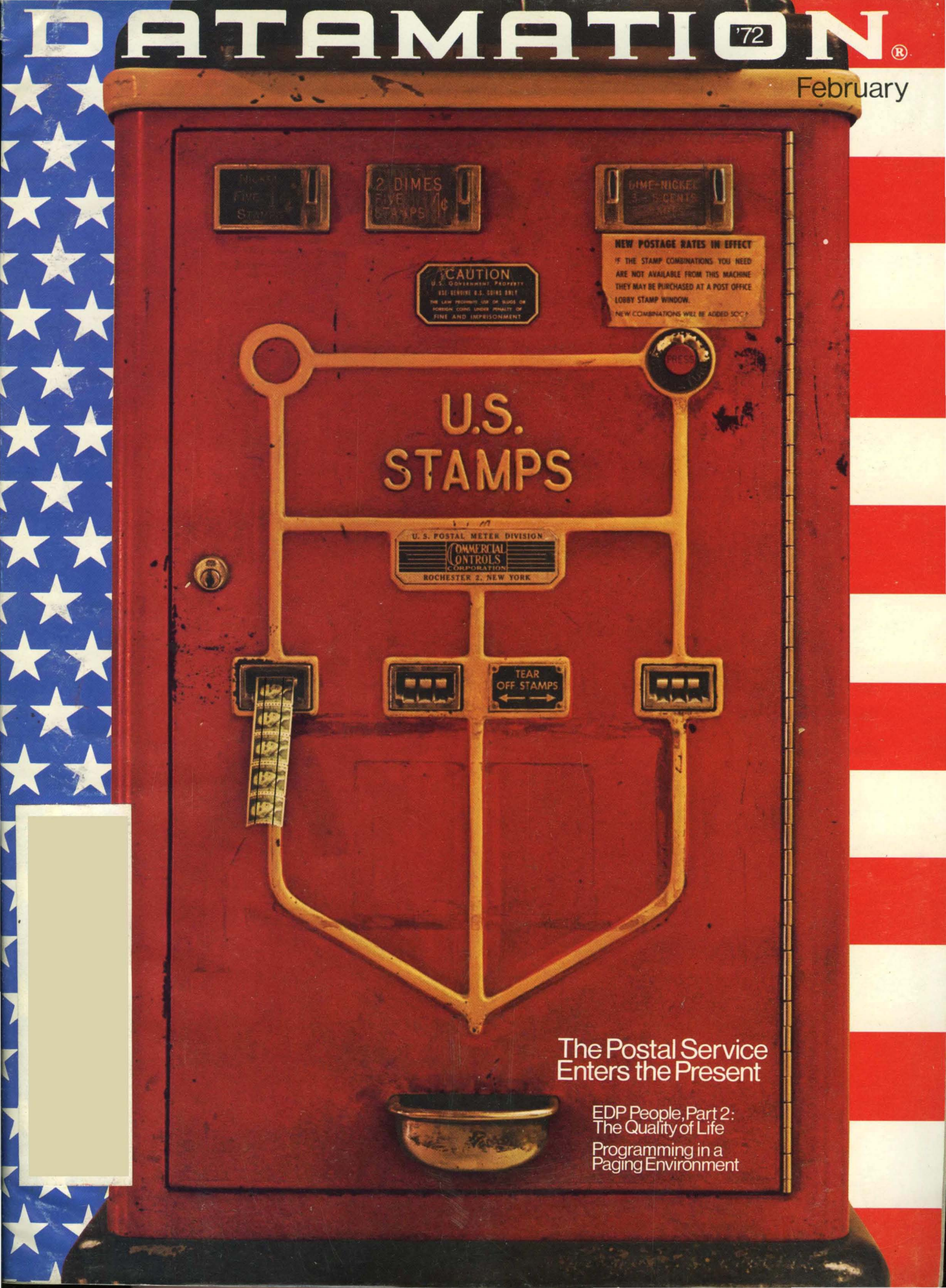
DATAMATION '72®

February

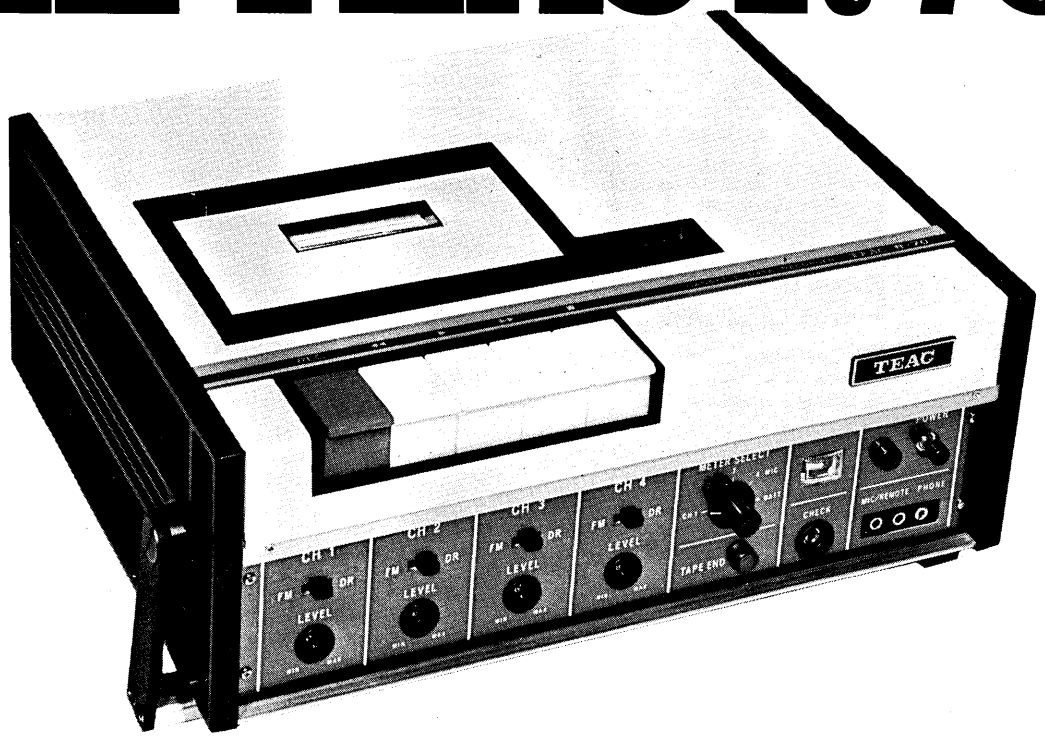


The Postal Service Enters the Present

EDP People, Part 2: The Quality of Life

Programming in a Paging Environment

THE TEAC R-70.



Don't knock it if you haven't tried it.

And now you can try it. For 10 days. Free. That's how confident we, of TEAC, are about our rugged little R-70 cassette data recorder holding up its end of our reputation.

Try it. See how it performs in your operation on its own self-contained batteries, or external AC or DC.

Check its frequency response: FM mode is now DC to 800Hz; direct from 100Hz to 8kHz.

And use it either FM or DR with a flip of a switch on any of its four channels.

Locate your voiced comments or other data quickly with its built-in tape counter.

Monitor the channels individually via the built-in meter and/or by output to your scope.

Watch the warning light wink on as you reach the end of your tape in the Philips-type cassette.

Then wonder at how we packed all of these features (and more) into this 5"x14"x10" totally self-contained 14-pound data recorder.

All for the price of $1995, including eleven accessories!

If you'd like to try out our R-70 on a current problem or project, we're game.

Just write or call Ken Williamson, Director of Marketing, Technical Products, TEAC Corporation of America, 7733 Telegraph Rd., Montebello, CA 90640. Telephone (213) 726-0303.

He'll tell you how you can

take a TEAC® and try it.

CIRCLE 28 ON READER CARD

SUPER DEAL $500 A MONTH

Line printer, keyboard, tape drive, communications

Compare your present deal with the Tally Super Deal. The new Tally 100 line per minute printer. The most reliable impact printer ever. Depend on it. A Tally Datascribe terminal for data entry . . . with data compression that cuts line time up to two-thirds. Triple your 1200 baud throughput. And that saves you money. Super deal. Let's communicate. Call us now for full information. Address Tally Corporation, 8301 S. 180th Street, Kent, Washington 98031 (206) 251-5500

TALLY

DATA TERMINALS • PRINTERS • DISC MEMORIES • CARD READER TERMINALS • PAPER TAPE PERIPHERALS

CIRCLE 4 ON READER CARD

360 CORE YOU CAN TRUST

MODELS 22+, 30+, 40+, 50+, 65+

Who has Fabri-Tek produced core memories for over the past 15 years?

Hundreds of companies, including:

CDC	Canadian Westinghouse
XDS	Ferranti (Canada)
Honeywell	GE (Canada)
DEC	Elliot (England)
GE	Olivetti (Italy)
Burroughs	ICL (England)
Varian	Honeywell-Bull (France)
NCR	AEG-Telefunken (Germany)
Litton	English Electric (England)
CFTH (France)	CII (France)

And yes — even IBM!

Now you can capitalize on this expertise, as this growing list of 360 customers and users are doing:

Booth Computer Corporation • Dearborn Computer Leasing • Diebold Computer Leasing • Leasco • Greyhound Computer of Canada Limited • National Computer Rentals • Rockwood Computer Corporation • Grumman Systems Corporation • Intertek, Inc. • Gant Shirtmakers • Chicago, Milwaukee, St. Paul and Pacific Railroad • Eagle Discount Supermarkets • United Farm Agency • Medtronic, Inc. • Accounting Corporation of America • Rome Research, Inc. • Weldon, Inc. • Certified Grocers Co-Op • Kentucky Farm Bureau Mutual Insurance Company • Graco Inc. • E.B.S. Data Processing Inc. • Bell Telephone of Penn. • Hudson Bay Company • Rockland State Hospital • J & L Steel • Trans Union Systems Corporation • University of Rhode Island • Computoservice, Inc. • Faultless Starch Company • Waldbaums, Inc. • MAI Equipment Corporation • G.S.A. • U.S. Department of State.

Our complete, high-performance line:

MOD 22+ expands main memory of 360/22 to 64K bytes.
MOD 30+ expands main memory of 360/30's to 128 K bytes.
MOD 40+ expands main memory of 360/40's to 512 K bytes.
MOD 50+ expands main memory of 360/50's to 1024 K bytes.
MOD 65+ expands main memory of 360/65 to 2 megabytes.

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Chicago, Ill.	312/437-4116	Houston, Tex.	713/772-7050
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Nationwide Service: Over 900 service representatives from Sorbus, Inc. provide you with 24-hour field maintenance in over 90 cities in the U.S.A. Canadian service available through MAI Canada Ltd. in 12 Canadian cities.

We back our products, and you can be sure we're going to be here to service your 360 memories — and provide spare parts — for as long as you need. And furnish your next generation memories as well.

Let us show you how a real leader can perform: Fabri-Tek, Inc., 5901 South County Road 18, Minneapolis, Minnesota 55436. Phone 612-935-8811. TWX 910-576-2913.

Leader in memory technology for over a decade.

FABRI-TEK® INC.
MEMORY PRODUCTS DIVISION

CIRCLE 15 ON READER CARD

DATAMATION®

FEBRUARY, 1972
volume 18 number 2
This issue 110,518 copies

About the Cover

While the gears of the postal gods grind slowly toward automation, the venerable stamp machine still functions with modest efficiency, offering sturdy hope for more zip in the future. Our design is by photographer Georg Schacht.

departments

DATAMATION®

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*BURROUGHS ANNOUNCES and DELIVERS**

KRAVEX *Manufacturing Corporation*
11300 N.W. 32nd AVENUE • MIAMI, FLORIDA 33167 • (305) 688-0591

November 18, 1971

Mr. James A McCullough
Vice President and Group Executive
Burroughs Corporation
Burroughs Place
Detroit, Michigan 48232

Dear Mr. McCullough:

We recently accepted delivery of one of your new L 7000 Series Computers. It is replacing one of the two L 2000 systems we installed in mid-1970.

We had two excellent reasons for choosing the L 7000. 1) The outstanding performance of our L 2000's and 2) the tremendous growth in our business.

The L 2000 systems gave us exactly what we wanted in an improved invoicing procedure, prompt sales analysis reports, and close control of component parts and finished goods inventory. But our overall volume of orders and deliveries has increased so rapidly that we now need the extra power and range of the L 7000. The increased memory will eliminate multiple rehandling of information and thus improve throughput. The L 7000 also has the flexibility to keep up with our growth needs over a longer period of time.

I continue to be impressed by Burroughs capability of designing equipment that will keep pace with the growth patterns of its users. Congratulations for another major advancement in a great line of equipment, and our sincere appreciation for the excellent support we have always received from your Miami team.

Very truly yours,

KRAVEX MANUFACTURING CORP.
Richard A. Kraver
Exec. Vice President

moving ahead with better products

THE NEW L 7000 SERIES of COMMERCIAL MINI-COMPUTERS

The L 7000 Series is a major extension of our highly successful "L" family of mini-computers, now in use in thousands of organizations, large and small, worldwide. It is available for delivery NOW along with a library of application programs.

The L 7000 has broad applicational flexibility which enables it to respond effectively to the needs of businesses of varying size. It delivers the level of accounting and management control so essential in today's constantly changing business environment.

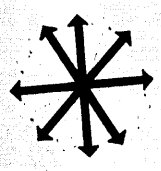
These are some of the features which contribute to its increased power and range:

- ☐ Modular memory, ranging from 2,560 to 8,704 words. Up to eight times as much memory as previous Series L mini-computers.
- ☐ Enhanced data input and output capabilities. Single, dual or mixed punched card and paper tape subsystems can be added as needed.
- ☐ Integrated circuitry. And a micrologic system that provides flexible processing and decision-making ability.
- ☐ Programable in COBOL, the standard business programing language of large electronic data processing systems.
- ☐ Dual-track magnetic memory records. Greater throughput from increased data storage and retrieval capability, plus the optional magnetic record reader.

If you would like to see an L 7000 in action, please call our local office or write us at Burroughs Place, Detroit 48232.

Kravex Manufacturing Corporation
has been in the automotive parts business since 1938. They manufacture and sell over 300 automotive parts and accessories to more than 10,000 major distributors and chain stores throughout the United States and Canada.

Burroughs



Look Ahead

A SHORTCUT TO VIRTUAL MEMORY?

IBM was close to announcing virtual memory or "relocate" machines several times. Once it was only two days from announcement--and you can even see a 145R (for Relocate) at Lincoln Lab. Some thought the RCA demise postponed a planned October or November announcement, but the latest is that IBM canned the whole project. Sources say they found a different way to give the user cheap working space--a low-cost, high-capacity integrated circuit memory that would not require a new VM operating system and all the training and conversion that implies. However, doubters say they can't conceive of an IC memory today that is less expensive than core.

Meantime, the advanced operating system (AOS), next replacement for OS, has gone back to the drawing boards because the formatting of its files wasn't compatible with that in OS and DOS. OS, we hear, will not be updated after version 21, due out in April. That may mean announcement of AOS this year. The 370/125, which was due to be heralded with AOS, now waits in the wings. And the 370/115 was junked long ago for the powerful "little" System/3.

WILL "CO-OPS" ERODE IBM CONTROL?

A new type of vendor--the "co-op lessor/manufacturer"--may be emerging on the systems market. Last month Mohawk Data Sciences raised $75 million to form Mohawk Financial Corp., a subsidiary that will lease 370s, as well as Mohawk tape drives and printers and the disc drives made by newly acquired Marshall Data Systems. Itel of San Francisco is the most broadly based of the lessor/manufacturer combinations. It will lease, in any of several combinations, IBM 360 or 370 cpu's, IBM peripherals and core memory, Itel 3330-compatible disc drives, and semiconductor add-on memories made by Advanced Memory Systems. Add the choice of Comma Corp. maintenance which Itel arranges, and you have almost complete loss of account control by IBM.

Leasing itself has already taken its toll on IBM's rental base and account control, and it's hard to tell now if this new trend will have enough further impact to bring IBM retaliation. Itel's exec vp Gary Friedman thinks IBM already made its move and decided "it can't wipe us out."

INDEPENDENTS EYE 360 MARKET FOR 3330s

At least two manufacturers of 3330-compatible disc drives plan to market them for use with 360/65s as well as IBM's 370 line. In fact, it's said IBM itself will be offering 3330s to 65 users by June. (IBM had a 360/67 with a 3330 system benchmarked for the Wimmix bid.) Memorex said its 3330 replacement will be offered on 65s, and Ampex said its product, due out in January '73, may be offered to both the 65 and 50 markets.

Century Data won't--at least not yet. It says two key commands are missing in the 65 for handling 3330s efficiently: rotational position sensing and command queuing. And Century is reluctant to commit the more than $500K it says it would take to add these commands and avoid degrading the 65's performance.

Meanwhile, Memorex has pulled its double-density 2314-type system off the market due to a disappointing order backlog of 24 systems. Its unusual design approach may have contributed.

Look Ahead

THE SOFTWARE TAX: QUESTION OF TANGIBILITY

Revenue-hungry California wants to slap property and sales taxes on software--and the industry is up in arms. The proposal by the State Board of Equalization is still being studied as hardware and software companies, users, and professional societies show up at hearings to protest. Tymshare's president Tom O'Rourke, who testified against the measure last month, is confident it can't be implemented for at least another year, if ever. Meanwhile, in Orange County, California Computer Products is in court to fight the county's assessment of its software as tangible property. In Los Angeles, IBM contemplates litigation with Los Angeles County for a ruling on whether applications programs can be taxed as personal property. IRS, by the way, rules that software is an intangible and cannot be lumped with hardware when taking investment tax credits.

SOFTWARE SALES TREND BRIGHTENS

After announcing a 35% price boost on its MetaCobol software package, Applied Data Research of Princeton had a dozen orders in two weeks from customers wanting to get in under the wire. It had sold only 35 all of last year. The company says sales of other packages also are picking up as customer budgets begin to loosen. Larry Welke, president of the newly formed software section of Adapso, says in 1971 a total of 29 software packages reached the $1 million sales mark, compared with three in '70.

U.S. SAYS PROGRAMMERS, ANALYSTS AREN'T PROFESSIONALS

Computer programmers and systems analysts are not professionals, according to a revised ruling by the Wages and Hours Div. of the Labor department. Therefore, it says, they are not exempt from receiving overtime pay. The ruling, affecting companies engaged in interstate commerce, is considered by some as an invitation to individual states to take similar action. Concerned companies were considering, among other things, changing titles from "programmer" to "mathematician." A spokesman for DPMA, which received lots of calls, says some companies plan to hire more people to avoid paying overtime. Others fear litigation for back overtime pay. Several unions, which under the ruling are free to organize programmers and analysts, sent representatives to hearings preceding its adoption, but at writing there was no evidence of any overt, active organizing campaigns.

CROWDED MEMORY MARKET PRODUCING BARGAINS

With more than a dozen independents now offering products, competition in the IBM 360 main memory add-on market is so intense that one suppler calls it "an auction." Front-runner Data Recall a year ago quoted 18% below IBM's price for a typical 360/30 add-on. It now offers 30% off. Others go below this. Electronic Memories and Magnetics entered the market last fall with prices up to 35% below IBM rental, and Itel says its prices on 360/65 add-ons are below half the IBM figure.

Some resist, notably Ampex and Fabri-Tek, saying customers soon will worry more about service guarantees than price, and they'll win them back. Ampex, with 37 devices installed, has its own maintenance staff. Fabri-Tek, with some 80 installations, uses the MAI subsidiary, Sorbus, as does Data Recall, which ended its contract with Comma Corp. in December. Data Recall has 225 add-ons installed and in April will deliver its first IBM 370 main memory

(Continued on page 106)

Colgate-Palmolive uses Sycor Terminals.

Maybe you should choose the same brand.

When you're a company like Colgate-Palmolive, moving a multiplicity of high turnover products through a variety of outlets every day, you rely heavily on rapid, precise communications. So the fact that Colgate-Palmolive chose Sycor Intelligent Terminals says a lot about our Data Communication Systems.

And we can tell you more. For example, the standard 8K bytes of read-only memory in Sycor's Model 340 Terminal can be combined with up to 3K bytes of read/write memory. As a result, programs such as Range Checking, Table Look-up, Equal Comparison, Check Digit Generation/Verification (and more) can be loaded from Sycor Program Library cassette and executed at the push of a button. At a fraction of what it would cost to create your own software.

Sycor's 340 Intelligent Terminal is also directly compatible with HASP Version III. In fact it is the *first* high-speed cassette terminal capable of interfacing with IBM computers operating under HASP control. Nice to know if you're interested in a remote batch system.

If you want to know more about Sycor Systems, fill out this coupon and mail it to: Sycor Inc., Department 705, 100 Phoenix Dr., Ann Arbor, Michigan 48104.

Please send literature describing the following typical Sycor equipment configurations (most configurations can be ordered on a building block basis):

- ☐ SYCOR SYSTEM 20 (complete data entry and communications system for branch offices) incorporating a Model 340 Intelligent Terminal with 1000 cps cassette recorders, 1200-2400 baud BSC communications, and a 30 cps printer.
- ☐ SYCOR SYSTEM 30 (a low-cost data communications central) consisting of a Model 340 Intelligent Terminal, a 7 or 9 track computer-compatible tape drive, and 1200-2400 baud BSC communications.
- ☐ SYCOR SYSTEM 40 (the first remote job entry cassette terminal with HASP compatibility) composed of a Model 340 Intelligent Terminal, 2000-2400 baud BSC communications, a 250 cpm card reader, and a 50-200 lpm printer.
- ☐ Please send detailed case histories of what Sycor is doing for many major corporations.
- ☐ Please have a sales representative contact me.

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NATURE OF COMPANY'S BUSINESS_____

SYCOR INC

ITEL
presents the expanding solution to computer system costs.

The expanding solution lies in ITEL's expanding capabilities. We started by offering you the best price/performance lease on the IBM System/360. Your benefits grew as we acquired our disk drive manufacturing capability, Information Storage Systems, developed marketing agreements with Advanced Memory Systems and added System/370 leasing to your options.

Fully committed to the Data Processing Industry, as demonstrated by this ever-expanding line of services, we now offer modern managers the best price performers in the industry, including System 360 or 370 Central Processing Units and the new ITEL 7330 disk subsystem and Monolithic Main Memory, plus the most favorable money savings in the business. And — highly important — the room to improve and expand as better techniques develop.

ITEL can supplant IBM arrangements or upgrade the whole operation, and leave you with substantial annual savings. That is because our financial people are data-processing professionals. Like you, they know that your problem is unique and you know your business best. So, every ITEL solution is tailored to the condition at hand.

A big part of your benefit is that the products we manufacture — an ever expanding line — are at the forefront of technological advancement.

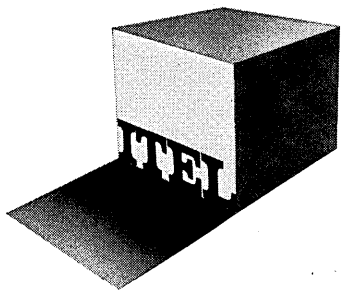
For instance, ITEL's Monolithic Main Memory Extensions, available for both the IBM/360 and 370, are of fourth-generation technology at significant cost savings over IBM prices. (This exceptional add-on is manufactured to our specifications by Advanced Memory Systems, Inc., Sunnyvale California.)

Similarly, the ITEL 7330 disk drive subsystem is plug-to-plug compatible with IBM's 3330 on all IBM System/370's and is actually a whole new level of high-density disk capability, in terms of both speed and capacity. Built by ITEL/ Information Storage Systems, it uses standard 3336 disk packs and has 800-million-byte capacity per subsystem.

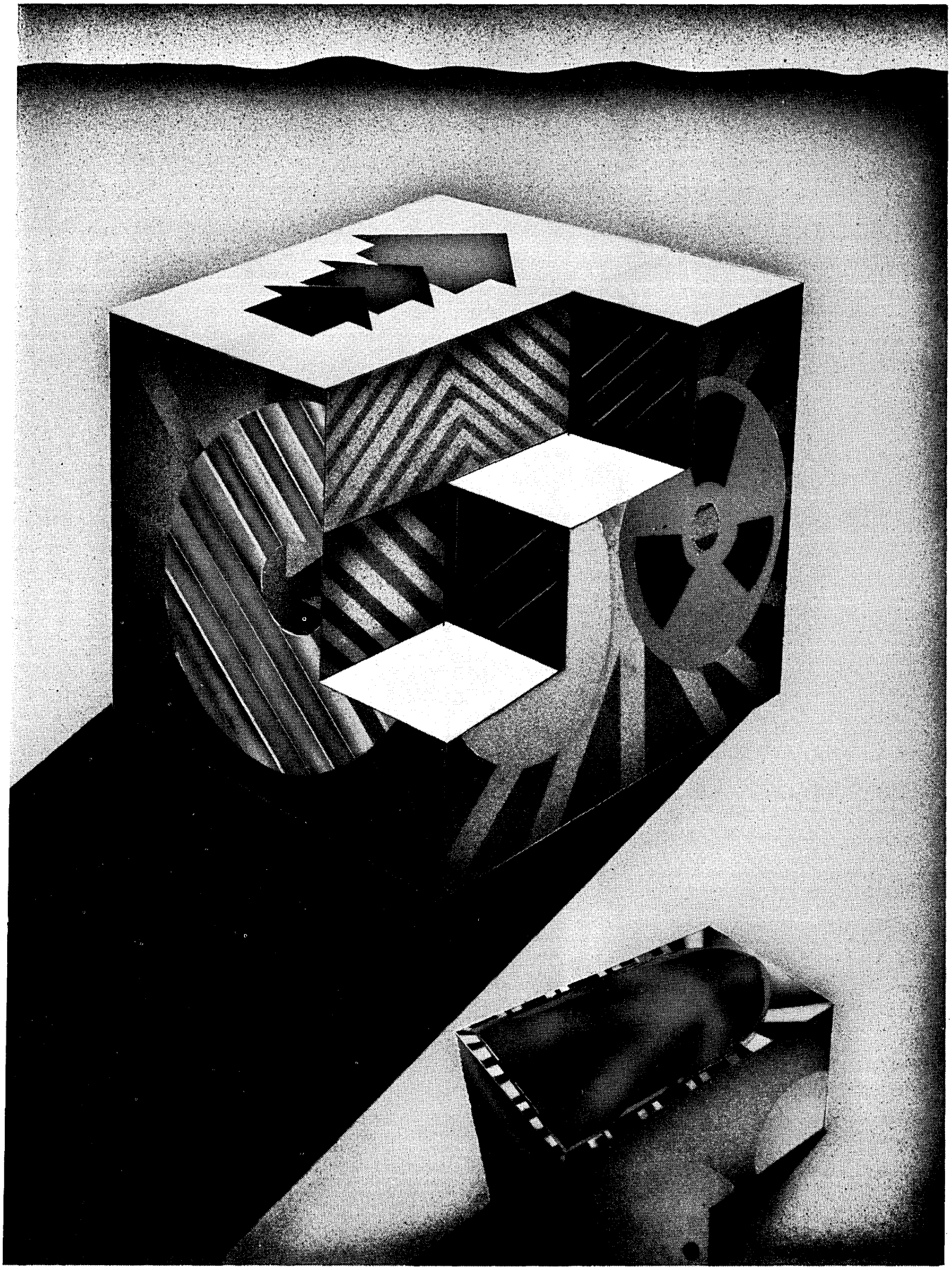
But what about service? ITEL has it. Economically, from a nationwide, on-call staff. A trained, qualified organization, skilled in servicing everything from IBM mainframes to add-on memories, disk drives, and other peripherals.

It comes down to this: ITEL gives you the in-depth experience of data processing and financial professionals. Strong technical capabilities and proven superior products. Follow-on service that means you needn't worry about service. When you are considering any data processing change — new installation, upgrading, or cost change — get in touch with ITEL.

ITEL's people and ITEL's products will show you our expanding solution to today's computer system costs.



ITEL Corporation, DPG, One Embarcadero Center
San Francisco, California 94111, Phone: (415) 989-4220



Why did OTB put its computer money on a dark horse?

Because we showed the Off Track Betting Corp. how they could save a bundle by using our totally compatible "8" series 12 bit minicomputer.

To date, we've installed six systems for OTB, each containing three specially expanded D-112's containing broad data communications capability.

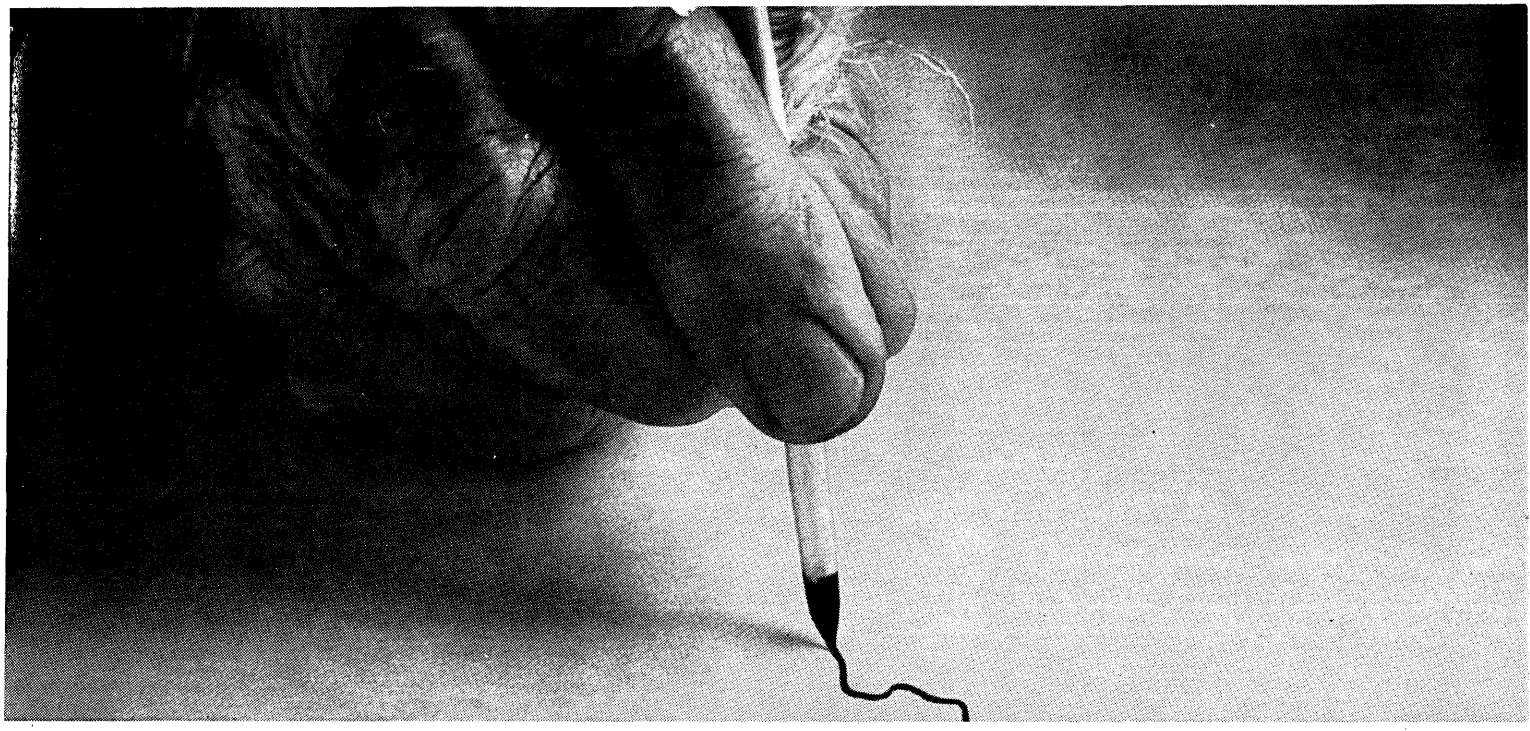
What's more, we've delivered over 250 of our D-112's as replacements for "8" series computers for many other companies.

If your budget could do a little better in the stretch, call us.

Digital Computer Controls Inc.,
12 Industrial Road,
Fairfield, New Jersey 07006.
Phone (201) 227-4861

DIGITAL COMPUTER CONTROLS INC
Coming up fast.

CIRCLE 81 ON READER CARD



Once maps were made by hand.

But why today?

Once, a man told another of what he'd seen and that man drew a map that all others could follow.

All of that was done by hand. That was then.

Today, a man takes a picture from an airplane of what he sees. And a second man prepares a manuscript from these photos. And then, this manuscript is transferred to film.

And then—incredibly—all of the lines that will make up the map (the rivers, the mountains, roads and streets) are *scribed* onto a negative master. By hand.

Finally, a swivel knife is used to cut outlines of specified areas. By hand. In the seventies of the twentieth century.

Someone doesn't trust someone.

We, CalComp, have told cartographers that our 745 flatbed plotter will scribe lines equal to the tolerances and standards of the most skilled mapmaker's hand.

Cartographers have told us that they tried plotters once. And the lines were not accurate. And they were uneven. And wiggly.

The CalComp 745 Plotter is accurate to a rate of plus or minus .001 inch. The lines it scribes or cuts are smooth and even. (Their step size is only .0001 inch.)

And our 745 plots at a speed of 4.2 inches per second. No hand alive can do that accurately.

If you make maps by hand, call us. We'll help you get from here to there.

Write us at California Computer Products, Inc., Dept. DM-M2-72, 2411 West La Palma Avenue, Anaheim, California 92801. Or call (714) 821-2011

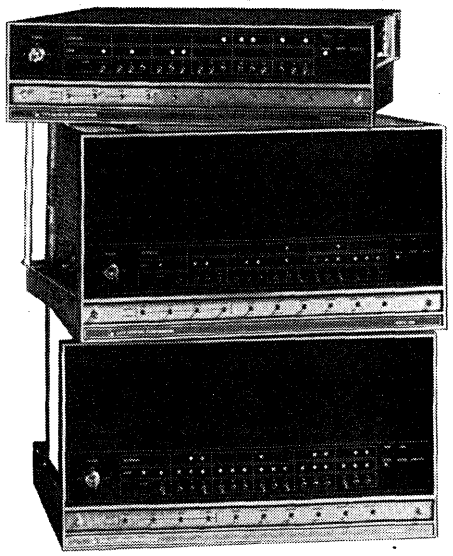
CALCOMP

Calendar

EVENT/SPONSOR	DATE	LOCATION	CONTACT	COST
	MARCH			
IEEE Symposium on Minicomputer Trends and Applications	**1**	Gaithersburg, MD	Minicomputers Box 639, Woodmoor Sta. Silver Spring, MD 20901	At door: $7.50, members $10, others
IEEE Computer Export Expansion Symposium	**2**	Washington, DC	Harry Hayman P.O. Box 639 Silver Spring, MD 20901	$10
AMA 18th Annual Systems Management Conference	**6-8**	New York City	Conf. Info. Coordinator American Management Assn. 135 W. 50th St. New York, NY 10020	$150, members $175, others
5th Annual Simulation Symposium	**8-10**	Tampa, FL	Annual Simulation Symp. P.O. Box 1155 Tampa, FL 33601	$85
IEEE INTERCON	**20-23**	New York City	William J. Hilty IEEE 345 E. 47th St. New York, NY 10017	$7, members $10, others $3, students
	APRIL			
IIA 4th National Meeting	**10-12**	New York City	Information Industry Assn. 1025 15th St., NW Washington, DC 20005	$100, members $150, others
	MAY			
21st National Microfilm Association Convention	**9-12**	New York City	Gordon Banks NMA 8728 Colesville Road Silver Spring, MD 20910	$50
Spring Joint Computer Conference	**16-18**	Atlantic City	AFIPS 210 Summit Ave. Montvale, NJ 07645	$20, members $50, others
ASM 25th International Systems Meeting	**21-24**	Miami Beach	Assn. for Systems Mgt. 24587 Bagley Rd. Cleveland, OH 44138	$125, members $175, others
	JUNE			
IEEE Technical Program at 2nd U.S. Computer Solo Exhibition	**8-13**	Tokyo, Japan	Harry Hayman IEEE Computer Society P.O. Box 639 Silver Spring, MD 20901	$100
35th ADAPSO Management Conference	**22-23**	Boston	J. L. Dreyer ADAPSO 551 Fifth Ave. New York, NY 10017	$85, members $120, others
DPMA International Data Processing Conference & Business Exposition	**27-30**	New York City	Richard H. Torp DPMA 505 Busse Hwy. Park Ridge, IL 60068	$90, members $115, others

THE NEW MINICOMPUTER ANNOUNCEMENT.

DATA GENERAL AGAIN.



Let's face it.

Right now, the competition in minicomputers is pretty stiff.

Well, we've just made it stiffer.

We've just come out with the strongest new line this industry has ever seen.

Nova 1210, Nova 1220, and Nova 820.

THE NEW NOVAS.

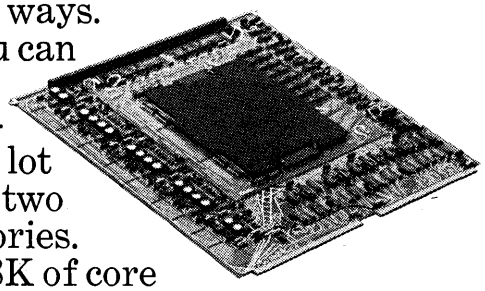
Nova 1210. The least expensive Nova. But to get the price, you don't have to sacrifice performance. Nova 1210 has a 1200 nanosecond cycle, and executes arithmetic and logical instructions in 1350 nanoseconds – the same performance as the Nova 1200. In its 5¼-inch high chassis, it has room for 24K of core, or multiple peripheral interfaces. Plenty for most OEM's. $4,350.*

Nova 1220. The most flexible, expandable, easily interfaced Nova yet. It holds a full 32K of core and still has five chassis slots left over for peripheral interfaces. It matches the performance of the Nova 1200 (1200 ns cycle, 1350 ns add), yet it has 50% more expansion capacity and a lower price. $5,250.*

Nova 820. The faster Nova. Its fully parallel central processor executes arithmetic and logical instructions in a single 800 ns cycle. And with a full 32K of core, there are still four slots left over for peripheral interfaces. $6,450.*

A NEW MEMORY.

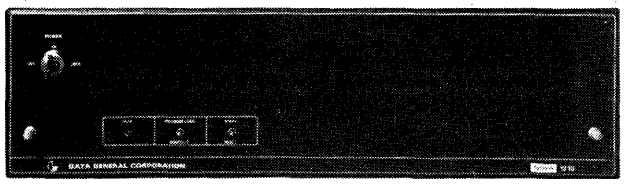
We've also come up with an 8K x 16-bit core memory board for each of the Nova computers. This reduces costs two ways. First, you can buy one 8K memory for a lot less than two 4K memories. Second, 8K of core



*Price includes central processor, 4K 16-bit words of core memory, programmer's console, Teletype interface, direct memory access (DMA) channel, automatic interrupt source identification, and rack-mount slides or table-top enclosure.

on a single board means you can fit more memory into a smaller, less expensive computer.

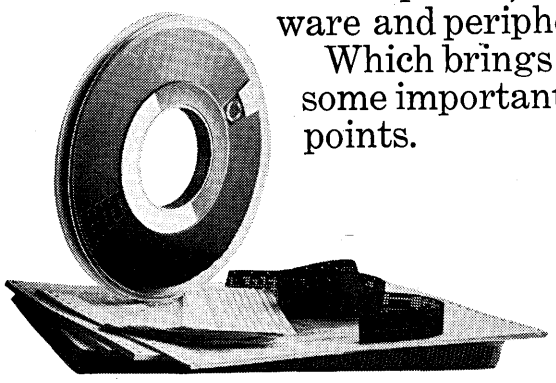
A LOW COST CONSOLE.



Our new turnkey console. It costs less than the standard programmer's console, and it's less susceptible to damage or program alteration in severe environments.

And, needless to say, these new computers and options are completely compatible with all the other Nova-line computers, software and peripherals.

Which brings up some important points.



THE SOFTWARE, PERIPHERALS AND SERVICE.

When you buy a minicomputer, you need more than just fancy hardware specs.

You need software. The Nova computers come with the broadest range of software available for any line of 16-bit minicomputers. Extended ALGOL, Extended FORTRAN IV, Time Sharing BASIC, Real Time Operating System, Disc Operating System, and lots more.

You probably also need peripherals. We offer every type of peripheral device commonly used in minicomputer systems. Discs, magnetic tape units, paper tape equipment, card readers, line printers, real-time clocks, A/D, D/A, and communications equipment. All completely interfaced and supported by us.

And you need solid support after you've bought. We've got field service engineers in major cities all over the U.S., Canada, and Europe, plus a full customer training program for every Nova computer.

A TRACK RECORD.

When you buy a minicomputer you also need some pretty solid assurance that the people you're doing business with can produce what they promise.

Three years ago, we promised we'd build the world's best minicomputers. Since then we've delivered over 2,000 Nova-line minicomputers, to become the world's number 2 minicomputer company.

Now, with these new Novas, we can promise we'll become number 1.

FREE READING MATTER.

What you need most of all when you buy a minicomputer is some reliable information. Like ☐ "How to Buy a Minicomputer" and ☐ "The Data General Catalog".

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ASI-ST cuts problem-solution costs by:

- ☐ Performing many operations automatically
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The effect of these language characteristics is that ASI-ST provides a skeleton solution to most data processing problems by merely calling ASI-ST through the host job control language. As a result, the user need specify only *what he wants done*. By contrast, conventional programming languages require the programmer to specify not only what he wants done, but also how to do it.

ASI-ST increases machine efficiency by:

- ☐ Generating completely optimized machine instructions
- ☐ Processing multiple jobs concurrently
- ☐ Accessing multiple data files in parallel
- ☐ Processing intermixed one-time and recurring requests

Want proof of ASI-ST's ability to increase machine efficiency . . . When Combustion Engineering converted an engineering drafting system, previously written in COBOL, to ASI-ST, elapsed time on an IBM 360/65 dropped from 36 minutes to 7 minutes.

Commenting on his experience with ASI-ST, Leo Craft, Manager Corporate Information Systems, Signetics Corporation, said recently, "In a two-year period, we lowered our aggregate data processing costs by 25 percent while increasing productivity by over 500 percent."

ASI-ST has been operational on IBM 360/370 and RCA Spectra 70 computers since March 1969. To find out how this proven system can *assist* you, we invite your inquiry: Applications Software Incorporated, 21515 Hawthorne Blvd., Torrance, California 90503 or call (213) 542-4381.

THE Software Manufacturer
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Letters

Ross is boss

Sir:

Reference is made to your 15 November 1971 news story on H. Ross Perot (p. 87).

Mr. Perot has given the Data Processing Industry a taste of honesty and shown the previously "snowed" Corporate World some of the true efficiencies and economies available from properly utilized ADP. I think we need more men like Ross Perot and fewer of the phonies with the buzz words and the ADP professionals who have tried to create a great mystique.

MAJ. JOSEPH B. BORNSTEIN
APO San Francisco

Born unfree

Sir:

"A Fable for Our Time," by Bruce C. Whitener, Dec. 15, p. 52, is too painful to be funny. The sourest part of the "humor" is the suggestion that the disillusioned user retains the power to cancel.

What bank could cancel its computer equipment without immediately declaring bankruptcy? What computer manufacturer could throw out its operating system in disgust and start over from scratch? What credit card company could decide that computer billing was causing more customer antagonism than it was worth and go back to manual billing? What computerized airline could drop its passenger reservation system as being too expensive?

The simple fact is that, after a *very* short transitional period, we become dependent on new technology. Once it has become thoroughly enmeshed into our business and/or personal lives, we no longer have the freedom to do without it. Most people like to pretend that they freely choose to do the thing that they have no real power *not* to do, but there has to be some question about that kind of freedom.

Is this really what we want?

DANIEL D. MCCRACKEN
Ossining, New York

Eastern update

Sir:

I would like to comment on the article "East-West Trade . . . Trickle or Torrent?" (Dec. 15, p. 44).

Having in mind that the article was probably written without extensive author's background in this area, I would consider it as relatively good. Unfortunately, there are some omissions and mistakes, including the following:

First, Czechoslovakia (TESLA) has had a licensing agreement for a line of middle-sized third-generation computers with GE-Bull since 1967. Second, ARITMA is not an East German company, but is located in Prague, Czechoslovakia, and none of its products can be considered as an ordinary computer. Third, the accurate statistics about computer installations are readily available for most East European countries.

Also, the statement about the needs of the different countries is misleading. The needs are dependent on industry or application, and not on geographic location.

ALOIS J. STRNAD
San Francisco, California

The name in the game

Sir:

I refer to a News Scene section in your Dec. 15 issue entitled "U.K. T-S Story: The Plot Is Familiar" (p. 65).

This article was compiled from an interview which I gave to your Miss Pantages some weeks ago. I would like to point out that although the facts are correct, the name of the Managing Director of TSL is not, as you will see from my signature, Dick Davis.

Perhaps you would take steps to remedy this error.

R. W. EVANS
Managing Director
Time Sharing Limited
London, England

Something borrowed

Sir:

It should have been noted in the Dec. 15 Look Ahead item (p. 7) on Xerox Data Systems that the APL product in use at Canada's Defense Research Establishment near Quebec City was designed and built by the user. XDS has adapted it for use with its Universal Time-Sharing System.

GLENN GIDDINGS
Xerox of Canada
Rexdale, Ontario

. . . while Allen burned

Sir:

In the Dec. 1 issue in the News Scene section (p. 42), you quote a C. Allen Burns. Mr. Burns spent less than six months at RCA, this time during a period of greatest change and uncertainty. I do not question Mr. Burns' qualifications for recognizing technical incompetence, but I have spent the last three years directly involved with some of the areas which Mr. Burns apparently feels to be populated with "old-line RCA incompetents" and saw no glaring examples except in very recent times.

RCA's new product series was planned to have the capability of running existing RCA operating systems. It was, however, optimized for the running of a totally new operating system which was not really abandoned until July of 1971. Only someone who has been intimately familiar with the management rationale behind various development decisions can really judge the technical competence of the engineering and scientific effort to implement management plans. Mr. Burns was not privileged to be particularly involved in such management decisions nor any of the significant implementations of them.

I believe that DATAMATION is guilty of irresponsible journalism because you apparently did not make the simple effort of a few phone calls to verify Mr. Burns' judgment of the situation. I believe that the technical people in RCA's computer effort have been poorly enough served by the events of the last few weeks without DATAMATION publishing such irresponsible verbiage. I trust that you will take the trouble to interview some knowledgeable and responsible people at RCA and print a more accurate analysis of the situation in your next issue.

SPENCER W. SPAULDING
Marlboro, Massachusetts

Intimations of sophistication

Sir:

I read "De Ludi Natura Liber Secundus" (Dec. 1, p. 32) with great interest; and at the authors' suggestion, Wordsworth's "Intimations of Immortality," which was not as enlightening as I had hoped. The only relevant commentary I could find on that piece was Ambrose Bierce's definition of Infancy: "The period of our lives when, according to Wordsworth, 'Heaven lies

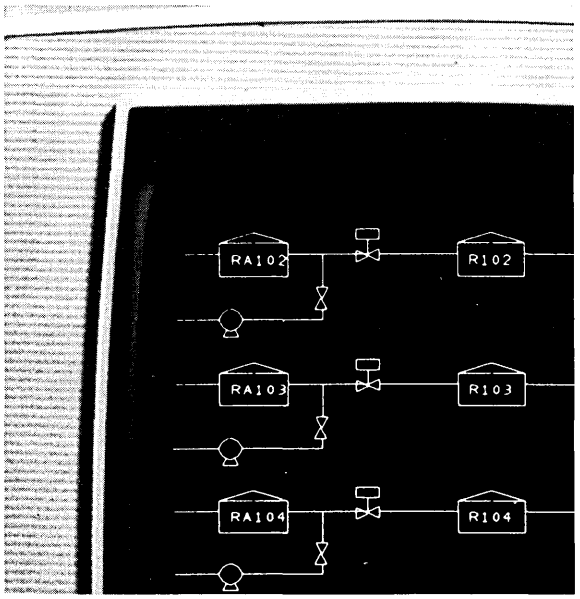
about us.' The world begins lying about us pretty soon afterward." Is this what is meant by an information system of considerable sophistication?

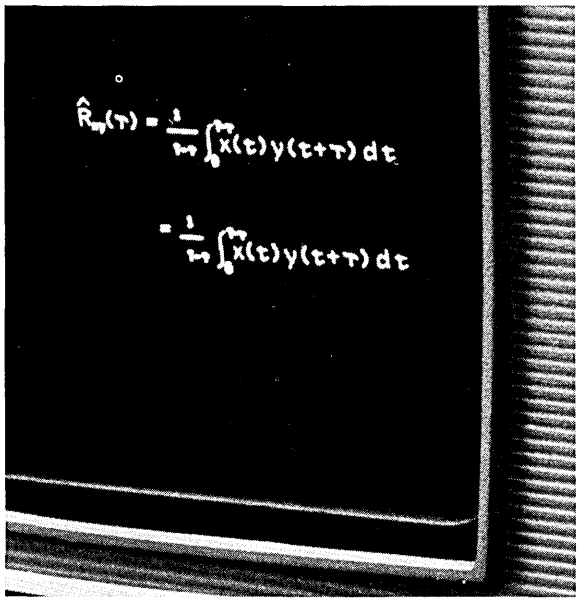
L. BENZLEY
Vancouver, British Columbia

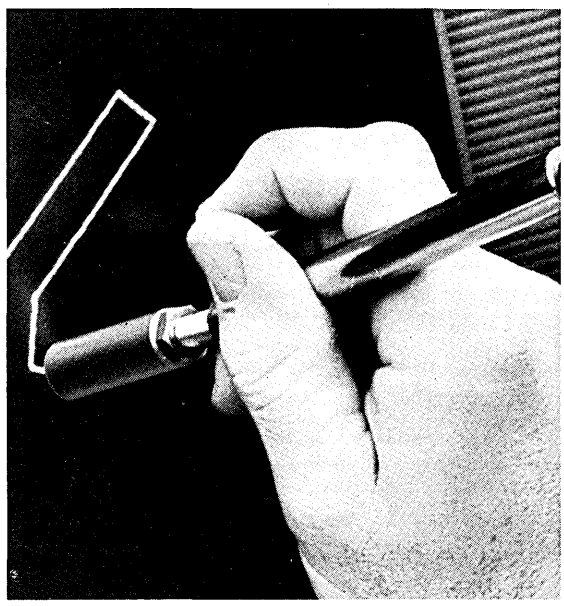
Picture the future

Sir:

Mr. Robert J. Robinson clearly states his opinion of the AT&T development of the Picturephone (Nov. 15, p. 152). His point is well taken that: "It behooves the computer community and the public in general to carefully question the policies and directions of AT&T, since these policies and direc-







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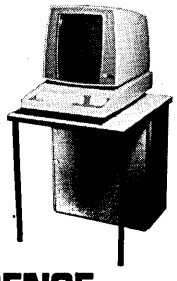


IMLAC

INTERACTIVE INTELLIGENCE

letters

tions generate future capability of the nation to maintain its 'information system,' and the effectiveness of it directly affects the future of the nation itself."

However, Mr. Robinson conveniently avoids his own directive "to isolate possible present and near-term alternatives to Picturephone and to examine the social costs and benefits of them." When I showed the article, "Picturephone—Who Needs It?", to a deaf coworker, he responded, "I do!"

O. DENNIS BARNES
National Technical Institute for the Deaf
Rochester, New York

Speaking of von Neumann

Sir:

Please make every effort to include the "Also Sprach von Neumann" series in your coming issues. They are priceless analogs of management climate and culture experienced in total or part by almost everyone. Excellent.

HILLYER SENNING
Bedford, Massachusetts

Two more chapters have been discovered, and we suppose they'll be published one of these days.

Cheap Marie

Sir:

Your reference to Ed Donegan (Dec. 15, p. 7) was offensive and misleading. Ed Donegan earned the trust, respect, and loyalty of the vast majority of RCA Computer Div. employees. Far from creating a mess, he and his "IBM people and organizational approaches" almost succeeded in rectifying the mess that he inherited.

I believe that most people will find that Ed Donegan's conduct, in the impossible position in which he was placed on Sept. 17, has been worthy of admiration rather than cheap comparisons with Marie Antoinette.

DAVID H. DIAMOND
Cherry Hill, New Jersey

Unrecognized

Sir:

Your Dec. 1 issue carried an article by P. L. Andersson entitled "OCR Enters the Practical Stage" (p. 22).

Datatype Corporation has been manufacturing and marketing the DATAFLOW page reader for over a year. We have over 40 installations to date. Our page reader pricing structure begins at $9950. The system scans typewritten documents and outputs to magnetic tape, paper tape, or on-line to existing computers.

In view of the above-mentioned facts, I cannot understand why we weren't mentioned in the article. I believe that we have made a major contribution in moving OCR into the practical stage.

RICHARD WRIGHT
Datatype Corporation
Miami, Florida

Scanning the field

Sir:

We wish to correct author P. L. Andersson who stated that Philco-Ford Corp. "has discontinued all OCR equipment."

This is incorrect.

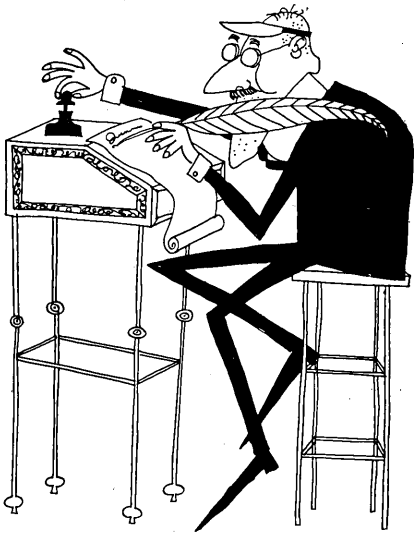
Philco-Ford continues to design and build OCR and scanning systems and equipment. Currently, we have three basic OCRs for the U.S. Postal Service, proprietary OCR products in development for the communications field, and several scanner products and systems under development and in field use.

R. G. CLOUSER
Philco-Ford Corporation
Willow Grove, Pennsylvania

Unresolved point

Sir:

Since we are engaged in systems and system software for minicomputers, primarily Data General's Nova line, I was very interested in "Speed Tests, Costs, and Word Length" (Oct. 15, p. 26). Dr. Cohn states that the tests were run on a "representative selection of small-to-medium computers of the



class commonly used for process control and data acquisition." He then presents the results of tests involving floating-point arithmetic almost exclusively.

However, most process control and many data acquisition applications use only fixed-point arithmetic. The information presented is of great interest to me and others involved in time-sharing and other floating-point applications, but someone looking for a process control machine may be misled by the implication that these tests are directly applicable to his problem.

For such applications, we might refer only to the times given for the DO cycle, the only test not involving floating-point arithmetic. Note that in this test the 16-bit and 24-bit machines are all in the range of 9 to 16 memory cycles. The glaring misfits are the 18-bit and 12-bit machines. Could these two have been FORTRAN interpreted rather than compilers?

We use 16-bit machines because, at the present time, they are more cost effective than the 24-bit machines, even for floating-point arithmetic. This is probably because there is so much competition in the 16-bit field. Another consideration is efficiency in byte manipulation; byte addressing is easier if the word holds a power-of-two bytes. As Dr. Cohn implies, perhaps 32 bits is the way to go. Why doesn't someone build a 32-bit mini?

I hope that Dr. Cohn's article will encourage others with such comparative information to publish it soon.

DANIEL G. PAYMAR
Educational Data Systems
Newport Beach, California

Dr. Cohn replies:

First, I must reemphasize that there is nothing so special about floating-point arithmetic. The execution of a floating-point subroutine merely involves a number of additions, shifts, maskings, etc.—the same operations that might be performed in a fixed-point calculation or any other data manipulation. Therefore, if the execution of a floating-point subroutine is abnormally slow on a given machine, isn't it most likely that other types of calculations will also be abnormally slow?

In response to the question raised at the end of the first paragraph of Mr. Paymar's letter, I might point out that all systems tested were compiler systems.

Manipulation of word subdivisions can be just as convenient with 24-bit as with 16-bit machines. In particular, character manipulation is readily done with a BCD code or with the 64-character "printing subset" of ASCII, packing four 6-bit characters per word.

Decyphering fortran

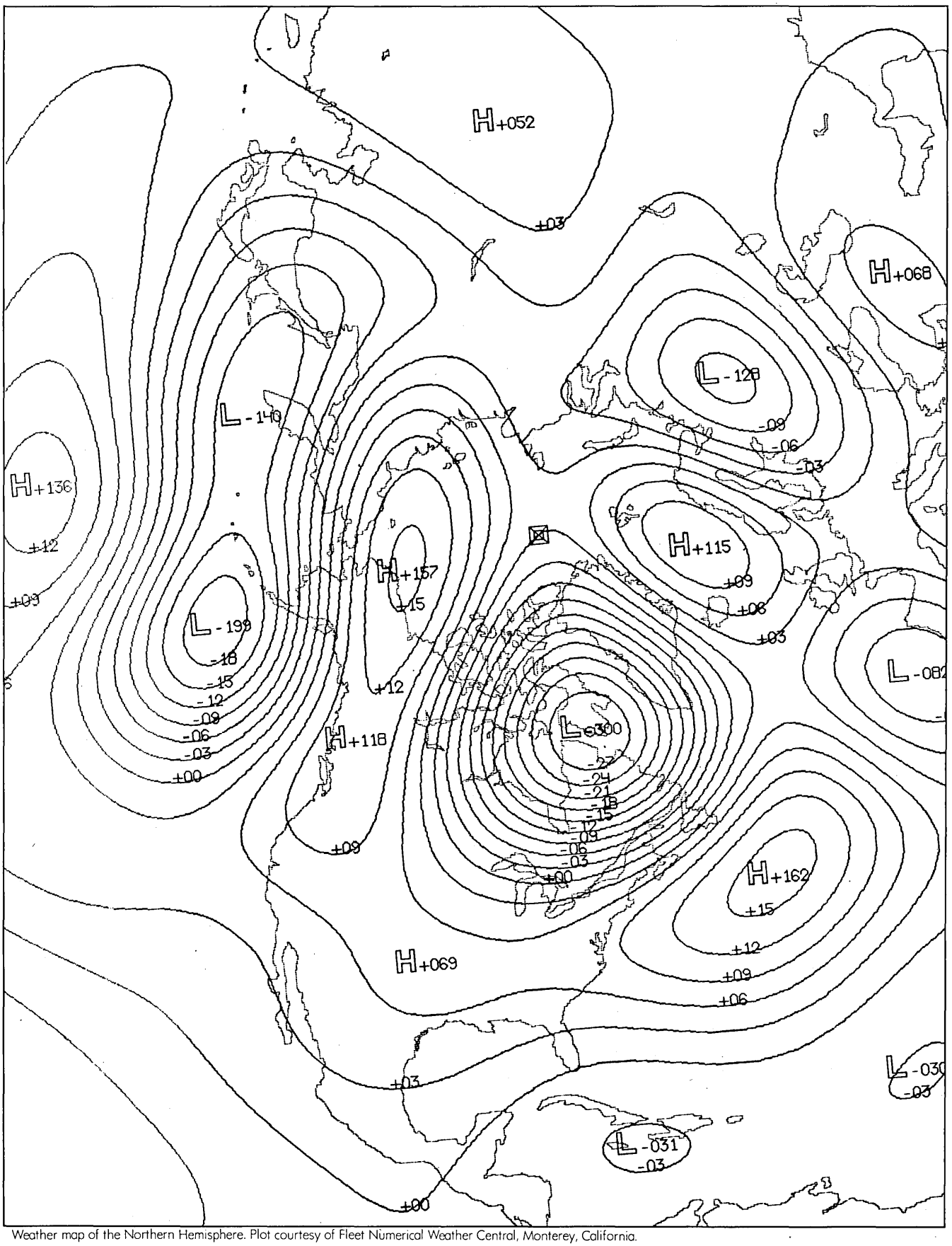
Sir:

As a graduate student learning the FORTRAN IV language using the WATFOR compiler on an IBM 360/50, I can vouch for the efficacy of debugging my programs with the aid of the excellent diagnostics provided by WATFOR.

Stan Siegel ("WATFOR . . . Speedy Fortran Debugger," Nov. 15, p. 22) said, "At present, there is no official publication which discusses the WATFOR compiler." Maybe so. But I have found a very useful and informative "unofficial" publication: *Introduction to* FORTRAN IV *Programming: Using the* WATFOR/WATFIV *Compilers* (Goodyear Publishing Co., Pacific Palisades, Calif., 1971), by John M. Blatt, professor of applied mathematics at the Univ. of New South Wales. This text is chock-full of sage and sometimes even witty advice to the student of FORTRAN programming. The chief

(Continued on page 118)

Time 00:00:00



Weather map of the Northern Hemisphere. Plot courtesy of Fleet Numerical Weather Central, Monterey, California.

Time 00:00:01

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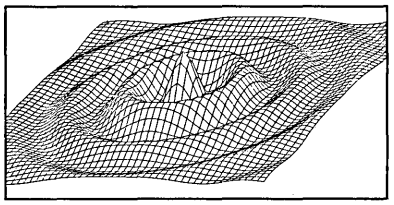

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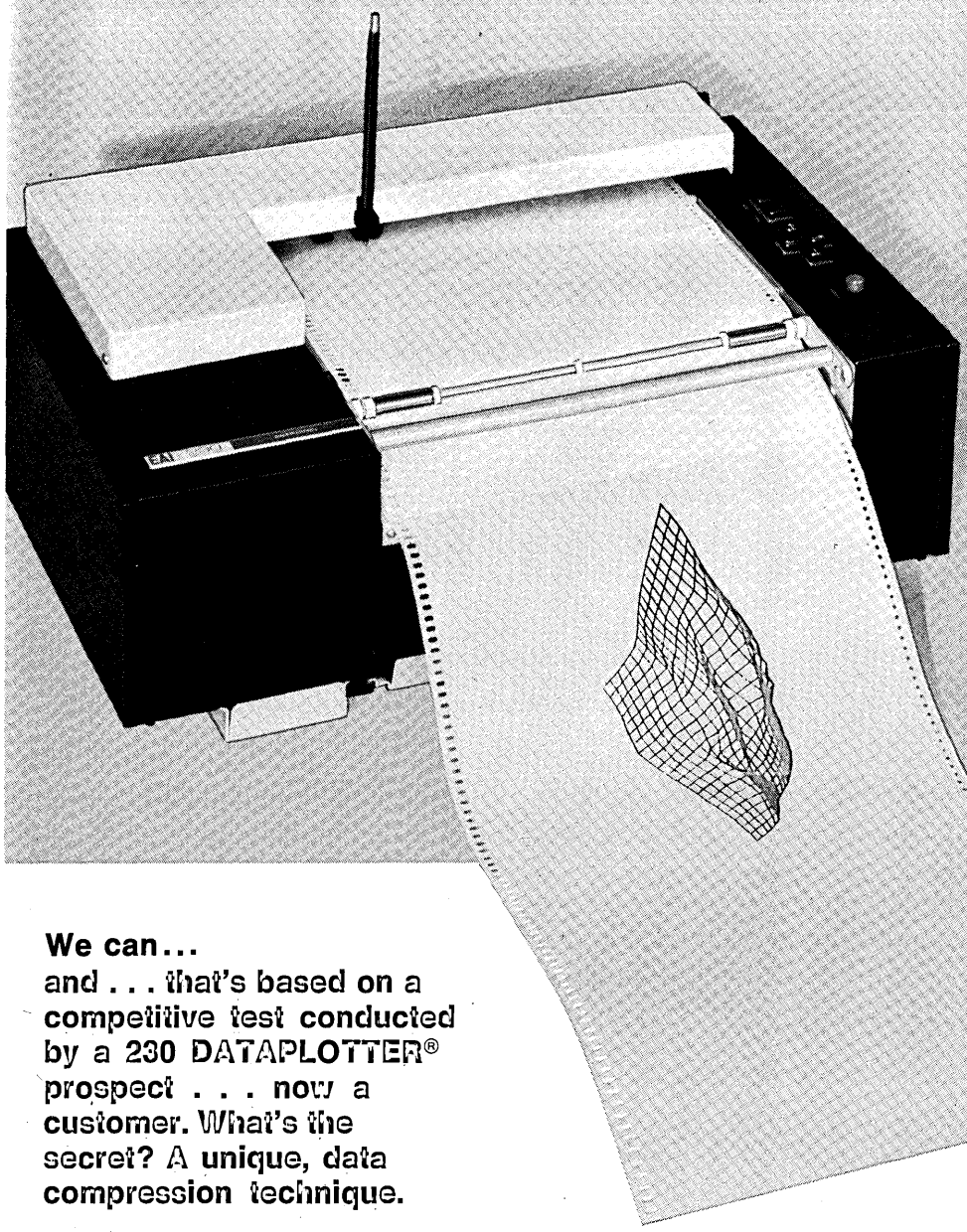

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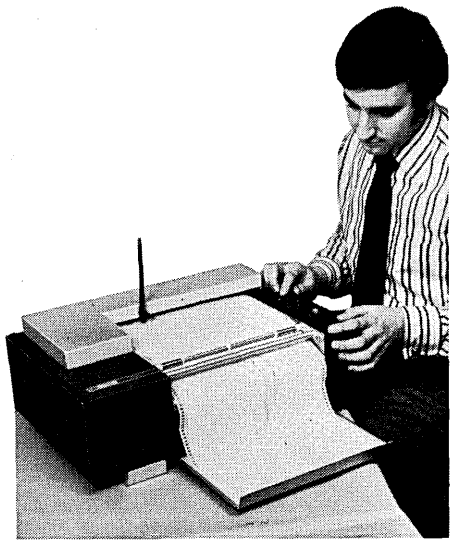

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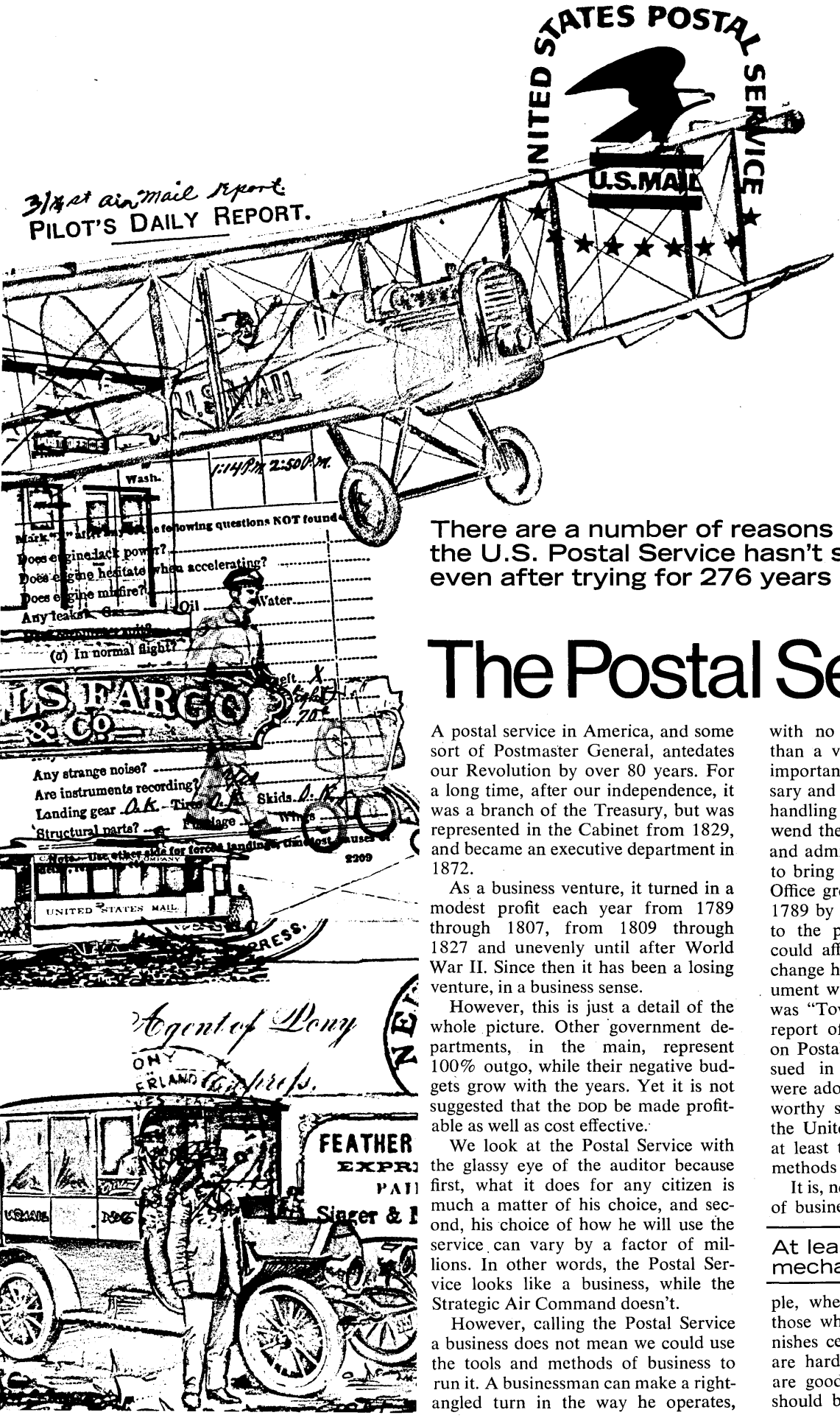
CIRCLE 58 ON READER CARD



There are a number of reasons why the U.S. Postal Service hasn't solved its problems, even after trying for 276 years

The Postal Service:

A postal service in America, and some sort of Postmaster General, antedates our Revolution by over 80 years. For a long time, after our independence, it was a branch of the Treasury, but was represented in the Cabinet from 1829, and became an executive department in 1872.

As a business venture, it turned in a modest profit each year from 1789 through 1807, from 1809 through 1827 and unevenly until after World War II. Since then it has been a losing venture, in a business sense.

However, this is just a detail of the whole picture. Other government departments, in the main, represent 100% outgo, while their negative budgets grow with the years. Yet it is not suggested that the DOD be made profitable as well as cost effective.

We look at the Postal Service with the glassy eye of the auditor because first, what it does for any citizen is much a matter of his choice, and second, his choice of how he will use the service can vary by a factor of millions. In other words, the Postal Service looks like a business, while the Strategic Air Command doesn't.

However, calling the Postal Service a business does not mean we could use the tools and methods of business to run it. A businessman can make a right-angled turn in the way he operates, with no more notice or preparation than a visit to his banker and a few important customers. Some very necessary and obvious changes in the way of handling the mails have taken years to wend their way through the legislative and administrative processes necessary to bring them to fruition. As the Post Office grew from a $2,000 business in 1789 by the factor of almost a million to the present day, the idea that it could afford the luxury of ponderous change had to be abandoned. The document which doomed the ancient way was "Towards Postal Excellence," the report of the President's Commission on Postal Organization, which was issued in 1968. Its recommendations were adopted by Congress with praiseworthy speed, so that today we have the United States Postal Service, with at least the charter to apply business methods to a business purpose.

It is, nevertheless, a very special kind of business. It must serve all the peo-

At least we are in the mechanical business now . . .

ple, wherever they are, and not just those who can return a profit. It furnishes certain kinds of services which are hardly ever profitable, but which are good from our view of what we should be as a nation. The principal

Past, Present, and Future

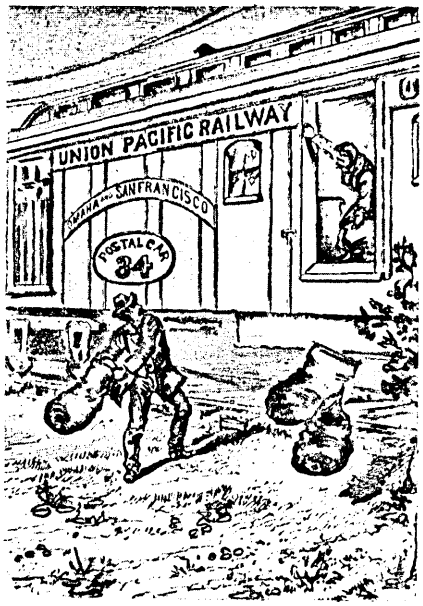
by Alvin P. Hanes

example of this is the special rates for news media. It has helped national growth by the establishment of the parcel post. It is also involved in many other services, often free of charge, having little or nothing to do with personal correspondence in the classic sense.

Carriage of mails is a very old business, perhaps as old as recorded history. The great Roman roads were perhaps as important for communication of information as for carriage of goods, or fast deployment of troops. International postal service goes back several centuries, and upon this business were founded several princely and private fortunes. We are Johnnies-come-lately in it, and unlike so many other fields of technology where we are front runners, the transition of the Postal Service into the 20th century has been done to a great degree with techniques borrowed from other countries.

Mechanization itself as a broad program in the U.S. mail service goes back only to 1949. Much of this work, in fact, was concerned with money-order mechanization, and better handling on the workroom floor. But even by that time a key driven sorting system was being put into use in Europe, so for a while, at least, we had the benefit of observing the travails or successes of others, rather than trying to outguess the future by clever specification writing.

In the meantime, in Canada, a system was being developed which is more nearly the starting point for major portions of our present approach to



the subject. This system consisted of the following steps:

1. The address was read by an operator.

2. The operator pressed certain keys on a keyboard which, as an end result, caused a dot code to be printed on the back of the envelope.

3. This dot code could be read by other equipment further down the line to operate sorting equipment.

The advantages of a system like this are as follows:

1. A human being handling mail cannot do much better than subdivide the mail into, say, 70 categories. Furthermore, his reading has left no mark on the letter. If it is to be sorted further, it must be read again. In the keyboard system, what is keyed can be expressed as code printed on the mail piece. Whatever more is coded than is needed for the first sort is grist for the mill of the second.

2. The number of pockets that can be used on the sort is a function of the reach of a man's mind, not of his arm. Hopefully, the former is longer.

3. It was possible to confine the operator's contribution to code keying only, mechanizing the balance of the letter-moving process.

The disadvantages of the idea were:

1. "Scheme" knowledge was required. In other words, where a mail clerk in front of a set of pigeonholes has the perpetual benefit of their labels to guide him, the destination of a letter in the keyboard system is entirely a matter of memory training. This training is in no sense trivial, taking six

months or more before a man is fit to operate a terminal.

2. Change of sorting criteria in a pigeonhole system involves relabeling the slots, and a certain amount of mental gear-shifting. The amount of instruction to memorize a changed sorting scheme, or worse, a new one, is on the order of that required to get set up for taking on the job in the first instance.

Nevertheless, the scheme-learning, long training procedure was the one that was followed when mechanical keyboarded sorting was adopted in this country. At least we are in the mechanical business now, and are trying out new and different ways to improve our position, including the substitution of computer memory for human memory, in a well-equipped installation in Cincinnati. This installation, which handles part of the workload of the Cincinnati center, is set up to try out various configurations for mail traffic, and also to operate and evaluate specific devices for handling letter mail. In particular, it caters to the special situation of "directs," the addresses or classes of addresses that get such a big slice of the daily mail that it is worthwhile to set up a separate set of paths just for them. (For a painful example, consider the Internal Revenue Service mail bags on any April 16.) Although largely a keyboard driven system, the design does not exclude the addition of optical character reading devices for suitable portions of the workload.

No background discussion would be complete without a few definitions and special descriptions.

In broad terms, mail can be in one of three general geographic statuses. It can be at the location where the letter carrier who will deliver it is located. Such mail is called "incoming" mail. Other mail has been collected locally, but must be transmitted to a more distant large facility for further handling, e.g., mail collected in Baltimore but addressed to New Orleans. Such mail is called "outgoing" mail. There is an intermediate state called "transit" mail. Such would be mail collected in Portland, Maine, for instance, but addressed to one of the states of the Southwest. It's more economical to put mail from several such (contiguous) states into one bag, and make an intermediate breakdown at the best-situated facility among them.

Postal Automation Moves into High Gear

Up to $30 million will be spent by the U. S. Postal Service during the next 18 months to further automate its Letter Mail Code Sorting System (LMCSS), if the front office—officially the Board of Governors—gives its blessing. The board was considering the matter as this article was being written; chances are the plan will be approved soon.

IBM has won a $4 million contract to develop functional specs for the new system (and perform other chores). Postal Service officials emphasize that no equipment is being acquired under this contract. That will come later, through a competitive procurement.

They are sensitive about the IBM contract because Ralph Nader recently criticized it. He said the Postal Service, contrary to regulations, didn't solicit competitive bids. Nader also charged that the Postal Service and IBM haven't agreed on the work to be done. Postal officials say these allegations are "ridiculous and absurd."

Right now, LMCSS consists of a test bed at the Cincinnati central post office, which sorts mail automatically after it has been semi-automatically imprinted with a bar code. The code-imprinting and code-reading equipment was supplied by Plessey Airborne, Ltd. A basically similar system has been operating in Australia for several years.

The new LMCSS will be a full-scale system. Hopefully, by mid-'73, it will be operating at four central post offices. Cincinnati, Columbus, and Toledo, Ohio, plus Indianapolis, Ind., are the probable sites.

Ultimately, all of the nation's 177 main post offices will be similarly equipped. At that time, the system allegedly will be able to deliver 97.6% of all first-class mail within two days. The current average is 78%. First-class envelopes will have to be scanned manually only once, if at all. Now, by comparison, postal personnel have to read each first-class envelope up to seven times before delivering it to the recipient.

Two major differences between the new LMCSS and the present one involve computers and coding schemes. The test bed is controlled by dual Sigma 3s. The follow-on will utilize a more sophisticated processor having greater capacity. It hasn't been selected yet.

The test bed employs phosphorescent ink to bar-encode name and address information on the back of envelopes. This is done semi-automatically by clerks who operate 24 Plessey coding stations. The clerk scans the name and address recorded on the envelope by the sender, then punches an alphanumeric code into a keyboard. The bar-code printer is controlled by this keyboard, through the Sigma 3.

The new system probably will be built around code stations supplied by LTV Systems, Plessey, or NCR. In any event, the keyboard will be linked to a nonphosphorescent, ink-jet printer which records name/address bar codes on the front of each envelope, in the lower right corner. The code contains 79 bits of data. Numerics are formatted in binary, alpha characters in BCD.

After being coded, some letters will

be conveyed directly to a letter-sorting machine. Here, they'll be accumulated inside 277 storage bins, each representing a specified destination. The whole operation will be controlled by a bar-code reader connected to the central LMCSS computer. Local mail that doesn't have to be sorted right away will be shunted into a holding area after it leaves the coding stations. This operation will be controlled in the same way.

In 1973, Postal Service officials plan to install the first of a new generation of letter sorters. Burroughs and GATX are now developing proto-

A mechanical mail handling system must be able to cope with situations like those described and also do all the preparation and postprocessing which would make the operation practical as well as theoretically correct.

The difference between the theoretical ideal and down-to-earth practicality is exhibited over and over again in the common practice of sorting. Four sorts, each involving 120 pockets, would direct a letter to an *exact* one of some 200,000,000 locations. How efficient! Every man, woman, and child in the country would have his own little box reached in only four operations. The contract for paving the road to Utopia has not yet been let, nor ever will be, because people are not identified by a nice dense set of natural numbers, but by a haphazard conglomeration of sparse, duplicated, vague characteristics, few of which are even numerical. Furthermore, as anyone who has ever watched a card sorter in operation knows, what makes sorting a practical business is not so much the ability to swap a set of objects to the set of integers, as it is the force of gravity! It is gravity which puts card number 5172 next to 5003, if no intervening numbers turn up.

So with the post office problem. We serve the people of the United States the way they are. This means duplicate names, sparse addresses, numerous address forms, long distances between correspondents, and last but not least, the realization that something that is good or useful or even profitable is not necessarily adopted out of hand by the general public. Witness the zip code. We must take tons of letters out of thousands of boxes, and arrange them in a practical way so that a carrier can deliver them efficiently and with the use of a minimum of extraneous gear. Our goal is to perform this kind of service on a one-day basis.

The other place where theory bruises its shins is in the industrial environment of the post office, in the preponderance of the gritty in the nitty-gritty. Why don't people address letters in perfect Roman capitals, 10 to the inch and 100 mils high, exactly centered on a standard envelope of size number 1 or size number 2? They don't because they won't, and they won't because we are Americans, warts and all, and if it costs a little more to be independent, we think it is money well spent. Someday we may come around to the idea that each little bit of cooperation helps a poor world to survive, but in the meantime the post office faces some of the facts of life. Optical character recognition has been touted, toasted and acclaimed as an end to our need for clerks, for over two decades. In some places it works, in others it even shows a profit. But a post office ocr must look at letters which, when addressed by printing, involve some 200 fonts, of which about a third occur with some frequency. Mixed in with these letters are others addressed in script, which use up machine time but produce no useful output. Envelopes themselves are of all thicknesses, textures, and tints, not all of which lend themselves to accurate handling or reading. We do have readers, and we get enough usable output from them so that our program to extend their use and improve their capabilities goes on. But it is worthwhile to bear in mind this closing thought, that what has been described above and what the other papers will describe is automation in the presence of noise. □

types. The sorting bins on this equipment will discharge mail automatically, according to a preprogrammed, variable sequence. This feature should reduce both the time and manpower now needed at the main post office to prepare truckloads of sorted mail for delivery to outlying postal stations.

Before first-class mail leaves the main post office, it will be sorted, by street and address, into the sequence followed by the carrier as he makes his rounds. Here again, the bar code on each envelope will control the operation. Burroughs is scheduled to deliver a prototype "carrier sequencer" to the Cincinnati post office this month.

A major aim of the whole LMCSS program is to reduce the amount of letter mail that has to be coded by clerks at the beginning of the process. One approach is to use an ocr reader connected to a bar-code printer. Next April, the first of these should go into operation in Cincinnati. It will be a Recognition Equipment scanner capable of reading "more than five machine-printed fonts," says a Postal Service spokesman. The machine will process about 40,000 letters/hour. A coding clerk averages 1,500/hour.

Another way of reducing the code clerk's workload would be to put the code on each envelope when it's addressed. When this mail reached the post office, it would be fed to a bar-code reader, instead of a clerk, and from the reader letters would be fed directly into a sorting machine.

The Postal Service hopes to sell "precoding" to volume mailers. The addressing equipment they're now using will have to be modified, but hopefully, by processing precoded letters in less time, postal officials will be able to persuade volume mailers to make the investment. A study has been launched to find out what equipment modifications are needed and what they will cost.

A preliminary step toward precoding has already been taken by 22 department stores, utilities, and other firms in the Cincinnati area. The bills they send to their customers each month are now accompanied by reply envelopes, which have the company's name and address bar-coded in the lower right hand corner. The code is put on by the envelope supplier while he's doing the rest of the printing job. According to the Postal Service, the code is added for little or no extra cost. Officials expect volume mailers throughout the nation to begin using bar-coded reply envelopes within the next year.

Meanwhile, the Postal Service has invited manufacturers to design a specialized reader to process precoded mail. Officially, it's known as a Pre-coded Originating Mail Processor —POMP for short.

—Phil Hirsch

Mr. Hanes is director, in the office of program director, preferential mail processing department, mail processing, U.S. Postal Service. He has been with the post office since 1967, previously as program director, letter mail processing, and before that as chief of the industrial engineering staff. He has a BS from Gonzaga Univ. and is a registered professional engineer.

Accurate sorting of mail by computer techniques depends on coding that provides redundancy and procedures for error recovery

Computer Addressed Letter Mail

by Arnold I. Dumey

The information necessary to sort a letter from the time it is first mailed until it reaches the letter carrier is divided into the following parts:

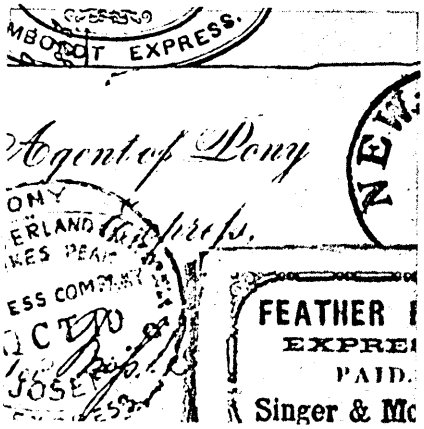
1. City and state. In Computer Addressed Letter Mail (or CALM) the zip code is substituted for these, and is assumed to be known accurately, in all its five digits, for the addressee.
2. Street name.
3. House number.
4. Secondary information relating to the first two items, of three kinds:

a. Compass direction. Most cities are either divided into quadrants or octants, or have compass direction prefixes or suffixes on street names, or use some combination of these.

b. Street type. The name of the street is usually, but not always, followed by a descriptive word such as Avenue, Lane, Highway, Street, Circle, etc.

c. Sort code. This describes the address generally as being in some category, e.g., rural route, post office box, building, named street, numbered street, etc.

In the case of business reply envelopes, furnished by the sender of the previous letter, binary bar codes for the above information would be printed on the lower part of the front



of the envelope, at the time the envelope is made. When a code is put on a letter in the post office, the same space will be used. It turns out that there is plenty of room for codes with very favorable optical reading characteristics—as well as desirable error detection or correction characteristics—in that space.

With respect to addresses produced by a computer printer, there is much less room for coding. This is because a good deal of mail is addressed using labels which are printed five at a time across the paper in the printer. Other kinds of mail are subject to other constraints. A survey seemed to indicate that an address field of 23 characters per line would cover the market adequately, i.e., the vast majority of firms addressing mail by computer allow at least that many characters per line of address. Other work indicated that a character set having eight elements, in other words an octal code, would be feasible for the coded line (the bottom line of the address). This meant that each character on the line was 3 bits of binary code, and that a full line of 23 characters would exhibit 69 bits of binary code. We allot these 69 bits as follows: zip code, 17 bits; street name, 20 bits; house number, 16 bits; compass direction, street type, sort code, 5, 4 and 3 bits respectively. Each of the

four fields has a single parity bit. This is the CALM code line.

The redundancy of each field is due to the fact that there are more codes available than are actually needed. This leaves a number of forbidden combinations, or invalid codes. The number of available codes in each field is equal to 2 to the power of the number of bits in the field, e.g., a 5-bit field can produce 2^5 or 32 codes. While redundancy reduces efficiency, or terseness, of communication, it has the virtue that it affords a means of signalling an error when a garble changes the appearance of the message.

Error recovery requires redundancy, but is not rendered necessarily easier to perform in proportion to the amount of redundancy in the code. Let us illustrate this by an example. Suppose we had designed a code set which used a field of 20 bits. Suppose there were 20 code values, i.e., 2^0, 2^1, 2^2, . . . 2^{19}, or in other words, code values with a one in one place and zeros everywhere else. Thus, only 38 out of over a million possible code values are used, and the code is tremendously redundant. Suppose further, that only single-bit errors can occur. It is plain that in this code there is no unique recovery where any of the 20 codes consisting of just one 1, and zeros elsewhere, is changed by a one-bit error. Many other such examples could be constructed.

Finding the errors

We rely on redundancy to point out errors, and contextual analysis to correct garbled text. Sometimes we can use redundancy to pick out which of several subfields is garbled, which leaves us free to use the information in the ungarbled subfields.

Redundancy and error recovery capability varies from field to field, so that each must be discussed separately. We will proceed from the least to the most promising.

Value	Code	Good	Bad
0	0000	4	0
1	0001	4	0
2	0010	3	1
3	0011	3	1
4	0100	3	1
5	0101	3	1
6	0110	3	1
7	0111	3	1
8	1000	2	2
9	1001	2	2
Total		30	10

Table I

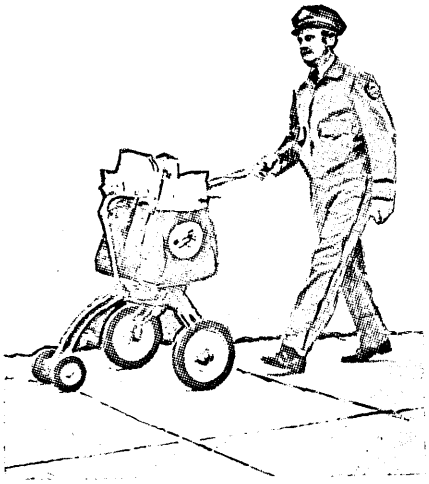
1. *Zip code fields.* The approximately 35,000 zip codes are dispersed in clusters among the numbers 00001 to 99999, using a little over one-third of the possible codes. The 17 bits allotted to this field can represent, in binary form, all numbers up to 131,071 (decimal). At first impression, the odds are almost two to one that a mistake in a decimal zip code would lead to an inadmissible value. Similarly, one would suppose that the odds on an error leading to an inadmissible code are about three to one, should the 17-bit scheme above referred to be used.

However, the actual odds are as much influenced by the kind of coding alphabet as by the redundancy given by the number of possible code values. The following pair of examples will illustrate this argument.

a. Table I shows the effect of a single-bit error upon each digit coded as a standard binary coded decimal (BCD) digit.

(N.B. Throughout this paper, we assume that almost all errors within a field are single-bit errors.)

The column labeled "Good" shows the number of cases where a change in a single bit results in a valid code, i.e., one of the 10 items in the column labeled "Code," while the column labeled "Bad" shows the contrary. Thus, the code for 4 is 0100. If we change a bit in each position to its complement, we get 0101, 0110, 0000, and 1100 as



we proceed from right to left. The first three codes are valid, having the values 5, 6, and 0 respectively. The last is not, giving us three good codes and one bad one.

A code which was once well known in computer practice is the excess-3 code. In this form of binary coded decimal, each digit is represented by a 4-bit binary number whose binary value is 3 greater than that of the digit. Table II is like the previous table except that it is constructed for the excess-3 code.

Single-bit errors give us 24 good against 16 bad codes, which is much better than in ordinary binary coded decimal, keeping in mind that we *want* an error to produce an improper code, so that we know that we are in trouble. There may be other codes which are even better for this purpose, and there is indeed a vast array of possible codes. Because of the present state of the computer art, however, it is likely that where binary coded decimal is used it will be the code shown in Table I.

The chance that a single-bit error will be discovered without resort to parity is the sum of two independent probabilities. The first is the chance that a valid digit's code has become invalid. There are 10 ways, according to Table I, out of 40 in which this can happen, or one chance in four, for a probability of .25. If a valid code is garbled into another "legal" code, which can happen 30 ways out of 40, for a probability of .75, then two-thirds of the time the zip code created by the garble is not in the directory. The product of the last pair of events, i.e., ¾ times ⅔ is ½ or .50. The sum of the two probabilities, .25 plus .50, is .75. Therefore, there is .75 probability that an error in a binary coded decimal zip code is detectable without a parity check. It must be borne in mind that it takes 20 bits to achieve this error detection capability. Furthermore, since we want to avoid the effects of a garble which produces a valid zip code, which occurs in 25% of the cases, we still need a parity check.

BCD recovery

Is there any opportunity for garble recovery in BCD coding? Yes. Suppose, by the failure of the parity check, we know there is an error. We can change each of the five digits into its other "good" forms, one change at a time being tried out. If only one of the changes yields a valid zip code, that must have been the original form, provided the received number was not a valid zip code. Easier is the case where one of the five digits is "bad." In that case, we need try only the two or three "good" forms which could have resulted in that "bad" digit and see whether only one good zip code results. For example, suppose the received digit is 1011. Only a change in the first (leftmost) or third bit can produce a valid digit, namely 3 or 9, respectively.

Value	Code	Good	Bad
0	0011	2	2
1	0100	3	1
2	0101	2	2
3	0110	2	2
4	0111	3	1
5	1000	3	1
6	1001	2	2
7	1010	2	2
8	1011	3	1
9	1100	2	2
Total		24	16

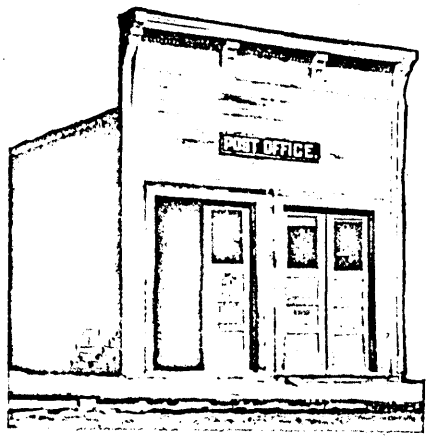
Table II

It is possible to estimate the actual redundancy and contextual analysis capability of a BCD-coded zip code directory by computer means. It may turn out that the computer cost may be reduced by performing the work upon a sample from the total data base.

The effect of a one-bit error on a 17-

bit binary code is roughly the same, as far as producing invalid zip codes is concerned, namely, the a priori probability of producing a bad code is about .75.

Garble recovery techniques, however, are quite different. There are 18 ways in which to correct a binary zip code which fails to check out on parity, i.e., try the complement of each bit in turn. The condition that the garble is correctable is that only one of the 18 results is a valid zip code. At random, this would occur in about 6% of all cases. We cannot use this percentage with confidence because of the way the zip code is constructed.[1] A computer program to establish the proper per-



centage by sampling, or even to enumerate all good cases, is not difficult to set up. We must also consider the effect of mail density, since it is more important to recover addresses for a locality which receives a lot of mail.

An additional benefit which accrues to garble recovery occurs when there is more than one possible recovery, but the routing for all cases is the same. Thus, Washington and Oregon zip codes can safely be confounded, if all mail from certain post offices to the West Coast goes into the same bag. Similar reasoning applies to incoming mail.

In conclusion, 18-bit binary code offers about the same redundancy as 21-bit BCD, each having a parity check, but BCD, at first impression, may be superior from the point of view of contextual analysis. The probability of error is almost certainly less for a shorter code, since there are fewer opportunities to misread.

In the case of garble recovery, it is well to bear in mind that searching a computer memory is neither instantaneous nor gratis. The system designer must find out whether it pays to try recovery, or just to consign all mysteries to the reject bin. If one opts for contextual analysis, there are some promising shortcuts. At the time the system is set up, every one of the 131,072 nonchecking 18-bit codes is tested for validity under the criteria of unique recovery (or its equivalent in routing capability, vide the Washington-Oregon case above). Only those which pass this test go into a garble recovery list, with suitable directory in core. Another well known form of table would consist of 8,192 Sigma 3[2] words of 16 bits each, giving a total of 131,072 bits. It is plain that every value from 0 through 131,071 can be mapped one-to-one into this table. Codes passing the test are represented by a 1 in the table, which has 0 everywhere else. Since location of the bit corresponding to a code is fast, that bit is first examined. Should it be 0, the letter is rejected. If there is a 1, the corrected value is found in a table.

Since volume of mail to a given place varies from post office to post office, the decision to implement code recovery of zip codes is made separately for each sorting facility. The same kind of local decision making will be discovered to be worthwhile for other fields also.

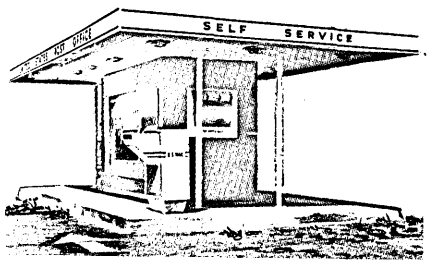
2. *Designator field.* There is a small amount of redundancy in each subfield of this field. Although in one case there are as many categories to be coded as there are codes available, practical considerations make it possible to avoid coding some of these categories, or to group certain categories together.

a. Address type: Since we cannot expect CALM to provide those sort groups that depend on having knowledge of conditions at the destination, such as "directs," we have five cases which have been discussed in connection with the Cincinnati configuration, namely P.O. box, rural routes, buildings, named streets, and numbered streets. In this field, as in all fields, it is desirable to reserve a "blank" category to cover cases of failure of information. Therefore, we enjoy the redundancy afforded by two illegal codes. Although there are other descriptions which might turn up to fit in this field, on the other hand, by taking fuller advantage of other characteristics of the structure of the total code, we may even be able to increase redundancy. For example, it may be possible to combine P.O. box, rural route, and other special cases into one code and use the additional redundancy made available in the street number and street name fields, little of which would be needed for box number, route number, etc. Similar "escape" or extension methods are used in the computer art and in communications.

b. Street name types: There are more than 15 names which describe streets. Street, avenue, road, drive, and place account for over 85% of the cases in the 21 cities which have been studied in detail. The next five names bring the number of streets accounted for to almost 98% of those in the data base. It would not be difficult to check out, by computer means, what the omission of the rarer names would cause in the way of ambiguity, and how recovery could be aided by restricting the number of items in the table for this field.

c. Compass direction code: There are 25 combinations, including blanks, of prefix and suffix direction code. Since five bits are allotted for this subcategory, there are seven unused codes to make this field somewhat redundant. Code recovery is accomplished by using the technique described in the next paragraph, which applies to the whole set of designators.

When there is a failure of parity in the designator field, we examine the subfields to see whether there is an inadmissible code in one of them. If we find one, we have accomplished two things. First of all, both other subfields are valid under the assumption that all errors are one-bit errors. Secondly, we can look at the name of the street to help recover the type of name, for example. Thus, if the code as received was 1110, and the name of the street was either Smith Street or Smith Road,



then if the code for street was 1000 while that for road was 1010, the corrected code must be 1010 since there is only a single bit difference between the garbled and true codes. Similar reasoning can be applied not only to the other types of designators, but to the resolution of more esoteric errors, as the reader can verify for his own amusement.

The economic justification for implementing these capabilities requires computer analysis of the file, as in other cases treated in this paper.

Before leaving this area of discussion, it is well to point out that the nature of the file, and the need to find

1. For example, the West Coast codes, which are in the high range, may be more likely to go over 99999 in case of garbles. Only 1's are changed in recovery.

2. This is the computer used by the code sorting system in Cincinnati.

a solid match, in the directory, for an input code, make possible the recovery of two-bit errors which the parity check would not catch, *provided it pays.*

d. Street number: There is great redundancy, in general, in the street number field. This is because the code makes provision for the large street numbers which occur in only a few places while for most streets the highest address is well under 1000. Furthermore, addresses are not even locally dense, since house numbers may be 10 apart, only one side of a street may be used, and there can be large hiatuses between numbers at the street break. The result of these characteristics is to afford recoverability when there is an error in the leftmost bits, or where the error leads to a number inadmissible within a street's range of numbers.

e. Street name: This field is large enough to accommodate numbered streets by direct encoding into binary, perhaps with extra safeguards against garbling, or other refinements. In the discussion of named streets, it is assumed that a method of selection with compression will be used.

In this scheme, a pair of positions in the original (literal) street name field is combined to produce a single five-bit number between 0 and 31. The rule tries to make each number equiprobable. Four such pairs of positions are chosen to give a 20-bit result.

Selection with compression is a nonredundant code. Every 20-bit binary number is legal on its face. This nonredundancy is a feature of construction, not content. A binary zip code field would be of the same character, were numbers as high as 131,071 permitted in the directory.

On the other hand, from the point of view of actual working codes, the ratio of codes that are actually used is so small as to make the redundancy of this field tremendous. One way of looking at this is by thinking of the code field as a combination of zip code and street name, which gives us over 13 billion possibilities, of which the actual codes used are but a minute fraction. More specifically, particularly from the point of view of generating code values at least expense, we observe that street name is a field *within* zip code as major. Even within the dense colonial layout of Boston streets, something less than one tenth of one percent of possible street codes are used within any zone,

The street name encoding scheme which is proposed herein is just one of many feasible forms of "hash" code (see "Indexing for Random Access Memories," Computers and Automation, December 1956). In fact, other randomizing techniques described in that and later papers may well be preferable. The point is that we want to pick relatively few points out of a space of a million points, with the idea, first, of reducing duplications in our choices, and, secondly, getting good enough (Hamming) separation to be able to recover from single-bit errors. Computer experiments with the data base again may well be the way to see how hard it is to achieve these objectives.

If we had a very good randomizing scheme, we could well expect no duplication at all. Most of this is due to the partitioning effect of the five-digit zip code. Moreover, the separation given

by street name type must not be disregarded. For example, if Alpha (Street) and Beta (Road) by chance led to deriving the same street name code, the directory would have a second criterion by which to resolve the duplication. Nevertheless, it might be well to calculate in a rough way what can be expected in the rather unlikely case of 2000 street names within a zone.

The probability of duplication at random is 2^{-20}, or about a million-to-one odds, for any pair of codes which are generated. The number of comparisons between all pairs of codes for the 2,000 names is 2 million. The expectation of duplications is therefore 2, and if we had many such cases of 2,000 names, we might look at a table of the Poisson function to see the range and frequency of duplications. Belaboring this point is not a particularly fruitful exercise, once we see in a broad sense that the approach offers some profit. The proper next step is to see whether the data yield results as favorable as the theory.

As for contextual analysis, street name code is 21 bits long and therefore can take 21 forms through an error in one bit. Incorrectness is always evidenced by failure of parity, under our assumption. By changing each bit in turn, we generate 21 "legal" codes. One of these is the correct code. However, one of the 20 other "legal" forms may be the same as some other code in the directory. What has happened here is that the garbled version of two different codes is the same code. Let us illustrate this by an example in a short (five-bit) code.

Let 00010 and 00100 be valid codes. 00010 can be read by mistake as 00110. 00100 can also be read by mistake as 00110. Therefore, when we read 00110, and produce its five forms, i.e., 10110, 01110, 00010, 00100, and 00111, we find we have two answers among the corrections, not one as we would want. It would almost seem that our 2,000 correct codes have generated 42,000 codes, based on a one-bit error, and that the expected number of duplications must go up to an unacceptable figure. This is not the case. Two correct codes can yield the same garbled version if and only if they differ in exactly two positions. If they do differ in this way, there are exactly two garbled versions of either which will find a match in a garbled version of the other. Because of parity, two valid codes can never differ in just one position.

By the binomial theorem, the most probable number of positions, in which two random numbers of 21 positions each will match, is 10 or 11. There are 210 ways in which two such numbers can match in all but two places, out of the 2,097,152 ways in which they can exhibit match and mismatch element by element. So between any two numbers, the probability is 1 in 10,000 that they will fail to match in exactly two places. However, we are making 2 million pairwise comparisons among 2,000 code words. Therefore, we expect about 200 to fall into this close match category, which augurs well for code recovery. The computer program to establish possible pairs and other details of this approach is not difficult, and should be implemented.

These features are now being checked for possible use by the U.S. Postal Service. □

Mr. Dumey has been an independent consultant in data handling since 1954, based in Princeton, N.J. His association with computing began in 1946, while he was an employee of the Department of Defense. He is a member of ACM, a senior member of IEEE, and holds two degrees from Columbia Univ.

This inspired technical analysis of the mailbox first appeared in Datamation's September/October, 1960, issue. We're reprinting it now as a tribute to the new Postal Service, in hopes that their new equipment will prove as satisfactory in operation as this unit.

Postal System Input Buffer Device

by ROBERTSON OSBORNE

ALTHOUGH NO PUBLIC ANNOUNCEMENT of the fact has been made, it is known that the United States Post Office Department for some time has been installing Postal System Input Buffer Devices as temporary information storage units on pseudo-randomly selected street corners. Several models are in use; some older ones are still to be found painted a color which may be described as yellow-greenish in hue, low saturation, and low in brilliance, but a significantly large proportion are now appearing in a red, white, and blue combination which seems to provide greater user satisfaction although the associational-algebra value-functions remain obscure. Access to the majority of these devices is from the sidewalk, although a recent modification (including a 180-degree rotation about a vertical centerline) makes some of them accessible from an automobile provided that the vehicle is equipped with either (a) a passenger in normal working condition, mounted upright on the front seat, or (b) a driver having at least one arm on the right-hand side which is six feet long and double-jointed at the wrist and elbow. Figure 1 shows a typical sidewalk-access model Postal System Input Buffer Device.

OPERATION

Most normal adults without previous experience can be readily trained to operate the machine. Children and extremely short adults may find it necessary to obtain assistance from a passerby[1] in order to complete steps 4 (Feed Cycle) and 6 (Verification), or both. The machine is normally operated as described below.

1. Position of Operator. Locate the Control Console (see figure 1). Stand in front of the machine so that the control console is facing you.[2]

2. Initial Setup. Grasp the Multi-Function Control Lever (figure 1). This lever performs several functions, each being uniquely determined by that portion of the Operation Cycle during which it is activated. The lever may be grasped with either hand. With the other hand, position the input in preparation for step 4 (Feed Cycle).

3. Start Operation. Pull the Multi-Function Control Lever toward you until it is fully extended. It will travel in a downward arc, as it is attached to a mechanical But-gate hinged at the bottom. (The But-gate, so named because it allows but one operation at a time, is specially designed to make feedback extremely difficult.) Pulling the Multi-Function Control Lever at this time accomplishes an Input Buffer Reset and Drop-Chute Clear. These actions are of interest only to the technician, but are mentioned here in preparation for the following note.

NOTE: The lever should move freely. If it does not, the memory is full and cannot accept further information until it has been unloaded. The operator may elect to (a) wait for a Postal System Field Engineer (a "mailman") or (b) find another Postal System Input Buffer Device. If choice (b) is elected, refer to Description, above; also see figure 1.

WARNING: **Under no circumstances should the operator attempt to clear the unit;** loss of a ring or wristwatch may result. In extreme cases, some individuals have lost 30 years.

4. Feed Cycle. Visually check to see that the input area is clear. The input area may be recognized because it is totally dark and makes a 90-degree downward turn; obstructions are hence not visible under normal circumstances. While holding the Multi-Function Control Lever in the extended position, start the input feed by manually inserting the information package.[3]

NOTE: One particularly advantageous feature of the Postal Service Input Buffer Device is that, at this stage, the address field may be mixed alphanumeric (including special characters) and may be presented to the unit in normal format (reading left-to-right and top-to-bottom), backward, or even upside down.

5. Transfer Cycle. Release the Multi-Function Control Lever. The machine will now automatically transfer the input to the delay-box memory (delay-bag in some models). The operator will soon become familiar with the typical "Squeak" and "Clank" signals, provided on all models to indicate satisfactory operation of the But-gate. Actual transfer of the information, however, is not signalled unless the information is very densely packed, in which case a "Thump" signal may occasionally be heard.

NOTE: A "Boing" signal indicates that the information is unsuited to the Input Buffer Device and that a programming error has therefore occurred.

6. Verification. Pull the Multi-Function Control Lever again (see step 3), check to see that the Input Zone (figure 1) is clear (see step 4), and release the lever. This completes one full Operation Cycle. Additional cycles, when necessitated by large input quantities, may be initiated by returning to step 1 (above).

NOTE: Step 6 is not actually necessary for machine operation. The Postal Service Input Buffer Device has been designed to permit this step, however, to satisfy the requirements of the overwhelming "Post-Mailing Peek Compulsion" which affects most users of the unit and which has been linked by some writers[4] to the "Unsatisfied Sex-Curiosity" Syndrome.

1. In this context, "passerby" may be defined as a member of the set of human beings having a maximized probability of occupying the event space.
2. The Novice Operator Trainee may prefer to face the console.
3. Perhaps better known to some readers as a "letter" or "postcard."
4. Op. cit.

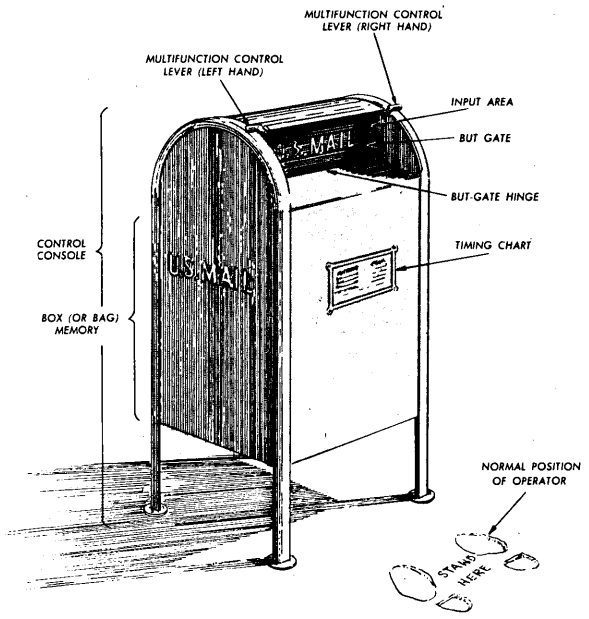
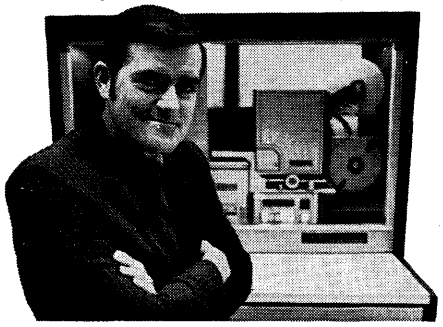


Figure 1.

"COMPUTER PRINTOUT WAS COSTING US A FORTUNE."

(G. E. Richards, Manager, Data Center, The Goodyear Tire & Rubber Company)



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CIRCLE 79 ON READER CARD

It's fun in the right group . . . a small group. Time is the problem, the sales rep is the friend, the establishment is the enemy . . .

The Quality of Life

by Milt Stone, Contributing Editor

"Consider the difference . . . The computer in its air-conditioned, dust-free, sanctum sanctorum . . . Next door, the programmer, in ghetto-like squalor, with printouts on the coatrack and cards on the floor . . ." ROBERT PROPST[1]

Garry Huggins is not a programmer but his desk, chair and feet are in constant contact with asphalt tile. The walls of his office stretch only half way to the ceiling but the carpeting beneath his System 3 covers the entire computer room. And he's having a ball (at E. B. Wiggins, Inc., in Los Angeles).

He was trained for this business. College work in business and accounting. Credit job with a steel distribution outfit. Branch manager for a wholesale liquor dealer. And then the big change. When the liquor dealer was faced with a conversion from a 1401 to a 1440, the installation manager knew how to program—so he became the programmer; Garry was a proven office manager—so he became the installation manager.

"But I knew I could be snowed," Garry says, "so I learned programming and I found that I had an aptitude for it." He got his kicks then, and still gets them, from "outguessing the machine."

Eventually he left to work, for less money, for a large insurance company —with a big stable of computers from large to small. "I had my own little corner, mortgage loan accounting and forecasting policy revenue. Systems work and programming. I got a lot of education but it was no fun."

Finally, the chance to run his own show, again. He now works for a $15 million, engineering-oriented, family-owned business—IBM, having found him, blessed him—the family wants them to approve—and he's built his operation from a monthly hardware bill of $2K to $6.5K in just two years. At the same time, he's cut his staff from six operators to one and from two programmers to one. "We had a three-shift operation producing nothing—now we have a one-shift operation and we'd be out of business without it."

What next? "Well, I'm happy here and there's a lot to be done. But ultimately I'd like to work for the top guy somewhere and have all administrative services reporting to me."

Garry Huggins' story is a good case in point. For a very large number of computer people: getting involved in the business was an accident; "outguessing the machine" is the fun part of the game; and being in a small, closely knit group with plenty of access to the computer makes all of the difference between a good work situation and a bad one.

In Garry's case, being with a small installation, and a small company, means "having contact with all facets of the company"—something that just didn't happen at the big insurance company. And for the honcho in a small installation the job is a different one. Superhoncho is primarily an evaluator of the people under him who give him technical advice—only secondarily an evaluator of the advice. The small installation honcho is a working foreman; *he* is the top techni-

> . . . a good number of people in the computer business are where they are because IBM put them there.

1. President, Herman Miller Research Corp.

cian—Huggins still programs and likes it—and his is the most important voice in a technical decision (after the vendor's, of course). Speaking of the vendor: a good number of people in the computer business are where they are because IBM put them there.

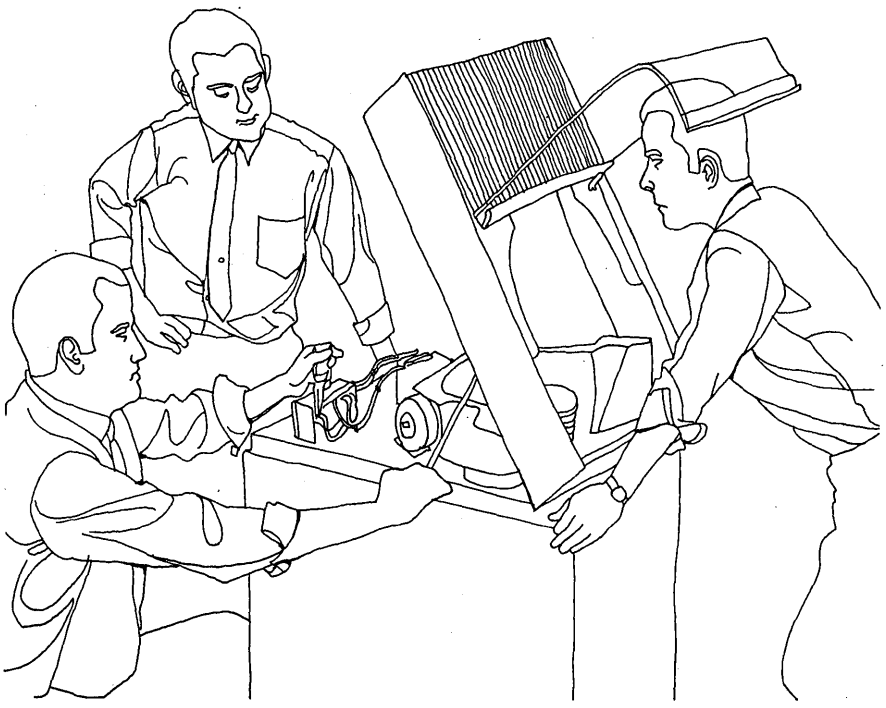
When the time comes for Huggins to move on (and this is understood to be inevitable by his employer), "IBM will help me," he says. "That sales rep can really do the manager some good." On that note he left for lunch—with the rep.

St. Louis, McDonnell Douglas Automation Co. and Ted Bellan are miles and light years away from Los Angeles, Wiggins and Huggins—and Bellan, vp-computer services, is the superhoncho exception who proves the rule. (He, the boss, may be the top technician—in a big shop.) He has two degrees in engineering, came up the ladder on the scientific programming side, has been heavily involved with the operation of hardware from the CPC in 1952 to the 360/195 in 1972—the lifetime of IBM computing. He calls his staff of 1,000 computer types the "engineering and manufacturing" segment of the automation company.

Bellan knows his business and therefore can be direct with the people who work with him—vital to morale, anywhere. He demands respect as a guy who knows so much about this discipline that his leadership is contagious. He talks about a familiar scene—repeated at other companies, too—the IBM man, the telephone man, and the independent peripheral man listening to Bellan say, "Nobody's going to leave this goddam office until you guys agree that everything's OK." You get the feeling that in this case—in the presence of this savvy guy—they felt sheepish and uneasy, especially if they were trying to get out of a responsibility.

Bellan says, "A company thinks highly of manufacturing, marketing, finance, because they produce profits. But data processing doesn't. It's considered a necessary expense and treated as such in many cases."

Although Ted Bellan was never unhappy with his lot, his outlook is a lot brighter now that he can combine computing with profit making. As J. Don Reisser, a Los Angeles headhunter, says: "Like it or not computer people are staff people. One of the comforts of staff people is that they don't have to put themselves on the line (for achieving results). One of the hazards of a staff job, however, is that that's where the cuts are made when times are bad. I tell my young son, 'Get a line job. You learn more. You earn more. You have more fun.' " Ted Bellan is having more fun in McDonnell Douglas Automation than he had as staff to the bird builders.



In New Orleans, at the Hibernia National Bank, David Burns is a 24-year-old computer operator who comes on like a banker—conservative dark suit, white shirt, neatly-trimmed hair with short sideburns. Four years ago he was working his way up the ladder in the Winn-Dixie Stores chain, taking junior college courses in business administration at night. A friend who worked for the bank suggested that he apply for a computer room job. In seven months he graduated from the "menial tasks" to an operator's job. He's now a day-shift operator. In the four years he's doubled his base salary. (The Hibernia is an NCR shop.)

He likes his job, thinks it's a good job, and not really too difficult, though there's a lot to learn. He says his father is proud of his son's job as a computer operator—"the coming thing"—and Burns is proud of it himself.

As for advancement, Burns is uncertain whether he should become a programmer or a supervisor of operators. He seems to lean toward the former, and is a bit regretful that he turned down an opportunity to take the programming aptitude test the last time the bank administered it a year and a half ago. He'll take it next time.

Before he rises higher, he needs a deeper knowledge of the computer and software. He'd like to understand more about programming in order to understand his work better. He now knows how to run nearly all jobs, though. He doesn't feel courses are a help—he says he learned far more from on-the-job-training than he would have from books.

"Jack Younger" works as an "information systems designer" for a large company headquartered in a small city in the boondocks. You'll meet his duplicate frequently, and this is how life looks to him:

How do you spend your time? "Maintaining current software packages. We are not developing any new packages until we get the ones we've been working on running. For example, we have an inventory program that has been in development for six years and still doesn't run very well,

The Quality of Life

and a payroll program that isn't running the way it ought to after five years. Management froze the programming section and said that no new packages would be started until these were running. Everyone is in limbo, and the morale is low, but people can't job-shop now—there just aren't any jobs to be found."

What went wrong? "I don't know. When I came here several years ago, the inventory package was out of control even then. It hadn't been planned right from the beginning, but something had to be up and running. We started patching it. I thought we should have thrown the thing out and started over from scratch, but the company figures any program is better than none at all."

How good are your managers? "I've had one good manager here—out of six. He was interested in what he was doing, but he was interested in what I was doing, too. He would get the job done even if it meant sticking his neck out. The typical manager is just concerned with keeping his position. This guy was a real-time problem solver. I could walk into his office and give him a problem, and he would jump on the phone and solve it *right then.* But he was wasted on this company, and he moved on."

What's fun or worthwhile in your job? "Nothing's fun here. It's all bad." What looks like success to you? "My own software company, and I'm starting to work toward that. Nothing big—just developing general packages."

One theme running through all these interviews is clear: programming is at the heart of computermanship. Computerman must be aware of what good programming is if he is to get the technical part of his job done. If time spent in the job of programming—no matter how short the time is—is one of the necessary steps for Computerman, then a knowledge of the attributes associated with the occupation of programming is useful. It's especially illuminating when used as a frame of reference for examining—as we will shortly—what the grunts and honchos say are their plans for the future and what they say are the obstacles in their way.

> "I've had one good manager here—out of six . . ."

Based on his continuing research into the matter, Dr. Edward M. Cross, Old Dominion University, sees the programmer as "a loner, an individual who wants to avoid confrontation, avoid being directed, is willing to do without much social interaction on his job, does not have an interest in social service—has no apparent desire to enter into the aggressive, competitive, confrontation-laden situation that is associated with line managerships. He is a 'staff' man—but a staff man working very much in isolation."

Cross elaborates on this mini-portrait. No surprise: programmers tend to stick to a job even when not particularly interested in it. No surprise: they use step-by-step methods for processing information (as opposed to intuitive, impressionistic approaches). No surprise: they are not motivated by Theory X management or by rewards—accomplishment, getting the job done, is the spur. (Marion Bell, Programmatics, Inc., Los Angeles, on writing assemblers for minicomputers: "It's really neat when you deliver it and the customer starts to run it. It's fun when the pieces all come together and they fit. One thing—they only take

The Order of Battle

. . . in the trenches

In its battle to stay alive in a sometimes unfriendly environment, the data processing activity depends on the efforts of a familiar troika—marketing, engineering, manufacturing. Marketing does the product planning and sells its efforts. Technicians call this systems design. Engineering draws up the plans—programming. And manufacturing—operations—delivers the goods.

THE ANALYST LEADS

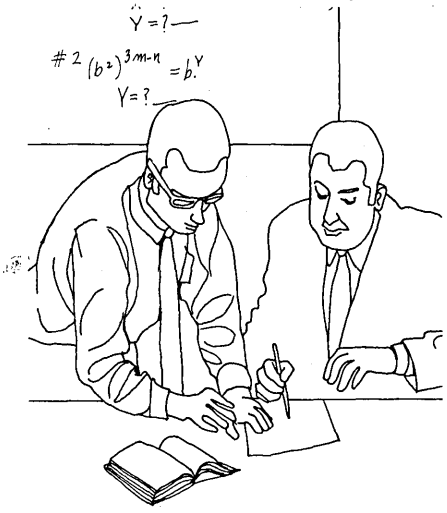
Grunts who design systems are called *analysts, designers, procedures people,* and *programmer/analysts* (if they do a cradle-to-grave job which includes writing the computer programs specified in their system design).

Given a project—for example, satisfying the requirement to handle customer orders from receipt of order through shipment of merchandise to final dispatch of an invoice to the customer—the systems analyst is expected to specify the flow of information that will do the job. His design must be workable, efficient, effective and politically acceptable. He is expected to work with the ultimate users of the system—the customers—and to incorporate their ideas and/or firm demands into his design. If he is creative and courageous, he proposes and presses for the acceptance of his own idea of the best way to get the job done. Thus, he must be both a good listener and an accomplished salesman.

ENTER THE PROGRAMMER

Applications programmers transform the individual computer programs visualized by the systems analyst into reality. The odds are good that a "lead" or "senior" programmer will second guess the analyst by restating some of the program functions specified—or by recombining the programs specified and resegmenting the whole into a different statement of individual programs. Why? Because it will be "better for the customer" or "more efficient" or because programmers are creative, too.

A "junior" programmer will probably be limited in his work assignments to writing code from flow charts produced by a "master"—probably for only a small segment of the total job—or he may be relegated to maintenance (the never-ending task of correcting errors and making minor changes in existing programs). In any event, the programmer is expected to see the program through its final checkout with both test data and live data, and he is expected to



prepare adequate instructions for the operations staff. He, too, ideally is both a good listener and articulate.

The *programmer/analyst* does the whole job from talking to the customers to writing the operating instructions for the individual programs. His scope ranges from consideration of the grand concept at a user level to the detection of an obscure bug in a program. Often, the programmer/analyst claims that he has less need for communication skill because he can conveniently carry the details of the whole system in his head. Listen to whom? Talk to whom?

In general, analysts and programmers choose between two polarized environments and work in only one of them—with scientists and engineers or with accountants, production people and marketeers. The choice has something to do with the computer skills required. But it is much more likely to be based on educational background and the ability to cope with the special vocabulary of the environment.

In general, too, applications programmers today do not communicate directly with the computer. They live within a set of rules for programming which permits them to communicate with an operating system (or a data management system under the control of the operating system), which in turn communicates with the computer. More and more applications programming has become confined to setting up files and manipulating transaction data according to the stylized rules of a programming language—and talking to an operating system with the help of another code book.

What's different? For a starter, even minicomputers today have more capability than many of the earlier computers. The ability to squeeze the most out of very limited resources (by taking advantage of an intimate knowledge of the machine) is not very important any more. In addition, the jobs of automating the scheduling of the computer,

three or four months to write and that's good. Other projects go on and on and you never see anything happen.")

No surprise: they may work irregular hours—frequently by choice. Surprise: they have a preference for stability and security as opposed to work which is irregular, challenging, dangerous, or otherwise exciting. Big surprise: programmers have very little desire to help other people as part of their jobs. Cross says that the data processing job is somehow devoid of far-reaching social impact (some would disagree).

Almost all of the grunts who contributed their thoughts to this series are, were, or hope to be involved (at some career stage) with programming. Five out of six see edp as their best and preferred career field, now and in the future. And almost every one who wants to stay in the field *sees himself as some sort of manager in the future.* There are exceptions.

> . . . almost every one who wants to stay in the field sees himself as some sort of manager in the future.

"I don't want to be a manager because management is selling" (systems analyst). "I have managed two multiple-man projects and learned that I am not tough enough to want to do that again. I enjoy managing and being responsible to myself." (Marion Bell)

But the itch to be the leader is far more typical—even on the female side of the house. "Alma Bond" (SE-type

IBM-er under wraps) would like to try management, specifically a supervisory job with eight to ten people under her. "I'm not sure I can handle it but if I find I can, I want to go as high as I can go—definitely within IBM." If she finds that she can't hack it as a manager, "I want to become a consultant systems engineer. There's not as much prestige . . . but there's lots of opportunity for fun, lots of challenge and I like to be with customers." And at National Life Insurance Co., Montpelier, Vt., Marcel J. Marineau, a senior analyst/programmer, has an optimistic but realistic view of the future: "Most positions on the management level require considerably more education than I have at the present time . . . but I can foresee that a position as a project leader over a number of programmers or systems people is well within my range."

But when you've had it, you've really had it. After nine years in the field and thirteen jobs, one programmer wrote, "My best career path is O-U-T — O-F — T-H-E — C-O-M-P-A-N-Y and O-U-T — O-F — T-H-E — F-I-E-L-D. I'm fed up."

A more reasonable—but less decisive—tone is adopted by a potential midwestern drop-out. His credentials: a BA in math, some graduate work, three jobs and 13 years in edp. His bag: operating systems, their care and tailoring. "My career advancement depends on my willingness to play the

---

making the best possible use of its resources, and, in fact, conventionally accessing each of its components have been taken over by the system software—the operating system—and by the *systems programmers* (a relatively small group). For many programmers, direct interaction with the machine was the fun part of the job.

AND SUPERPROGRAMMER

Systems programmers come in three flavors. The *developers* conceive and write the programs which comprise an operating system. Most of them work for computer manufacturers, some for software companies. Periodically, these companies release new versions of their operating systems. The *maintainers,* who work for the users, preside over the replacement of Version 12 with lucky Version 13 ("new and improved"). The introduction of each improved version can be counted on to cause a number of hitherto smoothly performing application programs to blow up. This adds another dimension to the job of the maintainers. They must seek out the reasons why the programs have blown, asking the manufacturer's representative to tell them what changes were made in the operating system. Then the maintainers can specify what changes in the application programs have now become mandatory. Finally, the *tuners,* who also work for the users, have the task of balancing the variable elements of the operating system so that throughput is maximized: they get rid of as much operating system garbage as possible—without the roof falling in—so the installation can get some work done.

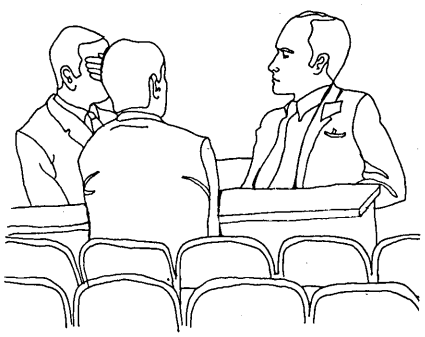
ALSO SUPERGRUNT

Finally, and really in the trenches, are the *computer operators,* the supergrunts. James A. Campise, Houston computer consultant, paints this picture of them: "Look into any busy information processing center and you will see several young men and women pushing buttons, changing magnetic tapes, flicking through punched cards and in other ways supervising the operations of the computer . . . When the control panel lights indicate that the machine has stopped for some reason, the console operator must investigate and correct the stoppage . . . He serves an apprenticeship . . . inserting punched cards in card readers and punches, inserting forms in printers, mounting reels of magnetic tape on tape drives and generally readying peripheral devices for operation . . . Many computer operators have successfully advanced to positions as supervisors of operations, programmers and computer center managers."*

The operators belong to the production staff, the manufacturing department, of the "information business." They receive the raw data flowing into the "factory." Regardless of whether it arrived at the right time or the wrong time, they must push that data through the complex of machines and programs to produce a finished product, timely information. As is true of production workers in other sophisticated factory environments, operators are expected to be able to "cope" when things go wrong—which is frequently.

. . . and at the club

Honchos are variously called *manager, director* or *vice president* of *data processing, systems, information systems, management information systems* or *management systems.* These are the guys who seemingly have it made in their chosen field. At any rate, some of them are firmly dug in. It has been estimated that one-third of the honchos have been with their present firm for nine or more years—and one-half have been around more than five years. Does this mean that the data processing honcho is finally stabilizing his own career planning and achieving a modest measure of security? Or does it mean that there's trouble in Computer City—that Computerman is losing the struggle for the honcho hat in more and more companies?



Leonard W. Snodgrass has been in charge of data processing at General Tel of California since the early 60's. As vice president and controller he was also in charge of five other functional areas. Until last July. At that time, Len Snodgrass explains, "Although my prime responsibility over the past, more than 30 years, has been financial—executive management felt that my knowledge of the operation of a telephone utility . . . financial background . . . administrative experience in edp particularly qualified me for a new assignment: vice president—data systems. This gives you a strong indication of top management's interest in data processing functions." And of top management's specification for honchos, too.

*AFIPS, Computer Careers, reprinted 1970.

corporate game. Ideally, I'd like to own a small, profitable business (entirely outside of data processing) and work occasionally as a free-lance in data processing. Practically, if I can achieve the stature of an 'expert,' I'd be better off elsewhere in the company . . . if not, I'd better stay where I am."

The honchos have a different view of their future in edp. There are traces of optimism, aggressiveness, cynicism, disillusionment, realism. Three out of five are committed to continuing in the edp field—despite the fact that many of them feel that they really have no way to improve themselves in a career sense. A solid 40% are looking forward to either a spinoff situation—a new and better career which has nothing to do with the management of edp—or an escalation situation—in which the edp function is absorbed into a grander, more pervasive activity over which they have control.

An aggressive view of escalation: "Frankly, I don't see a career path until the edp organization *is* the rest of the company, serving the whole works and with a voice at the top. We have to put our arms around the whole animal and, in our embrace, make it hum. I suppose it sounds like supreme arrogance but the fact remains that we feel we know more about running the company than the very people who *are* running it—and I'm not convinced that at one point in time that won't be fully acknowledged."

R. W. Blaylock, vp—management information services, Plough, Inc., Memphis, talks about escalation in more restrained terms: "I visualize my career moving into general management with specific interest in data processing, long-range corporate planning and management practices (the ground rules by which a company governs its own interactions to insure that corporate goals are met)."

The honcho who wants to spin his career off into other fields and the honcho who plans to continue in edp both say, in effect, the same thing, "I'm trapped." But the onward-and-upward-in-edp man concludes, "This is the thing I know best; hopefully there's room to grow; but, even if there isn't, I'm staying." An eastern manager of scientific computing put it this way: "I would give anything to get out of this disgusting and degrading staff job and into a line job. (He had previously labeled the work 'exhilarating'—the selling 'infuriating and discouraging'.) But at my level and salary there's no line career path open. (He's 50+ and makes $30K.) I am condemned."

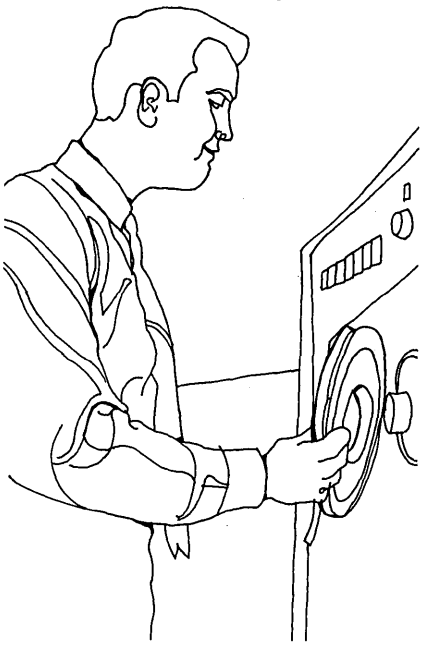
The spinoff simply says, "It's been great but now I'm trapped—I want to get out of edp and into the green world outside . . . "

In predictable ways some elements of a discussion of obstacles to success are the same inside or outside the computer world. The blacks feel put upon —lack of opportunity, both to get in and to go up. Some of their non-black associates, in turn, feel that all too often blackness is blatantly used as a substitute for performance.

Some of the women feel put upon. Most don't. A few are not at all hesitant to use their womanhood as a weapon—to the delight, irritation, or indifference of non-women. Nothing new there, either.

> . . . 40% are looking forward to . . . a new and better career which has nothing to do with the management of edp . . . or in which the edp function is absorbed into a grander, more pervasive activity over which they have control.

Practically, too, both honchos and grunts are reluctant to look inward in their discussion of obstacles. Grunts are more honest, though—or more



outspoken or more realistic. Lively Marion Bell again: "I'm the biggest obstacle in the way of my professional development and career advancement. I am a social creature and relish my private time away from the office." (After five jobs and almost 13 years in the business.)

Time—private or not—is the big obstacle in the way of self-development to grunt and honcho alike. Listen to Tom Southard, an outstanding manager of an outstanding installation (Westinghouse Air Brake Co., just outside of Pittsburgh): "Ours is a small, highly professional shop and I really have to be all things to all men. I talk to advertising agents, work up and live with budgets, lecture, provide a shop quality control function. I do everything around here, it seems. I haul the water, bake the bread, make the beds, sharpen the pencils, sweep the floors. If I could I would dedicate one whole of myself to administrative things and another whole of myself to professional things. My wife says, and she's probably right, that I have exchanged the family for my work."

Tom is a Phi Beta Kappa, a graduate summa cum laude from Kenyon College, a Fulbright Fellow, and a veteran of 17 years in edp. If time is a problem to him, consider the plight of Joseph J. G. Brooks, programmer/analyst by day (UFC Systems, Philadelphia), Villanova student at night, 30+ years old, and overwhelmingly involved in the process of bootstrapping himself up. Brooks started as an IBM customer engineer on unit record equipment. "I work full time . . . go to college full time at night . . . three hours per day for travel . . . six for sleep . . . the whole big weekend for studying, family life and maybe a little basketball. I do not have the free time I would like to improve my technical skills."

The grunts don't have a clear picture of what obstacles there are along their climb to the coveted managerships. They lack leaders, the economy is bad, the installation is too small, there's too much politicking, they're too old, they're too young, they lack education —it's a mixed bag. The honchos, however, have a clear picture of the "doomsday defense" standing between them and their rightful place in the sun. The enemy is the "organization establishment."

The descriptions of the problem were various. The explanations of the enemy's thinking ran the usual course from ignorance to fear to envy. But it all came out the same—the real problem for the dp honcho is "thoroughly entrenched top management, paying lip service to the new technology when all the time they're massively afflicted with the accountant's syndrome. They don't understand that the name of the game isn't to save money—it's to make it."

(IN THE MARCH ISSUE: The search for respectability and an identity. What's a professional? Who's a professional? To license or not? Are the societies, the "wise men," the "big men" and the customers talking about the same professional? What will finally happen to the professionalism crusade?) □

Tom Watson presents our newest way to reduce time-sharing costs.

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Z.V. Zakarian, president
Western Union
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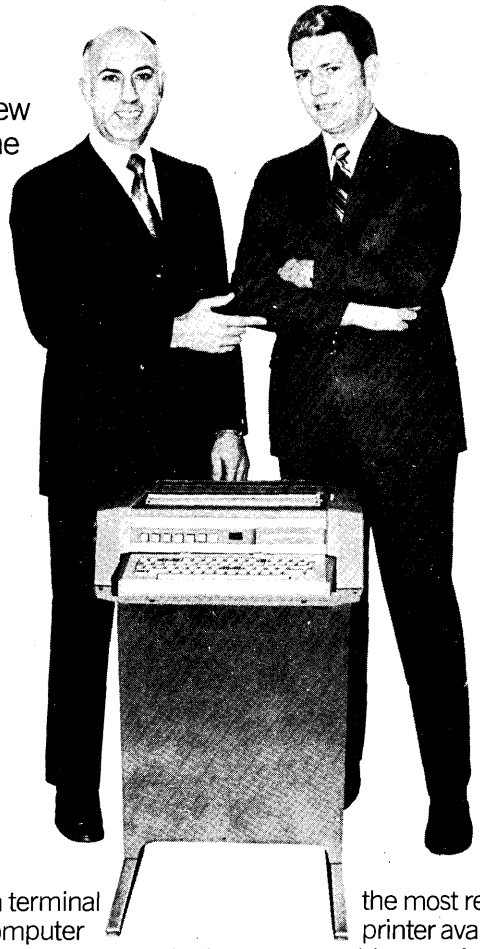

Our new 30 c.p.s. data terminal cuts in half the cost of computer connect time, compared to 10. c.p.s. terminals.

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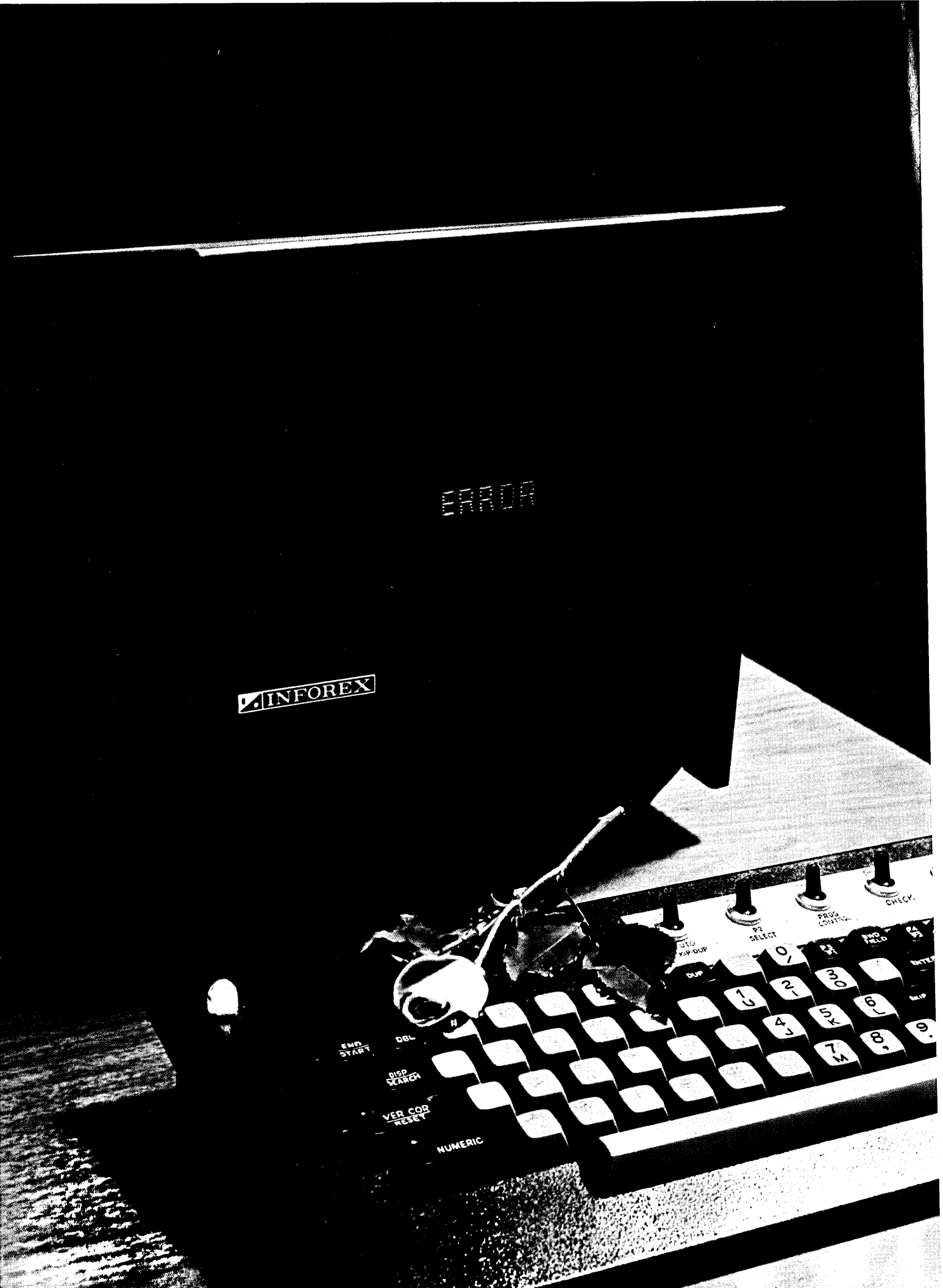
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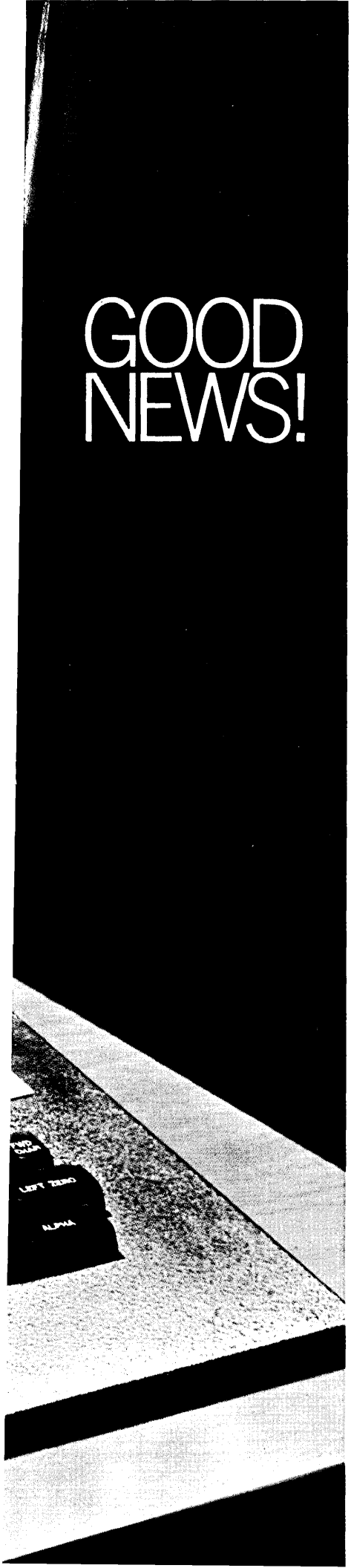

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Every element of Inforex Key Entry Systems, including the CRT display and flashing red indicator light, is designed for faster input with fewer mistakes. The CRT display not only tells the operator when she makes an error, it displays the full record as she enters it. Helps avoid duplicated or omitted data.

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INFOREX

CIRCLE 60 ON READER CARD

Techniques to speed throughput by reducing both the working set and the probability of page swaps

Programming in a Paging Environment

by R. L. Guertin

Considerable effort is being expended in the computer industry today to provide interactive time-sharing systems. Most of these systems make use of sophisticated "paging" techniques to provide massive amounts of virtual memory within relatively small amounts of physical memory. Each user's program resides on some mass storage device such as a drum or disc while the program is not executing, and then is transfered to physical memory when required for execution.

Usually the programs are divided into small, equally sized portions called pages, and only those pages required for execution are moved to physical memory on a demand basis. Thus, a program may be considerably larger than all of swappable physical memory, and yet execute efficiently if only a small number of its pages (termed the "working set") are required for execution during some small time interval. In general, a large working set leads to gross inefficiency since the operating system is constantly moving pages in and out of physical memory. This is especially true if the working set is larger than swappable physical memory.

The purpose here is to examine techniques which reduce the working set of a program or reduce the probability of requiring page swaps, and thus reduce the throughput time of the program.

A model system

In order to present realistic examples demonstrating techniques which reduce a program's working set, it is necessary first to have a programming language with which to give these examples substance. Secondly, a model paging system will be needed to supply appropriate constraints under which each example must operate.

The programming language I have selected is FORTRAN because it is widely known and accepted as a mathematical programming language. The recursive nature of FORTRAN's DO-loops is ideally suited to the purpose here, especially when array manipulations are involved.

As a paging system model, I have chosen the following:

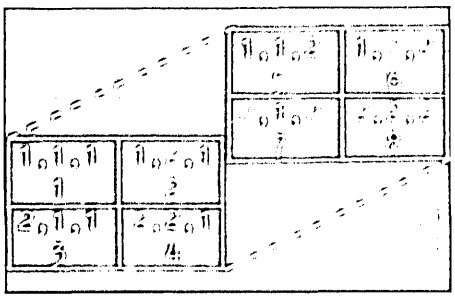
1. Demand paging system
2. 2048 word page size
3. 16 pages of swappable physical memory (32,768 words)
4. 1 usec memory cycle speed and average instruction time
5. Virtual memory on a drum with an average page transfer time of 30 msec.

Programming in a Paging Environment

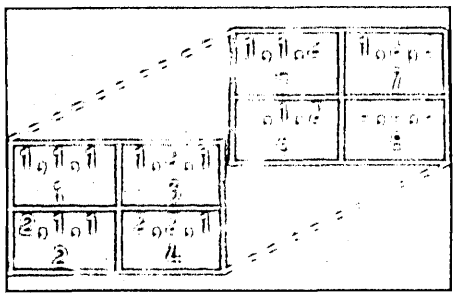
These values have been taken from an actual operating system. Although a specific programming language and paging system will be used throughout the remainder of this text, the concepts apply to other languages and operating systems.

Array layout

Multidimensioning of arrays is typical in FORTRAN, but since each element of an array generally occupies one word of memory, there must be some consistent method of mapping the rows, columns, and planes of a three-dimensional array into consecutive memory cells. The total number of elements in an array is the product of its dimensions. Thus an array A(2,2,2) has eight elements. But how are these elements arranged in memory? One method is to arrange by rows:



Another method is to arrange by columns:



There are other methods of arranging an array, but the preceding two examples are sufficient to demonstrate the concept. Column arrangement will be used throughout the remainder of this text.

Nested DO-loops

The reader may well ask, "What difference does it make how an array is arranged in memory as long as I reference it properly?" In a paging system it can make all the difference. Take the following rather innocent looking example for instance.

```
Example 1A:
      DIMENSION A(2048,8,2)
COMMENT—A TAKES 16 PAGES
            DO 1 I=1,2048
            DO 1 J=1,8
            DO 1 K=1,2
    1       A(I,J,K)=0.0
```

What is the working set for 16 iterations of statement 1? To answer this question, let us assume the array begins on a page boundary and compute the memory addresses relative to the origin of the array for the first 16 iterations of the DO-loops, remembering that each page is 2048 words. The subscripted positions, relative addresses and page numbers are:

Subscripted reference	Relative position	Page
A(1,1,1)	0	1
A(1,1,2)	16384	9
A(1,2,1)	2048	2
A(1,2,2)	28432	10
A(1,3,1)	4096	3
A(1,3,2)	20480	11
A(1,4,1)	6144	4
A(1,4,2)	22528	12
A(1,5,1)	8192	5
A(1,5,2)	24576	13
A(1,6,1)	10240	6
A(1,6,2)	26624	14
A(1,7,1)	12288	7
A(1,7,2)	28672	15
A(1,8,1)	14336	8
A(1,8,2)	30720	16

As the previous table demonstrates, within the first 16 iterations, 16 distinctly different pages are referenced. Add to this the minimum of one page containing the instructions for performing the DO-loops, and we have a working set of 17 pages for the example within 16 iterations—minimum. This working set is larger than the number of swappable pages in physical memory; therefore the paging system must swap at least once to satisfy the first 16 iterations. In so doing, one of the pages required on the next set of 16 iterations will be absent and the process described above will repeat itself then and on every set of 16 iterations. Since there are 2048 sets of 16 iterations, there will be at least 2048 page swaps at 60 msec transfer time per swap (30 msec to push out a page and 30 msec to bring in the demanded page). We are talking about 122.88 seconds or more than 2 minutes to satisfy all iterations of the DO-loops without counting instruction time. Compare this to approximately 33 msec of just instruction time if paging were not required. Quite a difference—almost 4,000 times!

Well, what can be done to alleviate the problem? Let's re-order the DO-loops as follows:

```
Example 1B:
            DO 1 K=1,2
            DO 1 J=1,8
            DO 1 I=1,2048
    1       A(I,J,K)=0.0
```

Now the first 2048 iterations are on only one page and only one page swap will be needed to complete all iterations of the DO-loops. So instead of a working set of 17 pages in 16 iterations, we have two pages in 2048 iterations (one for the instructions and one for the array).

As a general rule, then: "If the order of nested subscript-defining DO-loops does not affect the statements within the range of the loops, arrange the loops such that the outermost DO-loop defines the subscript of the widest separated elements when the other subscripts are held constant, and the innermost DO-loop defines the subscript of adjacent elements when the other subscripts are held constant."

But what can be done if one DO-loop defines the rows of one array and the columns of another, and a second DO-loop defines the columns of the first array and the rows of the other. Well, frankly—nothing. But if other references are also involved, ordering in favor of the most frequent form of subscript reference can help. Consider the following:

```
Example 2:
DIMENSION  A(125,125),B(125,125)
            DO 1 J=1,125
            DO 1 I=1,125
    1       A(I,J)=A(I,J)+B(J,I)
```

The DO-loops are ordered in Example 2 to favor the references to A(I,J). We will return to Example 2 later when another consideration will be examined (a better method of writing statement 1).

There are instances when an outer DO-loop contains statements which are not related to an inner DO-loop, yet statements within the range of both loops involve multisubscripted array references.

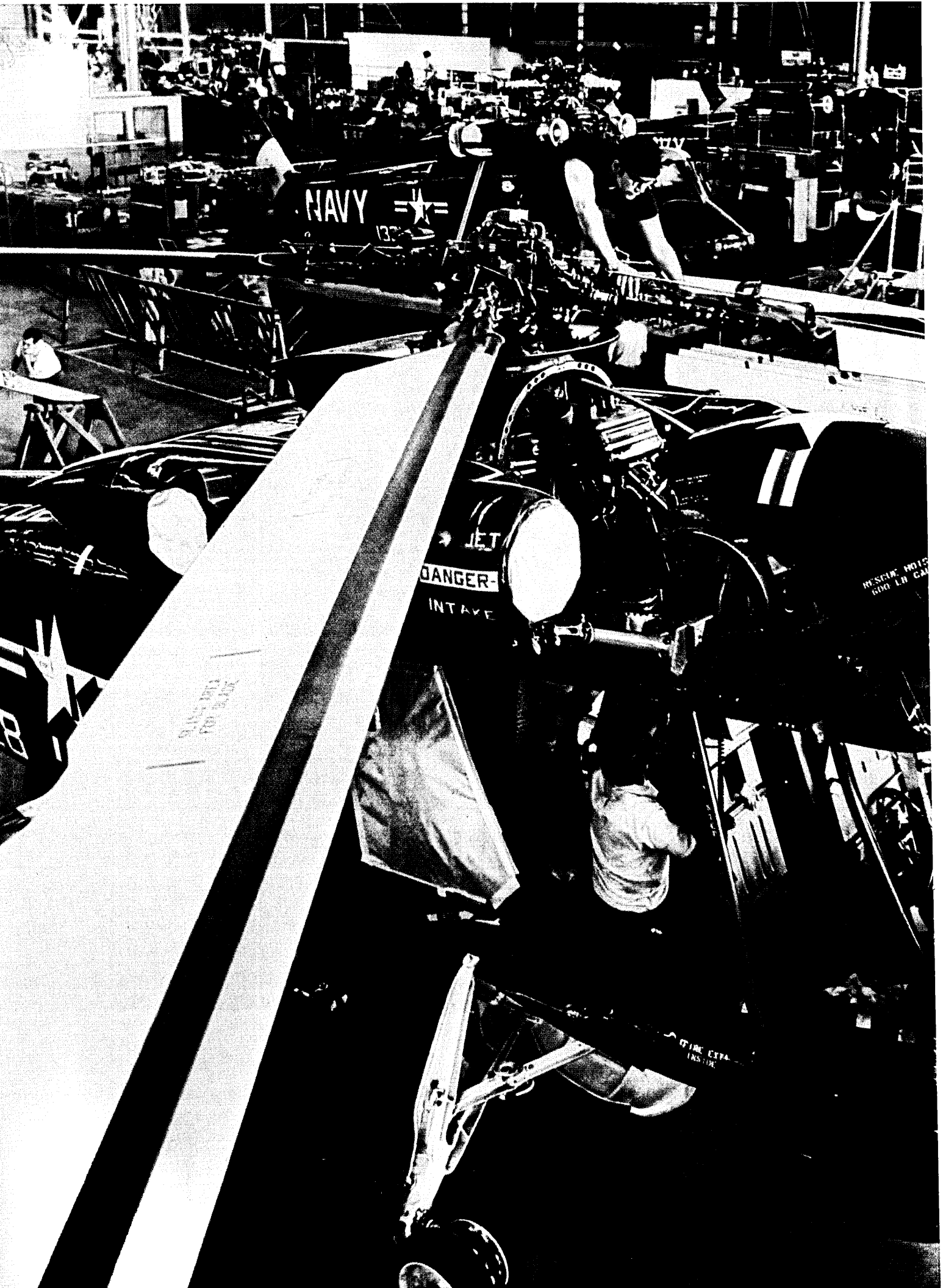
```
Example 3A:
  DIMENSION  A(125,100),B(125)
            DO 1 I=1,125
            B(I)=I
            DO 1 J=1,100
    1       A(I,J)=I+J
```

Note that the DO-loops are not in optimum order for the A(I,J) references. So, since the B(I) references are independent, they would best be done with a separate DO-loop as follows:

```
Example 3B:
            DO 2 I=1,125
    2       B(I)=I
            DO 1 J=1,100
            DO 1 I=1,125
    1       A(I,J)=I+J
```

Even if statement 1 had been A(I,J)=B(I), we could still make the indicated modification.

A similar situation to the one just described is that where the outer DO-loop defines the limits of the inner DO-


NAVY
JET
DANGER-
INTAKE

Kaman bought an HP computer system.

It knocked $30,000 off their annual time-share costs.

But that's not half the story. Before Kaman Corporation decided to buy a dedicated computer system from us, they spent nearly five months checking the usual alternatives.

"We chose HP for the price, reliability, storage and the enhancement of BASIC," says Jess E. Sweely, Controller of Kaman Corporation's Aerospace subsidiary in Bloomfield, Connecticut.

"We're using it for administrative and financial applications. We're also going to expand into the manufacturing area—for shop scheduling—as well as financial forecasting, statistical analysis and, ultimately, simulation. And our engineers will be using it for interactive computations in helicopter design and development work, including graphical analysis."

Cost, of course, was a major reason why they decided to get a time-share system of their own. "We were spending a significant amount monthly on outside time-sharing," Mr. Sweely said. "We found out that the Hewlett-Packard system could give us everything we were getting from commercial time-sharing at a fraction of the cost and with far better response time.

"Incidentally, the 2000C gives us so much capability that we're even selling time on the side. And if anyone around Hartford, Connecticut, needs a terminal or two, we'll be happy to talk to them."

But if you need more than one or two terminals, talk to HP. We now have a couple of new systems that make time-sharing from HP an even better deal than ever before. For instance, you can get started with one of our 16-terminal dedicated time-share systems for less than $50,000 (it's called the new HP 2000E). And we also have a new 32-terminal system (the HP 2000F) that offers all the power of our previous top-of-the-line 2000C model—at about one-third less cost.

Let us show you how to cut time-share costs to the bone. And maybe even do a little business on the side. Just give your local HP time-share specialist a call. Or write for complete information to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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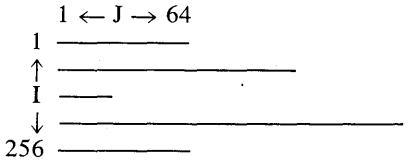
DIGITAL COMPUTERS

loop.

Example 4A:

```
DIMENSION A(256,64),B(256,64)
DIMENSION JUA(256)
COMMENT—JUA CONTAINS
RANDOM VALUES FROM
1 TO 64
        DO 1 I=1,256
        JU=JUA(I)
        DO 1 J=1,JU
  1     A(I,J)=B(I,J)
```

Here again the loops are not in optimum order, but close examination of the problem leads to a general technique for re-ordering the DO-loops. A picture of the referencing pattern would look like the following:



References go left to right, top to bottom. What we would like is references going from top to bottom, left to right. This can be done as follows:

Example 4B:

```
        DO 2 J=1,64
        DO 2 I=1,256
        JU=JUA(I)
        IF((J.GT.JU)2,1
  1     A(I,J)=B(I,J)
  2     CONTINUE
```

Although we have introduced more overhead with the IF statement and the computation of JU 64 times its original amount, we decrease the working set significantly. Instead of 17 pages in 64 iterations (JU at maximum) for the original example, we now have four pages in 2048 iterations (JU at maximum). The throughput improvement greatly surpasses the slight increase in overhead.

The technique just described can be expanded to allow for ranges with varying upper and lower limits.

Example 5A:

```
DIMENSION A(256,64),B(256,64)
DIMENSION JLA(256),JUA(256)
COMMENT—JLA AND JUA
CONTAINS RANDOM LIMITS
FOR J
COMMENT—IL AND IU
PREDEFINED LIMITS FOR I
        DO 1 I=IL,IU
        JL=JLA(I)
        JU=JUA(I)
        DO 1 J=JL,JU
  1     A(I,J)=B(I,J)
```

The working set for the above example can be reduced by:

Example 5B:

```
        DO 2 J=1,64
        DO 2 I=IL,IU
        JL=JLA(I)
        JU=JUA(I)
        IF(J.LT.JL. OR. J.GT.JU)
          2,1
  1     A(I,J)=B(I,J)
  2     CONTINUE
```

All of these examples involve multidimensioned arrays. Some programming languages allow multidimensioned arrays to be referenced with fewer than its full compliment of subscripts. Thus, Example 1B may be rewritten as follows:

Example 1C:

```
        DO 1 I=1,32768
  1     A(I)=0.0
```

In general, if the language allows it and the desired results are not changed, single-subscripting a multidimensioned array reduces the amount of code (and time) required to accomplish the task.

Now, before we leave the subject of DO-loops, let's look at one more example where a large working set exists and how to reduce it.

Consider a number of arrays all the same size, and the programmer wishes to preset (or reset) all of them at one time.

Example 6A:

```
        DO 1 I=1,IU
        A(I)=0
        B(I)=0
        C(I)=0
        .
        .
  1     CONTINUE
```

Each iteration of the DO-loop references one location in each array. When these arrays are large and/or scattered in memory, the working set is large for each iteration of the loop. One possible technique for reducing this working set is to process each array with a separate DO-loop. Another possibility is to add a subroutine to process each array as follows:

Example 6B:

```
        SUBROUTINE ZERO(X,N)
        DIMENSION X(N)
        DO 1 I=1,N
  1     X(I)=0.0
        END
```

with calls replacing the DO-loop

```
        CALL ZERO(A,IU)
        CALL ZERO(B,IU)
        CALL ZERO(C,IU)
        .
        .
```

The above example can be expanded to include a third parameter representing the value to which the array is to be preset (instead of 0.0 as shown).

Expression evaluation

FORTRAN, like other compiler languages, imposes rules of precedence and order in the evaluation of mathematical expressions. For the purposes of this text, let us assume the following:

1. Evaluation proceeds from left to right for operators of the same class.
2. In nested parenthetical expressions, evaluation begins with the innermost parenthetical expression.
3. Class hierarchy:
   a. Functions; Parenthetical expressions; Exponentiation (**)
   b. Multiplication (*); Division (/)
   c. Addition (+); Subtraction (−)

Thus, V=A**B/(C+D)*(E*F−G) is evaluated:

```
A**B→R1
C+D→R2
E*F−G→R3
R1/R2*R3→V
```

(R indicates intermediate results)

Basic mathematics also provides us with the following relationships:

1. B*A = A+A+A (B terms) = A*B = B+B+B (A terms)
2. A**B = A*A*A (B terms)
3. A/B = A*B′ = B′*A (B′ = 1/B)
4. A−B = −B+A
5. A+B = B+A

Now which of the following is better done on a computer? 2.0*A or A+A? On most computers, addition is faster than multiplication; therefore, A+A is better done on a computer. In a paging system we reap an additional dividend. Since the quantities 2.0 and A are separate and distinct, there exists a probability that they reside in different pages of the program. The working set of the expression could be two pages (disregarding the instructions). However, the working set of A+A is only one page (again disregarding the instructions).

This method of reducing working set is often overlooked, and yet the reduction of working set by even one page can make a significant difference in throughput. In our model system, consider the following.

Example 7:

```
      DIMENSION A(2048,15)
    COMMENT—THE ARRAY
      REQUIRES 15 PAGES
        DO 1 I=1, 2048
        DO 1 J=1, 15
  1     A(I,J)=2.0 * A(I,J)
```

Since the DO-loops are similar to those shown in Example 1A, we would have a 17-page working set in 15 iterations requiring at least 2048 page swaps to complete both DO-loops since only 16

pages can ever be in memory at one time. The 17-page working set is determined by the 15-page array, one page for instructions, and one page for the constant. By rewriting statement 1 as: A(I, J) = A(I,J) + A(I,J) we eliminate the constant and reduce the working set to 16 pages (exactly matching swappable memory). A 16-page working set does not require any page swaps since there is sufficient memory available to satisfy the working set.

Of course, reordering the DO-loops (as done in Example 1B) for Example 7 will also reduce the working set, but the elimination of the constant is still an additional reduction.

Similarly, A*A is better than A**2, both from the standpoint of working set and computation speed since exponentiation usually requires a subroutine to do the evaluation (possibly on another page), while multiplication is usually done directly by the hardware.

Since multiplication is also faster than division on most computers, computation speed may be increased by the application of the third relationship. But what effect can this have on paging? Both A/4.0 and A*0.25 require a constant. We can rewrite the expression as 0.25*A (which still requires a constant), but now the order in which the operands are taken could have an effect. Since the probability of page swap increases with every page change, the expression A(I)/4.0+A(I−1) with A(I) and A(I−1) on the same page (#1), and 4.0 on another page (#2), results in the following page reference cycle: #1, #2, #1. There are two page changes, and if in making the reference to page #2, page #1 is swapped out, then it will have to be swapped back in again for the last reference to page #1. By rewriting the expression as 0.25*A(I)+A(I−1), we now have a reference cycle of #2, #1, #1 and only one page change occurs. On the basis of the above, statement 1 of Example 2 should be rewritten as:

```
1    A(I,J) = B(J,I)*A(I,J)
```

In general, an expression should be ordered or constructed in such a manner as to have the lowest number of page changes. This can be accomplished by the use of the relationships shown earlier.

Also, the programmer should attempt to eliminate the computation of intermediate results during the evaluation of an expression. Thus, A+B*C should be rewritten as B*C+A or C*B+A and

```
B(I,J)*(A(I+1,J)+A(I,J−1)+
      A(I,J+1)+A(I−1,J))
```

should be rewritten as:

```
(A(I,J−1)+A(I−1,J)+A(I+1,J)+
      A(I,J+1))*B(I,J)
```

(Note the order of subscript references for A.)

Other considerations

Whenever possible, arrays and common elements should be kept adjacent to each other in memory when these elements are used frequently or together within expressions. The programmer should also consider the proximity of frequently used subroutines and functions to the calling program. Compactness reduces the probability that these elements or subroutines are on different pages and may thus reduce the working set of the program.

It has been my experience that all of the principles and techniques described will prove invaluable to the programmer when programming in a paging environment. □

Mr. Guertin is currently a systems programmer at Stanford Univ., Palo Alto, Calif. His previous employment included InterAccess Corp. and Control Data Corp., both in Palo Alto, as well as a stint at CDC's Minneapolis facility. His BSEE is from Michigan State Univ.

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Information Systems and Communications

The NRMA Annual Conference

Heightened interest in communications, "helped," according to electronics committee chairman Frederick Bleckwenn, "by the U.S. mail service," led the National Retail Merchants Association to call their annual meeting this year the Information Systems and Telecommunications Conference. And sure enough, there was an AT&T vice president, E. G. Greber, on hand to give the keynote address at the posh Fairmont Hotel in Dallas Oct. 18.

It was an odd and interesting speech —interesting because of the content and odd because of the tone, which ranged from such mild and humble comments at the beginning as "we're only one segment of the communications industry" to intimations at the end of zonking the new data transmission companies through price competition. Early in the talk, he had warm words for the Carterfone decision, "which stimulated use of the network," and for the terminal makers, who he said AT&T considers as partners.

Data transmission, he said, is now bringing in about $500 million a year. It was increasing at a rate of 50% per year, but slowed down last year to 30%. Greber (and others at the conference) sees the Bell digital network coming along fast. He said it will serve 24 cities by late 1973 or early '74, a hundred in three to four years. Claiming that there is "no limit to the capacity of the network to change," he mentioned the new data-under-voice and other techniques that have the potential of increasing transmission rates to as high as 25 million bits per second. Field trials of data under voice are scheduled for early '72.

Although communications was a big topic this year (most of the activity on the last day was devoted to it), point-of-sale devices got their share of attention. One of many discussion sessions on the subject was led by Dick Shaffer of Gambit Management Strategies, New York City. Most of the stores with representatives there seemed to be in either the planning or try-out stage, some with terminals from two or three different manufacturers being checked out.

Some over-all impressions on equipment from the session: modularity will be in, allowing, for example, removal of a reader/cassette unit for taking inventory; offerings from the various manufacturers are tending to become more alike. Shaffer suggested that the retailer should ask the manufacturer for a proposal—specifying such characteristics as reliability requirements and response time—and not worry about how the equipment works, as long as it does what it's supposed to.

Another panelist, Bill Martin of the May Co., had a useful comment on costs. An older gentleman he once worked for in a department store used to ask, when a capital expenditure was proposed, "how many pairs of sox do we have to sell to pay for it?" Martin said his estimate of the cost for TRADAR was "a pyramid of sox 250 feet wide at the base."

Judging by comments at Shaffer's session, and the general eagerness at the conference for The Word on point-

. . . a sample of the fallout from the RCA affair . . .

of-sale terminals, somebody is going to sell a whole lot of them pretty soon. A guess about when: mass orders in late '72; money changing hands in '73.

Although a distant runner-up for attention compared to terminals, data input preparation was a lively topic. John Silvi of Neiman Marcus described that store's adventures in switching from keypunch to a key/disc shared-processor system. They chose the GCS 2100, from General Computer Systems of Dallas, on the grounds of good editing characteristics, operating equipment to show, and generous assistance from the company in customizing software. Apparently all went well, with eight weeks of parallel oper-

ation and operator training completed in two weeks. Silvi cited an increase of 38% in keyboarding efficiency.

Questions at the end of the session, directed to GCS management, gave a sample of the fallout from the RCA affair: "Considering RCA and Farrington, what's your capitalization?" The answer from company representatives seemed to satisfy the retailers and included the fact that GCS has been in the black since the third quarter of last year and expects to earn around $1/share this fiscal year.

At the next morning's general session, Hans Kampgen, president of AGROS—a huge wholesale operation in Germany—described the successful Olivetti installation that uses Vector 5000 computers and a host of peripherals for complete management of all information needed. It's a rather specialized application because of the nature of the store—no credit, no deliveries, and all big buyers. But the system works so well that the store managers have analyses of what time certain classes of buyers are in the place and can thus make sales pitches to them over the public address speakers.

. . . useful advice for those who tried facsimile transmission a couple of years ago and found it pretty doggy.

At lunch that day, A. Zettler Greely, president of North American Rockwell Information Systems Co., drew cheers and applause when he began his talk by saying "I'm not here to sell you anything." This enthusiastic reaction, later conversation suggested, may indicate some dissatisfaction with the presentations at the show—especially the "workshop sessions." Typically these present a happy customer, backed by one or more layers of marketing people from the company supplying the product. And it's obviously useful, if the people at the session are in the market for such a product, to hear how it all worked out for the other guy. But there's a tendency to put only the most starry-eyed customers on the stand—and for the company representatives to jump in when the questions get hard to answer.

But back to Greely, who elaborated on some of the more popular complaints about MIS. If a system is really integrated, he said, that means removing one piece makes it all fall apart. Thus these big systems take on a life of their own; at North American, the edp budget rose from $4 million to $8 million while employment for the company was declining from 35,000 to 12,000.

One of the many point-of-sale sessions that afternoon was Janet Norman's, for the Singer Co. Most of her talk dealt with the tremendous amount of detailed analysis necessary to install a big system. But she also noted that the ambitious Singer scheme is coming along, with more stores being added gradually to the network that polls each retail outlet nightly to collect the day's record of transactions. She said that the software developed for this system would be available to buyers of Singer/Friden equipment.

Maybe it's a measure of the retailers' growing experience (or disenchantment) with computer equipment that the Wednesday luncheon speaker was the dreaded (but secretly lovable) Dr. H. R. J. Grosch. Grosch was in bad voice, from laryngitis, but great spirits as he condemned and sentenced too-frequent equipment upgrades, elephantine operating systems, IBM, AT&T, and the general tendency of our society to seek growth for growth's sake.

At an afternoon session called Advanced Management of the Telecommunications Function, R. C. Bennis, manager of telecommunications for Westinghouse, had lots of good things to say. (His talk didn't have much to do with the title, except that he noted the importance of communications deserves recognition in the corporate structure; at Westinghouse that function reports to the vice chairman of the board.) What he did talk about was the Westinghouse communications system, which is a wowser—six switching centers, lines covering the whole country and beyond, handling voice, Teletype, facsimile, and some data. The whole works is closely monitored, with time and distance charges accumulated. These cost elements are then compared with what the costs *would* have been using the services of the various telephone companies. The results show that Westinghouse is saving about 50% with their do-it-yourself approach.

Bennis also had useful advice for those who tried facsimile transmission a couple of years ago and found it pretty doggy. It now works so much better, he said, that his company has installed 145 units and they are candidates to replace Teletype printers, since they're quiet and don't require much of any operator training. Transmission rate is now three minutes/page and, he said, likely to increase soon.

In describing plans to use data communications in Europe, Bennis noted that the standard rate there is 1200 baud, but they will try for 2400. (There was a sort of love/hate relationship with AT&T prevalent in many sessions at the show; everyone hates the phone company until they try to get comparable service in Europe, whereupon the Bell System seems to take on a new allure.)

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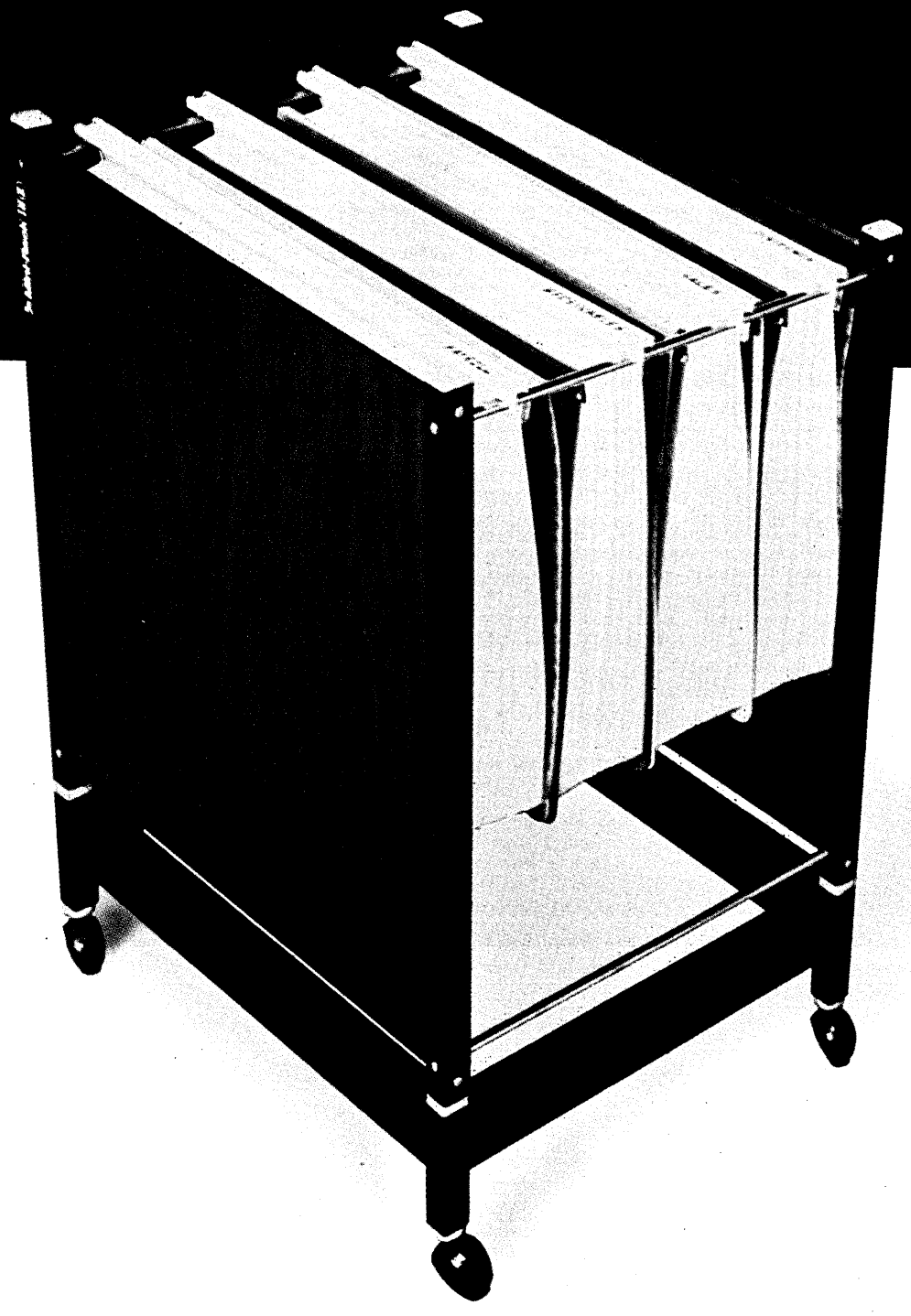

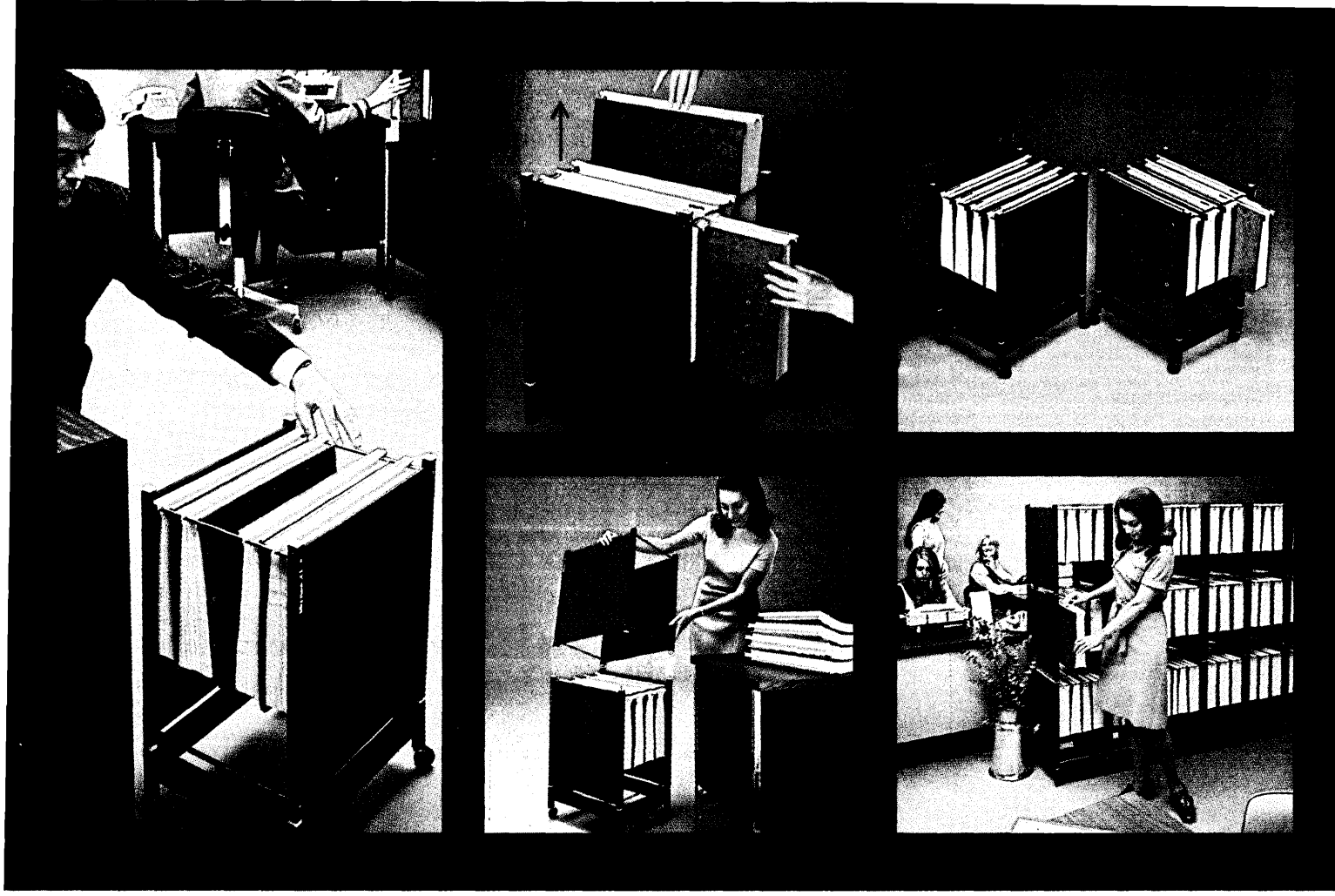

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CIRCLE 72 ON READER CARD

The NRMA Annual Conference

Westinghouse has also racked up a lot of experience with the Picturephone; they had 60 of them on a one-year free-trial offer. The trial is over, but the company still has a dozen or so in use. The bad news is that each unit ties up the equivalent of 200 voice-grade circuits. The good news is that they are very useful for certain kinds of things, such as remote interviews with applicants for employment, presenting slide discussions to many branch sales offices at the same time, or showing new products to the field sales force.

Bennis concluded with a suggestion that the retailers look into the private telephone systems, which are now quietly burgeoning. Some of them, he said, guarantee their rates for 10 years while, with the conventional phone companies, it's nearly impossible to know what your costs will be even 18 months in the future.

Thursday morning the general session was given over to a status report on the NMRA's telecommunication activities. Their counsel in Washington, William Borghesani, Jr., traced the committee's efforts in the past toward promoting greater availablity of, and lower rates for, communications—private microwave systems, Telpak, Carterfone, and other momentous FCC decisions. He expects AT&T to make some sort of "bulk offering" in two or three years, when the competition really gets started. Borghesani apparently thinks that the cable tv crowd has a better chance in the data transmission market than Datran does. The latter, he said, may be off by a factor of four in their estimate of $375 million capital needed to get the network built.

John Duffendack, of Com-Share, Inc., warned the audience to watch out for local operating companies of the Bell System filing tariffs with state public utilities commissions to introduce a service called ISAL—Information System Access Lines. What it means, in a nutshell, is rate increases of up to 600% when the lines are used with information systems. The strategy, so far, has been to introduce the tariff, withdraw it at the first sign of opposition, then resubmit it when the fuss dies down. The tariff has been accepted in Utah. Texas, where there is no PUC, is another victim. In California, the issue has been broadened to include voice transmission, which could affect, for example, catalog sales handled by telephone. Duffendack is a fan of Bell tariff applications, which contain, he said, "some of the most creative humor available today."

During this last day of the conference, pretty much devoted to communications, one session was put on by N. Richard Pyes, of Dittberner Associates, and included estimates of the present and future terminal market. Pyes said there are about 12,000 computers now using terminals—some 200,000 of them. But most of these are keyboard types, using low-speed transmission. Airlines and stock quotation systems have about half of all the installed crt terminals. Right now, retailers have perhaps 5,000 terminals of all types, but some 3,000 of these are Uni-Tote's. He too, though, sees a great wave coming—with the big retail stores and chains using some 100,000 by 1975 and perhaps 240,000 by '77.

At lunch on the last day, H. A. Latimer, an assistant vp of AT&T, summarized the company's reasons for needing vast new sums of capital (some $20 billion) in the next few years. Besides the more familiar reasons, he brought up one that was new to us: the increasing transience of the U.S. population is making it difficult for the phone company to recover installation costs. These come to about $45 a unit—including setting up billing, etc. But of every 20 phones installed now, only one is a net gain—and the user may move on before the costs are recovered. So the company intends to increase its installation charges and, perhaps, require a higher rate for the first year's use than for succeeding years at the same location.

> Airlines and stock quotation systems have about half of all the installed crt terminals.

The usual afternoon exodus on the last day of a four-day conference left the final sessions sparsely attended. One of interest was offered to a lingering half dozen by M. C. Knoll, of Teleprocessing Industries, Inc. This subsidiary of Western Union Corp. consists of about 500 of the people who designed, developed, and operate the considerable computer/communications facilities for Western Union. The organization is now going after outside business, and Knoll described the nature of facilities management, one of their offerings, as a possible solution for the retailer without computer and communications experience, with admirable objectivity and minimum sales pitch.

There were lots of exhibits, with many of the larger companies using large rooms off the main corridor—a convenient layout for visitors to drop in on the way to the next session. There were about 20 exhibitors in all, with several of the smaller companies tucked away in suites throughout the hotel. Some vendors, such as NCR, now offer very complete packages for the retailer. But the most noticeable feature of all the exhibits was the general enthusiasm and swinginess. New products, new pitches, young faces. You might almost think you were at a Fall Joint three or four years ago.

—William Rolph

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CIRCLE 53 ON READER CARD

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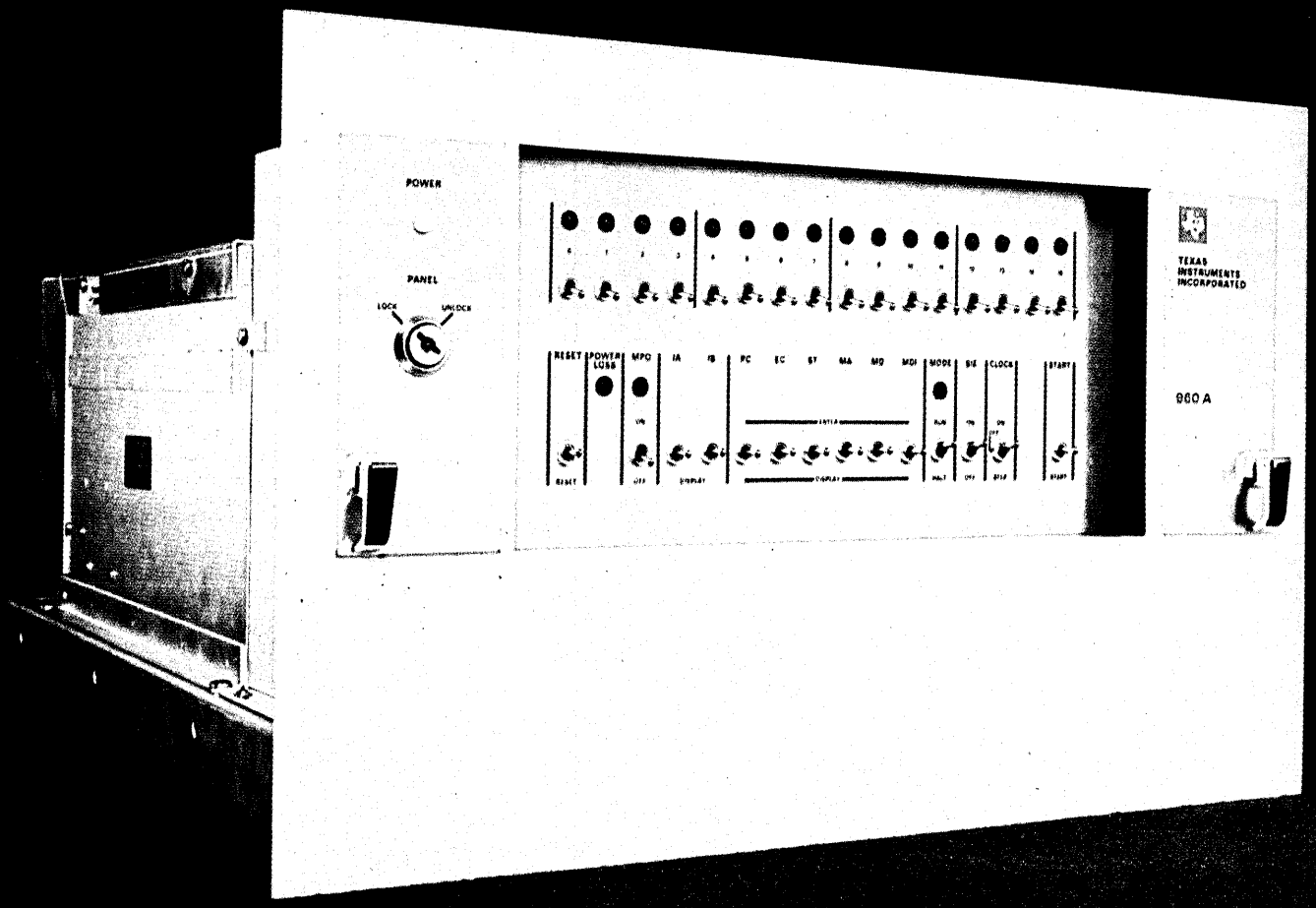

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TEXAS INSTRUMENTS
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IEEE Computer Society

The program of the Fifth Annual IEEE Computer Society Conference was designed largely to assist computer people in cutting costs, but, unfortunately, the conference was something of a victim of its own philosophy: attendance was down sharply, because many companies are trying to save money by having their computer professionals stay home.

> . . . cost-consciousness that covered just about everything from time-sharing and data bases to microprogramming and memory technologies.

In describing the *raison d'être* of the program, technical program chairman Norman Rasmussen of IBM said: "We were influenced by the evident slowdown in the computer industry. Could it be that some of the softness in the computer market is related to poorly cost-justified applications or systems, systems performing less well than expected, or costing more to implement than planned? There was strong agreement that the answer was yes."

There seemed to be a near unanimous belief among participants that the conference, held in Boston in September, offered a stimulating program. Conference-goers were given a soup-to-nuts guide on computer cost-consciousness that covered just about everything from time-sharing and data bases to microprogramming and memory technologies.

In the area of solid state electronic devices—chiefly memories and circuitry—Robert W. Keyes of IBM's Thomas J. Watson Research Center observed that increases in speed and decreases in costs have occurred as devices have become smaller. He said: "It has been found that small size is the avenue to decreases in cost, since, roughly speaking, the manufacture of solid state devices involves a fixed cost per unit area . . . Apparently the most basic question to ask is how small can devices be made?"

The speaker gave some answers to the question himself, suggesting that the devices are capable of being made a great deal smaller indeed. In the memory area, Keyes said that the bubble memories should allow for a reduction "in the size of magnetic storage elements by at least an order of magnitude."

The speaker's company—IBM—is known to be working with bubble and moving magnetic memories, as is Bell Labs and Cambridge Memories, a Boston-area company.

Several of the papers presented at the conference centered around microprogramming. Stuart E. Madnick, of MIT's project MAC, observed that microprogramming has already provided a bridge between software and hardware. And he predicted that the trend will stimulate the growth of a "control hierarchy," which will become increasingly important in computer systems.

Another MIT scientist, Hoo-min D. Toong, presented a discussion of microprogramming as it relates to storage devices. "At present," said Toong, "the major contender of high speed, moderate cost control store is semiconductor devices, both MOS and bipolar. Semiconductor memories use many of the same types of components and manufacturing techniques used in microprogrammed control units and arithmetic units, thus allowing them to be packaged integral with the logic."

While the technical sessions of the program were acclaimed, conference officials were disappointed at the low attendance. Paid attendance was just over 600 compared with the 1060 who paid to attend the conference last year. In addition, the exhibits were dropped this year because of lack of interest on the part of exhibitors. Last year, there were a total of 45 exhibits and the total attendance for the technical sessions and the exhibits was 2495.

—W. David Gardner

"Mr. Dunnock, I'm ready for more work and greater responsibilities."

News in Perspective

IBM wants a ruling from the GSA on a computer reliability question. But two firms competing with IBM for the big Air Force Logistics System contract says it's really only IBM's excuse for a high bid. That reports starts on this page . . .

The feds are going to pressure systems suppliers to make it easy for them to add peripherals made by independents, as reported on page 73 . . .

The telephone company still balks at efforts to ease interconnection restrictions. Ma Bell's latest statement is on page 77 . . .

How did computer stocks fare at the close of 1971? Honeywell led the crowd with a 60% surge, page 79 . . .

Meet James Guzy. Learn, on page 80, what legal steps the youthful Memorex executive thinks should be taken against IBM for a more competitive industry . . .

Univac's John Butler is the man who'll nursemaid his firm's newly acquired RCA users. Meet him on page 83 . . .

All about the wrangling, page 85, that follows a plan in California to put an on-line welfare reporting system on the air in the short time of seven months . . .
A small software subsidiary changes well-known hands, page 88 . . .

Procurement

IBM Feuds With Feds

IBM and the General Services Administration (GSA) are battling over contractor liability for "consequential damages." It's a fight that could significantly impact every federal dp supplier.

Basically, IBM wants its liability for consequential damages defined before it signs any dp contract with the federal government. Otherwise, the company argues, it could conceivably be forced to pay out billions. For example, if an Air Force bomber crashed because an IBM computer didn't schedule engine maintenance at the right time, the feds could ask the company to pay for a new plane. Or, if an IBM system broke down for reasons not explicitly covered by the warranty, the feds could still ask for damages.

GSA officials aren't talking on or off the record, but apparently they believe the whole issue of contractor liability has to be adjudicated by a court before the feds agree to any limitation.

The issue came to a head last December, when IBM filed a complaint with the General Accounting Office, the first in the company's history. It was signed by general counsel Nicholas Katzenbach, who was Attorney General in the Johnson Administration. Because GSA wouldn't accept any limitation on contractor liability for consequential damages, Katzenbach said, IBM couldn't submit its "final and most favorable offer" on the Advanced Logistics System (ALS), a huge Air Force computer buy now under way. (However, the company did submit a bid, reportedly, and is still being considered, along with CDC and Univac. Burroughs has dropped out of the competition.)

IBM asks GAO to delay award of an ALS contract until after the agency has ruled on GSA's right to demand unlimited contract reliability for consequential damages.

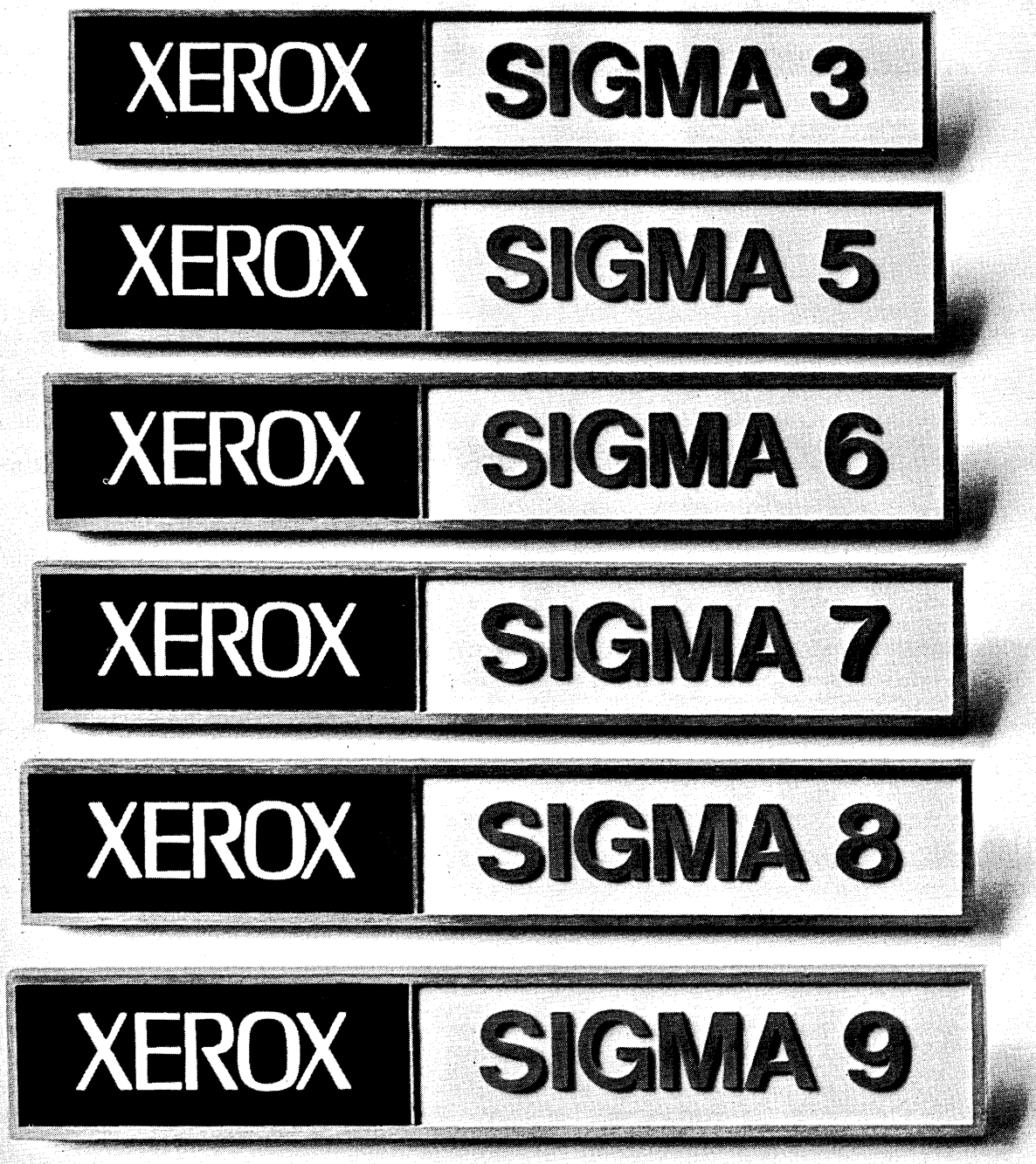
Since then, IBM has submitted a second complaint to GAO. This one involves the defense integrated data system, an upcoming Defense Supply Agency buy. Here again, GSA, the federal negotiator, is insisting on a contract which says nothing about contract reliability for consequential damages, and IBM wants that liability defined. The company also is trying to develop industry support for its position through BEMA.

Meanwhile, CDC has asked GAO to let the ALS buy go forward, a company source says. "We have reluctantly accepted unlimited responsibility." Univac, the other ALS bidder, apparently has done likewise. A Univac source believes IBM's creating an issue because they know "they can't win the ALS contract; we're offering far bigger discounts, and so is CDC."

A congressional source says the General Accounting Office "probably" will side with GSA "because it's within GSA's power to impose this requirement, and GAO doesn't have authority to look any farther." Then he added, "but Congress does."

GSA's refusal to limit contractor liability "represents a change in the practice uniformly followed in every prior contract with IBM," said Katzenbach in his December complaint to GAO. A press statement issued about the same time explains that IBM is willing to "fully warrant its product and stand behind any legitimate responsibility for nonperformance, provided this responsibility is defined. However, it is simply not reasonable to expect a vendor to assume open-ended responsibility for whatever might go wrong, since the government — not the vendor — is operating and controlling the system."

GSA apparently feels that if it agrees to a limitation before a court has decided the issue, the government might be giving away more than it has to. The agency became aware of all this only recently, says a knowledgeable outsider, while developing a "model contract" for the ALS. A basic aim of this effort, which could lead to major changes in the way GSA deals with dp suppliers, is to get contract offers which can be compared directly with each other, according to our source. "Right now, GSA frequently must compare apples against oranges, in effect, because the contract provisions permit bidders to price their systems and warrant performance in myriad and wondrous



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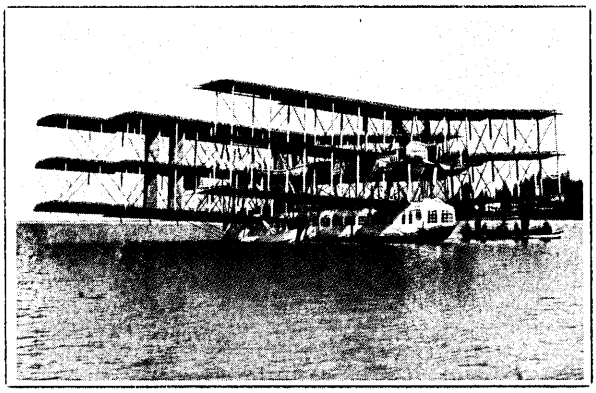

This 1919 conception of the future airliner looks like anything but because the nine-wing, eight-engine airliner was designed using only those technologies familiar to folks back then. The basis for its hasty demise can be compared to obsolete computer installations where users have been supplied a patched computer that was quickly grounded by obsolescence . . . and replaced by a larger but incompatible computer in an attempt to meet future requirements.

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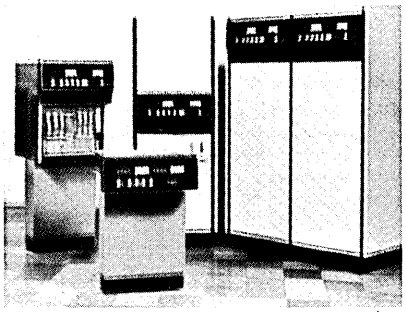

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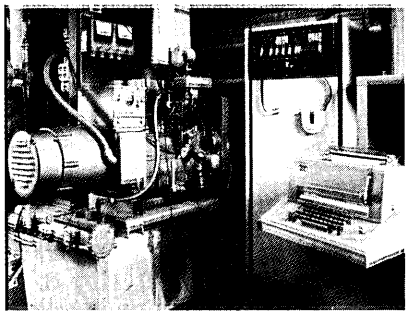

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ways. The model contract would limit these options by defining requirements more precisely and making far greater use of mandatory provisions."

While GSA looks upon the model contract as a way of bringing order out of chaos, IBM apparently is convinced it will "impose unnecessary burdens and risks on vendors" and will "stifle imaginative and innovative offerings . . ." The quotes come from a statement IBM recently sent to BEMA in an effort to promote industry support.

The company is particularly incensed because GSA began drafting a model contract for ALS after the rfp was issued. While bidders have been consulted, the contract—in its present form—changes the system requirements considerably compared to those stated in the rfp. As IBM put it to BEMA: "Such unilateral announcements of mandatory conditions, made after large investments in proposal expenses have been incurred, leave little choice to vendors who might not have participated if those conditions had been known at the time rfp's were issued."

GSA obviously will be in a much stronger position to promote the model contract if the agency is upheld by GAO and is allowed, unilaterally, to do away with any limitation on a contractor's responsibility for consequential damages. Conversely, if IBM wins, GSA might very easily end up with less control than it has now.

—Phil Hirsch

Peripherals

Feds Consider Peripheral Option

Independent peripheral makers will gain some leverage in their competitive battle with computer manufacturers if a proposed "foreign attachment" option is added to the FY'73 Federal Supply Schedule (FSS). The option would allow the feds, at their own risk and expense, to install independently made peripherals and/or extended memories to systems leased from the computer makers.

Right now, Univac, Honeywell, and Burroughs permit such changes only if they give permission in writing. IBM and CDC allow the government to use foreign attachments at its discretion (although IBM retains the right to say no if, in its opinion, the modification creates a safety hazard). All of these firms require prior notification.

GSA, which negotiates the Federal Supply Schedule each year, has proposed a foreign attachment provision allowing "substitutions" and "additions" to leased systems under the following terms:

The government will be responsible "for damage caused to the system" provided it results "solely and directly" from use of equipment obtained from another manufacturer; the system supplier won't have to supply credits for system malfunctions "provided the downtime conditions . . . were caused by or resulted directly and solely from use" of another supplier's equipment; the system supplier won't be held responsible for "defects in software provided such defects are caused by or result solely and directly from" another suppliers' equipment.

The system supplier must also provide the feds "or its authorized agent(s) with any detailed technical information that either may require, to insure that the contemplated equipment additions and/or substitutions can be used safely and efficiently . . ." This language, if finally adopted, could force a system manufacturer to give independent peripheral makers his I/O interface specs. This is something the computer firms have vigorously resisted so far.

GSA's draft went to FSS suppliers last month. Meanwhile, an interagency committee that advises GSA on adp policy is evaluating the virtues of the foreign attachment idea. If they turn thumbs down, it will be abandoned. But, according to a knowledgable source, this isn't likely. He indicated that a final version of the foreign attachment option, possibly modifying the draft, may be completed this month. GSA negotiators would then try to persuade system suppliers to accept the provision as a part of their FY'73 FSS contracts. GSA also intends to add a foreign attachment option to one or more upcoming big system contracts, which are negotiated outside the Federal Supply Schedule.

The GSA proposal is the latest outgrowth of Dick Caveney's years-long campaign to gain a bigger piece of the systems market for independents. Last year's hassle between Sci-Tek, Inc., on one side, Univac and Burroughs on the other, almost certainly persuaded the feds to draft a foreign attachment contract provision at this time.

Sci-Tek wanted to install an independently made extended memory on a Univac 1108 system used by the Navy at China Lake, Calif.; the company also wanted to by-pass one of the I/O controllers on the Air Force's Phase II system to test a new RJE terminal. Phase II runs on Burroughs 3500s. Sci-Tek lost out in both cases, although it subsequently filed a $150 million antitrust suit against Univac (and others), and apparently found a sympathetic ear on Capitol Hill.

Univac probably provided the best statement of the system suppliers' case when, at the height of the Sci-Tek hassle, a spokesman said:

"When Univac wins a competitive award (from the federal government), we assume the equipment is going to be productive for a period of time depending on the size and complexity of the system. If this revenue does not materialize, the attractiveness of bidding is diminished." Although use of foreign attachments may appear to save money, Univac added, it "usually costs more in the long run" because of hardware, software, and maintenance responsibility problems. "Univac is not adverse to making use of non-Univac equipment for the best total system . . . but it must be done on a contractual basis with both vendor and customer having a clear understanding as to responsibility."

Memories

LCS Suppliers — The Ins, the Outs

While there still are some IBM 360 users around giving testimonials that independently supplied large core storage systems are cost-effective life stretchers and efficiency enhancers for their cpu's, all of the independent vendors aren't as sure as they were a year ago.

One that is is Data Products Corp., Woodland Hills, Calif.; and one of the most recent testimonials came from a Data Products' customer, United Air Lines, which is using a DP model 6000 LCS interchangeably on a Model 50 and a Model 65 in its San Francisco-based maintenance and engineering operations. A simple switch moves the one-megabyte capacity of the LCS from the 65 to the 50.

Alan Peters, the installation's manag-

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er for computer services, wouldn't reveal the purchase price of the LCS but said if he were renting it the price would be $5-6,000/month, compared to $10,000 for an IBM 2365 LCS. Another route they were considering, upgrading the 50 to a 65 and adding 256K of core to their existing 65, would have cost them $20,000 more a month, he said. "And the way we've done it has given us more throughput than either of the other alternatives."

United formerly used the 65 primarily for batch operations. The 50 was used for on-line, real-time operations. Since the LCS was installed last June, the large on-line real-time operations have been moved to the 65, to which the LCS is hooked most of the time. Peters, noting that a different job mix makes exact comparisons difficult, said "even with additional on-line applications running on the 65, we are able to process 4,000 jobs in two weeks," which is 300 more than they were able to handle before.

Before the LCS, he said, testing time was difficult to schedule. The 50 as a dedicated on-line system could barely accommodate the compiler in the remaining core, and program turnaround was lengthy. Now the 50 is reserved for batch jobs and gets the help of the LCS only when the 65 is down. With the 65 on-line, Peters said, "many regions are available for testing during the prime shift, and the program turnaround has been cut in half."

Data Products, which had some 20 large core store systems installed at the end of '70, still sees a "good future" in the market through 1974. A major competitor and the front runner in the field, Ampex Corp., agrees, and seemingly with good reason.

Ampex, which started selling large core storage systems in mid-'69 and had some 45 systems installed a year ago, expected to have 175 installed at the middle of this month and was estimating the market at $300 million through '74. This was up from a $250 million estimate a year ago when, as one spokesman put it, "we were concerned about people going to 370s in droves. Now we see that's not happening."

Ampex and Data Products were two of a field of three LCS end-user suppliers a year ago. They still are. But the third face has changed. Fabri-Tek, with a total of 10 LCS systems installed, has bowed out of that market in favor of pushing main memory extensions, particularly an add-on for 65s it announced late last year (Dec. 15, p. 83). And Lockheed Electronics, which previously sold LCS units only on an oem basis, has bowed in.

But Lockheed, unlike Data Products and Ampex, isn't betting its marketing efforts on the extend-the-life-of-your-360 fever. It's going after big 360 users, those with 67s and 65s, and at the same time is readying an attack on the 370 market for LCS units.

"Admittedly we won't have the big price advantage there we have in the 360 market," said Ian Ebel, Lockheed's LCS marketing director, "but we feel we can make it on performance. Ebel said Lockheed will offer LCS units to 370/155 and 165 users which will be priced about 10% below IBM's rental and will be twice as fast. Their units for 360/65s and 67s are 50% below IBM's in price and the same in speed.

Ebel said last month that Lockheed already had lined up 15 "good prospects" for 370 LCS units and expected to begin taking orders in "a couple of months for units to be delivered this summer."

All three LCS suppliers still will be up against Fabri-Tek, however. Fabri-Tek considers even its 10 LCS installations as potential converts to main memory add-on. Richard Baker, the firm's vice-president and extended core product manager, said technological advances, especially three-wire plane designs, have made it possible for them to offer main memory extensions that give a user twice the performance at just slightly more cost (or in some cases less cost when auxiliary equipment is included) than LCS units.

Under Test

OCR Could Read for the Blind

A major problem for blind persons is obtaining all the written materials they need in a form they can "read." Only a small percentage can actually read Braille with skill, and the rest must use recordings — seldom available in the quantity and with the timeliness necessary.

Haskins Laboratories, New Haven, Conn., has been researching this problem for almost 20 years. Its hope is that some day major libraries will have centers which can take text, optically read it into a computer-based system, and produce an audio recording — on request. But this hope is millions of dollars and years of effort away.

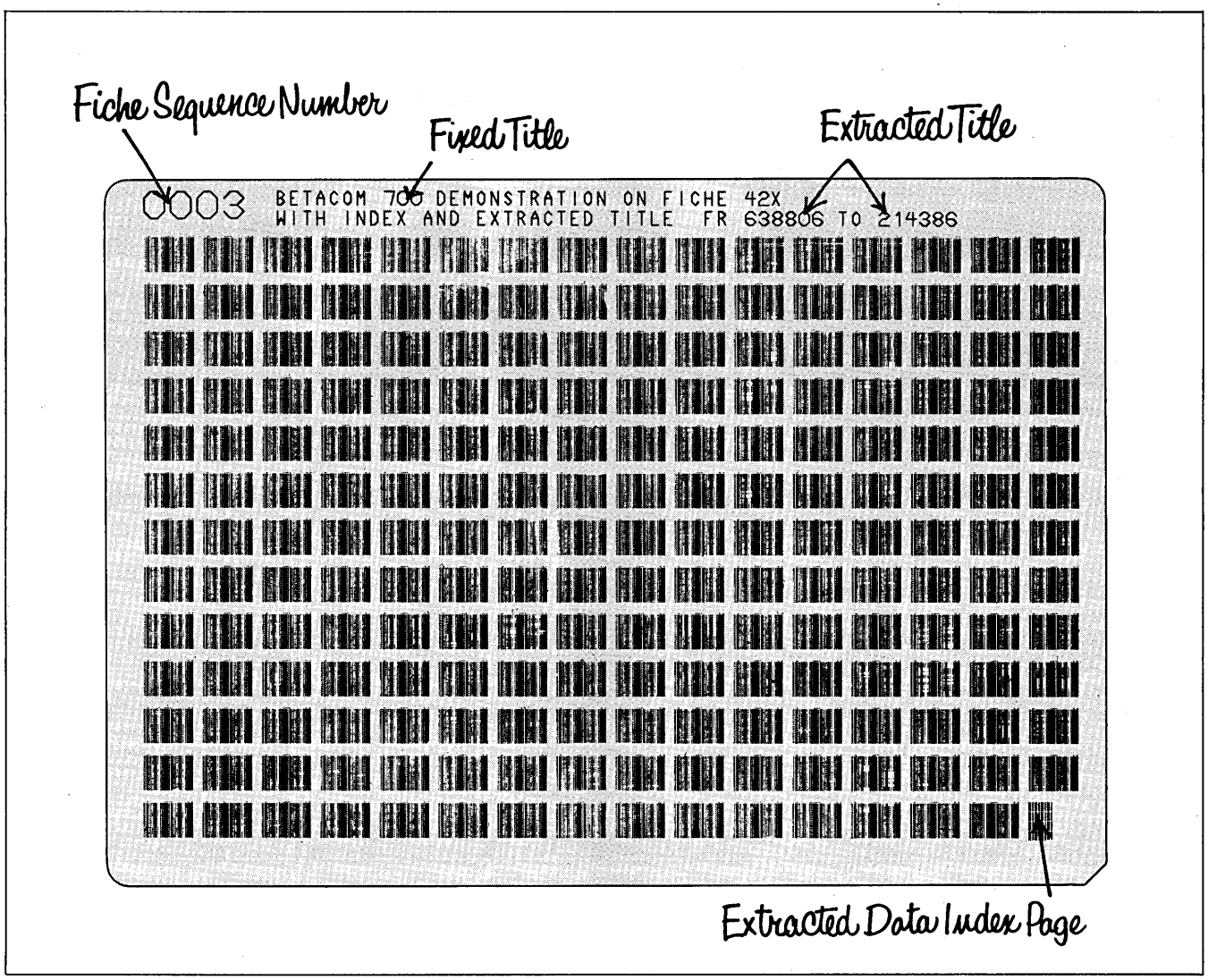
Under a project funded by the Veterans Administration, Haskins is quite close to a technical solution toward that goal. Currently the Laboratories has a computer-based system which accepts text entered through a phonetic keyboard and translates it into an audio recording via a speech synthesizer. But the real key to production of the infinite number of texts that must be recorded is optical character recognition. Toward that end, Haskins, a specialist in research in phonetics and linguistics, is about six to eight months from completion of a 150,000-word dictionary. The disc-stored dictionary will accept the ocr input and translate each word into phonemes which the speech synthesizer will record. And, according to a staff spokesman, Dr. Patrick Nye, when that task is done, the work begins. Next fall, blind students at the Univ. of Connecticut will begin experimenting with the system and help the researchers determine the "economic, technical, and human factors feasibility" of the system, said Nye. Of course, "students are only a subset of the blind community," and the real test will come when a pilot center is made available for general use. Nye feels it will take "two and a half to three years to lead up to the development of such a center."

Besides the major task of human engineering, the biggest problem will be funding. The VA has supported the laboratory development, but "hundreds of thousands" of dollars will be needed in the Univ. of Connecticut experiment alone. Ultimately such a system will also face obstacles like the font limitations and cost of available ocr equipment and the potential copyright problems involved in translating written materials. "We are still a long way from practical implementation," said Nye.

Communications

Interconnection Fight to FCC

AT&T told the FCC's Common Carrier Bureau last month that it would not be a good idea to ease present restrictions on foreign attachments. No one was particularly surprised. Ma Bell has sung



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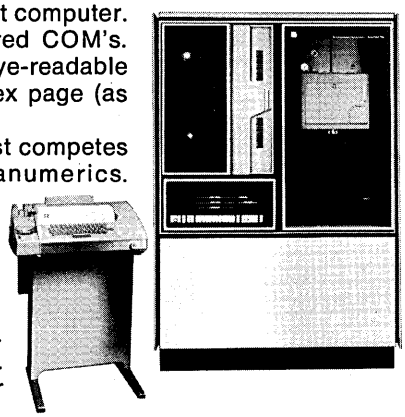

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DATA HANDLING SYSTEMS

the same song many times before. But the AT&T statement produced a rather surprising reaction from the bureau, one that suggests growing disenchantment with Ma Bell's position on foreign attachments.

Bernard Strassburg, chief of the Common Carrier Bureau, suggested a relaxation of foreign attachment restrictions last December. Specifically, he thought Ma Bell should let independent terminal makers who now sell equipment to the phone company on an oem basis sell the same equipment to Bell's dial-up customers without requiring them to rent connecting arrangements. These arrangements now must be obtained exclusively from the phone company and have evoked steadily growing criticism, initially from foreign attachment users, but more recently from state and federal regulatory officials. The critics say that requiring a foreign attachment user to obtain a connecting arrangement from the phone company unnecessarily increases his cost, deprives him of valuable service features, and helps perpetuate the phone company's stranglehold on the dial-up terminal market.

A Common Carrier Bureau official, asked what the next step in the current FCC-AT&T dialogue might be, said, "the bureau has just about shot its wad. The next step is up to the commissioners." He then volunteered the statement that "we don't have the power to issue an order, but if we did we'd tell the phone company to permit direct interconnection, without connecting devices, of Magicall and Codaphone terminals plus any others meeting those standards."

Magicall and Codaphone are trade names for terminals made, respectively, by Dasa Corp. and Ford Industries. The former is a reportory dialer, the latter a message recorder and automatic answering device. Both are made for the phone company according to phone company approved specifications.

Related Developments:

An advisory committee appointed by the FCC several months ago to work out a scheme for attaching independently made PBX equipment directly to the dial-up network ran into more trouble last month: NARUC — the National Association of Regulatory Utility Commissioners — objected to a certification scheme which had been tentatively approved earlier by most members of the advisory committee, including NARUC. A final plan, allowing direct connection of at least some foreign PBX units, is supposed to be completed by April 1. It has been apparent for some time that the group would have trouble meeting this deadline. NARUC's objection makes it even more doubtful.

MCI, which represents the first real competition to the long-established carriers, went into commercial operations between Chicago and St. Louis Jan. 1. The company forecasts revenues of $1.4 million in 1972 and says these will increase to $2.2 million in 1974. MCI offers a number of service features not available from its competitors — notably, foreign attachments can be connected without any MCI-supplied connecting arrangements. Also, MCI rates are considerably less for comparable service. "We expect to file competitive rates within the next few weeks," said an AT&T spokesman.

Western Union and Law Research Service, a computerized information retrieval firm, settled a protracted law suit last month. WU pays the firm $1.4 million and agrees to buy $50,000 worth of services annually for seven years; in return, LRS forgoes $1.1 million in damages awarded by a New York court and drops 18 other suits filed against Western Union.

AT&T has proposed reduced rates for series 200 Data-Phone data sets. Monthly charges would drop from $72 to $47, and installation charges from $100 to $75. Series 200 equipment operates on private lines at 2000 and 2400 bps. The reduction was supposed to be effective Jan. 21, but it has been delayed until the 11th of this month, at the request of EIA. Reportedly, the association suspects Ma Bell is reducing charges in a highly competitive area — modems — while hiking them in a non-competitive area. Recently, AT&T proposed substantial increases in private-line termination charges.

FCC Sizes Staff, Bows to AT&T

Throw away the guidelines. From now on, users can acquire computers solely on the word of the supplier that his machine is priced competitively. And never mind the benchmarks. The salesman says they're unnecessary.

This could be likened to the disheartening position forced upon the Federal Communications Commission's Common Carrier Bureau. Bureau chief Bernard Strassburg has said he just doesn't have sufficient manpower to audit AT&T, so the FCC would have to take Ma Bell's word that it is telling the truth.

All this stems from the FCC's attempt to determine a proper rate of return for AT&T, based on its invested capital. To do this requires that one find out what the invested capital is. And that takes more people than the FCC currently is budgeted for. It is this problem that Strassburg is airing. But some close observers of the data communications scene say Strassburg's announcement was an effort to get the larger budget he seeks. They also admit the people problem is real. One source has even gone so far as to say that if the FCC is too small to regulate AT&T, perhaps the problem should be handed over to the Justice Dept.

Financial

Predictions for Computer Issues

No one would claim that investors are consistently right about the course of stock prices, but the consensus of large bunches of them has often been a reasonably good guide to the fortunes of companies six months to a year in the future. So let's take a look at how those masses of individuals and institutions that make up the market regarded some of the computer stocks at the close of the year's trading.

First, it should be noted that the market as a whole — as represented by the Dow Jones Industrial Average — hasn't really got anywhere for the last five years. Leaving out the decimal points, the average closed at 890 for 1971. But five years ago, in 1967, it closed at 905. It was higher at points in between — 985 during 1968. But the main characteristic has been swings that tend to get sharper and wider, not a succession of record highs.

If you like simple rules for measuring things, it's also worth noting that the average closed out 1970 at 838; from there to 890 gives us an average gain of about 6%. So, if you want to, you can compare the fate of your favorite computer stock to the progress of the 30 grand old companies making up the DJI.

Starting (of course) with IBM, we find one right in line with the average. It closed at 336½, up 18¾, for a gain of

5.9%. Perhaps there is a clue here to which side is right in the continuing argument about whether the computer business is still a vigorous growth industry or is becoming cyclical. That's the only clue, though, from the big mainframers; the other five were all over the lot. Control Data was down 10.3% and NCR fared even worse, down 25.2%. But the others were winners: Sperry Rand was up 20%, Burroughs up 39.8%, and Honeywell up a glorious 60.7%.

A sampling of the mini and midi makers shows most making good gains during the year. Digital Equipment was up 34.5%, Hewlett-Packard up 59.6%, General Automation up about 60%, and Data General about 100%. Two manufacturers that just about came out even in price level were Interdata and Varian. Xerox was in the middle, up about 45%.

The best known firm in facilities management, Electronic Data Systems, closed at exactly the same price in 1971 as it did in 1970 — 46⅛ — despite the wide swing between the year's high of 85¾ and a low of 32¼.

Investors were not very fond of the major software/services firms during the year. Computer Sciences lost about 13%. Computing & Software was down 19%, Informatics down about 15%, and University Computing down 6%. Computer Usage, though, bucked the trend with a gain of about 30%.

Some examples from the peripherals group, each concentrating on different types of equipment, were all down — CalComp 18%, Recognition Equipment 25%, Memorex 41%, and Mohawk 18%.

So it wasn't 1968-69 last year. But it wasn't a complete disaster either, if the stockholder didn't panic at the lows.

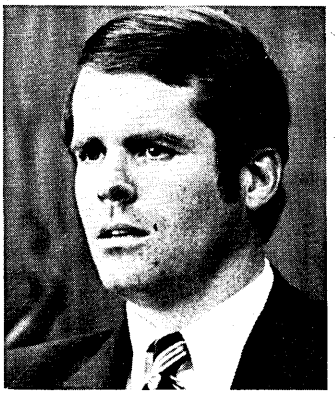
Besides, savings and loan accounts only paid 5%.

—William J. Rolph

Companies

Speak Out at IBM

Outside of the antitrust suits against IBM, most of the computer industry's experts and leaders have been loath to speak publicly on the issue of IBM's dominance and the prospects of a new IBM consent decree — perhaps in 1972. Some say it's because IBM's "contributions and corporate excellence" are difficult to contest and compare. Others claim the financial community gets "powerfully mad" about the negative impact on the ticker. And still others feel "the giant shouldn't be riled." IBM just says the discussion should be left for the courtroom.



D. JAMES GUZY: "If IBM so chooses they shall not compete."

A few stalwarts have gone to the podium, but their words have often been clouded or buried. For example,

ex-RCAer Brian Pollard broached the issue in an historical session at the Fall Joint Computer Conference. He asserted that since only the rich can afford the rental business, manufacturers should be required to sell only, providing more competitors with a chance to survive. But the session ended and the audience didn't get a question in.

D. James Guzy, executive vice president of Memorex, spoke out in his own dramatic press conference in November. He rapped hard on IBM's exercise of power over the industry: "There is no strategy, no superior logic that will enable any company in this business to compete; *if IBM so chooses they shall not compete.*"

Guzy also called for a special presidential commission to study and recommend the "means by which essential competition can be restored to the computer industry." But he was figuratively booed off the podium by angry journalists because he didn't fulfill the promise made in an advance telegram (printed in that day's papers): to provide a six-point program for dismantling IBM. Too, Memorex's own competitive and legal battles with IBM tainted Guzy's contention that he spoke only as an "industry statesman."

Still, Guzy's opinions on what should be done to IBM and why were implied in his speech, and in an interview with *Datamation* he tried to clarify them. Whether or not one agreed with his ideas, "the restructuring of the industry is too complex for IBM and the government to negotiate in private," he said. IBM's "legal budget is 50 times greater than the entire funding of the Anti-Trust Division," so the justice Department alone doesn't have the resources to devise a truly "constructive blueprint." While he held no real hope that a commission would be appointed, he insisted the industry, users, and experts from economics, law, political science, sociology, etc., had to participate in the restructuring. The time alloted for public comment on a consent decree is 30-60 days, and "that's nonsense.

"I'm concerned that IBM is going to do exactly the same thing it did with the 1956 decree," he said. In his view, IBM's "supreme sacrifices" in its punched card and service bureau business under that decree were used to "strategize for a new monopoly." The customer base that had been built by and "locked into" those operations was moved over to small computers (1400 series) IBM announced a few years later, he contended.

Guzy's own opinion is that three basic actions should be taken with IBM. First, he reasserted that IBM should be dismantled. The break-up, he specified, should be "horizontal, by product line." As the "user migrates upward, he should have to make a new decision on a vendor." In other words, no single IBM could provide a full line of small-to-large systems. Coincident with that, the industry would have to develop hardware and software standards that would make this possible.

Guzy disputed the idea that the result would be several monopolies. The answer lay in the second action. Besides total divestiture, there would be "distribution of ownership" to prevent each new entity from having access to all IBM's capital. (Ownership of Service Bureau Corp. was not distributed.) Guzy would like to see how an IBM small computer business would fare without access to the total capital base.

"What makes IBM strong is their money. T.V. Anybody could run that company ... They have made mistakes, simple mistakes, that they could afford, but would have been disastrous to others." In his speech, Guzy had exclaimed that "with the incredible capital

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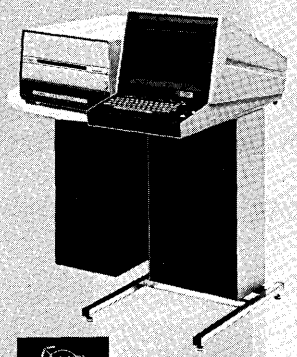

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requirements existing in the data processing industry, IBM's $1.5 billion in cash items stands as an affront to the concept that a competitive industry is self-controlling with regard to private economic power." Nowhere, Guzy asserted, is the economic imbalance in favor of one company as great as in the computer industry; and if the industry grows from $12 to $50 billion by 1980, as he projects, "the imbalance will be four times as great," unless IBM is restrained.

Finally, Guzy suggested that IBM should be forced to share its technological developments with the industry, particularly in sectors like components.

The young Memorex executive paced back and forth, tracing U.S. economic history, outlining how the computer industry is an "analog of America itself," and repeating examples of how IBM had used its power to "bludgeon competition." There had been the massing of free support to sweep customers away from the hapless RCA and GE, the premature announcements of supercomputers to fight competition, price-cutting in peripherals, numerous moves to stave off the leasing companies.

Still in his speech, he'd felt compelled to say that "the unchallenged primacy of IBM in the computer business has been won by generally responsible action and intelligent policy and with few, but notable, exercises of monopolistic power." Still again, "I must also insist that IBM's dominance and capacity for monopolistic action is not in the best interests of our society, our industry, or our profession . . . I am concerned . . . this industry will continue under the control and at the initiative of, a single private corporation . . . "

In another arena, the "single private corporation" sought further to establish that there is competition. IBM, battling the Control Data and Greyhound suits, sent depositions for information to 700 more firms — bringing the total to 3,400.

— Angeline Pantages

New Commo Service from WU

A new communications service, designed primarily for computer network operators, is expected to be unveiled by Western Union this month. Tentatively dubbed "CDS" (for Computer Data Service), it offers the prospect of lower circuit costs, reduced investment in terminal and switching hardware, and greater reliability. A CDS system is already in operation at Travelers Insurance Co., and WU is negotiating with a large retail chain for installation of another.

Essentially, CDS is a multipoint, private line communications system which can link as many as 4,000 remote terminals to two customer computer sites. Between the ends of the system are a number of intermediate nodes, a feature that helps pinpoint interrupts and facilitates patching around them. The system is automatically monitored, on a continuous basis, so problems can be detected quickly. Also, messages travel in modulated digital form between the computers and the remote terminals, which further improves reliability. "After the system has been on the market for about a year, we expect to offer guaranteed error performance," says a WU spokesman.

A typical CDS consists of two central processors at separate customer locations. They're connected by full-duplex, broadband channels (56 kilobit capacity) to a "network control station" (NCS) which monitors the system and polls the out-station circuits linked to it. There are up to 10 of these.

Data can move either way through the CDS network at speeds up to 4800 baud. The tariff Western Union is expected to file this month will be restricted to 1200-and 2400-baud service, however.

Teletypewriters, as well as all of the other commonly used keyboard terminals, can be attached to the system in addition to graphic display units, computers, and any others having digital outputs.

Monthly line charges for 2400-baud CDS service will be $1.25/mile for the first 250 miles, 95¢/mile for the next 250, and 75¢/mile beyond 500 miles. There is a charge of $90 per month per multiline controller (MLC), which includes network monitoring service, modems at the related CCU (call control unit) locations, and local line charges between the latter and former points. (If interexchange channels are needed to span this gap, they cost extra.) Each CCU costs $40 per month.

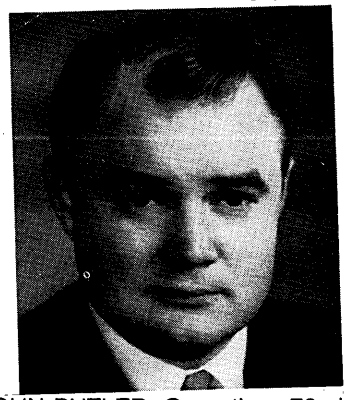
The total cost of a typical system, says WU, averages $240-300 per CCU location, and $268 per terminal (including the terminal rental). This estimate is based on a system encompassing 600 CCU locations, 840 terminals, and 275 channel miles. The comparable cost for individual interexchange channels connecting the same points is "at least 40% higher."

RCA Users Are Series 70 Now

They're calling it Series 70 Operations. It used to be the RCA computer customer base, but now it's a new operational group of the Univac Div. of Sperry Rand Corp.

Running it is the job of 38-year-old John C. Butler, who last month was named vice president and general manager, Series 70 Operations. The RCA customer officially became Univac's on Jan. 1 following a final agreement signed by executives of both Sperry Rand and RCA Corp. Dec. 17. It was the culmination of a whirlwind of negotiating which included signing of a preliminary agreement Nov. 19 followed by a quickie tour of the country by top Univac execs who talked to RCA users in an effort at a quick evaluation of what they were buying. It must have been satisfactory. They bought. And the new head of Series 70 was one of the chief advocates of the purchase of the RCA base from the very beginning.

Butler has spent all of his working years with Univac, having joined the



JOHN BUTLER: Operations 70 chief

company in 1960 following college and the service. He joined as manager of large-scale system sales for the eastern region and progressed through various regional executive posts to become

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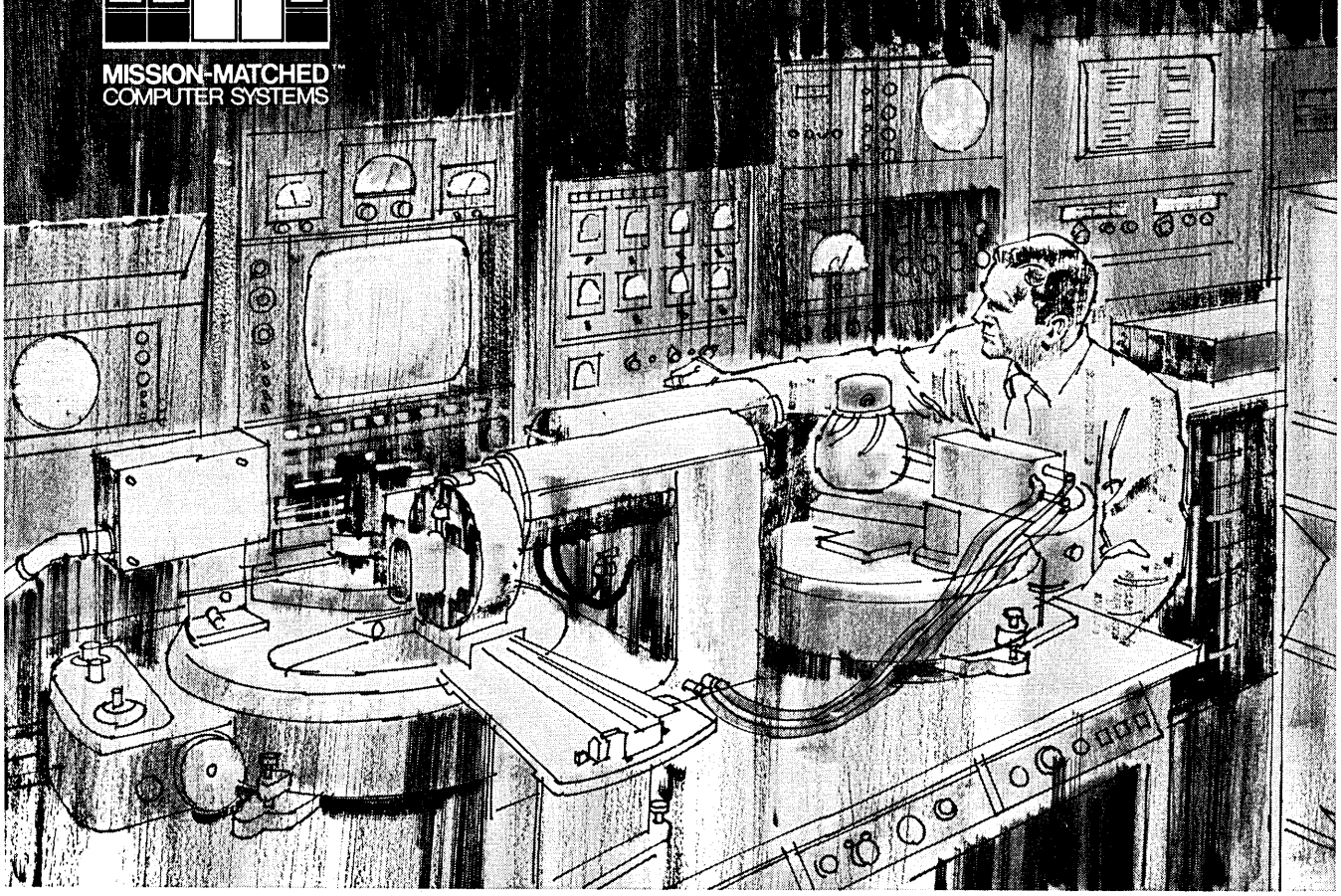

vice-president-national accounts in the Univac Americas Div. in 1970. It was this job he vacated to take on Series 70.

And he takes on supervision of some 2,500 suddenly transformed RCA employees who changed to Univac hats Jan. 1. And some Univac people are on his team too. So lets hope integration works.

Governments

Welfare Reform for $4 Million

In mid-January a "little old lady" in Ventura, Calif., filed a suit in her county's small claims court for $10. The defendants were California's governor, Ronald Reagan, the state's social welfare director, Robert B. Carleson, and the welfare department of Ventura County.

Hers might be termed a crank case, but it got statewide press coverage and was categorized as a class action on behalf "of all the little old ladies and gents in nursing homes." It was, in effect, a demand for two months' back payment of a $5/month raise in state old age assistance which excepted recipients living in nursing homes.

Whatever the outcome of the case, the attention it drew from the press exemplifies something. Welfare expenditures are being watched, and reforms are being damanded.

And the state of California last month was about to award a contract to a major computer firm for what ultimately would be a $4 million (implementation), $28.5 million per year (operating costs) computer-based "Expanded Data Reporting System" (EDRS). The initial contract, for $800,000, was to be awarded in December 1971. In mid-January, although the State Dept. of Social Welfare had selected a vendor and passed on its recommendation to the Dept. of Finance, which has the final say in state edp procurements, the contract had not been awarded, and it was expected, according to one government spokesman, "to reach the cabinet level" before any decision could be made.

Why? Politics, said most concerned parties. But some common-sense edp-level objections also were raised to the rfp put out by the Social Welfare department.

The proposed system is supposed to make it easy and expedient for California's 38 counties to communicate pertinent data from their welfare case loads to the SDSW. A feasibility study by SDSW preceded the issuing of the rfp. The rfp brought in proposals from "seven qualified vendors plus a few token proposals," according to Carl Williams, EDRS project manager.

SDSW evaluated the responses and made its selection. It all seemed routine, and the recommended vendor (sources say it was either Burroughs or IBM) probably would have gotten the initial contract in December except for a monkey wrench in the form of an eight-page letter from the state's legislative analyst's office.

The letter was addressed to SDSW director Carleson with copies to a number of other state bodies, including the Dept. of Finance. It recommended delay of the EDRS project on grounds which many who have tried to implement big systems too fast might secretly endorse. The rfp, said the analyst's letter, called for installation of the system in seven months' time, a period the analyst deemed "unrealistic." (An official of a

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California county listed in the rfp as a participant in the project went further. He said "no way.") But seven proposals came through, and even critics of the rfp refused to fault the vendors. "These are tough times," said one, "and they can write commitments into their proposals which they know the state can't meet and thus lift the time constraint."

But getting a big on-line, real-time system going fast has often cost more than doing it slowly. A case in point might be New York's off-track betting system, which some say should have had a dedicated control system instead of OS/360 but got stuck with the latter and its attendant problems because of the crash nature of the project.

But there were other objections to the SDSW rfp. In fact, objections were legion. Among them was the fact that the counties listed in the rfp as pilot counties for the project either didn't know about it or had strenuously objected to the project and had declined to participate.

One which declined, Santa Clara County, had done so in writing at least four times. Tom Johnson of the county's data processing department, a former social worker and a strong supporter of welfare reform "if and when it benefits recipients," said the state failed, after several requests, to give Santa Clara County cost/benefit figures for EDRS.

Santa Clara County developed a working edp system for its welfare department's day-to-day operations back in 1968. This system, called Case Data System, currently is the property of a private contractor, Alpha Beta Associates of San Jose, and is used by seven California counties. Three more are said to be considering it.

According to Johnson, comparing CDS to EDRS is like "comparing apples and oranges," since the former really handles operational problems of county welfare departments, while the latter is concerned only with statistical reporting to the state. Yet comparisons have been made by SDSW which reportedly deterred at least one county which was considering it from going to CDS.

And, says Johnson, we have to think of what the federal government might do. "Welfare rules are changing. It's OK to build a simple system that will work under existing circumstances for a few years — but $4 million?"

The question of federal participation in EDRS was among those raised in the analyst's letter. It stated: "We also note in the feasibility study that only *tentative approval* has been granted by the federal government for $150,000 of the funds required for Phase I and Phase II of the project. Although it is indicated that this $150,000, once appropriated by the federal government, can then be matched equally by another federal grant, the department in fact has no federal commitment for $300,000 of the $1,283,880 required during the current fiscal year." In other words, federal support is pretty iffy.

And then there was the biggest objection of the analyst's office — lack of legislative review of the rfp. But then the state's legislature had finally adjourned after its longest session in history when the recommendation to award a contract reached the Dept. of Finance.

And the Dept. of Finance is relatively new to the job of approving or disapproving edp expenditures, having taken it on only last July when the state's Office of Management Services was budgeted out of existence (Aug. 15, p. 39).

But a Finance spokesman had a comment on the legislative analyst's objections to the SDSW rfp.

"The analyst's office looks at things from a different angle. I won't say that we agree with their objections, but I won't say we disagree either."

Lots of luck to the little old lady in Ventura.

— Edith Myers

LEAA Official Linked to DP Firm

Conflict of interest charges involving a Houston systems consulting firm and a regional administrator of the Law Enforcement Assistance Administration (LEAA) were the object of three separate investigations last month. One likely result is that administrators of the program will have a harder time obtaining funds to continue it. A substantial percentage of LEAA money is being invested in information systems.

The official at the center of the storm is John Hickey, an ex-FBI agent who was director of the Arkansas Crime Commission for nearly two years; last summer, he was promoted to head of LEAA's regional office in Dallas. According to a story published in the Arkansas Democrat last December, Hickey purchased a minority interest in Management-Computer Interlock, Inc., of Houston, in 1969. Subsequently the Arkansas Crime Commission, while Hickey was its director, awarded contracts to the Houston firm worth $600K.

The newspaper account suggests that some of these contracts were awarded on a sole-source basis, at least partly because of Hickey's explicit recommendation. One of the contracts involved a management study for the state corrections commission. The commission chairman, John Haley, is quoted as being dissatisfied with the job.

Hickey reportedly insists that his mother purchased the stock and that he didn't want her to. In any event, about three months after Hickey became a stockholder, Interlock, Inc. (as the firm is now called) won its first contract from the Arkansas Crime Commission.

Currently Hickey is on "voluntary leave" from LEAA. According to the Arkansas Democrat, Interlock stock has also been acquired by the present and former head of the state police, plus a member of the corrections commission. Together with Hickey, they are said to own $15,000 worth.

The governor of Arkansas, Dale Bumpers, is investigating this tie-up for possible violation of state securities and conflict-of-interest laws. Meanwhile, the state attorney general is checking possible criminal violations.

The FBI has entered the case on behalf of LEAA administrator Jerris Leonard, who is "deeply disturbed."

Rep. John Monagan, of Connecticut, says the case "raises additional questions about the integrity of LEAA's operations."

Software

Ferguson Leaves Programmatics

Whither software companies?

David E. Ferguson, who early this year quit the presidency of Programmatics, Inc., a Los Angeles subsidiary of Applied Data Research, Inc., of Princeton, N.J., thinks the way to profitability for them is through proprietary packages rather than contract programming. He said it was a disagreement on this issue that led to the split.

The new president, Richard C. Jones, who acquired a 35% interest in Programmatics in return for about $150,000 that will be used as working capital, has an option to buy a controlling interest before April 1. Jones was president of ADR before retiring in May 1970. ADR acquired Programmatics in 1969, a year after both firms had received widespread attention by filling a $900 million antitrust suit against IBM. IBM settled out of court for $2 million in cash and a promise to market some of ADR's software products.

With that $2 million infusion of cash just about depleted, ADR last year sold its computer centers in Washington and Princeton. In mid-1971, its president John R. Bennett predicted a better second half (it lost $310,000 in the first half), citing as one factor a large backlog held by Programmatics. But in January, Jones said this had withered. He said Programmatics was actively pursuing contract programming work to provide it with immediate business and would pursue development of proprietary packages at a later date. Contract work accounts for 90% of the firm's revenue, and Ferguson had hoped to

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pare this to 50%.

ADR retains PI SORT, a sort package licensed to some 60 customers. Programmatics' lastest product is a FORTRAN compiler called PI FORT, for the System/3 market. It was to have been the first of many packages the company would develop to offset its dependence on contract work. But Jones said only three PI FORT packages had been sold in January. The staff had been chopped to 16 from a high of 34. "Our first move had to be a mundane one — search out contract programming work to stay in business."

A System/3, on which the firm had been developing packages at its West Los Angeles offices, will be returned to IBM to save the firm $2600 a month in rental costs.

Ferguson insists contract systems programming is too competitive to be profitable. He said he will now pursue his plans to develop System/3 packages on his own. But Jones and Ferguson are long-time friends and sports car buffs, and Jones said he expects Ferguson will maintain some form of "consulting" association with Programmatics, the company he formed in 1963.

Shortlines

Point of sale, as a market, is bigger and better than ever. Singer's Friden Div., under its new name, Business Machines Div. of the Singer Co., said last month it has "achieved a commanding position" in the market. Orders for its Modular Data Transaction System point-of-sale terminals now exceed $100 million. Documentor Sciences, which has had something of a head start in the fast-food POS market, said it has signed up two "of the nation's leading fast-food organizations." One was named — Gino's Inc. The other was "an industry leader in hamburger-type fast-food outlets (McDonalds at last?). And American Regitel, San Carlos, Calif., is laying claim to having installed "the nation's largest system of electronic cash registers controlled by a minicomputer" at the Northridge department store of Gimbel's Midwest, the Milwaukee-based division of Gimbel Brothers, Inc. . . . Tulsa-based Comptran Computer Corp. isn't called that any more, and it's said to be twice as big as it used to be (by the management). The enlarged version of CCC calls itself The Mentor Corp. and says it is "one of the largest computer service companies in the Southwest" . . . Computer Dynamics, Inc., Oakland dp services firm, agreed to purchase Pacific Data Services . . . Fairfield Communities Land Co., Little Rock, Ark., has been merged into Computer Property Corp., New York City . . . EPSCO, Inc., Westwood, Mass., said its wholly owned subsidiary, the Edityper Corp., has sold its automatic typewriting and word processing business, trade names, and certain assets to Edityper Systems Corp., a subsidiary of Terminal Equipment Corp., Pompton Lakes, N.J., for cash and Terminal common stock . . . Pertec Corp., Los Angeles, and its affiliate, Allison Coupon Corp., Indianapolis, agreed to combine Cummins-Chicago (an Allison company) and the Printing Div. of Allison with Pertec . . . UCLA (the Univ. of California at Los Angeles) is claiming the largest computer network of any university in the world following linking of its system to those of the 19 California state colleges. Guess the state colleges could make the same claim on their academic level. □

Hardware

Product Notes . . .

Though final figures are not in, it appears MOS integrated circuits increased their share of the total digital market pie from 17% in 1970 to around 25% in 1971, according to figures released by Motorola Semiconductor Products, Inc., in Phoenix. The size of the market was around $350 million for '70 and '71. It's expected to more than double by 1975, and the Electronics Industries Association predicts MOS will have 43% of it.

While on the subject of circuitry, TRW Inc., in Redondo Beach, Calif., has developed a process for making triple-diffused bipolar LSI circuitry said to make add times of 100 nsec economically practical in minicomputers. That's about 10 times faster than average minis, and three times faster than the very fast Data General Supernova SC. TRW will license the process to manufacturers.

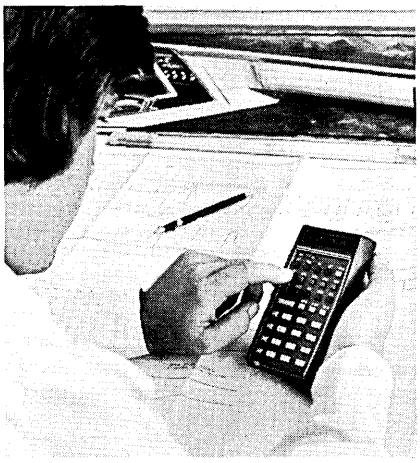
"A calculated risk," says president W. R. Hewlett of his company's entry into the pocket calculator market. "We may sell 5,000 or 50,000 of them, but we feel there are 3 million people who could use them."

Universities that add micro-programming courses to their curricula are offered discounts on micro-programmable computers by their manufacturer, Microdata Corp. of Santa Ana, Calif. So far, says Microdata, 15 schools have signed up.

Pocket Calculator

We may have to wait a few more years for the "wrist watch" computer to arrive, but here is a product available now that might suffice until that day comes. It's a powerful pocket-sized calculator weighing only 9 ounces. It does computations ranging from addition and subtraction (typically in 60 msec) through multiplication and division, square root, and logarithmic functions, to the more difficult trigonometric functions, which require typically 500 msec. The HP-35 is perhaps better than a slide rule because it keeps track of decimal point placement, which should eliminate magnitude errors. Numbers as small as 1×10^{-99} and almost as large as 1×10^{100} can be handled, with answers appearing across the light-emitting-diode display.

The HP-35 can be used for three hours of computing before the battery must be recharged, and the battery is



capable of some 500 recharges. It can also be plugged into a wall socket. A battery charger comes with the HP-35, and the calculator can be operated during the recharging process.

For $395, the buyer gets the calculator, the battery charger/a.c. hookup, a leather carrying case, name tags, an instruction manual, and a travel case. It will be sold primarily by direct mail. HEWLETT-PACKARD CO., Palo Alto, Calif. For information:
CIRCLE 237 ON READER CARD

3330 Replacement

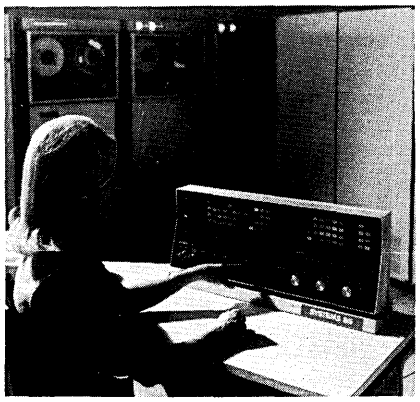
The DD 4330/DC 5830 disc storage facility is an alternative to the IBM 3330 disc, having the same 800-megabyte capacity, the same transfer rate of 806 KB, and even the same power consumption and physical size. Its access times are a little quicker, however, with an average of 25 msec, a maximum of 45 msec, and a single cylinder track-to-track jump requiring 3.5 msec. Those differences can save money over a period of time. The controller will rent for $1810/month when it becomes available in June of next year; an optional two-channel switch for connecting it to separate channels on 360 model 85s and 195s and the 370 series will rent for an additional $150. Each two-spindle, 200-megabyte 4330 drive rents for $1030. POTTER INSTRUMENT CO., INC., Melville, N.Y. For information:
CIRCLE 240 ON READER CARD

Storage Upgrade

Now that there are several companies capable of upgrading the 360 model 30 to 128K of memory from its prior limit of 64K, this firm has developed a way to take 30s up to 256K 1.5-usec bytes. It can be done 45 days ARO, and the purchase price for the 64 to 256 kilobyte jump is $139,500. COMPUTER HARDWARE CONSULTANTS AND SERVICES, INC., Warrington, Pa. For information:
CIRCLE 238 ON READER CARD

Computer System

The Systems 85 is a little brother to the firm's Systems 86 (see Sept. 1969, p. 86) and is similar in many ways. This model, however, is restricted to a single processor, has no memory interleaving for its 8-128K 850-nsec core; but there's still bit, byte, halfword, word, or double word addressability for the basically 32-bit word machine. The I/O bus of the model 85 makes each of the up to 16 channels into selector channels, each running at up to 1.17-megaword/second rates. Some little brother. Arithmetic is 2's complement, hexa-



decimal, and binary.

A 24K configuration of the 85, including a FORTRAN monitor, console tty, 6 megabytes of moving-head disc capacity, a 300-lpm printer, a 300-cpm reader, and a paper tape reader/punch

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- ☐ OS/360 Job Control Language
- ☐ OS/360 Techniques and Aids
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- ☐ OS/360 Core Dumps—MFT
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- ☐ Reading Efficiency System
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edutronics

Edutronics Systems International, Inc.
3345 Wilshire Boulevard, Los Angeles, California 90010.

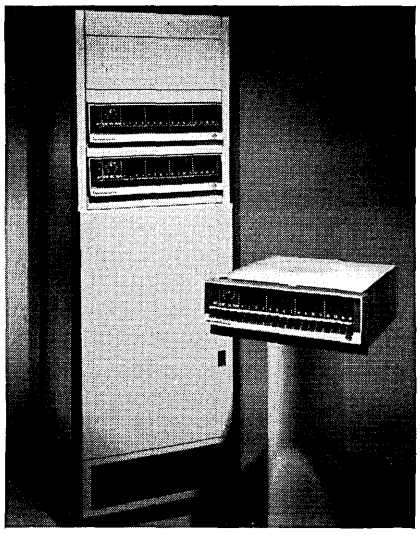
is priced at $170,500. That would seem to be the lowest priced 32-bit machine around. Deliveries begin in July. SYSTEMS ENGINEERING LABORATORIES, INC., Ft. Lauderdale, Fla. For information:
CIRCLE 239 ON READER CARD

Disc Storage

This primarily oem-oriented manufacturer is testing the end-user market with a line of head-per-track disc systems for the Digital Equipment PDP-8/I/L and Digital Computer Controls D-112, and the Data General 16-bit mini line-up. The DMS-8 and DMS-16 discs range from 64K to over a million words of capacity, with average access times of 8.3 msec. The memories are supplied with controller, software, power supply, and cables for approximately $7695, and are available 90 days ARO. DIGITAL DEVELOPMENT CORP., San Diego, Calif. For information:
CIRCLE 252 ON READER CARD

Communications Minis

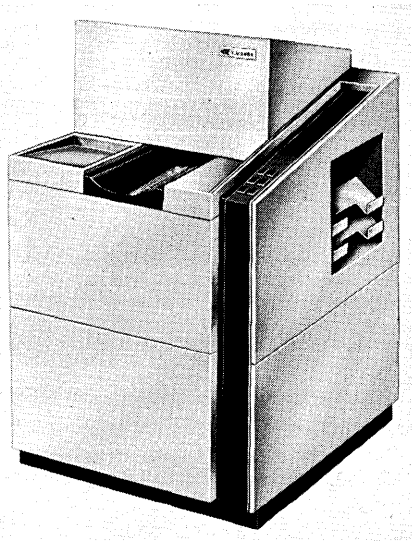
Data communications and real-time applications for end users and oem's are the principal targets for the models 50 and 55 16-bit minicomputers, further broadening this manufacturer's recently announced New Series. The model 50 is a single cpu model that has



80-nsec ROM as its heart for instruction implementation. The instruction set has had some surgery performed: 26 general-purpose instructions have been removed in favor of 26 others that are better at doing real-time and communications work. Regular memory is 1-usec core, expandable from 8 to 64K. With 8K of core and a tty interface, this model sells for $6800.

The more powerful model 55 is a dual processor, with 227 g-p and communications-oriented instructions between them. A memory controller permits each processor to access a common memory partition concurrently with the other, while each cpu retains a private memory. The memory performance and allotment characteristics are the same as the model 50 above. This model is $15,900 with 16K of memory and the tty interface. A real-time monitor is included in these prices, and there are a number of software packages available. INTERDATA, Oceanport, N.J. For information:
CIRCLE 241 ON READER CARD

product spotlight



Laser OCR Reader

Laser light and fiber optics technology have been combined in the LV-2000 ocr page reader, the letters "lv" standing for laser vision. A laser was chosen the light source because it requires much less power than a high-intensity standard light bulb, generates less heat than such a bulb, and the laser can reasonably be expected to last about five years before needing replacement.

The unit recognizes Logic Font, a modified bar code that is printed underneath regular upper and lower case alphanumeric characters by Selectric typewriters equipped with a special "golf ball" (priced at $18 or so). The LV-2000 reads at 2,000 cps, accommodating documents up to 9 x 11 inches in its vacuum paper transport. This rate translates to 8½ x 11-inch documents being read in six seconds, and the documents can have the printing spaced three or six lines/inch, with 80 characters/line maximum. The software in the LV-2000's minicomputer can be set to reject on character, line, or page error.

Several different models are available, and they'll be pitched at everything from current users of machines with the performance of the CDC 915, down to keypunch installations having as few as three units. Available during the first quarter, an LV-2000, including minicomputer and 7- or 9-track tape drive, sells for $30K and can be rented for about $1200/month. CREATIVE LOGIC CORP., Paramus, N.J. For information:
CIRCLE 236 ON READER CARD

Microfilm Terminal

The DMS Microsearch System is a terminal that stores 16mm microfilm in cassettes. Only the indexing and current updated information reside in the computer. As new documents are received and placed on microfilm, indexing information is entered into the computer via a tty-like keyboard on the terminal. The index can consist of any number of parameters or search keys, such as name, date, key words, or identifying numbers. When the operator is instructed by the computer to load a particular cassette, it is automatically advanced to the proper location, and a strip printer types out updated information. The terminal with an acoustic coupler leases for $465/month on a one-year contract. A hard-copy attachment is offered as an option. STROMBERG DATAGRAPHIX, INC., San Diego, Calif. For information:
CIRCLE 243 ON READER CARD

Magnetic Tape Units

Already offering its plotters, discs, and other pieces of dp gear throughout the country, this company has decided to enter the tape drive field. The first product is called the 1040 system, con-

sisting of a 1040 controller and a large number of 340 series magnetic tape units. These drives can be selected as plug-compatible replacements for IBM's 2420 and 2401 magnetic tape systems, as well as the recently announced IBM 3420 models 5 and 7. Rental on the 1040 controller is $559/month (one-year lease), and a 3420 mod 5 125-ips tape drive replacement is $463. Production deliveries are scheduled for June. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif. For information:
CIRCLE 244 ON READER CARD

Disc Drive

Latest to announce a 3330-like disc drive subsystem for the IBM 370 market is ITEL Corp., who says its lease prices will be 10% below IBM rental plans and that purchase price for the controller is nearly $18,000 below IBM's $95,880. The system, called the 7330 (the controller is the model 7830), retains all the specs of the IBM systems: 100 million bytes per spindle; 27 msec average access time; 806 KB transfer rate; 3600-rpm disc rotational speed. A reliability feature: Before any newly loaded disc pack is activated, a check of 100 factors in the system is made automatically to identify any problems. Models are to be ready for delivery in August. ITEL CORP., San Francisco, Calif., For information:
CIRCLE 257 ON READER CARD

Core Storage

Apparently the potential revenue obtainable by replacing memories on Univac 1100 and 400 series computers reached critical mass for this manufacturer—which happened to offer the first plug-compatible core for IBM systems some years ago. The ARM-1108 is available in 64K-word modules up to a maximum 256K words, and it is both electronically and logically compatible. A 64K module rents for $8325/month on a one-year contract. AMPEX CORP., Marina del Rey, Calif. For information:
CIRCLE 251 ON READER CARD

Remote Terminals

The latest addition to the COPE terminal line is the 1200 series. The basis of the series is the UCC-12 communications processor which enables data to be transmitted at rates ranging from 2,000 to 50,000 baud. A communications console is provided along with two 4,800-baud voice-grade channels, four peripheral I/O channels, and the customer's choice of 4,800-baud half- or full-duplex communications interface. A second model has four voice-grade and/or Telpac A channels.

There is a choice of various speed card readers, printers, plotters, tape units, paper tape, and even verify/interpreting keypunches. Software includes an rpg, utility programs, and packages that allow the 1200 series to function as IBM 2780 and 1130 units, 360/20 or 360/25, Control Data UT-200, or Univac 1004, 1005, 9200 and 9300 terminals. A 4K model with communications interface, card reader and line printer rents for $665 on a one-year contract. Delivery is approximately 30 days. UNIVERSITY COMPUTING CO., Dallas, Texas. For information:
CIRCLE 253 ON READER CARD

Computer Series

The 2000 series represents Honeywell's second major product line improvement in the past 12 months. Last year the 6000 series came in for some major changes. Byte manipulation capability was added, and so was a black box containing instructions that ran COBOL faster than the prior 600 series. And there were bigger, faster peripherals with faster channels to accommodate them. It worked—the 6000s started selling better than even HIS thought they would, according to a source.

This year the 200 series, of which there are several thousand in the


0685

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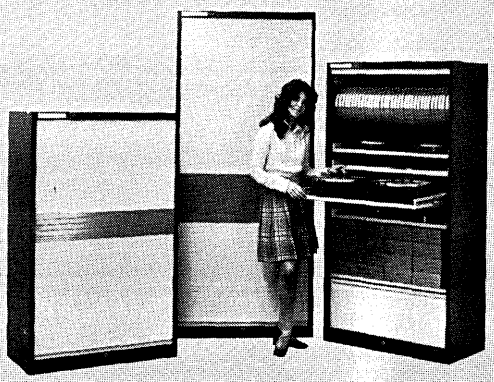
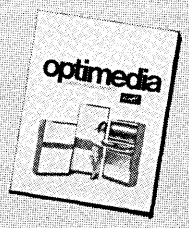




Wright LINE

MEDIA MANAGEMENT SYSTEMS

CIRCLE 69 ON READER CARD

world, gets its "0" added: The 2000 series features improvements principally in communications capabilities, memory allotments (and prices of them), and software. There are five machines in the line-up. They are grow-to models for the 200 series starting at the model 200/115, and compete with the IBM 370 models 135, 145, (and perhaps even the 155, but we'll have to wait for benchmarks), the XDS Sigma 6, Univac 9000 series, and others. The first four models, the 2040, 2050, 2060, and the 2070, are single-cpu systems; and the top-of-the-line model 2088 has dual processors.

The 2040 starts off the series with 48K of six-bit characters cycling at 1.6 usec, expandable to 128K. The cpu fetches one character a cycle. Up to eight peripherals can be sharing that memory simultaneously with program execution. There is direct, indirect, or indexed addressing of memory using 2-, 3-, or 4-character addressing modes. A system with 48K, a card reader, card punch, printer, console, and a 36-megabyte disc system rents for $6152 on a five-year contract, and is available 90 days ARO.

The model 2050 is much like the 2040, but its memory starts and finishes twice as large as the 2040, with 96K minimum, 256K maximum. Two characters are fetched per cycle on this one, and 12 parallel I/O operations can be in progress during program execution. A typical configuration here includes 96K of memory, five tape drives, a printer, card reader, card

punch, and 192-megabyte disc system for $11,674 on a five-year contract.

The 2060 memory cycle time drops to 1.14 usec for two characters, and memory goes from 128-512K characters. Typical configurations for this model run $16,171/month on a five-year contract.

A 2070 gets the same memory allotment as the 2060, but the cycle time is a bit faster at an even 1 usec, and four characters are fetched in the cycle. This model has a feature allowing the operator to logically bypass any 64K memory chunk. Channel rates on this model are up to 2.5 million characters per second. A typical 2070 system leases for $21,761/month.

The 2088 has two physically identical processors, each with a separate memory and I/O controller. While one processor can be handling real-time inquiries from remote terminals, the other can be concentrating on batch jobs. Memory for the 2088 is available in 512K, 768K, or 1-megacharacter boxes with cycle times of 750 nsec, four characters to an access. This model can have up to 32 peripheral operations in progress during program execution. For $36,888/month on a five-year lease, a user gets two cpu's with 256K of memory each; a memory controller; an I/O controller; a memory-to-memory transfer unit; two scientific units that perform floating-point operations, binary/decimal conversion, and mantissa shifts; a crt operator's console; six tape drives; a card reader; punch; two printers; and 320 million characters of disc storage. Seems like a lot for the money.

Assigned to the Datanet 2000 is the responsibility of processing remote information from up to 120 lines. Typically, 64 asynchronous low-speed lines rent for $1382 on a five-year contract.

The MOD 4 operating system is required on the dual-processor 2088 and

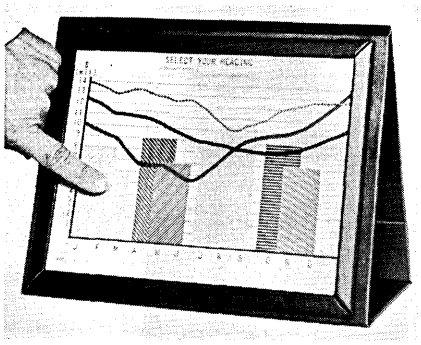
can also be run on the four smaller machines for batch and real-time work loads. Chances are, however, that more machines will be ordered with the OS/2000 monitor that permits up to 15 jobs to be run concurrently. The monitor supports ANSI COBOL (in 32K), a FORTRAN compiler, and the Easycoder assembler. Up to 10 of the program partitions can be hardware protected and can be dynamically altered to make up five for remote jobs, five for batch, etc. All partitions can access data base information simultaneously.

All things considered, the 2000 series is balanced, appears to offer lots of features for the money, and should sell well. HONEYWELL INFORMATION SYSTEMS, INC., Wellesley Hills, Mass. For information:

CIRCLE 282 ON READER CARD

Graphic Display Aid

Few ways of presenting information are more effective than graphs, and the Graphmatic kit, priced at $88, has some nice features. Chart paper measuring 8½ x 11 inches is inserted into the Graphmatic by the user after he has made up the headings for the chart. A magnetic plate inside holds the bar-sheets and bend-lines in place until necessary to change the values. The



Graphmatic comes with a quantity of graph-sheets in five variations and everything necessary to start drawing graphs. When the graph makes sense, it can be placed on a copier to produce multiple hard copies. The kit is supplied with a carrying case. COMMUNICATION AIDS, INC., Kalamazoo, Mich. For information:

CIRCLE 250 ON READER CARD

Peripherals

A number of peripherals have been made available for this manufacturer's Micro 1600/21 minicomputer. They include a 2.5-megabyte disc with an access time of 75 msec ($12K); a 5-megabyte disc with access times of 95 msec ($13K); a 12.5-ips, 7-inch reel tape drive and controller ($5K); and an 80-column, 64-character buffered line printer that operates at 150 lpm. Its price is $9K. Delivery on the peripherals is 90 days ARO. MICRODATA CORP., Santa Ana, Calif. For information:

CIRCLE 255 ON READER CARD

Numeric Data Input

The TTS-ANK-16 is a 16-key calculator-style accessory that plugs into tty's or other ASCII terminals to permit more rapid input of numeric data. The unit can be used on-line or in the local mode to produce paper tape. Besides the regular 0-9 keys, there are comma, decimal, minus, space, carriage return, and line feed keys. EBCDIC and other non-ASCII codes are offered as options, but the basic model is priced at $224. REMOTE DATA TERMINALS, INC., Santa Monica, Calif. For information:

CIRCLE 256 ON READER CARD

Add-on Memory

Equipment manufacturers planning to incorporate either the PDP-11 or the Data General Nova 1200 into future products are offered extended memory for these computers. The DEC alternative is called the PM-1100 and is for use on those systems having memory models MM11-E or MM11-F. Up to 128K 16-bit words can be configured

building from 16K modules of 950-nsec core. Prices are approximately $3K for oem orders in the hundreds of 16K chunks.

The Nova replacement memory is called the PM-1200 and does not require additional cables, power supplies, etc. This 1.2-usec memory can be expanded from 8-32K in 8K blocks and is priced at $2350 each for orders of several hundred. PLESSEY MEMORIES, INC., Santa Ana, Calif. For information:
CIRCLE 283 ON READER CARD

250-ips Tape Drive

The ST3480 tape drive is unusual in that it is a plug-compatible replacement for a tape drive that IBM doesn't even offer yet! The big advantage is the increase in speed over the IBM 2420 drive's 200-ips speed and 320 KC transfer rate. The transfer rate of the 3480 is 400 KC. It is available only as a 9-track, 1600-bpi unit, and no software changes are required to take advantage of its increased performance. It is primarily intended for the more powerful 360s and 370s above the 370/155 level. Monthly rental is $670 on a one-year contract, including 24-hour, 7-day maintenance service. First units will be installed around May 1. STORAGE TECHNOLOGY CORP., Louisville, Colo. For information:
CIRCLE 254 ON READER CARD

OCR Reader

The LSL OCR page reader takes a different approach to reading the OCR-A font and mark sense notation. Documents ranging in size from 8½ x 11 inches down to 3¼ x 7⅜ inches are fed at a continuous rate (15 pages per minute and 30 pages a minute, respectively) across a field of photodiode arrays. The advantage here is that there are no moving parts in the 540-cps scanning operation. A built-in crt display provides the operator with error correction and editing capability, and standard output is 9-track, 800-bpi IBM-compatible tape. Numerous other fonts are offered as options. Prices start at $99K. LITTON SYSTEMS (CANADA) LTD., Rexdale, Ontario. For information:
CIRCLE 248 ON READER CARD

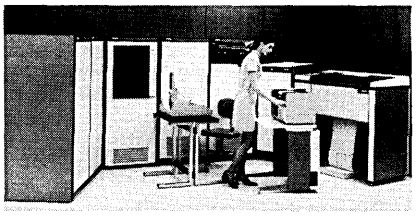
Disc Storage

The several hundred Univac Fastrand II and III drum storage systems that support 1100 and 400 series computer systems have been around awhile, and progress has caught up with them. AMPRAND is an electronically and logically compatible removable pack disc storage system that has better performance and lower prices than the Fastrands. The AMPRAND consists of the FC-900 controller and five FD-914 disc drives to replace Fastrand model IIs, and eight drives if the configuration is to replace a Fastrand III. The average access time of the AMPRAND is 30 msec, compared to the 92-msec time of the original Fastrand. Available 90 days ARO, an AMPRAND II sells for $168K. Units may also be leased. AMPEX CORP., Marina del Rey, Calif. For information:
CIRCLE 245 ON READER CARD

Computer System

The model 6145 computer is designed specifically for real-time applications in data communications, laboratory automation, industrial process control, seismic data processing, and telemetry data acquisition. It is the largest and most powerful 16-bit computer ever offered by this manufacturer, complementing earlier offerings. Basic hardware starts with 32K words of 650-nsec memory, expandable in 16K increments up to 128K with a single processor. The addition of a second processor ups the maximum memory to 192K of both shared and privileged memory. There are 16 levels of memory protection and up to 64 interrupt locations. A full complement of peripherals is offered.

A real-time and batch processing monitor called ASSET coordinates the use of the FORTRAN IV compiler, a symbolic translator with macro capa-



bility called ASIST, and such specialized programs as SEITRAN, for doing seismic trace analysis. A basic 6145 processor with 32K memory and two direct-memory-access channels is $135K. Deliveries begin in the middle of the year. EMR COMPUTER, Minneapolis, Minn. For information:
CIRCLE 247 ON READER CARD

S/3 Multiplexor

The MPX-3 permits the attachment of tty equipment, crt displays, this vendor's head-per-track discs, and IBM 1403 line printers to the IBM System/3. Basic model has eight channels (expandable to 64) and is priced at $24K. Availability is 60 days ARO. DIGITAL DEVELOPMENT CORP., San Diego, Calif.
CIRCLE 275 ON READER CARD

Tape Controller

The TC-38 is an electronically and logically compatible replacement for the IBM 2803 and 3803 tape controllers. The unit can be specified for 7-track (200-, 556-, or 800-bpi) or 800/1600-bpi 9-track drives. A 3803 replacement model on a one-year lease is $560/month. AMPEX CORP., Marina del Rey, Calif.
CIRCLE 260 ON READER CARD

Disc Pack Inspection

The system 316 checks the disc pack alignment, runout deviation, and surface deviation of IBM 1316 and 2316 or equivalent disc packs, and can also be used to clean the pack. A high-intensity light and mirror are used to inspect individual tracks. The price is under $1K. THE TEXWIPE CO., Hillsdale, N.J.
CIRCLE 261 ON READER CARD

Calculator

The model 3660 features automatic program input from magnetic cards, has a 144-step program memory, and performs arithmetic functions plus square root on numbers of up to 32 digits. It sells for $1795 and rents for $54/month on a three-year contract. BURROUGHS CORP., Detroit, Mich.
CIRCLE 262 ON READER CARD

Optical Data Set

The model 1811 transmits data at switch-selectable synchronous data rates of 2400, 4800, and 9600 baud and also accommodates any asynchronous rate up to 1800 baud. Transmission is line-of-sight for distances up to one mile, and repeaters are available for greater distances. The price is $2950 per end. COMPUTER TRANSMISSION CORP., Los Angeles, Calif.
CIRCLE 263 ON READER CARD

Oem Line Printer

The model 200 is a 132-column impact printer capable of printing a 64-character ASCII set at 202 lpm or a 96-character set at 142 lpm. The handsome unit is not much larger than a typewriter and is priced in single quantity at $8850. DIGITRONICS CORP., Albertson, N.Y.
CIRCLE 264 ON READER CARD

Storage Vault

A complete line of walk-in prefabricated storage vaults is available. The units can withstand 450° temperatures for 30 minutes without damaging the contents. Various sizes and shapes can be constructed with the flame-proof panels, but a typical 8' x 10' x 8' model sufficient to hold several hundred tapes is priced at $2377. BALLY CASE AND COOLER, INC., Bally, Pa.
CIRCLE 270 ON READER CARD

Tape Cleaner

The Mark IV cleans reel sizes up to 10½ inches at a rate of 180 ips, requiring only about five minutes to do the two-pass operation on 2,400-foot tapes. Availability is two weeks ARO, and the price is $2300. DATA PRODUCTS CORP., Woodland Hills, Calif.
CIRCLE 266 ON READER CARD

Optical Mark Reader

The OMR 650 reads marks, Hollerith images, and handprinted numerics from card size to 8½ x 11-inch sheets. It hooks to any tty-compatible device and operates at speeds from 110 to 2400 baud. The price is $4900. DECISION INC., Oakland, Calif.
CIRCLE 267 ON READER CARD

OCR Feature

Addition of the SCAN-PLEX feature to this company's model 200, 250, 300, or 350 ocr systems enables the systems to file away rejected characters for operator correction without slowing the system down. The feature adds an additional $12K to the price of the system. SCAN-DATA CORP., Norristown, Pa.
CIRCLE 268 ON READER CARD

Modems

The 3872 modem operates over dedicated or dial network lines at synchronous speeds of 1200 and 2400 baud. Rental starts at $85/month. The model 3875 operates at 3600 and 7200 baud and is intended for communication between computers or from batch terminal to computer. Rental starts at $240, and both units are scheduled for delivery in the third quarter. IBM CORP., White Plains, N.Y.
CIRCLE 259 ON READER CARD

Card Reader

An 80-column, 300-cpm card reader in a table configuration is offered for attachment to the ALPHA and NAKED MINI computers. Complete with interface unit, the reader, a Bridge 8000 model, sells for $3850. COMPUTER AUTOMATION, INC., Newport Beach, Calif.
CIRCLE 269 ON READER CARD

Cassette System

Replacement of paper tape units on nearly every minicomputer is the aim of this firm with its first entry into the cassette market. The KYDEK is a dual-transport unit that operates at 7½ ips (750 cps), and it can be written and read simultaneously. Deliveries begin this quarter, and the price is $3495. KYBE CORP., Waltham, Mass.
CIRCLE 271 ON READER CARD

Auxiliary Storage

A new model auxiliary storage system is offered to 360/65 users needing only 512K of 1.8-usec core. The unit is a plug-compatible replacement for the IBM 2361 LCS. A one-year contract on the system 6000 runs $5500/month, and the unit is available 30-60 days ARO. DATA PRODUCTS CORP., Woodland Hills, Calif.
CIRCLE 272 ON READER CARD

Tape Reformatter

The 2022A is a programmable system that converts 7- or 9-track, NRZI and phase-encoded information into formats suitable for COM units, plotters, or other tape units. Special packages are available for Kodak KOM-80 and KOM-90 microfilmer conversion. Prices start at $28,800, and deliveries begin in June. HEWLETT-PACKARD CO., Palo Alto, Calif.
CIRCLE 265 ON READER CARD

H 8200 Enhancements

The largest Series 200 computer in Honeywell's fleet, the 8200 model, can now have up to 2 million 6-bit characters. The models 775 and 785 crt displays can now be attached to the 8200, and a new disc drive called the model 277 offers 133 million character capacity. HONEYWELL INC., Waltham, Mass.
CIRCLE 273 ON READER CARD

Commo Preprocessor

The model C2000 can front-end up to 256 synchronous and asynchronous lines to Univac 1100 and 400 series computers. Synchronous circuits can be as fast as 9600 baud; asynchronous maximum is 1800 baud. Primarily marketed to oem's, line cost varies between $550 and $700 per line. Availability is six months ARO. TELEPROCESSING INDUSTRIES, INC., Mahwah, N.J.
CIRCLE 274 ON READER CARD

Media

Users of this vendor's CARD microfilm storage system are offered a modified carousel for holding three cartridges containing 50 microfiche each. Each carousel is $200, and retrofit of CARD systems is only $25. IMAGE SYSTEMS, INC., Culver City, Calif.
CIRCLE 258 ON READER CARD

The flexible tape reel this vendor uses in mailing out its software releases is now offered to other firms desiring to do the same. The collapsible reel holds up to 300 feet of tape and stores inside a plastic tube for shipping purposes. In low quantity, the price is $2.95 each, and the mailing cost is much less than with standard tape reels. DYLACOR COMPUTER SYSTEMS, INC., Van Nuys, Calif.
CIRCLE 278 ON READER CARD

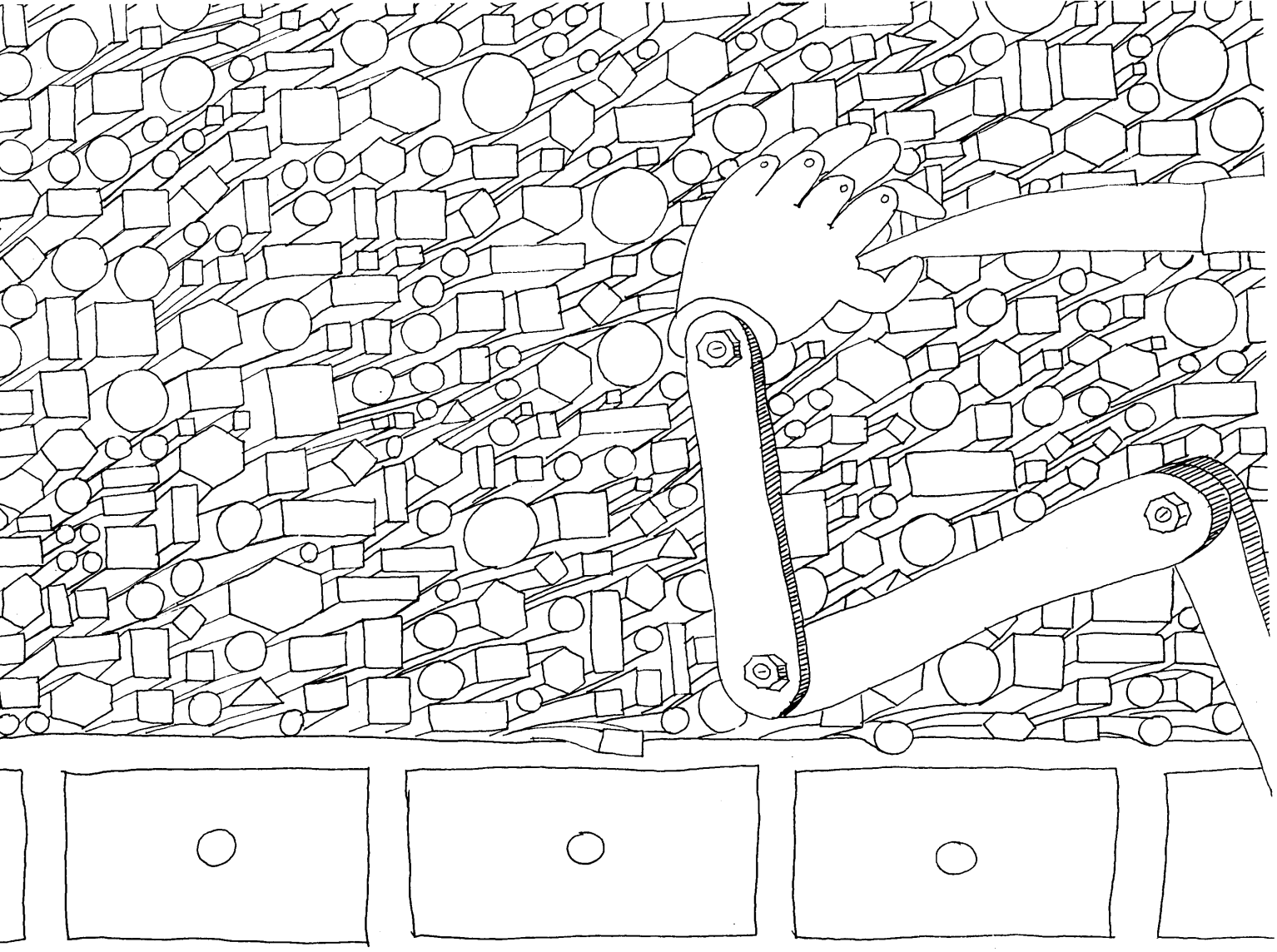
A tape cartridge storing 300 feet of quarter-inch tape for use with this manufacturer's cartridge drives is available to oem's. The cartridge is designed to withstand 180-ips speeds and acceleration rates of 2000 ips², perhaps solving somebody's high-performance product design problem. The cartridges are $10 in low quantity, and the drives that use them are about $250 each in oem quantity. 3M CO., St. Paul, Minn.
CIRCLE 279 ON READER CARD

Data Acquisition

The model 503 coupler/recorder takes decimal or BCD information, converts it into computer-acceptable codes, inserts housekeeping and identification characters into the data using an 18- or 30-character module programmed to customer's request, and punches the output on paper tape. The price is $2495. AMBIENT SYSTEMS, INC., Santa Clara, Calif.
CIRCLE 280 ON READER CARD

Add-on Memory

Renters of 360/30s who are on the fence on whether to trade their 30 back to IBM for the recently announced model 22 might like to know about the CorPak 22, which, in effect, puts back the 32K lopped off by IBM (from 64K down to 32K). This gets the customer almost back to the model 30 he had, except for some channel capacity and emulation capability. The CorPak 22 rents for $900/month. INFORMATION CONTROL CORP., Los Angeles, Calif.
CIRCLE 281 ON READER CARD □



Supercomputer at Chase Brass can pick out any one of 300 products in one second

There's nothing to it.

The fact is, Supercomputer practically runs the Williams County Rod Division plant.

It tells Chase people just where every order is. And when it'll be ready to go out the door.

It updates their production schedules every day.

It reviews bids on scrap material, factoring in even the cost of trucking it to the plant.

It tests every bit of scrap that comes into the plant.

It keeps an eye on all the furnaces. And spots problems before they cause trouble.

It knows exactly what's where in inventory.

Even plans the best routes for delivery trucks.

Chase Brass cut their lead time. Reduced cost. And improved customer service. All with one big, interactive supercomputer.

DECsystem 10.

Write for DECsystem 10 literature. It'll open your eyes. Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754. (617) 897-5111.

digital

CIRCLE 46 ON READER CARD

Software & Services

Software Notes . . .

A survey conducted by a California firm on user opinions of OS/360 has turned up generally favorable comments. While admitting to its high overhead, users were much more impressed with the fact that "it gets the job done." There were dissenters, however, and one particularly strong comment came from an analyst familiar with GECOS who's currently learning OS: "OS/360 is such a kludge I'm surprised the whole world hasn't revolted!"

Three more years of work have been spent on the NASTRAN structural analysis program to add capabilities for analysis of solid elements, substructuring for both static and dynamic analysis, solution of heat transfer problems, and acoustic analysis of enclosures. The program originally took five years to develop for NASA, and it's available on CDC's Cybernet service, from McDonnell Douglas in St. Louis, and from IBM in the U.K.

A large-scale textual management program called SPIRAL is nearing completion after six years of development by Sandia Laboratories, an AEC workshop located in Albuquerque, N.M. The program will be available only to government agencies and their contractors.

Who says programmers are not in demand? We know a company that has advertised for real-time and data management programmers for months —apparently without success.

Data Management System

UAIMS is a package similar to the IBM IMS 360 but contains both a data definition language and a nonprocedural query language. The data management portion of UAIMS can also be used by COBOL, FORTRAN, or BAL programs to operate either in an on-line or batch environment. It is programmed in FORTRAN and BAL, requiring about 90K bytes on 360 models above the 40. With DMS the user can define data structures, file parameters and protection, and specify multiple inverted indexes which are created automatically. The DMS portion of the package is priced at $24K, and the full UAIMS package, including the teleprocessing module, is $27K. The package may also be leased, and the price includes installation and documentation. UNITED AIRCRAFT RESEARCH LABORATORIES, East Hartford, Conn. For information:

CIRCLE 217 ON READER CARD

Cobol Aid

BUG (Basic Update Generator) is the name of this package that permits programmers to generate COBOL programs to edit data, create new files, update master files with an optional transaction report, merge files, match files, and produce reports with as many as 10 levels of control. It's done by using two specification sheets. The input from these is used to generate basic sequential logic that can be modified at the COBOL source level. BUG is currently running on a 64K 360/30 and a similar size Sigma 6 and can be installed on other systems having COBOL compilers. The price is $5100, including documentation. COMPUTER TASK GROUP, INC., Buffalo, N.Y. For information:

CIRCLE 227 ON READER CARD

Financial Reporting

The REACT financial reporting and responsibility accounting package is unusual in that it contains flexible routines to automate foreign currency conversion—handy to have these days—and thus would be of interest to government installations, banks, and international companies. There is a ledger system within REACT that can interface with the user's other financial programs, and there are also editing, control, and file handling routines. In addition to the usual financial statements, reports consist of matrix reports and graphic displays; and fast summarization of any desired account grouping can be done. REACT requires 64K bytes on OS or DOS 360 and 370 computers, and the $40K price includes documentation and the COBOL source decks. ASYSTANCE CORP., Research Triangle Park, N.C. For information:

CIRCLE 220 ON READER CARD

Routing/Sequencing

This routing and sequencing program is not necessarily limited to handling salesman or distribution routing, though that's one of its more obvious applications. Additionally, ROUTE/SEQ can be applied to the problems of sequencing work through production or service applications. The FORTRAN IV program can be used either in a batch or time-sharing mode, and typically 28K words of memory is required on a PDP-10. Several modules make up ROUTE/SEQ, but the basic program starts at $9600, plus installation. MANAGEMENT DECISIONS DEVELOPMENT CORP., Cincinnati, Ohio. For information:

CIRCLE 218 ON READER CARD

Project Management

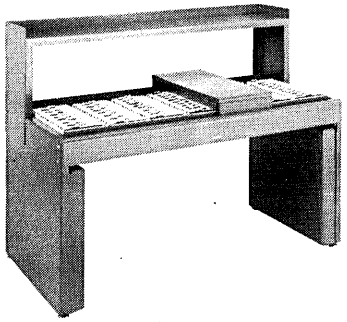
The Project Management and Control System generates a number of reports relating to the status of systems and programming projects and time expended by each employee. The reports include employee hours report (by project and project leader), daily and weekly project status, company or department report, billing report, and project completion report. Also reported are project history of all time spent versus budgeted man-hours. All IBM DOS 360 and 370 models having at least 16K of memory can accept the set of 16 RPG programs, which is priced at $1500. DATAROYAL, INC., Nashua, N.H. For information:

CIRCLE 222 ON READER CARD

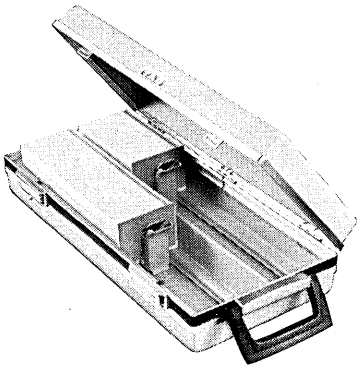
DOS Module Change

The IBM DOS system as supplied by the manufacturer has an indexed-sequential function in it called SETL that is nonresident and must be loaded each time it's used. The replacement offered here is called CORESETL. It is added to the relocatable library, together with another SETL macro for addition to the source library. The systems programmer may then specify through a parameter whether SETL is to be resident or nonresident. If resident, it adds 1,176 bytes to the program. It's claimed that this relatively simple change typically drops the time required for SETL KEY or GKEY commands from 332 msec under DOS version 25 (245 msec under DOS version 24) to 134 msec. The price of $300 includes the BAL source cards

Tab has 700 ways to make your computer work better.

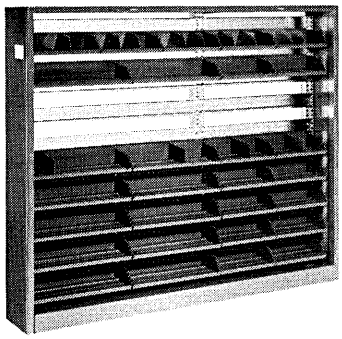


Tab Open Reference Files. Horizontal and vertical models available. Standing or sitting heights. Interchangeable construction permits adaption to many uses. For 80 and 96 column cards, 4 x 6, 5 x 8, 3 x 5 and letter size ledgers.

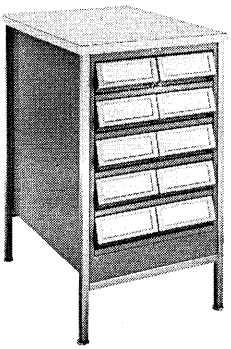


Tab Card Carrying Cases. For 80 and 96 column cards. Provide safe, lightweight protection for cards in transit. Built-in locks for security.

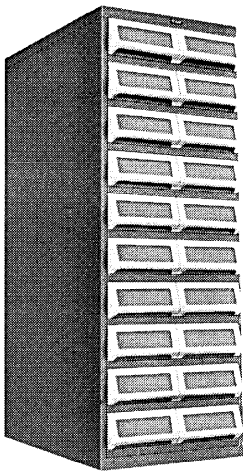
Here are some for Cards.



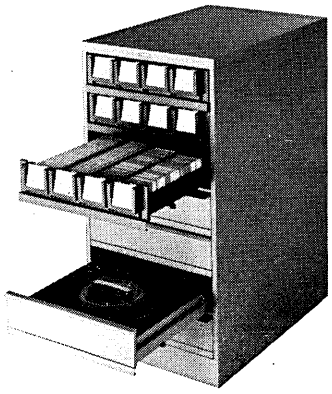
Tab Unit Spacefinder Card Files. A major advance in open access card storage. Patented Tab Unit Spacefinder features stair-step visibility and accessibility to speed filing and retrieval.



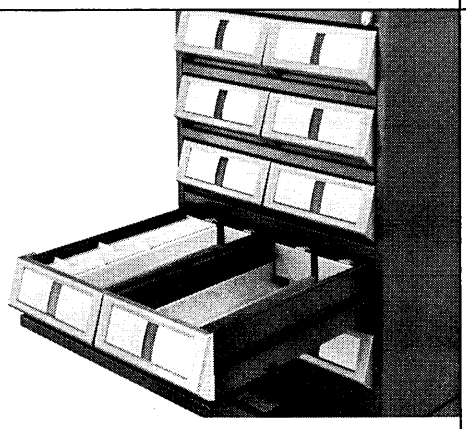
10 and 20 drawer Programmers' Work Station Files, for 80 or 96 column cards. Match Tab's Data Media Storaways. Slim legs and formica tops provide beauty and function. Drawers in either 3/4 or full suspension.



Tab 80 column Card Files. 10, 14 and 20 drawer models with or without locks. Drawers available 3/4 or full suspension. 5 year unconditional card file guarantee, offered only by Tab.



Tab System/3 Card Files. In 20, 28 and 40 tray sizes. Plastic trays are removable, lightweight and stackable. Full-width index label holders. Wide drawers also available for 5440 disks.



Conversion inserts for System/3 instantly change standard Tab card files to System/3 storage. One set of two formed aluminum inserts per drawer. Capacity is 7500 cards per set.

WANT MORE CARD STORAGE INFORMATION?

Write for our 68 page catalog.

Name _____

Company _____

Address _____

City _____

State _____ Zip _____

TAB
PRODUCTS CO.
2690 Hanover St.,
Palo Alto, Calif. 94304.

CIRCLE 41 ON READER CARD

and an instruction sheet. BOOTHE DATA SYSTEMS, New York, N.Y. For information:
CIRCLE 223 ON READER CARD

Hospital Software

Medical facilities ranging from the smallest clinic to the larger hospital are offered six field-developed application programs under an unusual license agreement: The user only pays the monthly rental listed below with each program for 12 months.

Disc-oriented System/3 Model 6 users are offered a billing and accounts payable program called Clinical Accounting. The program verifies all transactions as they are entered and produces accounting statements, revenue and expense summaries, insurance statements, and completed Medicare forms. The rental is $235. For information:
CIRCLE 213 ON READER CARD

Card-oriented System/3s qualify for the General Stores Accounts Payable package for maintaining a cash disbursements file, generating and reconciling checks, and doing monthly purchase analysis and trial balance jobs. Rental is $115.

The General Stores Inventory program keeps an eye on inventory levels, reorder requirements, and departmental cost distribution for small hospitals. Additionally, the program generates purchase orders, posts inventory movement, and prints monthly summary reports. Rental is $100.

Medicare Billing is the final card-oriented S/3 program, and its rental is $125. For information:
CIRCLE 214 ON READER CARD

Hospitals running IBM's Shared Hospital Accounting System (SHAS) are offered the Pending Insurance Claims Accounting program for generating and maintaining a file of claims forwarded under the Medicare Part A program. The program generates a log of all claims, processes adjustments to the register records, and summarizes patient records for audit. A 360 or 370 mainframe is required, and rental is $470. For information:
CIRCLE 215 ON READER CARD

The Hospital Data Collection and Communication program supports an IBM 1800 computer and 2790 terminal network for linking nursing and service areas in the hospital. Automatic message routing, patient charge handling, and bed availability information are among the features of the program. It rents for $1185. IBM CORP., White Plains, New York. For information:
CIRCLE 216 ON READER CARD

DOS Procedure Library

The incorporation of D-PROC into the IBM DOS system allows users to catalog JCL job streams in a system procedure library, as in the more sophisticated OS system. From here the processing can be initiated by console request. The best features of the program are the elimination of JCL card handling, the ability to get current directory listing of all the JCL, the ability to make run time device assignments, etc. The nonresident BAL program is priced at $2400. VITAL COMPUTER SERVICES INTERNATIONAL, INC., New York, N.Y. For information:
CIRCLE 225 ON READER CARD

services . . .

Info Systems Cookbook

PRIDE (profitable information by design through phased planning and control) is the name assigned to this proprietary methodology for the construction of information systems. It is really a cookbook of how to construct such a system, as it lists what the inputs to the different stages should be, gives examples, things to watch for, etc. The major phases covered in PRIDE are system study and evaluation, system design, subsystem design, procedure design, program design, computer procedure test, system test, system operations, system audit, project management, and data management. These phases are broken down into subheadings and are quite detailed. A single installation can obtain PRIDE for $8K, including the manuals, free updates, three days of follow-up consulting that can be used as the customer sees fit, a newsletter, an implementation guide, and logs. M. BRYCE & ASSOC., Cincinnati, Ohio. For information:
CIRCLE 234 ON READER CARD

Bond Evaluation

The Telprice/70 municipal and corporate bond service is based on a mathematical model residing on this firm's Sigma 7 computer. From this continually updated model, information such as the general strength of a bond, recent trading history, general monetary conditions, and the opinions of professional traders who make a market in the security is supplied to subscribers either in the form of a magnetic tape, or on-line to the computer. Prices vary with the number of bonds priced and the frequency of delivery, but typically, pricing for 100,000 bonds over a one-year period is $9K in tape form. TELSTAT SYSTEMS INC., New York, N.Y. For information:
CIRCLE 235 ON READER CARD □

device. Electronic Memories says it's "getting pressure" from users for 370 add-ons and will have its first product in the fall. Advanced Memory Systems, whose semiconductor devices are sold by Itel, announced a 370 product in January. Itel reports some 50 installations and EMM expects to have "more than 50" by April 1.

Estimates of the market's size vary widely, mostly because nobody knows whether and how IBM will counter the independents. Late last year Memorex Corp. took a long hard look at the market and was disheartened by the price erosion. Nevertheless, it still hadn't reached a final decision by mid-January.

PRACTICAL, LOW-COST, "FAR-OUT" MEMORY MAKES BOW

Holographic memory systems with capacities in the 10-trillion-bit range and with microsecond speeds have long been talked about. They're still in the lab. But next month, first units of a holographic system are scheduled to be shipped by a new firm, Optical Data Systems, Mountain View, Calif., for field testing. Significantly, ODS president Kent Sutherlin chooses not to push the state of the art with his first product, settling for a mere 12-megabit capacity and a slow access time: 1-1.5 seconds. But he has the price of his holographic read-only memory down to 0.01 cent per bit.

Initial marketing of the off-line Holoscan system will be for credit verification, storing up to 250K 12-digit numbers. Those could be for bad credit cards, stolen airline tickets, or special floor limits. To update, a small cartridge carrying the film memory is replaced, ODS providing the updating service on a weekly or more frequent cycle. The system contrasts with those requiring a phone call to a computer center and interrogation of a data base there.

RUMORS AND RAW RANDOM DATA

As competition stiffens in the key-to-disc data preparation field, front-runner Computer Machinery Corp. is offering a 16-keystation version of their model CMC 5 12-station system at $90.90 per keystation, $10.10 cheaper than runner-up Inforex...DP people rearranged their payroll systems with ease to comply with California's withholding tax. Only 400 firms out of 400,000 on file were unable to withhold on January paychecks...Burroughs is expected to announce a new machine this month that competes head-on with IBM's System/3. Called the Model 710 in development stages, it is expected to be ready for first deliveries in the third quarter...One System/3 customer says IBM has slipped delivery of his S/3 disc drives and Cobol from April to December. Tape drives will also be a couple of months late. But IBM says it must be an isolated case...IBM during '72 is projecting only a modest gain in net sales revenue, a condition that will affect its salesmen as in the 1401 delivery days. Emphasis now is on the installation of equipment previously sold and increased loading of existing systems...A Soviet trade delegation will be in the U.S. next month for about 25 days and will visit CDC, IBM, Honeywell, and Univac. The group has a specific shopping list... Why was Edwin Donegan under consideration for the presidency of the RCA Corp. at a time when he was losing control of RCA's computer operation? Why was his RCA series such a disaster? For the answers, see next month's Datamation analysis of RCA's flop in the computer business.

On the surface, our keyboard looks like a typewriter's.

That's just the way we intended it to look.

Our key arrangement is the USA standard for nonlogical typewriter pairings, and it features "n" key rollover. The same as your electric office typewriter. So, no special operator training is needed.

This can save you a lot of mistakes, as well as a lot of time and money.

But, beneath the surface, our keyboard looks like anything but a typewriter's. The keys are all solid state with MOS encoding. In addition, the control keys are set apart from the touch typing area in block arrays. The end result is the most reliable and versatile keyboard available.

Even the pricing is revolutionary. When you buy this stock keyboard, you get a high quantity price—regardless of the number you buy. And they're available right now.

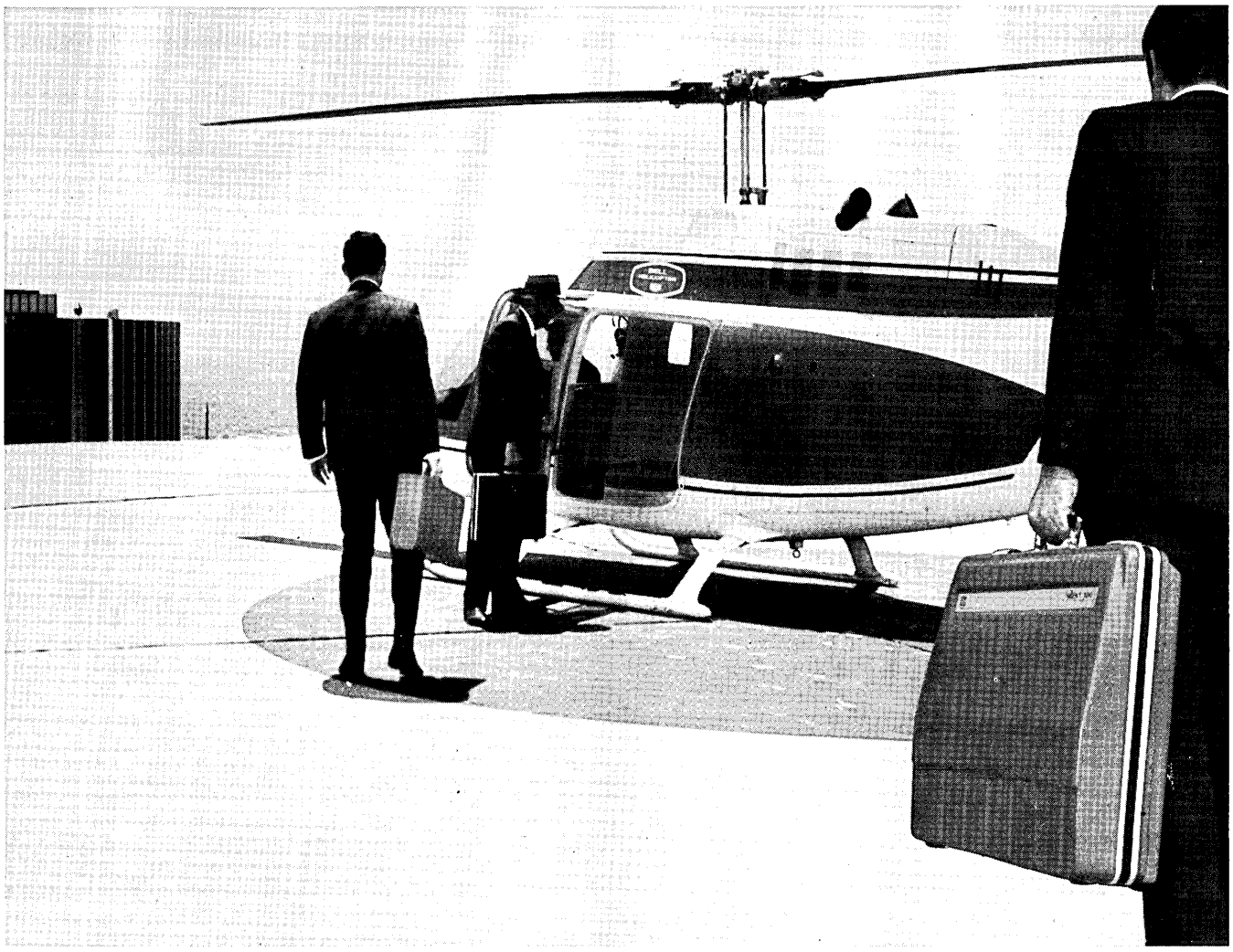
For more information, see your MICRO SWITCH Branch Office (Yellow Pages, "Switches, Electric"). Or send for our keyboard literature.

MICRO SWITCH makes your ideas work.

MICRO SWITCH
FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL

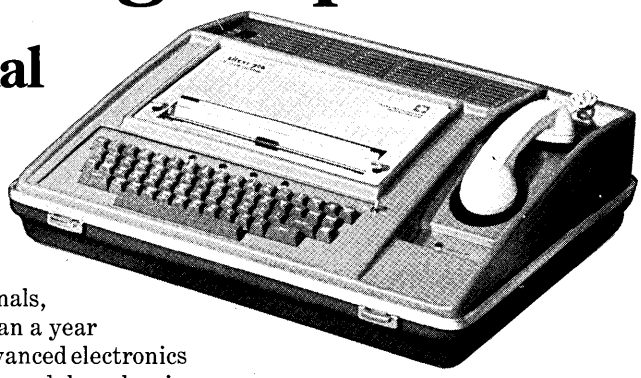
MICRO SWITCH products are available worldwide through Honeywell International.

CIRCLE 17 ON READER CARD



Now, the "Silent 700*" goes portable:

The Electronic Data Terminal you can take with you.



Your computer data is as close as the nearest telephone. At 10, 15 or 30 characters-per-second. Full or half duplex. All switch selectable.

It's so unnoticeably quiet, you can use it anywhere.

Like all "Silent 700" terminals, the Model 725 Portable Data Terminal uses TI's unique solid-state printhead, an integrated circuit matrix of 35 elements which instantly create the characters on thermographic paper.

Without noise.

Without impact.

"Silent 700" terminals, in operation more than a year now, use the most advanced electronics available. . .including modular, plug-in MOS/LSI ICs and solid-state keyboards. Moving parts are greatly reduced, and maintenance simplified.

They're available in either portable or desktop models.

For a demonstration call the TI office in the major city nearest you. Or contact the Digital Systems Division, Texas Instruments Incorporated, P.O. Box 1444, Houston, Texas 77001. Telephone 713-494-5115, ext. 2126.

*Trademark of Texas Instruments Incorporated

TEXAS INSTRUMENTS
INCORPORATED

Literature

Datamation Subject Index
The 12-page subject index of 1971 DATAMATION, Vol. 17, Nos. 1-24, includes references to feature articles, conference reports, book reviews, Perspective, Editor's Readout, and The Forum. DATAMATION, Pasadena, Calif. For copy:
CIRCLE 200 ON READER CARD

Used Computer Prices
Winter issue of the "Computer Price Guide," also known as the "Blue Book of Used Computer Prices," lists prices which reflect the changes of the last three months of 1971. TIME BROKERS, INC., Elmsford, N.Y. For copy:
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Program Abstracts
A collection of computer program abstracts on software of use to social science researchers is described in a flyer which also lists prices. The collection is part of an effort sponsored by the National Science Foundation as part of a project titled "A National Program Library and Central Program Inventory Service for the Social Sciences (NPL/CPIS)." NPL/CPIS, Madison, Wis. For copy:
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FJCC Proceedings
Proceedings of the 1971 Fall Joint Computer Conference, Vol. 39, contains 68 formal papers plus 28 panel "position papers." Price for the 678-page volume is $26 with a reduced rate of $13 available for prepaid orders from members of AFIPS' constituent societies. AFIPS PRESS, 210 Summit Ave., Montvale, N.J. 07645.

For the Professional
Six-page brochure describes the "Computer Professional's Update Digest," a monthly publication designed to maintain, educate, and keep the computer professional "up-to-date on current changes in the computer field." THE PROFESSIONAL UPDATE CO., Oakton, Va. For copy:
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ASIS Proceedings
Proceedings of the annual meeting of the American Society for Information Science (ASIS) held last November in Denver is available in both microfiche and hardbound versions. Titled "Communication for Decision-Makers," the volume contains 56 papers. Microfiche versions are priced at $2.50 for members and $3 for nonmembers. Hard copies go for $10 to members and $11 to others. GREENWOOD PRESS, 51 Riverside Ave., Westport, Conn. 06880.

Microprogramming
Second edition of the "Microprogramming Handbook," at 448 pages, is a sequel to a shorter first edition. It tells how to microprogram, why the concept is effective, and when it is appropriate. Its first section contains a primer with a glossary of data processing terms. MICRODATA CORP., Santa Ana, Calif. For copy:
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Graphic Display Systems
Eight-page brochure on graphic display systems lists applications, contains block diagrams, and describes system hardware. A typical system described consists of from 4 to 32 independent displays. DATA DISC, INC., Sunnyvale, Calif. For copy:
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Retrieval-Display Reader
A cartridge-load card system described as an automated retrieval-display reader is the subject of a one-page data sheet which lists its specifications. Depending on fiche format, maximum online storage capacity of the unit is 68,000 or 130,000 frames of text, graphics, or pictorial information in black-and-white or color. IMAGE SYSTEMS, INC. Culver City, Calif. For copy:
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Telephone Traffic Systems
Sixteen-page catalog briefly describes a line of telephone traffic measuring and service observing systems. It covers traffic scanners, count monitors, controllers, readout devices, a peg count concentrator, portable traffic measuring systems, computer-controlled systems, and service observing systems. ALSTON DIV. OF CONRAC CORP., Duarte, Calif. For copy:
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Computer Systems
Characteristics of vendor's family of 16-bit Modcomp computers and system building blocks are described in a 28-page brochure featuring three-color block diagrams. The family includes real-time process peripherals and subsystems as well as dp peripherals. MODULAR COMPUTER SYSTEMS, Fort Lauderdale, Fla. For copy:
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Software Brochure
Twelve-page brochure covers the operation of software packages offered with vendor's 620 family of computers. Included are VORTEX, a multitask real-time operating system; MOS, a batch operating system; FORTRAN IV; RPG IV; BASIC; and extended BASIC. VARIAN DATA MACHINES, Irvine, Calif. For copy:
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Peripherals and Interfacing
Handbook on peripherals and interfacing describes standard peripherals and options for vendor's PDP-11 family of systems and gives information on interfacing to the PDP-11 Unibus. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:
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Speech Plus
Complete technical specifications are included in a product bulletin describing the new "speech plus" data adapters that permit simultaneous two-way communications of both voice and digital signals over 3kHz voice channels. TELE-DYNAMICS, Fort Washington, Pa. For copy:
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NMA Officials Listed
A new directory of officials of the National Microfilm Assn. shows two new permanent and two more ad hoc committees than last year's version. The directory lists names and addresses for all officers, directors, committee members, and chapter presidents. NATIONAL MICROFILM ASSN., Silver Spring, Md. For copy:
CIRCLE 212 ON READER CARD

Charge Card Systems
"Microfilm Systems For Charge Card Programs" is the title of a six-page brochure which describes a variety of automated methods by which microfilm can be used to make maintenance of a charge card system more efficient. EASTMAN KODAK CO., Rochester, N.Y. For copy:
CIRCLE 276 ON READER CARD

All About Minis
A 32-page report covers 93 minicomputers from 43 different manufacturers and includes 19 pages of comparison charts describing the data formats, processing facilities, peripheral equipment, software pricing, and availability status. Copies are priced at $10. DATAPRO RESEARCH CORP., 2204 Walnut St., Philadelphia, Pa. 19103. □

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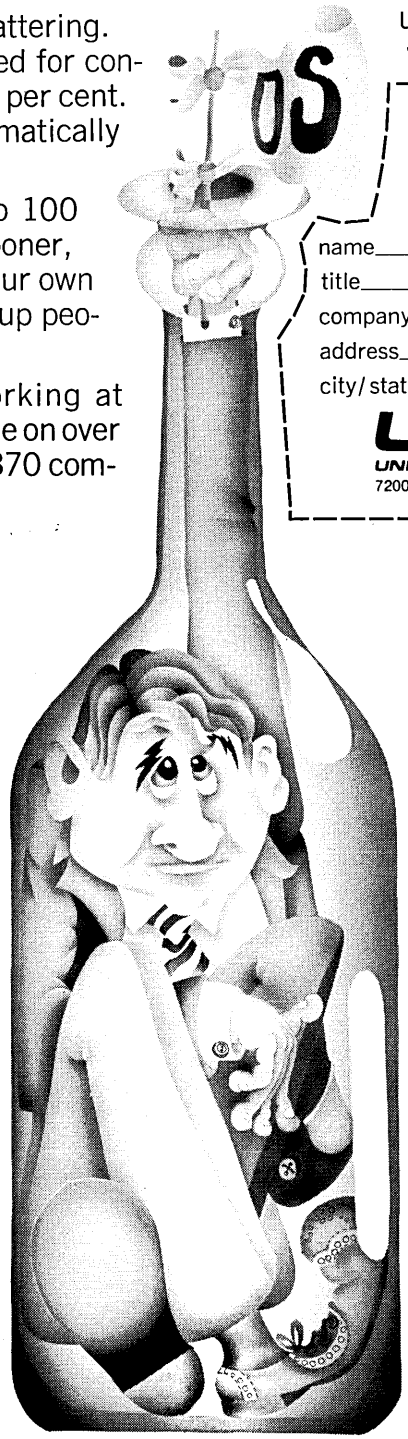

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People

In the year-end top level shift at Xerox Corp., executive vice president RAYMOND A. HAY surprisingly was named to fill the computer operations exec vp spot vacated by JOSEPH B. FLAVIN. Flavin was made chief of overseas operations in which there is little computer activity and little more foreseen in the future. Hay's background is largely in non-edp marketing and sales at Xerox (since 1961), NCR, and Monroe Calculating Machines Co. He is the first senior executive in charge of all U.S. and Canadian operating units of Xerox's computer, copying/duplicating, education, aerospace and medical businesses—units which do worldwide product development.

Xerox's chief executive officer and new chairman of the board, C. PETER McCOLOUGH, said Xerox is committed "to provide increasingly broader based information systems and services that include both graphic and digital capabilities." Exactly what that means hasn't been publicly defined yet, but it does include bringing the copying/duplicating and computer operations "closer together." Raymond Hay is in charge of that.

Now, does that mean Xerox is getting out of the general-purpose computer business with the Sigma series? Not so, says a spokesman. All that's discernible is that Xerox plans to be there if and when the trend turns away from hard copies.

McColough was succeeded as president by ARCHIE McCARDELL, formerly of Ford Motor Co., and exex vp at Xerox since 1968.

The job of riding herd on the many technical problems besetting New York's computerized off track betting system has been taken over by JEROME T. PAUL who sees the task as "a hell of a challenge." Paul said 35 of a planned 100 branch offices (betting parlors) were installed and operational at the beginning of the year, and the schedule called for all 100 to be operational by June. But the system still was "not performing satisfactorily." As one of his early acts, Paul planned a "frank discussion" with representatives of Computer Sciences Corp., developer of the system, "to define where we are, to establish a base for correcting problems, and to make sure they understand and relate to the sensitivity of the system."

Jerome T. Paul

Paul is no stranger to sensitive, on-line, real-time systems, having worked with American Airlines' Sabre system and other airlines' systems while with IBM. But he says the OTB system is even more sensitive than an airline reservation system in its need to service the public on a continuous basis. "When a guy wins money on a race, he wants it now. We can't afford to be truly down."

Paul left IBM in 1969 to help form Data Dimensions, Inc., a data processing services firm. He resigned as executive vp of Data Dimensions in December 1970 and had been doing independent consulting to OTB prior to joining the firm.

Although it was formed three years ago, the Association of Independent Software Companies (AISC) hasn't gained widespread support from the industry it represents. Its membership still is a thin nine companies and does not include such industry leaders as Computer Sciences Corp. and System Development Corp., the latter once having been an AISC target when it turned into a for-profit company. WAYNE SHELTON, who has been elected AISC's 1972 president, hopes to change all of this. He says his primary goal is to boost AISC's membership . . . but will he be in time? The association now has competition: the newly formed Software Section of ADAPSO (Association of Data Processing Service Organizations), with 56 members. Another drawback: AISC often has been accused of being dominated by Planning Research Corp., a charge denied by the association. But by coincidence, Shelton, a senior vp with PRC Information Sciences Co., owned by Planning Research, succeeds as president JACK LITTLE, who also is from Planning Research.

THOMAS STEEL, charter member and historian of IBM user group SHARE and practically the only man who can make the subject of standards sound interesting, has migrated to New York to be senior technical consultant at Equitable Life Assurance Co. Steel spent 15 years in California at System Development Corp., starting with its inception as a division of Rand Corp. His various positions included principle scientist and staff to the vice president of commercial systems, head of the research staff, and programming languages manager. In 1970, during the bloody upheaval caused by the SDC switch from nonprofit to profit status, Steel departed to become an independent consultant

At Equitable, Steel is working as technical staff to vice president JOHN GOSDEN, another alumnus of the nonprofits (Mitre Corp.), and will be involved in the development of a giant on-line data base system storing all the insurance firm's policies.

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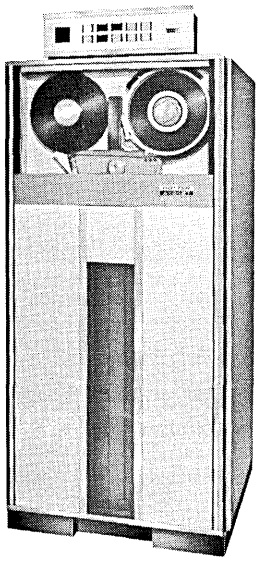

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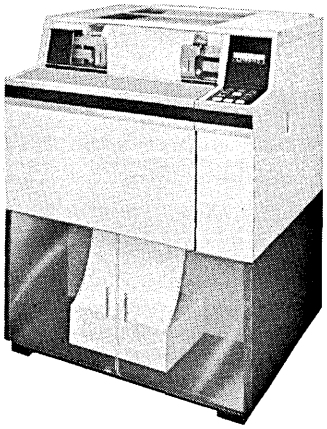

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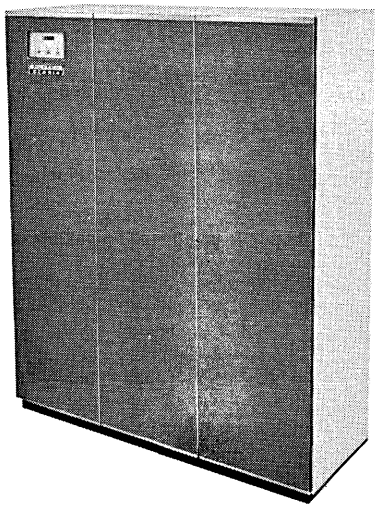

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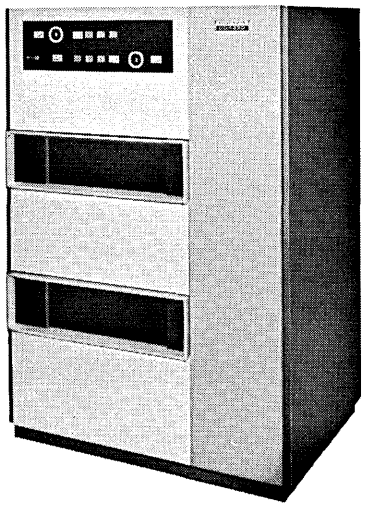

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The outspoken Steel has been one of the leading figures in the standards world, particularly in programming languages. He led the hotly contested fight to give PL/I an early start toward both national and International standardization. The current Steel cause is to convince the American National Standards Institute to reverse its decision to leave development of data base standards to Codasyl.

Eminent industry figure, DR. EMANUEL R. PIORE, has retired as vice president and chief scientist of IBM. He will remain as a member of the board of directors and IBM's Science Advisory Committee. Joining IBM in 1956 as research director, he was elected vp in 1960 and became a member of the board of directors in 1962. Dr. Piore has not retired from the scientific community, where he serves as treasurer of the National Academy of Sciences and as a member of both the National Science Board and the New York State Science and Technology Foundation. Chairman of the board of trustees of the Hall of Science of the city of New York, he is also a trustee of both the executive committee of the Sloan-Kettering Institute for Cancer Research and the Woods Hole Oceanographic Institution. Among an imposing list of credits are fellowships awarded Dr. Piore by the American Physical Society, Institute of Electrical and Electronics Engineers, American Academy of Arts and Sciences, and the American Association for the Advancement of Science. □

Emanuel R. Piore

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Books

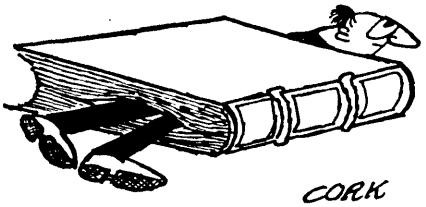
Computers—A Systems Approach

By Ned Chapin
Van Nostrand Reinhold,
1971, 686 pages
$13.95

Dr. Chapin's newest book is a colossal work. While its preface suggests that it could serve as the text in an introductory survey course, there is enough material here to fill three semesters: ". . . the book attempts not to be exhaustive but to be comprehensive." That it is. The sheer bulk—nearly 700 pages, 8 by 9 inches—is awesome.

Each of the 22 chapters begins with an overview of its subject, which in itself is thorough and authoritative. The over-all arrangement of the book is this: first, philosophy; then the man-computer interface; then hardware; then software (programming is first discussed on page 428); and finally system management. It is difficult for those who grew up with computers to decide on a proper ordering of topics for beginners; the ordering used here may be the correct one.

There are things to quibble about in this encyclopedic treatment of all of computing. For example, the author's definition of software includes reference manuals, customer training, cards, and ribbons; this seems rather broad, and contrary to current usage. He treats program testing as a small subset of debugging and then confuses the issue even more with some faulty guidelines for testing repetitive portions of a program. Perhaps the worst fault in the book is the appearance of



precise definitions of terms, with no clue as to what the term means in practice or examples of its use.

The author evidently lost the perennial battle with his copy editor, who insisted on the use of "data" as consistently plural. This leads to locutions that grate on the ear, like " . . . input data normally are not claimed by the input-output operators until just before they are needed, and they are returned as soon as the processing is completed."

Statements about card column positions for FORTRAN are wrong, and the BASIC programming example given lacks statement numbers, which are sort of vital to BASIC. There is a reference to a nonexistent Appendix D.

But all these things are minor matters in a magnificent work that could well become a standard reference text. The index contains over 5000 entries. The coverage includes topics like the layout of a typical data processing installation, typical organization charts (both for functions and personnel), vendor relations, employee relations, and definitions of down time. Each chapter contains an extensive reading list. The history of the field is well done—and is in the *last* chapter. The discussion of all the popular programming languages is particularly good, with examples of each given in printouts.

The book is not a programming text; it avoids numerical methods; and it does not dwell on the logic of any given machine. Given that those topics are not its province, it is hard to find any concept in modern data processing that is not covered. The experienced computer man might quarrel with the emphasis given some topics—but no book would ever satisfy on that score.

Finally, the book is magnificently produced, with evidence of care in proofreading, typography, and layout. It is a pleasure to note that the stockpile of good books in our field has gone up by one.

—Fred Gruenberger

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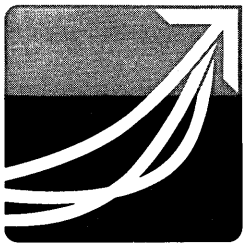

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letters

virtue of the text, however, is Professor Blatt's explication of WATFOR diagnostic messages.

JAMES R. CYPHER
Beacon, New York

Sliced bread

Sir:

We have both WATFOR and WATFIV installed on our IBM System/360 Model 85 and think they are the greatest thing since peanut butter.

R. V. GILMORE
Systems Dimensions Limited
Ottawa, Ontario

Reviews computing articles

Sir:

I choked a bit when Dr. Vander Noot (Nov. 15, p. 60) told us that he could find only one article on system and program testing from the last few years. Especially since I have written a few myself, one of which (1966 September DATAMATION) covered pretty much the same ground as he does.

Lest your other authors, and readers, fall into the same trap, may I suggest that the yearly Bibliography and Subject Index for *Computing Reviews* (published by the ACM, 1133 Ave. of the Americas, New York, NY 10036) provides a good place to check for background. I found an average of six pertinent papers per year by looking under "test(s) (ing)."

This alone will not do it, however. In my own case, I have never used the word "test" in the titles. One would do much better to subscribe to *Computing Reviews* and read it thoroughly each month.

R. W. BEMER
Phoenix, Arizona

Reality

Sir:

I enjoyed Mr. Lafon's article and am indebted to him for the quotation by Wallace Stevens, a favorite poet, for it expresses a philosophy I have adopted as the explanation of existence. But I would like to explain, from a mathematician's point of view, why we cannot divide by zero. And when I say cannot, I mean it literally, and not because division by zero yields unpredictable results.

The real numbers (the numbers which you and I deal with every day) constitute what mathematicians call a complete ordered field. Defining a complete ordered field would be too technical and take too long here, but suffice it to say there are only two operations on this field; namely, what we call addition and multiplication. What we usually think of as division is really multiplication. For instance, $5 \div 3$ is really 5×3^{-1}, where 3^{-1} is the multiplicative inverse of 3; that is, 3^{-1} is that number such that $3 \times 3^{-1} = 1$.

It can be proved from the axioms which define this field (the axioms from which all properties of the real numbers can be derived) that each element of the field (that is, each number) has a unique multiplicative inverse, except for zero. Zero does not have a multiplicative inverse because there is no number X such that $X \times 0 = 1$. In fact, it can be proved from the above-mentioned axioms that $X \times 0 = 0$ for all numbers X. Hence, $5 \div 0 = 5 \times 0^{-1}$ is as meaningless, or, if you like, undefined, as $5 \div \$ = 5 \times \$^{-1}$, because neither 0^{-1} nor $\$^{-1}$ are numbers.

JOHN COPE
Austin, Texas

Assuming something

Sir:

I totally agree with "The Fallacy in the Fallacy" by Jeryl Lafon (Nov. 15, p. 36); but if we could ever possibly change zero divide to have a real result, then what would people like Mr. Reeves ("APL-aPotential Liability?" Sept. 15, p. 71) do for letter material?

If our "zip error" could ever be eradicated, Mr. Reeves' APL program "BOMB" would work, so I urge Mr. Lafon and Mr. Reeves to petition Ken Iverson to change his notation! Since division by zero of zero is accepted as one (at least in APL), then why not assume a certain answer for all cases of

zero divide?
MICHAEL MASSEY
Atlanta, Georgia

Full circle

Sir:

Mr. Lafon's excellent exploration of "The Fallacy in the Fallacy" is indeed a pragmadox.

We traced his reasoning full circle and were amazed to discover that one side of his "0" is twisted like a Moebius strip, but we don't know which side.

Mr. Lafon is to be commended for proving nothing, but if one can conceptualize nothing as a pseudo-unit, then he has validated the infinitely nested fallacy!

This would vindicate English teachers who maintain that mathematics can't prove nothing . . . or is it the other way around?

DAVID R. BELL
East Hartford, Connecticut

Laugh on

Sir:

I wish to thank those readers of DATAMATION who wrote the editors to express amusement and interest in my article, "The Fallacy in the Fallacy." I frankly feared that the article might ruffle a few feathers, but the responses which I've seen to date have been uniformly good-natured and witty.

Mr. John Cope's letter adequately sums things up from the mathematician's point of view. However, he states that zero has no multiplicative inverse because there is no number X which satisfies $X \times 0 = 1$. It would be more precise to say that there is no *finite* value of X which *safely* satisfies the equation. Thus we are obliged to assume that the hypothetical quotient of $X \div 0$ is infinite. But the product of zero and infinity may be interpreted as either "an infinite amount of nothing" or as "no amount of infinity." Clearly the two ideas are diametrically opposed, and we should conclude (logically, if not pragmatically) that $\infty \times 0 \neq 0 \times \infty$. This, in turn, throws considerable suspicion upon the validity of $X \times 0 = 0 \times X$.

As long as we permit this patently non-finite number (zero) to masquerade as an integer, I'm afraid the semantic contradictions are going to remain.

JERYL W. LAFON
3816 Shenandoah Place, N.E.
Albuquerque, New Mexico 87111

P.S. Based on the concept of neutral numbers as additive identities, I think I have worked out the axioms for a self-consistent mathematical model which would permit—in essence—a division by zero, without prohibiting any of the other conventional operations. However, from the computer designer's point of view, the remedy might be worse than the malady. Interested parties may contact me directly at the above address.

Programmer care and feeding

Sir:

I rather enjoyed the article by John Cosgrove on "Needed: A New Planning Framework" (Dec. 1, p. 37). Many of his points were well made and appropriate.

However, I do disagree with the statement: "Programmers are hard to manage and, perversely, the best ones seem to be the hardest to handle." This is an improper license for programmers to be cantankerous to prove they are the best. Quite generally the best programmers are easiest to handle.

Unfortunately there has been great disrespect for the programmer in the scientific community. His view of management has often been one of headless chickens chasing abstract principles and demands for satisfying crash requirements which simply do not stand the test of time. Competent programming demands respect for the efforts, rights, and opinions of individuals. The best programs are produced when the programmers have some degree of freedom in which to work and then show appreciation for this by their productivity without trying to reinvent everything.

D. R. VONDY
Oak Ridge, Tennessee □

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This forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

The Forum

The End of Adolescence?

It is my opinion that:

a. In general, the quality of the software produced by our "profession" is shoddy. It is unnecessarily expensive and definitely unprofessional.
b. The fundamental problem which has led to the above sad state of affairs is that we have been operating with a critical shortage of manpower throughout the history of our business.
c. The current economic slump can be turned to our long-term advantage, in that it offers us the opportunity to institute some long overdue "reforms" and to lead our industry out of its adolescence and into responsible maturity.

Since I learned a long time ago that it is impossible to win an argument without the cooperation of your opponent, I have decided to place the burden of constructing my side of the case on your shoulders. I have posed some questions below which I feel should help you in that task.

1. Name three projects which were completed on schedule.
2. Name three projects which were completed within budget.
3. Name three projects which (eventually) performed up to their specifications.
4. Name one which did all three of the above.
5. How often have you worked on a project which had no open personnel requisitions?
6. How often have you had to make a selection among several qualified candidates in filling a position?
7. How often have you seen someone receive the same assignment two or three times in a row? (Or, alternatively, how many people do you know who have written three schedulers? or Fortran utility packages? or _____?)
8. How many times have you seen a supervisor audit (review or "read") the code of his subordinates? How is his "superior" experience supposed to be transmitted to his staff?
9. How much code in any significant project is drawn from previous work? Do they let design engineers wind their own transformers?
10. Is "Coder" a less honorable vocation than "Electronics Technician"? If we called them "Computer Sciences Technicians" could we have more of them?
11. Prior to January 1970 what fraction of the programmers working in your area do you suppose would have quit if practices were instituted to "correct" some of the above circumstances? Would you?
12. How many programmers have been laid off by your company since January 1971? Were you?
13. How many "good," "famous," "recognized" or high-salaried people do you know of who are out of work at the moment? How many have been since January 1971?
14. How many people do you know who have taken jobs at lower salaries? or less impressive titles? or lesser responsibilities? or less "interesting" work than they enjoyed in their previous job?
15. Is the job market bad enough yet that some significant number of programmers will be willing to work for a living? ("Work" is defined here as doing something which is not among your top three favorite activities.)
16. Do you suppose that you will mourn:
    a. one-half as much as, b. as much as,
    c. considerably more than

I the end of this era?

—C. A. Irvine

Mr. Irvine is manager of advanced software development for NCR's San Diego area plant.

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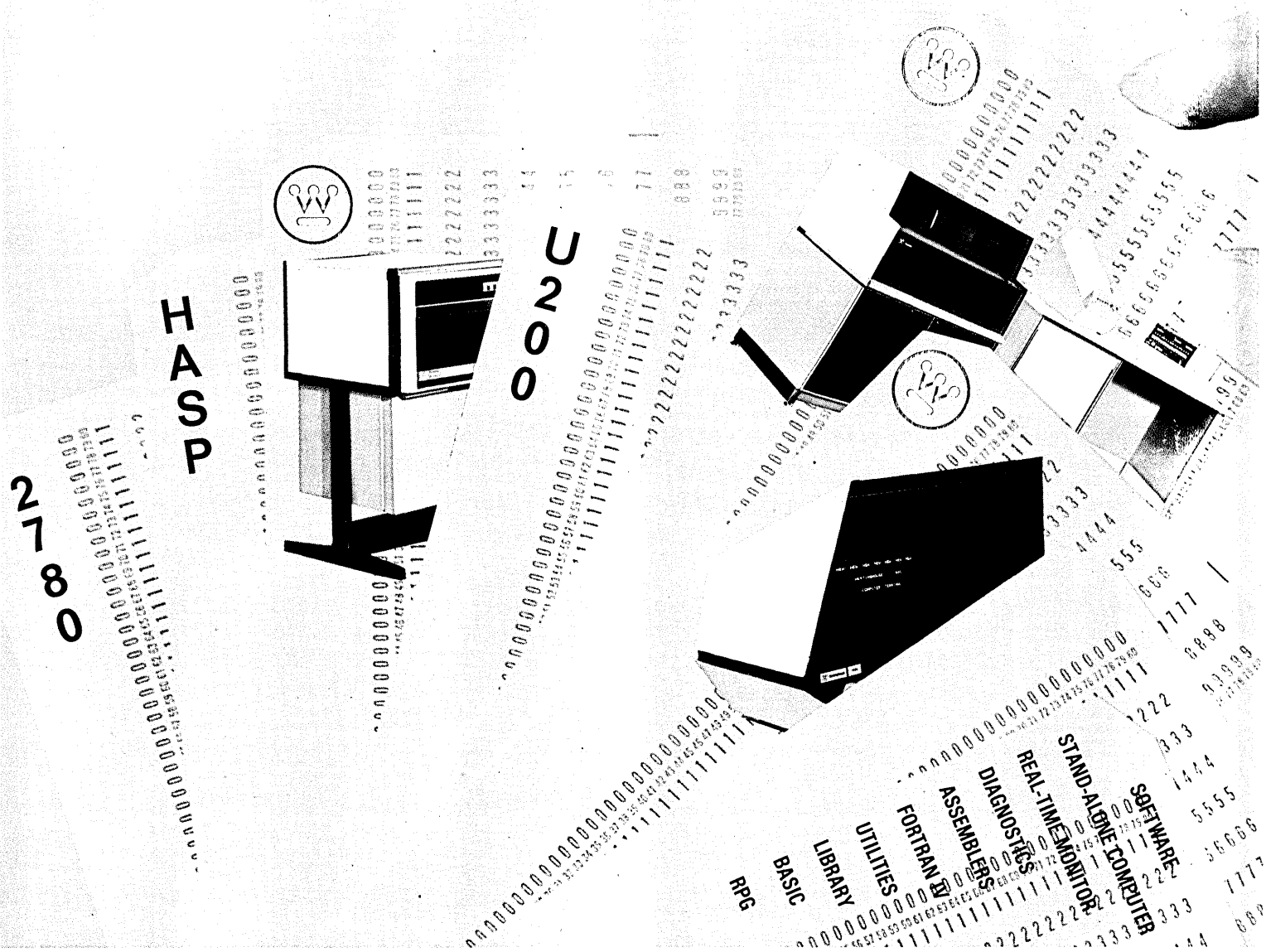

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