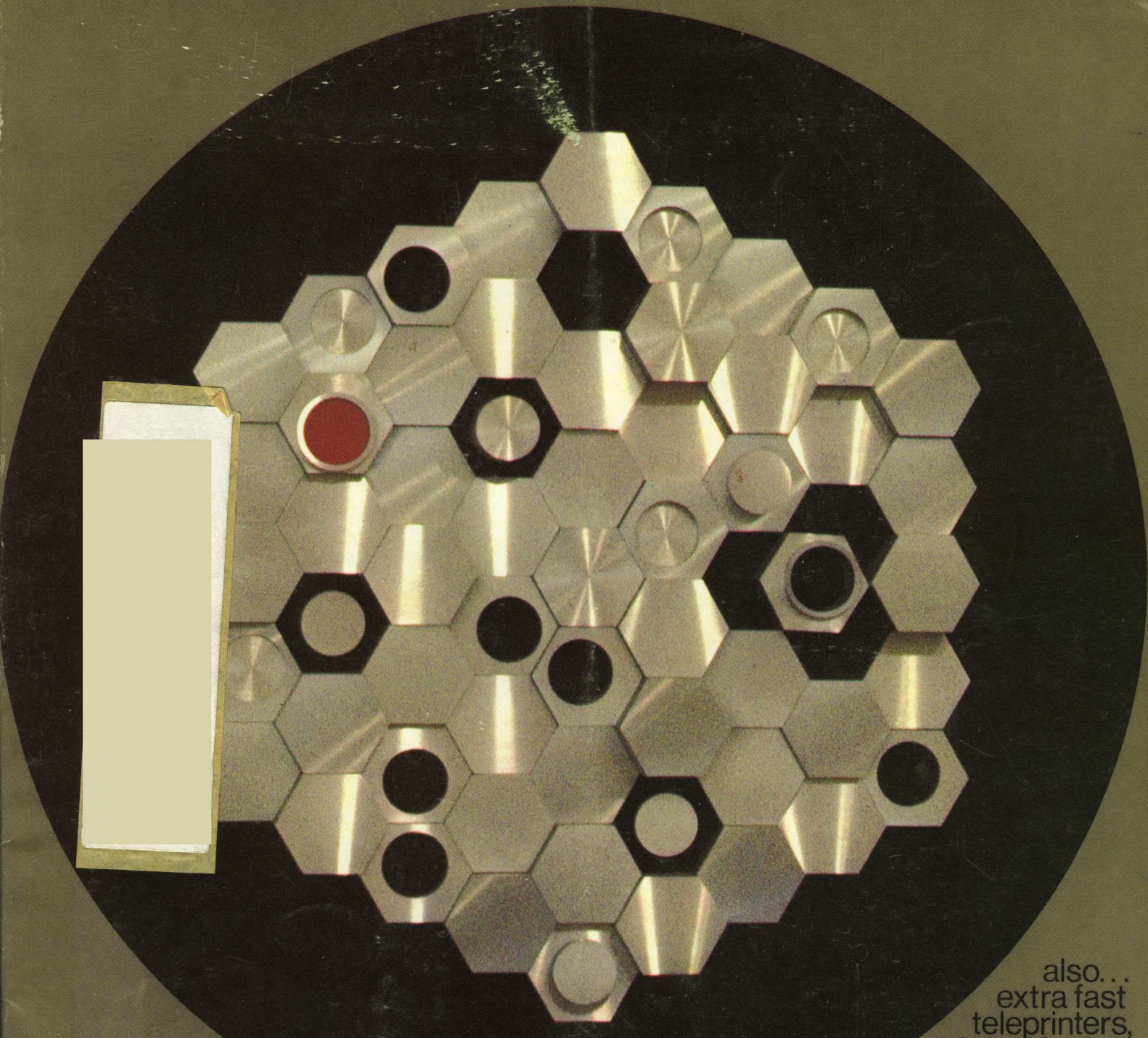
DATAMATION '73®

October

Toward Mass Storage



also... extra fast teleprinters, time-sharing ground rules, and a new perspective on anti-trust.

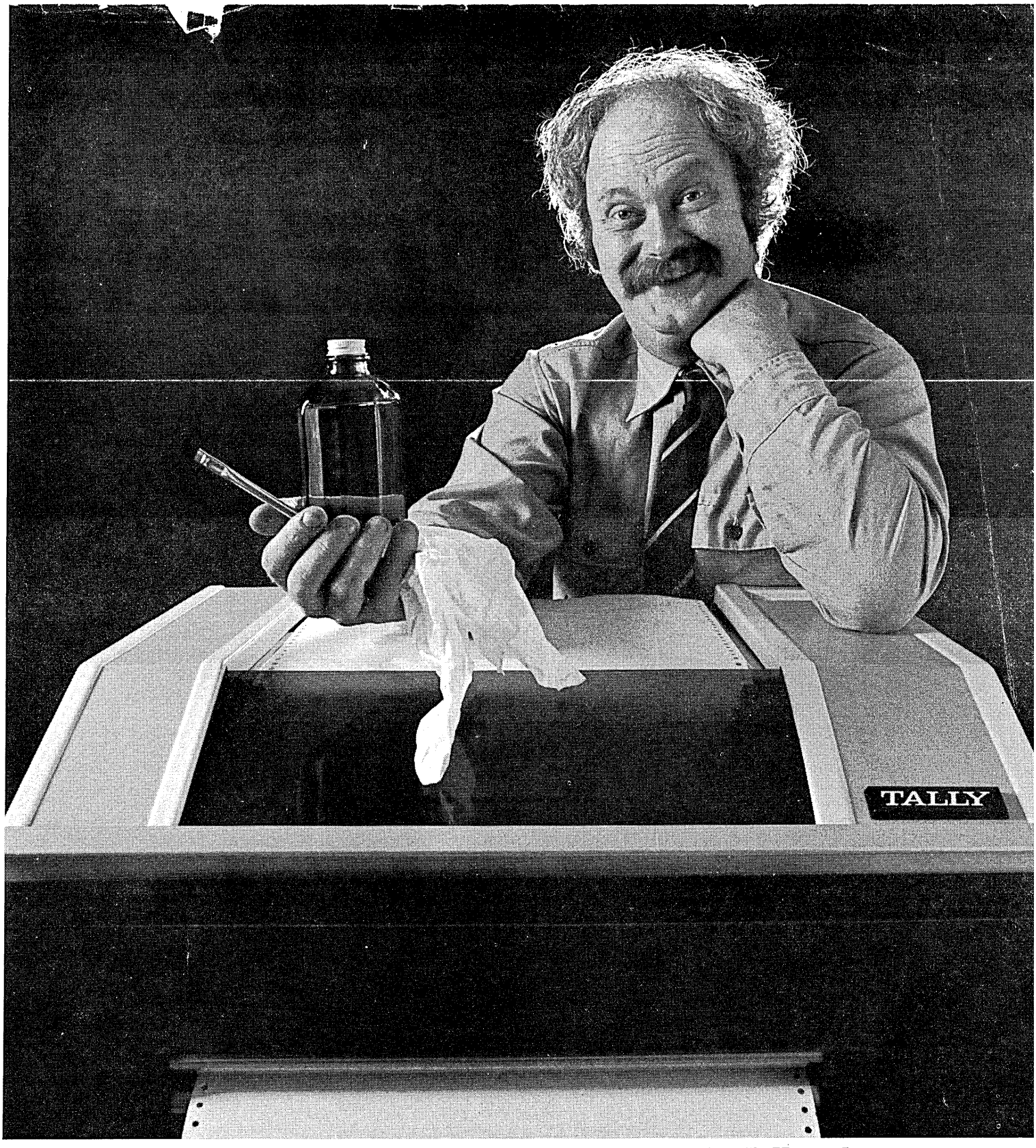
QUALITY.

It's something you sense in a product.
It's a Mercedes-Benz, a Tissot watch, a Weatherby rifle,
a Model 9000 synchronous tape transport. Quality means
features such as the exclusive customer-engineered,
front accessible test panel; a rigid cast deck;
crystal controlled timing and marginal skew check.
Those are but a few of Model 9000's many features.
And, as with any product of surpassing quality,
Model 9000 is not necessarily the most expensive —
merely the finest. Write today.

KENNEDY CO.
540 W. Woodbury Rd.,
Altadena, Calif. 91001
(213) 798-0953

KENNEDY • QUALITY • COUNT ON IT

ON READER CARD



How to maintain the Tally printer

Just clean it. Occasionally—like every month or so. Easy. No lubrication. No adjustments. No grief.

Our elegantly simple print mechanism is so reliable that we guarantee it for one full year. Our original 1000-hour predicted MTBF now looks a little conservative.

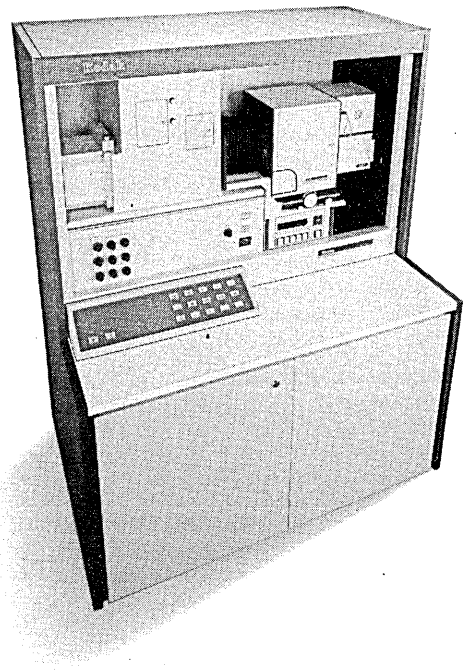
No wonder the Tally printer is becoming the first choice of computer manufacturers and users who demand reliability. If you're looking for an impact printer that can churn out 200 lines per minute day in and day out without fuss or failure, see your Tally man, now.

TALLY®

Tally Corporation, 8301 S. 180th Street, Kent, Washington 98031 (206) 251-6770
Data Terminals • Printers • Card Reader Terminals • Paper Tape Terminals

CIRCLE 4 ON READER CARD

COM can boost your throughput.



That's what Kodak computer output microfilm is all about.

The idea of bypassing impact printers to go directly to microfilm via COM is bound to appeal. It's an electronic path versus a mechanical one. That means speed with reliability.

Kodak KOM microfilmers do this job at 20 or more times the speed of impact printers. So you have more time to get more jobs done on the mainframe.

Besides speed, consider what else comes with a KOM microfilmer. First, Kodak specialists will help you design, develop, and implement your COM system. Second, Kodak software helps you get each job done faster and in the format you need. Third, Kodak equipment service that will help keep your COM unit up and running.

Take the important first step.

Write us for our new booklet, "The New Generation of Computer Output". Eastman Kodak Company, Business Systems Markets Division, Dept. DP617, Rochester, New York 14650.

Kodak: for better use of information.

OCTOBER, 1973
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departments

DATAMATION®

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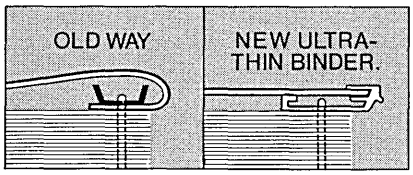
Introducing the new Ultra Thin Binder.

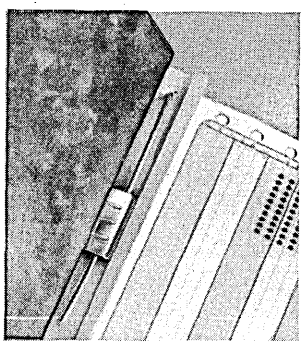
Our binder's loss is your gain. By developing a new, thinner kind of binder, Boorum & Pease has created more room for your growing mass of unburst computer printouts. Without taking up any more room!

In fact, the new Ultra Thin Binder is the slimmest data binder you can buy. With its unique hinging, it lies flatter. Takes up less room in your file. Space saved is space gained. With our Ultra Thin Binder, you can put more pages in each volume. Or fit more binders in each Data File Module.



Ultrasonic welding makes it ultra slim, ultra strong.

Unlike the pressboard binders you're used to, the Ultra Thin Binder doesn't have a tuck fold. There's no riveting, no stubs. The Ultra Thin Binder is made differently: its pressboard covers are ultrasonically welded to a plastic channel master. As a result, the hinging is stronger. The Binder's overall construction is neater, smoother. It is also furnished with two tapered Wire Flex® (wound wire encased in plastic) posts and steel locking slides for easy loading and unloading.



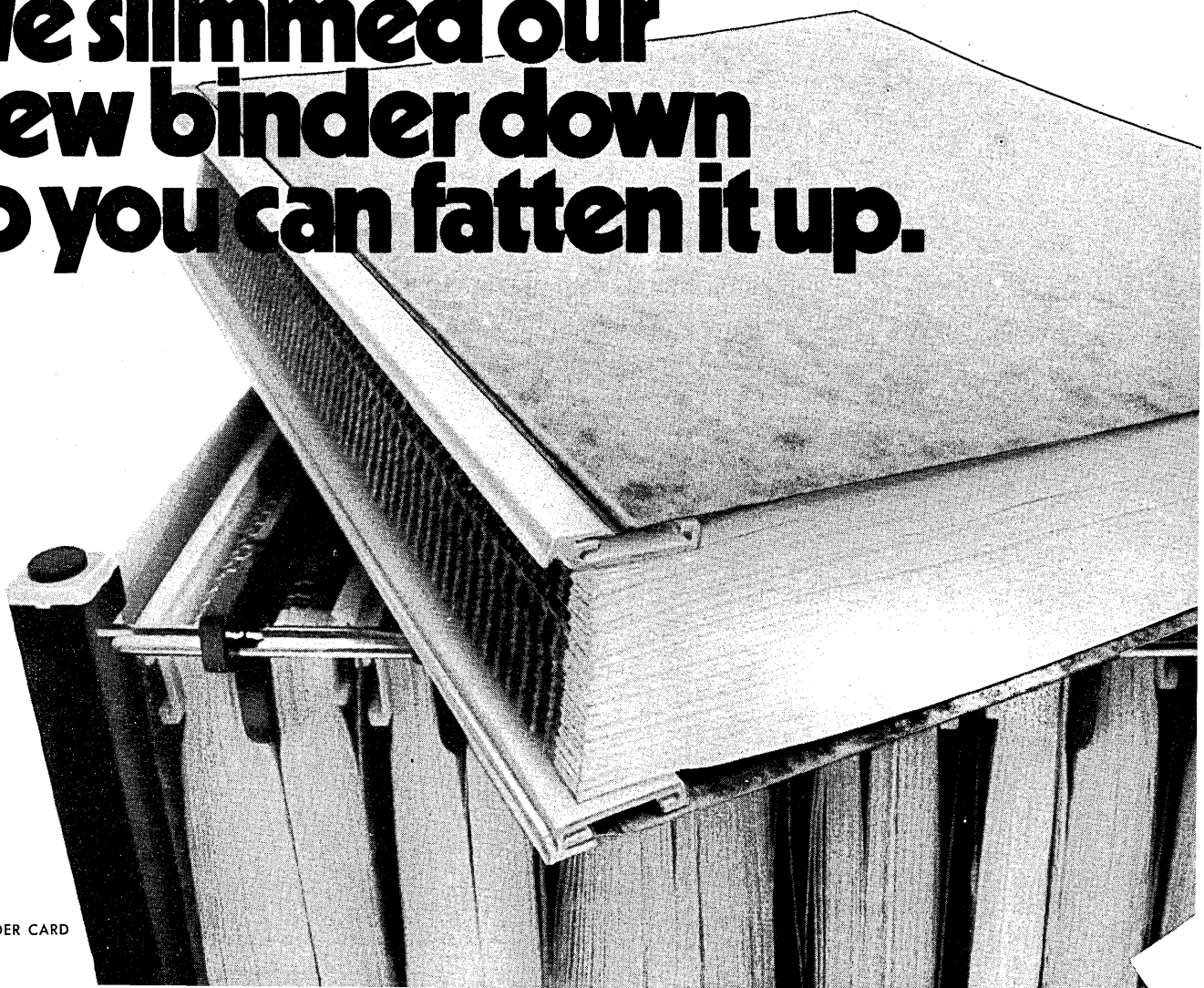
Think thin.

The Ultra Thin Binder comes in a choice of colors: dark blue, hot orange and executive red. It accommodates unburst sheets (14 7/8"x11"). And is ideal for temporary records or long term storage. Though there's little to it, the Ultra Thin Binder has a lot going for it.

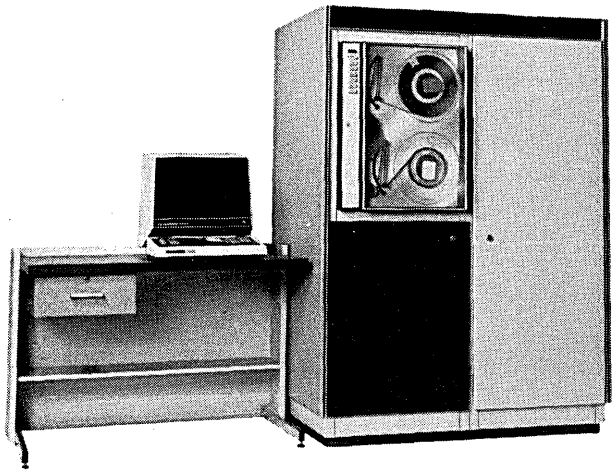
For more information, call your office products supplier. Or write us. Boorum & Pease, 84 Hudson Avenue, Brooklyn, N.Y. 11201. Tel. (212) 875-8818.

Boorum & Pease

We slimmed our new binder down so you can fatten it up.



CIRCLE 14 ON READER CARD

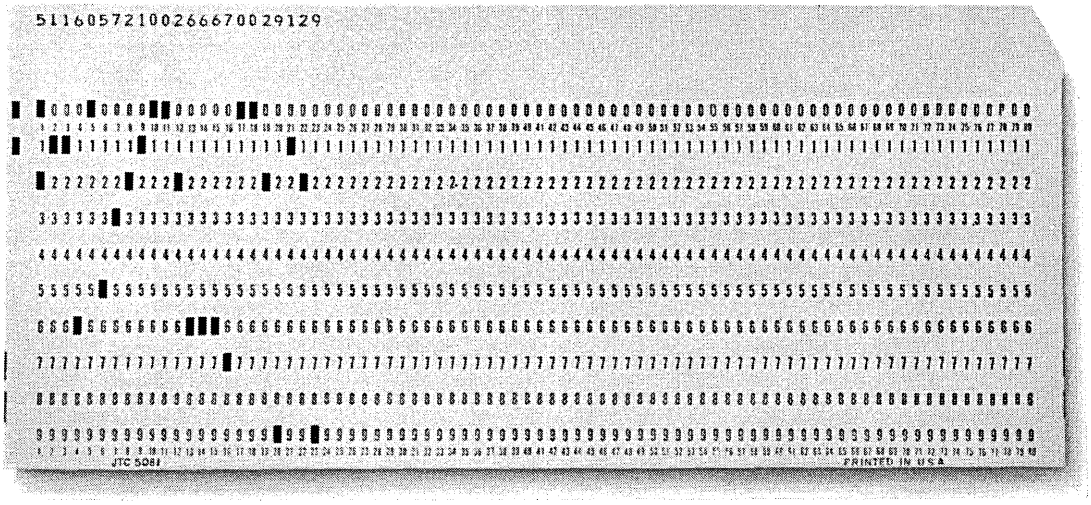


We're not about to predict the end of punchcards. But we would like to offer an alternative. A data entry system that is superior to punchcards in many ways and can be expanded in ways punch operations can't be.

We're talking about our new IS/1511 key-to-disk data entry system. For data entry it's superior to punchcards because it offers substantial error reduction. There are a total of four warning devices. And errors are so much easier to find and correct on a big screen than on a little punchcard. The IS/1511 data entry station is designed to make the operator as comfortably efficient as possible. Which results in increased operator speed. Naturally, the IS/1511 eliminates cards and card handling. It also makes for greater throughput and better formatting on input and output.

But the IS/1511 isn't just *better* than punchcards. It's

A punchcard is only a punchcard,



different. Its controller is a small computer with a big capacity. So when you want the IS/1511 to take on a new task, you just have it reprogrammed.

And it offers modular expandability thanks to a communications port that permits data transmission at speeds from 1200 to 9600 baud. So you can move data directly from a remote terminal to the central processor. Or to another terminal linked into a data communications system. That means your IS/1511 can become a shared processor, a remote batch processor, a distributed data base manager, a distributed processing system, or a whole data communications system. Which makes it a lot more than a punchcard operation can ever be.

It's nice to know the IS/1511 is so versatile. It's even nicer to know that it's backed up by a service organization that has 96 locations all across the country. No matter where you are, you're not very far from help if you need it.

The IS/1511 can be almost anything you want it to be. And GTE Information Systems can provide you with almost anything you want when it comes to data communications equipment: modems, multiplexers, video and typewriter terminals, front-ends, even programming.

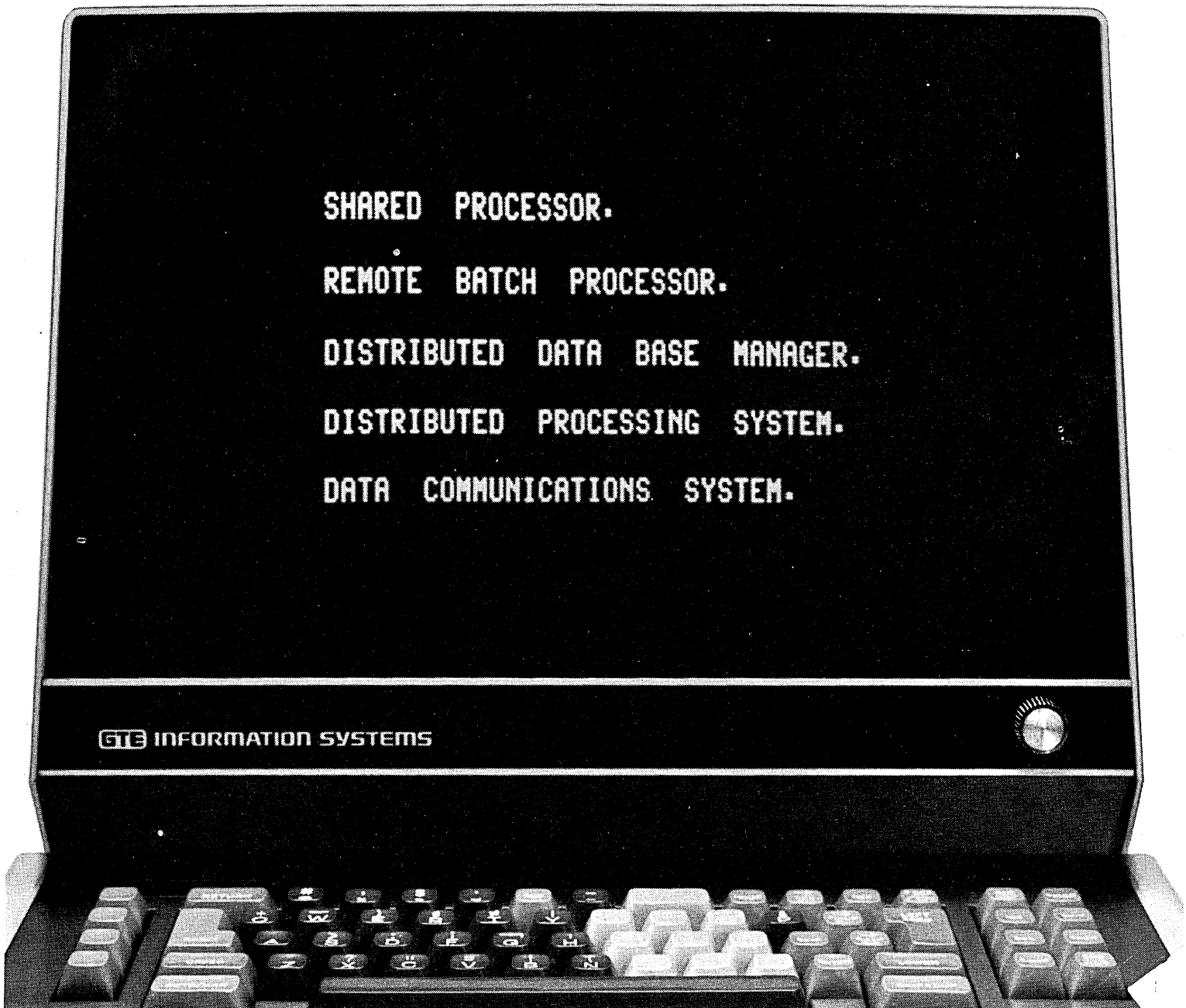
Only a company that can offer you almost anything could offer you a data entry system that can be almost anything.

GTE Information Systems, One Stamford Forum, Stamford, Connecticut 06904. Regional offices: Mt. Laurel, New Jersey, 609-235-7300; Chicago, Illinois, 312-332-7800; Anaheim, California, 714-993-6000; Montreal, Quebec, 514-866-9324; Toronto, Ontario, 416-362-1541.

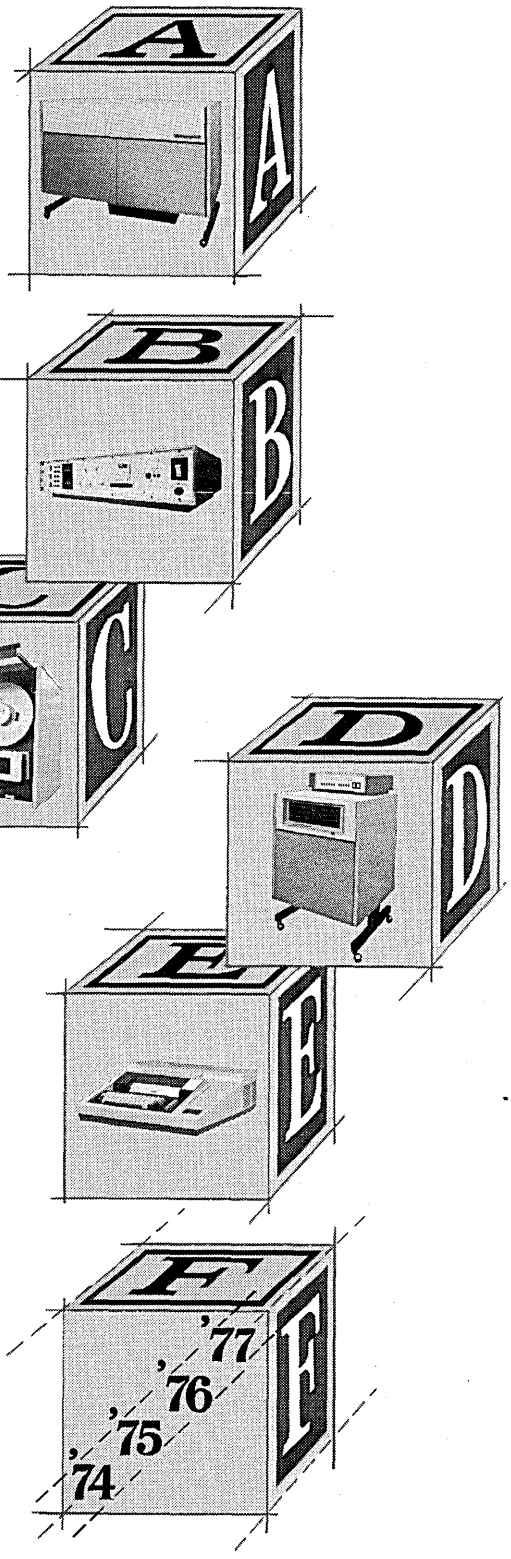
GTE INFORMATION SYSTEMS

CIRCLE 32 ON READER CARD

but our new data entry system can be almost anything.



Let's put a better COM recorder together... together.



Your COM requirements won't be the same in a few tomorrows as they are today. That's why we designed the System 4500 in modular blocks—units that fit together now to meet your exact needs. And even more important, you can build on each unit with additional modules that practically "plug in" for future flexibility.

Our basic Model 120 COM recorder [A] is designed for direct online interface with existing high-output computer equipment. The convenient operator control panel [B] with job setup card virtually assures error-free operation. Moving up to a versatile Model 130 offers you off-line capability and allows acceptance of magnetic tapes [C] from a wide variety of computers.

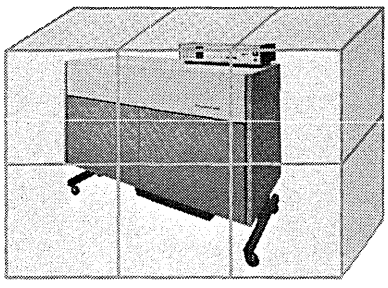
When you incorporate a high-speed minicomputer [D] and solid-state electronic data terminal [E], you have the Model 150, which completely eliminates the need for host computer data handling and reformatting. Future growth [F] is assured as new modular developments emerge.

Want to make COM obsolescence obsolete? Check our modular System 4500. Just call us—(714) 283-1038—or write Stromberg DatagraphiX, Inc., P.O. Box 2449, San Diego, CA 92112.

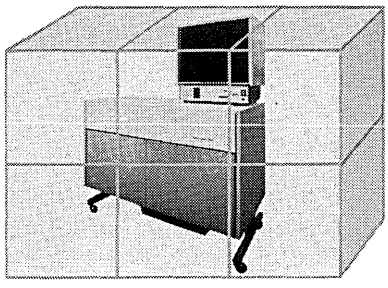
DatagraphiX

Stromberg DatagraphiX Inc ▫ a General Dynamics subsidiary

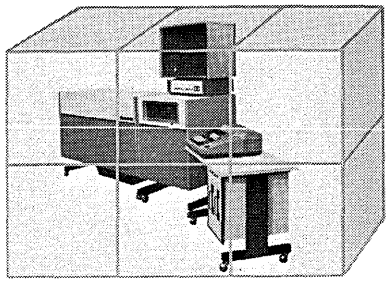
MODULARITY. Only DatagraphiX System 4500 offers add-on capability that grows as your needs grow.



Model 120



Model 130

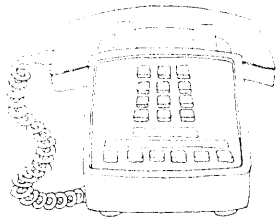


Model 150

meet the WAVETEK ADC-1000. it's a new breed of Audio/Data Communications cat!

It's the most advanced computer communication system available, and will link more people to your computer in more different ways than you thought possible!

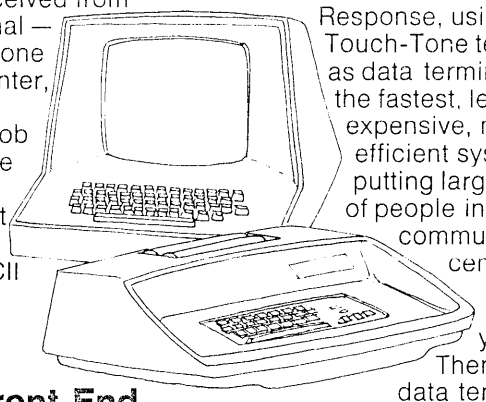
That's because the primary communication mode in the



ADC-1000 is Voice Response, using low-cost, efficient Touch-Tone* telephones as data terminals.

Accepts All Types of Terminals

Our system is different from the rest because information can be transmitted and received from every type of terminal — Touch-Tone telephone or pad, CRT, teleprinter, credit card, cash dispenser, remote job entry etc. — all at the same time. Imagine a compact, low-cost system with either Touch-Tone or ASCII input and Voice or ASCII output!



A Powerful Front-End Processor Or Stand-Alone System

With its built-in, lightning-fast minicomputer, flexible high-level control program, and a host of available peripherals such as mag tape or disk, the ADC-1000 can function as a powerful front-end processor or operate as a stand-alone system. In either case, it will take over many of the routine operations that bog down the main computer.

The Great Impersonator

The ADC-1000 is a great impersonator, too. It can be programmed to directly replace an IBM 7770 ARU, emulate an IBM 2848/2260 System, or handle IBM 270X functions. Yet this Wavetek system is inexpensive to install, since it requires little or no programming or procedure changes.

The Touch-Tone Telephone Is The Most Economical Terminal Of All

There's no doubt about it. Voice Response, using ordinary Touch-Tone telephones as data terminals, is the fastest, least expensive, most efficient system for putting large numbers of people in direct communication with a central computer.

Look around your company. There are potential data terminals sitting on every desk — in every office, every department, every work station, every branch. Touch-Tone pads as accessories to dial phones are available. Soon, there'll be Touch-Tone telephones in every home, every hotel, every gas station and every phone booth. Touch-Tone is truly the universal data terminal.

Many Touch-Tones — A Few CRTs & Teleprinters

The ADC-1000 is the ideal solution to most data collection & information retrieval problems because the system is low-cost, flexible and so simple to use that everyone with need to know can have immediate access to central data file. That's the beauty of Voice Response, using ordinary Touch-Tone telephones. However, where visual or printed output is needed, CRT displays and teleprinters can be added to the system.

We're experienced too. With Voice Response Systems operating all over the country — in major banks, department stores, and diverse industries including the world's largest audio response user.

Write or phone for the whole story today.

WAVETEK®

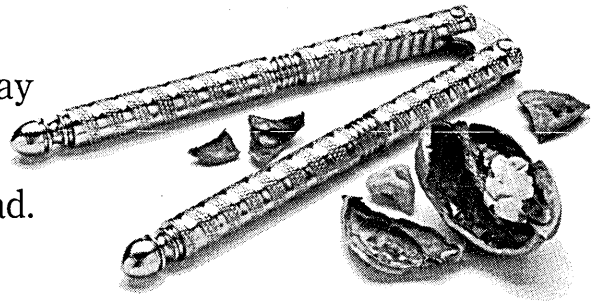
DATA COMMUNICATIONS

P.O. Box 651
San Diego, Ca. 92112
(714) 279-2200

*AT&T Trademark

CIRCLE 69 ON READER CARD

Caught in the old cassette vs. ½"-drive, price vs. performance crunch?



With a choice like that you pay the price no matter what you do.

So we've come up with the first real alternative you've ever had.

The "Scotch" Brand Data Cartridge.

It's a unique approach to digital tape storage that's priced like a cassette but performs like a ½" -compatible drive.

It operates at speeds up to 90 ips, starts/stops with accelerations up to 2000 in/sec^2 and offers transfer rates up to 48,000 bps.

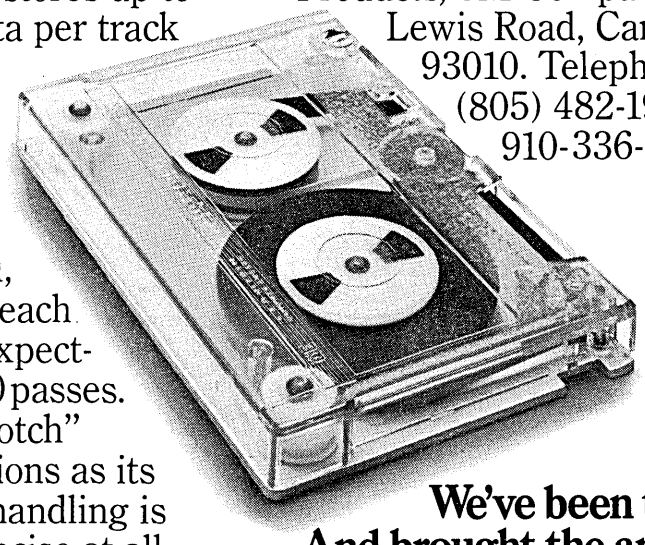
It uses ¼" tape and records at up to 3200 frpi, so it stores up to 5.5 million bits of data per track on 1 to 4 tracks.

It needs only a single point drive and no external tape guidance, so tape can never cinch, spill, stretch or break and each cartridge has a life expectancy in excess of 5000 passes.

Because the "Scotch" Data Cartridge functions as its own transport, tape handling is fast, accurate and precise at all times. It's ideal for: Word processors and terminals. Point-of-sale data capture and computer data entry. Minicomputer I/O and paper tape replacement.

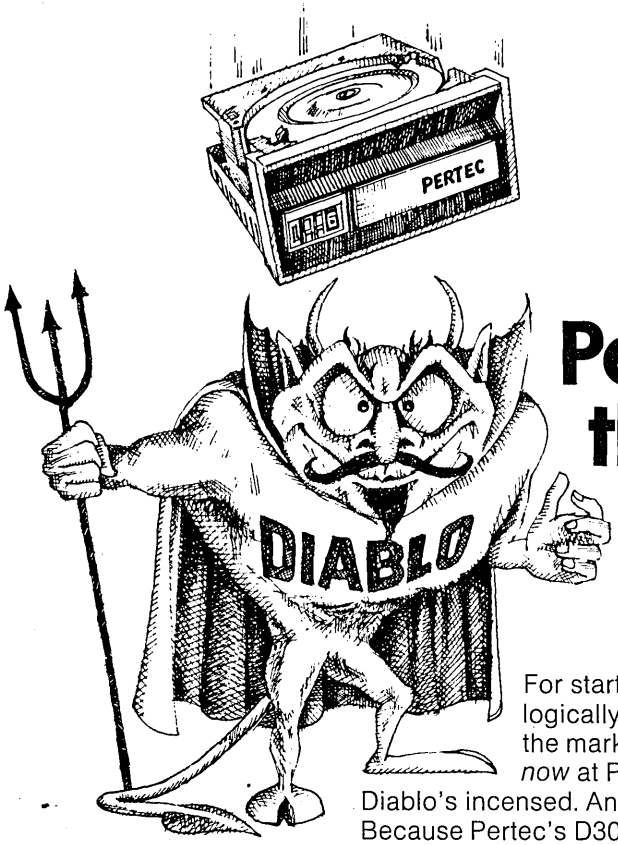
And if you need more information, you've got a choice there, too.

Just contact any of the major peripheral manufacturers or Data Products, 3M Company, 300 South Lewis Road, Camarillo, Calif. 93010. Telephone: (805) 482-1911. TWX: 910-336-1676.



We've been there.
And brought the answers back.

3M COMPANY



Pertec's out to beat the devil at his own game.

For starters we've developed the most technologically advanced and complete disk drives on the market. They're available and deliverable *now* at Pertec.

Diablo's incensed. And for good reasons.

Because Pertec's D3000 disk drives are available in top and front loading versions, plug-compatible, and identical in interface and size (8¾" x 26"). Both offer 35 msec access time, margin testing, a choice of electronic or mechanical sectoring, an optional fixed platter. And a built-in power supply—all within the drive and identical in both configurations.

And you get the same assistance in design, development and maintenance of your system with our disk drives as you do with our tape drives . . . Factory training for your service people. Back-up by a service and support network spanning 30 U.S. cities and 20 foreign countries.

All at surprisingly low prices.

Pertec is serious about satisfying your disk drive requirements, and we're proving it.

Find out more. Call us collect in the area nearest you: Boston (617) 890-6230; Chicago (312) 696-2460; Los Angeles (213) 996-1333; London (Reading) 582-115. Or write us at 9600 Irondale Avenue, Chatsworth, California 91311.

The best values in computer peripherals come from PERTEC

Already the world's largest independent manufacturer of tape transports.

CIRCLE 83 ON READER CARD

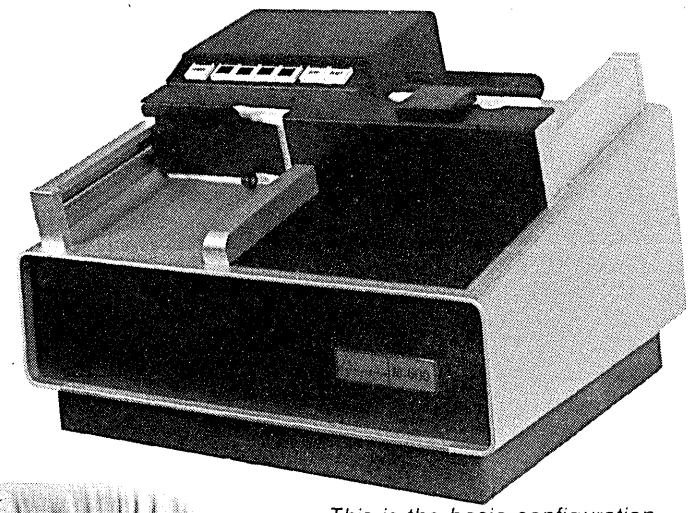
Blow Through A Card Deck to See Why A Documation Reader Should Be in Your Next System Spec

Go ahead. Blow through a card deck. See how air pressure causes the cards to riffle and gently separate. No friction. This basic air flow principle is behind all high speed Documation card readers.

Conventional card readers use wheels or other friction devices to push or drag cards through the throat of a reader. Friction causes card wear. Stress during the critical start up can crumple cards. Jams occur.

A jet of air generates initial thrust on Documation card readers in the 285 to 1200 cpm range. No friction means no wear. Then to virtually eliminate the source of jams, a vacuum pick places only one card at a time on the track.

Today Documation provides card handling equipment for more than 100 computer system manufacturers. Ask your computer representative for more details about how Documation helps make a more reliable computer system. If he can't tell you, then maybe you should be talking with another computer company.



This is the basic configuration for high speed Documation card readers. Look for it in your system.

DOCUMATION
INCORPORATED

Post Office Box 1240
Melbourne, Florida 32901

Calendar

OCTOBER

DATAMATION Grand Tour, Oct. 30-Nov. 1 (London), **Nov. 6-8** (Stockholm), **Nov. 12-14** (Paris), **Nov. 19-21** (Milan), **Nov. 27-30** (Munich). DATAMATION, with the support of the U.S. Dept. of Commerce, is sponsoring this series of five major exhibitions of U.S. dp products, with emphasis on peripherals, special-purpose systems, terminals, and computers. Accompanying technical symposia will describe advanced systems techniques to top technical, edp-oriented management. Contact: Charlie Asmus, DATAMATION, 35 Mason St., Greenwich, CT 06830, 201/444-4271 or 203/661-5400.

National Conference on the Use of On-Line Computers in Psychology, Oct. 31, St. Louis. This third annual meeting, for professionals in all allied areas, will be a forum for the exchange of information on all aspects of on-line computer applications in psychology, with invited and contributed papers, equipment and literature exhibits, workshops, and tutorial sessions. Fee: $2, members; $6, nonmembers; after Oct. 20, add $2. Contact: Donald I. Tepas, Dept. of Psychology, St. Louis Univ., St. Louis, MO 63103, 314/535-3300, Ext. 371.

NOVEMBER

Programming Languages and Information Retrieval Interface Meeting, Nov. 4-6, Gaithersburg, Md. Jointly sponsored by the ACM special interest groups on programming languages (SIGPLAN) and information retrieval (SIGIR), this meeting will identify, define, and explore common problems in the two fields. Topics will include: query languages, languages for implementing information retrieval (IR) systems, language functions in IR systems, and language requirements for document and fact retrieval. Fee: $25, ACM/SIG members; $30, ACM only and SIG only members; $35, nonmembers. Contact: Margaret Fox, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, DC 20234.

Mini/Micro Computer Institute, Nov. 4-9, St. Charles, Ill. Sponsored by National Electronics Conference, Inc., the institute will consist of three seminars on minicomputers (Basic Concepts and Applications; Hardware, Software, and Systems; Software Engineering Techniques) and one on microcomputers (Introduction and Applications). Fee: $395 for one seminar, $595 for two. Contact: NEC Office, Oakbrook Executive Plaza #2, 1211 W. 22 St., Oak Brook, IL 60521.

IEEE Conference on Systems, Man, and Cybernetics, Nov. 5-7, Boston. In this conference on the role of systems analysis in solving societal problems, over 140 papers will be presented in 32 sessions on the delivery and planning of public services (transportation, medicine, justice, water resources, etc.). Exhibits will be held in conjunction with NEREM (Northeast Electronics Research and Engineering Meeting). Fee: $30, members; $35, nonmembers; at conference, add $5. Contact: R. Christensen, c/o Arthur D. Little, Inc., 32 Acorn Park, Cambridge, MA 02140.

Symposium on High-Level Language Computer Architecture, Nov. 7-8, College Park, Md. Sponsored by the IEEE Computer Society and ACM SIGPLAN and SIGARCH, the symposium will attempt to identify and focus on a new kind of computer architecture whereby the machines are designed for accepting high-level languages and/or direct-users' languages. Proceedings will be available. Fee: $32, members; $42, nonmembers. Contact: Prof. Eliot Feldman, Computer Science Center, Univ. of Maryland, College Park, MD 20742.

Third National Conference of the Society for Computer Medicine, Nov. 8-10, Denver. For all interested in the use of computers in health care, the conference will include sessions on multiphasic testing, computer EKG's, on-line patient monitoring, laboratory systems, medical information systems, history systems, computer based medical records, and medical standards and automation. Fee: $85, members; $100, nonmembers. Contact: Joseph Edelman, Society for Computer Medicine, 200 Professional Center, 244 Peachtree Blvd., Baton Rouge, LA 70806.

44th National Meeting of the Operations Research Society of America, Nov. 12-14, San Diego. Emphasizing methodology and application areas of operations research, the program will include about 54 technical sessions, with exhibits and workshop groups. Fee: $30, members; $50, nonmembers. Contact: ORSA, 428 E. Preston St., Baltimore, MD 21202.

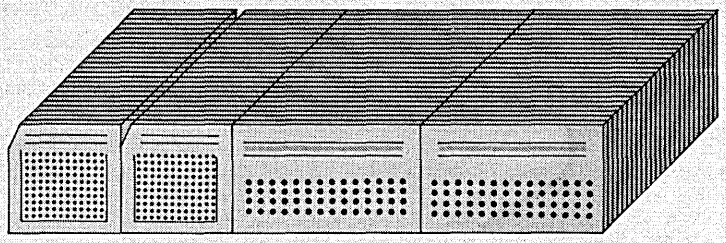
'73 Data Networks—Third Data Communications Symposium, Nov. 13-15, St. Petersburg, Fla. The focus of this ACM/IEEE Computer Society technical symposium will be the design, analysis, and operation of data networks. Topics will include: packet, message, and data switching; modems and multiplexors; sophisticated concentrators; network design and control; models and analytical techniques; standards; and existing networks. Fee: $60, members; $70, nonmembers; participants must register in advance. Contact: '73 Data Networks, P.O. Box 639, Silver Spring, MD 20901.

Second National Conference on the Effectiveness of On-Line Biomedical Computing, Nov. 29-30, Rosslyn, Va. Sponsored by the Assn. for the Advancement of Medical Instrumentation, the conference will allow physicians, engineers, research scientists, and industry representatives to evaluate present accomplishments and explore future uses of on-line biomedical computing in major medical applications including multiphasic health testing, general patient care, nuclear medicine, laboratories, and monitoring. Fee: $90, members; $100, nonmembers. Contact: Joy Skillin, AAMI, 1500 Wilson Blvd., Suite 417, Arlington, VA 22209.

DECEMBER

National Symposium on Computer Applications in the Juvenile Justice System, Dec. 6-8, Atlanta. This symposium will examine the status and potential of computers in the juvenile justice system, with emphasis on both the theoretical and practical applications in research, administration, and decision-making in courts and agencies working with juveniles. Topics will include: juvenile court information systems, behavioral research, statistics, record systems, legal research, confidentiality and security of computerized records, contracts with consultants and vendors, simulation models, and systems analysis. Fee: $115; after Nov. 1, add $10. Contact: Lawrence A. Boxerman, National Council of Juvenile Court Judges, P.O. Box 8000, Reno, NV 89507.

Tab makes one storage cabinet for cards,



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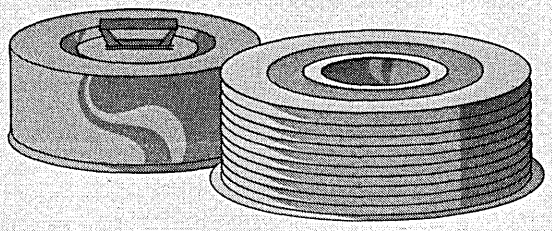

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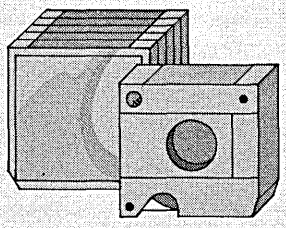

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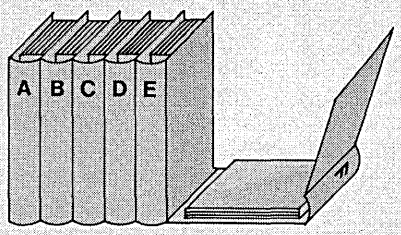

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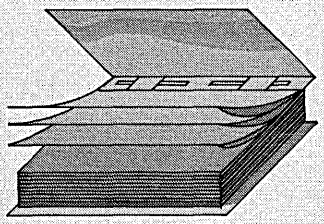
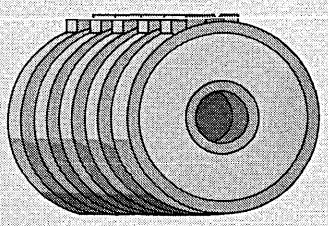
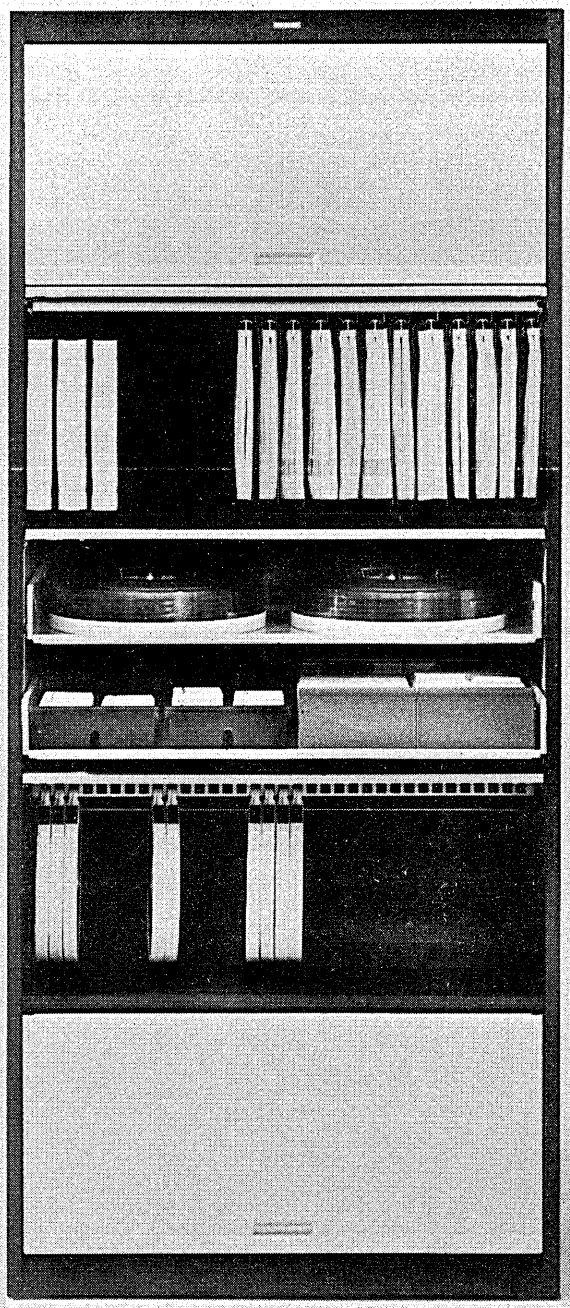


and one for tapes.





This one.

The Data Media Cabinet. Since 1956 when Tab introduced it, this revolutionary cabinet has quietly become a computer room word in media storage. With its broad selection of shelves, inserts, racks and rollout trays, it has readily and easily adapted to provide safe storage for 80 and 96 column cards, microfilm rolls and cartridges, fiche, mag tapes, disc packs (2315, 1316, 2316, 3336, 5440), printouts, manuals, binders, forms in cartons; even the department coffee pot. Others have tried to improve on it. But the two-, three-, four- and five-compartment Tab Data Media Cabinet has proven unbeatable over the years. Unbeatable still. One of its many configurations will meet your precise storage requirements, even as one of its many colors will complement your office landscape or computer room environment. Contact your local Tab representative, or write Tab Products Co., 2690 Hanover Street, Palo Alto, Calif. 94304.

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CIRCLE 49 ON READER CARD

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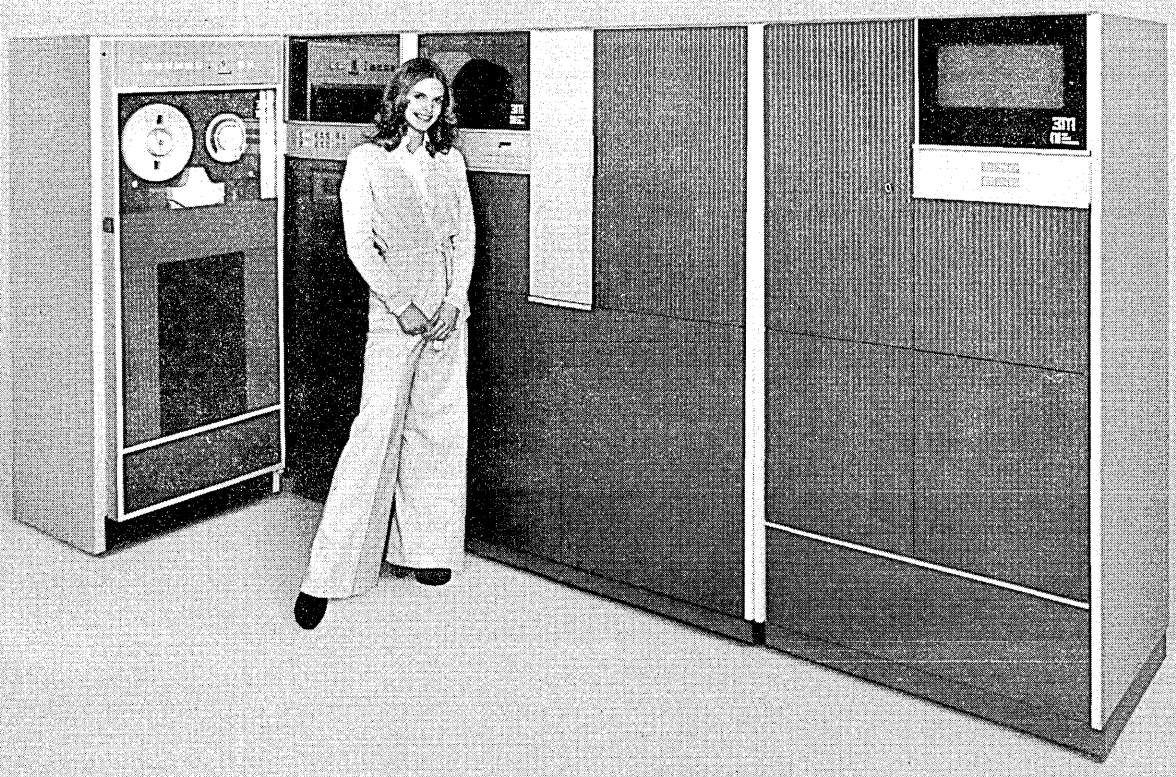
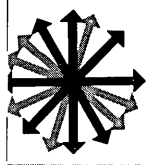
Best of all, the 3M EBR is compatible with your computer. Ready for a COM solution with one less problem? It's time to call us.



The age of microfilm is here... 3M COMPANY

CIRCLE 53 ON READER CARD



Look Ahead

JUDGMENT AT TULSA: AFTERMATH IS SHOCK

Evidence presented during last spring's Telex-IBM anti-trust trial in Tulsa reinforced all the suspicions about the plug compatible manufacturers; they were locked in a desperate fight for survival, and IBM was winning. During the three months when trial Judge A. Sherman Christensen was preparing his judgment, financing for the independents was "virtually non-existent," according to G. Harry Ashbridge, former Telex vp (see p. 174).

In agreeing in his judgment of Sept. 17 that IBM indeed was in a price war with the independents -- with no apparent benefit to customers -- Judge Christensen ordered Armonk to take four specific steps to plug PCM gear back into its cpu's. He also ruled that IBM's actions had damaged Telex in the amount of $117.5 million and ordered IBM to pay the Tulsa company treble damages of $352.5 million. Telex, found to be guilty of raiding IBM of talent and trade secrets, was ordered to pay IBM $21.9 million and return to IBM the confidential information it got.

The judgment left the industry in shock during the week following. IBM's stock plummeted 38 points in two sessions of trading, but began to recover even though analysts were saying that the stock, which earlier in the year sold at a high of 340, might now be considered a bargain at 230. Telex, as shocked as the rest, wasn't sure whether it would appeal the trade secrets judgment. IBM charged that the $352.5 million damages figure was "scarcely supportable" and that it would appeal. Both were given until Oct. 16 to comment to the judge.

IBM SUSPENDS PENALTIES

Although Judge Christensen granted a stay until the October 16 hearing, IBM immediately suspended the cancellation penalties on its long-term lease plans, pending the outcome of the appeal. It had no other choice if it wanted to appeal the order which prohibits IBM for the next three years from levying penalties on its FTP, ETP and TLP leases that are cancelled with 90 days notice. Loss of the appeal would have subjected IBM to lawsuits from users denied their rights to terminate and move to independent equipment.

Although the judge slapped Telex for stealing trade secrets, he effectively ended the need for this kind of espionage by ordering IBM to give out interface specs when announcing any future products. IBM will have 60 days after Oct. 16 to release details on 370 interfaces. In the week following the judgment, the industry was not certain whether the order would require the release of software details. The judgment orders IBM to "describe and disclose the design of the electronic interface...in sufficient detail as to make feasible the reproduction of such interface."

While the judge rejected Telex's demand that IBM stop bundling main memory and the cpu in the same box, he did order IBM to price them separately. And he required that IBM price peripheral systems with their controllers, even though the controllers were integrated with the cpu, and to apply a uniform percentage markup to these costs.

PROTECTION ISN'T ONLY FOR TELEX PRODUCTS

Faced with the threat of lawsuits by other similarly-damaged peripheral makers, IBM is expected to vigorously fight the $352.5

million in damages awarded Telex. (A person very close to the case estimates it could be liable for damages of $600 million to $1 billion to other vendors.) It might not fight the injunctive portions of the judgments as vigorously, setting these as the basis for a consent decree in the Justice Dept. case against IBM.

If IBM follows this course, the user is bound to benefit from the economies of a viable competitive industry that is free, as the judgment points out, from "predatory pricing, leasing or other acts, practices or strategies" of IBM. (The judge specified that the injunctive action isn't limited only to cpu's, memories, tapes, discs, and printers mentioned in the Telex case. In fact, he extended this to communications controllers because Telex said during the trial it is developing one. The implication: the injunctive relief could extend to data entry products, terminals, minicomputers -- virtually anything IBM plans to announce.)

With interface specs available sooner, independents -- with fewer false starts and less rework -- could reach the market with copies of or improvements to IBM products in time for users to take longer-term advantage of any price/performance edges. It might also mean that IBM, to maintain its revenue base, would accelerate its competitiveness in the technology arena, also benefitting users.

THE FINANCIERS ARE CAUTIOUS

Bankers, alarmed at the Memorex debacle and the heavy losses of Telex, probably will continue to be stingy with the financially-hungry independents. One banker, expressing cautious optimism over the Telex victory in court, thinks the funds will loosen slightly, but will be "a well-scrutinized doling out of money" to the independents. A lot will depend on how the financial institutions view the long-range plans of these companies, since the life span of the traditional compatible peripheral is shortening. IBM's Jacques Maisonrouge has talked of the day "when the whole memory, the cpu, and channel control will be in a box, like a shoe box" (see December 1972, p. 54).

JUDGMENT AIDS FEDS' INTERFACE PLAN

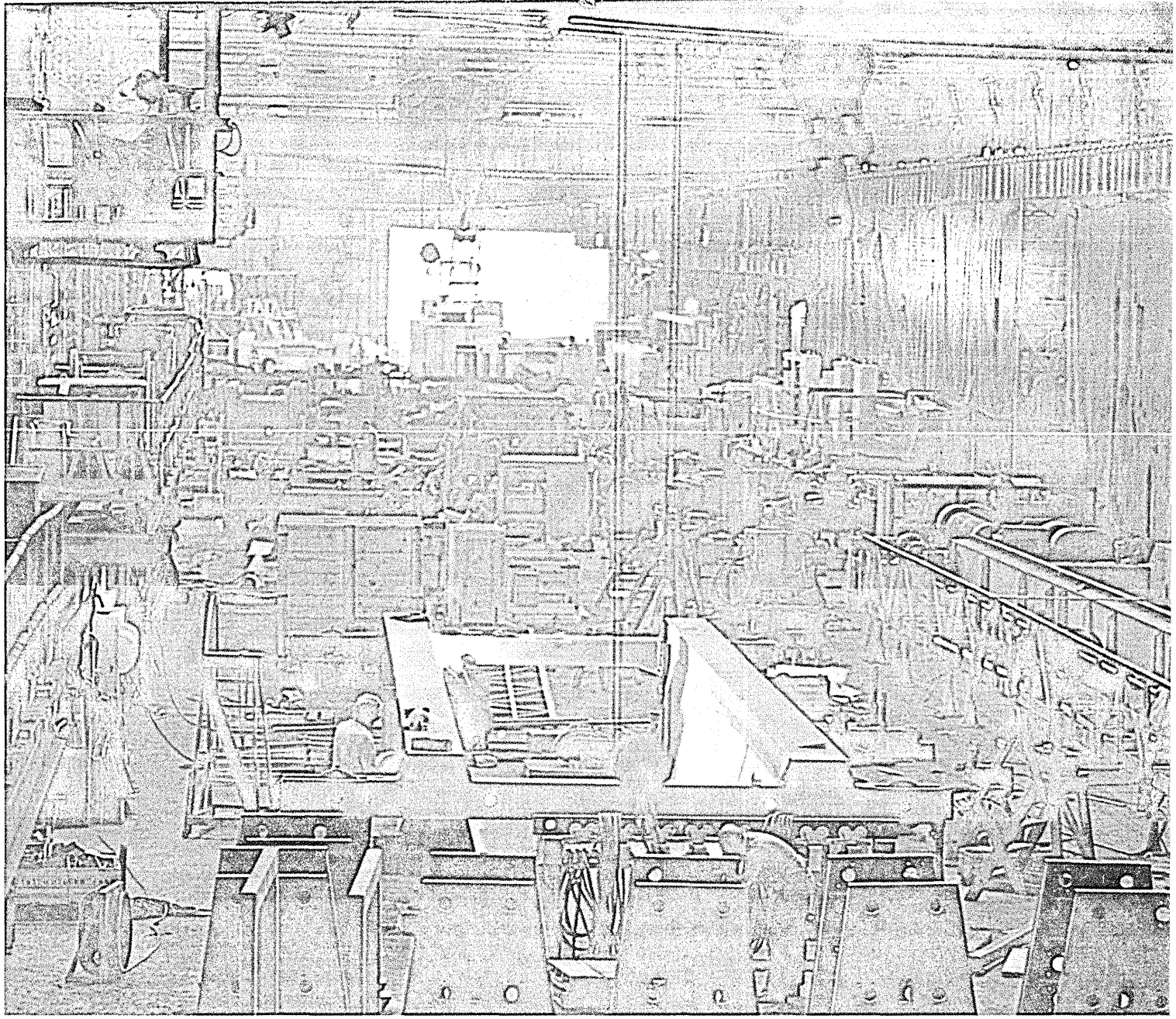
Washington sources agree that if Judge Christensen's decision survives appeal proceedings, all mainframers selling to the federal government will be required to disclose their interface specs. General Accounting Office is now preparing a report to Congress that will advocate this.

But if the government makes disclosure mandatory, an official of the Computer and Business Equipment Manufacturers Assn. predicts that suppliers will demand a "whopping" extra payment for systems integration whenever foreign attachments are used. The feds might be able to counter this move by hiring third party systems integrators at lower prices, he admits, but it "won't work" because disclosure of the I/O specs alone won't give outsiders enough information to make a hybrid system work.

AS TOM WATSON LEAVES

The Telex decision is viewed as a strong personal blow to Thomas J. Watson, Jr., coming as it does so shortly before his planned retirement at the end of this year. He relinquished the chairmanship two years ago but still carries the title of chairman of the executive committee and of the board of directors, and still is perhaps one of the two or three strongest men within the corporation.

(Continued on page 181)



A minicomputer here?

Sure!

It's solving a king-sized inventory problem at Harnischfeger, Inc., a world-wide producer of material-handling equipment. They had a king-sized material-handling problem right in their own shop. A customer would submit an order for a dozen hoists. And he'd want each one customized, too.

So expediters were running all over the warehouse keeping tabs on more than 10,000 different parts. Even then they sometimes had too many bushings and not enough bearings. Which meant the whole production system could come to a grinding halt.

A job for a big computer? Not necessarily. Harnischfeger is using an inexpensive batch system built around a Hewlett-Packard minicomputer. And it gives them virtually automatic inventory control.

For instance, they now get a "low level" signal on all parts, so they know exactly when to reorder. They also get an up-to-the-minute rundown on every job in the shop. The system also eliminates an enormous amount of bookkeeping and cuts "parts-picking" and handling time at least 20 percent.

Besides dedicated batch systems that maximize throughput, we have some other low-cost choices too . . . like time-share systems that give up to 32 users at a time instant access to data . . . and real-time systems that collect data and control jobs on a priority basis.

These are just a few examples of why Hewlett-Packard dedicated data systems are making their mark in more and more industrial and commercial applications these days.

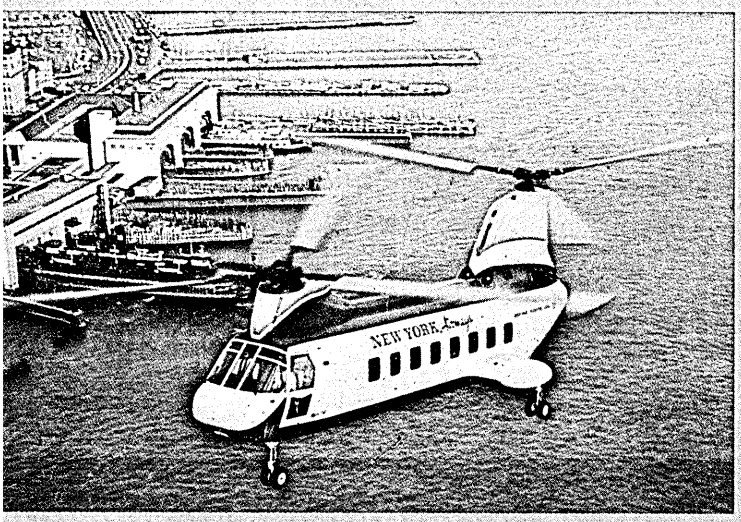
For more information, just call your HP data systems specialist. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: P.O. Box 85, CH-1217 Meyrin 2, Geneva, Switzerland; Japan: YHP, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

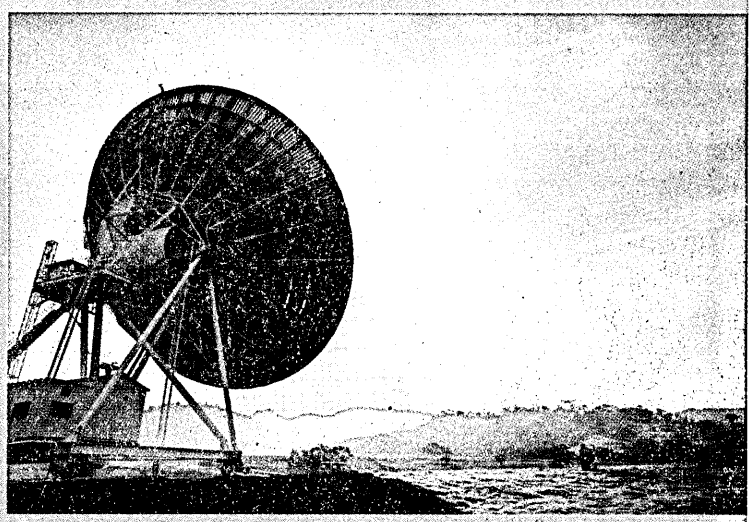
22244

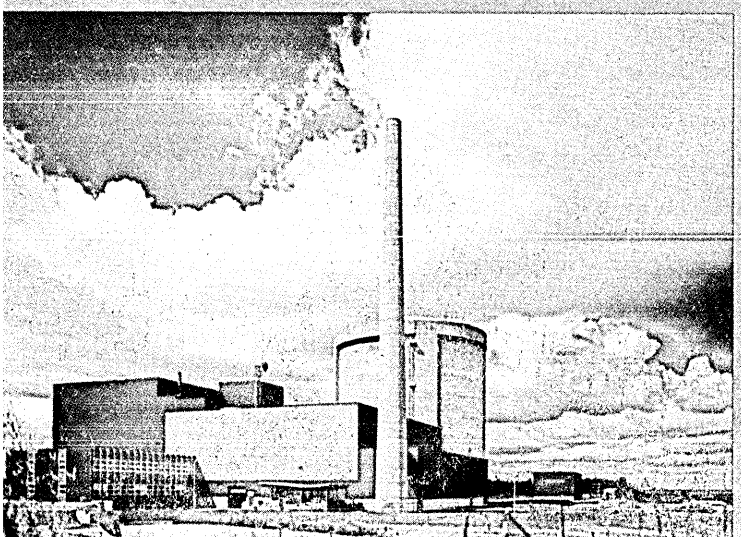
HEWLETT hp PACKARD

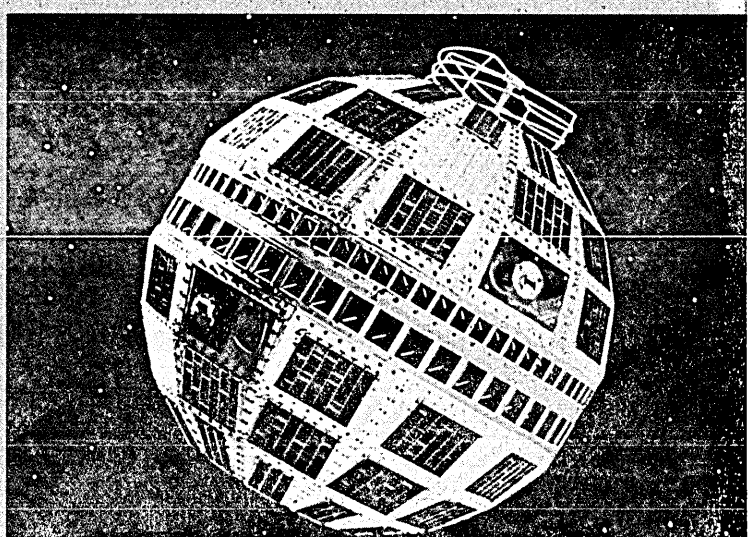
CIRCLE 18 ON READER CARD

SYSTEMS 85 and SYSTEMS 86 train pilots, control nuclear power, test auto parts, talk to satellites, forecast storms, run high-voltage experiments...









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Name your toughest real-time problem and chances are a SYSTEMS 85/86 has solved it. Or one pretty close to it.

Like simulators. Pilots of the nation's newest jet planes are trained in simulators controlled by SYSTEMS 86 computer systems. And telemetry. A top helicopter manufacturer uses an 86 to provide real-time and on-line answers for on-site helicopter flight test programs.

In power plant control — nuclear and fossil — we're big, and getting bigger. A leading supplier of nuclear steam supply systems has recently chosen our SYSTEMS 85 to monitor and supervise future pressurized water reactor (PWR) plants. An exacting hardware test. An even tougher software challenge.

Industrial control has always been our bag. For instance, in the auto industry alone, we have over 50 computer systems performing tasks that range from testing critical auto components to monitoring exhaust emission levels.

Communications? In one of the most sensitive and critical computer applications in history, a SYSTEMS 85 keeps the country's highest governmental figures in constant and instant contact via communications satellite and a comprehensive, worldwide air and ground terminal network.

In real-time lab operations and research jobs, scientists recognize us as a leader. For example, a SYSTEMS 86 conducts high-voltage experiments for the most comprehensive electrical research and testing center in North America. Another 86 helps a federal weather research lab improve storm tracking and forecasting throughout the central U. S.

And the list goes on. Telephone traffic simulation and voice synthesization studies for the nation's major communications research facility. Radar signal processing for the military. Mission simulation for the manned space shuttle development program.

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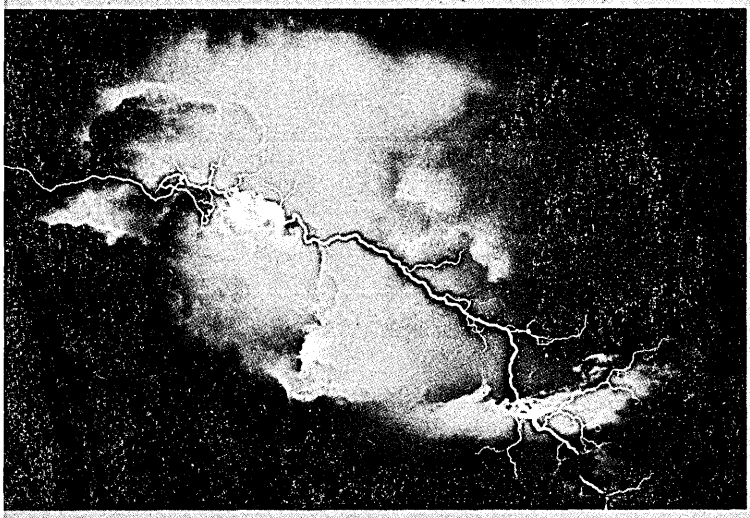
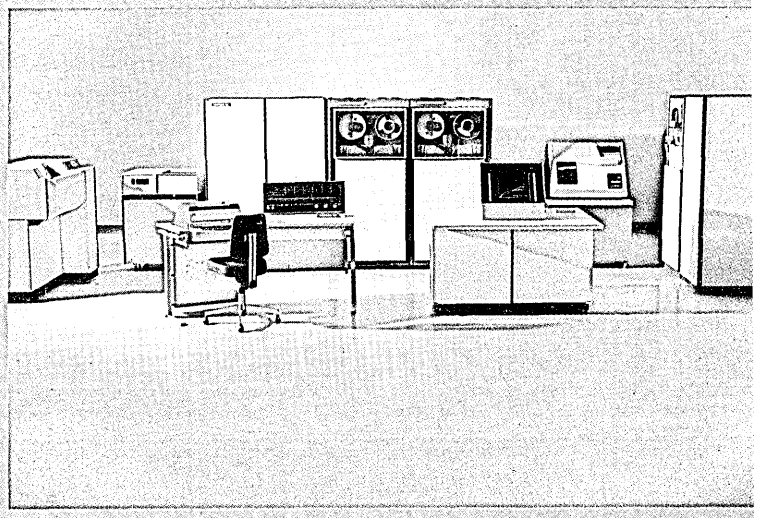
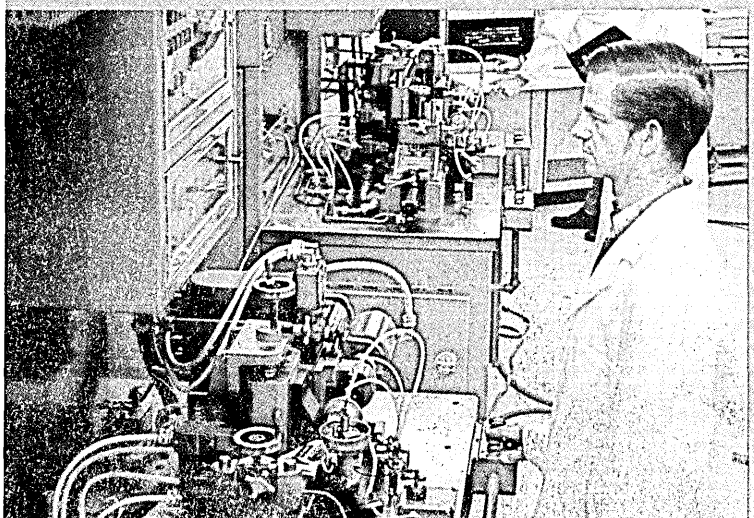
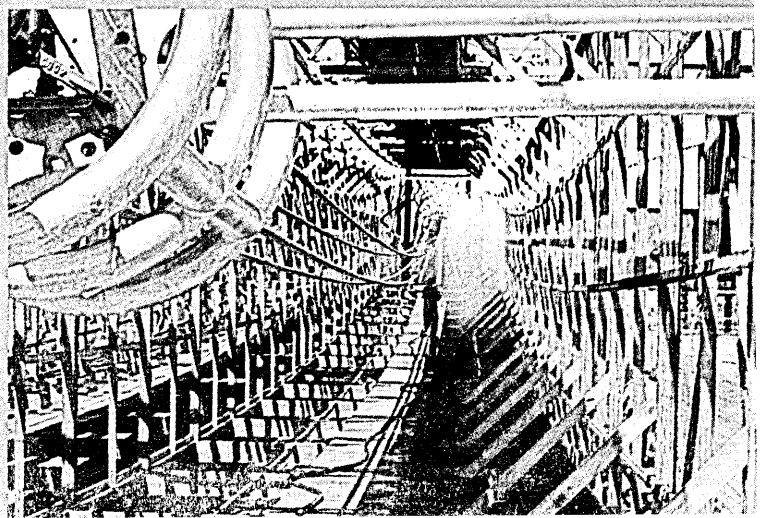
CIRCLE 94 ON READER CARD







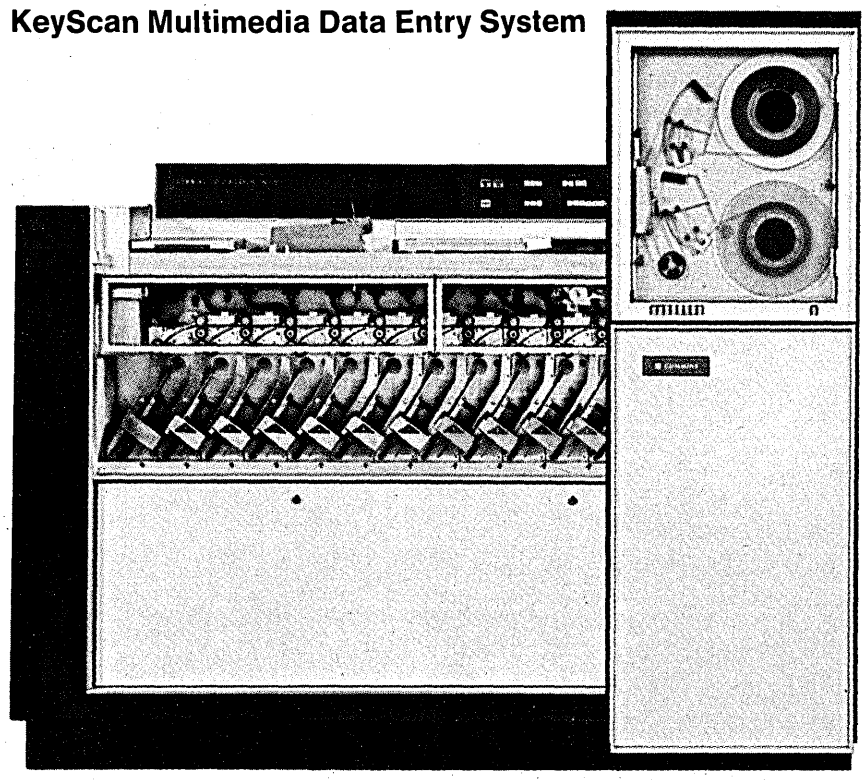


Look at scanning. Keydisk. Look at performance.
And costs. Look at multimedia.

When you look at the best... you'll see the Cummins KeyScan™ Data Entry System.

4400

KeyScan Multimedia Data Entry System



Look at scanning. With KeyScan, a single key stroke of each unrecognized character provides re-entry of rejects without rehandling while still scanning the same block of documents. Data from all documents is edited and balanced by batch, in a single pass through the System.

Look at key entry. Cummins key/disk terminals provide more power per dollar than any other key entry system.

Look at both. KeyScan is a shared processor, key/disk scanning system that affords unparalleled flexibility. It's the first multimedia data entry system, the only high performance system *and* it's moderately priced.

Whether you need an OCR scanning system, a stand alone key/disk system, or an off-line print station . . . KeyScan enables you to select what you need at a price you can afford.

And, as your requirements change, you can reconfigure your hardware and software to do the new job . . . the best way.

All this from a company with systems, programming, and forms design support, and over 45 branch sales and service offices located across the country. So write today for our new 4400 KeyScan System brochure. Write: Cummins, 836 Waukegan Rd., Glenview, IL 60025. Or better yet, call us at 312/724-8000 and make an appointment to visit our demonstration facilities.

And remember, when you think data entry, look at Cummins KeyScan Multimedia Data Entry System. Then look at other systems and you decide which is best.

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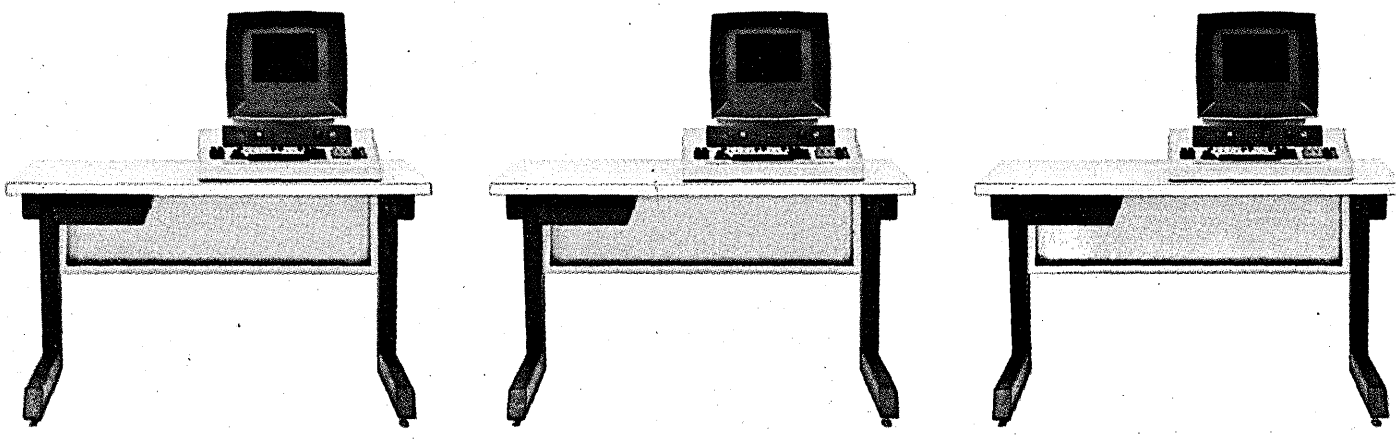

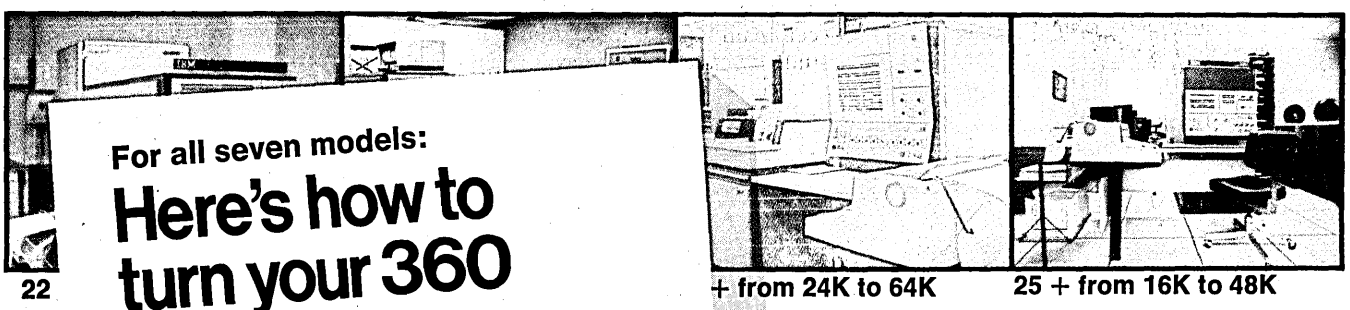

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50 + from 512K to 768K

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65 + from 256K to 512K

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Letters

Grosch's lament

Robert, when *you* change jobs, *Computerworld* will carry the story.
HERB GROSCH

DATAMATION apologizes for not telling its readers that renowned mouth and mind H. R. J. Grosch has been appointed editorial director of Computerworld, a weekly news publication in our industry. When he leaves there, we promise to report that as promptly as possible. As for our editor changing jobs, that will herald the end of the world.

Damned proud

Apparently your research and information department has been misinformed. In your August "Look Ahead," (p. 18), in the paragraph captioned "It Takes a Problem to Sell a Solution," the first sentence, which reads "On-line registration of voters hasn't taken place anywhere as yet," is an untruth. At this time in DeKalb County, Ga., there is an on-line voter registration system that has been in operation for several months. The county officials are very pleased and satisfied with the system. They are, in fact, showing the system to several counties which have inquired about it.

The system consists of IBM 3270 display stations and attached printer terminals, all of which are located in the voter registration office. New registrations as well as change information is keyed into the system by terminal operators. When the information has been verified by the system program, that entry is made to the voter registration file which at present has over 200,000 registered voters on it. Also, a card is printed on the printer terminal showing the updated information along with the polling place where that person should go to vote at election time.

I would like to suggest that in the future, if you are going to report on an item, that you thoroughly research the subject. Inaccurate statements of this type could hurt someone's feelings (especially mine, being the author and programmer of said system and damned proud of it).
LARRY W. PRESSLEY
Programmer
Southern Airways, Inc.
Atlanta, Georgia

Palatability

While converting large libraries of tape from canister to ring seal storage, Ms. Doreene Brown, a secretary at Scripps, discovered the discarded canister tops make excellent artist palettes and the bottom forms an air-sealed cover which preserves oil paints indefinitely between painting sessions. About 30 art students have used the system and pronounce it the greatest contribution of the computer to the art world.
WESLEY W. HILTON
Scripps Institution of Oceanography
La Jolla, California

'Up' the specialized carriers

Two of your August articles (Specialized Communications Common Carriers, 1973-1974; and Trends in Data Communications) are "down" on specialized common carriers. Unnecessarily so. The specialized carrier article questioned the carriers' "long term survival" and the article on data communications states "whether . . . (specialized carrier) operations can be profitable in this competitive environment is questionable."

Both comments are gratuitous, not backed by analysis, irrelevant, and possibly self-fulfilling. The two articles were directed at communications users, and as such delineated the many new alternatives opening up to users. To inject unsubstantiated doubts about the long-term survivability of the specialized carriers into such a discussion performs a disservice to your user readers for the following reasons:

1. The communications industry is not the computing industry. Nobody is going to get "stuck" with communications equipment. You sign up for one month's service from the specialized carriers. If you don't like it (or in the unlikely event the carrier goes broke) you simply swap over to another carrier with little, if any, inconvenience.
2. Several of the specialized carriers are well-financed—sufficiently so that nobody could reasonably question their ability to deliver the service. U.S. Transmission Systems has ITT, MCI has $100 million, Southern Pacific Communications has Southern Pacific Railroad, Nebraska Consolidated has over $20 million, etc.
3. If you believe that specialized carriers are not economically viable, and you don't take service from them for that reason, they probably will never become economically viable. The self-fulfillment of disasters is not forecasting, nor fulfilling.
4. I think a better way of choosing communications service is by what it gives the user—possibly better quality, lower price, better maintenance, etc.
5. The specialized carriers' presence alone has brought many, many changes in Bell's competitive posture—DDS, DUV, Hi-Lo pricing, hybrid data vendors, etc. If competition were to wither because of a lack of user support, we'd be back to "business as usual"—one supplier, one price, one option. Take it or leave it.

Thomas A. Farrell and I have written a rather extensive (300-page) study of the *Specialized Communications Market* for New York City publishers Frost & Sullivan, Inc. We're a little more optimistic.
HARRY NEWTON
New York, New York

Divarication

Professor Emery's article "Problems and Promises of Regional Computing," (August, p. 55) perceptively documents the failure of UNI-COLL to deliver its promised "economics of scale." The article's conclusion, therefore, that "regional computing offers substantial advantages," is extremely puzzling. Moreover, I fail to understand how the creation of an even larger, more expensive, more complex hierarchical network will solve the problems created by lack of commitment and cooperation on the part of member

colleges/universities. It seems to me that rather than building an even larger empire, UNI-COLL's management should work harder at keeping its original promises.
BARRY D. GILLIGAN
Consultant
Aeronautical Research Assoc. of Princeton, Inc.
Princeton, New Jersey

Dr. Emery replies: I don't see why Mr. Gilligan is puzzled by my statement that regional computing offers substantial advantages. It is difficult to refute the argument that a large computer of the 370/168 class is exceedingly cost-effective for certain types of jobs—particularly remote job entry batch processing. On the other hand some services, such as handling a large number of small interactive programs, can often be provided more economically on a dedicated computer. This is the scheme that I proposed in my article. The management and technology of "decoupled distributed computing" (as the scheme might be called) are not particularly complex.

Since my article was written, UNI-COLL has made some substantial management changes. The new management shows every indication of concentrating on the services for which a large computer can be particularly cost-effective. I am sure that

Custom-tailored keyboards at factory-to-you prices.

At MICRO SWITCH, 99% of our keyboard production is built to individual customer specifications. To date, we haven't found any application too unique.

When you need a keyboard, immediately there are thousands of decisions that have to be made. For example, what's the right button? Or array? Or which switch module is correct?

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letters

Mr. Gilligan would find this new emphasis entirely consistent with his views.

Dr. James C. Emery's article on regional computing was excellent. It should be read by every college and university computer center director in the country. His conclusions are a succinct statement of our own experience after five years of regional computing in Ohio.

E. C. ZIMMERMAN
Director of Academic Computer Services
The College of Wooster
Wooster, Ohio

Crosspatch

It was unfortunate, at least from our point of view, that Decision Science, Inc. was not mentioned in the article "All About Cross Assemblers" (July, p. 77).

This firm markets cross assemblers for the PDP-8, PDP-9/15, PDP-11, GA SPC-16, CA 216/ALHPA 16, DG Nova, GE 412, and Honeywell 316 at prices below those quoted in the article.

We have sold four to the same client so they must be pleased with our product.

A. J. OWENS
Vice President
Decision Science, Inc.
San Diego, California

Base inaccuracies

We would like to correct a number of inaccurate statements in your "Look Ahead" column (June, p. 17) referring to Sperry Univac's series 70 operations (the former RCA customer base).

Specifically, the statement that our company was attempting to delay the Invitation For Bid (IFB) issued by the State of California for the Dept. of Motor Vehicles is completely untrue.

We are not interested at all in delaying the bidding. To the contrary, we want to have a completely new bid specification drawn up as soon as possible so that we may help relieve the pent-up demand for new applications being experienced by our users in the state.

We did bid on the original Request for Proposal (RFP). However, when the IFB was issued, it was so structured that it would have absolutely precluded Sperry Univac and other competitors from bidding on a truly competitive situation.

Accordingly, a protest was submitted to G. Lee Smith, of the State Data Processing Office, Dept. of Finance, stating that the restrictive nature of the IFB prevented competitive bidding as required by the Budget Act, by narrowly circumscribing the methods of obtaining the ultimate goals of consolidation.

In regard to your report on the Utah situation, you referred to this as a Spectra upgrade whereas, in fact, it is an upgrade of two IBM centers!

The alleged threat to "junk" Sperry Univac's plans to expand the division's manufacturing plants in Utah "if we didn't get the State of Utah's business" has nothing to do with the current situation and is, in fact, patently incorrect. The facts are as follows: Since 1969 we have increased our personnel in Utah from 1,800 to 2,950 and increased floor space in our manufacturing facilities by 30%. Finally, we have established the headquarters of our Communications & Terminals Div. in Salt Lake City. Once again the facts speak for themselves.

For the sake of factual reporting, to say nothing of objectivity, we would appreciate it if you would publish our rebuttal in the next issue of DATAMATION.

H. GLEN HANEY
Vice President—Marketing
Americas Division
Sperry Univac
Blue Bell, Pennsylvania □

Control Data offers you more peripheral products and services

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There are many reasons for considering CDC as the alternate source for the next peripheral product you add to your IBM system, but here are the three we believe will be most important to you...

EXCLUSIVES CDC has product and service advantages (flexible financing plans, for example) that no one else offers you.

SELECTION We have more products and services for you to choose from.

The CDC 28211/14031 Advanced Train Printer and Controller will functionally replace the 2821/1403N1, give 10% greater speed, lower costs, and the additional "replacement plus" advantages noted below...

- 132-column train printer with speeds of 1200 lpm (48 char. set), 1500 lpm (special 36 char. set), burst speeds to 2500 lpm (reduced char. set)
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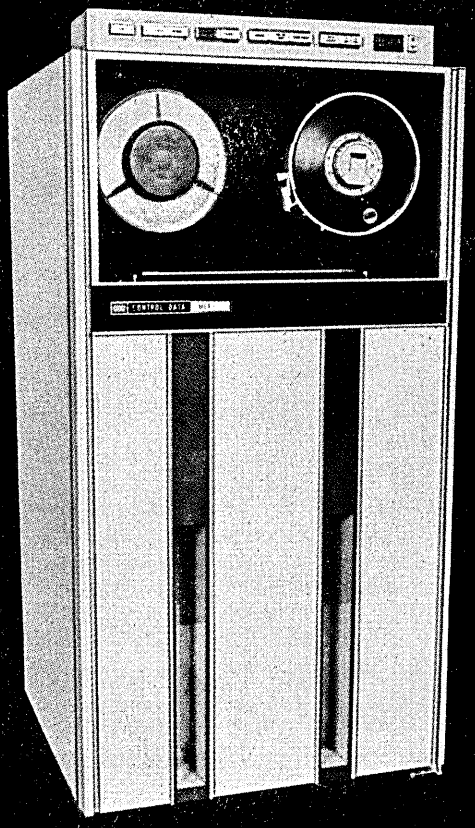

The CDC 38031/34201 Magnetic Tape Drive and Controller functionally replace the 3803/3420 at improved price performance. They also offer such important "replacement plus" features as...

- Successive motion command capability without program restrictions
- Single-capstan drive with precision tape guiding system, automatic threading and powered windows
- 75, 100, 125, 150 and 200 ips models available... 9 and 7-track drives can be intermixed using same controllers... PE, NRZI, dual-density, 2-channel, 2 x 16, 3 x 16 and 4 x 16 controller/drive combinations... recording densities of 556, 800 and 1600 BPI available

MONOLITHIC MEMORY • TAPE TRANSPORTS • CORE MEMORY

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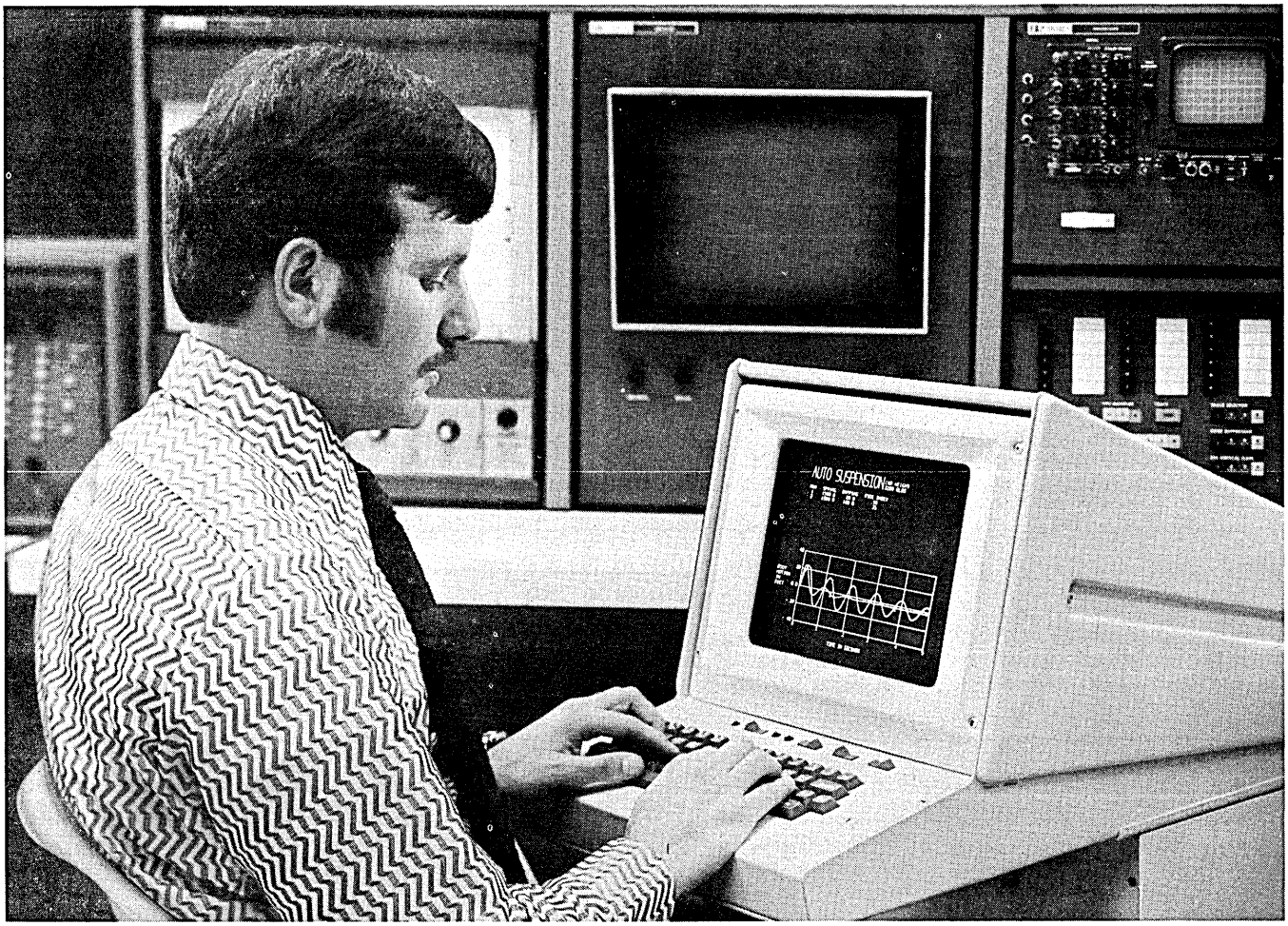
CORPORATION



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That's just a fraction of our story. The new PACER™ computer systems by EAI can actually deliver price/performance ratios that run well over 100 times those of conventional digital computers. Whether the problem is simulation, optimization, control, design or data reduction.

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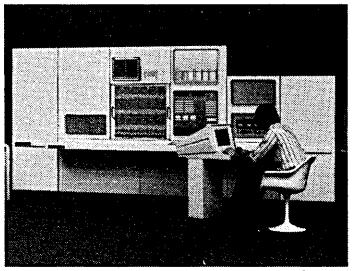

For details on our whole PACER story, please write or call today.

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West Long Branch, New Jersey 07764
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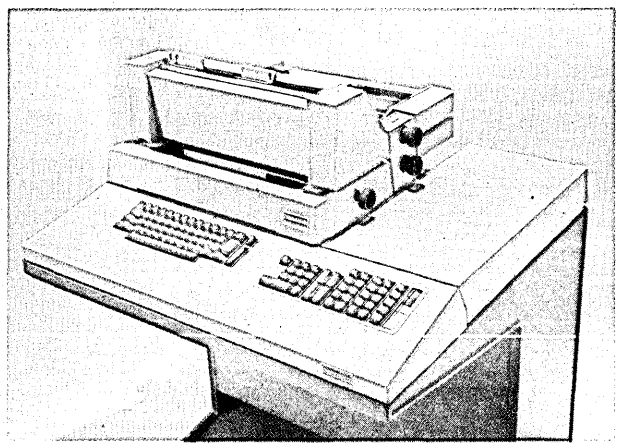
Nixdorf presents a no-nonsense guide on how to buy a business computer



1. Know the manufacturer.

Some computer firms are really brokers for other companies' computers. Avoid them. Buy your business computer from well-known, established manufacturers like Nixdorf, with 20 U.S. offices and over 30,000 business computers installed around the world. Depend on a company that has grown up in the business market . . . one that designs, builds, and services its own computers. Nixdorf, with $140 million in annual sales, is that kind of company.

2. Know the computer.

First decide what you want your business computer to do — receivables, payables, payroll, sales analyses, inventory control . . . you name it. Then be sure it's programmed exactly as specified *before you accept it.* (That's Nixdorf policy.) Be sure it's modular, too. That way, you'll never outgrow it as your company grows. In Nixdorf's case, you simply plug in memory cells, discs, printers, cassettes and other modules as your business expands.

3. Know the service.

If you call up for service in a hurry, will the field engineer come right out? Most computer manufacturers can't promise that. Nixdorf can. Because every Nixdorf office has a full-time field engineering staff waiting to help you. All Nixdorf computers are built of solid state modules, so a service call usually lasts only as long as it takes to change them.

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I want to know more about Nixdorf . . . now. 34-C

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Before you buy just any business computer, learn about Nixdorf. We sell everything from $7,990 accounting computers to $100,000 data processing systems. And our modular machine will adapt perfectly to your present office procedures . . . as a stand-alone system or on-line terminal to a large-scale computer. If you need to know . . . send in the coupon now.

NIXDORF COMPUTER

More than 30,000 computers installed around the world.

CIRCLE 17 ON READER CARD

Shhhhhhhh

Here's the best-kept secret in the data processing industry:

There is an intelligent terminal system that can stand alone without technical personnel, and handle up to 20 workstations simultaneously. It's remarkably effective for the price. System Ten* computer, by Singer.

*A Trademark of The Singer Company

And it's already installed in all of these industries.

Agricultural Production
Building Construction—Gen. Contractors
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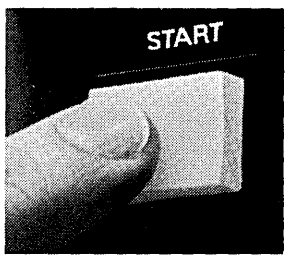
Mfg—Furniture & Allied Products
Mfg—Paper & Allied Products
Mfg—Printing & Publishing
Mfg—Chemicals & Allied Products
Mfg—Petroleum Refining
Mfg—Rubber & Miscellaneous Plastics
Mfg—Stone, Clay, Glass & Concrete Products
Mfg—Primary Metal Industries
Mfg—Fabricated Metal Products
Mfg—Machinery, Except Electrical
Mfg—Electrical Machinery & Equipment
Mfg—Transportation Equipment
Mfg—Photographic & Scientific Instrmnt
Mfg—Miscellaneous Mfg Industries
Motor Freight Trans & Warehousing
Water Transportation
Transportation Services
Communication
Electric, Gas & Sanitary Services
Wholesale Trade
Building Material, Farm Equip Dealers
Retail Trade—General Merchandise
Food Stores
Apparel & Accessory Stores
Furniture & Home Furnishings Stores
Eating & Drinking Places
Miscellaneous Retail Stores
Banking
Security & Commodity Brokers & Exchanges
Insurance Carriers
Real Estate
Holding & Other Investment Companies
Miscellaneous Business Services
Motion Pictures
Medical & Health Services
Legal Services
Educational Services
Nonprofit Membership Organizations
Miscellaneous Services
Federal Government
Local Government

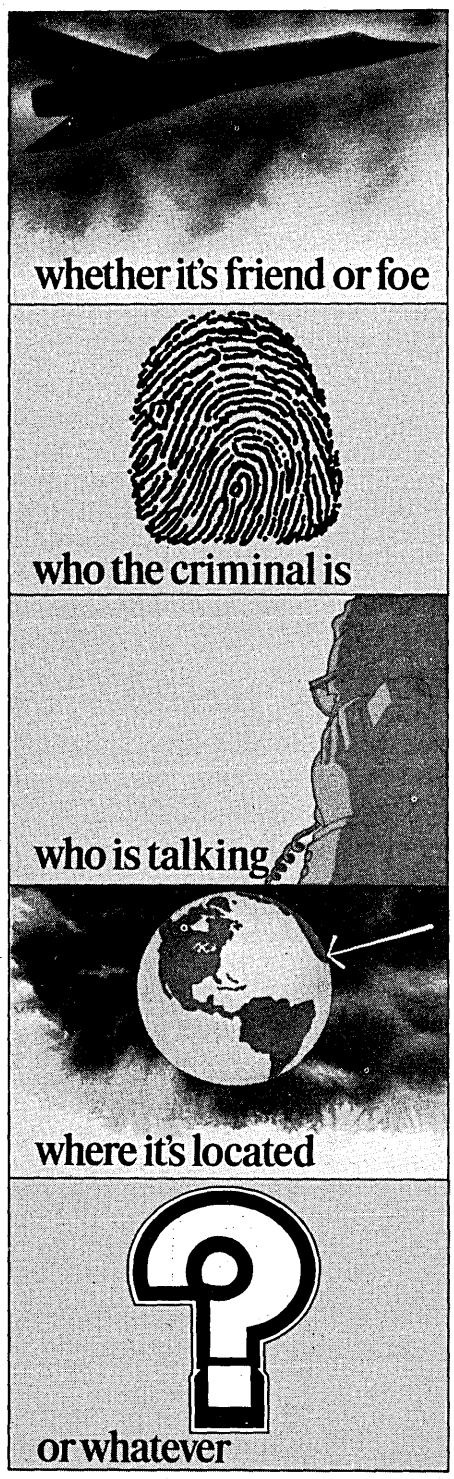
For complete information on your particular industry, call or write: Singer Business Machines, San Leandro, Calif. 94577.

System Ten Touch & Know Computer by SINGER



CIRCLE 62 ON READER CARD

Nothing matches Staran for matching. It can tell you in micro-seconds:



Goodyear's STARAN™ associative array processor has no match for correlation capability. Its true-content addressibility (matching data in memory) allows STARAN to search its entire memory in micro-seconds to match given data. Correlation of radar or infrared signatures, map areas, fingerprint files, waveforms from voiceprints, EKG's, etc., are all possibilities. There are more.

STARAN is not everyman's computer. But for those who have problems that require high speed searching of a dynamic data base—or those whose problems require high speed operations on similar data streams—the STARAN associative array processor may very well be the most cost-effective solution.

STARAN is a combination system that does both associative array and sequential processing. It can be added to your system or used in new system developments.

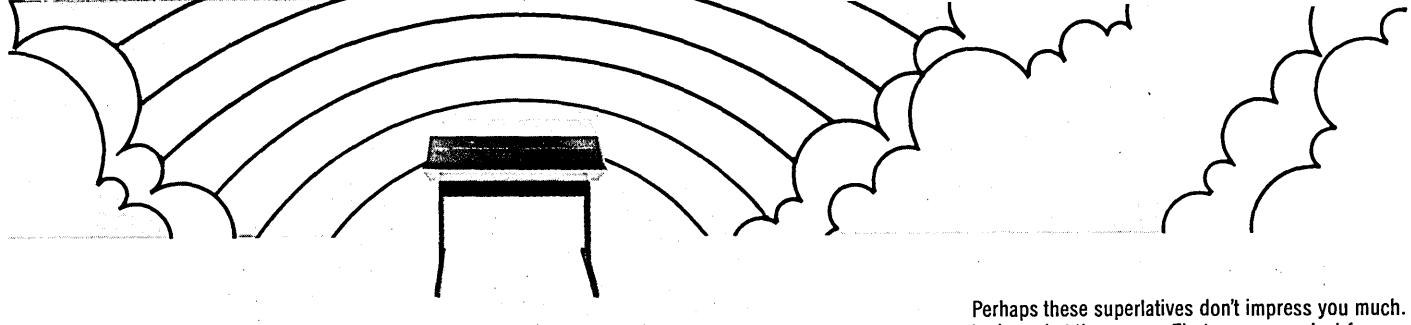
A minimum basic STARAN system sells for as little as $250,000 and software costs can be reduced to one-third of amount required for a conventional system.

Goodyear invites you to try your system problems on the STARAN Evaluation and Training Facility at our plant in Akron, Ohio. See for yourself how STARAN can handle your specific data processing problem.

For more information, or to plan a demonstration, write: STARAN Marketing, Department 920, Goodyear Aerospace Corporation, Akron, Ohio 44315. Or call (216) 794-3631.

GOODYEAR
AEROSPACE

CIRCLE 77 ON READER CARD



THE LONGEST LINE. FASTEST SPEEDS. MOST INTELLIGENT. LEAST EXPENSIVE REMOTE BATCH TERMINALS AVAILABLE.

Perhaps these superlatives don't impress you much. But, let's look at what they mean. First, you can select from several different systems to meet your precise current requirements without paying for more than you need. Yet, we can upgrade your system any time at your facility without costly down-time. If you are ready for a high speed system (up to 50.kbps) we can provide the most efficient terminal available plus a wide variety of peripherals for maximum through-put. Being intelligent, Singer-M&M terminals are compatible with all major main frames. Emulators are available for IBM System 360/370, UNIVAC 1108, Control Data Corporation 6000, Honeywell 6000/355 and others. When you consider price/performance, the chart below quickly shows that basic Singer—M&M Remote Batch Terminal Systems deliver more for the money than any other equipment now on the market.

BASIC SYSTEMS	520	580	565	560
Card Reader				
300 cpm	x	x	x	
600 cpm				x
Line Printer				
200 lpm	x			
400 lpm		x	x	
600 lpm				x
Communications				
2. to 4.8 kbps	x	x		
2. to 7.2 kbps			x	
9.6 to 50. kbps				x
ASR 33	Opt	Opt	Std	Std
Multileaving HASP Work Station	N/A	N/A	Std	Std
Monthly Rental Including Maintenance	$675	$940	$1160	$1645

Call today for a demonstration or send for complete literature. SINGER-M&M COMPUTER INDUSTRIES, INC., 2201 N. Glassell St., Orange, Calif. 92665 (714) 998-1551. Telex 65 5464

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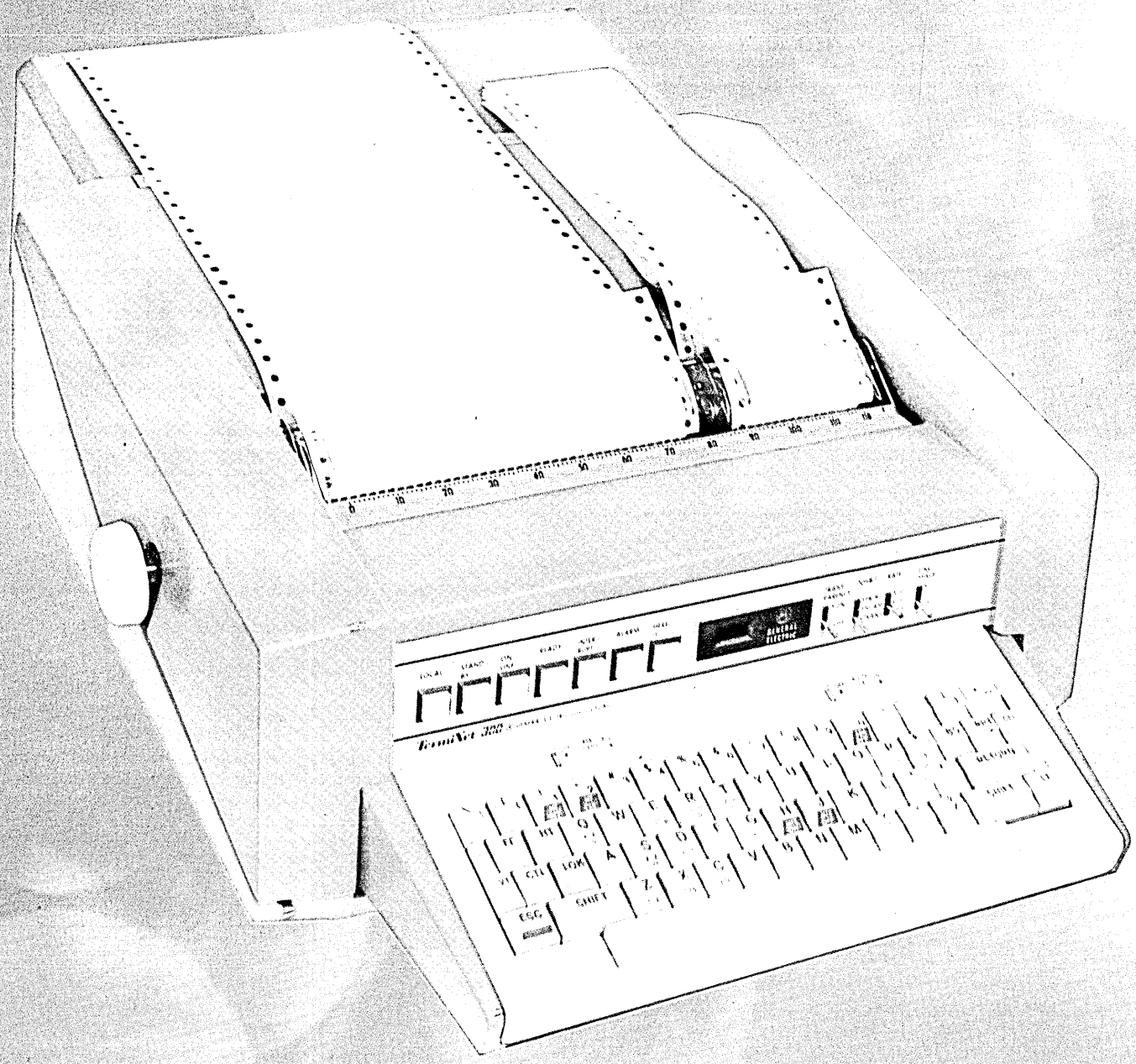
CIRCLE 11 ON READER CARD

General Electric's answer to dual-output



The new split-platen TermiNet* 300 SP printer

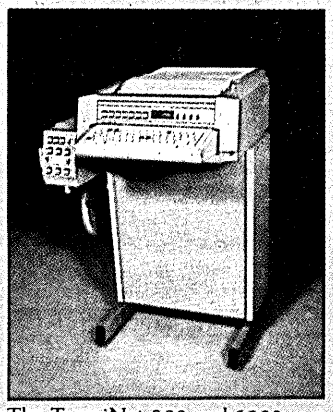
- **2 platens operate independently**
- **2 separate forms**
- **Unlimited application flexibility**
- **Reduces costs of printers**
- **30 characters per second**

With General Electric's new split-platen TermiNet 300 SP printer you now can prepare two separate forms at the same time.

The applications for this new concept in printers are endless. Any data communication system that requires hard copies for parallel but dissimilar information will find the split-platen TermiNet 300 SP printer an efficient and cost-saving method.

On-line inventory control, an order entry system providing simultaneous orders and credit memo, hospital admission systems are just some examples where the split-platen is ideally suited. In some cases the cost of printers can be reduced over 50%.

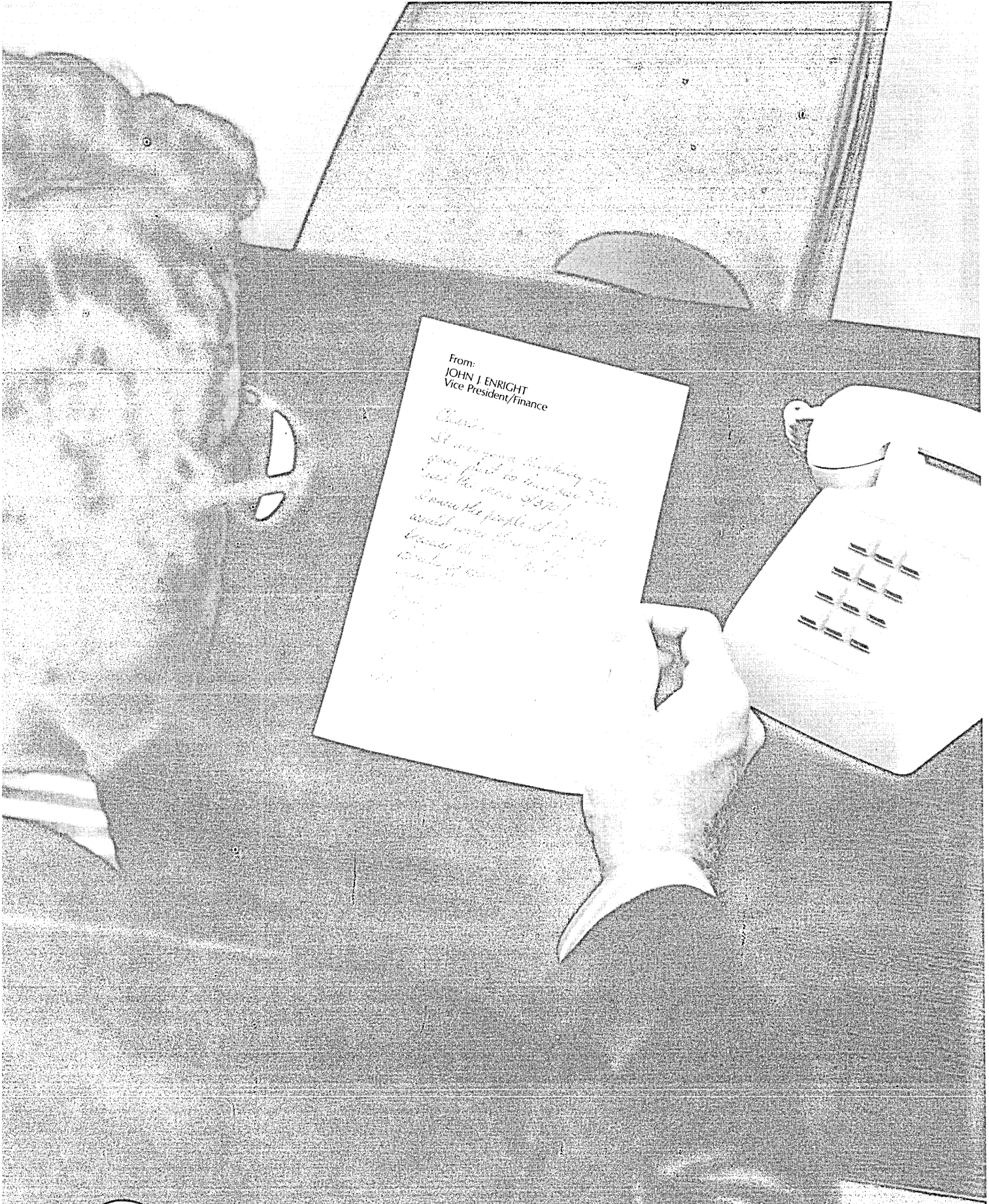
For more information on the split-platen TermiNet 300 SP printer and pedestal write: Section 794-08, P.O. Box 4197, Lynchburg, Virginia.



The TermiNet 300 and 1200 printers, in addition to the split-platen 300 SP printer, are available in pedestal configurations. These compact and convenient units offer major savings on premium floor space.

GENERAL ELECTRIC

*Trademark of General Electric Company.



United gives you
The box that you built.

The LD-11.

We knew our shippers wanted a container larger than the LD-3. So we asked a cross section of our best customers, who we knew would speak for all our shippers, specifically what you wanted in a larger container. *You* told us you wanted:

1. Straight sides
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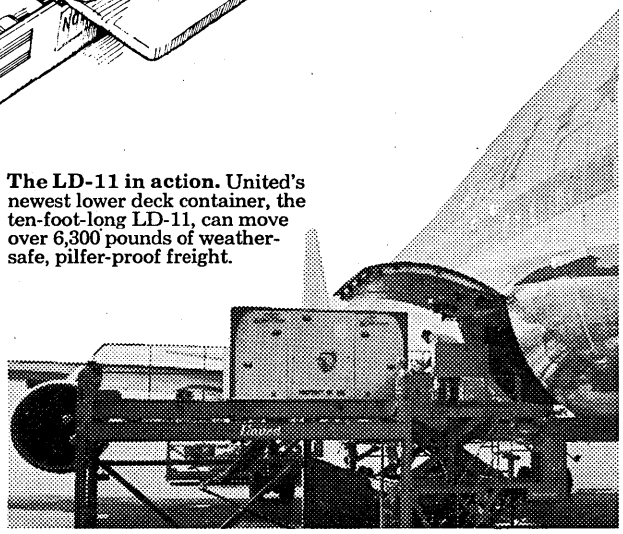
3. Tie-down (United's "Soft Touch") capability
4. One-seal security
5. Bars for garment-on-hanger shipments
6. Off-airport dollies
7. Full-width door opening
8. Internal height of 61 inches
9. Pull-rings and Push-plates
10. 6,300-pound-plus net capacity
11. Most important to many shippers, a Time-of-Tender rate structure.

You've got it. It's United's LD-11. It fits in all our 747's and DC-10's. And our "Daylight Savings" time-of-tender rates are designed to make it fit your shipping budget.

Typical "Daylight Savings" rate: 6,300 lbs. in one LD-11 container from New York City to Los Angeles for $482—only $7.65 per 100 lbs.



The LD-11 in action. United's newest lower deck container, the ten-foot-long LD-11, can move over 6,300 pounds of weather-safe, pilfer-proof freight.

UNITED'S LD-11

Dimensions	Internal	External
Length	120″	125″
Width	56″	60″
Height	61″	64″
Capacity		
Cubic Feet	242	277
Net Pounds	6,300 plus	
Minimum Chargeable Weight (Pounds)	1,800	

United Air Lines

Jet Freight *No. 1 in the U.S. sky*

October, 1973

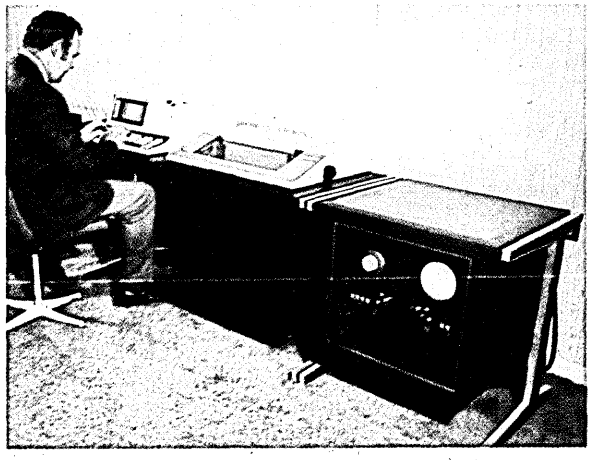
Here's how

with the Datapoint 2200 -a single integrated system for:

Data conversion/Entry

Datapoint delivers

Data processing



Data communications

The Datapoint 2200 Business Computer System from Datapoint Corporation has given new meaning to the term versatility. In one typewriter-sized unit, the 2200 combines a powerful general purpose computer, a full sized CRT display screen, a comprehensive keyboard, and dual tape cassette units which can store both source and program data. A choice of communications adaptors is available for easy interface with other computing systems and data networks over standard telephone service.

Datapoint 2200 software includes DATABUS, the high-level Datapoint Business Language; a BASIC language compiler; SCRIBE, a text processing language; a macro assembler; RPG II; Disk and Tape Operating Systems; emulator software packages for most standard terminal units and many utility programs. The basic processing power of the 2200 can be augmented by a complete roster of optionally available peripheral units, which include serial and line printers, 7- and 9-channel tape units, a multiple drive disk attachment and numerous communications interface adaptors.

This comprehensive hardware/software capability makes it possible for the 2200 to work effectively in a variety of applications, including:

1.) **Data Conversion and Entry** — Possibly the most popular current application for the 2200. The CRT display screen permits easy visual scan of data entered via the keyboard. The internal computer's full programmability allows full and varying format display plus incorporation of various error checks, for fully verified data entry. This data can be stored in the unit's own tape cassette, for either on-line or off-line transmission to a central processor system.

2.) **Dispersed (On-Site) Data Processing** — Through a simple selection procedure, the Datapoint 2200 can be utilized as a formidable independent computer system with up to 16K memory. Through DATABUS, it's especially well suited for business applications such as inventory control, general ledger, payroll, accounts receivable and payable, and production scheduling. With the BASIC programming language the 2200 can serve many scientific, engineering and educational applications. Used in combination with a larger central system, it can remove the burden of pre-processing and editing chores for input data that would otherwise tie up the larger system. Under control of the special DATASHARE program, the 2200 can serve as a central computer for up to 8 remote terminals.

3.) **Remote Job Entry** — The Datapoint 2200 functions efficiently as a high speed terminal for the transmission of source data in volume to a central processor and the receipt at field offices of management reports and statements. Utilizing optionally available tape and/or printer attachments, data can be moved at up to 9600 baud.

4.) **Time Sharing** — The 2200 can be readily utilized as a time sharing terminal, linking directly via telephone service with a central time shared computer system for interactive problem solving. Its video screen allows easy problem statement display and editing.

All these capabilities are combined not in four separate units but in a single integrated system, the Datapoint 2200. Prices on the 2200 begin as low as $6,040. For information on how Datapoint can provide you with a single answer to your data conversion, data communications and data processing requirements, write or call the sales office nearest you or contact: Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284, (512) 696-4520.

Datapoint

Home Office: 9725 Datapoint Drive/San Antonio, Texas 78284/(512) 696-4520 • **Sales Offices:** Albuquerque, N.M./(505) 225-0120 • Atlanta/(404) 458-6423 • Boston/(617) 237-2090 • Chicago/(312) 671-5310 • Cleveland/(216) 283-9323 • Dallas/(214) 630-1342 • Darien, Conn./(203) 655-4800 • Denver/(303) 771-0140 • Detroit/(313) 557-6092 • Greensboro, N.C./(919) 299-8401 • Liberty, Mo./(816) 781-0400 • Los Angeles/(213) 645-5400 • Melbourne, Fla./(305) 727-3205 • Minneapolis/(612) 854-4054 • New York/(212) 759-4656 • Orlando, Fla./(305) 671-4500 • Philadelphia/(215) 643-5767 • Phoenix/(602) 265-3909 • Portland/(503) 244-0101 • Salt Lake City/(801) 272-3681 • San Francisco/(408) 732-9953 • Washington, D.C./(301) 937-2215
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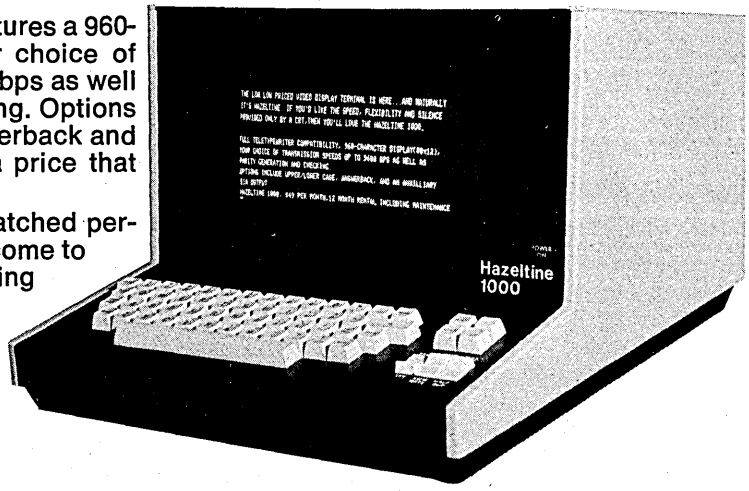
We would suggest you compare the Hazeltine 1000 with other teletypewriter-compatible CRT Terminals at its price* ...if there were any.

The Hazeltine 1000 Terminal features a 960-character display (80x12), your choice of transmission speeds up to 9600 bps as well as parity generation and checking. Options include upper/lower case, answerback and an auxiliary EIA output. All at a price that fits easily into your budget.

And of course you get the unmatched performance and reliability you've come to expect of every product bearing the Hazeltine name. For an on-site demonstration, call your Hazeltine representative.



Hazeltine 1000 * $49 mo.

12-month rental, maintenance included.

Hazeltine Corporation COMPUTER PERIPHERAL EQUIPMENT GREENLAWN, N.Y. 11740 (516) 549-8800 TELEX 96-1435

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HAZELTINE AND THE PURSUIT OF EXCELLENCE

DP DIALOG

Notes and observations from IBM which may prove of interest to data processing professionals.

DP DIALOG appears regularly in these pages. As its name suggests, we hope DP DIALOG will be a two-way medium for DP professionals. We'd like to hear from you. Just write: Editor, DP DIALOG, IBM Data Processing Division, White Plains, N.Y. 10604.

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From the manuscript, Hystoria de Corpore Christi, by St. Thomas Aquinas.

Jesuit Father Uses Computer to Analyze Works of St. Thomas Aquinas

After almost 25 years of collecting data, organizing and revising it, Roberto Busa, a Jesuit father, and scientists from IBM have completed a computer-based linguistic analysis of over 10 million words from the works of St. Thomas Aquinas. Called the Index Thomisticus, the scholarly work is now on magnetic tapes at IBM's scientific center in Venice. Father Busa expects to see the first of 45 volumes in print by the end of the year.

Of the 179 works which were examined, he notes 100 are directly attributed to St. Thomas Aquinas. Another 61 are by other authors, who were associated with the Thomistic works. The final 18 "are of doubtful authenticity," says Father Busa.

The Jesuit scholar began the project in the early 1940s when he was teaching at the Aloisianum Faculty in Gallerate, Italy near Milan. But when confronted with its enormous size and complexity, Father Busa went to IBM in 1949 with the idea of using data processing equipment to record the vast amount of information on the project. He recalls: "I was convinced the computer with its speed and accuracy would help enormously in the compilation of data involved in this study."

That same year IBM offered its full scientific and technical support and soon afterwards work began at Gallerate. There Father Busa and other scholars transcribed each line and then each word from all the works of St. Thomas Aquinas to punch cards and then to tapes.

St. Thomas Aquinas, the 13th-century philosopher and theologian, taught that philosophy is based on reason and theology on faith and revelation. Many attribute his greatness to the originality with which he brought Greco-Roman and Arab thought to terms with Christianity.

Father Busa, who wrote his own

(Continued on next page)

Also in this issue...

Can a Computer Help Fix a Computer?

Deliveries to supermarkets were overdue; grocery items were backing up at the main distribution point in New Jersey; and original orders were not available. In short, the whole distribution system for a major supermarket chain had been thrown out of kilter. A management snafu? No. Simply a computer system which needed help.

As soon as the local IBM branch office learned of the problem, it reached Ken Brady, the customer engineer on the account, through its radio dispatch system. Brady quickly drove to the customer site.

He found the computer was receiving intermittent channel overruns caused by heavy programming demands on the channel. However, after going through his diagnostic procedures he ran into trouble in solving the problem. Brady called his regional technical support center in Springfield, New Jersey for help.

Here he talked to Tech Edenfield, who acts as an interface between the customer engineer in the field and IBM's remote maintenance support program or RETAIN/370 (REmote Technical Assistance and Information Network/370) in Raleigh, North Carolina.

Edenfield then keyed in the symptoms to an extensive data bank of information in the IBM system in Raleigh and within seconds was able to get an answer to the problem, which he passed on to Ken Brady at the customer site. The final solution—a minor part change. What might have taken several hours to diagnose took a fraction of that with the help of the RETAIN/370 computer system.

Other situations, however, are more complicated and not so easily solved through a search of the data bank. In such a case, when the customer engineer needs additional help, he can link the System/370 equipment which has problems with the RETAIN/370 computer.

This data link allows the remote support center representative to run diagnostics on the customer's system just as though he were on site. Results of the RETAIN/370 diagnostic runs appear on the representative's terminal where he can look at them while discussing recommended courses of action with the customer engineer.

Both problems and corrections are fed back to RETAIN/370's data bank to keep it current for future users. Publication of appropriate new solutions then follows. RETAIN/370 was designed to support most IBM products, in both hardware and software areas, (including the System/3 and System/7 as well as the System/370). Only the System/370, though, can be linked to RETAIN/370 to display diagnostics remotely.

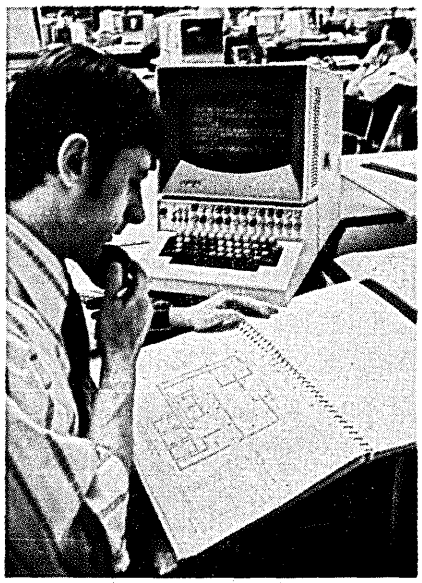
IBM's four field technical support centers, located in Los Angeles, Chicago, Washington, D.C. and Springfield handle calls from all over the country. At least one of the centers can be reached 24 hours a day, 365 days a year.

Teleprocessing Link

The remote maintenance support program also involves another function —the Teleprocessing Test Center, also in Raleigh. This additional aid makes it possible for a customer engineer anywhere in the country to use a regular phone line to test a teleprocessing terminal by working directly with the test center computer.

Both the teleprocessing test center and the four field technical support centers across the United States through the use of RETAIN/370 provide quick and efficient support to the customer engineer in the field.

With this strong backup "the customer is able to get service, which in the end reduces the computer's downtime significantly," says David Brown, manager of the Springfield support center. "This is probably the single most important factor of the program." **IBM**



Tech Edenfield at the Springfield support center goes over feedback from RETAIN/370 on a computer problem as he talks to customer engineer Ken Brady.

Jesuit Father Uses...

(Continued from preceding page)

doctoral thesis on the terminology of the spiritual life in the works of St. Thomas Aquinas, feels the Index Thomisticus will be an important aid to other Thomistic scholars. He says: "For the first time scholars will be able to examine in depth even such matters as authenticity, textual criticism, style, chronology and translation quickly and accurately with the help of computers."

He says: "This is the first work which will document the medieval Latin used by scholars after the 12th century." He explains: "Scholarly Latin was the international language of all sciences and learning up until the 19th century, but until the Index Thomisticus we did not have any historical dictionary of the Latin in use since the 12th century."

The Index Thomisticus, itself, is divided into two parts—the indexes and the concordances. The index alphabetically notes each word along with a reference to its distribution and frequency. Besides a general index for the entire study, there is also one for each work. The concordances, on the other hand, list alphabetically all the words and cite every passage in which a word appears.

Complex Methodology

In preparing this broad project for the computer Father Busa and IBM engineers developed a complex methodology. Every text was edited and annotated with the right codes to define the types and characteristics of each phrase and each word. After this tedious process, the texts were transcribed onto magnetic tapes and then revised. The next step was to establish all the root words or "lemmas". Finally, five separate concordances were drawn up according to types of terminology, morphology and word frequency.

While the system was especially designed to organize the Index Thomisticus, it has proved useful for many other literary projects and other areas of study involving large amounts of text. One of the most prominent was the indexing of the Dead Sea Scrolls. Many words were missing and whole sections had crumbled to dust. But by using this new method, scientists were able to program the computer to analyze the words preceding and following each gap. Then thousands of words were scanned to find the ones which most nearly fit into the context.

Thus, by introducing these indexing and coding techniques, Father Busa with the help of IBM has made it possible for scholars to make further strides in the field of linguistic analysis. **IBM**

First Customer Receives IBM System/370 Model 125

"With this new system and our new application approach, we can virtually double our loan processing load without significantly increasing our administrative costs. We also can easily handle a full line of mortgage banking applications including maintaining the status of applications in process, servicing all types of mortgages, such as payment of property taxes and insurance premiums, the automatic generation of accounting entries and interfacing with other systems such as general ledger and checking accounts."

This is how vice president Wayne Spielman feels about the newly-installed IBM System/370 Model 125 at the Wells Fargo Mortgage Company in Santa Rosa, California, which services a total of $850 million in loans primarily for the residential market in California.

The Model 125 has a high-speed monolithic circuit technology and a virtual storage capacity many times larger than the computer's actual main storage. Another advantage is its internal storage, which provides greater memory in a given space and higher speeds than found in earlier machines of comparable size.

Another feature of the Model 125 is the cathode ray tube console, which greatly simplifies the operator's job. The TV-like screen can display data being entered through the console keyboard, as well as information in the system. It can also show the internal status of the system.

The new System/370 Model 125 is an apparent success at its first customer, the Wells Fargo Mortgage Company, where Wayne Spielman says: "In the end, the Model 125 offers us the flexibility and speed we need in this highly competitive mortgage loan business."

Wayne Spielman with DP Manager Larry Bonin (right) at Wells Fargo Mortgage's System/370 Model 125.

IBM

IBM's Graduate School for DP Professionals

"The course was both comprehensive and interesting and gave me a greater insight and perspective of my role as a DP manager."

"It was thoroughly professional and highly informative."

"The course was very stimulating with first-rate instruction. I have some definite ideas I want to implement in our own DP department upon my return."

These are just a few of the reactions from students at IBM's Systems Science Institute. Now in its sixth year, SSI provides graduate level studies on a tuition basis to its customers who are qualified data processing professionals or financial managers. At four locations —New York, Washington, Chicago and Los Angeles—SSI is teaching customers advanced courses similar to those taught IBM's own systems engineers.

"Information processing systems are becoming more and more complex," says Brew Merrill, coordinator of the four SSI centers. "This is mainly because of advancements in computer systems and the greater use of data processing in the business decisions of a company. We hope SSI will help all of our students to apply today's sophisticated systems to the complex management needs of our contemporary world."

To reach this end SSI is offering a wide variety of courses in the areas of management of data processing projects, system design and analysis and financial modeling. Classes are small and emphasis is on a low student-to-teacher ratio. Practical applications of theoretical problems are key.

"The thrust of everything we do is to help the executive solve a specific problem relating to his own business," says Merrill about the financial modeling course. On the technical side: "Our aim, is to give the senior systems analyst more modern tools such as queuing theory and simulation so that he can use them in the implementation of his own company's system. Equally important is the actual management of data processing projects. Through our courses here, we help the student develop his management techniques and skills."

The SSI faculty, many of whom have advanced degrees, are all experienced DP professionals with many years in the industry. Brew Merrill says: "Our whole philosophy at SSI is the instructors should have 'lived' the material they are teaching. Only in this way can we give DP professionals the up-to-date tools and techniques needed in the data processing industry."

Jim Greenwood goes over a problem with Denise Seizer, Director of Management Information Systems at the Community Blood Council of Greater New York.

IBM

Community Projects Get Boost from IBM Fund

Community projects around the country are getting a boost from the IBM fund for community service. The fund, started last year, supports volunteer projects through community organizations to which IBM employees belong. Most of the grants range from $100 on up to $1,000 but there is no specific limit. Already nearly $400,000 has been contributed.

The approach is simple. "We want the money to go where it will make a real difference—not where it will take the place of donations from other sources," says Walton E. Burdick, IBM vice president for personnel plans and programs. "Our real aim," he continues, "is to encourage employees to commit themselves to community projects."

So far IBMers from at least 44 states have used the IBM fund. Here are just a few examples.

Aid to Fragrance Garden for Blind

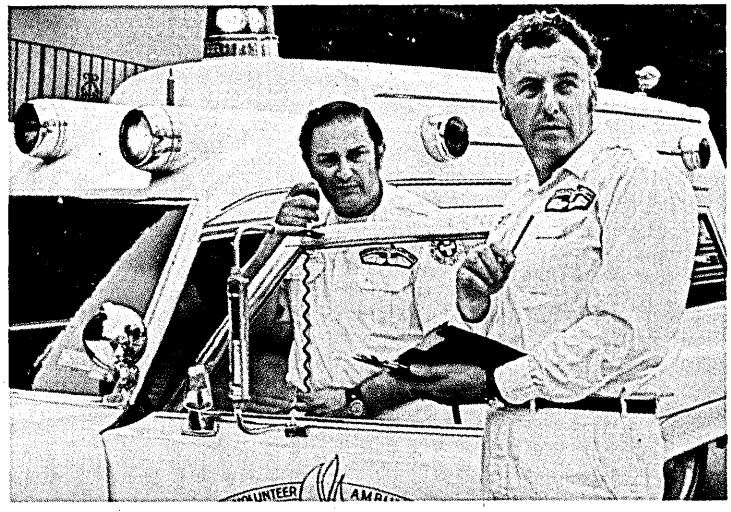
In Piedmont Park in Atlanta there is a small fragrance garden for the blind with gardenias, roses, mint and other herbs and scented flowers—all placed in raised flower beds for easy reach. Handrails guide the blind along shaded paths. There is also a nearby fountain and a small garden sculpture.

The Cherokee Garden Club is now working to complete the project, which was started two years ago. The club is also arranging to have several hundred brochures printed in Braille to serve as a guide to the garden. One of the club's active members, Margaret Duval, who is an administrative account specialist in IBM's Data Processing Division, asked IBM to help support the project. She was given $450 to cover the expense of the Braille brochures and two concrete benches which were placed in the garden.

Radio System for Ambulance Corps

In Yorktown Heights, N.Y. the Yorktown Volunteer Ambulance Corps now has a radio in each of its two ambulances so that its volunteers can call ahead to local hospitals to alert them to the arrival of a patient and inform them of his condition. Both ambulances can also communicate with each other and with local police headquarters.

The radios cost almost $1,500 each. Volunteers were able to raise enough money for one but not the other. At that point two volunteer ambulance attendants, Jim Cooley, a mathematician at IBM's Thomas J. Watson Research Center, and Lou Gulitz, an electronic technician in the Systems Products Division, were able to interest IBM in the project. Within a month they received a check to cover the cost of the second radio.



Costumes and Sets for Theater

Barbara Tasker, of IBM's Office Products Division in New Orleans, has been an active member of the Dashiki Project Theater, which was founded in 1968 to promote black productions of new and original plays written and performed by black Americans, West Indians and Africans. "It is one of the few consistently producing black theater groups in the entire South," says Barbara. When Dashiki needed additional funds to finance a musical comedy, Barbara applied for and received $500 from IBM to help pay for costumes, set construction and the auditorium rental.

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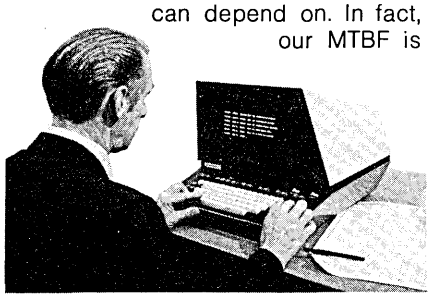

Besides reliability, the Westinghouse 1600 provides the user with exceptional flexibility thanks to an extensive range of features offered as standard in the base price. These include both synchronous and asynchronous operating modes, eleven switch-selectable data rates plus format mode and a full selection of edit functions. In addition, a low-cost option—station address for polling by computer—can yield significant cost reductions by line sharing.

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CIRCLE 71 ON READER CARD

This looks like just another ordinary data terminal.

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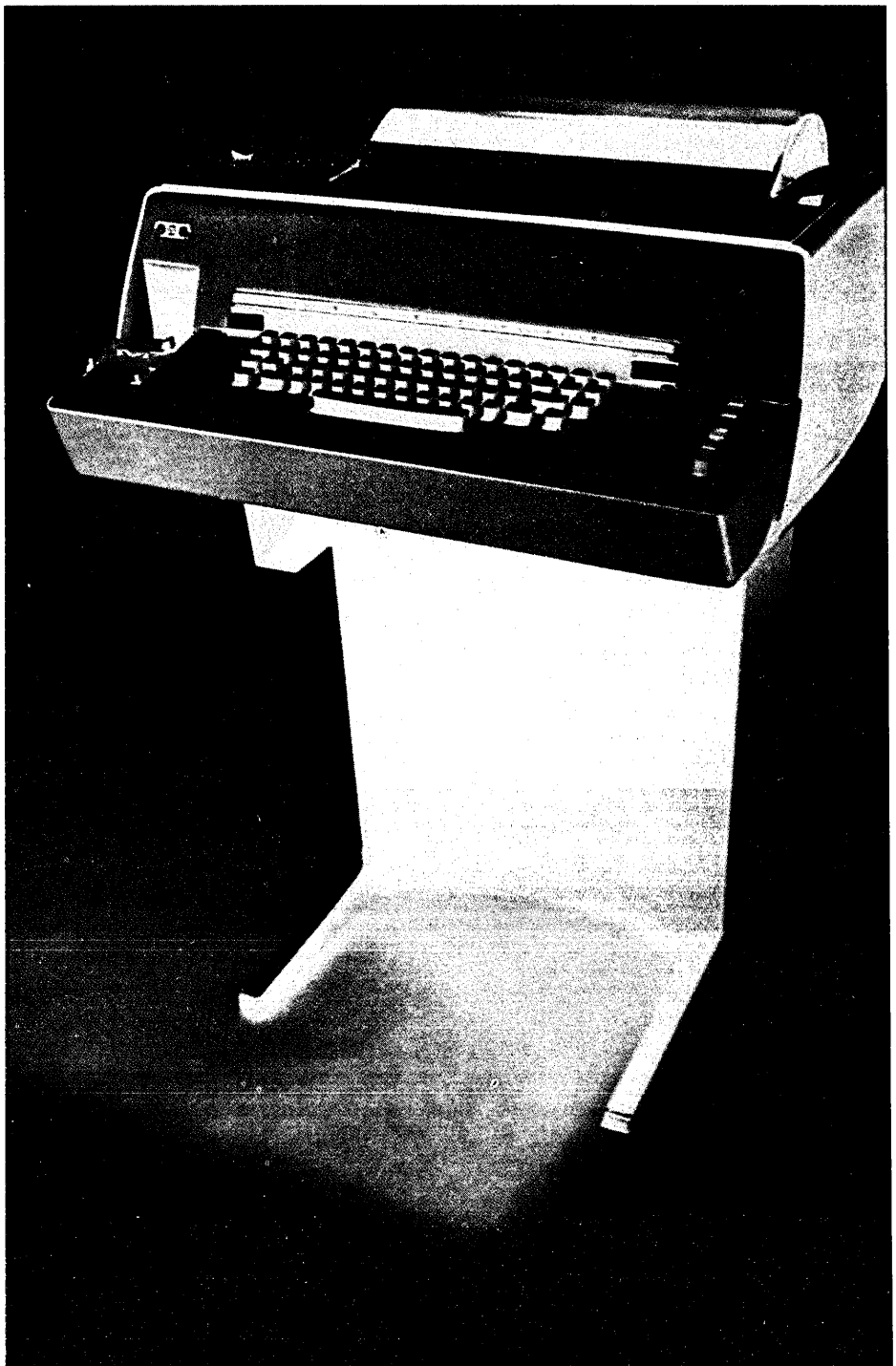

Our new model 38 eight-level data terminal is anything but ordinary.

Because it's loaded with big machine features.

Like a 132 character printing format on a 15-inch wide platen. It's designed to handle computer print-out paper so you can eliminate time-wasting reformating procedures. And for added versatility, there's a simple modification kit that permits you to use standard friction-feed rolls, too.

More big machine features? The model 38 prints both upper and lower case, in two colors, for maximum visibility and clarity in data presentation. And the four-row keyboard generates all 128 ASCII characters.

Speed? The model 38 moves data at 100 words per minute. For on-line speeds up to 2400 words per minute, it interfaces with the Teletype® solid-state 4210 magnetic tape data terminal.

The model 38 is flexible enough to fit into practically any switched or private-line system. That's why there are three interface options available. You can select from a built-in, factory-tested modem; a current interface; or an EIA interface.

You also get a choice in receive-only, keyboard send-receive, and automatic send-receive configurations.

Finally, the model 38 was designed to offer plug-to-plug compatibility with just about anything—including the model 33.

You'd think that all these big machine features would carry a big machine price tag, right?

Wrong.

We priced the model 38 so low it can be used economically in most applications—even in low usage locations where terminals couldn't be justified before. To offer real-time system up-date, data entry and retrieval, and inquiry response throughout your operation.

It takes more than manufacturing facilities to build the machines Teletype Corporation offers. It also takes commitment. From people who think service is as important as sales. In terminals for computers and point-to-point communications.

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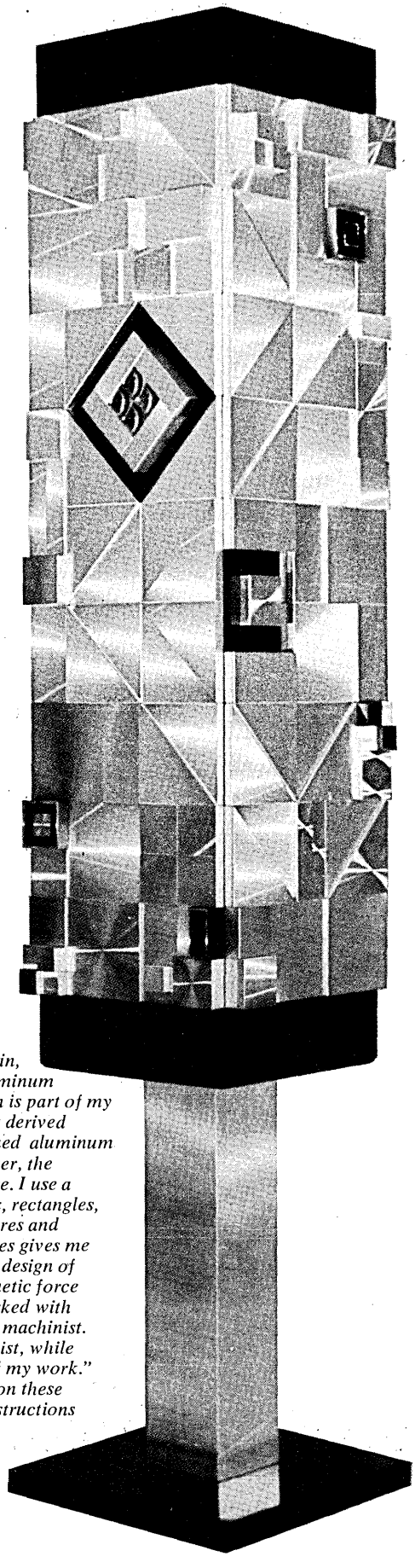
CIRCLE 78 ON READER CARD

Mass store memory systems will dominate multiple-machine computing facilities and will determine the performance of the entire network

Trillion Bit Memories

by George B. Houston



our cover *is the work of Max Finkelstein, who has this to say about his complex aluminum constructions: "The aesthetics of precision is part of my way. I am looking for a pure image that is derived from modern materials. To me, machined aluminum reflects the spirit of our times: the computer, the automated product and the poetry of space. I use a module in common with industry: squares, rectangles, hexagons and circles. The machined textures and consequent development of unitized images gives me an infinite number of combinations in the design of my sculpture. The viewer becomes the kinetic force activating color and dynamics. I have worked with metals and blueprints for many years as a machinist. The idea of working unrestricted as an artist, while utilizing my past experience is the basis of my work." More of Mr. Finkelstein's work is shown on these pages and elsewhere in this issue. His constructions are in many major collections, public and private, throughout the country. He is represented by the Esther-Robles Gallery, Los Angeles.*

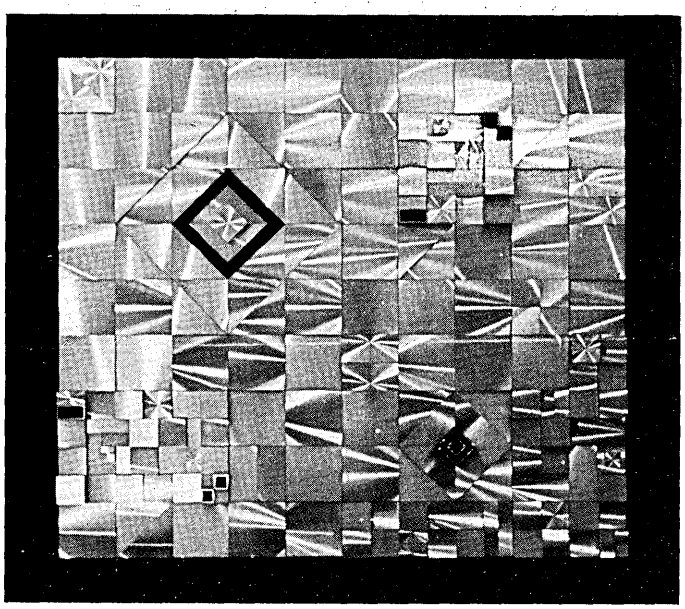
A new type of computer memory system has recently become available in the commercial marketplace. These systems are capable of storing more than a trillion (10^{12}) bits of information—about a hundred times more on-line data capacity than conventional disc storage systems provide. Thus they offer great potential benefits in handling large data volume applications. As such, they provide a challenge in their application and implementation. The computing community has just begun to meet this challenge, and this article will introduce some important factors in the challenge. Particular emphasis will be placed on the analysis of the performance of these systems, and the results of some models will be presented. A profile of characteristics of applications for which they are suitable will be introduced.

In this article, these memory systems will be referred to as *mass stores*. The term mass storage in the past has been applied to disc memory systems, but this article will show that such usage is becoming inappropriate.

The generalized mass store

Some characteristics common to all mass stores will first be considered. These characteristics will help the reader to understand the nature and utility of these devices.

Major characteristics and applications. A mass store is a system which provides on-line access to about a trillion bits of data. In contrast to conventional magnetic tapes, no manual intervention is involved. Access time to a randomly selected piece of data usually



does not exceed 15 seconds.

The position of mass stores in the hierarchy of classes of storage devices is illustrated in Figs. 1 and 2. Mass stores provide capacities one to three orders of magnitude larger than drums and discs, and access times one to three orders of magnitude slower. However, storage costs are only about one order of magnitude less. (Fig. 2 includes the costs of both the storage mechanism and the transport mechanism. For magnetic tape, transport mechanism cost is highly dependent on installation, so this class has not been included in this figure.)

A natural application for mass stores is the replacement of moderate to large libraries of conventional magnetic tape. They can also be used to hold data now kept in large disc systems. Data is often kept on disc so that it is accessible without the delays attendant in a magnetic tape staging system. However, for much of this data, the access time of about 10 seconds provided by mass stores is adequate—the tens of milliseconds access time provided by discs is overkill.

Additionally, mass stores open up applications previously considered infeasible because of the large data volumes involved.

Advantages and disadvantages. Mass stores can provide the advantages of:

1. Relatively fast access to very large quantities of data.
2. No human handling of data, with the consequent elimination of human errors (such as misfiled tape reels).
3. The ability to share the stored data amongst several host central processors.
4. Reliability improvements over conventional magnetic tape recording technology.
5. Reduced operating costs for a given level of service.

Additionally, mass stores open the way for archiving massive amounts of data—up to 10^{14} or 10^{15} bits. This is made possible by the ability in most systems to remove recorded data in relatively small units (of about 10^{11} bits), which are maintained off-line in libraries. Care must be taken with use of this feature not to subvert the other advantages already mentioned.

As will become apparent, disadvantages include:

1. The inability to readily adapt to random processing.
2. The inability to readily handle structured files.
3. Little experience with these devices in the user community.

Users. The mass store user community is still small. U. S. Government agencies have been the pioneering customers, with earliest installations (1968-1969) at the Atomic Energy Commission's Lawrence Radiation Laboratories. The AEC has IBM 1360 photodigital stores, no longer in production. Other systems exist at the Defense Department's Tablon Network (IBM 1360's and an Ampex TBM), and a Precision Instruments Unicon at the Illiac IV installation on the Advanced Research Projects Agency's nationwide computer network. NASA issued a request for proposal (now cancelled) which included acquisition of a mass storage system for its satellite telemetry data, and the Patent Bureau has actively studied its mass store requirements.[1] Industrial use began with installation last summer of a Grumman Masstape System in a Grumman data center, and two further Masstape Systems have been ordered for commercial-user data centers.

Services. General-purpose computing systems provide a wide range of services for the user and the installation which extend the utility of the systems far beyond the basic central processor function. An example of such a service is the ability to edit job files at a remotely located terminal, submit them for execution, and retrieve the results at the terminal.

An analogous situation holds with mass stores. They provide services for the user and the installation which extend the basic functions of reading and writing data. These services include buffering of data, emulation of standard peripherals, directory functions, data and device storing, archival storage, data and code conversion, security controls, error control, graceful degradation, backup and recovery, and system accounting and reporting.

Hardware architecture. The architecture of mass stores usually contains three major subdivisions:

1. A *memory section,* containing the storage medium, transport mechanisms, read/write devices, and data channels.
2. An *interface & buffer section,* which provides the physical connections to the host machine,

[1] Nugent, William R., "Mass-Cache Memory Requirements for Trillion Bit Patent Stores," *Proc., IEEE 5th Annual International Computer Society Digest,* 1971, pp. 153-154.

and up to two levels of buffering to match the data transfer and access characteristics of the host. This section may be controlled by a minicomputer.

3. The *system control section,* which coordinates the activities of the entire mass store, and provides directory and operator control functions, and usually contains a mini or small computer—the system control processor.

The key factor limiting performance of today's mass stores is that the basic access time to an arbitrary record in the system is about 10 seconds. The buffering system minimizes the negative impact of this relatively long access time.

Software. The small- or medium-size processors contained in a mass store usually have a basic real-time operating system with an assembler, loader, and utilities. Software is also required for specific mass store functions, such as controlling transport mechanisms and maintaining a directory. Some of this software is provided by the manufacturers, but each installation will need to tailor or develop this software for its particular needs.

A mass store can be attached to a host so that only minor host operating system changes are required; and no application program changes are needed, other than to a few control cards. However, mass store efficiency may be improved by more extensive host software modification.

The marketplace

Organizations that are involved in the research, development or manufacturing of mass memory systems can be divided into two broad categories. In the first category are those that already have some type of hardware device that is, or within a few years could be, the storage element of a complete mass store. Several different technologies are being used, with emphasis on improvements to conventional magnetic recording techniques and on newer laser-based techniques.

In the second category are those organizations that are doing basic research in new recording technologies. Mass stores using such new technologies can not be expected to be operational for at least three years, but will be more capable and cost-effective. Technologies of potential interest include erasable and non-erasable holography, magnetic bubbles, magneto-optics, and amorphous semiconductors. But be aware that each predictive pundit projects varying payoffs for the various technologies. Continuing improvements to magnetic recording technology are also expected.[2]

Three currently available products are:*

1. Ampex Terabit Memory (TBM) System[3,4]
2. Grumman Masstape System
3. Precision Instruments Unicon[5,6,7,8]

Laser Computer Corporation

Considerable interest has been aroused in the last two years by Laser Computer Corp. and its president, Dr. Frank Marchuk. Early in 1971, a report[9] appeared of a "laser computer" device (the LC-100) with a storage capacity of 10 x 10^{12} bits, and with a read/write cycle time of 20 nsec. "The rest of the system specifications read like a computer designer's vision of perfection: data volatility guaranteed for 25 years, storage cost of 10^{-7} cent per bit, less than 1 error in 10^{9} bits, associative memory organization, an arithmetic execution time and rate that far exceeds any computer system, no moving parts in main memory, automatic error control and correction, and plug-to-plug capability with standard IBM peripherals."[10] And all this for $1.2 million. In addition, a larger LC-500 has 50 trillion bits, 100-nsec cycle time, and $2.4 million price tag.

Laser Computer Corp. continued to make remarkable announcements, with claims of an LC-10 with 5 x 10^{11} to 10^{12} bit capacity in December, 1971,[11] and also of a 10^{40} bit Atomic Computer "Brain One"—due for breadboarding in 1977 and production in 1978.[12]

Few concrete details of the devices have been released and the industry awaits the opportunity to view models in production. Understandably, with the little information available, a club of skeptics has arisen.[13] The claimed capabilities of Laser Computer's devices can offer the opportunity to alleviate several of the major problem areas in current computing technology.

Technology predictions

Despite the uncertainty about the exact nature of future technology developments, it is interesting to project the future growth of on-line storage. Fig. 3 shows the storage volume accessible to the central processor within a few seconds and without operator intervention (so that conventional magnetic tape is excluded). This plot shows the largest capacity available in a single device.

The point for the 650 represents main drum storage; the 704, main core storage. Points above this represent auxiliary storage, chiefly drums and discs. Two IBM devices, the 2321 data

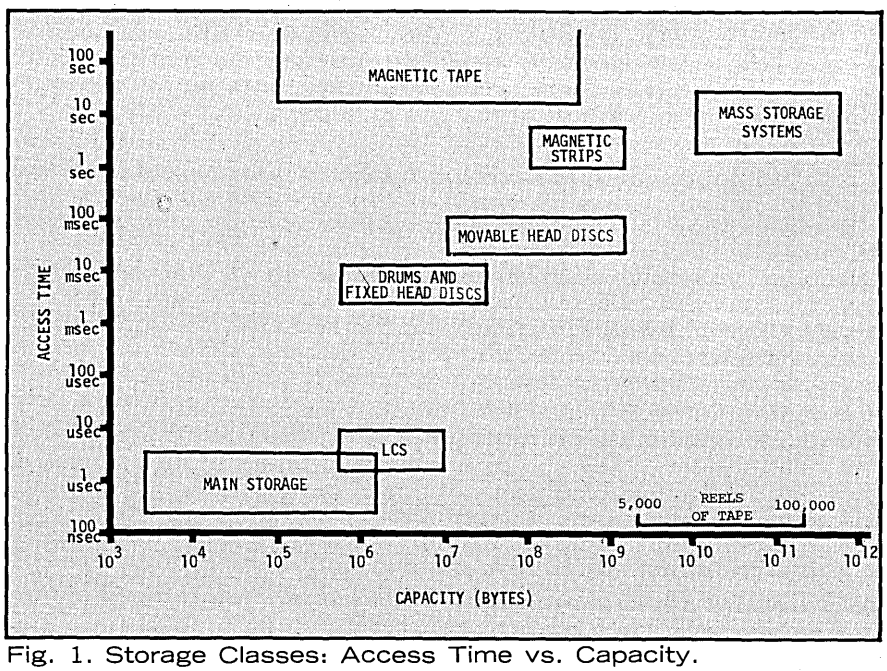


Fig. 1. Storage Classes: Access Time vs. Capacity.

[2] Hoagland, Albert S., "Mass Storage—Past, Present and Future," *Proc., AFIPS FJCC 1972,* Vol. 41, Part 2, pp. 985-991.

*TBM, Masstape, Unicon are trademarks of their respective companies.

[3] Damron, S., Lucas, J., Miller, J., Salbu, E., and Wildmann, M., "A Random Access Terabit Magnetic Memory," *Proc. AFIPS FJCC,* Vol. 33, Part 2, 1968, pp. 1381-1387.

[4] Gentile, Richard B., Lucas, Joseph R., "The TABLON Mass Storage Network," *Proc. AFIPS SJCC,* Vol. 38, 1971, pp. 345-356.

[5] Becker, C. H., "Unicon Mass Memory System," *Proc., AFIPS FJCC,* Vol. 29, 1966, pp. 711-716.

[6] McFarland, K., and Hashiguchi, M., "Laser Recording for High-Density Permanent Digital Store," *Proc., AFIPS FJCC,* Vol. 23, Part 2, 1968, pp. 1369-1380.

[7] Parnas, S., and Peters, C. J., "Laser Recorders Pick Up Where Magnetic Machines Leave Off," *Electronics,* February 16, 1970, p. 101.

[8] Pickering, Harold L., "Planned Application of a Massive Memory Device," *Proc., IEEE 5th Annual International Computer Society Conference Digest,* 1971, pp. 151-152.

[9] *Business Automation,* February 15, 1971, p. 5.

[10] *Electronics,* March 29, 1971, p. 81.

[11] *Electronics,* November 22, 1971, p. 26.

[12] *Datamation,* December 1, 1971, p. 8.

[13] *Datamation,* February 1973, p. 24.

cell, and the 1360 photodigital chip store, have served to extend the upper limits of single device on-line storage capacity over the more immediate past. It is interesting to note that the slope of the line corresponds to a factor of about 10^4 per decade, i.e. an increase of an order of magnitude every two-and-a-half years.

The line is projected through 1980 with the same slope, and two of the technologies which may provide the growth are shown in the figure. The same growth implies capacity of 10^{17} characters in 1990 and 10^{21} in 2000. The trend must slow sometime, however, since there are only 10^{88} electrons (give or take a few) in the universe. From the figure it is apparent that the performance specifications for Laser Computer Corp.'s devices place them about five years ahead of the state-of-the-art.

A mass store is a sufficiently complex device that effective use of both it and the host systems demands careful analysis of its performance. This article will discuss five factors significant in the analysis.

Throughput capacity. Throughput capacity is the total number of bytes per second that can be transferred to and from the mass storage medium over sustained periods. It has been found helpful to develop a generalized throughput capacity analysis schema.

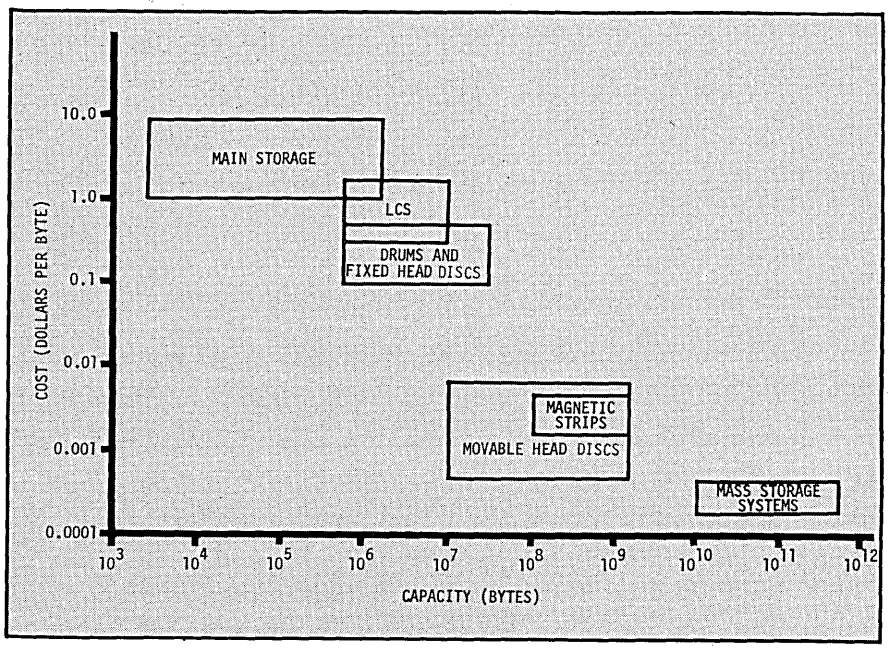


Fig. 2. Storage Classes: Cost vs. Capacity.

This schema defines the general process that must be followed in the throughput analysis, but it allows for the details to be worked out using the best or most appropriate tools available. The schema identifies the critical parameters that must be determined, but does not commit one to a specific technique of determination.

Two application characteristics that significantly affect throughput are:

1. The distribution of file sizes.
2. The degree to which the application can control allocation of files amongst the physical devices of the mass store.

An important physical characteristic of the devices is their mechanical positioning times.

Some mathematical models have been used to fill in some of the details of the schema. Various reasonable simplifying assumptions have been made to provide mathematical tractability.

Fig. 4 compares the throughput rate attainable on today's three systems, assuming that only one file at a time is being processed. In most expected applications, several files will be processed simultaneously. This introduces conflicts for transport devices and access mechanisms which reduce the effective file transfer rate possible.

An important conclusion which these mathematical models demonstrate is the necessity for reading or writing a large data block for each access to a particular location in the store. This application characteristic is conveniently termed *basically sequential access,* and is incorporated in an application profile to be introduced below. Basically sequential access precludes the use of mass stores for effective random processing or handling of structured or indexed files.

More sophisticated techniques such as simulation could be used as schema elements to widen the range of applicability.

Storage capacity. The gross storage capacity of a mass store is reduced by the space requirements of error detection and correction codes, housekeeping data, and provision for leaders and bad spots. These requirements total 5-10% of gross capacity, leaving 90-95% available to the user.

In a mass store, the recording medium is subdivided by the control software into *allocation units.* The space required to store a file is made up of an aggregate of allocation units. Each allocation unit can be used with just one file at a time, and is thus analogous to the allocation of a track or cylinder in a disc system.

The size chosen for this unit represents a compromise between space efficiency and processing efficiency. If the size of the unit of space allocation is too large, the effective user capacity will be reduced significantly, possibly by as much as 33%. The impact of the overhead data and of the allocation unit size is shown in Fig. 5 (page 57).

By way of illustration, it is interesting to note some potential trades possible with the Grumman Masstape System. For allocation unit size A, allocation units are such that the beginning of any file can be accessed in an average of less than a second (in the absence of any conflicts); however, storage utilization is relatively low. For size B, storage utilization is much improved, but average access time to the start of the file is increased to about five or six seconds. Grumman plans to implement allocation unit size B.

Maximum available system capacities range from 88 gigabytes* in the Precision Instrument's Unicon, through 110 gigabytes in Grumman's Masstape, to 362 gigabytes for the Ampex TBM.

TBM and Masstape allow one to add on-line capacity in units of 11 gigabytes and 14 gigabytes respectively, thus allowing relatively easy matching of capacity to application requirement. The Unicon has no incremental capability—each system provides exactly 88 gigabytes.

System costs. Basic hardware prices are in the range from $400K for a 14-gigabyte Masstape system to $4.6 million for a 362-gigabyte TBM. Both Masstape and TBM provide a series of intermediate price levels which depend on both capacity and throughput capability. Unicon costs $1.6 million per 88 gigabytes.

Directory alternatives. A mass store usually contains a *directory* which locates by name large data units (like files) for host programs and users; automatically manages allocation of storage space; and implements access and security controls. The user is thus isolated from the details of specific hardware and volume assignments and the mass store can allocate its resources so that optimal system performance is achieved.

*1 gigabyte = 1 billion (10^{12}) bytes

The directory can be located on either the host machine or in the mass store, but the advantages noted can be readily achieved only if the directory is placed on the mass store, probably on a disc or drum attached to the control processor. If more than one host uses the store, then the complexity of coordinating directory changes demands that the directory be located on the mass store.

So far, directory support software has been developed on an installation-by-installation basis, and the potential user should be aware that the software available will need to be tailored or developed so that it is suitable for use in his installation.

Mode of operation. There are two ways in which users' files can be passed between the mass store and the attached host computers. These will be called *direct* and *staged.* Each represents a distinct mode of operation.

That collection of mass store resources that must be dedicated to the transmission of large units of data is referred to as a *data path.* These resources include the buffer space required in the interface and buffer section, and control tables in the system processors. The key distinction between the two modes of operation is that for direct mode a data path must be allocated for each active file on each host, whereas in staged mode one data path can serve for all files.

In direct mode, a data path is usually allocated to a file for as long as it is open, and must be dedicated while the host application is processing the file during execution. The file must be processed in "basically sequential mode." The number of data paths required is likely to be large, particularly in a system supporting multiple hosts. For example, to replace a tape library for two hosts as many as 48 paths could be needed, resulting in large expense for the required interface and buffer hardware.

In the staged mode of operation, when a file is required by a host application, the entire file is moved at one time to (probably) disc storage on the host. This operation—*pre-staging*—is completed before the application reaches execution on the host. The application may create files intended for eventual storage in the mass store. During actual execution, these will be written on host direct access storage. After the application job completes (or at some other appropriate time), the file is transferred at one time to the mass store. This operation is *post-staging.* Post-staging is also required for files that have been pre-staged and then modified by the application.

Staged mode thus reduces the number of data paths required in the mass store to just one or two per attached host. The corresponding reduction in data path hardware will usually lead to substantial dollar savings, which may be partially offset by the need for additional host direct access storage. Very large files may need to be staged in a sequence of large blocks, e.g., several disc cylinders at a time.

If a file is small enough to be pre-staged in its entirety then it can be processed randomly, and so the basic sequential usage restriction of direct mode is partially eliminated. Staged mode requires more extensive host operating system software modifications than direct mode. Staged mode is used in Tablon, and was expected for Telops. Staged mode allows an application that has been optimized for a specific direct access device to retain the optimization. Overall, a mass store is better used in staged mode, unless exceptional conditions dictate use of direct mode.

Again, tailoring or development of software both for host and the mass store will be needed to fit the mode of operation of the mass store to the needs of the installation.

Applications

A *characteristic profile* that an application should fit for effective use of a mass store can now be identified. It incorporates the following six requirements:

1. The minimum data volume be 20 to 50 billion bytes. (For

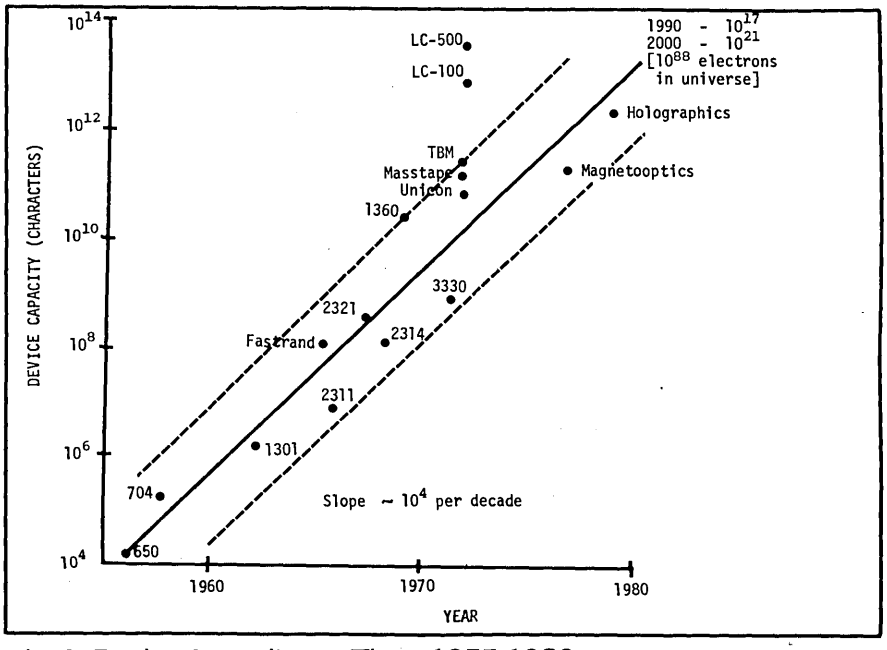


Fig. 3. Device Capacity vs. Time, 1955-1980.

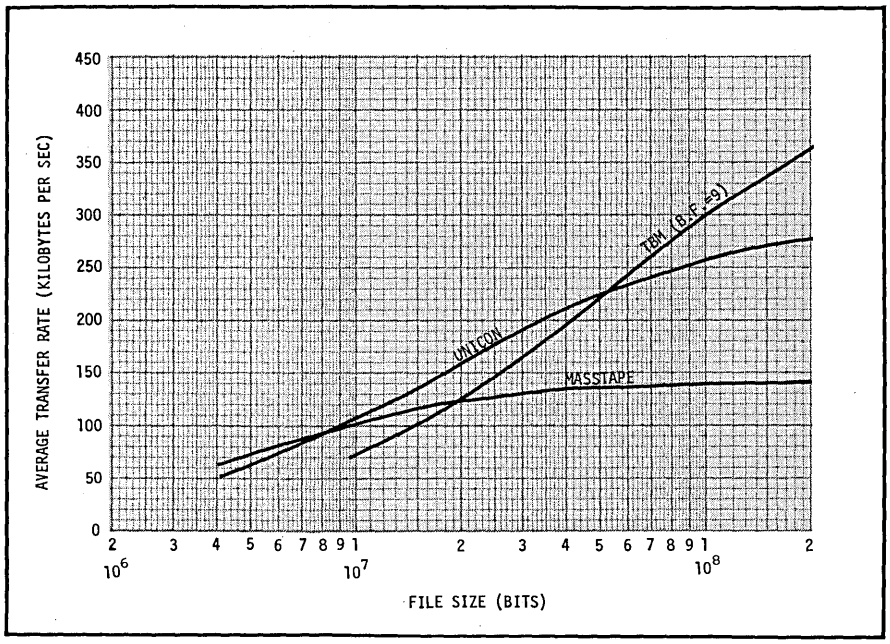


Fig. 4. Comparative Single Stream Throughputs.

smaller data volumes, a mixture of discs and magnetic tapes provides a viable alternative. This alternative remains cost effective because of the large investment required to acquire and implement a mass store.)

2. Large blocks of data should be processed for each access to a particular location in the store. From the throughput analysis presented earlier, one can suggest that at least one million bytes be transferred per access.
3. The sustained throughput rate per file should not be much in excess of 100 kilobytes/second. This also follows from the throughput analysis presented above.
4. The response time required for a data request should not be much less than 10 seconds. This requirement stems from the mechanical positioning time constraints of the devices.
5. A long application life is needed to establish adequate cost savings, since large investments are required to acquire and implement a mass store.
6. A competent software source is needed to tailor the manufacturer's standard software to the particular requirements of the installation.

Two existing or proposed mass store environments—Tablon and Telops—fit this profile well.

Tablon, a Department of Defense system already mentioned, provides mass store services for more than a dozen large computers made by several different manufacturers. It uses two IBM 1360 photodigital stores and an Ampex TBM system. Tablon automatically provides code conversion and word size matching between each of its hosts. Tablon is described in more detail in a report by Gentile and Lucas.[14]

The National Aeronautics and Space Administration issued an RFP, now cancelled, to update its Goddard Space Flight Center satellite telemetry data storage and processing facilities (Telemetry Online Processing System —TELOPS) by inclusion of a mass store. A notable Telops requirement was the ability to handle two trillion bits of new data per year. A prime justification for the Telops mass store system was a potential annual savings of millions of dollars spent on conventional analog and digital magnetic tape. The requirements of the RFP were probably too demanding of current capabilities, resulting in few responses, and, hence, in its cancellation.

Some other potential mass store applications do not fit the profile as well, and it is interesting to examine their limitations.

The first such potential application is as a tape library replacement. An in-house study to improve the efficiency of a 60,000 reel tape library servicing one data center using IBM 360-370 large-scale systems was conducted. The study showed little cause for optimism for these reasons:

1. A massive investment ($3 million) was involved.
2. Payoff would have not occurred for five years.

However, the particular library was not representative of general industry conditions since a semi-automatic tape staging system had already been implemented. This system reduced personnel costs and increased machine efficiency, thereby eliminating the major element of the possible mass store cost benefit. For an installation without such semi-automatic tape staging, a mass store might well produce greater savings than a similar semi-automatic tape staging system.

Other initially attractive application

SYSTEM		Ampex TBM	Grumman MASSTAPE		PI UNICON
			ALLOCATION UNIT SIZE A	ALLOCATION UNIT SIZE B	
OVERHEAD DATA IMPACT	ERROR DETECTION & CORRECTION CODES (a)	32/955[1] 3%	5%	262/8180[1] 3%	16/2048[1] 3/4%
	HOUSEKEEPING DATA (b)	0		2218/130,880[1] 2%	10%
	TOTAL ERROR AND HOUSEKEEPING [(a) + (b)]	3%	5%	5%	11%
	NET CAPACITY AVAILABLE TO USER	97%	95%	95%	89%
ALLOCATION UNIT SIZE IMPACT	ALLOCATION UNIT	tape block	half track	1/9 of half-track	track
	ALLOCATION UNIT SIZE (Kilobytes)	120	1500	131	17
	UTILIZATION OF NET AVAILABLE USER CAPACITY				
	Case 1: 1 megabyte average file size	94%	67%	93%	99.1%
	Case 2: 3 megabyte average file size	97%	80%	97%	99.5%

[1] Number of bits of error codes per number of user data bits

Fig. 5. Comparative Storage Medium Utilizations.

CHARACTERISTIC	DATA VOLUME	BASICALLY SEQUENTIAL ACCESS	PER FILE THROUGHPUT MODERATE	RESPONSE TIMES	COST SAVINGS	SOFTWARE	APPLICATION EFFECTIVE OVERALL ?
PROFILE REQUIREMENT	over 50 billion bytes	over 1 megabyte per access	less than 100 kilobytes/sec per data path	not less than 10 sec, better than 100 sec.	that cost savings exist	that source be available	
TABLON	Yes (150 billion bytes)	Yes (3.3 megabytes avg. per file)	Yes (system = 60 kilobytes/sec.)	Yes	?	Yes	Yes
TELOPS	Yes (300 billion bytes +)	Yes (6.85 megabytes avg. per file)	Yes (system = 550 kilobytes/sec.)	Yes	Yes (media savings)	Yes	Yes
TAPE LIBRARIES	Marginal (40 billion bytes)	Yes (8 megabytes avg. per file)	Mostly	Yes	Possibly	?	Possibly
MINI MASS STORE	No	?	Yes	Yes	Probably Not Today	?	No
TIME SHARING	Probably Not	?	Yes	Yes	Probably Not Today	?	No

Fig. 6. Profile Match Summery.

[14] Gentile, Richard B., and Lucas, Joseph R., "The TABLON Mass Storage Network," *Proc., AFIPS SJCC*, Vol. 38, 1971, pp. 345-356.

areas for mass store technology include semi-archival storage for time-sharing usage, and also installations containing several IBM 2314/3330 type disc systems. In these cases, storage volumes required are in the range of 2-20 billion bytes—below the lower limit of the profile. A system that provides inexpensive storage at this capacity level can be called a *mini-mass store*. However, current mass store technology is over-engineered for a mini-mass store, and as a result, implementation costs exceed any possible cost savings.

Fig. 6 summarizes the match of each of these application areas to the profile.

Conclusions

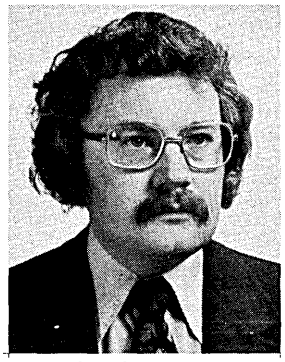
In summary, the major considerations that must impact use of mass stores employing current technology are that:

1. The analysis and prediction of the performance of mass storage systems is at least as complex as the analysis and prediction of the performance of current computing systems. Mass stores are not just another peripheral: they will dominate multiple-machine computing facilities and networks. The performance of an entire facility or network will be limited by the performance of its mass store. Thus, the industry cannot afford to fail to manage mass stores as it has sometimes failed to manage computing systems. "As they increasingly come into use in the near future, the current piecemeal approach to using such [mass storage systems] will almost certainly lead to disaster."[15]
2. A large cash investment involving a long payoff period is needed to implement a system. The investment falls in the range of one-to-two times the cost of the basic system, e.g. as much as $2-$4 million. Costs involved include raw hardware, host and mass store software development, system integration, and implementation. The payoff period is likely to be three to five years—long enough that there is a risk that technology developments might economically outflank today's systems. While the exact course of such developments cannot be predicted, they cannot be overlooked.

   Exceptional conditions can alleviate the discouraging economic picture. For example, in Telops it was expected that a major cost savings would be over $2 million annually for raw magnetic tape.
3. Mass stores have several technical limitations, including:
   (a) The inability to handle online transaction systems, random processing, and structured files.
   (b) A lack of measurement and prediction tools which allow one to refine throughput and cost studies to more sophisticated levels of detail than those presented earlier.
   (c) Over-engineering for storage requirements in the 2-20 billion byte range (the *mini-mass store* range).
   (d) The need for software tailoring and development for use in each specific installation.
   (e) High technical risk—resulting from little user experience.

Thus mass stores present a major challenge to the computing community. Successful responses to the challenge will use significant technical, economic and management resources. A maturing process of several years is foreseen before mass stores will perform adequately over the entire spectrum of large volume data storage environments.

Acknowledgements: The author wishes to thank C. W. Bower and several other colleagues for their contributions to the material presented in this article. □



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[15] Lynch, W. C., "Operating System Performance," *Communications of the ACM*, Vol. 15, No. 7, July 1972, pp. 579-585.

Certain brands of old tapes may have an error rate as high as 20%

On the Reading of

Almost every computer installation in operation today continues to increase its holdings on magnetic computer tape. Some of these installations contain a library of tapes dating back to the early 1960's. Depending on the type of data, size, and activity of the library, these computer installations now possess thousands of reels of magnetic tape originally purchased, written and stored five or more years ago.

Aging magnetic tape is becoming a concern as installations ponder the condition of what may be irreplaceable data. Recovery of data from very old magnetic tape is a problem that we will undoubtedly all have to face some day. With increased activity on all fronts of the mass storage horizon, that day may be closer than we think (see References).

One element of the Department of Defense (DOD) now stands on the threshold of just such an undertaking. Employing a totally new concept of online massive storage in the trillion bit range,[1] data stored on thousands of reels of very old magnetic tape must now be read into a new storage technology. The transfer process involves fetching a tape from the library, then mounting and reading its data. Many tapes are old, some worn and dirty, others low bid and still others written by tape drives of unknown compatibility and alignment.

This article documents results of an experiment into the reading of very old magnetic computer tape. It attempts answers to two important questions:

1. What success can be expected in reading very old tapes?

2. What can be done to circumvent the read errors encountered?

Since this was an operational experiment as opposed to a laboratory study, actual causes of read errors encountered were not fully investigated.

[1] R. B. Gentile and J. R. Lucas, "The TABLON Mass Storage Network," 1971 Spring Joint Computer Conference, AFIPS Press, p. 345.

Very Old Magnetic Tapes

by Richard B. Gentile

The library from which these tapes were selected is fairly typical. Some 80% of the tapes are less than full. The average tape contains just over three million characters or about 350 feet of data. Although the library contains some multi-file tapes, most are single file, as were all the tapes examined in this experiment.

Tape characteristics

The majority of tapes tested were used for archival storage, some since their virgin use. More than one-half of this particular library has not been referenced within the last year. About 30% of the library has not been touched in the last two years; 10% not in the last four years.

Since this particular DOD installation has always employed a variety of different types and models of computer systems, tapes were written on many different makes of tape drive. The majority were written on the IBM seven-track tape drive most predominately used during that particular era. The remainder were written on tape drives from many other computer manufacturers as well as on oem drives. All tapes examined in this experiment were seven-track.

As far as is known, all tapes were retained in a near-identical computer room environment. Except for an occasional summer power outage and a two-inch flood in 1968, both temperature and humidity were controlled. All tapes were relocated once during a move of the entire library some years ago, but this move was from one adjacent area to another and involved no major temperature or humidity changes.

Up until 1968, tapes were housed in plastic canisters and stored vertically on shelves. Later these canisters were phased out in favor of wrap-around tape seals. During changeover, any tapes with open holes in the reel flange had them closed with a stick-on covering. Once stored in the library, tapes remained undisturbed until referenced. There have never been any periodic cleaning or rewinding procedures in use.

Finally, a visual inspection of all tapes showed most had fairly smooth wraps from their last rewind. The leader on most was worn, creased or otherwise ragged and no vinyl strips or rubber holders were used to secure the leader in place during storage.

In short, no special preparations or periodic actions of any kind were made for long term storage of these tapes. They were simply written and sent to the library where they remained undisturbed until released to this test.

Test procedures

In order to keep accurate records, a special tape testing program was written. Parameters of parity and density were obtained from the tape label and input to the program at the start of each run. The program then began reading the tape continuously while recording characters read, record length and count, time of day and read errors encountered. From the density, character and record count, an approximate footage of tape passed was computed and output for each pass of each tape. At each read error encountered, the time, date, record number and footage were output, along with the number of rereads attempted and whether or not the error was consid-

ered permanent[2].

Once a read error was determined to be either permanent or correctable, the program continued reading tape, investigating each error in turn until End-of-File. At this point the tape stopped so an oxide sample could be taken. The tape was then rewound and positioned at the beginning of its first data record. A short summary of total errors encountered, total records read and final footage was also output at End-of-File. Variations in the program were included so as to permit stopping on errors or passing the entire file without stopping.

Older vintage tapes filed more than two years ago were the primary target of this experiment. Since the government usually purchased tapes in quantity by year from one or a few low-bid vendors, the library contains clusters of tape by vintage and manufacturer. Knowledge of the probable reading success within each of these cluster areas would then provide knowledge about the majority of library tapes.

Some 11 different tape types from eight manufacturers were tested; a simple sticker identification was used as shown in Fig. 1. Omitted from Fig. 1 are Memorex and Audio Devices; these tapes have the manufacturers' name embossed on the reel flange and tape hub respectively.

Tapes investigated were intercepted just prior to being released from the library. Thus, data was in a sense "live" but could be destroyed if necessary. Most tapes had not been read since their storage dates in the mid-1960's.

An initial random selection of 100 older tapes was made to get things started. Results were then studied and additional tapes selected so as to gather sufficient data in all investigation areas.

Actual running of the test was straightforward. One tape drive (Digital Equipment Corp. model TU-30 seven-track) was dedicated, aligned and used exclusively throughout this experiment. To begin operation, the tape drive head was cleaned, the tape mounted and the special test program executed. Usually, two back-to-back passes were made on each tape, the drive being cleaned between passes. Printer output was accumulated and the tapes retained in a separate storage rack for possible rerun at a later date.

After the experiment was well underway, a number of tapes known to contain permanent errors were accumulated. At this point a parallel effort was launched to determine what (if anything) could be done to the tape to circumvent the errors encountered. Of primary interest were the two actions deemed "feasible" for an operational environment: (1) immediate rereading of the tape, or (2) cleaning the tape and then rereading.

The experiment continued in several areas simultaneously. As known error tapes were identified and then (say) cleaned, they were cycled back into the queue of tapes awaiting testing. Operations personnel tested all tapes alike whether it was a first or later pass of the tape.

When the experiment was concluded, 719 tapes had been tested, resulting in 1,682 actual tape passes. Since these 1,682 tape passes generated an enormity of test data, another program had to be written just to aid in keeping track of the tapes and helping with analysis of accumulated data.

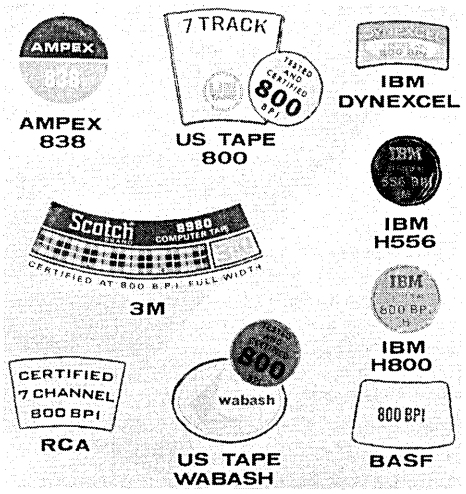

Fig. 1. Identification of tapes tested.

Results of experiment

Drive errors. The first result was immediate and cast a doubt upon the validity of the entire experiment. Tapes recorded at the 800-bpi density were found to contain nearly three times more errors than did tapes recorded at the 556-bpi density. Since the 800-bpi tapes were of newer vintage and most recently recorded, it was expected they would read better than their older 556-bpi predecessors. Yet when the first read pass of all 719 tapes was examined, 32.6% of the 800-bpi tapes were in error against only 12.9% of those written at the 556-bpi density.

An investigation was launched into the stability of the TU-30 tape drive hardware; it was found suspect at the 800-bpi density. Detailed examination showed that the recovery time of the read amplifier circuits was not always sufficient for bits passing at the 800-bpi rate. There was a tendency for the clipping level threshold to creep at the higher data rate, eventually causing false error indication. As a result, in-house engineering actions were initiated to correct the problem at our site. Just recently, the Digital Equipment Corp. has proposed an engineering change to correct this problem on all TU-30 tape drives.

Unfortunately, data gathered at the 800-bpi density could not be trusted and all tapes examined at this density were eliminated from the experiment. Performance of the TU-30 tape drive at the 556-bpi density was reviewed and found to be technically sound. Results from tapes read at the 556-bpi density stand valid and are reported here.

Tape errors. The table in Fig. 2 shows the final tally of 556-bpi tapes studied. Results were analyzed for a number of different factors but the overriding characteristic turned out to be manufacturer and vintage. These can be broken into three groups:

TOTAL TAPES EXAMINED (ALL 556 bpi)			VOLUME OF DATA EXAMINED (FIRST READ PASS ONLY)			PERMANENT ERRORS ENCOUNTERED (FIRST READ PASS ONLY)			
MANUFACTURER & TAPE TYPE	MAJORITY VINTAGE	TOTAL TAPES	TOTAL RECORDS	TOTAL FOOTAGE	ESTIMATED CHAR. $\times 10^6$	ERROR TAPES	PERCENT ERROR	ERROR RECORDS	PERCENT ERROR/10^3
AMPEX—838	68-69	41	369,800	57,259	286.5	6	14.7	1,144	3.09
AUDIO DEVICES	69-70	30	148,084	30,742	170.3	0	.0	0	.00
BASF—800	1971	14	79,800	19,231	109.8	0	.0	0	.00
IBM—Dynexcel	67-68	95	760,317	133,978	706.7	23	24.2	1,548	2.04
—M556	63-66	99	707,309	93,926	443.9	25	25.2	670	.95
—H800	66-69	128	1,154,417	171,642	859.1	14	10.9	88	.08
MEMOREX	68-69	72	619,499	96,911	484.3	2	2.8	277	.45
RCA—800	68-69	22	226,322	22,681	94.6	3	13.6	8	.04
U.S.—Wabash	70-71	18	61,925	17,000	96.5	0	.0	0	.00
—800	69-70	62	400,214	61,960	306.3	3	4.8	3	.01
3M—8980	68-69	15	95,024	11,443	51.0	0	.0	0	.00
ALL TAPES	63-71	596	4,622,711	716,773	3,609.0				

Fig. 2. Statistical results.

[2] Each read error was reread to an arbitrary maximum of ten times. If the data could not be obtained correctly within ten rereads, it was considered a permanent error.

1. Very old tapes: as characterized by the IBM "M" Series 556-bpi certified tapes of 1963 to 1966 and the IBM "Dynexcel" 800-bpi certified tapes of 1967 to 1968. One in four of both these tapes contained permanent errors with the supposed better quality Dynexcel tapes containing twice as many error records per thousand as their M Series predecessors.

2. Moderately old tapes: of the 1968-1969 vintage. Of the five different manufacturers' brands in this date range, Ampex, RCA and IBM H Series appear to have the highest error rates. Ampex tapes had both the greatest percentage of tapes in error and the largest percentage of records in error. Conversely, Memorex and 3M tapes from this same era were nearly error-free.

3. Recent tapes: of the 1970-1971 vintage. Almost no permanent errors were encountered on these tapes, as was expected.

An attempt was made to correlate error rates against other factors such as time since last recorded, time since last referenced, tape drive which wrote data, size of file and period between first use and last reference. No specific trends could be established beyond the overriding factors of manufacturers' brand and vintage.

Since this was an operational experiment, as opposed to a laboratory study, causes of read errors encountered were not fully investigated. However, some contributing causes and effects were noted and are reported here.

A tally was made of the location of errors down the length of tape. Examination of 64 full reel tapes is shown in Fig. 3. Most errors occurred within the 400 feet at either end of the tape. In some cases errors within the first hundred feet can be attributed to heavy usage of the tape in this area prior to its being written full and stored. Errors within the area nearest the reel hub are suspected to be the result of dirt, dust and oxide debris. Pressure and tensions are greatest near the hub, thus such particles become imbedded and eventually cause permanent errors. Also, there is reason to suspect that the inertia of rewinding has effect on tape wind. It was easy, for example, to tell how much data had been stored on a virgin tape by examining the wrap and where it changed from smooth to rough. Investigation of a dozen tapes only one-half full of data showed characteristics similar to full reel tapes, namely a higher error density at the beginning and end of the data area.

Oxide accumulation on the drive head was recorded after the first read pass. Subsequent examination revealed a variation by manufacturer and type of tape. Although identical tapes varied in amount of oxide shed, some brands were obviously and consistently worse than others. No firm correlation was established between the amount of shedding and error rates. For example, the error-prone IBM Dynexcel tapes appear very "dirty" as do the almost error-free Memorex tapes. Perhaps dirty tapes only begin to cause errors after extended term storage. Cleaning, as is explained later, did eliminate almost all permanent errors encountered in this experiment.

It was clear that pressure and tensions near the hub do create error conditions. An example of these pressures was found while investigating a permanent error on a tape stored more than five years. The imprint of an End-of-File reflective marker had caused several error records, spaced apart by the distance of once around the hub. Similar conditions (a crease, scratch, imbedded hair, oxide, etc.) were found on other tapes.

Other sources of errors were loss of amplitude and physical tape damage. In almost every case, both appeared to be caused by the drive at the time the tape was written. An amplitude adjustment on the TU-30 enabled better reading of tapes with amplitude loss. Not much could be done for the couple of tapes found with physical scratches and oxide damage. These type errors were minimal compared to the overall experiment and did not bias the statistics to any significant degree.

Recovery. Having identified the likelihood that some brands will contain many errors, the question of what can be done to circumvent errors becomes important. Rereading the data is the easiest and most common recovery technique. Rereading can be done in two ways—*retrying* an error record as individual errors are encountered and completely *rereading* the entire tape. Both techniques were examined. Note that *retry* means an immediate backspace and try again (single record) while *reread* means to rewind the tape from EOF and start the reading process over.

The selection of nine retrys maximum as the point beyond which an error was considered permanent was

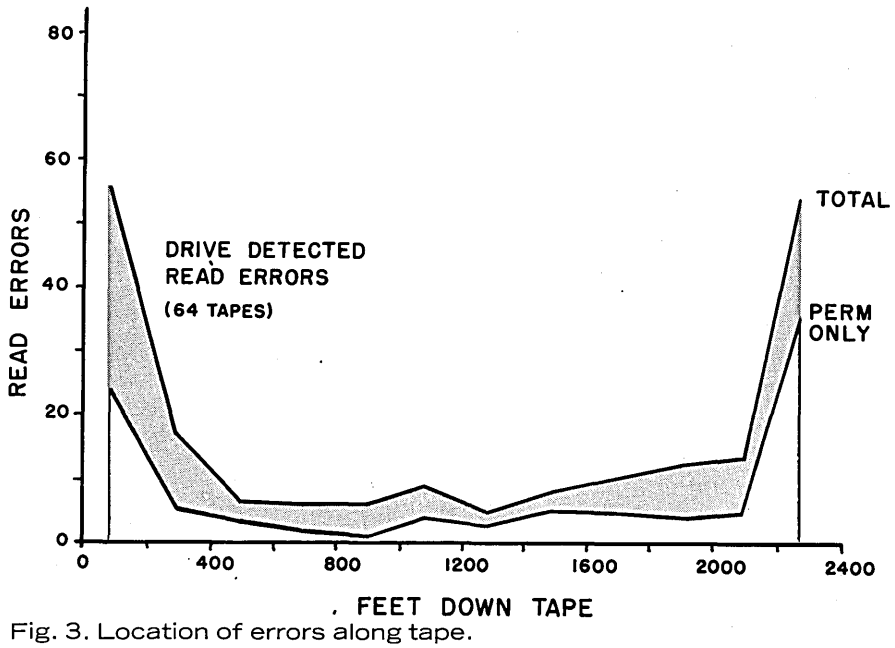

Fig. 3. Location of errors along tape.

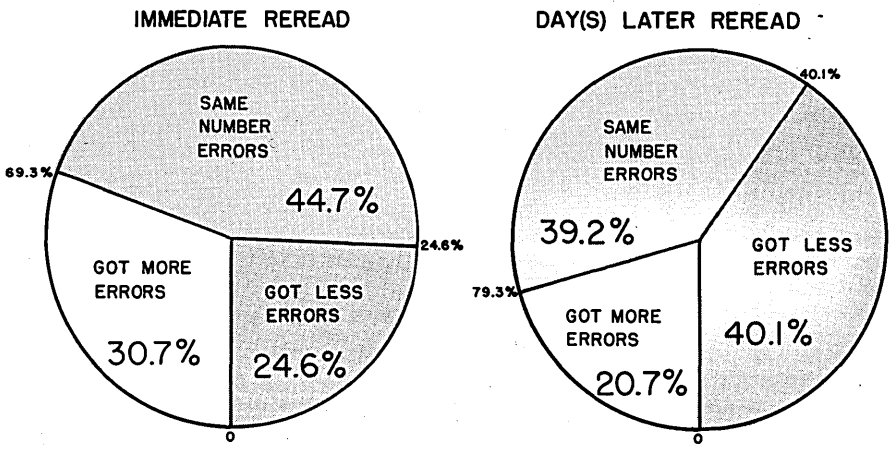

Fig. 4. Effects of rereading.

Reading Old Tapes

somewhat arbitrary. Examination of 47 tapes recorded at 556 bpi revealed the following recovery success:

UPON RETRY, THE ERROR:	
Read OK on 1st retry	47.8%
Read OK on 2nd retry	3.7%
Read OK on 3rd retry	2.7%
Read OK on 4th retry	2.3%
Read OK on 5th retry	1.3%
Read OK on 6th retry	1.0%
Read OK on 7th retry	.9%
Read OK on 8th retry	.0%
Read OK on 9th retry	.9%
Never able to read OK*	39.4%
	100.0%

*i.e., a permanent error.

Rereading the entire tape, as opposed to retrying an individual error record, is the second approach to error recovery. Two choices are available; an immediate reread of the whole tape by rewinding the tape and trying again or rereading the entire tape sometime (usually days) later. Both cases were tried and found to have vastly different success rates as shown in Fig. 4. This author cannot attempt explanation of why delayed reading brings more success than immediate rereading, except to say there are theories which support these findings.[3]

Immediate retrying the record when an error is encountered, or rereading the entire tape at a later date, may still not achieve recovery of bad data. What then? From an operational standpoint there remains another possible corrective action—non-destructive cleaning of the tape. This experiment tried two approaches: portable tape cleaners located in the operational area and a commercial cleaning facility located off-site.

Two types of portable tape cleaner were tried, the Kybe TMS-70 Cleaner/Tester and the Recortec Computer Tape Evaluator (CTE). These two cleaners were coincidentally available on a trial loan basis while this experiment was underway, thus they were used. The Kybe TMS-70 used a sapphire cleaning blade; the Recortec CTE was tried with both its stainless steel grid blade and its optional razor blade.

Using portable cleaners on seven tapes having known permanent errors, three read error free after cleaning, one had its error count reduced, and three tapes showed no decrease in permanent read errors after cleaning: a partial improvement at best. Two error free tapes were also cleaned; they remained error-free.

Receiving only mixed success from the use of portable tape cleaners, a commercial cleaning facility was tried. Nine additional tapes were cleaned using a General Kinetics M-7000 cleaner with endless loop blade. Of the seven tapes known to have permanent read errors, all seven read without error after cleaning by the M-7000. Two other error-free tapes cleaned on this device also remained error-free.

The commercial cleaning facility also examined 29 tapes for quality, both before and after cleaning. Using a GKI Model 97 Computer Tape Tester, these tapes were examined from end to end. Based upon a 50% clipping level, signal dropouts were recorded against their position on tape and plotted in Fig. 5. Cleaning efficiency against signal dropout was reported at 85% while stating the majority of errors were caused by oxide buildup which was removed in the cleaning process.

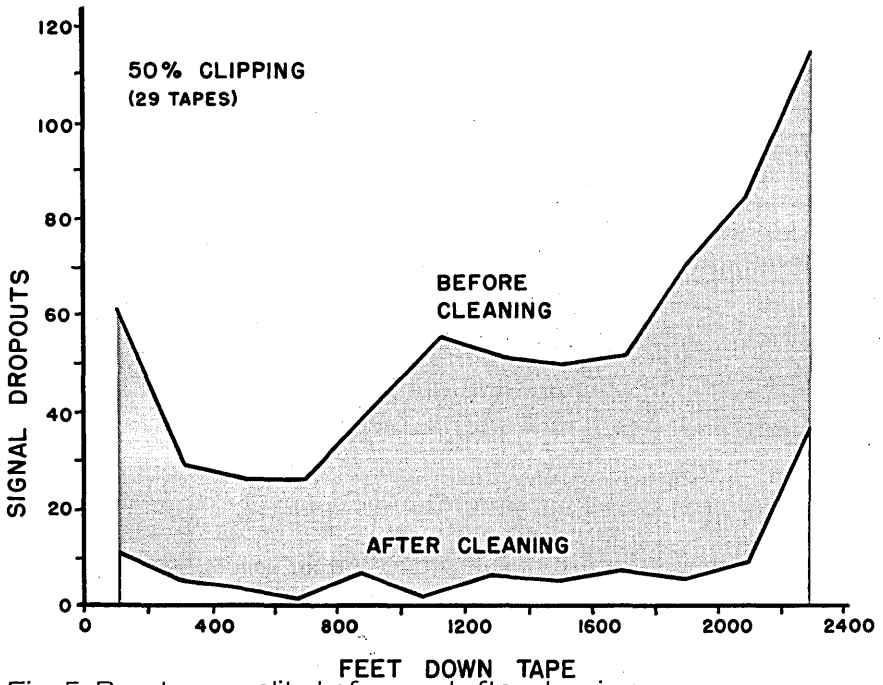

Fig. 5. Raw tape quality before and after cleaning.

Conclusions

There are a number of general conclusions reached at this single DOD installation which could apply to other installations with large tape holdings:

- The brand and vintage of tape seemed a much more significant factor in predicting read problems than were all the other factors of environment. This applies to older tapes not specifically prepared for long term storage, as is the case in many installations.
- Of the read errors encountered, most were caused by contamination which could be eliminated by professional cleaning.
- Portable tape cleaners only provided marginal success in removing "hard" errors.

Based upon what was learned in this limited experiment, tapes which encounter permanent read errors on their first read pass will be set aside for rereading a day later. If error(s) persist, professional cleaning will be tried. If the results of this experiment hold true, and based upon the heavy population of older vintage IBM M556 and Dynexcel tapes, our installation anticipates a tape error rate as high as 20% —but that a combination of cleaning and rereading will reduce the tapes with one or more read errors to less than one tape in 20. □

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Mr. Gentile is deputy manager of engineering services for an agency in the U.S. Dept. of Defense. His background is in mass storage technology, techniques of computer use, and maintenance of computer hardware. He has a BSEE and an MS in computer science from the Univ. of Maryland.

[3] These theories involve "relaxing" a tape, either by unwinding it once first, letting it sit for a period in the computer room area, making a few or many full reel passes prior to reading, exercising the tape, or various combinations thereof.

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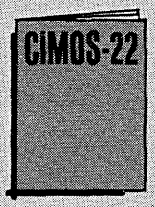

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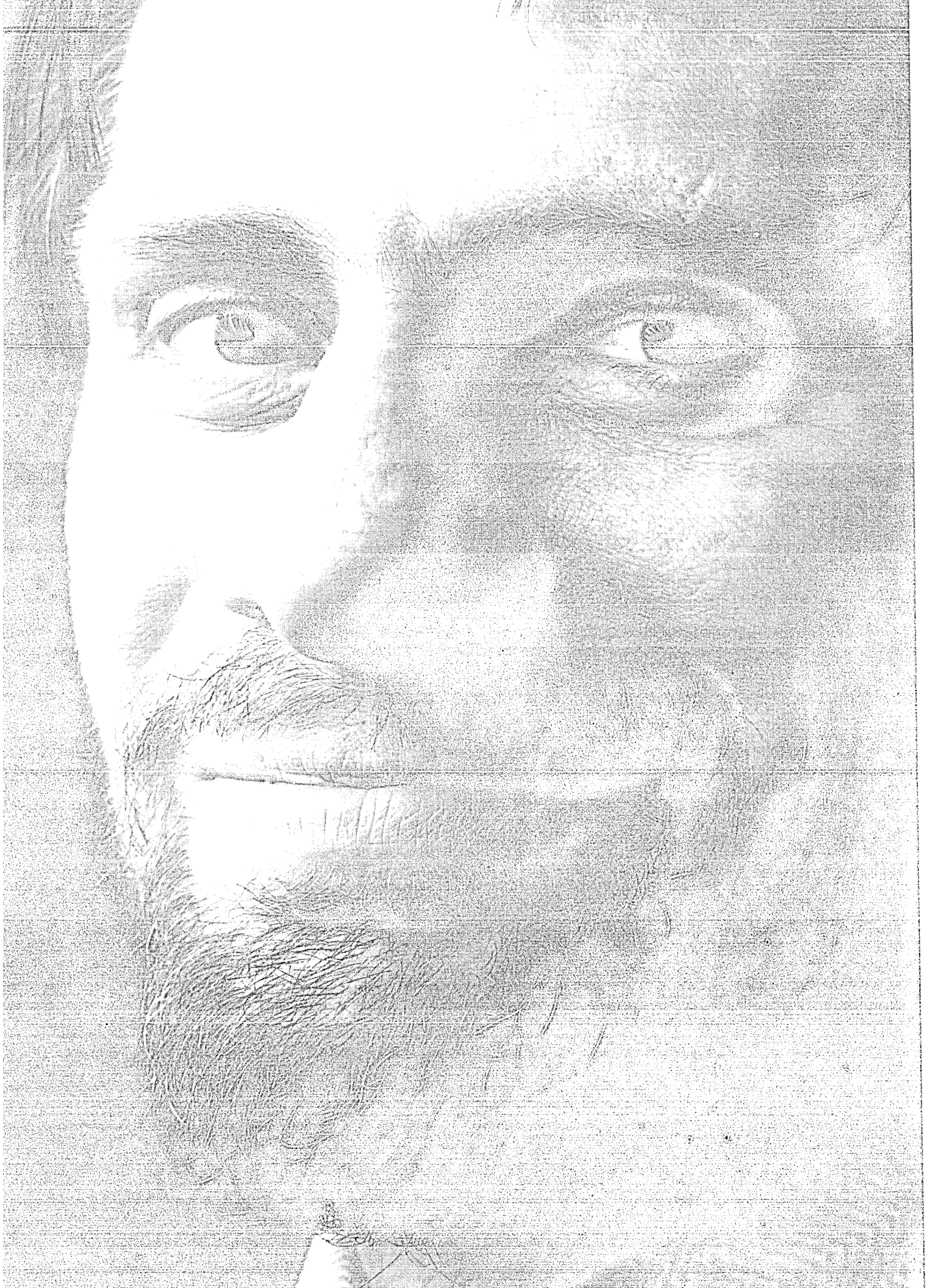

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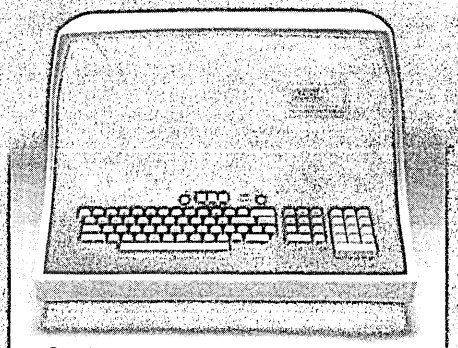

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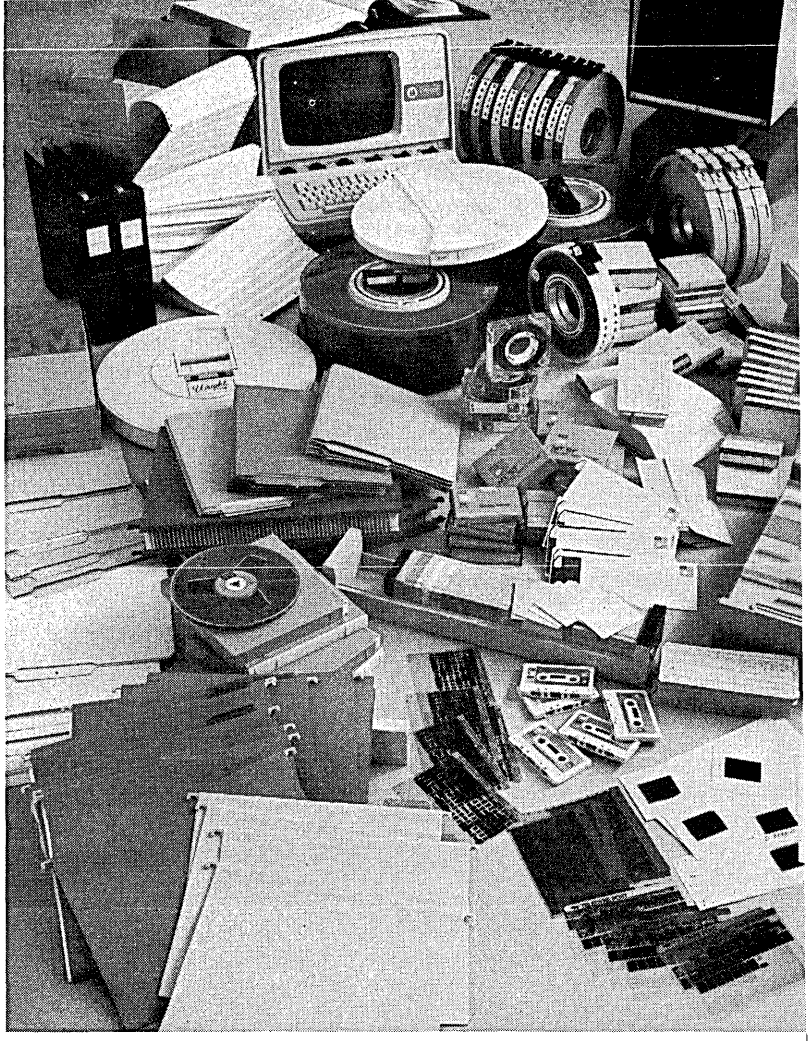

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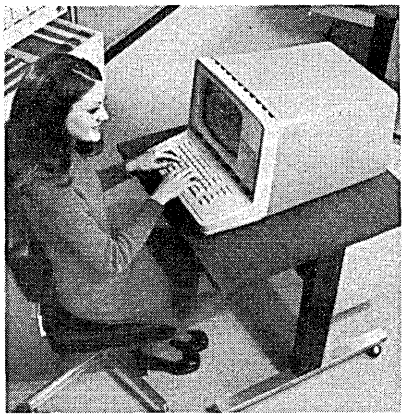

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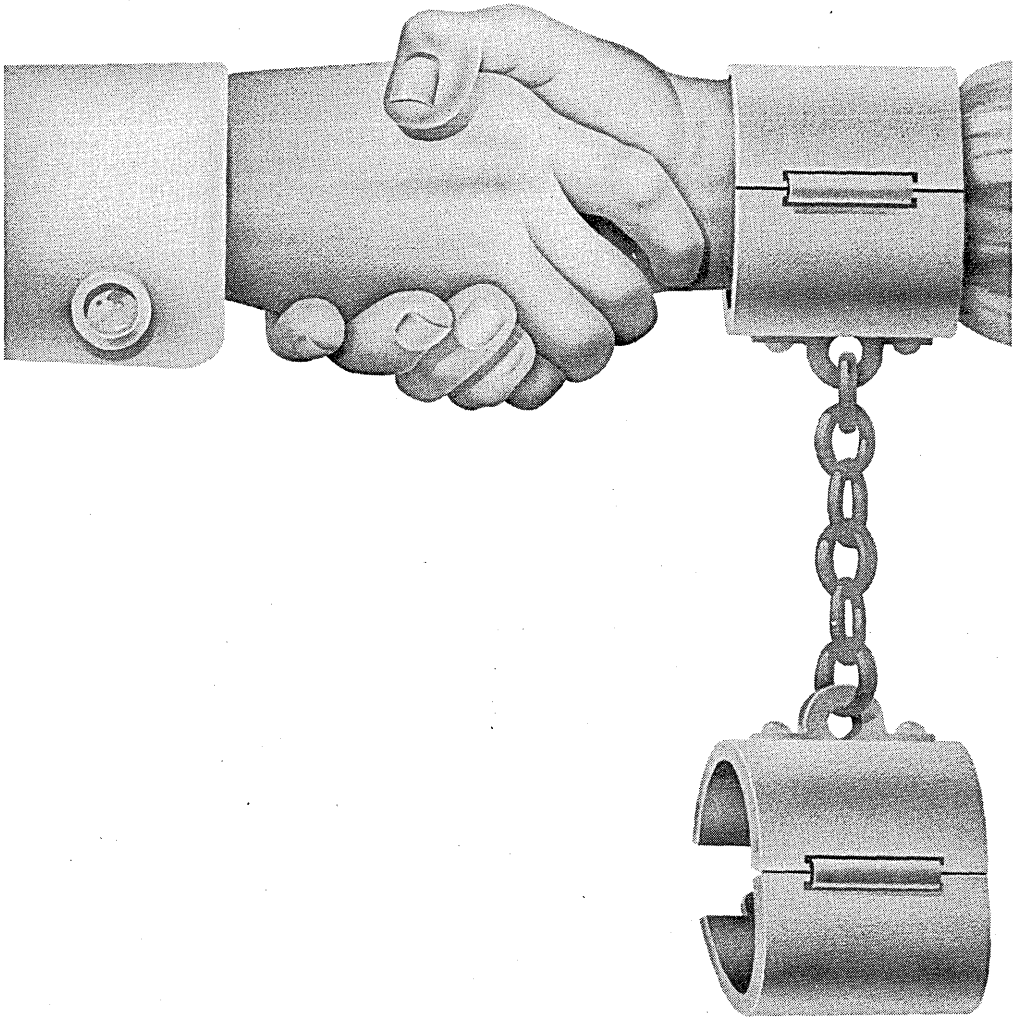

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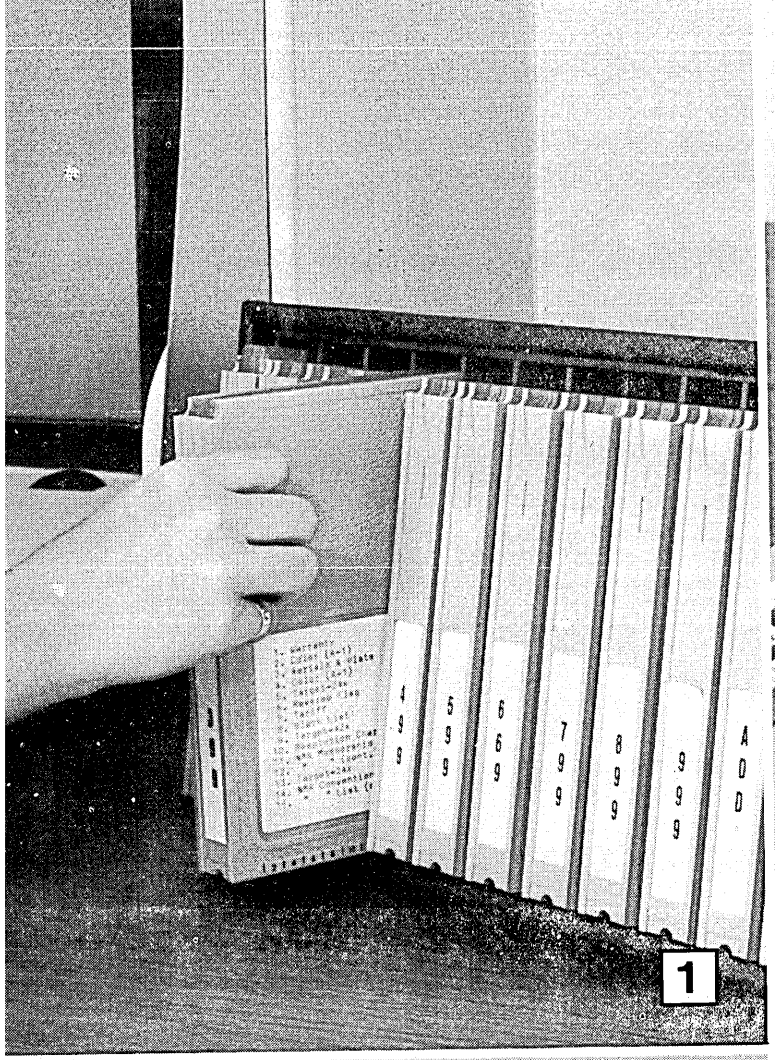

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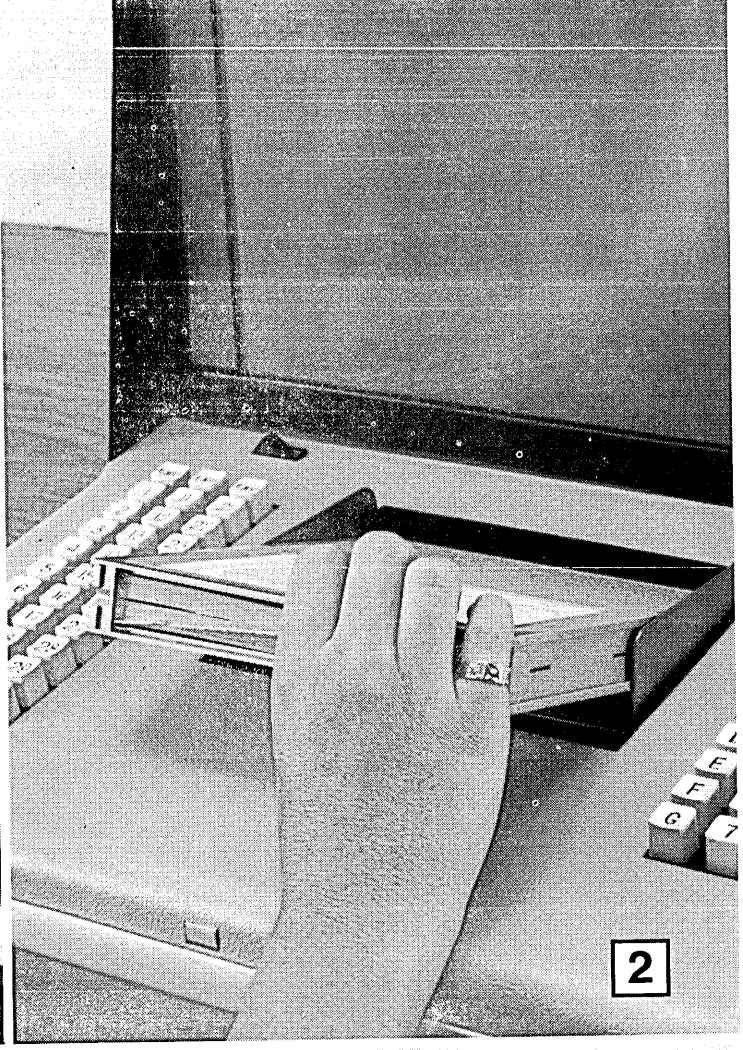

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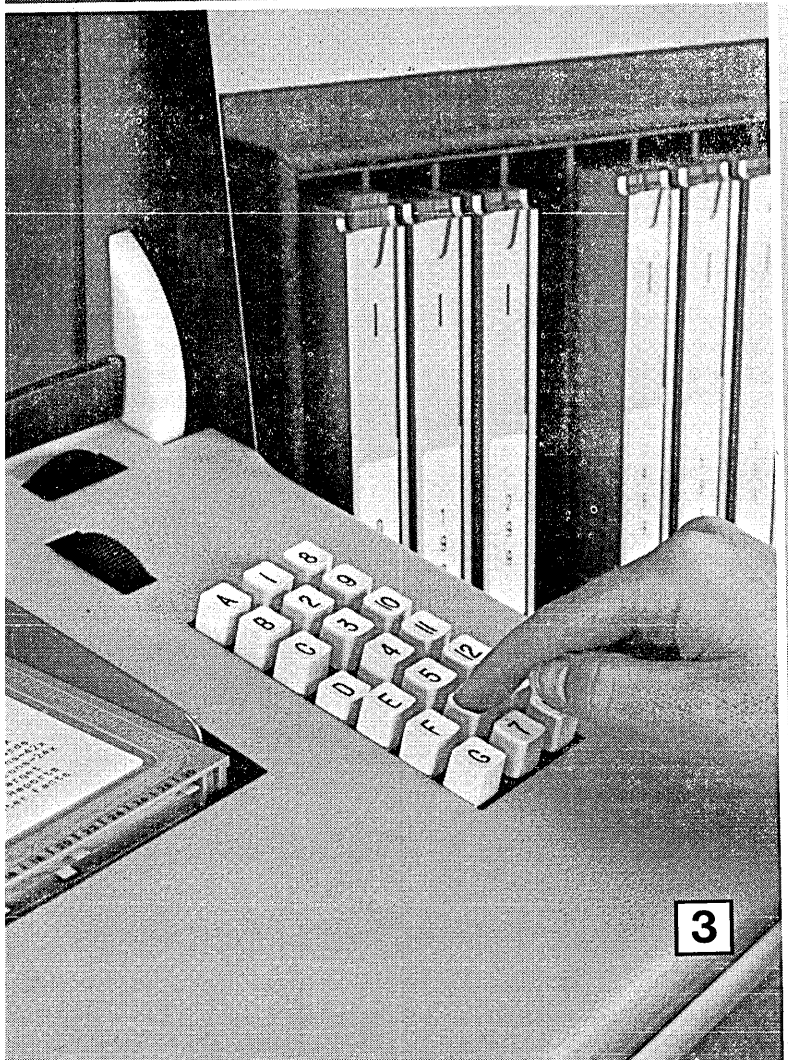

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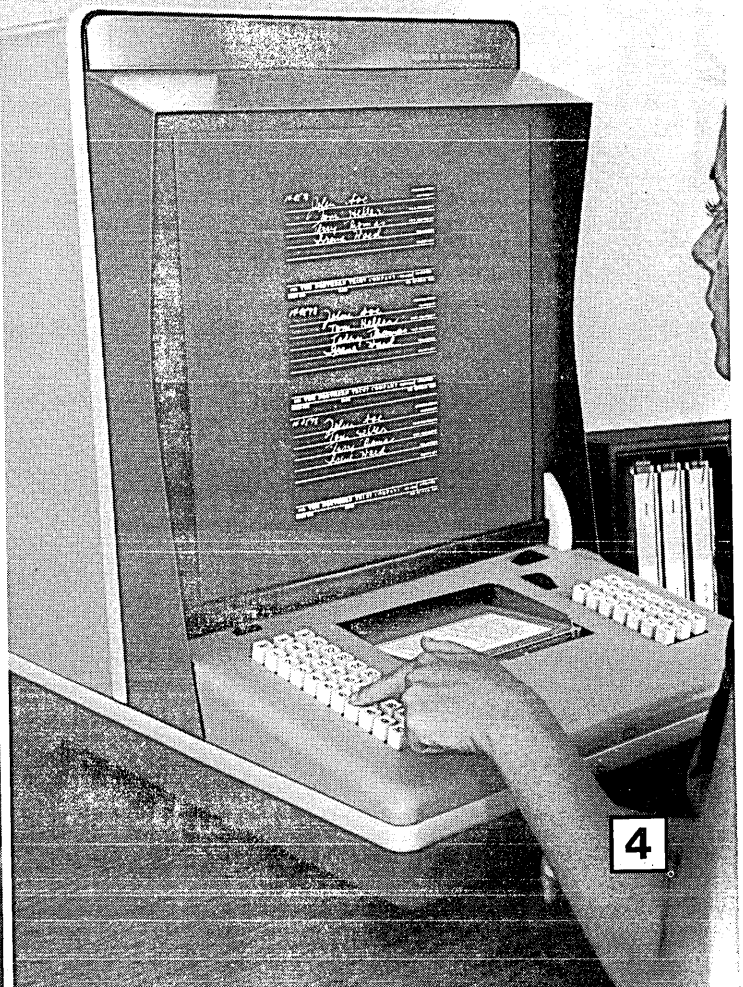

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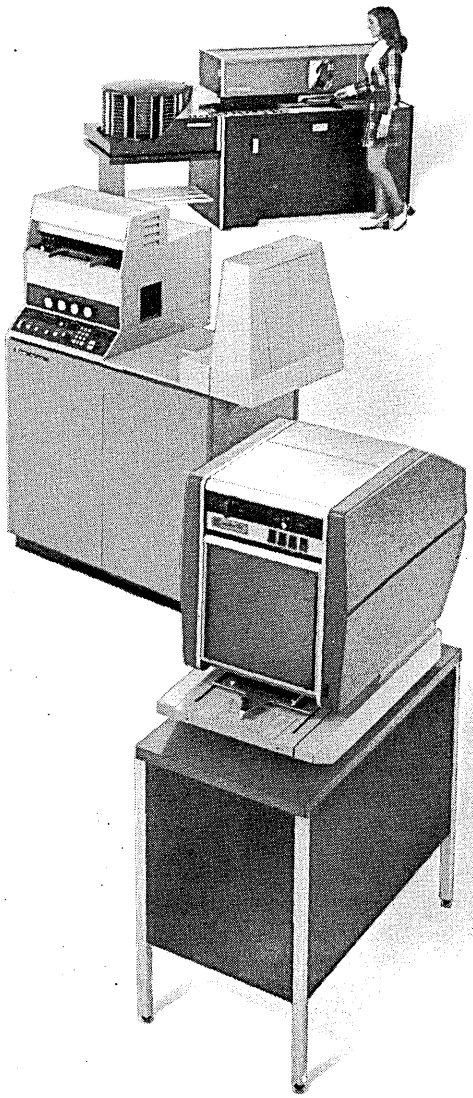

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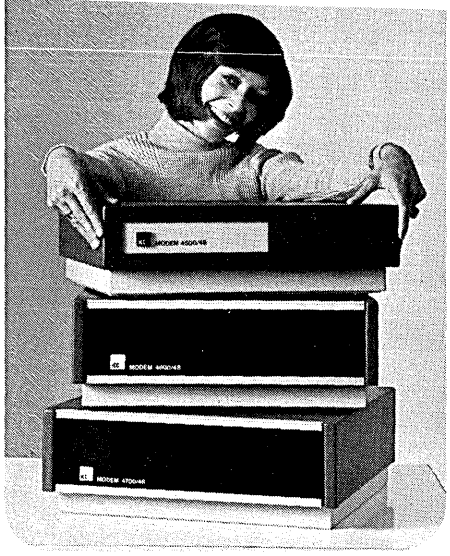

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An overview of cost analysis and need assessment techniques necessary in implementing a data base management system

Building a Base For Data Base: A Management Perspective

By D. E. Cuozzo and J. F. Kurtz

Today's economic uncertainties are causing many senior executives to reorder their priorities. To meet new priorities, most executives are closely scrutinizing business information needs. Often this scrutiny places new demands on the MIS/EDP function.

Rather than reworking old (and sometimes patchwork) systems, today's MIS/EDP manager may be tempted to turn to new data base management system (DBMS) techniques as a way of satisfying senior management's directives. But, before bolting down this uncharted path, a manager should ask and find answers to a probing question—can my organization really benefit from using a DBMS?

True, sophisticated DBMS's promise a large, bewildering and enticing array of benefits to potential users. But, are they *real* benefits or just snares and delusions? To new users, a mystique often shrouds the true costs of implementing DBMS-based applications. Unfortunately, many users are plunging headlong into implementing DBMS-based systems when, in fact, their payoff is far into the future. A more practical solution for these users might be to take other action now to prepare the groundwork for a future move to DBMS Clearly, any manager seriously considering a DBMS must explore all aspects of this commitment thoroughly before proceeding.

The purpose of this article is to help potential users make a DBMS go/no-go decision. The material is tailored to assist the decision-maker surface, sort out and relate to his/her installation the costs and benefits of DBMS. The material is drawn from recent and ongoing client experiences where Booz, Allen & Hamilton has assisted medium- and large-scale users to plan and implement integrated data base systems. The article begins with a simple explanation of fundamental terminology to pinpoint DBMS functional boundaries.

EXHIBIT I

EXAMPLE OF A DBMS AND A DATA BASE

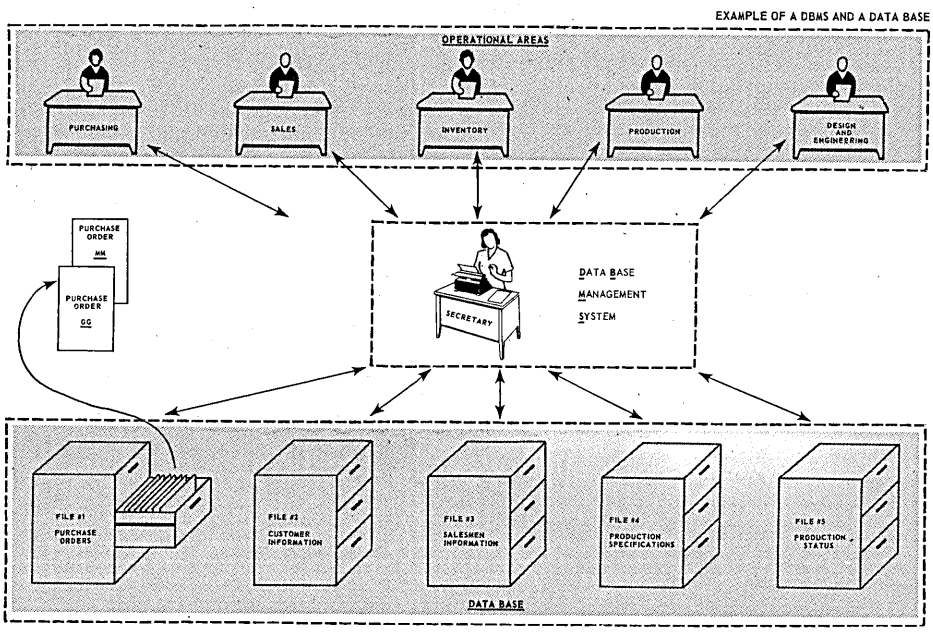


Fig. 1. Example of a DBMS and a data base.

It then discusses the benefits and costs of implementing a DBMS, and it concludes with a description of alternatives to DBMS which some users might want to consider.

Data base terminology

Data base terminology need not be confusing, in fact, it is really used in every firm's day-to-day operations. Figs. 1 and 2 help analogously to define and delineate a data base, a data base management system (DBMS) and a data base design approach.

Simply, a data base (Fig. 1—contents of file cabinets) is a collection of related information supporting a firm's business needs. Furthermore, a DBMS (Fig. 1—portrayed functionally as a secretary) is a structured series of generalized system programs that act as a common interface point to intercept and satisfy data base information requests.

Finally, a data base design approach (Fig. 2) is a way of optimally organizing information stored in the data base so that it can support processing demands imposed by a firm's operational areas.

All computer installations have some sort of data base. It can vary from sequential, indexed or direct files to highly complex segment or network oriented data structures. The borderline between a data base and a file need not be razor sharp. Sometimes only size, frequency, habit of reference or personal outlook distinguish the two. In other cases the use of a data base design approach or a DBMS's data organization scheme makes a file part of a data base.

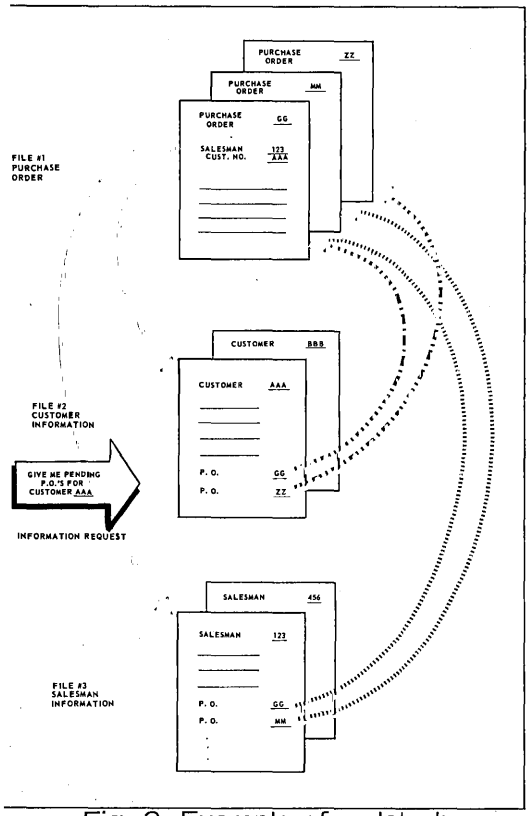


Fig. 2. Example of a data base design approach.

Solutions

A DBMS can provide a practical solution to problems spurred by on-going business needs. Some MIS/EDP managers are just recovering from the impact of the recession felt in the early '70s. This downturn resulted in tightened budgets, pared staff levels and higher machine utilization leaving fewer available resources to absorb new workloads. Also, new hardware and software announcements[1] are casting a shadow of obsolescence over existing facilities. Who wants to be left behind?

Caught in this whipsaw, some managers have reacted with a DBMS action plan to cope with current demands to respond to senior management's new directives and to counter technical obsolescence. These managers perceive some very compelling reasons to use DBMS:

1. Respond more quickly to changing business needs by having a well-organized pool of interrelated business data.
2. Reduce program and file maintenance costs because data organization methods offered in a DBMS are more flexible.
3. Consolidate diverse systems operations and staff skills to improve efficiency.
4. Enhance the timeliness and validity of data by eliminating duplicate entry.
5. Reduce data storage costs by eliminating data redundancy.

Major DBMS selling points fall into two broad categories—integrated data storage and common data access. Many users have installed a DBMS solely to use its common data accessing facilities, even though it can help principally to integrate and centralize data storage. On the other hand, data can be integrated and centralized without a DBMS. Fig. 3 highlights operational, financial and technical benefits possible under these two key features. Some of the more important benefits are:

1. *Reduced data storage costs*—Data is stored once and is organized to support major application needs. Other applications requiring the same data gain access to it through a system of linkages maintained by a DBMS. In systems designed without integrated data, common information must be repeated to support the needs of each application, thereby increasing total storage costs for an installation. As with any good thing, eliminating redundant data, however, can be carried to extremes. *Planned* data redundancy is necessary to achieve the proper balance between data storage costs and processing efficiency.
2. *More timely data*—A single update of common data provides all applications with new information instantaneously. So, the total integrated system is now able to process this new data immediately after update. For example, when a bank customer with multiple accounts submits an address change, his address is altered in one physical location. Thereafter, when access is made through any of his accounts, his new address is displayed properly.
3. *Reduced data entry costs*—Pro-

KEY DBMS FEATURES	ALLEGED BENEFITS		
	OPERATIONAL/ FUNCTIONAL	FINANCIAL	TECHNICAL
Integrated Data Storage	• All systems use same data values • Data are immediately available upon update	• Reduced storage costs • Data entered only once for all applications • Reduced input costs	• Fewer updates • Less files • Consolidated backup
Common Access Point	• Unauthorized personnel/ applications restricted from sensitive data • Data recovery and backup function are unified	• Business secrets are protected • Reduced program maintenance cost	• Concurrent data updates are eliminated • Performance optimized through buffer and device management • Applications transparent to physical data storage

Fig. 3. DBMS benefit matrix.

1. Cuozzo, D. E., and Kurtz, J. F., "How to Get Real Benefits From Virtual Storage," *Datamation*, Feb., 1973.

cessing time can be cut because only one update is required to change data for all applications rather than one update per application file. One source entry (or document) can trigger the update and possibly replace several entries and/or associated documents previously required.

4. *Secure access to privileged data*—Data requests can be examined and, if desired, be granted or denied. Data security is more cumbersome to provide when not using a DBMS.
5. *Eliminate concurrent data update conflicts*—Data requests are "scheduled" to avoid dangerous uncoordinated update and retrieval of the same physical data.
6. *Optimize performance and offer greater access flexibility*—Sophisticated routines are sometimes provided to manage data buffers, reduce channel conflicts and disc unit arm movements, and overlap physical I/O calls. Complex routines for automatically traversing data linkages can be included more economically in a DBMS because they serve many applications. These routines provide varying levels of data transparency to users.
7. *Unify data recovery and backup functions*—A single internal recovery system works for all data processed through a DBMS. Uniform format journal records are created to backup and recreate data used by all application systems.

The value of each DBMS benefit can be scored for any installation. Fig. 4 is a checklist to help managers sort out, focus on and value *real* needs that can be solved by implementing a DBMS. (To complete the checklist, assign a value of 1 through 5 to each item). A total score of 18 or more points signals a strong need for overall DBMS facilities. This need must then be viewed in light of important cost considerations before embarking upon a DBMS implementation.

Users strongly needing a DBMS must recognize today's higher costs of implementing applications within a DBMS framework. DBMS technology will continue to mature during the 70s. At some point hardware will match up better with software technology and will provide users with a truly integrated and balanced environment. When that point is reached, more economical ways will exist to implement and process corporate and management information under a DBMS.

IBM virtual storage announcements decisively point up attempts to complement software products with equally powerful hardware and software operating systems. Excessively large software main storage requirements can be offset by virtual storage hardware/software operations. Since this evolutionary process is not yet complete, users needing a DBMS today must recognize and be willing to pay the higher costs. Current typical cost trends are characterized graphically in Fig. 5.

Fig. 6 (p. 74) identifies that, like an iceberg, major DBMS costs are hidden at first glance. Unless users sound-out the depth of these costs at their installations, DBMS expectations are likely to sink as higher costs surface.

Most users lack DBMS experience at their installation. Two years ago, approximately 200 installations could qualify as DBMS sites. Today, the DBMS population is in excess of 1,000, though most of these installations are only partially converted. Clearly, there are not enough truly experienced DBMS specialists to meet this explosive demand. Yet, qualified staff and internal training programs are imperative. Most installations moving to a DBMS, now, will have to pay this cost of training.

Furthermore, installations which have little in-house staff experience are especially vulnerable to high costs stemming from associated trial and error. Severe penalty costs await users who zealously attempt to over-utilize DBMS technology. These penalties are not obvious to the new user, since the full implication of exercising this technology is not widely understood and generally does not surface until actual testing occurs. For example, substantial update time can be saved merely by not sequencing a key field in some logical data structures.

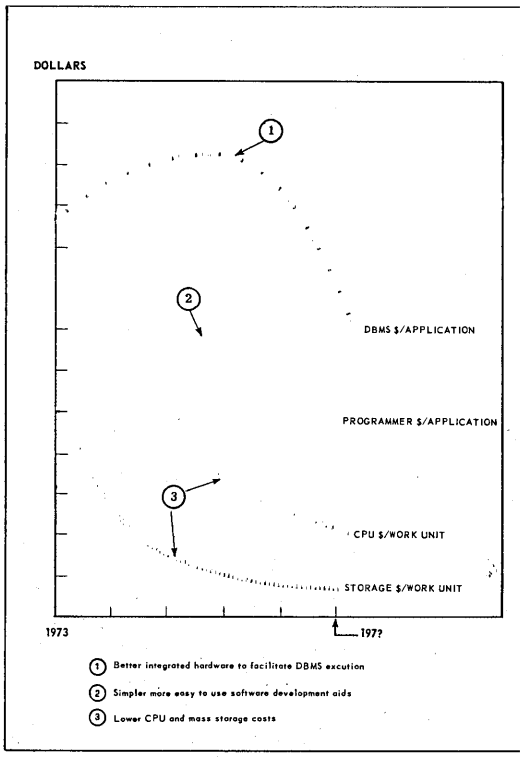


Fig. 5. Edp cost trends.

INSTALLATION CHARACTERISTICS

Benefits	Low Score	High Score	Score (1-5)
Eliminate Data Redundancy	Already have integrated file system	Same data appears in many files	_____
Provide Timely Information to All Applications	Have on-line system with integrated data approach	Files are so scattered, it would be hard to update them all in a timely fashion	_____
Reduce Data Entry Costs	Have minimum number of source documents now, programs handle explosion	Many forms are required to adjust all account references	_____
Secure Access to Privileged Data	My computer room is secure; all programs are audited on an on-going basis	Data are accessible by people outside my company; people would pay to see what's on my files; I work on government contracts	_____
Optimize Performance and Offer Greater Access Flexibility	Data has one level of relationship at most; programmers use assembly language or direct access COBOL processing	Data has complex relationships; must have flexibility for change	_____
Unify Recovery and Backup	Almost no on-line updating requirement; checkpoint facility works fine for long runs; never had a problem with backup	Heavy on-line update requirements for many applications; difficult to keep track of all backup files	_____
		Total Score:	_____

Fig. 4. Installation characteristics.

Building a Base

Faced with this danger, users must weigh, in advance, the cost of qualified service organization assistance against the uncertainties of pioneering and experimentation.

Higher hardware cost may result with a DBMS. Admittedly, computer systems are becoming more attractive financially as manufacturers respond to the need for an integrated hardware/software environment to process corporate information. But, users should recognize that installing a DBMS today may continue to result in higher equipment costs when compared to either current expenditure or to an approach that does not involve a DBMS.

Higher hardware costs stem from the increased coding within a DBMS because of its generality and complexity. More main storage, virtual notwithstanding, and cpu cycles are needed to execute DBMS modules. This one-two squeeze can cause users to move to a larger, more expensive machine.

The generalized access techniques available with a DBMS offer another tempting trap. They appear to offer almost unlimited flexibility and are, therefore, usually overworked by the application system designer. This condition can result in increased instruction execution and excessive I/O operations that may require faster or more data channels. Under these conditions, excess computer capacity can quickly evaporate. Of course, careful balancing of general and specific access can minimize costs in this area.

Finally, a comprehensive DBMS will usually require a top-of-the-line operating system configuration to provide acceptable performance. Even with virtual storage operation, a large enough real storage must be provided to achieve reasonable system performance levels. And, likely IBM VS degradation of cpu performance (30-40%) coupled with another layer of cpu overhead for a DBMS (typically 20-30%) will no doubt accelerate a cpu model upgrade.

Application development costs and lead time can expand dramatically with a DBMS. Some of the major escalation factors are described below:

1. New inter-project communications pipelines must be established initially and exercised frequently. Standards and procedures must be reevaluated and adjusted to ensure timely and accurate notice of data definitional information. With many applications referencing the same data, changes in common data will have a far more reaching impact on a development effort and must be controlled.
2. Systems programming functions must expand to handle requirements of, and inherent complexities in a DBMS. Some DBMS's are as complex as the operating system which services them. Also, this group must continuously apply and test program fixes and new features to keep the system "alive and well." It is not uncommon to see a small systems programming staff double or even triple as the result of a DBMS.
3. Adequate testing and debugging tools are just becoming available. Users should identify that they may have to either "jury-rig" standard vendor supplied aids, develop new tools in-house or pay for a testing package to meet their specific requirements. Inefficient or inadequate testing will produce schedule slippages that, subsequently, translate into higher costs.
4. All of the above real cost factors will compound and subvert traditional project control efforts to get the job done. As a first cut, users should tackle one or more small, manageable and partially automated systems for DBMS implementation. More and cheaper results are likely to occur.

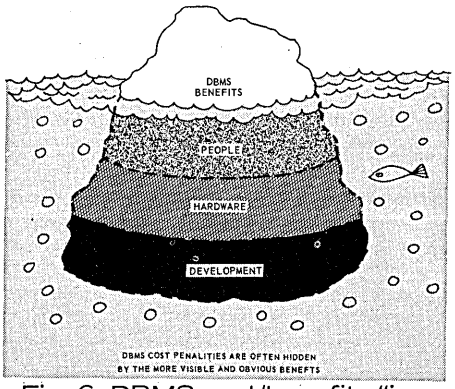


Fig. 6. DBMS cost/benefits "iceberg".

Yet, users having little need today can avoid some of these higher cost areas just discussed and still prepare themselves for a DBMS when newer hardware and software technology reduce these cost considerations to acceptable levels.

If a DBMS need is not critical, users can avoid unnecessary cost penalties by initiating a thorough planning and preparation program for future data base facilities and by pursuing attractive nearer-term alternatives to data base. In the end, all MIS/EDP managers want to cross home plate when undertaking new automation efforts. But, some fail to recognize that they must reach first base initially, especially when a DBMS may be involved. To do this successfully, managers should initiate a comprehensive program to prepare their organization for a future move to DBMS. Execution of this program will position an organization to capitalize on today's technology and skills and, at the same time, improve its ability to respond quickly to changing business needs.

The objectives of this program are to:

1. Enhance capability to satisfy requests for management information.
2. Reduce program maintenance costs.
3. Reduce clerical costs by consolidating or eliminating redundant operations.
4. Upgrade programmer productiv-

STEP 1—ESTABLISH A CENTRALIZED CONTROL FUNCTION FOR DATA AND PROGRAMS
- Install as staff or line function depending on organization hierarchy
- Give authority to enforce standards
- Coordinate and tie break inter-application needs
- Control maintenance of production programs—audits

STEP 2—IDENTIFY AND RECORD HOW DATA IS USED
- Initiate firm-wide data collection
- Specify standard formats for names and commonly used data—dates, dollar amounts, grand totals, etc.
- Develop ways to catalog and display results—look at available data dictionary packages, establish copy libraries (common data)
- Cross reference data—input documents, files, reports
- Surface current processing bottlenecks

STEP 3—REDESIGN AILING APPLICATIONS USING TODAY'S MORE MODERN APPROACHES
- Use the output of data dictionary to identify multi-application usage
- Consolidate input, updating and retrieval functions—anticipate future reporting requests
- Provide simple cross reference capability—most applications require only single level relationships
- Design modular programs—I/O access thru callable subroutines
- Zero-in on specific access requirements—use standard access methods

STEP 4—REPROGRAM ENHANCED DESIGN USING TODAY'S TECHNOLOGY
- Enforce use of common data definitions and naming conventions
- Set up commonly used procedural code and modules in program libraries
- Use coding, debugging and control aids like decision table translators, test data generators and library maintenance packages

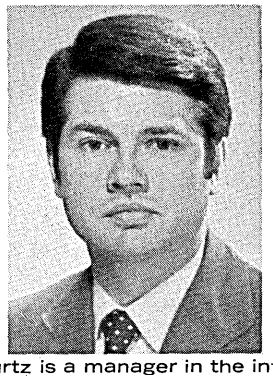
Fig. 7. Getting to "first base" program.

ity through the use of automation aids.
5. Establish a discipline for current and future application designs.
6. Prepare for conversion to a DBMS when the time is right.

The scope of this program will vary depending on the level of automation at each firm. But, these benefits are *real* and can be achieved faster and at lower cost.

Now, more urgently than ever, an MIS/EDP manager seriously considering a DBMS at his installation needs to recognize and quantify the true one-time and ongoing incremental costs. These must be carefully weighed against DBMS benefits, some of which may be more "virtual" than "real." Developers of airline reservation systems in the early '60s paid an enormous price for mandatory on-line capability, whereas others with less pressing need waited wisely and reaped the benefits of this pioneering effort. Perhaps, in part, DBMS implementation today can be viewed in this same light. □

Mr. Cuozzo is a manager in the information systems division of Booz, Allen & Hamilton, Inc. He has been active in planning banking, insurance, and health care applications and in the evaluation and selection of hardware and software. He has a BS from St. Peter's College.



Mr. Kurtz is a manager in the information systems division of Booz, Allen & Hamilton, Inc., and has worked with investment and commercial banking and government organizations in designing and implementing systems. A recent project included large-scale extract processing for IMS-II data bases. He has a BSEE from Virginia Polytechnic Institute and an MS in management from Rensselaer.

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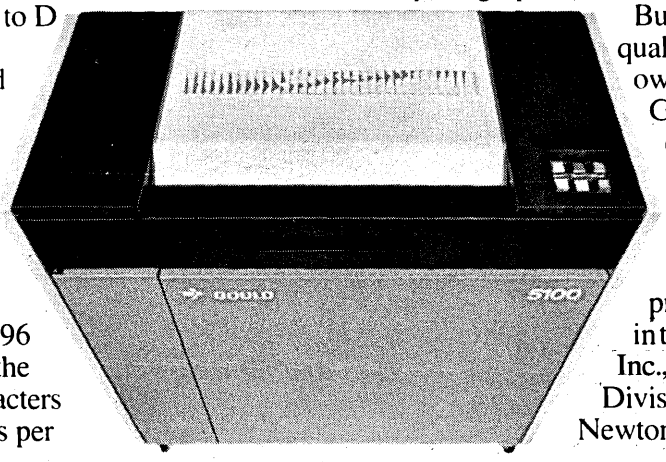

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CIRCLE 28 ON READER CARD

The real applications for these terminals are yet to be discovered; meanwhile they substitute for things from Teletypes to S/3s

Fast Interactive Hardcopy Terminals

by Richard A. McLaughlin, Technology Editor

Most of the interactive hardcopy terminals in the world still run at Teletype speeds, speeds of around 10 cps, in sending, receiving and printing. Keyboard/printer combinations that can run at up to 30 cps have begun to replace the slower ones in some applications for reasons of phone line economy and user convenience. For these same reasons, and for others that are potentially more important, terminals with rated print speeds of over 30 cps may shortly become extremely popular. Not many are presently marketed, but now is the time for the average user to start looking at them.

Slow terminals outnumber fast ones mostly because they have been around longer, but also because they can be used on almost any phone line, they are relatively reliable and inexpensive, and they have been extensively marketed by the biggest companies in the communications terminal business, Teletype and IBM. There isn't always a strong incentive to replace them. For some low-volume applications they are perfect. Further, most terminal applications were designed around them, so there is no question that they can do the job, even if they're slower than other equipment announced since their prime.

The up-to-30-cps terminals have found their homes by replacing the slow stuff. The arguments in their favor involve phone line charges (you can get the job done and get off the phone quicker). They also involve user time and convenience. (Interactive code checking is a good example of an application where the terminal operator is too expensive a piece of the system to be allowed to be idle while waiting for a print line to be hammered out.)

The firms offering over-30-cps terminals use the same arguments of phone line charges and operator time to place their hardware, and aim at many of the same applications, including inquiry response, time-sharing, message switching, data entry, and batch processing. But the arguments for faster operation lose some impact when the application is tied to how quickly an operator can read the printout (as in inquiry response, time-sharing, and message switching). Soft copy, or display terminals, can often do a better job in these situations anyway. Further, in data entry and even in some kinds of remote batch work, the slower terminals work adequately and cost less when buffered with a tape cassette of some sort.

What all this suggests is that, with few exceptions, the applications for which the fast terminals are being pitched are the wrong ones. When users do figure out where these devices best fit in, the complexion of some kinds of data processing may change. While a 30-cps device allows its user to do the same things he did at 10 cps, only quicker, a 120-cps device may enable its user to implement whole different kinds of applications and to change the nature of his use of dp.

We don't pretend to be clairvoyant, but it appears to us that one place these terminals could find a happy home would be in a small business where an in-house computer is desired but cannot be afforded. Just as the System/3 established a whole new market, the fast terminal could be a System/3 substitute in even smaller shops, functioning as a kind of cross between console typewriter and line printer. Small companies, or branches of large ones, could have their personnel files, billing, accounts receivables or other commercial reporting done in their office—with up to six-part output on preprinted forms just as they would receive from a line printer.

We don't mean to belittle the cost-effectiveness of using these terminals in interactive code checking or other applications where the slower terminals are now carrying the load. Certainly in those cases where speed is the primary criteria, as in console printers for computer systems or in text editing, these new devices will slide into the slots previously occupied by the slower ones. We simply propose that fast interactive printer terminals surveyed here have the potential to do more kinds of applications than slow ones do, and they should not simply be considered flashy Teletype 33 replacements.

Building the market

Although conspicuously absent from the short list of vendors offering over-30-cps terminals, IBM and Teletype may be the ones to determine the acceptance of these units. Both offer fast printers that can be attached to remote terminals, but only as auxiliary equipment for larger crt-based products like the IBM 3270 and the Teletype Dataspeed 40.

Teletype could easily offer the 120-cps printer/keyboard combination of the Dataspeed without the crt, but it is

unlikely that it will do so for some time, as the resulting product would strongly impact its established rental base of slower equipment. And IBM, who likes to offer Cadillacs rather than Chevys, can be expected to push its 3270 before looking for a cheaper way to upgrade from 2741s. Still, IBM has already introduced fast serial printers that could easily be given keyboards. Among these are the 120-lpm 3618 Administrative Line Printer announced as part of its finance communications system for bankers, as well as the 66-cps unit made for the 3270.

It is quite likely that the field will not really bloom until one of these giants steps in; none of the firms presently active has the clout to advertise, sell, and educate the potential customers. Two things seem likely: that when either IBM or Teletype plunges in, the other will follow rather quickly; and that neither will ignore this market much longer.

Another factor that can inhibit or promote the spread of faster teleprinters is the time-sharing service bureau. If these products are to operate as System/3 substitutes in tiny companies, service bureaus must support the right line speeds and communications protocol, and have the right terminal administration software. Branch offices of companies with in-house computers won't have quite the same problem, but even for them there may be some difficulty in obtaining the service.

The machines available today, those that are pioneering the market, differ in many particulars but usually share several basic features, including: full- or half-duplex operation on asynchronous lines, an RS232 interface, logic compatibility with the Teletype Model 33 KSR, upper and lower case ASCII, and a top sustained printing speed of 120 cps through a serial interface. (Some of these features are optional on some of the terminals.) Further, they can usually be ordered with computer-controlled horizontal tab, vertical forms control, and the ability to operate off-line.

Four of the five are impact printers that can produce multiple-copy output on pin-registered forms. Four of them have easily interchangeable type fonts. All of them can handle at least 80-column printout. In other particulars they sometimes differ broadly.

Table 1, which compares their specifications, requires some explanation. First, communication line speeds are not shown since minimum requirements can be easily determined from print speed (a 30-cps printer requires a 300-baud line; 120 cps requires 1200 baud, etc.). The maximum line speed effectively accommodated is largely determined by the peripheral chosen as a buffer (generally a mag tape).

Second, the error checks mentioned are those implemented to guarantee the accuracy of data transmissions. The codes longitudinal redundancy check character (LRCC) and cyclic redundancy check character (CRCC) are not familiar to everyone; they can be thought of as complicated kinds of parity checks. "Echo-back" is a kind of reverse transmission intended for comparing what was received with what was sent.

Third, when "polling" is used it means multi-drop operation, where several terminals can be connected to the same phone line and addressed individually.

The final clarification, or warning, comes when reading the prices. Most of these devices can be ordered as stripped models, without some functional features like tab setting and vertical forms control, without multiple print fonts, and often without lower case letters. Where the vendors have informed us, we have indicated options with asterisks, but a good rule is not to expect very much in the low dollar figures when a range is given.

The table and accompanying product descriptions have been compiled from information supplied by the terminal manufacturers. We have tried to be extremely careful in translating what they have told us, but the vendors are the ultimate authorities on their product lines. For more information on any of the products, either contact the vendors directly (their names and addresses are listed at the end of this article) or circle the appropriate number on the reader card.

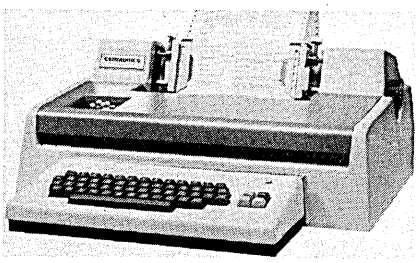
Centronics 308

The Centronics 308 Teleprinter is presently offered only in an 80-column version, although the firm has announced a 132-column printer that will probably find its way into a terminal configuration sometime next year. The company has built a solid reputation as an oem supplier of serial printers, and has only recently branched off into the end user terminal business—so recently that production quantities of the 308 won't be available until January.

The 308 uses a matrix of solenoid-driven stylii or pins to form its 5 x 7 dot matrix characters. The print head moves on a carriage across the forms. This dot-matrix technique is not unique to Centronics; another version of the mechanism can be seen in the photo of the Computer Transceiver Systems unit.

The 308 comes with two print faces, regular and extended boldface. The transition between the two is accomplished through a single button on the terminal. Although additional fonts can be substituted, only the choice of two at a time is currently offered. The firm is primarily concerned that its customers in any country can at least have their own languages printed. The charge for developing a new character set is basically the expense of making a mask for a read-only memory used; the price to the customer is based on its own cost for doing this.

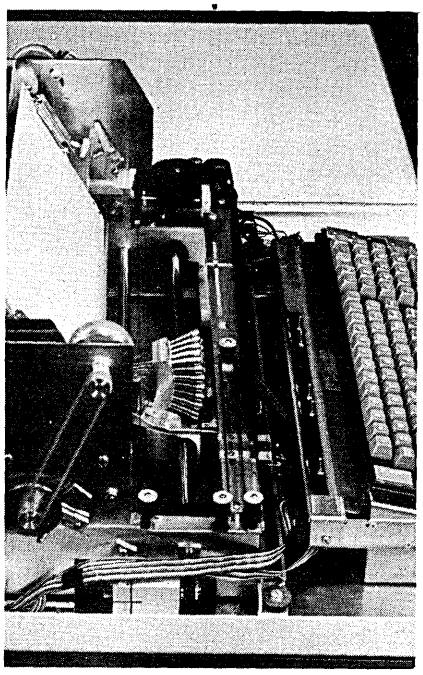
The Centronics device can operate on 9600-baud lines for data transmission, but note that its print speed is limited to 120 cps regardless. It is also capable of burst-mode communication at up to 75,000 cps when attached



directly to a computer through a parallel interface. According to company spokesmen, the 308's input functions are separated from output functions so that the terminal can be buffering incoming data while performing a keyboard command.

CTS Execuport 1200

The Computer Transceiver Systems terminal operates like Centronics' in many respects, including its manner of constructing 5 x 7 dot matrix characters. Like it, it operates incrementally, printing a character at a time as received "on the fly." However, it has the advantage of being the only terminal



listed here that prints a full 132-character line. It is therefore compatible with central site line printers, a very obvious advantage for flexibility in output.

The 1200 has an integrated keyboard and is handsome in an unpretentious way. It can have other character sets, including EBCDIC, but the fonts are hard-wired and therefore not operator-changeable.

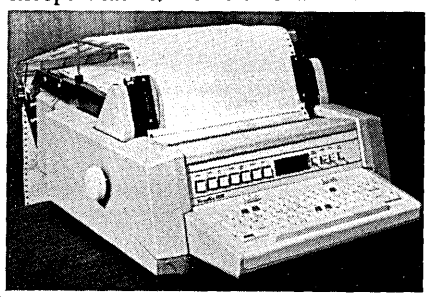
It is so new that only trial machines have been installed, but its components have proven themselves in the Execuport 300, an up-to-30-cps sibling that has been around for three and a half years. Over 3,000 copies of the earlier machine have been installed.

CTSI will market the device to end users. Quantities of the terminal for oem's are available through Litton Automated Business Machines. The Litton version shares the features listed for the Execuport, but is priced at $2,098 in quantities of 500.

GE TermiNet 1200

The biggest company represented here is GE, and it has had its product out for about a year and a half. The TermiNet has proven popular in its 120-cps form as well as in its earlier 30-cps form. Between the two models, over 20,000 units have been installed since 1969.

This unit differs from the others in several respects. First, it is not a serial, character-at-a-time printer even though it sends and receives data that way. Its print mechanism is much like that of a line printer with a print chain, except that its vehicle is a character



belt. There are two copies of the print font on the moving belt and print hammers at every character position. This means that a full line has to be formatted before being printed—although the lines can be as short as 36 characters including fill characters. On the other hand, since there is no mov-

MANUFACTURER	CENTRONICS DATA COMPUTER CORP.	COMPUTER TRANSCEIVER SYSTEMS, INC.	GE DATA COMMUNICATIONS PRODUCTS DEPT.	MEMOREX CORP.	SCOPE DATA, INC.
MODEL	308 Teleprinter	Execuport 1200	TermiNet 1200	Models 1240/1242/1280	Series 200 KSR
First installed	Jan. 1974 production	1972	1972	1970	1973
Number installed	none	4	approx. 2,500	6,000	not given
Compatibility	Teletype 33	Teletype 33	Teletype 33	Teletype 33, IBM 2741[1]	Teletype 33, IBM 2741
PRINTER					
Type	5x7 dot matrix impact	5x7 dot matrix impact	character belt impact	char. cartridge impact	7x9 dot matrix electro
Columns	80 col	132 col	80 or 120 col	120 col	80 col
Speeds	120 cps	10, 15, 30, 60, 120 cps	10, 15,* 20,* 30, 60,* 120 cps	10, 15, 30, 60,* 120*[2] cps	7.5, 10, 15, 30, 60, 120 cps
Font changes	1 second	not interchangeable	5 minutes	2-3 minutes	one second
Extra font charge	$100-$600 (one-time)	—	not given	not given	$500-$1,000 (one time)
Paper feed	tractor	tractor	tractor	friction or tractor	friction
COMMUNICATIONS					
Line speed choice	hardwired	switch-selectable	switch-selectable	switch-selectable*	switch-selectable
Interfaces	RS232B, current loop, parallel (75,000 cps)	RS232B, current loop, parallel	RS232C, current loop, parallel	RS232C, parallel	RS232C, current loop, parallel
Internal buffer	133 characters	132 characters*	none	none	none
Error checks	LRCC, echo-back	echo-back	CRCC, echo-back, parity	LRCC, even/odd/no parity*	odd/even/no parity
Special functions	polling,* auto answer*	polling, auto answer	polling, auto answer*	polling,* auto answer*	auto answer
SPECIAL FEATURES	Selectable elongated boldface, detachable keyboard		selectable 3 or 6 lpi, split platen, backspacing		portability (30 lbs)
PRICING					
Purchase	$2,690	$5,035	$4,595-$4,955 plus options	$5,000-$8,000	$2,055 (end user)[1]
Lease	$90/mo (3 years)	$221/mo (1-year)	$179-$301 plus options	—	not available
Min. maintenance	to be determined	not established	$15/month (4-8 hr. call)	not given	contract service
Options	7x9 characters, foreign characters, backspacing	mag tape, paper tape, built-in modem	mag tape, paper tape, desk or pedestal, built-in modem	mag tape, numeric keys, acoustic coupler, built-in modem	detached keyboard, second character set

*asterisks refer to optional features

[1] When Memorex 1270 Terminal Control Unit is used
[2] 120 cps is for upper-case printing only

[1] oem sales $1,400-$1,755 in lots of 100

ing head, there is no carriage return delay either. And since the belt is interchangeable, so is the print font.

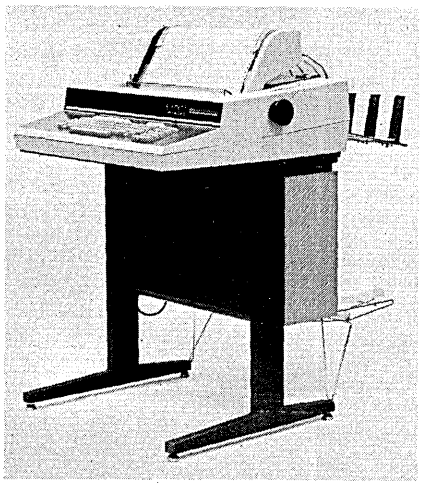
One advantage of the TermiNet 1200 is its split platen, a feature considered indispensable in many commercial applications. It is the only product we know of that has two line spacings, three or six lpi, and a simple switch to choose between them.

The 1200 can print at five different speeds, 10, 20, 30, 60, or 120 cps, but the 20-cps speed and the 60-cps speed cannot be ordered at the same time. The user can select a TermiNet with speed combinations of 10/20/120 cps or 10/30/120 cps or 30/60/120 cps.

One feature in its favor that does not show up on the table is the fact that there are at least 56 offices in the U.S. that support the device. That is, there are 56 GE branch offices of GE contractors that support the 1200. In addition, a version of the device is marketed by Western Union Data Services Co. As far as we can tell, the biggest differences between the two devices are in Western Union's pedestal packaging and in the fact that WU maintains its own nationwide service centers. Between the two sources, users should be assured of local support and good service.

Memorex 1200 Series

As the world knows, Memorex is fighting for its corporate life. Hopefully its terminal line will survive. The terminals exist in very respectable numbers; 6,000 have reportedly been installed. The Memorex units include



the 1240 (a polled terminal), the 1242 (buffered), and 1280 (which has a mag tape cassette). They are based on an interchangeable print cartridge, and like the preceding devices they are impact printers.

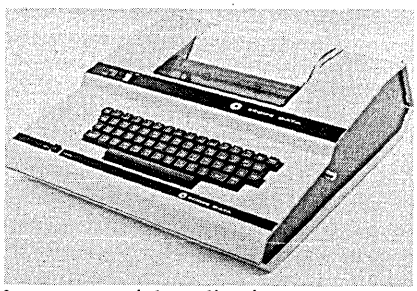
In standard trim they are logically compatible with the Teletype 33, but the company maintains that they are compatible with the IBM 2741 also, when the Memorex 1270 Terminal Control Unit is installed—which probably means that the 1270 can camouflage the terminal rather than that the terminal is functionally like the IBM 2741.

The Memorex units come with either a friction platen or tractor for paper feed, and the user may switch between the two if he prefers. There are no limitations on line speeds in the fully-equipped versions; the terminal operator can switch select speeds of 110, 150, 300, 600, or 1200 baud.

The terminals are presently supported out of 98 U.S. offices as well as through an impressive-sounding remote analysis center for dial-up on-line diagnostics. In addition, the company keeps a communications consultant on hand for phone consultation during day shift. Score Memorex A-plus for maintenance services, even if they won't tell us what the service costs.

Scope Series 200 KSR

The Series 200 terminal is the only non-impact device in the survey. It prints only one copy at a time using electro-resistive print methods to lay down 7 x 9 dot matrix characters on specially treated continuous forms. Its paper is friction-fed, not pin-registered, but this matters little since it cannot accept pre-printed or multi-part forms



for commercial applications anyway.

The unit has advantages as well as disadvantages. For instance, it is portable—at least, it can be carried. Dressed in its heavy duty aluminum covers it weighs 40 lbs. Another advantage is that it prints 7 x 9 characters instead of 5 x 7, and therefore the characters should be easier to read than those printed by the stock models of the other manufacturers. Further, it can operate at up to 240 cps with a parallel interface, and can run on synchronous as well as asynchronous lines.

So far only an 80-column print width is offered, but a 132-column model is planned. Operators will be able to switch-select a second print font with either version, and can also control the print density.

The 200 can be ordered with ASCII, EBCDIC, Hollerith, or Baudot codes as its native language, and in Teletype 33 or IBM 2741-compatible form. The terminal is available with an integrated or separate keyboard, and either style is extremely attractive.

Scope is a very small, very new company. We assume few units have been shipped, if any, but service contracts have reportedly been established for all states and for 13 foreign countries. Prospective customers are also assured that the terminal has been built in chunks so that there should be no component-level maintenance in the field.

Vendor Index

CENTRONICS DATA COMPUTER CORP.
One Wall Street, Hudson, NH 03051
Established 1968; 400-plus employees
Gross sales over $24 million
Jack Flynn, director of sales (603) 883-0111
FOR DATA CIRCLE 280 ON READER CARD

COMPUTER TRANSCEIVER SYSTEMS, INC.
E. 66 Midland Ave., Paramus, NJ 07652
Established 1968; 70 employees
Gross sales $2.5 million
Offices in 48 states
Charles Kaplan, sales mgr. (201) 261-6800
FOR DATA CIRCLE 281 ON READER CARD

GENERAL ELECTRIC DATA COMMUNICATIONS PRODUCT DEPT.
GE Drive, Waynesboro, VA 22980
Established 1970; 3,900 employees
Gross sales not released
Offices in 56 cities, plus Australia, Canada, England, France, Germany, Italy, and Sweden.
Harold Stover, sales mgr. (703) 942-8161
FOR DATA CIRCLE 283 ON READER CARD

LITTON AUTOMATED BUSINESS SYSTEMS OEM PRODUCTS DIV.
(For oem's sales of the Litton 120, equivalent to the Computer Transceiver Systems Execuport 1200.)
600 Washington Ave., Carlstadt, NJ 07072
Jim Lundrigan (201) 935-2200
FOR DATA CIRCLE 284 ON READER CARD

MEMOREX CORP.
San Tomas & Central Expwy, Santa Clara, Calif.
Established 1961; 5,500 employees
Gross sales $150 million
Offices in 98 cities
F. Kirchhoff, product sales mgr. (408) 987-3412
FOR DATA CIRCLE 285 ON READER CARD

SCOPE DATA, INC.
5870 S. Tampa Ave., Orlando, FL 32809
Subsidiary of Scope Inc., Reston, Va.
Established 1972; under 100 employees
Gross sales not released
Offices in 48 states plus Australia, Benelux, Canada, Denmark, England, Finland, France, Germany, Israel, Italy, Japan, Norway, and Sweden.
Fred Lovelady, sales mgr. (305) 859-1410
FOR DATA CIRCLE 286 ON READER CARD

WESTERN UNION DATA SERVICES CO.
(For a specially packaged and separately maintained version of the GE TermiNet.)
16 McKee Drive, Mahwah, NJ 07430
Sales information: (800) 631-7050
FOR DATA CIRCLE 287 ON READER CARD □

A saga of management control in edp—ground rules for the ingenious but non-professional user

Time-Sharing Ground Rules

by Perry J. Davis

Pepsi-Cola has been a large-scale time-sharing user since 1969. User acceptance of time-sharing gained popularity rapidly and very soon spilled over into bootleg systems development. This article describes how the enthusiasm for computer-based information almost got out of hand prior to the installation of effective professional edp and management controls. A description of these controls is included here, in detail. "The Case of Brian," which follows, is adapted from a real-life experience at Pepsi-Cola. Everyone's intentions were in the best interests of the company and oddly enough the company was well-served, although not in the manner originally intended. Rather, the environment created by this overly enthusiastic non-professional involvement encouraged edp management-user communication and better edp management control of time-sharing by non-edp users without substantially impairing user innovation.

The case of Brian, boy whiz in the sales department

"Brian, let's see if we can put together a computer program to keep track of the names and addresses and a few other things about our salesmen in the field. Nothing fancy. Just enough so we won't have to go to six different sources everytime we need something." The person speaking was not the manager of programming, but the sales vice president. Brian was not a programmer but a sales administrator. The program they discussed was for use on a time-sharing service computer, outside the scope of projects normally handled by the company's systems department.

Brian was valuable to the sales vice president as an administrator, his primary function, but also because he had once done some programming. Brian talked the language of the systems people and operated the sales department's time-sharing terminal to retrieve reports from the company's sales data base. It was not a big leap for the sales vice president to ask Brian to do a little more programming.

"It's all in the interests of getting our job done," the vp continued, this time addressing the programming manager. "They've cut our secretarial support and I'm supposed to use ingenuity to get along. But I just can't keep our mailing lists up to date or get our bulletins out fast enough. I know the systems department is over-worked, so let's see what Brian can do."

And so, almost unheralded, the program was installed. It was a little expensive to set up because Brian had forgotten some of his COBOL, but the cost was unintentionally hidden in the lump sum of sales data retrieval costs.

For almost a year, with Brian's help on updates and whatever else might be required, the terminal produced lists and labels and delighted the vp. Then Brian was promoted into marketing. Not long after that, he left the company for an opportunity half-way

"This above all, my son: stock up on spare parts for your 360."

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Alone.

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In fact, you can further enhance the 340's built-in error detection and arithmetic capabilities to include operations like Range Checking, Table Look-Up, Multiply and Conditional Data Entry.

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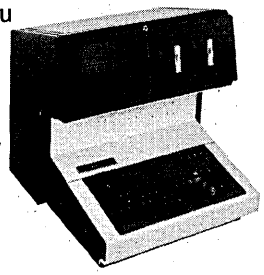

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across the country. Although able to operate the terminal, Brian's replacement was not a programmer.

After Brian left, funny things began to happen to the name and address system. "Garbage" appeared on the printouts, but they worked around it. Then came a massive reorganization of the field salesmen. Many were reassigned to new regions, while others left, and some changed jobs within the company. The name and address system completely broke down. A hurry-up help call went out to the systems department. Although Brian had written meticulous instructions for his successors on how to use the program, technical documentation on the program itself was virtually nil. These problems required over four work-weeks of professional systems department effort to fix. During this time, sales department mailings were a mess and target dates for other systems' projects had to be put off to release the systems department people necessary to fix the name and address system, which had now become virtually indispensable to the smooth functioning of the sales department.

The dilemma

Not long after the problem was uncovered, it became evident that the company's personnel system could be adapted to produce both the information needed and the mailing labels. However, the adaptation would require approximately two to four weeks to program and the time was not readily available.

The problem of the over-eager user and the over-burdened systems manager, who cannot give every user the top priority each user would like to have, is not unusual. Perhaps the solution found by Pepsi might be of value to other organizations in similar circumstances.

When the problem created by Brian's program surfaced at Pepsi, in-depth discussions on its broader implications were held by systems management not only with the sales department, but also with all other major time-sharing users within the company. Eventually, it was agreed that regular management review of activities and a simple control system must be instituted. Policy and groundrules were established for all projects handled outside the systems department to:

1. Provide more and better cost-control information on time-sharing to executives (like Brian's boss) who must assume the financial responsibility.
2. Improve the efficiency of existing and new applications.
3. Provide centralized professional-caliber documentation and evaluation to assure satisfactory effectiveness of operation.

A more detailed breakdown of these three points follows:

Ground rules

Users of the specially designed systems which merely retrieve and print out data are not required to make a report to the systems department. These special systems include the sales data retrieval system (DARTS), the field information system, the media planning model and media calendars. Systems department management is automatically informed as to who uses these systems and how often.

A service request form is completed and forwarded to the director of information systems for all new systems and changes to existing programs. This is a restatement specifically of a basic policy in effect for batch computer program development, updated and restated to be applicable to time-sharing development.

If the systems department cannot service the request on a mutually agreeable time schedule and an alternative source of system design or programming seems advisable at the request of, and in consultation with, the department head who requires the service, the director of information systems will arrange for outside assistance. The systems designee outside the systems department must be approved by the director of information systems, who also closely monitors subsequent programming. An alternative source to outside professional assistance may be the users' staff people, like Brian. However, Brian's efforts are now monitored from conception through careful documentation and subsequent follow-up check-ups by the edp staff.

At the end of each month, the data center manager, independent of the users, receives a catalog of all programs and data files, printed out for each user on every time-sharing service. This printout has on it file names, language used and program size. In addition, the data center manager is responsible for collecting and maintaining complete documentation on each program. He further requires users to regularly erase data files no longer needed and to accurately cross-reference permanent data files with appropriate programs.

All programs written outside the systems department, with an expected useful life of 60 days or more, must be documented by the programmer who wrote it, within 30 days, to the satisfaction of the systems manager. This documentation must include:

1. Project feasibility
2. Cost/benefit worksheet
3. Block diagram
4. Programming specification sheet
   Narrative of system flow, programming details and:
   a. time-sharing service utilized
   b. language used
   c. name and purpose of proprietary subroutines of modules supplied by the time-sharing service
   d. formulas
   e. access method (sequential, random)
   f. file types (binary, ASCII, etc.)
   g. explanation of how to access the system. Additional information of value to others who wish to understand the program is encouraged.
   h. program and data file names
5. Detail logic flowchart
6. Program listing
   An up-to-date program listing is required each time a program is changed.
7. Console messages halts
8. Illustrative run of system
   One copy of each report generated.
9. Data file identification
   Each data file is identified with the program(s) which generated it.
10. Retention
    A retention schedule states when each program and each data file can be scratched.

Conclusion

Since these controls were inaugurated, the data storage has dropped by over 40%. The rate of new development has slowed only somewhat and production is manageable. The sales vp would probably still be able to get his system implemented today on a temporary basis, but long-range plans for a permanent system would be far more quickly initiated to integrate his needs into the larger personnel system when systems time became available. □

Mr. Davis is information systems director for the Pepsi-Cola Co. He previously served as manager of the management information center for PepsiCo, Inc. He has an MBA from New York Univ.

From a schematic, a

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We have the flexibility to configure any kind and size of computer communications network. And we can design and develop a solution for any application.

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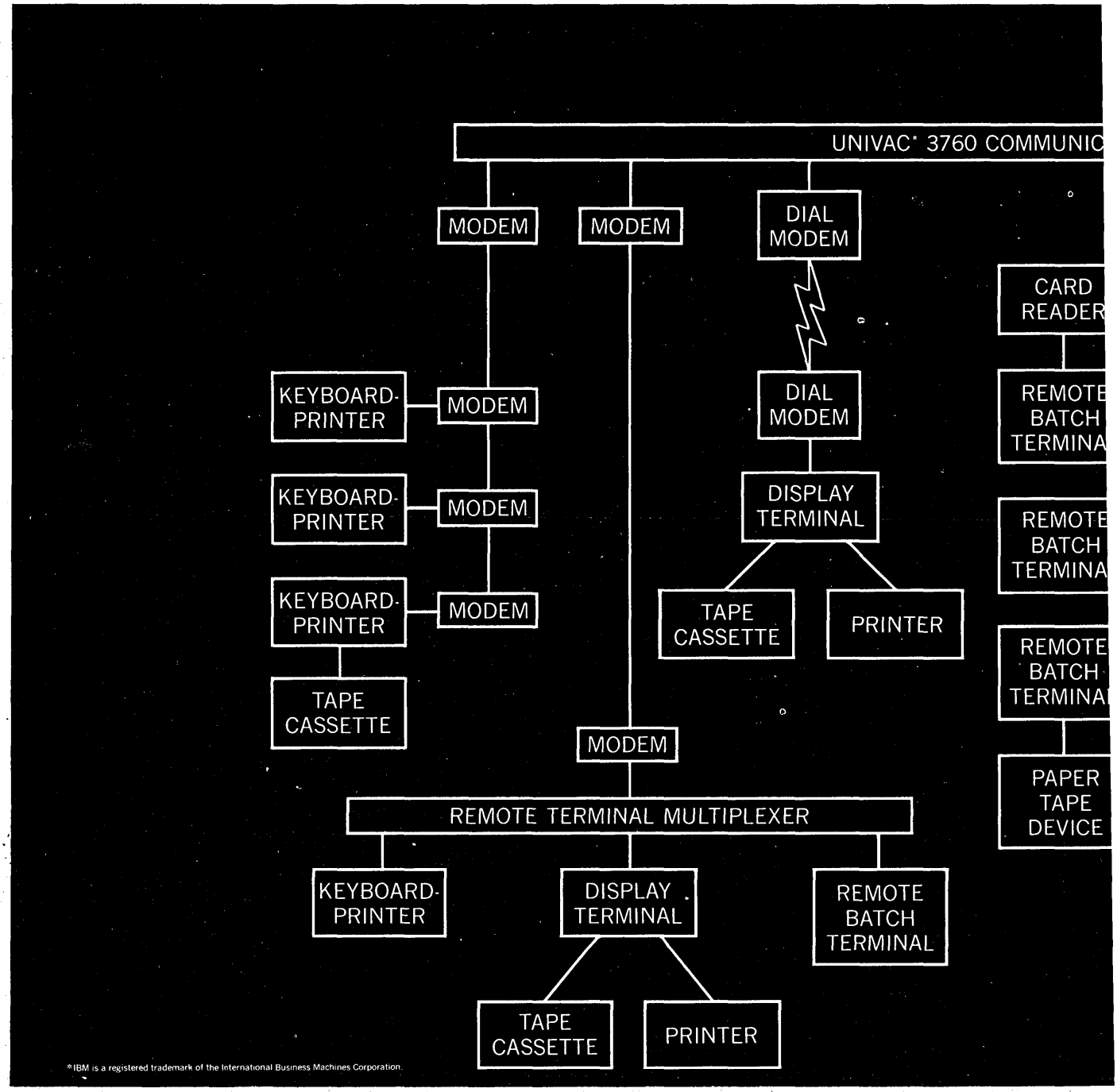

otal network story.

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With the assurance of high-performance equip-ıent. The UNIVAC DCT 1000 communications terminal, ɔr example, speeds information over common carrier lines t up to 4800 bps as it outperforms competitive equip-ıent in just about every area. The DCT 1000 is fully buf-fered, synchronous or asynchronous, and operates in batch and interactive mode under computer control.

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Or call free 800-453-5323.

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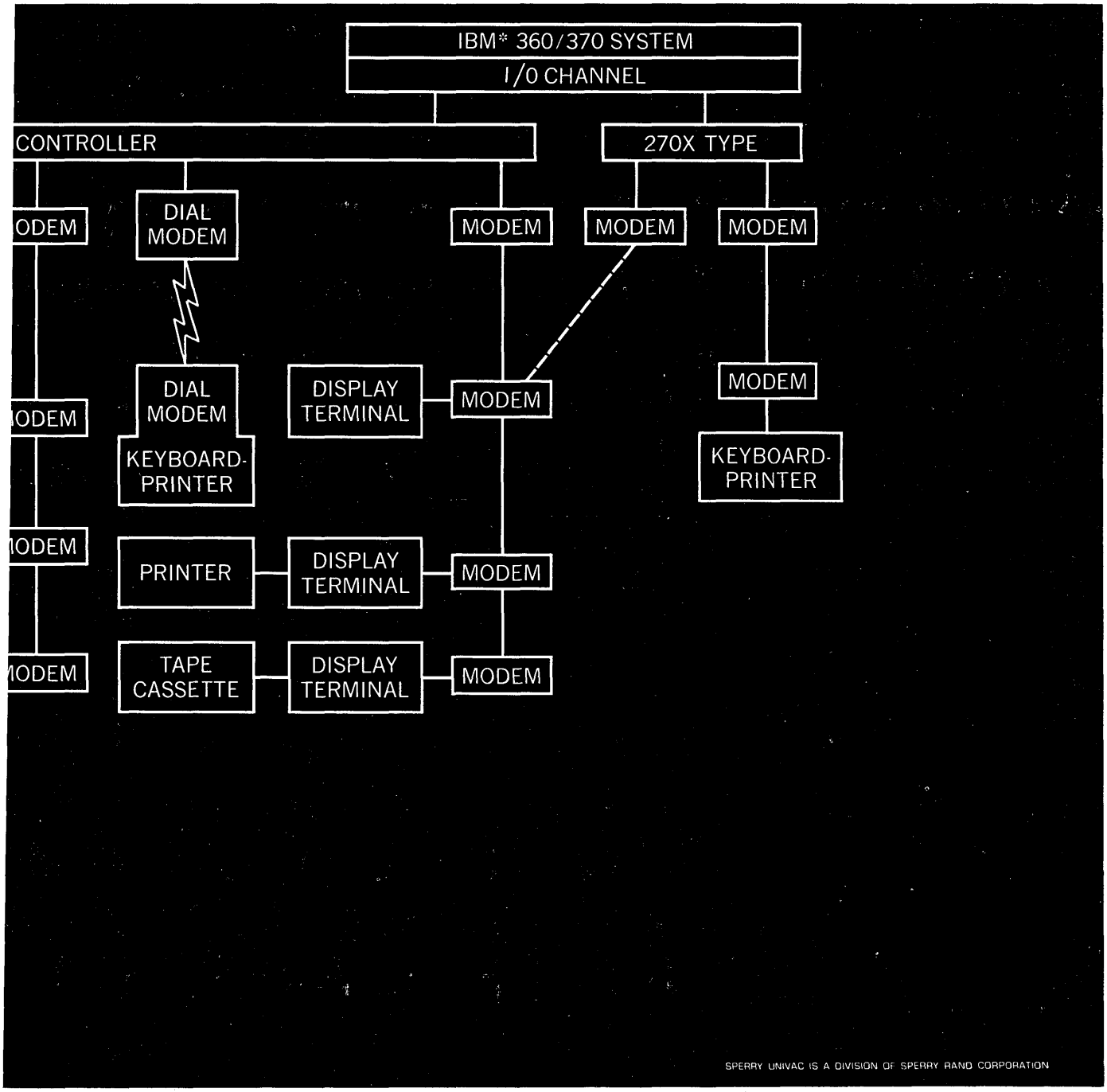


CIRCLE 51 ON READER CARD

Our new time-sharing terminals operate at 120 cps in interactive or batch mode. Either way you save.

And you save in two ways: You reduce communications line costs and cut computer connect time.

With these 1200 baud terminals you make full use of telephone line capacity. So even with moderate terminal usage, your savings can really mount up.

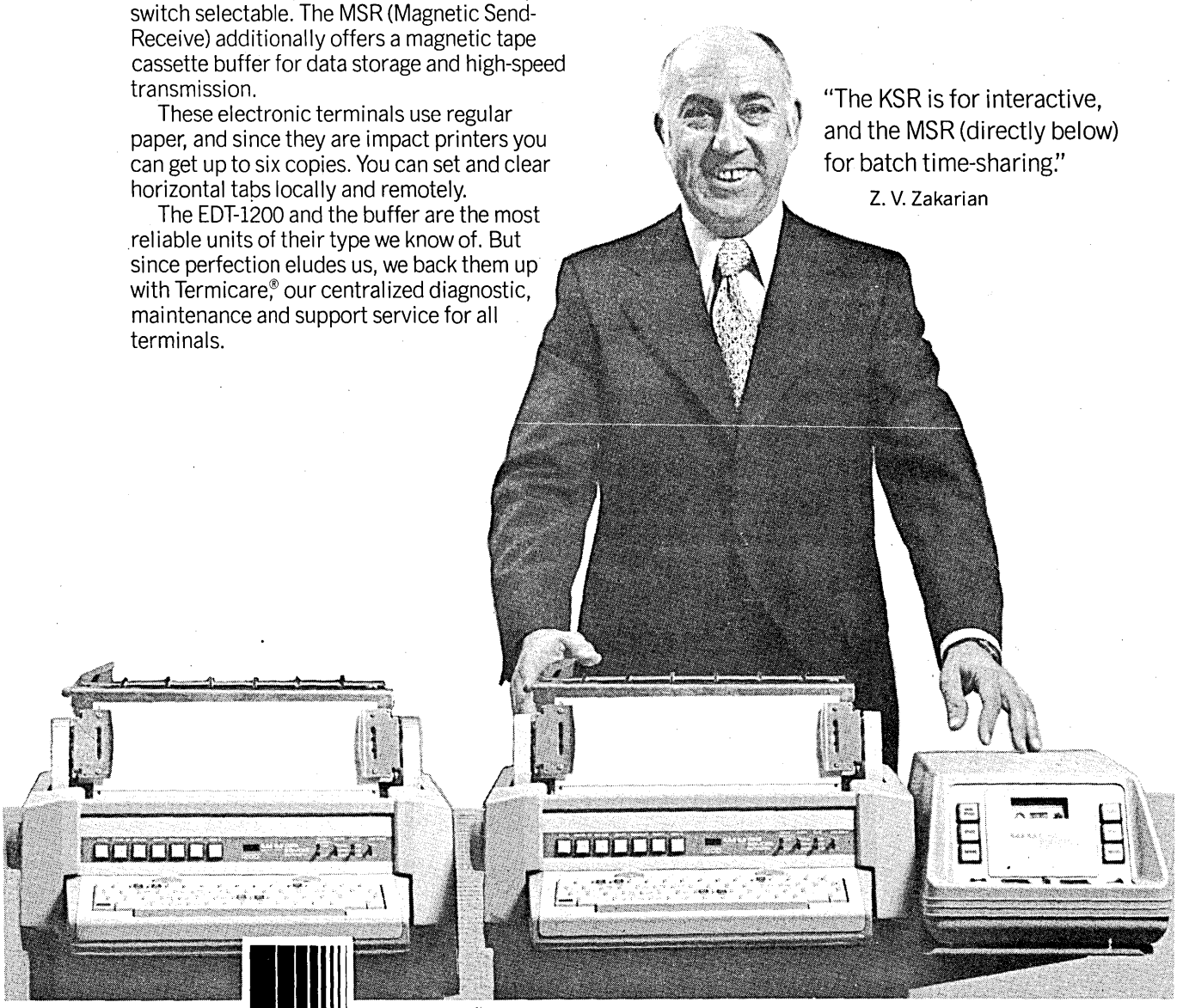
We offer two models of our EDT-1200 series: The KSR, which operates at 10, 30 or 120 cps, switch selectable. The MSR (Magnetic Send-Receive) additionally offers a magnetic tape cassette buffer for data storage and high-speed transmission.

These electronic terminals use regular paper, and since they are impact printers you can get up to six copies. You can set and clear horizontal tabs locally and remotely.

The EDT-1200 and the buffer are the most reliable units of their type we know of. But since perfection eludes us, we back them up with Termicare,® our centralized diagnostic, maintenance and support service for all terminals.

With these new terminals our product line is now up to 78 models with 228 options, with speeds of 10, 15, 30 and 120 cps.

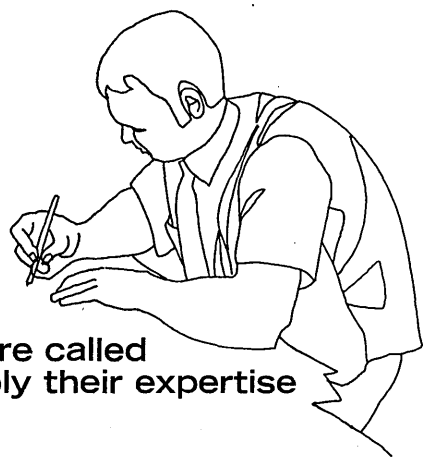
For details about the EDT-1200, or about any of the 306 ways we can help you with terminals, please contact me. Z. V. Zakarian, Western Union Data Service Company, 16 McKee Drive, Mahwah, N.J. 07430. 800-631-7050 (N.J. 201-529-1170).



"The KSR is for interactive, and the MSR (directly below) for batch time-sharing."

Z. V. Zakarian

western union data services company



Librarians are called upon to apply their expertise

Cataloging Computing Software

by Karl M. Pearson, Jr.

Why shouldn't computer software be managed by the corporate library or technical information center? Programs have much in common with other materials that librarians manage as a matter of course, and the same principles that help you find a particular item in a collection of books, technical reports, or musical scores should work equally well in helping you locate a software system, program, or routine. At System Development Corporation we have put this idea into practice by making the corporate technical information center responsible for managing the inventory of all software developed or acquired by any division of the corporation. Now, instead of reinventing the wheel, we can check the software catalog first to see whether a program that might be applicable to a new task is already on hand.

The software catalog is the key to management of the software inventory, especially when programs are available in several different application areas. Even when existing programs cannot be modified economically, their design concepts can sometimes be translated into new program code at a fraction of the cost of starting anew. But such savings can be realized only if people working on a new project can discover what potentially pertinent software is available in the inventory.

A catalog of program descriptions can also help a manager identify and define the range of programming skills and experience that he can tap within his organization. The software catalog can be more useful than personal resumes to find out exactly who can do exactly what.

The catalog serves two primary functions in a library: it describes each item, and it shows which items in the collection pertain to a particular subject. The catalog entry for an item should contain enough descriptive and subject information to allow the user to decide that the item is *not* relevant to his needs, thus sparing him the burden of examining every item in the collection. Descriptive cataloging is based on a well-defined set of practices established for librarians in the *Anglo-American Cataloging Rules*. These rules provide both for creating a unique identification for each item in the collection and for summarizing the most important characteristics and features of the item.

Subject cataloging is much more difficult than descriptive cataloging because rather than just describing the subject matter of an individual item, it must provide a framework for the collection as a whole whereby each item is related to other items bearing in any way on the same subject. Subject cataloging is accomplished with the techniques of classification and indexing. Classification provides for grouping items on the basis of a general similarity in their subject matter. This allows a user to find items that might be relevant to his needs when he does not know exactly what he wants, or is interested in material similar to a particular item that he does know about.

Indexing provides access to items that are specifically similar in one or more aspects of their subject content, and so helps a user find items when he knows exactly what he wants—if the index terms are those the user is likely to think of. The utility of indexing for a particular library is highly sensitive to the "goodness of fit" between the vocabularies of indexers and searchers. If indexers and searchers use different words for the same concept, or ascribe different meanings to the same word, indexing fails to work well. This problem severely limits the value of KWIC automated indexing wherein a computer prepares an index by listing an item under each significant word in the item's title or description.

In passing, let me note the scope of the vocabulary problem as shown by one instance. The terms "catalog" and "library" have been co-opted by programmers to describe computer operating system facilities for handling stored programs and data. The terms are thus almost semantically useless as index terms where the universe of discourse encompasses programmers as well as other users who expect a catalog to be a set of file drawers containing 3 x 5 cards and a library to be a place where books are kept.

What's wrong with other software catalogs

If a good cataloging system for computer programs had existed, it would not have been necessary to invent one. We performed a limited literature search that identified several software catalogs, but we failed to find one that provided both adequate subject access to a software collection and useful descriptions of the salient characteristics of the programs. Most program catalogs (or, more properly, indexes) are simple listings of each program's acronymic title or code number, and are sequenced by a contract, project, or similar identification number. In most indexes, the listed pro-

grams are similar in type or focus of application, and the indexes serve as an inventory list for users who are already familiar with the programs.

Descriptive cataloging for computer programs is an unknown art in most of the systems reviewed. However, the SHARE program catalog does provide a reasonably complete model for describing the salient characteristics of a program. Unlike most other systems, SHARE includes the one element of information most likely to be of value to a person considering whether to use a particular program: the name of the programmer who created or maintains the program. A program's author is far and away the best source of information on the program's capabilities, limitations, and adaptability for use in another application.

Few software catalogs employ a classification scheme and subject headings or index terms to provide subject access to programs. Indexes of the KWIC variety are clearly inadequate for program collections encompassing more than one or two main areas of application because of the lack of standard and stable vocabularies in dp.

Because the functions performed by computer programs are often so generic that they occur in many different applications, subject (function) access to programs is as useful as subject access is to literature. If a software catalog is to serve a wide range of users, it will be necessary to develop a suitable thesaurus (since none is now available) of software function names and terms to provide subject access to the program library.

Let the user be the guide

The procedures for cataloging software should be similar to cataloging practices for other materials. In short, the main objective is to be user-oriented to the degree that the catalog is easy to use, has sections for each of the most valuable points of access to the software collection, provides an adequate description of each program, and furnishes an array of access points to the collection so that a user can select alternative search strategies on the basis of his knowledge, interest, and need for information. The system can best achieve this goal by following the standard principles and techniques of cataloging and information retrieval, in relation to the information-seeking habits of the library's users.

As we were relatively unconstrained by cost considerations in determining the number, format, and content of the divisions to be used for the printed catalog, we decided to implement a wide variety: applications, author, title, subject, language, and machine. The latter two divisions were designed as indexes, rather than catalogs, in that only one line was allotted per entry. Based on user preference, and reinforced by our own conclusions in the matter, the complete entry for a program appears in the applications division.

The applications division illustrated in Fig. 1 contains three types of entries: main entries, cross-references, and classification headings. Cross-references consist of a tabular list (under a classification heading) of the call numbers of all main entries that specify this heading as a secondary classification. Main entries designating the heading as the primary classification then follow in call number order.

The classification schema adopted for the software catalog had to be one that was acceptable to the potential users of the catalog. They opted for the simple type of classification employed by International Computer Programs, Inc. (ICP). The catalog employs a two-level, five-digit class code to characterize each program in terms of the major area of its application. Initially, we assigned about 70 codes, all on the first level. Additional structuring will be done when necessary as the number of entries under a code becomes so large as to substantially increase the amount of time required for locating a particular entry under that code.

The author division illustrated in Fig. 2 contains entries for primary authors and cross-references from added authors. In author entries, only the most important elements of information contained in the full entry record are listed, as a space conservation measure. Added author cross-references contain the title and class number of the referenced program. Entries are sequenced by the author's name, then by program title.

The title division contains title entries, system name cross-references, and program acronym cross-references. The titles of all the programs that are part of a system appear under that system's name. As with author entries, only the most important elements of information in the full record are listed.

The subject division illustrated in Fig. 3 contains only subject entries. The basic consideration for the content of the subject entry is to provide adequate information for the user to discover the types of programs available to perform a particular function and to decide which programs or kinds of applications to focus his attention on. The classification division shows what programs are available in a general application area while the subject division displays the programs that perform a particular function.

We are beginning to develop a thesaurus by allowing the persons filling

```
030.00  ARTIFICIAL INTELLIGENCE


030.00 SEE ALSO:
   630.00.1       920.00.5


030.00.1  NATURAL LANGUAGE DATA MANAGEMENT
SYSTEM (SYSTEM: CONVERSE)
  Kellogg, Charles H.  ORG: 3326.  INSTAL-
LATIONS: An early version is in use at
NELC, San Diego.

LISP.  S/370, ICOS.  340K bytes core.
Interactive.  Requires SDC LISP Compiler.

DOCUMENTATION: user manual; TM-4720; TM-
5015; TM-4885; SP-3679.

DESCRIPTION: CONVERSE is an experimental
natural English data management system.  It
is a research vehicle for use in investiga-
ting problems in computer understanding and
computer question answering. It consists of
an input scanner, dictionary lookup rou-
tine, morphological analyzer, parser (both
deep and surface structures), semantic
interpreter, spelling corrector, concept
network, and set-theoretic organized data
management system.

INDEX TERMS: Natural I/O; Natural language
processing; English analysis; Syntax analy-
sis; Semantic processing; Relational data
files; Set-theoretic data files; Data mana-
gement; Information retrieval; Question
answering.            730420  610.00, 630.00


040.00  BANKING
```

Fig. 1. Applications division of the software catalog.

out the software cataloging forms to assign whatever terms they wish. In most cases, these persons are the authors or maintainers for the programs and so are likely to come up with the terms and phrases most meaningful to potential catalog users. The cataloger edits these terms into a standard form and adds other terms if those supplied do not fully cover the functions listed under the program's description.

The two indexes, one for programming languages, and the other for computers and operating systems, simply show under each language or computer the call number and as much of the title as will fit on the rest of the line for each program in the catalog that uses that language or computer.

We use a full upper- and lower-case character set for the catalog for both esthetic and practical reasons. Upper- and lower-case printing is easier to read than is the all-upper-case form traditional in the computing field, and its use allows a variety of format clues that assist the reader in locating a particular element of information within a printed entry. There is a slight additional cost for using the full character set, and its use can create some processing difficulties in obtaining adequate input devices and prompt return of a job from the computer center, but the advantages outweigh the disadvantages. We have had a number of favorable comments from users, including some from people who hadn't realized that computers could print in lower case!

The workings of the system

Program authors (with a little coaching from the library staff) fill out a standard input form to describe their programs. As many as 21 elements of information may be used in describing a program; most of these elements correspond to ones used in cataloging traditional library materials. The information elements are:

Primary classification code (call number). Indicates the primary application area for which the program is intended. In addition, the code is supplemented with an accession number to uniquely identify the program.

Secondary classification codes. Indicates other application areas where the program might find use.

System name. Contains the acronym or title for the system or package of which the program is a part. Only two hierarchical levels are allotted for indicating the relationships among systems, subsystems, modules, programs, routines, blocks, etc. This constraint is desirable for two reasons: a. it would be difficult to establish a rigorous definition of the various levels of software that would be commonly accepted; b. the cross-referencing structure for the

PARK

PARK, Matty
(continued)
73.
PL/1. S/370, OS. 300K bytes core.
100.00.3, 060.00, 610.00

Text editor for making final changes in proof before photocomposition (PREDCYST) (SYSTEM: MEDLARS II) BY **, prog. and Schoene, William J., prog. ORG: 6221, 12/73.
PL/1. S/370, OS. 200K bytes core.
100.00.2, 060.00, 250.00

PARK, Matty, prog.
Management information analysis reports.
100.00.11

PEARSON

PEARSON, Karl M., Jr.
Composition for software bookform catalog (PROCAT) (SYSTEM: PROFORM) BY **, prog. and DeLanoy, Diana D., anal. ORG: 6221, 03/73. Proprietary.
PL/1. S/370, OS. 200K bytes core.
060.00.9, 250.00

Converts a print file from upper- and lower-case to all upper-case and prints it. (PROOF) BY **. ORG: 6221, 1972.
PL/1. S/360-370, OS. 62K bytes core.
680.00.5, 060.00, 250.00

Copy a file selectively. (COPSEL) BY **. ORG: 6221, 1972.
PL/1. S/360-370, OS. 62K bytes core.
680.00.4

Fig. 2. Author division of the software catalog.

CORRELATION
Factor analysis (B020B) (SYSTEM: Statistical Program Package). BY Rogers, Miles S., anal. and Hartley, Jane A., prog. ORG: 4628, 12/69.
FORTRAN. S/360-370, OS. 300K bytes core. Disk pack number 475 VLR001 is required.
320.00.11

Multiple regression (B012B) (SYSTEM: Statistical Program Package). BY Rogers, Miles S., anal. and Hartley, Jane A., prog. ORG: 4628, 12/69.
FORTRAN. S/360-370, OS. 300K bytes core. Disk pack number 475 VLR001 is required. Two utility data sets are required and assigned data set reference numbers 3 and 4. A third set is required if regression equation cards are requested and this set is assigned reference number 8.
320.00.6

CORRELATION COEFFICIENTS
(continued)
core. Disk pack number 475 VLR001 is required. A utility data set is required and assigned data set reference number 4.
320.00.10

COUNSELING, academic
Data base extraction program (BWAC20) (SYSTEM: CACS). BY Southworth, Loren L. ORG: 4628, 03/72.
COBOL. B3500, MCP. 30K bytes core.
060.00.13, 610.00

Prediction module (BWAC10) (SYSTEM: CACS). BY Wake, Alexander W., prog. and Southworth, Lemont E., anal. ORG: 4628, 03/72.
COBOL. B3500, MCP. 30K bytes core. Interactive. Handles 1 to 4 remote terminalss.
060.00.12, 320.00

Fig. 3. Subject division of the software catalog.

catalog would become too complex, causing an increased cost for computer processing and printing for the cross-references.

Program acronym or code name.

Program title. As an indicative title, this element should not begin with a content-poor phrase such as "A program to . . . . "

Author (main entry). Contains the name of the person most responsible for the creation of a program, when such a person can be distinguished.

Added authors or information source. Contains the names of persons other than the main author who are responsible for the creation or maintenance of the program, or the name of some other person who knows what the program does.

Source. Names the organization that developed the program or from which the program was acquired.

Operational date. Contains the date when the program first became operational or available.

Special Protection. Designates any special protection required for the program, such as a security classification.

Price and terms.

Language.

Machines and operating systems. Contains authorized abbreviations for the computers and systems needed to operate the program.

Mode. Indicates that the program operates only in interactive mode (on-line), or in both interactive and batch modes.

Core requirement. Indicates the minimum amount of computer core or main memory required for operation of the program, including data areas and buffers.

Minimum system requirements. Describes any special equipment needed for operation of the program, assuming a standard computer configuration with a card or tape reader, a high-speed printer, and magnetic disc drive or two tape drives.

Other technical information. Contains additional information about the program such as running time or productivity statistics, a citation to the processing algorithm employed, etc.

Documentation. Contains a list of the types of documentation available in the library for the program, and a citation to any other documentation concerning it.

Description. Summarizes the functions performed by the program, in detail sufficient to allow a user to decide whether to investigate the program further.

Index terms. Lists words or phrases that are descriptive of the program's specific functions.

Installations. Lists organizations where the program is used.

The cataloger examines the completed input forms to check for completeness and consistency, resolving problems through discussion with the person making out the form. The cataloger also edits the information, assigns the accession number portion of the call number, and ensures that elements such as author names are written in the proper form, and that authorized abbreviations or values are used for retrieval (indexed) elements.

The next step is to keyboard the forms to create the initial machine-readable record for the entry. New records are processed by a computer program that makes a number of legality checks on various information elements in an entry and expands standard input abbreviations. This program outputs a proof listing that shows any errors or anomalies found in an entry and displays the information elements for an entry in a format similar to the input form. Once the cataloger is satisfied that all new records in a batch are correct, the batch is transferred from the input holding file and added to the master file, at which time sort keys are generated for elements used in sequencing entries in the printed catalog.

Publication of the printed catalog is a three-step process. In the first step, the records in the master file are selected and formatted to generate the content of the entries destined for each catalog division; a separate output file is produced for each division. These files are then sorted and passed to a program that composes pages and produces a print file. The catalog is listed on a printer equipped with an upper- and lower-case print train to obtain camera-ready copy for plate-making and printing, or a COM device can be used to generate a microform edition or printing plates.

SDC's bookform catalog program package was modified to produce the software library's catalog. This package has been in operational use since 1970 for production and maintenance of a machine-readable catalog for a large junior college. The package incorporates many desirable features for file handling: controls on the release of entries to the master file, separation of non-entry-specific cross-references into a separate physical data set of the master file, and use of an in-process file for new entries to allow for verification and correction before addition to the master file. A well-proven sort key generation routine is included for modifying names and titles so that the computer's collating sequence approximates the most important library filing rules for entries. Cross-references based on entry-specific information, such as an added author or title, are automatically generated. The catalog page composition program contains a simple hyphenation routine and allows for specifying at run time the number of columns per page, the number of characters per column line, and the number of lines per column.

The decision to use the existing program package ensured that we would follow as closely as possible the cataloging rules established for book and non-book materials. The software cataloging system thus benefits by its foundation on the body of rules and practices, international in scope, that are maintained and improved upon by a recognized body of librarian representatives. And the adoption of the Anglo-American cataloging rules confers an additional cost-saving benefit in that little training is required to prepare library personnel (who have some knowledge of programming) for cataloging software items.

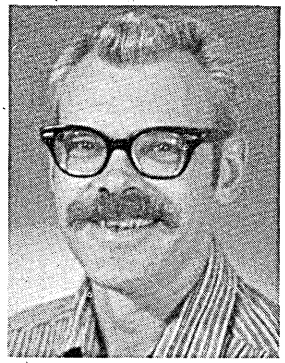
The first edition of the SDC software catalog was published in April 1973. Since it was intended as a pilot test of the cataloging procedures and system, it contained only 100 entries. Copies were distributed to managers and senior staff, several of whom soon reported that they made use of it in preparing new business proposals and in demonstrating corporate capabilities to potential customers. Several users were stimulated to contact a person named in a catalog entry or to request program documentation. The applications division was reported to be used most heavily, followed by the subject division and the computers and operating systems index. As expected, the volume of use was apparently low, which we attribute to several factors: lack of publicity for the new information service, the small number of entries in the catalog, and the predictable rarity of need for this type of information.

The second edition of the catalog

will be published in November. This edition will have about 500 entries, representing the major software items available in-house. We expect the catalog to stabilize at about 1200 to 1500 entries by the end of next year, when programming techniques embodied in subprogram routines have been added for the use of the workaday programmer. With the publication of the next edition, we will promote usage by mounting a publicity campaign aimed at all professionals in the corporation.

Until now, few librarians have been called upon to apply their expertise to the problem of controlling computer software. This task has usually been assigned to clerical personnel with no special training and has been an outgrowth of their responsibilities for managing the computer center's physical storage devices like card decks, magnetic tapes, and discs. Although these so-called "librarians" can locate or replace a storage device, they usually have no idea just what a program on the storage device does. Thus, in most computer installations there are no means for intellectual access to the contents of the "library" other than through the personal knowledge of the programming staff.

As software inventories pile up, and as concern mounts over the traditional programming practice of "reinventing the wheel," management should become more hospitable to the concept that a software *catalog*, used instead of a simple list of programs, can save money. The agency within the organization that is best qualified by training and practice to develop a software catalog is the library. □



Mr. Pearson is an information science and system specialist in the education and library systems dept. of System Development Corp. He has participated in a number of information and library system R&D projects, including the MEDLARS II system for the National Library of Medicine. He has an MS in information science from UCLA.

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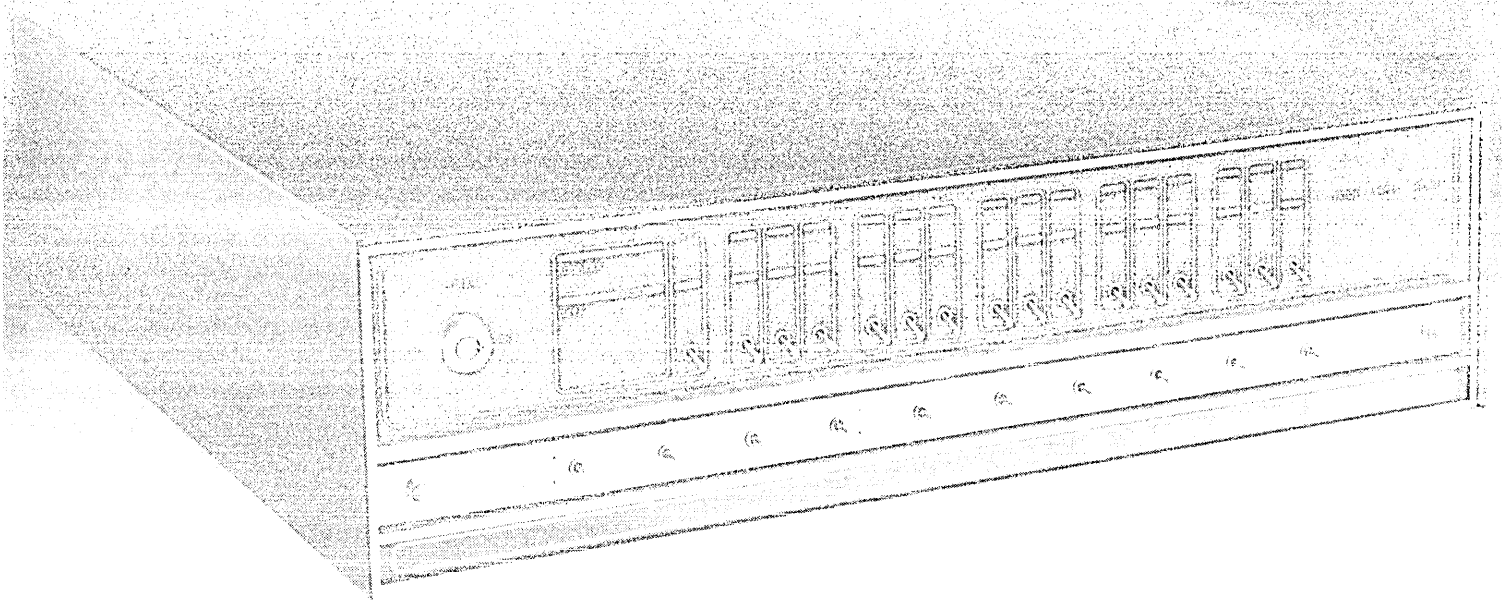

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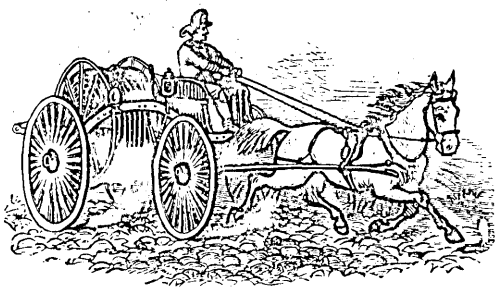
CIRCLE 20 ON READER CARD



Adequate security diminishes the possibility of disaster and, sometimes, decreases insurance premiums

Protecting Computers

by J. J. Caffrey

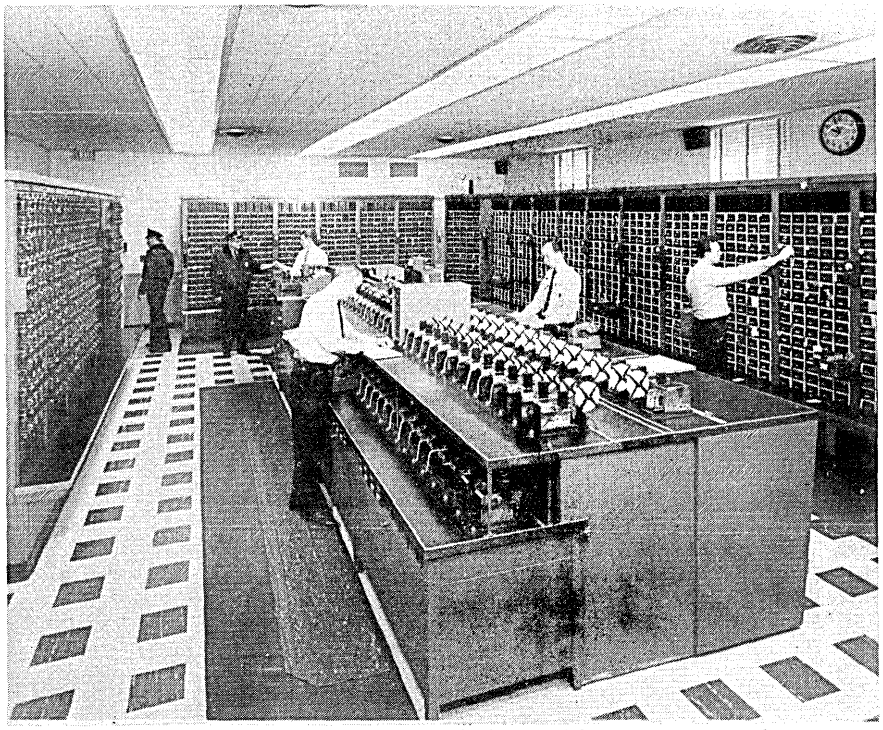
Hardly a business or industry exists today that does not depend to some degree on computer technology, and dependence upon computer information is so great that a sudden cutoff could affect the very continuity of some businesses. Critical information ranges from inventory figures and financial records to research results and future corporate plans—information that no company head would like to consider vulnerable.

Yet loss of tapes or an extended downtime period can occur and can be extremely costly to a business. Where more than one business relies on the same edp system, time-sharing could turn into "loss-sharing."

One of the most potentially serious threats to computers and tapes is fire. It comes as something of a surprise, therefore, to learn that fewer than 1,000 of some 40,000 computer systems in the United States are protected with some type of special extinguishing system.* At the same time, many of those 40,000 systems are also not provided with even the most basic of protection programs to warn against fire and intruders with criminal intent. Concern among senior executives (rarely technically oriented) for edp systems too often is focused on the maintenance of a smooth-running operation. Problems of security are frequently left to data processing technicians who often lack complete authority or background to initiate adequate protection programs.

Though constant improvements are made in the manufacture of edp equipment, the problems of protection remain much the same. The latest computers are as susceptible to damage from fire as the earliest. Much of the hazard stems from the great number of electrical components and miles of wiring that runs beneath floors, behind ceilings, and through computers and auxiliary apparatus. The amount of heat normally generated when equipment is in operation increases the risk of fire.

Because fire in the edp center is



Manned 24-hours by security specialists, this central station provides protection services. Coded signals indicating fire, intrusion or other emergency problems are received at the station, where supervisors notify police or fire departments and also dispatch security personnel to check premises.

*This from a member of panel of experts discussing computer and data-processing protection at the 1970 annual meeting of the National Fire Protection Association.

apt to be smoky, and all the more so if electrical in origin, it is important to have automatic smoke detection and alarm service.

The heat generated as well as the presence of electric current in the myriad of wires and electrical components, and the presence of paper forms, tapes, cards, and sometimes film, all increase the risk of fire. During this initial smoldering stage, the small amount of heat released is insufficient to activate a heat-responsive fire alarm system, especially when the air temperature in the edp center is rigidly controlled by air conditioners.

A smoke detector, however, will respond to a very low density of smoke, sometimes before it becomes apparent to the eye, which compensates. The projected-beam smoke detection system is highly dependable and versatile. Its advantage lies in the cumulative effect as even very light smoke, barely perceptible to the eye, intercepts more and more of the length of the light beam, thus obscuring the light to the point of alarm.

For smaller rooms, such as those used to house tape libraries and other ancillary functions, spot-type detectors utilizing the intensification-of-light principle offer optimum protection. These also are highly favored for protection of confined spaces such as under-floor and above-ceiling wiring areas and air ducts. Operation of this type of detector is simple. When smoke swirls into the detector chamber, smoke particles diffuse and reflect light onto the photocell, actuating the alarm. An additional feature of each spot-type unit is a fixed-temperature thermostatic detecting element which responds to heat created by fire even if there is no smoke.

Both the projected beam-type and the spot-type smoke detectors are equipped for simple testing by known obscuration transparencies, or by a remote pushbutton electrical method, respectively.

A third protective device is the ionization spot-type detector which will warn of an incipient fire by sensing invisible and visible particles of combustion.

These three types of remote sensors all offer viable means of sensing the presence of fire well before the fire can actually produce extensive damage. The sensors should be linked to an audible alarm in the computer area, so that personnel can be alerted in case of fire and immediate action can be taken to extinguish the blaze. In addition, contactors and controllers can be actuated instantly and automatically to effect necessary control functions to reduce the fire's hazard; for example, by cutting off air conditioning air flow, and by removing current from circuits (a suitable warning and delay can be introduced as needed).

But even an on-premises alarm, while better than nothing, has its drawbacks. What if a fire were to develop in the early hours of the morning, or on a weekend or holiday when there was no one on hand to respond to the alarm? In this case, the fire would continue to gain in intensity until extensive damage would occur, destroying hardware and software together and producing serious losses that could culminate in a business failure.

For this reason, many computer centers use the services of commercial central station protection companies (Fig. 1) Meeting standards established by Underwriters' Laboratories, these central stations monitor subscribers' premises 24 hours a day to detect fire, intrusion and other problems which could endanger lives or assets.

Upon receipt of a signal, security supervisors at the central station take immediate action. Signals are transmitted over leased lines and are received at the central station in code, indicating fire, intrusion, or a breakdown in critical operating machinery, flood condition, or other problem. Signals are relayed and telephone calls are placed to police or fire departments and to one or more designated officials of the company, alerting them to the problem.

Despite the emphasis on electrical fires, automatic sprinkler protection should not be rejected out of hand when discussing programs against fire. It is a fact that the largest single owner of computers, the Atomic Energy Commission, usually uses sprinklers. Rapid detection of water flows in sprinkler systems and dispatch of signals and actuation of controls thereby make sprinklers all the more acceptable.

Besides fire, intrusion too can be a real problem. Computers and their associated software are vulnerable to attacks from all imaginable—and some unimaginable — quarters. Vandalism by disgruntled former employees with real or imagined grievances, by deranged persons, or by youngsters looking for thrills can be responsible for overwhelming losses. In addition to the destruction caused by vandalism is the carefully planned, insidious damage that is brought about by industrial espionage, and which can account for substantial losses as highly confidential business plans and records find their way into the hands of competitors.

The two main methods of protecting an unattended computer area are perimeter protection and space protection. Furthermore, employees can be provided with fixed or wireless holdup alarm devices for use in emergencies.

In perimeter protection, the perimeter formed by walls, ceilings and floors is secured against intrusion by the use of electromechanical and other types of basic sensors. The most common of these is the magnetic contact, used in sets on doors and windows to indicate when an opening has occurred. Other perimeter protection devices include pressure-sensitive floor mats which respond when stepped upon, conductive tape which is placed on window areas and breaks when glass is smashed, and vibration detectors which sense when attempts are made to drill or hammer through walls and roofs.

The second category of protection equipment, space protection devices, detect any movement within an enclosed space. Mainly electronic in design, and more sophisticated than most electromechanical perimeter protection units, these units include ultrasonic sensors which emit inaudible patterns of high-pitched sound which, when disturbed, will initiate an alarm; microwave units that are akin to radar, invisible-ray detection systems based on sensitive photoelectric equipment; and many others.

Like the fire detecting sensors, these intrusion detectors ideally should be linked to a central station.

In the best protection system applications, both the system on the protected premises and the central station are backed up by a stand-by reserve providing for continuous electric power in event of a black-out or other failure in the primary electrical power source.

Finally, in addition to reducing the probability that the data processing manager will need to replace his destroyed data files or edp equipment, the use of a comprehensive security system can often provide for tangible cost-saving benefits in the form of reduced insurance premiums in many states—an important consideration in this day of increasing business costs. □

Mr. Caffrey is vice president, marketing, for the American District Telegraph Co. (ADT), an electric protection organization. He is a graduate of Fordham Univ., and has an MA from Columbia Univ.

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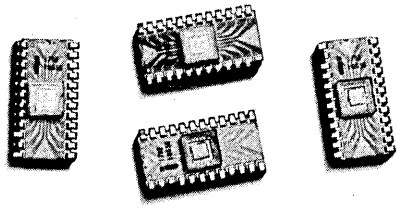

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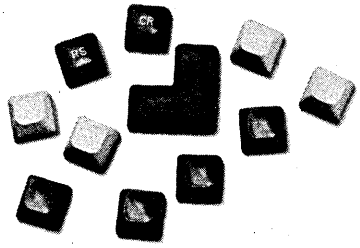

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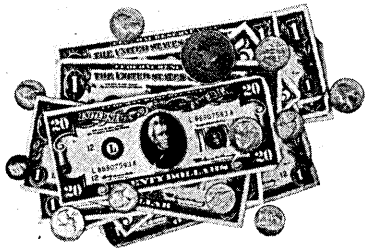

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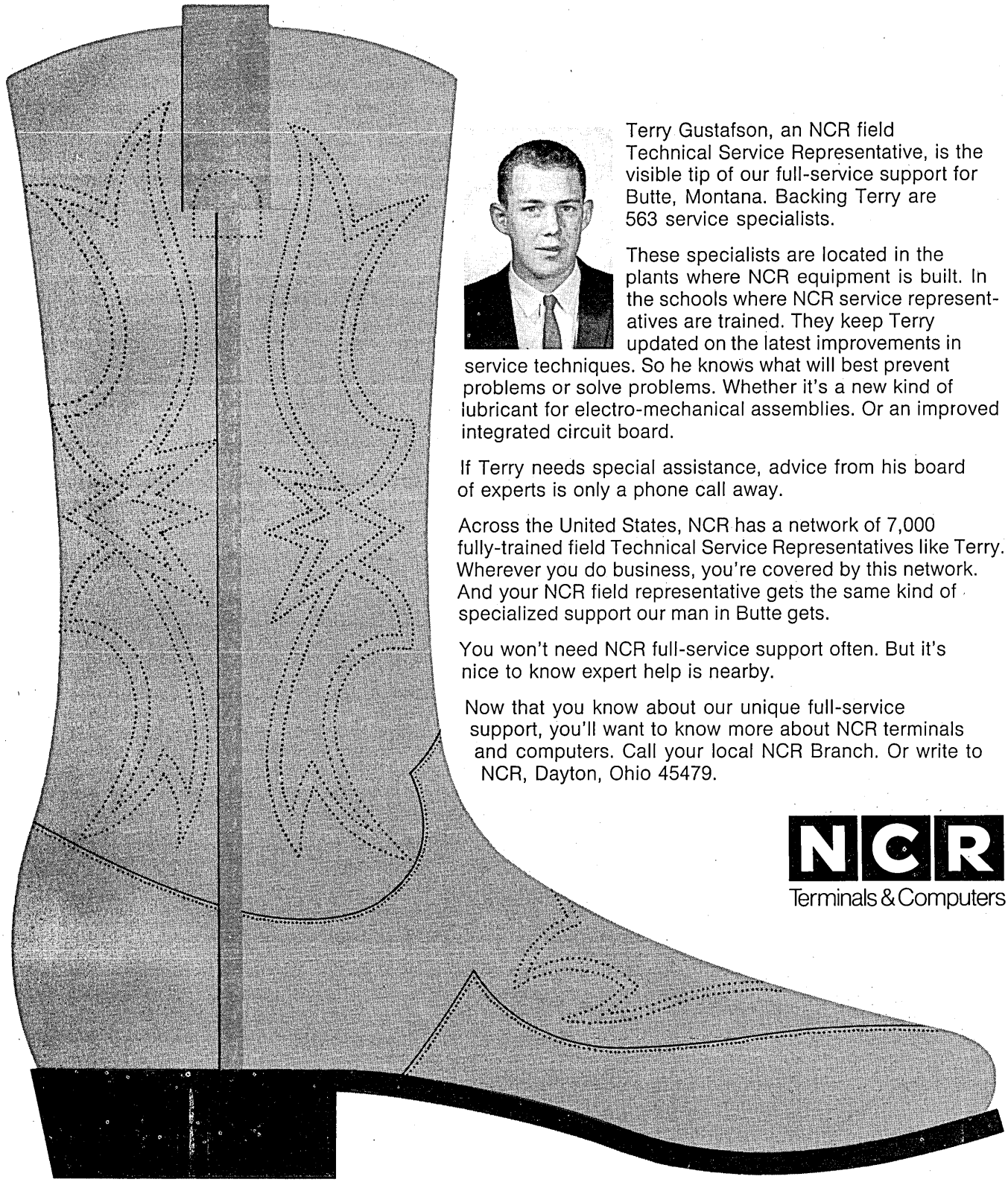

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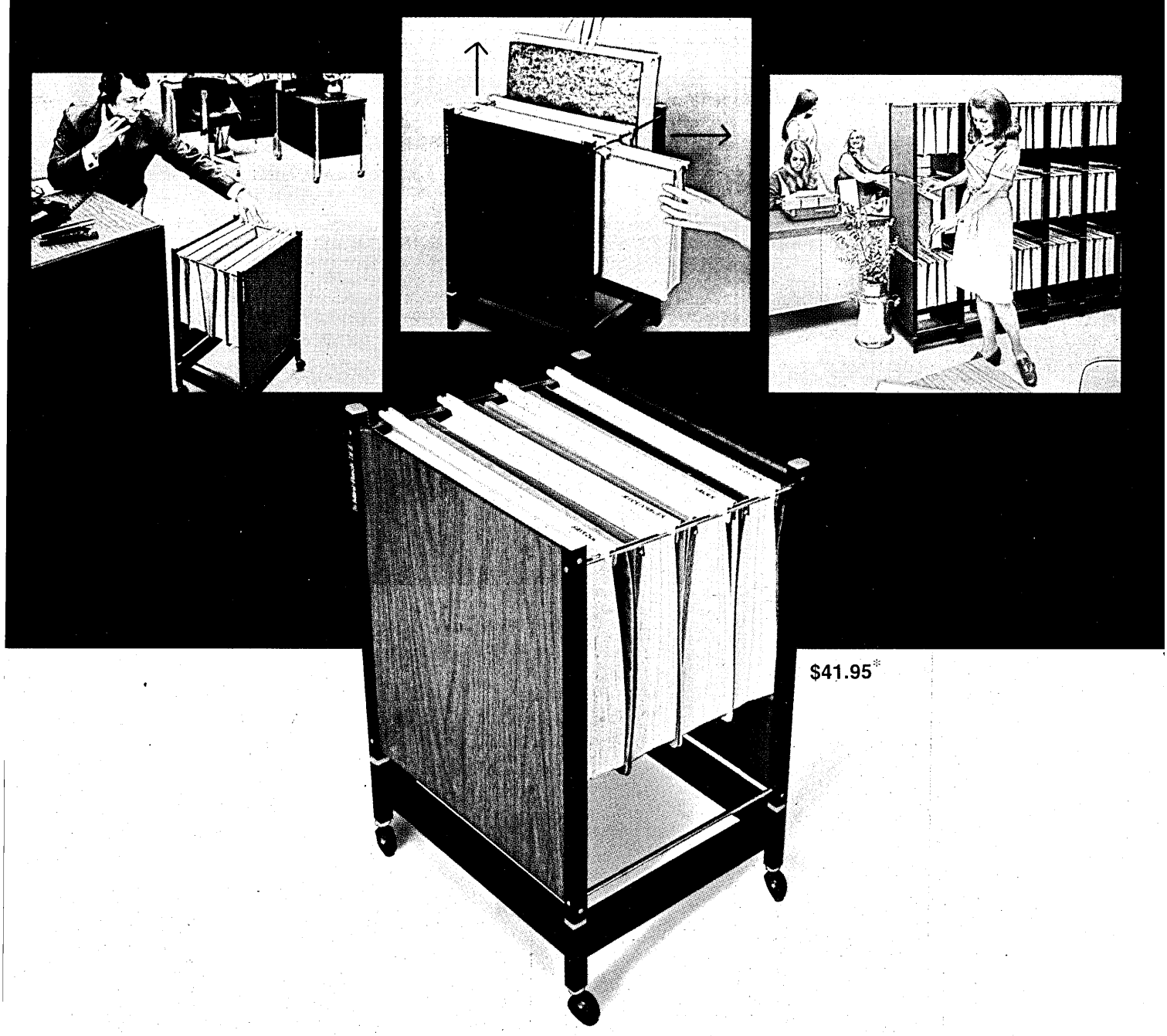

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A shorthand scheme for program design

Solving a Software Design Problem Using Plain English

by Ned M. Cole, Jr., and Michael J. Sukel

Recently, the computer application section of the Union Switch & Signal Div. of the Westinghouse Air Brake Co. (WABCO) was confronted with a problem not uncommon in the software industry. The first phase of a process control and on-line operating information retrieval system had been completed for some time and the programmers were preparing to design the remaining program modules. The diversion of talent to other jobs, along with normal attrition, left only two of the original programmers who were familiar with the functional scope of the job and who possessed intricate knowledge of the information retrieval software. Other programmers capable of performing detailed flowcharting and coding tasks were available. Over 100 program modules still remained to be designed, coded, and implemented.

Several options were open to us: train programmers to a level of system understanding required for design; delay the project; schedule overtime for the two experienced programmers; use FORTRAN or COBOL; and devise a shorthand scheme for program design. Schedule commitments to the customer prohibited any delay in the project. The schedule also could not tolerate the delays which would be induced by training lead times. Our past experience indicated that scheduled overtime accomplished little more than wearing out programmers and increasing costs, without materially improving production rates.

Little consideration was given to FORTRAN and COBOL for several reasons. All of our on-line control system programs to date had been written in assembly language. Also, previous studies, including a FORTRAN vs. assembly language study shortly preceding this job, had indicated that assembly language was more efficient for our application. Because of all these factors, the fifth approach was chosen. The shorthand program design scheme which resulted is the subject of this article.

A narrative/symbolic logic design technique was applied to on-line information storage, retrieval, and reporting programs. All of the program modules were fixed page, disc resident and were executed under the control of a tailored unsophisticated executive system. Operating software, also tailored for the system, provided about 100 subroutines for utility, I/O, and file accessing support. Most jobs were single page and averaged about 400 instructions per page. Several programs were standalone in structure, but a significant number were interactive. Some communicated information to other program modules. Others interfaced through common core variables with the process control portion of the software system. Several real-time programs executed automatically under executive control, but most executed in response to operator input commands. Although narrative macro flowcharting techniques deserve attention for other types of program design, the approach can only be recommended for the type of program modules described above.

We found that an experienced programmer could design (flowchart) a typical applications program in complete but not final form in slightly less than a day, using conventional flowcharting techniques. The original designer added one to two hours to the design time if he chose to initially draw the flowchart in final form. A draftsman could copy the rough chart into final form in three to four hours.

We then established that the experienced programmer could write a narrative macro for the same program in two to three hours. A much less experienced programmer could draw a final detailed flowchart from the macro in about half a day. We determined that a final form flowchart could be produced in about one day either by an experienced programmer doing all the work himself, or by an experienced programmer writing a macro with less experienced programmer drawing the detailed chart.

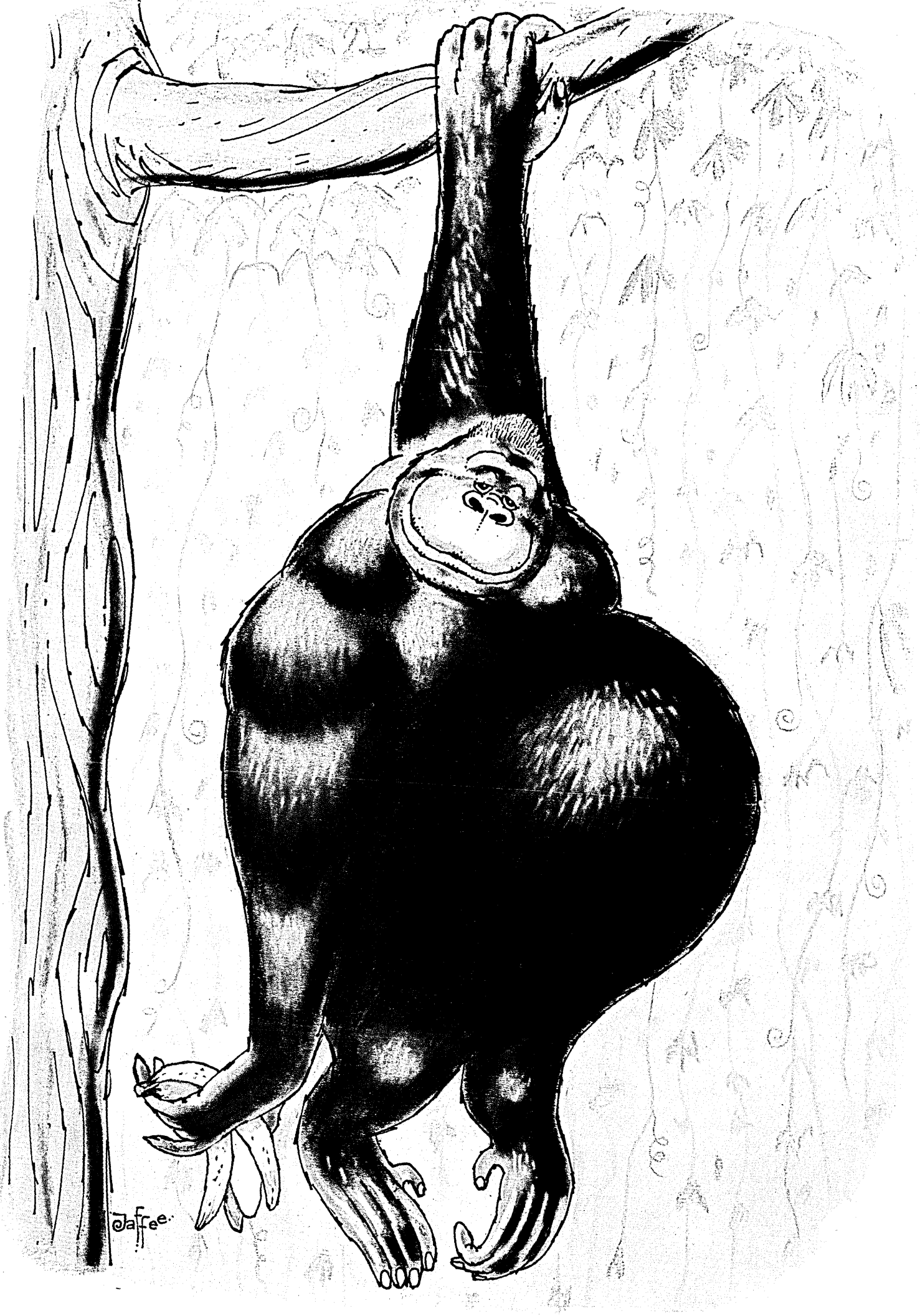
It occurred to us that if an inexperienced programmer could draw a detailed flow chart from a macro, then code from the chart, he should be able to code directly from the macro. However, two factors mitigated against this. For one thing, we were committed to supplying detailed flow charts to the customer. Secondly, the emphasis was on devising a mechanism to convey design concepts with a minimum expenditure of designer time. In order to shorten design time, final form documentation rules were not stressed.

The narrative macro in itself did not convey all the information required by the programmer performing the detailed flowcharting task. When appropriate, the format of the input command and output report and the table and file layouts were also furnished. The input and output formats had been decided upon in the early, scope-definition phase of the project. Many of the table and file formats were also defined in the first phase. Those that were not were prepared by the experienced programmer. The experienced programmer, however, would have had to define the tables and files no matter which design approach was taken.

After a short time, we discovered that the advantages exceeded expectations:

1. Once the less experienced programmer drew a few detailed flowcharts from the macros, almost no communication between the macro writer and the flowcharter was necessary.

2. The less experienced programmer had no difficulty in either coding from the flowchart or machine testing. Except for the most complicated interactive program modules, the programmer who drew the detailed flow-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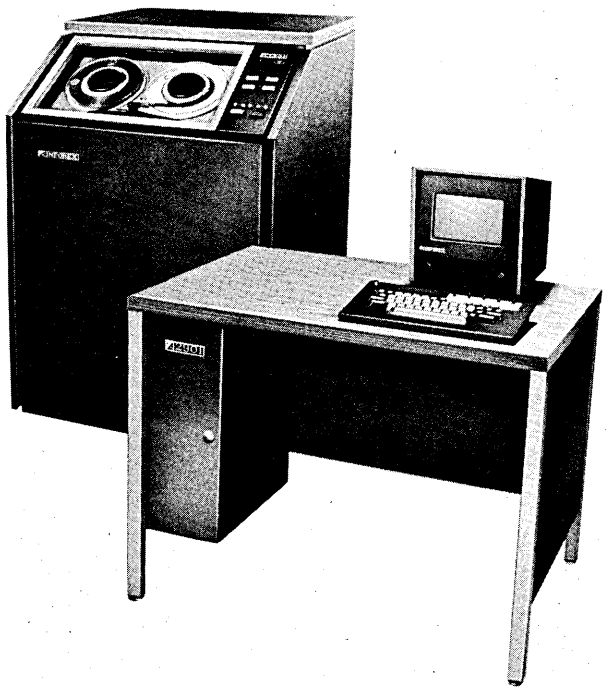

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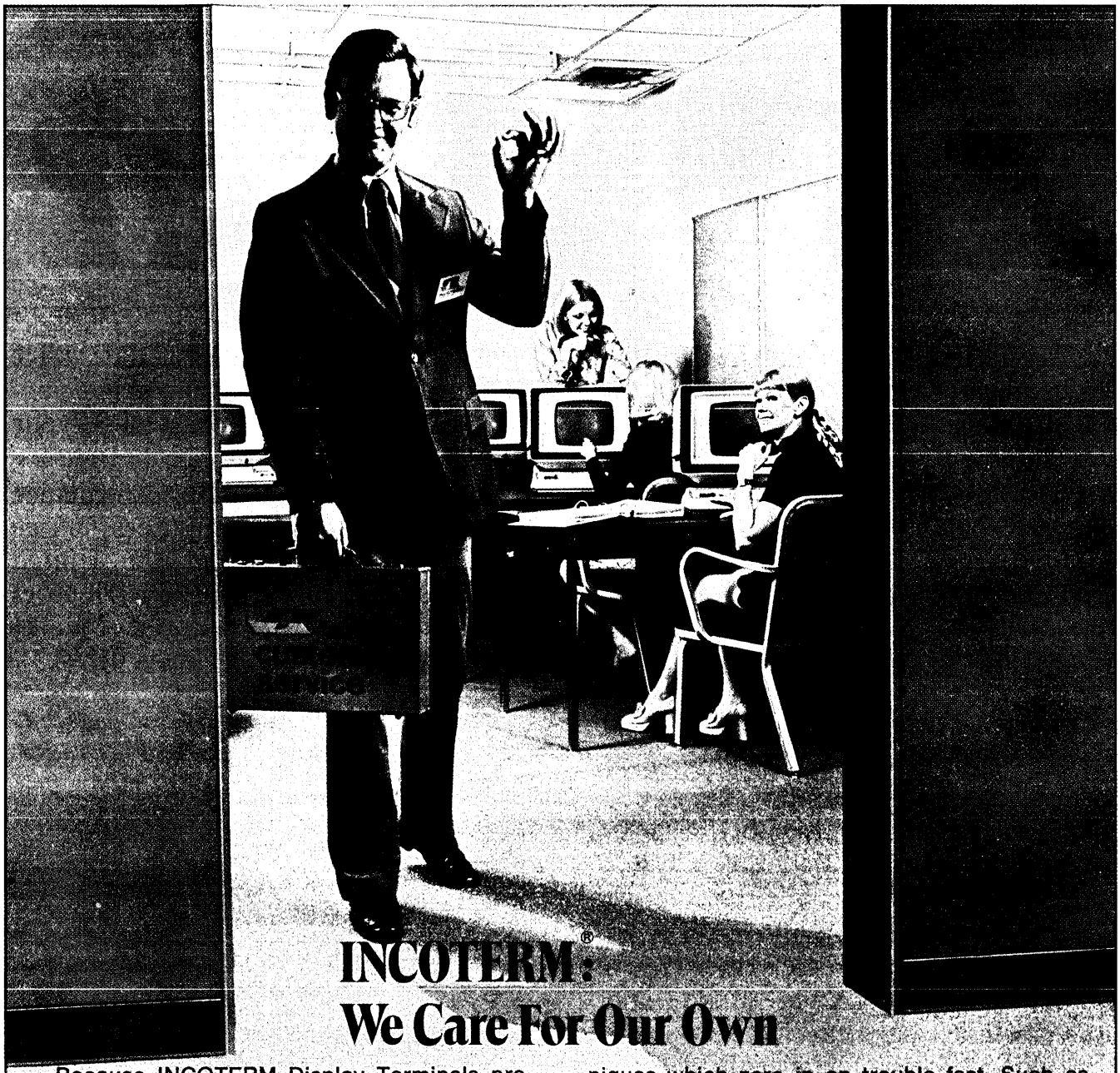

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chart and coded the program nearly always also performed the machine test.

3. Either the macro writer or the detail flowcharter/coder could machine-test the program. After macro design was completed and the experienced programmers became free for other duties, they assumed a portion of the coding and machine-test workload.

4. The experienced programmers, who spent more than two years working with the system, were able to spend nearly 100% of their time on work that they alone had the knowledge to efficiently perform.

5. The average cost of producing code was less than either of the other methods (the designer to final detailed flowchart approach or the designer to draftsman to final detailed flowchart method). Actual savings depended upon the spread between the salary levels of experienced and lower level programmers.

6. More programmers were efficiently used on the project than would have otherwise been possible. As a result, the schedule benefited.

7. After the project was completed, we reviewed cost figures for the first and second phases of the contract. We found that the average engineering cost per instruction was reduced by nearly 20%. More importantly, we found that the average number of checked-out instructions per unit of calendar time nearly doubled from the first to the second phase. As a result, we were able to divert the attention of the experienced designers to other projects four to six months sooner than would have been possible otherwise. The availability of the designers' talents materially contributed to our success in procuring other contracts. The benefits derived from such use of resources are difficult to measure, but appear significant.

Narrative program design concepts are not new, nor is a mix of narrative and symbolics. The mechanics we chose took advantage of the power of narrative description and the simplicity of symbols to present a new twist. In order to establish standard guidelines for the technique, rules were developed, a form was made and one example (Fig. 1) was written. The rules are as follows:

1. Write out the narrative macro flowchart (MACRO) in longhand.
2. Furnish table and I/O formats as appropriate.
3. Start numbering the lines on each sheet at X00. (The detail flowcharter was directed to use the same line numbers on the detailed flowchart and in the coding. This rule greatly facilitated later spot checking of the detail work by the macro designer.)
4. Increment the line count by 5. (Originally we incremented by 4. After a few tries at the scheme we found that 5 worked much better.)
5. Do not use a line number for general heading or comment statements.
6. Signify a "no" decision transfer with N→*XXX*.
7. Signify a "yes" decision transfer with Y→*XXX*.
8. Assume a fall through to the next line if the rule 6 or rule 7 condition is not met.
9. Signify an unconditional transfer with →*XXX*.
10. Signify variable names with [VARI].

GENERAL LOGIC FLOW

PROGRAM NAME: (UR) Update Bad Order and Spot Code **PROGRAMMER:** M. J. Sukel

I.D. NUMBER: 954019-MIS-106 **DATE:** 8/12/71

```
100     Save "A" reg entry code
105     Isolate and save input dev #
110     Set [TRUN] bit
115     Initial entry N—>140
120     Reset [ACBT] bit
125     Card reader free N—>325 [U4BZ=0]
130     Call card read (U400)
135     Release OVL-B and return to exec (B10B)

140     Card read err Y—>330
145     Get 512 buffer (CK5)
150     Buffer found Y—>160
155     Resch exec return to 145 (B110)

160     Open U400 card file (I$RC)
          Disc error—>340
165     Col 1 = "S" Y—>225
170     Col 1 = "B" N—>335
        Process bad order code
175     Get next card (G$RC)
          End of cards—>300
180     Get 'BO" code from Col 1-2
185     Scan BO tab for match [BOCC]
200     Match found—>N 175
205     Get class code from Col 4-6
210     Convert to binary (AIBI)
          Non-numeric—>345
215     Update tab of "BO" class codes [BOC5]
        using index from [BOCC] scan
220     —>175
        Process spot code cards
225     Get next card (G$RC)
          End of card—>300
230     Get spot code from Col 1-5
235     Scan table of local spot codes for match
        [TLSC]
240     Match found N—>225
245     Get class code from Col 7-9
250     Convert to binary (AIBI)
          Non-numeric—>345
255     Determine class code position in associated
        spot code/class
        code tab and up date tab [SCCC]
260     —>225

        End of data cards
300     Release 512 buffer (DBZF)
305     Clear [U4BZ]
310     Queue comp/err megs (MER1)
315     Reset [TRUN] bit
320     Release OVL-B and return to exec (B10B)
        Error exits
325     Save CR/P busy err code—>300
330     Save U400 card read err code—>300
335     Save invalid function err code—>300
340     Save SRC disc err code—>300
345     Save invalid card param err code—>300
```

Fig. 1.

Plain English

11. Signify program subroutine or transfer point names with (PROG).
12. Indent subroutine returns—do not use a line number for the return(s).
13. Double space between major logical blocks.
14. Abbreviate as much as possible.
15. Use clear text comments as deemed appropriate.
16. The macro is considered an intermediate design note and once having served its usefulness need not be kept up-to-date. (Originally we intended to have the macros typed. We also intended to update the originals to reflect all changes. We found the task of formalizing the macros cumbersome and determined that "pretty" macros did not significantly enhance definition of the end product. The macros were used as an interim design document only. Formal flowcharts, program abstracts, table and variable definitions and subroutine call descriptions were submitted to the customer. The formal documents are now used to maintain the system.)
17. Do not indicate error message or alarm numbers. The detail flow charter will assign error and alarm number.
18. Do not indicate subroutine call parameter or other similar information contained elsewhere in system documentation.

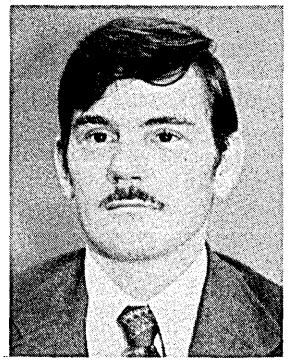
The intent in establishing the rules was to set forth a set of guidelines which would permit the designer to produce a macro with minimum reference to detail. As part of the system documentation, a book was maintained which listed error codes, alarm codes, system table and file layouts, system variables, disc file address assignments, subroutine calling sequences, and similar information. Abbreviated reference in the macro-to-detail information in other documents provided the detail flowcharter with quite sufficient direction. The designer was thus relieved from the time-consuming work of looking up error code numbers, disc addresses, exact table formats, exact subroutine calling sequences, etc.

The sample macro in Fig. 1 represents a program module which was implemented. The final product was 203 instructions long and was somewhat smaller than the average. The program is quite representative, however, of the majority of the program modules in the system. A macro like this can be written in 1-1½ hours.

Because programmers are conditioned to flowcharts, the narrative approach requires some retraining. To gain maximum benefit from the technique, programmer supervisors should provide good initial instructions and insure followthrough. Most programmers should become proficient in the technique after completing two or three examples.

Although the technique required some effort to develop, the advantages it provided soon made the time spent well worthwhile. It enabled us to maintain a schedule that was impossible by other methods, given the constraints under which we had to operate, and at the same time provided and continues to provide a considerable cost reduction. It's a rare and happy case when these two factors go together.

All programming projects are now reviewed for application of the technique. Where circumstances warrant, projects are organized, manned and scheduled to take advantage of this tool, which has provided a dramatic increase in productivity. □



Mr. Cole has been both the supervisor and a working member of several railroad control system computer programmer teams during the past five years. In addition to being a project supervisor and coordinator, his experiences include the design, code, debug, and implementation of several real-time control and operating information software systems.

Mr. Sukel has been a systems programmer with the computer application section of the Union Switch & Signal Div. of WABCO for the past three years. During this time he has been involved with the analysis, design, and integration of real-time information and control systems.

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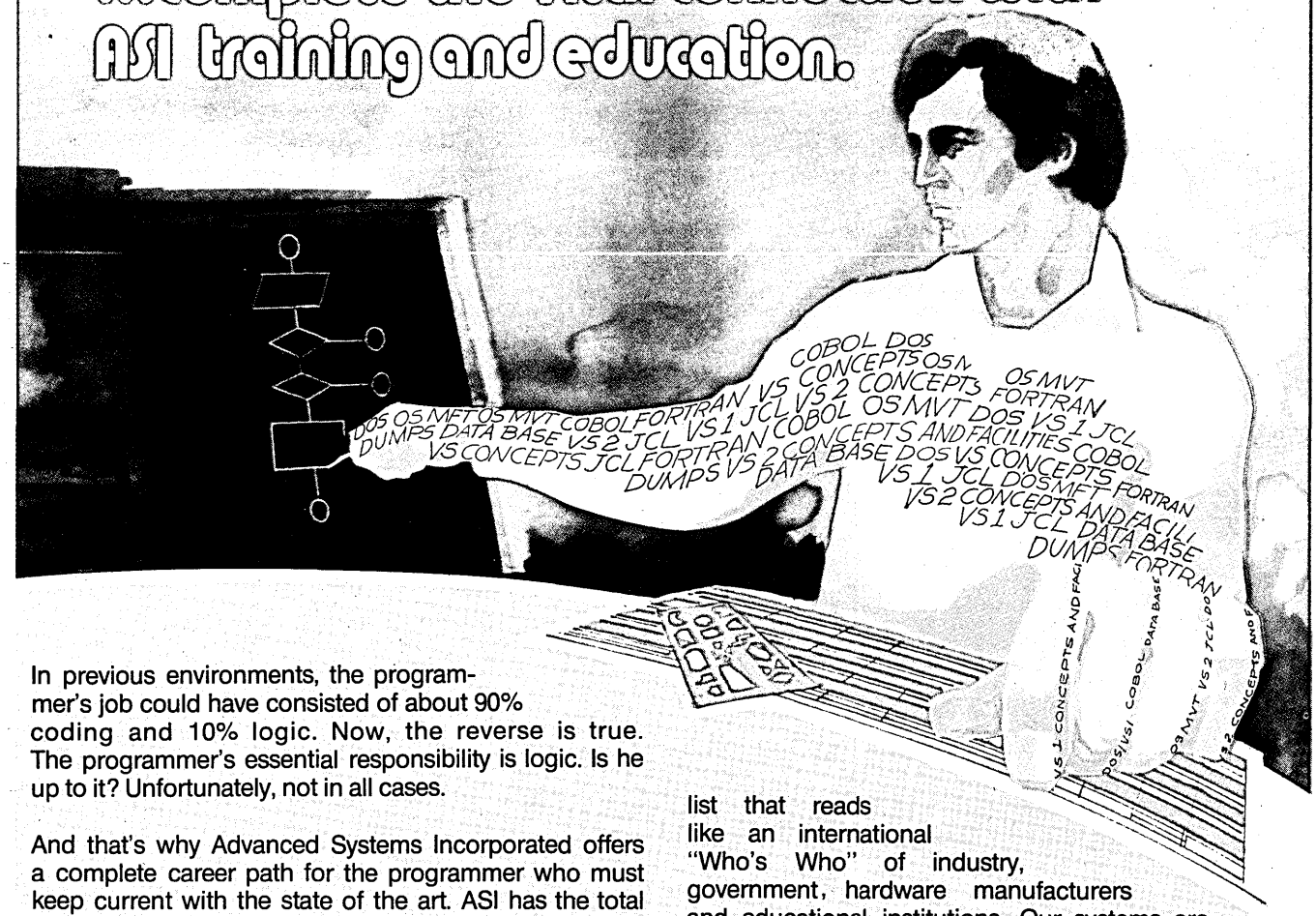

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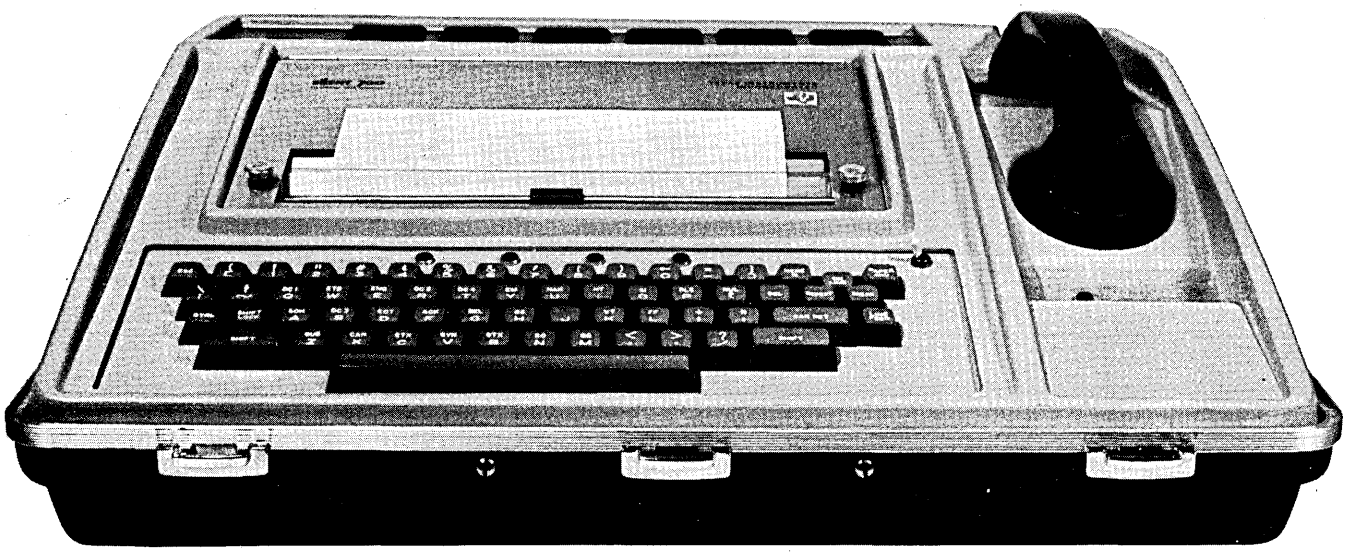

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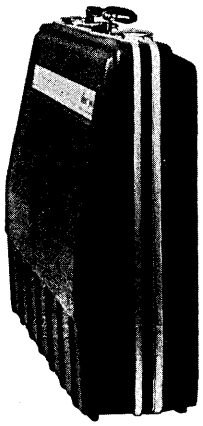

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The number of languages is mushrooming—but few are widely used

Programming Language Usage

by Andreas S. Philippakis

The proliferation of computer programming languages is a well-known and documented phenomenon.[1] According to one authority on the subject, there were over 170 languages in use in the United States in 1972.[2] Many of these languages were created to satisfy a local need. Others, such as PL/I, were created with the widest audience in mind. While languages are many, it is common knowledge in the field that only a few languages are widely used. Proponents and opponents of each language offer a variety of claims for or against a given language.[3] Yet it seems that there is a real interest in knowing which languages are actually being used and which languages ought to be used.

This article reports on the results of a study intended to collect information on actual usage of programming languages. The study was conducted throughout the summer and fall of 1972 by means of a questionnaire distributed to a cross section of computer installations across the country. Table 1 shows the composition of respondents to the questionnaire. A total of 390 questionnaires were sent, of which 164 were returned for a 42% response rate. The category entitled "other" includes miscellaneous service-oriented businesses such as credit card, hotel, stock brokers, etc. The sample may be considered representative as it included a very broad range of computer installations both in terms of employees and budgets.

Group	Number Responding
Banking	16
Utilities	12
Health Care	13
Federal and State Government	14
City and County Government	18
Manufacturing	27
Retail and Distribution	20
Insurance	12
Other	32
Total	164

Table 1. The sample.

Regarding programming language usage, the respondents replied to the following question:

"With respect to each programming language that you use, indicate the estimated percent of programming effort that goes into using that language. (This percent should represent the *approximate* man-hours of programming in each language per one hundred man-hours of programming.)"

The questionnaire then listed the

[1]See for instance: (ed.) Rosen, S., *Programming Systems and Languages*, McGraw-Hill, 1967; Higman, B., *A Comparative Study of Programming Languages*, American Elsevier Publishing Co., 1967; and Sammet, J. E., *Programming Languages: History and Fundamentals*, Prentice-Hall, 1969.

[2]Sammet, J. E., "Programming Languages: History and Future," *Communications of the ACM*, July 1972, p. 601.

[3]For some literature see: Higman, B., op. cit.; Sammet, J. E., op. cit.; Vaughn, P. H., "Can COBOL Cope?" *Datamation*, September 1, 1970, p. 42; Frampton, L., "How Does PL/I Compare with its Forebears?" *Computer Decisions*, May 1970, p. 12; Rubey, R., "A Comparative Evaluation of PL/I," *Datamation*, December 1968, p. 22; Lipp, M., "The Language BASIC and its Role in Time-Sharing," *Computers and Automation*, October 1969, p. 42; McCracken, D. D., "Whither APL?" *Datamation*, September 15, 1970, p. 53; "APL—the Language of the 4th Generation?" *Computing Newsletter*, March 1972, p. 1.

Language Usage

seven languages[4] shown in Table 2 and requested responses of the estimated percent of effort with respect to programs written during the past 12 months and the past 13-36 months as two separate figures. Tables 2 and 3 show a compilation of the responses.

Before commenting on the results shown in Tables 2 and 3, it should be mentioned that these results are likely to be correct within a margin of error that may range from trivial to substantial. The respondents were asked to *estimate* their usage. It is likely that in some instances the respondent's estimate was inaccurate, especially regarding language usage during the past 13-36 months. Records of this kind are often not kept and memories of individuals may be biased or incomplete. With these reservations in mind the reader may view Tables 2 and 3 as adequate representations of reality.

The following conclusions can be extracted from Tables 2 and 3:

1. COBOL is the most extensively used language.
2. Assembler-style languages are in substantial use and do not seem to have declined in use over the last three years.
3. FORTRAN is used by about half the respondents and is in relatively low use (about 10% of effort).
4. PL/I is used by a relatively small number of the respondents, but is in extensive use when it is.
5. Report generator languages are used often. As might be expected, smaller installations tend to be heavier users. However, no statistically significant correlation was found between size and usage for report generator languages.
6. BASIC is limited in use both with respect to number of users and extent of usage.
7. APL is nearly never in use among these respondents.
8. In the "other" category, about one-fifth of the respondents showed some activity. Examination of the responses revealed no general pattern or preference for "other" languages.
9. Differences in usage exist among the different groups represented in the sample. For instance, average use of FORTRAN in manufacturing is 14% whereas in retailing it is only 1%. However, statistical tests for significant differences gave mostly negative results.

Table 4 summarizes the current and past language usage. The results may seem to contradict the observations of readers who are familiar with university and scientific laboratories. Such institutions were not included in the sample. It seems likely, that had they earlier been surveyed, such institutions would have shown substantial usage for FORTRAN, APL and BASIC, among others. The intent of the questionnaire

Language	Past 12 Months		Past 13-36 Months	
	# of Users	Average Use %	# of Users	Average Use %
COBOL	138	70	138	63
FORTRAN	79	11	78	13
ASSEMBLER	124	27	131	30
PL/I	26	28	29	16
RPG	49	20	66	20
BASIC	14	13	9	18
APL	1	1	2	25
OTHER	33	17	35	17

Table 4. Programming language usage.

Group	Banking		Utilities		Health Care		Federal and State		City and County		Manu-facturing		Retail Distribution		Insurance		Other		Total	
# of Responses	16		12		13		14		18		27		20		12		32		60	
LANGUAGE	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %
COBOL	13	68	9	55	12	71	13	69	17	71	24	71	13	82	10	70	27	69	138	70
FORTRAN	7	12	7	13	4	12	11	15	10	7	15	14	5	1	3	4	17	11	79	11
ASSEMBLER	14	30	9	33	11	27	8	26	14	23	19	17	15	46	11	18	23	28	124	27
PL/I	1	90	3	43	2	9	1	65	3	2	4	39	3	4	2	27	6	31	25	28
RPG	2	4	1	10	6	13	4	3	5	28	11	22	4	32	5	27	11	21	49	20
BASIC	4	27	1	10	0	0	1	5	1	1	5	11	0	0	1	4	2	3	14	13
APL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
OTHER	1	5	3	22	0	0	4	12	7	6	4	5	2	47	3	29	9	10	33	17

Table 2. Percent programming effort devoted to languages during past 12 months.

Group	Banking		Utilities		Health Care		Federal and State		City and County		Manu-facturing		Retail Distribution		Insurance		Other		Total	
# of Responses	16		12		13		14		18		27		20		12		32		60	
LANGUAGE	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %	# of Users	Aver. Use %
COBOL	12	57	10	51	11	63	13	60	17	61	24	66	13	76	10	58	28	67	138	63
FORTRAN	5	15	8	15	4	9	12	21	9	8	14	15	5	2	3	4	19	13	78	13
ASSEMBLER	15	35	8	45	12	24	9	29	14	24	20	21	17	42	11	27	25	28	131	30
PL/I	1	90	2	4	3	8	1	45	5	3	5	25	3	27	2	16	6	7	29	16
RPG	3	8	2	4	7	31	6	5	12	19	12	21	4	39	6	25	14	18	66	20
BASIC	1	100	1	10	0	0	1	5	0	0	4	11	0	0	1	3	1	2	9	18
APL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	25
OTHER	1	2	4	19	2	17	4	14	8	14	5	13	3	18	2	57	6	18	35	17

Table 3. Percent programming effort devoted to languages during past 13-36 months.

[4]The reference to report generators as languages might raise objections. However it is this author's judgment that from a user viewpoint they *are* languages even though their structure may be extraordinary.

The far-sighted approach

Gregorian reflector by
J. van der Bildt,
18th. century

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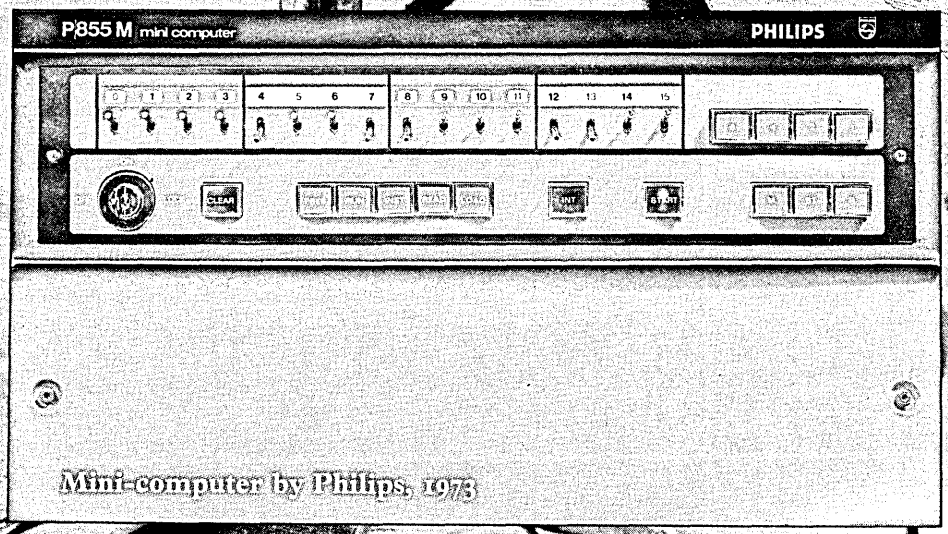

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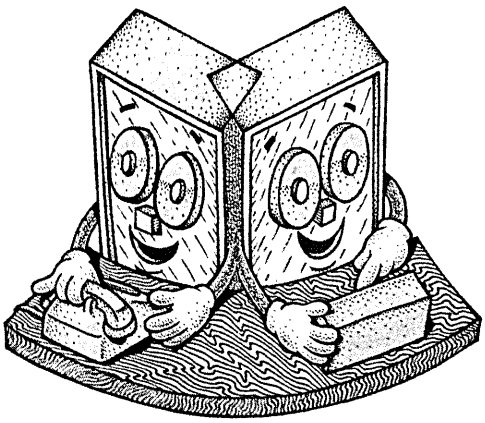

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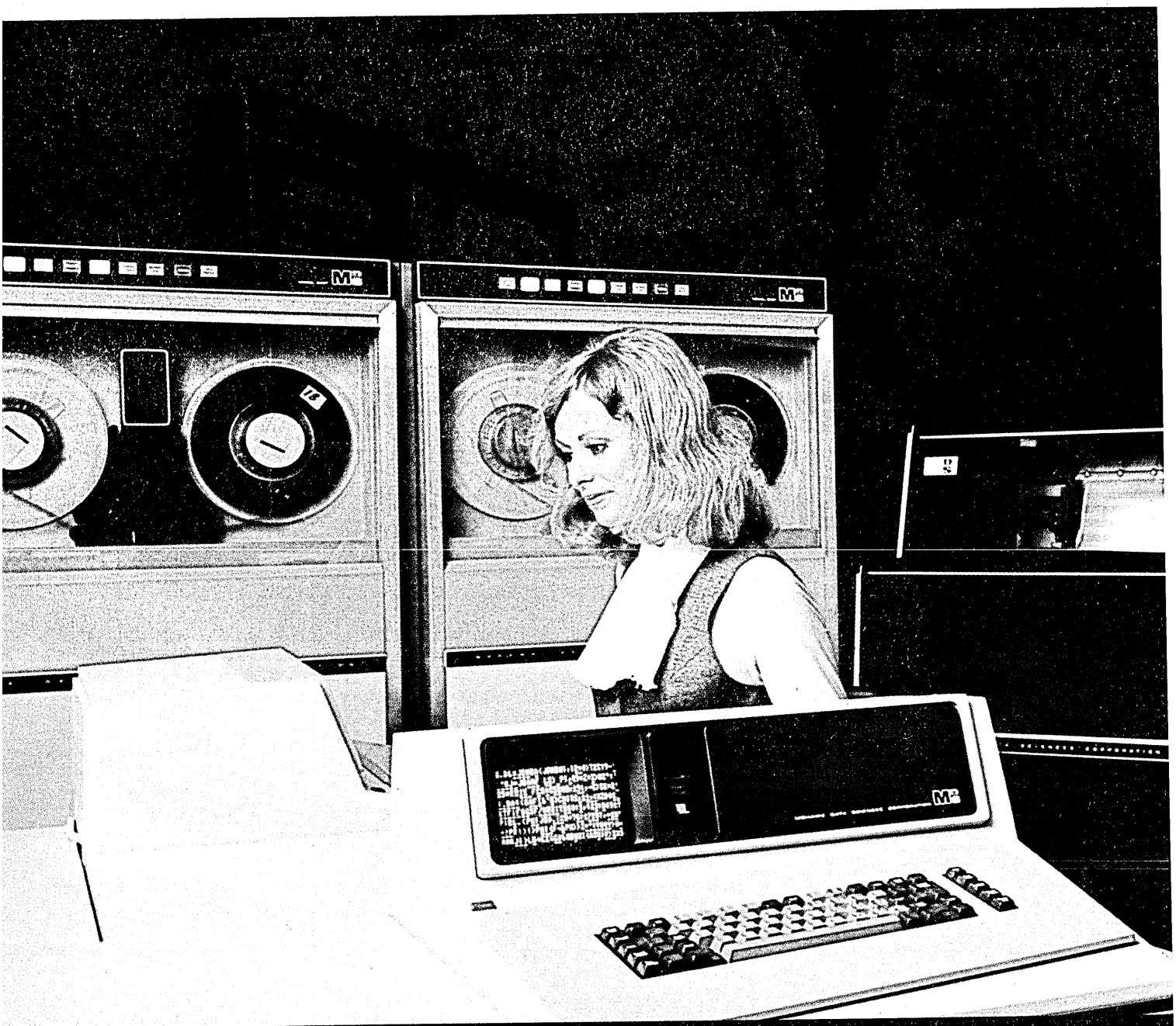

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Language Usage

was to find out what usage is made by institutions that do business dp as opposed to scientific computations.

The following index further summarizes the results of the survey:

$$\text{index} = \frac{\text{number of users}}{\text{total respondents}} \times \text{average use}$$

The index is only a rough measure to summarize the data. It has the advantage of weighting average use by the ratio of users to the total sample. Its disadvantage is that it does not discriminate among size or types of users. Table 5 shows the index of usage for the data relating to the past 12 months. Languages are ordered on the basis of the computed index.

Language	Usage Index
COBOL	59
ASSEMBLER	20
REPORT GENERATOR	6
FORTRAN	5
PL/I	4
OTHER	3
BASIC	1
APL	0

Table 5. Language usage index.

The results of the survey reported here should add some missing data to the question of what languages users actually do use. The data are no more accurate than their source and it is acknowledged that the source was not a controlled variable. Still, it is reasonable that the respondents gave reasonably accurate estimates and therefore, the data collectively are accurate representations of reality. The dominant conclusion that emerges is that COBOL is the most common and the most heavily used language. The second most-used type of language is assembler language, and it seems to be holding its own over the last three years. □

Dr. Philippakis is associate professor of quantitative systems at Arizona State Univ. He has been involved in the field of computing since 1962 and is co-author of two books on computer programming. He has a PhD from the Univ. of Wisconsin.

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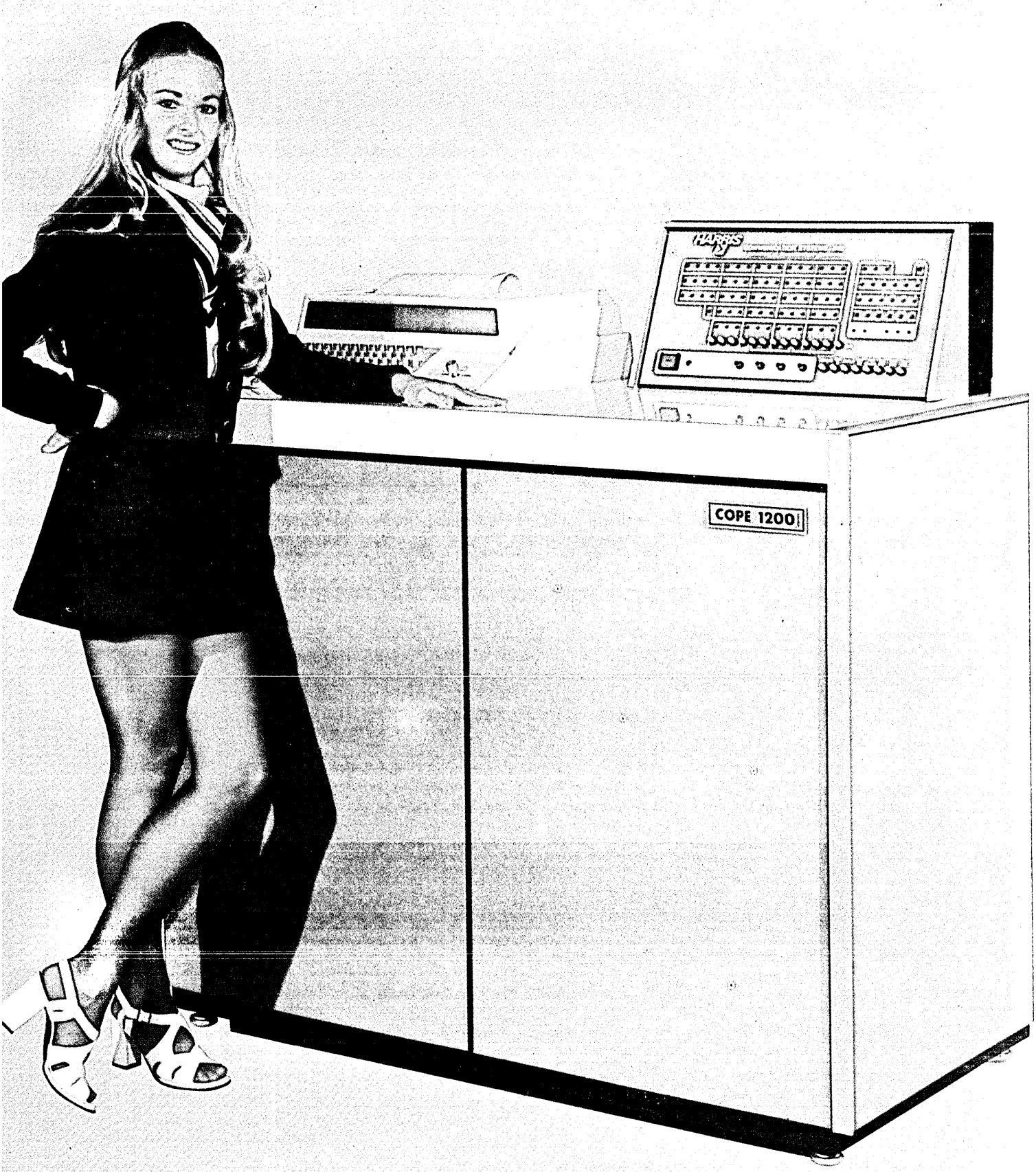
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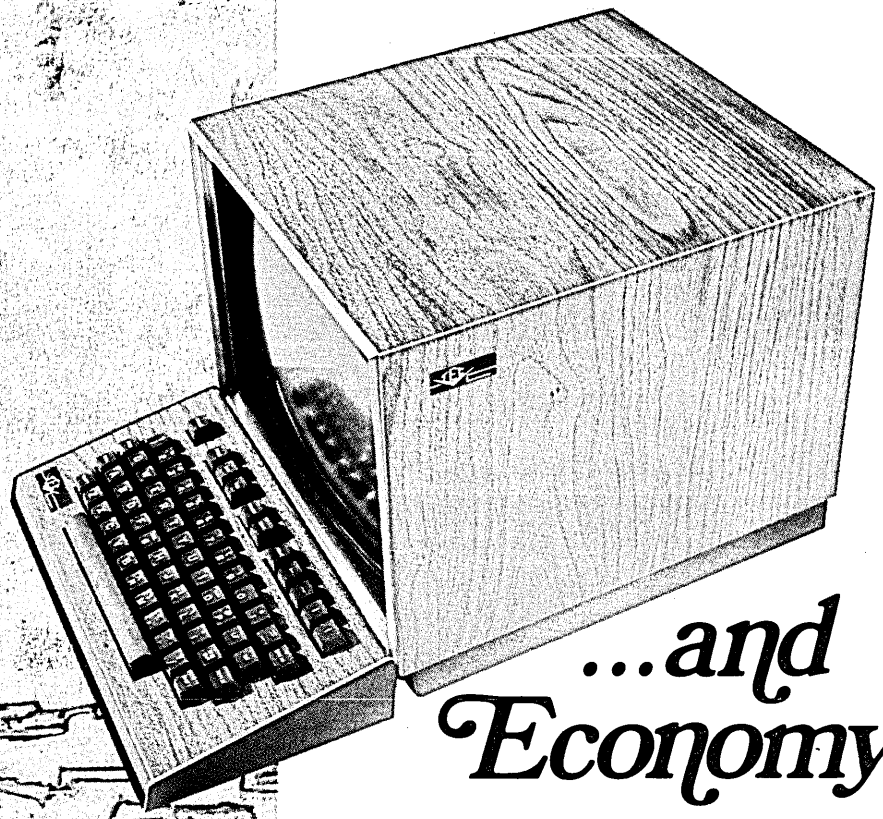

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One error
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IEEE Symposium On Software Reliability

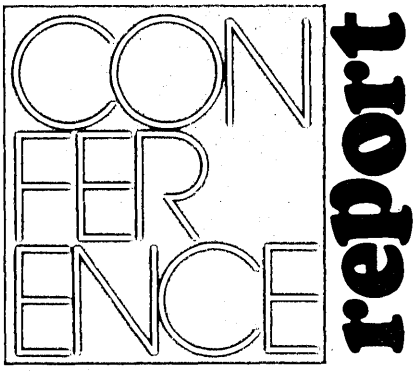
An astounding statement to emerge from the recent IEEE Software Reliability Symposium in New York City in early May was made by Harlan Mills of IBM. He stated that he had a programming approach which will propagate a new generation of programmers who will produce less than one software error per man-year. These programmers will not only approach zero software errors but will also remember vividly every error they had committed in their entire programming career. This, indeed, is a startling statement when one considers the state-of-the-art of software reliability. Most of us concerned with the production of large complex software systems wonder if software will ever be as reliable as Mills suggests.

The papers presented at the 1973 IEEE Symposium on Computer Software Reliability are representative of the amount of study, development, and worry that is currently going on with regard to software reliability. Not only were the papers at the symposium representative of the theoretical and practical approaches to software reliability, they were also representative of the growing concern involving the practical limitations of software systems due to program errors. Some 26 papers were presented to about 300 data processing professionals. The papers addressed six software reliability areas: 1) software system design for reliable software, 2) software testing techniques, 3) testing tools, 4) modelling of software reliability systems, 5) management techniques to produce reliable software, and 6) programming techniques to produce reliable software.

An interesting aside to the agenda of the symposium was the total absence of papers on software programming proofs, an analytic approach to proving software correctness. This probably stems from the fact that this method has not been found to be practical to date for medium-to-large program systems.

The introductory paper of the IEEE Symposium was made by Dr. W. H. MacWilliams of Bell Telephone Laboratories, Inc., in which he compared software reliability against hardware reliability with the intent of providing a definition and theory of software reliability. The conclusion of MacWilliams' paper is that although the theories concerning software reliability are "embryonic" in the current state-of the-art, reliability can be defined as "the *probability* that an item will perform its *intended function* for a specified *time interval* under stated conditions." While one must agree with MacWilliams in theory, the practicality of defining terms such as "intended function" and "specified time interval" is difficult and complex for any program.

One topic which has been discussed both in the past and in the present, and for which there is a large consensus of opinion, is the need for statistical data on failure rates both in hardware and software. This problem has been examined and re-examined; the conclusion remains that this data must be collected and correlated before successful reliability modelling can be achieved.



Martin Shooman of Bell Laboratories presented a paper which attempted to quantify the mean time between failures found in software during the development debug stages of the software. The estimation was obtained by using the reliability function and the mean time between software error detection. The conclusion was that in this model, the mean time between failures improves as man-hours and computer time are increased, but that additional data is necessary to support the methodology employed for the modelling technique.

B. Littlewood and J. L. Verralls' paper was based on a Bayesian reliability growth model, generated by the failure rate of a given real-time operational, continuous running, utility software system. One interesting and rather startling aspect of the presentation was that the length of time periods between software failures improved as repairs were made *until* a point where the system began to degrade as repairs were being made. In other words, at some point in time in the evolution of an operational software system, it pays to leave the software alone and simply document the program failure.

Another modelling technique employed by A. Jelinski and P. B. Moranda of McDonnell Douglas Astronautics Co. is an intriguing and controversial method for developing a projection of error detection rate in reading and analyzing software. Jelinski and Moranda purposefully introduced a known quantity of errors in a program, then proceeded to measure the step-size in the error detection rate of an individual desk-checking the seeded program. The conclusion was that the estimated times for this type of error detection are not cost effective, and that the more optimal method of debug consisted of a man-and-machine error detection team.

Much investigation has recently been made into the software testing techniques of predicting an optimum set of test cases which will thoroughly exercise the software in question. The theory behind this type of investigation is that when all logical paths of a program have been successfully exercised, the probability that the software will fail is lower than for a partially or incompletely exercised piece of software. There have been a number of attempts to solve this very difficult problem. One such attempt was presented at the IEEE symposium by K. W. Krause and R. W. Smith, and the method employed is currently operational on a NASA executive system.

The software test planning tool utilized employed a network analysis technique which analyzes the source code to determine all seemingly compatible and logical paths through a program. With this analysis, the user can generate test data sufficient enough to exercise the entire program. Krause and Smith were refreshingly honest in their attempt to objectively evaluate the constraints and successes to date, and their paper identifies an approach for providing a systematic methodology for establishing both the number of tests and the test inputs necessary to guarantee the execution of all logical elements contained within a program.

This paper certainly does shed some light upon the magnitude of the problem or achieving the stated goal. The use of Polish Strings to eliminate "impossible pairs" of segment relationships shows some promise and the use of syntax analysis is undoubtedly necessary. However, the heavy reliance upon user interface to accept or reject

(Continued on page 125)

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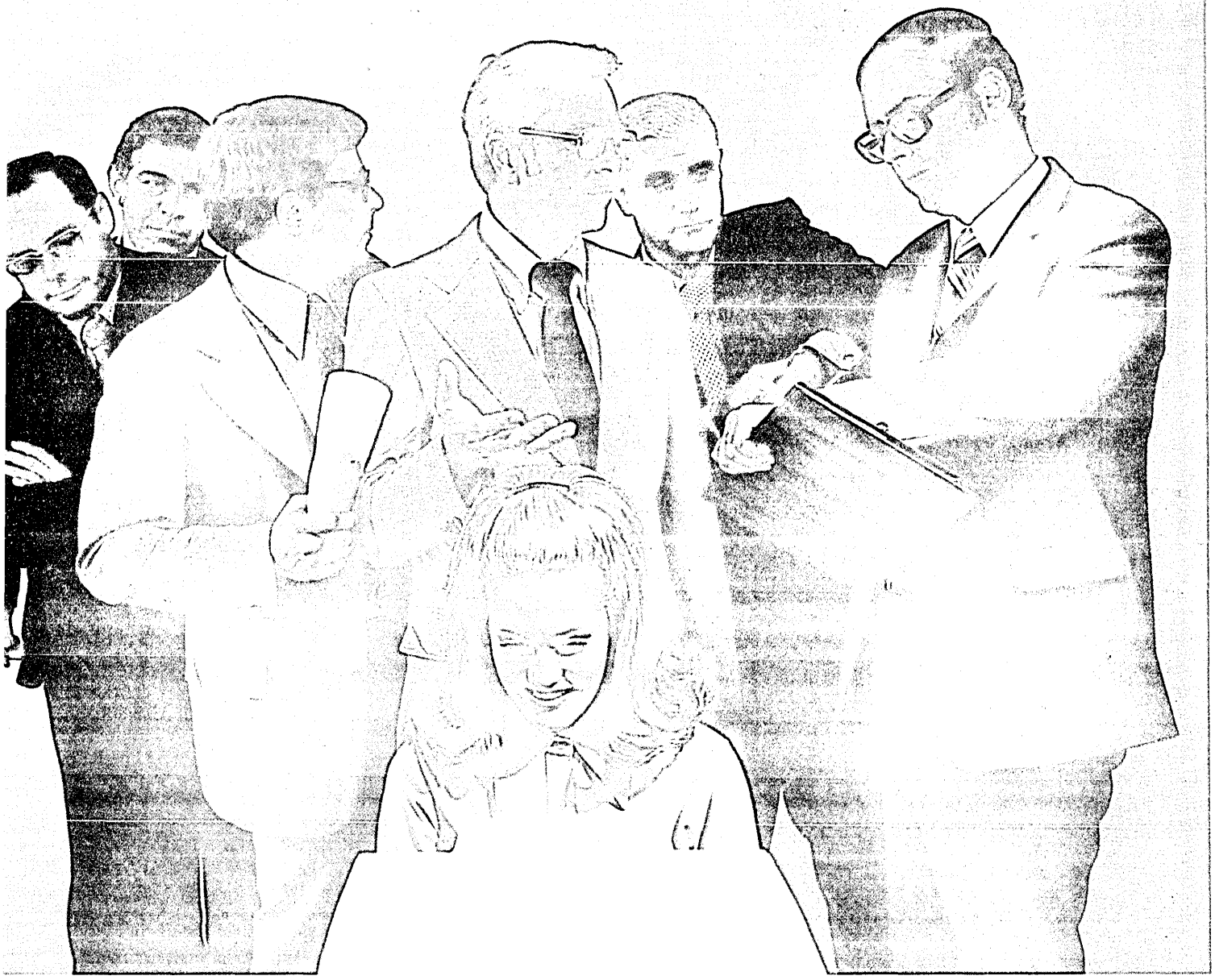

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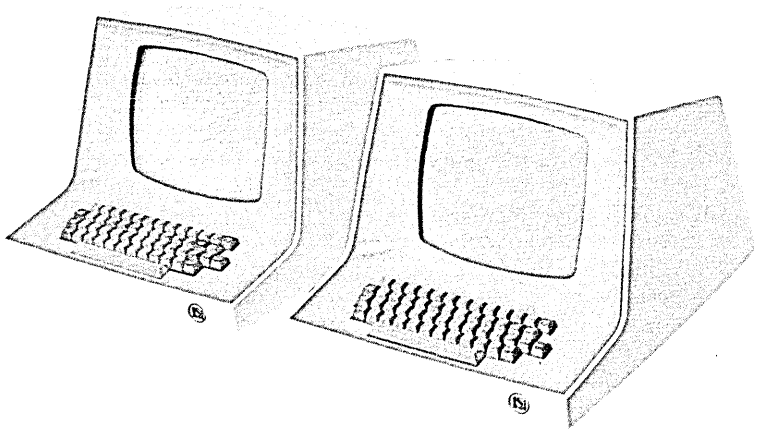

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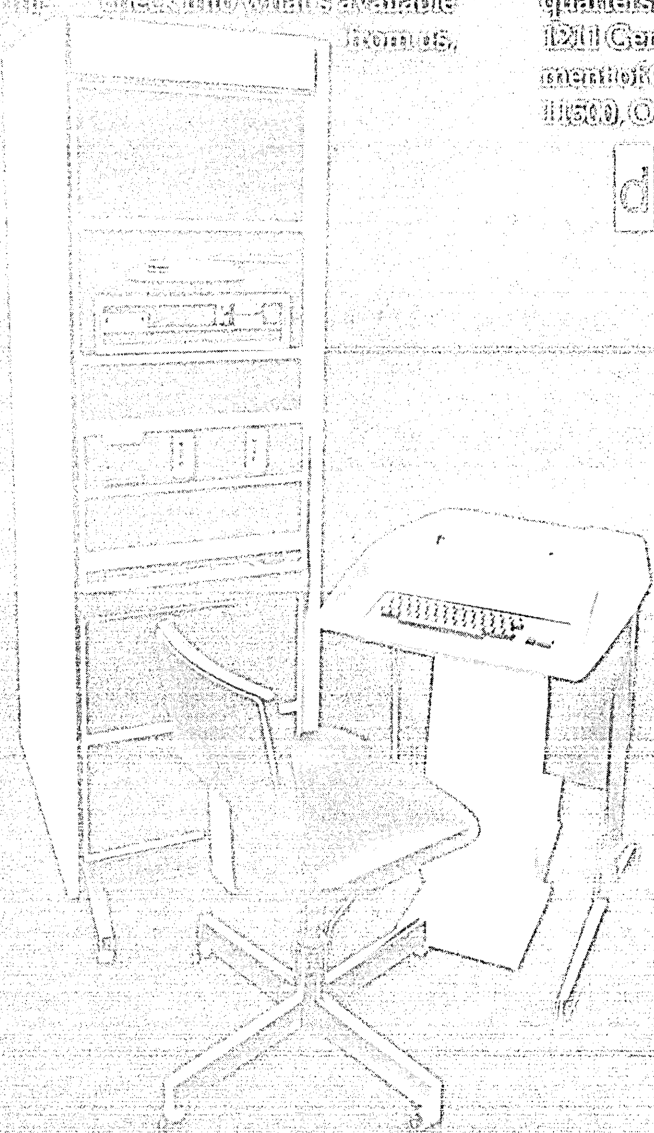

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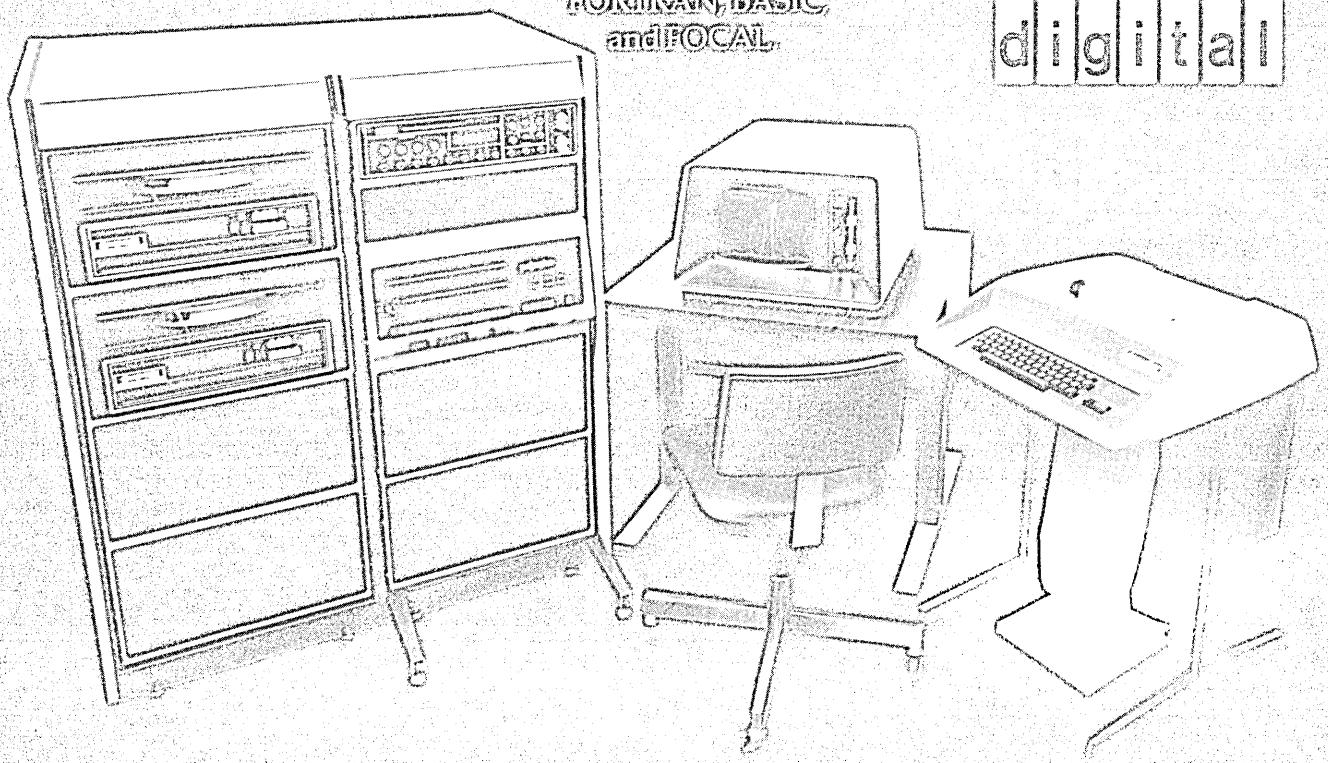

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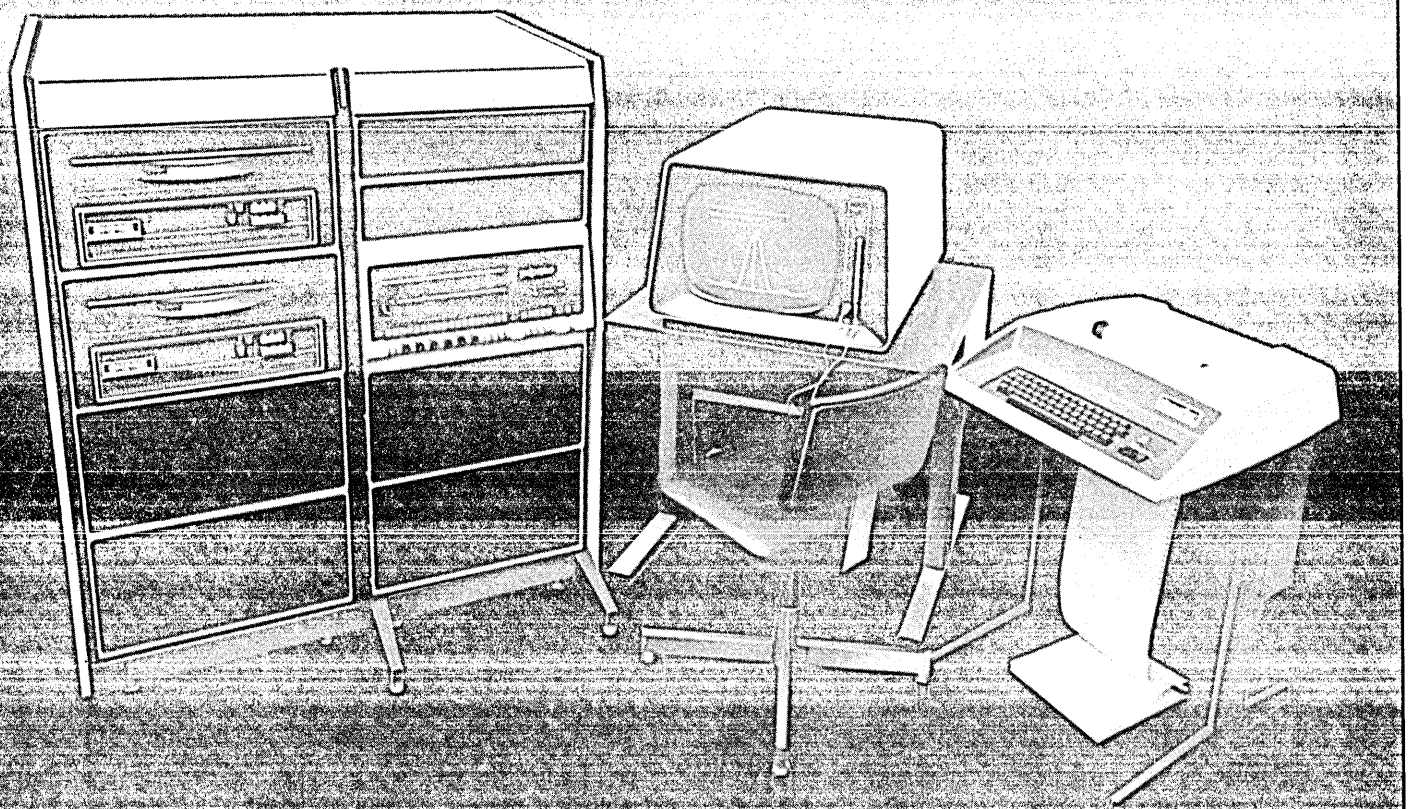

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candidate paths, generate input data to exercise the path, and identify impossible pairs or strings of segment relationships which were not detected by the automated tool, leaves much to be desired.

Test auditing

A number of people in the software industry including our company, Computer Software Analysts, Inc., (CSA), are examining the approach to software reliability by test auditing. In general, this method monitors a piece of software by tracing that software's logical operation during program execution. The analyses that the test auditor presents to the user include data about the program's execution and logical elements. L. G. Stucki of McDonnell Douglas presented a paper supporting his work in this field, and suggested a self-metric systems approach to the reliability problem called PET. This type of an approach certainly makes clear to programmers and management alike the quantity and quality of testing which has been applied to the software under test. CSA has developed a system called QUALIFIER to perform test auditing. QUALIFIER, in addition to determining whether all statements have been exercised, determines whether a wide distribution of input data has been utilized in the testing process.

Management's pessimistic views of software reliability have always been rather loudly expressed and have been right in most cases. Two management themes were presented at the symposium: techniques for configuration management and change control; and techniques for solving the practical problems existing in procuring, developing and administering controls for software reliability.

Configuration Management is a system for accounting and auditing the evolution of a software product. It has been developed over the past decade for the Air Force Systems Command. It is one more attempt to standardize the reliability of all components of a computer system, from concept to completion. A paper presented by O. E. Ellingson of System Development Corp. described the change control procedures which have evolved in the complexities of Configuration Management. We conclude from Ellingson's remarks that Configuration Management is a necessary tool as the foundation for a reliable software system development.

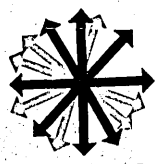
Management's reliability problem was well documented by facts presented by S. Bloom and associates of Bell Laboratories on techniques for software quality control in large systems. Bloom's paper points out that for the Bell System's No. 1 Electronic Switching System, with more than five million programmed instructions, software quality assurance administration alone required an annual budget of $750K. This did not include programming costs, test designing costs, or supporting activities for executing quality assurance procedures.

Turning again to Harlan Mills' presentation at the symposium, he is quite optimistic about the directions of software reliability. In particular, Mr. Mills pointed out that the development of large, nearly error-free programs is not only possible, but also practical using standard programming techniques.

Structured programming is a system of programming rules and constraints for the structuring of program code in such a way as to make it logically consistent. The most well-known characteristic of structured programming is the elimination of the "GO TO" statement. Citing a report in the IBM *Systems Journal* by F. T. Baker, Mills described the development of an online information system with more than 80,000 lines of source code that represented a programming productivity of 10,000 lines per man-year. In spite of its magnitude, the system came down only once from a software error during its first year of operation; a few other errors were detected, but they did not cause system failure. "All in all," Mills says, "the rate of detected errors produced by the principal programmers was about one error per man-year of effort (one error per 10,000 lines)." Mills theorizes that this kind of performance is a result of more widespread education and motivation in the art of programming. As for Mills' speculation that the programmer of the next generation will not only produce less than one error per year, but that he will also remember every error that he has made during his career, one can only hope that this will be true.

The writer must conclude that like the participants and presentations of the IEEE Symposium, the general feeling about software reliability is that it is, indeed, coming of age. Software reliability now expresses a degree of confidence heretofore lacking when speaking of software quality assurance. Modelling and test tools are now being employed with significant success; the art of programming has definitely progressed to the point where it is being recognized as a task that needs definition, and management is seen as attempting to solve the problems inherent in software production.

—Levi J. Carey



News in Perspective

Holding the lion's share of Medicare dp contracts, Electronic Data Systems attracts a lot of government attention. No less than three federal agencies, a House subcommittee, and a state agency are looking into the way the company gets its business, page 130 . . .

When a $40 million computer contract is at stake, the infighting can be tough. That's the way it's been in California (page 131) where an order, expected to go to IBM, blew up last month . . .

The nation now has its first real law concerning the kinds of software that can be taxed, page 133. It happened in California late this summer after a stormy, confused discourse involving that state's tax collectors and the nation's users and vendors . . .

Since the IRS has admitted to giving tax return information to about a dozen federal agencies (page 133), look for a close examination by Congress into how much the Nixon Administration needs to know intimate facts about individuals . . .

Remember the many firms that once offered in-home shopping via computer? Most have failed, but some are coming back (page 137). Is it still too early? . . .

What ever happened to Illiac IV? The massive computer system is alive, and struggling to operate 16 hours a day in California, page 141 . . .

A California hospital adopts a computerized medical information system, page 142. Some like it, some don't . . . but they've agreed to stay with it for a while . . .

Japan is about to become a strong force in world dp markets, page 148. The threat this time may be real.

Mainframers

IBM and Politics: Company Stayed Away While the Watsons Covered the Bases

When a top executive of a large American multinational corporation calls upon the U.S. Secretary of Commerce to explain the firm's balance of trade and other international problems, it would normally be looked upon as a routine business meeting.

But that meeting in 1970 begins to look less routine when we learn that the executive is Arthur K. Watson, who two years later would donate $300,000 to President Nixon's 1972 reelection campaign. The chief fund raiser of that campaign was none other than the man who was U.S. Secretary of Commerce at the 1970 meeting—Maurice H. Stans.

According to IBM's Management Review Committee minutes of January 23, 1970, Watson was going to call on Stans "to seek relief from the balance of restrictions."

While there is no evidence to indicate there is any correlation between Watson's purpose for the meeting and his later political contribution, the whole situation serves to illustrate the web of interconnections that have long existed between the Watson family and influential politicians.

Indeed, the Watsons, from Thomas J. Watson, Sr. to his two sons, stand out in bold relief in the annals of American businessmen who support politicians. The support has been admirable in its non-partisanship. The chief criterion seems to be the same as IBM's—excellence. The Watsons have had an uncanny knack for supporting winners.

Chief issue

IBM's Management Review Committee and Management Committee minutes indicate that Arthur Watson's 1970 meeting with Maurice Stans would focus on IBM's balance of trade payments and on business with Eastern European countries. The chief issue, however, appeared to be the balance of trade matter.

Essentially, IBM was seeking an exception from the regulations of the Commerce Dept.'s Office of Foreign Direct Investment (OFDI), which had been established primarily to improve U.S. balance of trade figures. Basically, IBM appeared to be seeking permission to leave profits in foreign countries to finance growth in those countries rather than repatriate them home to the U.S., as required by the OFDI regulations.

IBM reports that the corporation did receive some exceptions—or "authorizations" as they are called by the OFDI—but that the company did not receive all of what it had requested.

An OFDI spokesman said he could not discuss the matter, because the OFDI regarded all such transactions between itself and companies as confidential. However, the spokesman said that many firms apply for and receive "authorizations" and that such a request and approval from a firm such as IBM would not be unusual.

All in all, considering the hyper-activity between the Watsons and politicians, the IBM corporation itself has been quite free from involvement in politics.

1971 flap

There was a brief flap in October of 1971 when CBS news contacted IBM management and asked it about contracts the firm had with a construction firm owned by then Postmaster General Winton Blount. IBM management speculated at the time that the CBS inquiry had been prompted by a "Post Office bid previously highlighted in the national press by Ralph Nader." Nader had charged that IBM was "locking in" key postal contracts and was moving towards monopolizing the letter sorting system of the Post Office Dept.

When DATAMATION asked about the 1971 flap, IBM had no comment.

Historically, the Watsons have been amazingly adroit in their political contacts. Thomas Watson, Sr. was a Democrat who ardently supported his friend Franklin D. Roosevelt, even during the period when the Democratic president was drawing fire from many businessmen. Later, the elder Watson engineered Dwight D. Eisenhower's installation as president of Columbia Univ., which served as a sort of decompression chamber before the ex-general successfully sought the presidential nomination.

The constant interplay between the Watsons and influential politicians continued with the Watsons' sons. Arthur Watson, who had dated Margaret Truman, later became a loyal supporter of Richard Nixon and has remained so through the years. Nixon selected Watson to be his Ambassador to France in

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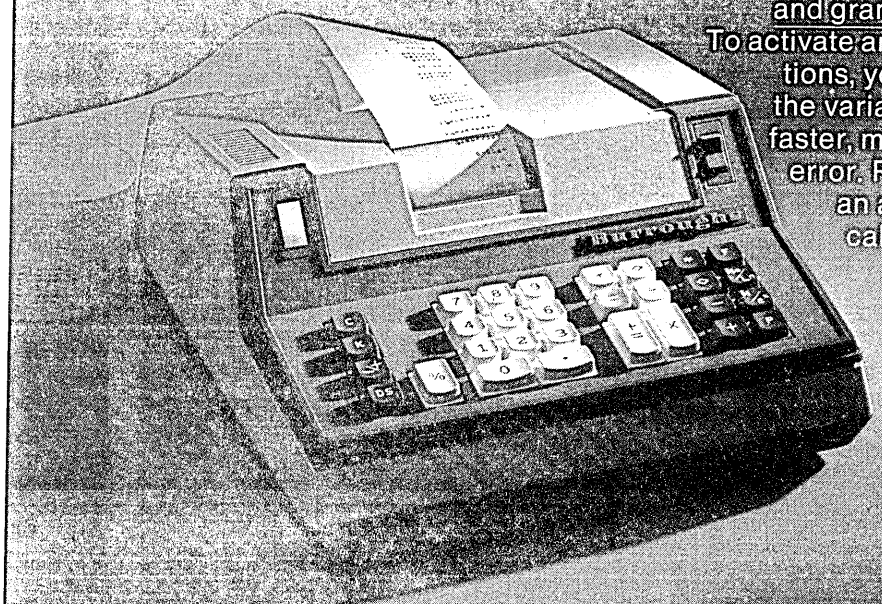

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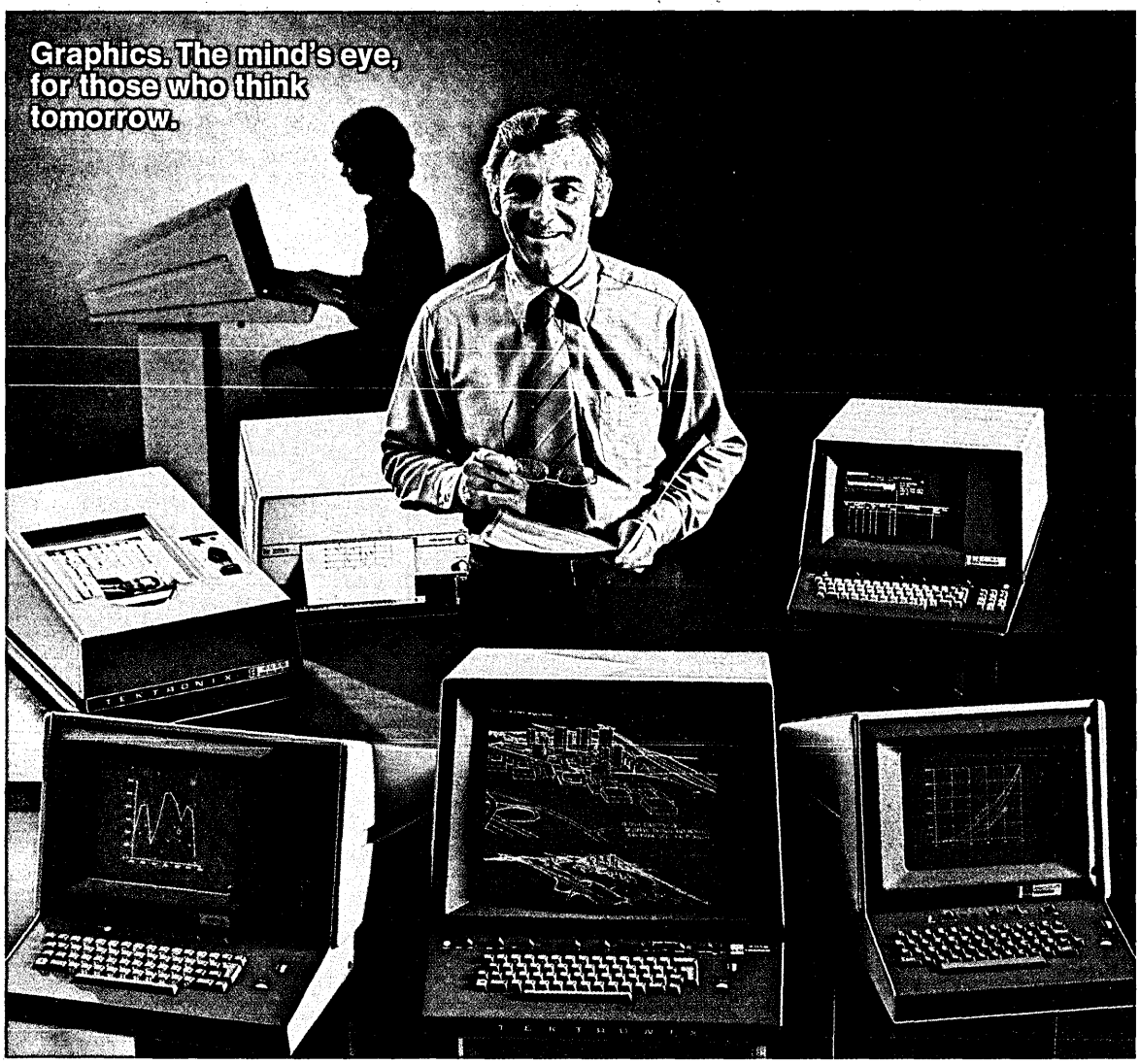

CIRCLE 50 ON READER CARD

1970.

Thomas Jr. worked both sides of the political fence, donating $10,000 to the Eisenhower campaign in 1956 and later becoming very close to the Kennedys. According to the Citizen's Research Foundation of Princeton, N.J., which compiles statistics on political contributions, the younger Thomas Watson donated $10,600 to the Democratic party in 1960 when John Kennedy was running for president.

In 1964, Thomas donated $37,000 to the Democratic party when Lyndon Johnson was the candidate and, in 1968, he donated $11,000 to Humphrey's campaign and another $10,000 to Muskie's. He also gave more than $7,000 to Republican Senator Jacob Javits' U.S. Senate campaign in New York in 1968.

Switch to Nixon

Then, in 1972, Thomas Watson jumped to Richard Nixon, and he and his wife donated—according to some records—at least $15,000 to the Nixon campaign. Moreover, Thomas served as vice-chairman of the Democrats for Nixon committee.

One of the quirks of the 1972 campaign was that Thomas Watson was on John Dean's famous White House enemies list even though Watson later became a Nixon supporter. That dichotomy is best explained by the fact that Watson was a supporter of Democratic presidential hopeful Edmund Muskie and has also been a long-time Kennedy supporter.

Early in the 1972 campaign, Thomas Watson was a Muskie supporter. Although records at both the Citizens Research Foundation and at the GAO's Office of Federal Elections could locate no record of Watson contributing to Muskie in 1972—both organizations are still compiling records of contributions to the 1972 campaign—a spokesman in Sen. Muskie's office said Watson had contributed to the Senator's campaign.

After Muskie's campaign went nowhere, Thomas Watson began appearing as a supporter of President Nixon by August, 1972.

While Watson's friendship with Muskie is not considered to be particularly deep, his friendship with the Kennedys was very close indeed (and presumably continues with Sen. Edward Kennedy). Sources who were active in the late Sen. Robert Kennedy's presidential drive in 1968 report that Bobby was giving serious consideration to asking Watson to become his vice presidential running mate. Later, after Kennedy was assassinated, some of his supporters—casting about for a substitute candidate — considered a Watson candidacy for a brief period, but that idea came to nothing.

A McCarthy choice

During that same 1968 campaign, Sen. Eugene McCarthy said Thomas Watson would be one of his choices for Secretary of Health, Education and Welfare, if he were elected President.

Thus, in a remarkable bit of political maneuvering, Thomas Watson managed to be well-connected in 1968 with all the serious Democratic candidates. Richard Nixon was covered by brother Arthur. Conspicuous by lack of coverage in the 1968 campaign was Nelson Rockefeller, the perennial Republican presidential candidate. While DATAMATION could find no record of the Watsons having contributed to the Rockefeller campaign, it should be noted that George H. Hinman sits on IBM's board of directors. Hinman has managed Gov. Rockefeller's numerous political campaigns.

Thomas Watson didn't win them all, however. In the 1972 Rhode Island senatorial campaign, he donated $3,000 to former Governor John Chafee. However, Watson's wife, Olive, contributed $3,000 to the winner of that contest, Sen. Claiborne Pell, so at least the Watson family continued its streak of supporting political winners.

The IBM executives who have worked their way up through the corporate ranks appear to show little interest in or sophistication for politics. In 1972, for instance, T. Vincent Learson, then chairman of IBM, gave just $500 to President Nixon's campaign while Frank T. Cary, current chairman of IBM, gave $500 to the campaign of Illinois Senator Charles Percy. DATAMATION could find no other political contributions from them. The new leadership at IBM appears to be apolitical.

IBM, however, has occasionally brought in political and government figures to fill top management positions. The most visible of these is Nicholas Katzenbach, current vp and general counsel of IBM, who was U.S. Attorney General at the time his subordinates at the Justice Dept. were beginning the investigation of IBM that would lead to the filing of the present anti-trust case against the firm.

Kennedy confidant

Another who joined the firm was Burke Marshall, former top Justice Dept. official who is a close Kennedy confidant.

What does all this political activity mean? Normally it would mean nothing. But in the light of the government's current anti-trust case against IBM it could mean a great deal.

No less a person than Thomas D. Barr, IBM's lead attorney in the anti-trust case, raised the ugly spectre of politics in the case. Last fall, Barr said, ". . . the timing of the commencement of the litigation has been something that I could never explain to my client in terms which did not include the taint of politics . . . We think that in . . . January of 1969 the IBM Corporation was a political football, and we are afraid that IBM in October of 1972 is about to become a political football here—and the problem with being a political football is that you get kicked."

Barr appeared to be particularly concerned about any rash decision regarding the case being made just before the national elections in November. Nothing significant on the case happened, however.

Raised eyebrows

There is no evidence that political influence or political factors figured in the filing of the anti-trust case. It was, however, filed on the last working day of the Johnson Administration in January 1969, and the timing of the filing has raised eyebrows.

The investigation of the current case began when Nicholas Katzenbach was still Attorney General. IBM has maintained that Burton R. Thorman, who was in charge of investigation of anti-trust cases "had been responsible for the government's investigation." Such activity would come under Thorman's normal duties.

When the case was filed, Ramsey Clark was Attorney General. The case came to him and he made the ultimate decision to file the action. The precise feelings of President Johnson about the case are not known. However, *The New York Times* reported recently that the Justice Dept. had been "persuaded to delay action by President Johnson personally. It is also understood that when Ramsey Clark, then Attorney General, took the case to court, President Johnson reacted with anger."

An undercurrent of politics continued to swirl around the case. In 1972, when IBM attorneys were pressing to bring Judge David Edelstein on a tour of NASA installations, Edelstein, who is presiding over the case, stated in court that he had been told that IBM's attorney Barr was prepared to go to the White House to gain permission to visit the NASA installations. In court, the judge stated that "Mr. Barr indicated that he would to (sic) the Presi-

dent if necessary to obtain clearance."

In addition, there appear to be at least two documents regarding the case that passed between the Dept. of Justice and President Nixon and his staff. The documents are alluded to in a government memorandum filed in the case, but their contents have not been made public.

Attention getter

All this has attracted the attention of the Assn. of Data Processing Service Organizations (ADAPSO), which has urged Atty. Gen. Elliot Richardson to turn over the potential acts of political activity in the case to special prosecutor Archibald Cox for investigation.

Another party that has been interested in the political overtones of the case is the Computer Industry Assn. "We have been concerned about the political pattern in the case," said A.G.W. Biddle, exec director of the CIA. "We're interested in finding out more about the circumstances of Arthur Watson's large donation, and, at the same time, we've been concerned about the excessive delay in the Justice Dept.'s prosecution of the case. It is our hope that Mr. Cox of Sen. Ervin's committee will investigate the matter."

It should be observed that the membership of both ADAPSO and CIA are composed, to a large extent, of IBM competitors.

IBM, too, has had additional complaints about government and political figures misbehaving. The firm has filed papers which maintain that the Justice Dept. has "documents, involving former Atty. Gen. John N. Mitchell and former assistant Atty. Gen. Richard W. McLaren, which discuss injuring IBM commercially through exploitation of delay attributable to the government." IBM believes the two men attempted to persuade federal government computer users not to acquire IBM equipment.

As this is written, IBM had not been able to obtain copies of the documents just as the Justice Dept. has been unable to obtain several IBM documents that it has been seeking.

At any rate, as the case moves ahead it is probable that an increasing amount of time and effort will be expended in examining the past political aspects and ramifications of the case.

—W. David Gardner

Companies

EDS: Feds Want Another Look

How does Ross Perot's Electronic Data Systems do it? The Dallas company, which has enjoyed frequent attention from federal and state investigators over its lion's share of Medicare dp contracts, hit the jackpot this summer: the Dept. of Justice, Federal Trade Commission, General Accounting Office, House Intergovernmental Relations subcommittee, and the inspector general of the New York state welfare dept. were all investigating the company's operations, or preparing to do so.

One reason for their interest is a contract Nationwide Insurance Co. awarded last year to EDS Federal (EDSF), a subsidiary that specializes in processing Medicare claims. EDSF won the job even though its bid was about three times higher than the price quoted by University Computing Utility, another contender.

Rep. H. L. Fountain, chairman of the House Intergovernmental Relations subcommittee, charges "there has been an inexcusable disregard for fair competitive (procurement) procedures and a reckless waste of the taxpayers' money." He based his charge on information in a GAO report on the Nationwide contract.

Newspapers and politicians have criticized EDSF for the way it won two consulting contracts from the New York state welfare dept. One of two contracts involves preliminary study of a statewide welfare eligibility system and the other is a preliminary study of a statewide Medicaid management system. The contract is worth $20,000, but the systems, if and when developed, will cost a total of around $30 million.

Three companies—Touche Ross, IBM, and EDS—were selected to do both studies. Originally it was planned to award the multimillion dollar system development contracts to the firm submitting the best study, but because of a controversy surrounding the EDSF selection, the whole project currently is in limbo.

Perot visits the governor

The controversy arose in February when the New York state welfare dept. sent EDSF a letter saying the company's bid on the welfare eligibility study had been rejected. That letter arrived in Dallas Feb. 2. On Feb. 9, Perot, founder and board chairman of EDS, met privately with New York's Gov. Nelson Rockefeller. Rockefeller's press secretary, Ronald Maiorana, said Perot and the governor are "good friends." Afterward, state officials announced that the Feb. 2 letter had been mailed by mistake and that EDSF was still in the running for the consulting contract. They denied any connection between this apparent reversal of gears and the Perot-Rockefeller meeting.

A source close to the affair said the team that evaluated bids for the welfare eligibility contract agreed unanimously that EDSF had submitted an "incredibly bad proposal." But when the team met with their boss, state social services commissioner Abe Lavine, they found that he thought EDSF was entitled to further consideration. Four days later Lavine became angry when he came into the office on a Saturday and found the carbon of a letter sent to EDSF advising them they were not selected to join five other bidders to make oral presentations. He ordered a second letter sent cancelling the first one.

The *New York Daily News* reported that Wes Amend, a systems analyst loaned to the state of New York by the Dept. of Health Education and Welfare, was sent packing back to Washington because he opposed award of the consulting contract to EDSF. Lavine said, "Amend was not removed because of any question of his technical competence, but rather because he was opposed to Perot's facilities management approach." The newspaper reported that Amend, shortly before being fired, was visited by "three men from EDS" who "spent three hours quizzing me about my attitude and position." The EDS men were identified as James Anderson, Robert Neighbors, and Paul Bucha.

90% to EDS

Rep. Fountain's subcommittee probably will hold hearings on the New York consulting contract within the next few months. GAO also is looking into the matter. The Dept. of Justice and the Federal Trade Commission have been asked to look into the antitrust aspects by Rep. Ben Rosenthal of New York. He said EDS "currently has as much as 90% or more in dollar value of all data processing subcontract work for Part B of the Medicare program."

Basically, the hassle over the Nationwide contract involves the question of whether EDSF ought to be paid significantly more than either of the other two bidders – University Computing and McDonnell Douglas–because of EDSF's better track record in processing Medicare claims. The differences amount to somewhere between $5 million and $7 million over a six-year period, depending on which of three analyses you want to accept.

Nationwide, which made one of

these analyses, argued that the extra expense of hiring EDSF was justified because at the time bids were evaluated EDSF had Medicare dp contracts with 10 carriers. Six of these systems were on-line operations, the same type sought by Nationwide. University Computing, by comparison, was in the early stages of implementing its on-line system, while McDonnell Douglas offered only a plan for converting its batch system to on-line operation.

The Social Security Administration (SSA) made the other two analyses. It found that all three bidders as well as their systems had the "technical capacity" to do Nationwide's job, and concluded that award of the contract to EDSF was "not warranted." Nationwide remained adamant, however, and ultimately SSA had to change its mind. The only concrete result of the disagreement was addition of a complex amendment to the contract which may force Nationwide to pay some of EDSF's charges out of its own pocket.

The GAO report includes a long letter from EDSF vp Gary Anderson, supporting Nationwide's position. Anderson argues basically that EDSF offered a number of technical and support features which the others didn't. He adds that SSA was prejudiced against his company's bid because the other two contenders, UCC and McDonnell Douglas, were offering the "Model B" Medicare dp system, which was developed with SSA money.

GAO concludes that various procurement practices, designed to assure fair competition, were not followed by Nationwide and SSA. GAO says the agency should take steps to prevent a repetition in the future. But a knowlegeable source believes the GAO report doesn't really address the key issue.

Sale sourcing issue

"EDSF may be right when they claim superior ability to process Medicare bills," he explained. "If that's true, however, the Nationwide contract was a sole source procurement, not a competitive buy, since, as EDSF officials insist, their bid wasn't really comparable to the others. In most cases, when a federal agency awards a sole source contract, the winning contractor has to disclose and certify his cost and pricing data. In this particular case, the rule may not apply because of some language in the Medicare Act, but it *should* apply because no one knows, even now, whether EDSF is overcharging for its allegedly superior competence."

In a recent interview, Milledge A. Hart III, president of EDS, said that only 15% of EDSF's costs are not subject to federal audit. They cover general and administrative expense incurred by EDS on behalf of the subsidiary, plus charges for personnel and machine time which the parent company provides when EDSF's own staff and facilities are loaded. Hart said machine time is billed at IBM's published availability rates. The man time charges are also published by EDS and are identical to the rates the company charges its outside customers.

Hart agreed, however, that a federal audit would not be concerned primarily with the question of whether EDSF is paying commercial rates for the services obtained from EDS, but rather with the question of whether EDSF really needs, and is actually receiving, all of the services being billed by its parent company.

—Phil Hirsch

Where EDS Claims an Edge

Electronic Data Systems explained that its extensive use of data processing in handling Medicare claims saves 72¢ per claim over the model system developed with money from the Social Security Administration. Referring to statistics published by the SSA on specific carrier performance, EDS admitted that its dp costs per claim are higher than the model system ($1.22 vs. 85¢), but that its system out-performs the other in reducing clerical and general and administrative costs.

It lists features in its on-line claims control and correspondence control systems that the model system doesn't have. These include crt entry and update of claim locations as well as automated claim splitting and cross referencing. It also maintains an on-line beneficiary history summary and a three month detailed claim history. It uses microfilm records of its monthly claim processing and a paid case index of processed claims.

Other automated features which EDS says are exclusive in its system: automated hospital-based physician claims pricing, verification of independent lab certification, application of provider and beneficiary withholdings, durable medical equipment installments, processing of automatic notification responses, query processing, and resource management systems.

It said these features helped to reduce its clerical cost per claim to $1.26, compared with $2.10 listed by the SSA for the model system. General administrative costs per claim also are lower on the EDS system (57¢ vs. 66¢). The SSA figures show that the total cost per claim under the model system is $3.61 and when the SSA subsidy, figured at 16¢, is added to this, the total is $3.77. This compares with $3.05 charged under the EDS system. □

State Government

"It's a Jungle" Says State Lawmaker

For hardware vendors, California's first major consolidation effort, the proposed $40 million Stephen P. Teale Center, is up for grabs again after a series of hearings, accusations, and other strange goings on which caused one legislator to declare "this is a jungle."

IBM was the sole bidder from a field which once numbered 12 when the bid deadline of July 31 was reached. The center will serve 34 state agencies including the Dept. of Motor Vehicles. The DMV's critical requirements, including a mandatory conversion date of June 1974, were the reason for some vendors declining to bid. Honeywell and Control Data pulled out of the competition in July. Univac said all along it wouldn't bid and filed an objection to the Invitation for Bid (IFB).

Left with one bid (IBM's) state officials hustled last month to get some kind of legislation passed which would allow them to at least consider it. Hearings, held by the Assembly Ways and Means Committee, were lengthy and heated. Somehow it was leaked to the press and to legislators (no one was willing to say by who or why) that the Dept. of Finance's edp expert Kent Gould had a small amount of stock in Boole and Babbage (he once worked there), a software firm which is a subcontractor to IBM, and might benefit should IBM get the Teale award. Ira Isbell, Teale Center director, was accused of holding stock in another company which might benefit, but the accusation didn't hold water. Coincidentally, the wife of Lee Smith, director of the Dept. of Finance which has ultimate responsibility for state edp expenditures, received a series of obscene phone calls on the day the hearings opened.

"No weasel words"

Isbell, Gould, and Smith favored going ahead with the procurement on a sole source basis since IBM's was the only bid they'd received and they liked it. According to Gould it contained "no weasel words." But they hadn't seen the price tag yet and now they never will.

The senate committee members de-

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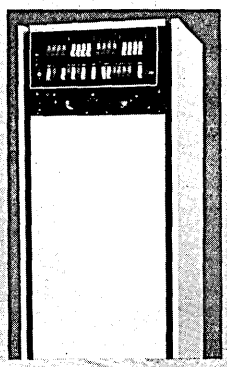

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The senate committee members decided it wasn't their place to legislate for sole source procurement. They legislated instead to send the whole thing back to where it was more than a year ago . . . to the lap of the responsible state agency, the Dept. of Transportation which was authorized to negotiate with all interested vendors and select that solution which is "in the best interests of the state."

This was what had been done once with IBM, the selected vendor. But Univac pressure resulted in legislation requiring competitive bidding and was said by some to have had a hand in the legislation that prohibited award unless there were two qualified bidders. And they now, with all other vendors, have another chance. A decision of some sort was expected by Oct. 15.

Software

California Passes Software Tax Law

With both opposition and time dwindling, California's state legislature last month passed the nation's first real law concerning the subjectability of computer software to personal property tax.

The legislation culminates a stormy, confused discourse which began early last year when the state's Board of Equalization decided software was tangible, and therefore taxable, and drew up a tax rule to that effect. The new legislation, labeled AB 69, was passed by the legislature in the final day of its current session, Sept. 14. It provides for "the valuation of storage media for computer systems as if there were no computer program on such media."

The exception to this, and the subject of the eye of the storm, is "basic operational programs." The amended version of AB 69 passed last month contains a definition of this term which finally seemed to be acceptable to computer software producers and users and to government representatives scared of losing existing revenue.

WEMA, a trade organization headquartered on the West Coast and representing high technology and information processing companies, was principal author of the amendment which defines basic operational programs as control programs which "control operation of a computer by managing the allocation of all systems resources including the cpu, main storage, input/output devices and processing programs."

The amendment was added at the point at which the bill was being reviewed by the Senate Revenue and Taxation Committee. Principal contributing authors who worked with the committee on it were James Case, Dylakor Computer Systems, Inc.; Evan Linnack, Informatics, Inc.; and Eben Tisdale, WEMA's government affairs manager. All were representing WEMA.

AB 69 is an offspring of AB 438, a bill introduced in February 1972 following pressure from industry groups frightened by the Board of Equalization's tax ruling on software's tangibility. Both were authored by Assemblyman Joe Gonsalves and were the subject of many and varied interpretations. The father, AB 438, was intended to put a two-year moratorium on software taxation but it contained the controversial exception "basic operational programs." So did AB 69 which had as its basic purpose indefinite extension of 438.

Problem of definition

Both were beset by the problem of the definition of basic operational programs. The Board of Equalization last fall came up with a lengthy definition that would have included some in-house produced programs. Its definition was a series of a series of vocal hearings in which a number of organizations opposed and approved. WEMA was the most vocal opponent but ADAPSO and CBEMA were there too. Those who liked the B of E definition, besides the board itself, included the County Assessors Assn., the County Supervisors Assn., the California League of Cities, and the state's Dept. of Finance.

AB 69 passed through the state's Assembly with the Board of Equalization's definition of basic operational programs still the only official one. The WEMA-pushed amendment attached in the Senate Revenue and Taxation committee takes the same tack as the Board's definition, according to Tisdale, with the exception that it specifically would not tax language translators, service programs, data management systems, and processes developed by or for a user.

During hearings, while the bill was in the hands of the Senate, committee opponents of the point of view represented by WEMA became fewer. The Board of Equalization didn't even send representatives. The League of California Cities and the state's Dept. of Finance decided that the amendment would not erode the existing tax base and withdrew their opposition. Only the County Supervisors Assn. continued opposition when the bill reached the Senate floor where it was passed 40-0.

Dylakor's Case believes the passage of AB 69 bodes well for producers and users of software throughout the country. "Every state has been watching California to see what would happen. This is just super."

—E. M.

Privacy

Who "Needs to Know" Tax Return Data?

How private is your income tax return? Recent disclosures that thousands of returns are being opened to scrutiny by federal agencies and others have resulted in investigations by Congress, and even the Internal Revenue Service is considering taking a closer look at the Administration's need to know in-

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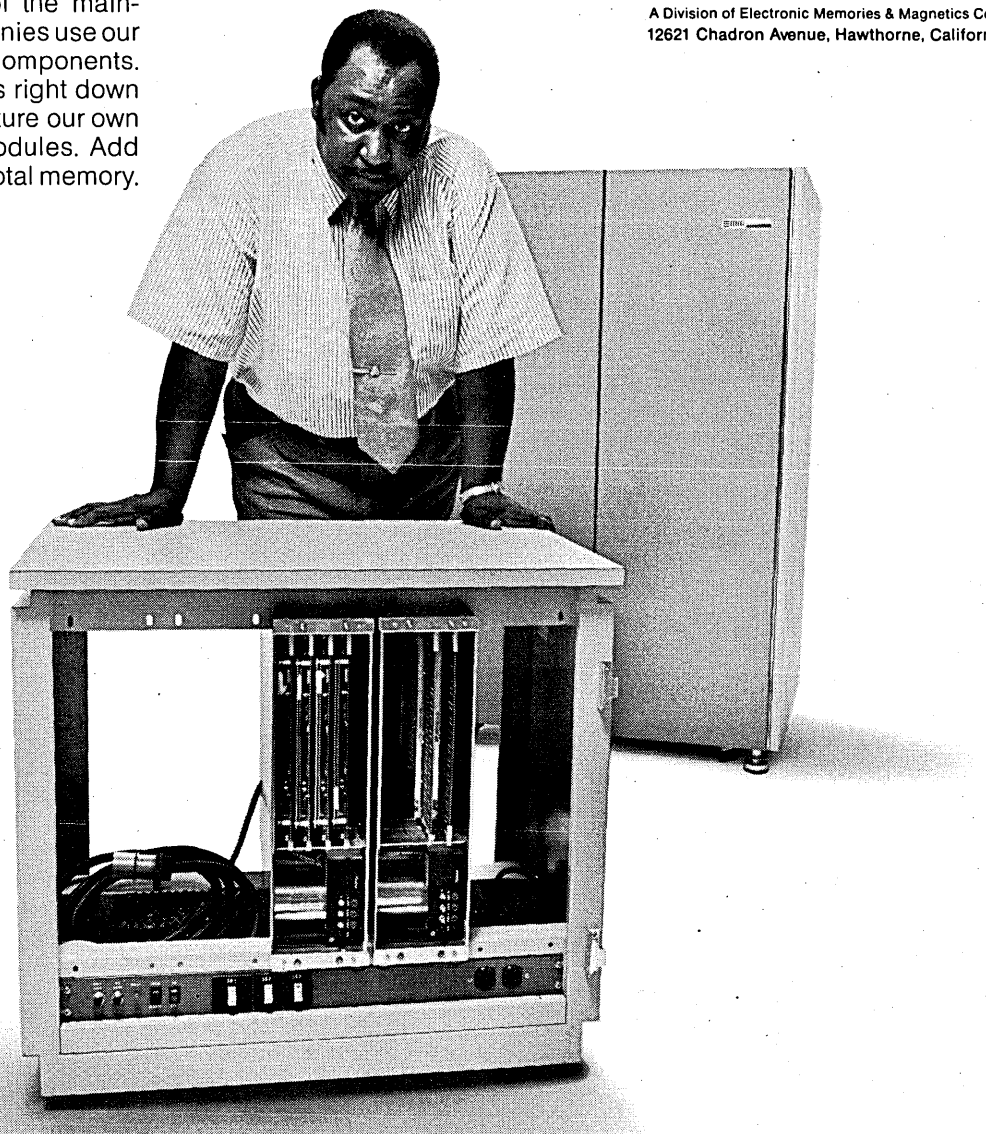

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ing operation.

Rep. Jerry Litton, Missouri, one of the critics of the order, says inclusion of this last item gives agriculture officials entree to just about any part of the return.

A prototype

Hearings by the House Agriculture and Government Operations committees have disclosed that the department received considerably more authority than it had asked for, or needed. This was because "the order was . . . designed to serve as a prototype for future tax return inspection orders," Assistant Atty. Gen. Robert Dixon told the Government Operations subcommittee. He reviewed the document before the president signed it.

Last June, former presidential counsel John Dean shed more light on the matter when he gave the Senate Watergate committee a 1971 memo received from another White House staff member, John Caulfield.

"Republican appointees appear afraid and unwilling to do anything with IRS that could be politically helpful," says the memo, adding that "we have been unable to stimulate audits of persons who should be audited." It then suggests various ways of getting the agency to cooperate. On the last page, Caulfield reports that "a knowledgeable source at IRS was . . . given a hypothetical situation in which the White House made a request for an IRS audit of a group of specific individuals having the same occupation . . . The source suggested that a priority target be established within the group with preference given to one residing within the New York area. He further stated such targets could discreetly be made subject to IRS audit without the clear hazard for a leak traceable to the White House . . ."

The day after this memo became public, Rep. Bill Alexander of Arkansas, in a speech on the floor of the House, pointed out that the Agriculture Dept.'s executive order permits "a department of this government for the first time, to make tax returns available for an entire class of people." And last August, at a hearing of the house GovOps subcommittee, Alexander wondered aloud whether "the inordinate and unnecessarily broad nature of the (Agriculture Dept.'s) executive order . . . had any relationship to the presence . . . in the (Treasury) general counsel's office, and the employment of, John Caulfield and Gordon Liddy during the period. . . this executive order was formulated and ultimately executed."

Alexander's question wasn't answered, but subcommittee sources say it's being pursued. (Actually there is some question whether Caulfield worked for the Treasury Dept.'s general counsel. A department spokesman says he didn't, although Caulfield *was* employed in various law enforcement jobs at Treasury between April '72 and May '73, the period in which the executive order was "formulated and ultimately executed." Liddy was at the Treasury Dept. from April '69 to July '71, but his last three months there were spent in the general counsel's office.)

Besides trying to find who really authored the executive order, the House GovOps subcommittee is trying to deactivate it. Although Agriculture Secretary Earl Butz has refused to delay implementation of the order, his subordinates haven't yet seen any income tax returns. According to Burke Wilsey, an assistant to IRS Commissioner Don Alexander, this is partly because some details of the information-gathering operation haven't been resolved, and partly because of the House subcommittee's "reservations."

Wilsey added that his agency is now drafting proposed amendments to Section 6103 of the Internal Revenue Code, which governs disclosure of income tax returns. He indicated the proposals probably will be submitted to Congress before the end of this year.

—P. H.

Feds Denied Data in Privacy Issue

New Hampshire, Alaska, Pennsylvania, and South Dakota have joined Massachusetts in refusing to provide the federal government with personal data on individuals participating in a federally-funded drug abuse program called CODAP (see September, p. 119). Thirty other states have expressed "serious concern" about Washington's demands for this information.

When Massachusetts balked at federal demands, the Special Action Office for Drug Abuse Programs, a White House group which conceived the CODAP program, backed down and allowed the state to receive its share of CODAP funds, amounting to $9 million, without disclosing sensitive information about individuals participating in the program.

The 30 states that recently expressed concern about this aspect of the program made their feelings known to the National Association of Drug Abuse Administrators (NASDAA). A special NASDAA subcommittee was scheduled

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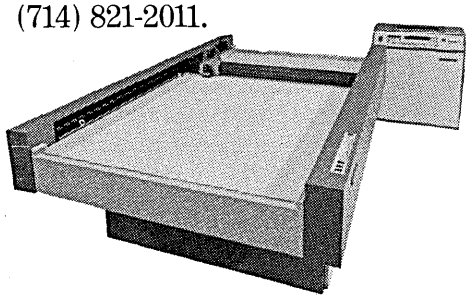

CALCOMP

last month to hold closed-door talks with White House representatives, and with officials of the National Institute of Mental Health, the program administrator, to discuss confidentiality and procedural aspects of the CODAP program. Gov. Francis Sargent of Massachusetts has urged the subcommittee to reject further participation if they can't persuade the feds to abandon their demands for sensitive data on participants. The Massachusetts delegation to the Sept. 13th meeting wanted an open session, but NASDAA decided that the discussion would be held behind closed doors.

Protect the President

Meanwhile, the Secret Service has tried, but failed, to get information from Massachusetts about 20 individuals with mental health problems. The agency contended the information was needed to protect the life of the President. The request was denied because the Secret Service did not specify what information it wanted, and the bay state was not about to turn over complete files. Under state law, mental health files cannot be released without a court order or unless it is determined that disclosure is in the patient's best interest. So far, the Secret Service hasn't pursued the matter further.

Copies of Massachusetts mental health records are stored in a computer system, located in New York state, which supports a federally-funded program called the "Multistate Information System" (MIS). Its regulations require all access requests to be funneled through the participating states. But Chester Atkins, a member of the Massachusetts senate, isn't satisfied.

He has threatened to hold up approval of $344K which the state needs to continue participating in MIS. As a result, Gov. Sargent has announced that names and social security numbers will no longer be sent to MIS, and state records already fed into the MIS data base will be purged of this information.

Atkins heads a state senatorial committee on data processing which is drafting a report on H.E.W.'s recent recommendations concerning protection of individual privacy. The "Atkins Report" is expected to be the basis for new state legislation next year.

On the national level, California Rep. Barry Goldwater, Jr., has introduced two bills aimed at implementing the H.E.W. recommendations. One measure limits the use of the social security number to agencies which must, by law, obtain the information. This bill, which also allows an individual to refuse to disclose the number in all other instances, has been referred to the House Ways and Means committee.

Goldwater's other bill establishes a "Code of Fair Information Practices," like the one recommended by H.E.W. It would allow the individual to see his record, and to correct erroneous entries. This measure has been referred to the House Judiciary committee. Legislation affecting computerized criminal records systems is expected from Goldwater shortly.

Retailing

In-Home Shopping: Is Now the Time?

Talk of in-home shopping via computer is as old as the computer industry itself.

So far, attempts to offer such services have been noteworthy for their successes and failures – successes in terms of consumer acceptance, and failures of systems to cope with this acceptance.

And the systems failures weren't necessarily machine failures. One of the first companies to offer such a service, Telemart Enterprises Inc. of San Diego, operated only 11 days before folding in the fall of 1970. One reason given: the computerized portion of the system was working fine, but the company was getting an average of 3,000 orders daily, and warehouse personnel collecting ordered items from shelves couldn't keep pace.

E. J. Crofoot's Store-to-Door, in Sacramento, operated a little longer than Telemart – from Sept. 7 through Nov. 4, 1972. Crofoot isn't sure what was to blame, but he feels he knows who – Univac. He and other founders of the firm have filed a $21 million suit against Univac for failure to live up to a contract which Crofoot said included furnishing hardware, and programming and operating the computer system for the first full year of the company's operation. Univac's Sacramento branch manager, Malcolm Hill, had only one comment: "The claim is invalid."

Crofoot said he and his associates were determined to obtain a single source for hardware, programming and operation because "we lacked knowledge of computers ourselves and in case of difficulties we wouldn't know what to blame." When he first conceived the plan for Store-to-Door, he said, he was "very much inclined to want IBM equipment and we worked with IBM for three years. IBM spent $250,000 with us." But, when it came down to programming and operation, IBM would recommend outside firms and that wasn't what Crofoot wanted. He said his contract with Univac stipulated the ability of the system to handle 3,400 orders a day averaging $25 per order. "It didn't begin to approach that. The best it could handle was 500 orders."

Nothing on schedule

Store-to-Door promised afternoon delivery on items ordered in the morning and next-morning delivery for items ordered in the afternoon. This slipped right away to some time the next day for all orders—it took all night to process and collect the orders, and even then, invoices weren't printed in time. The system was supposed to take orders from operators in the order the customer requested and print out a pick-list which would be in the order in which products were stacked in the warehouse. It did this too slowly, according to Crofoot. Then the system was supposed to take the order list as entered by the warehouseman, reverse the sequence of items to match the customer's order and print an invoice. This it never did, Crofoot said.

He still thinks in-house shopping is the way to go and he plans to try again, next time with minicomputers. He says he's hired several computer consultants to look over the mini field for him.

"I had enough experience to know that acceptance is so great that this is definitely the coming method of the distribution of foodstuffs. Supermarkets have developed bad practices over 40 years, and so many expenses have crept into their operation that it is no longer economically feasible to distribute food in that manner." Crofoot feels he can distribute foodstuffs by the Store-to-Door method at 5% less markup than can supermarkets.

Crofoot was an early-day participant in the setting up of Seven-Eleven markets, and is a former chairman of Lucky Stores.

He'll start slow

A newer entrant to the in-home shopping scene came not from the market ranks but from the computer industry. Mark Weiss, a 29-year-old former IBM employee, last month launched Call-a-Mart in Louisville, Ky. He believes he has licked the problem of too much too soon by starting slowly. He limited the initial $5 memberships to 300 families from selected zip code zones and, at first, allowed only 500 members to place orders each day.

Shoppers pick what they want from a catalog that is updated regularly. Customers may call in between 7 a.m.

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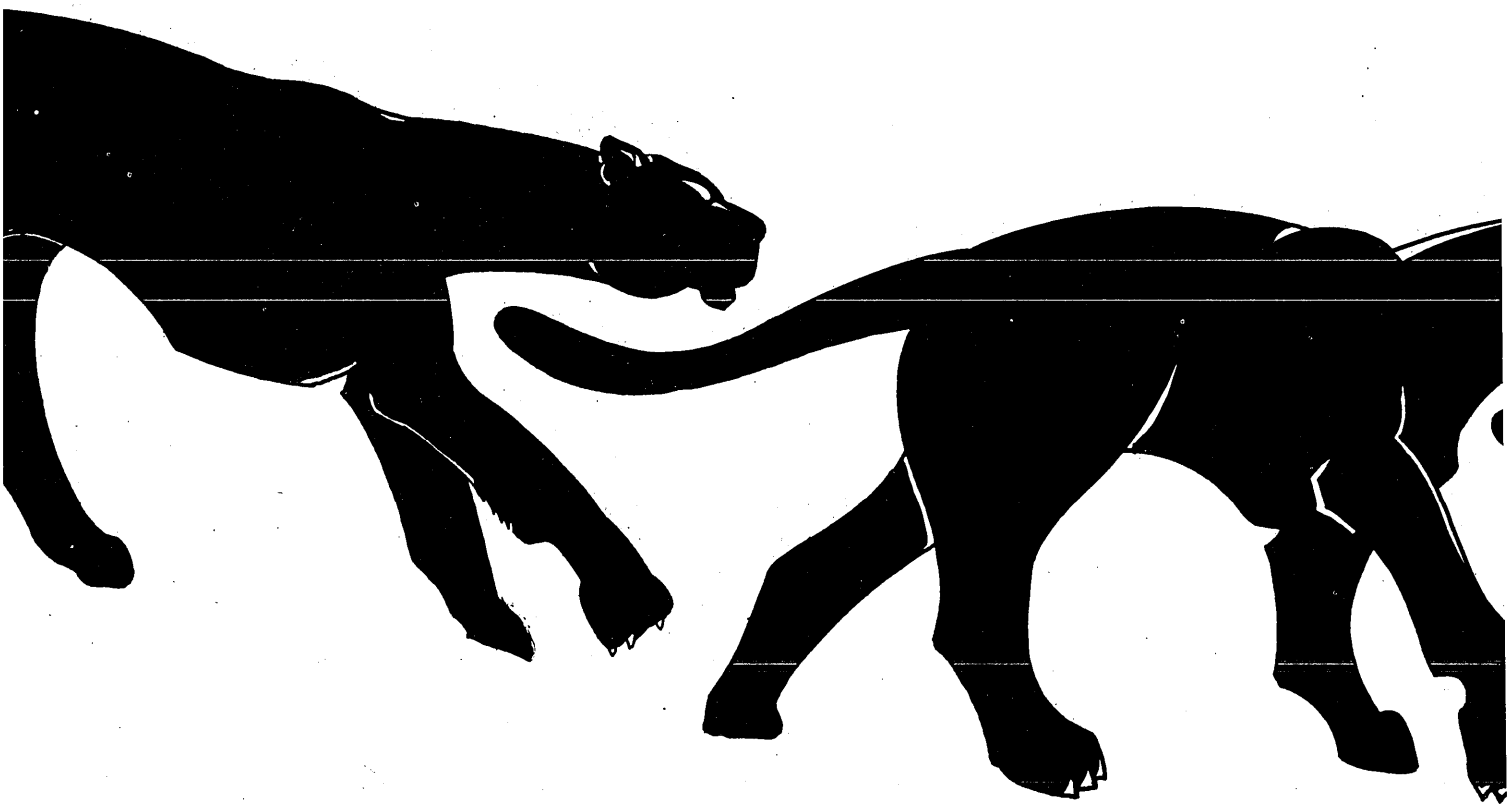

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The mini killers
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and 9 p.m. Monday through Friday. After a three-way telephone conversation involving a shopper, the computer and a key-punching Call-a-Mart operator, workers along computer-guided conveyor belts in a warehouse fill the order. The system then picks the best delivery route.

If the shopper places an order before noon, same-day delivery is offered free if the order totals $20 or more. There's a $1 delivery charge for smaller orders. So far Weiss' system seems to be working.

Dial a low price

One that isn't working yet, but when and if it is will be by far the most ambitious in-home shopping service offered to date, is that planned by Computer Shopping, Inc., Washington, D.C. This company will not stock its own warehouse. Its stock will consist of the stocks of any and all retailers and wholesalers in a given area wishing to participate.

The proposed system would work this way: A consumer would look through an alphabetical merchandise directory to find a special product code for whatever he wants to buy. Then he would call the firm's computer, using a touch tone telephone, and would dial in his identification number and the appropriate product code. He then would hear a computer-generated voice response telling him the five lowest prices asked for the product he wants, by five different merchants in his area, and the names of these merchants. On a sale of $10 or more, he could actually place an order by pushing the asterisk button on his phone. A human operator then would come on the phone to verify identification and to record planned mode of payment. The computer then would print out a shipping label/purchase order on a teletype, via phone lines, in the appropriate store or wholesale warehouse.

The consumer would pay an initial $4 fee to Computer Shopping, Inc. to get a merchandise directory and to have his name and address entered into the firm's data bank. He then would pay 1¢ each time he requested a price quote. These charges would be accumulated and added to his bill each time he bought anything.

Merchants, using a touch tone phone and a special security code, could enter and change prices as frequently as they wanted, without charge. They would, however, be charged a 5% fee each time a Computer Shopping customer made a purchase through the system.

Richard A. Ahern, president of Computer Shopping, said the firm currently is developing audio multiplexing technology which will reduce costs per price quote to less than a tenth of a cent, allowing a quarter-cent charge per price quote to the customer, and making it possible to add a full line of food products to the directory, some selling for as little as 10 cents.

Ahern said Computer Shopping has designed and integrated its computer itself, using a network of Intel in-26 semiconductor random access memory systems, Vortrax V phoneme synthesizers and a number of components of its own design.

In tomato red

"Within 18 months," he said, "we will have technology that will allow high-speed transmission of color images over voice grade telephone lines. At that time the consumers will be able to see the products on which they are being quoted prices right on their home television screens." Computer Shopping will offer its services initially in the Washington, D.C. area some time this year. During 1974, Ahern said, "we will sell licensing rights in more than 50 American cities. By the

end of the following year, we should have more than 100 systems installed and working."

As Weiss of Call-a-Mart thinks he has learned from the mistakes of Telemart, Ahern thinks he has learned from his own mistakes. An earlier venture, offering a similar shopping service under the name Price Club of America, failed, he said, because he made two serious mistakes. He signed contracts with independent marketing companies and distributors which allowed them to sell unlimited numbers of distributorships, but did not require them to support or train the new distributors. Also, the company did not develop an audio response price-quoting and order-taking system, due to high computer costs and unallowable time delays, and wound up swamped with paper work and unable to make money on costly clerical price quotes, most of which did not even result in orders.

Acceptance of those in-home shopping services offered to date would seem to indicate that the consumer is ready for it. Maybe the technology is too. Time will tell.

—Edith Myers

Technology

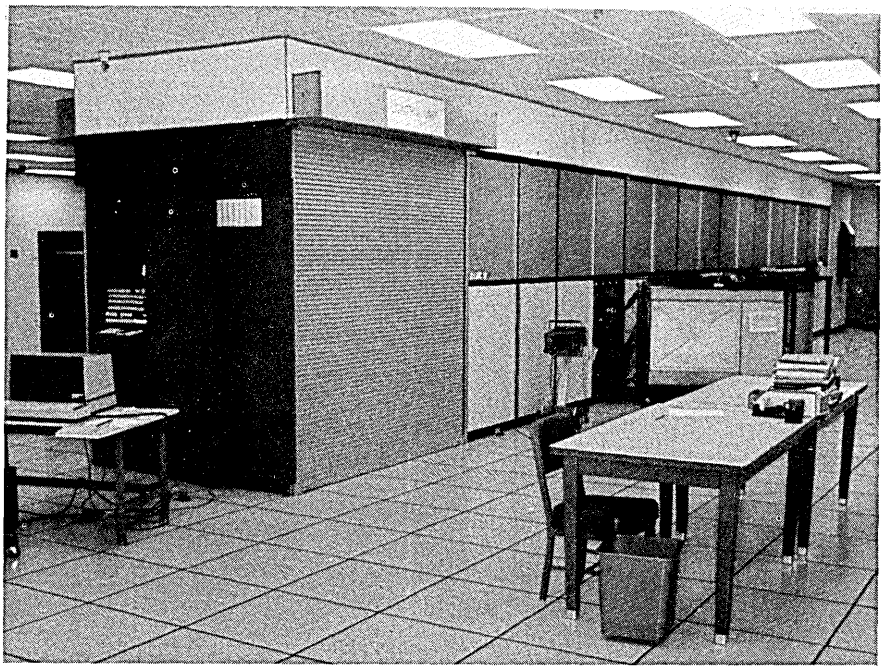
Illiac IV Running Eight Hours a Day

It's been eight years since the Illiac IV parallel array processor was conceived at the Univ. of Illinois under Prof. Daniel L. Slotnick. But it'll be another year and a half before the system is available to its ARPA network users for some 16 hours a day. Currently it's up and running only about eight hours a day, says Mel Pirtle, who's responsible for getting the system on the air, and the longest job to date has been a program that ran about 10 minutes. But Pirtle hastens to add that test programs of "many hours" in duration have been run.

It was in 1967 that Burroughs Corp. was given the contract to convert Slotnick's design into hardware form, delivering it last year to NASA's Ames Research Center in Mountain View, Calif. (Other sites that bid for the system were said to be Los Alamos and Kirkland AFB.) There, an Institute for Advanced Computation was formed to pump life into the large computer, to integrate it into the ARPA net, and to operate it. The system is not yet fully operational, and won't be until next summer, Pirtle told a small gathering of journalists. He was asked whether there would be any real-time processing, and his deputy, Ron Schwartz, said they anticipated the worldwide collection of seismic data for transmission to the center in real-time. But it wasn't certain that the Illiac would be involved; other elements of the system could be used for real-time data collection/retrieval functions, he said.

Other applications for the Illiac, a $35-million investment to date and currently requiring a $4-million/year operating budget, include huge dynamic simulation and optimization problems, as in global climate predictions, aircraft and spacecraft designs, logistics, and economics.

The other elements of the system—PDP-10s and -11s and a laser memory—play important supportive and control functions. Supplying such utilities as a general purpose text editor, language translators, and an Illiac IV simulator, they make it possible for the user to perform his program preparation without tying up the Illiac, and to submit his data in the same off-line mode. Similarly, they store the results of computation for recall by the user. Once the program has been developed, however, final testing involves use of the Illiac.



ILLIAC IV mainframe installed at NASA's Ames Research Center.

Super processing

Thus the Illiac IV houses no operating system and performs no utility functions, but instead is dedicated totally to the execution of user code. It consists of one control unit for instruction decoding/program control and 64 processing elements (arithmetic and logic units). The processor has a 256K (32-bit word) semiconductor memory with a 300-nsec cycle time and 32 million words stored on a head-per-track disc file capable of transferring its entire contents in one second. The parallel processor, which has execution overlap, performs an average instruction in 7 nsec, a 64-bit floating point normalized add in 300 nsec, and a 64-bit floating multiply in 600 nsec. Handling up to 64 independent data streams, it reportedly comes to something like 150 million operations a second.

The system configuration currently includes two Digital Equipment PDP-10s, six PDP-11s, and the Unicon laser memory from Precision Instruments. The PDP-10s execute all of the software subsystems that provide direct support to users, running under the Tenex operating system. Performing system management functions not controlled directly by the user are the PDP-11s, which execute communications, diagnostic, and device control functions.

Pirtle said the mean time between failures for the Illiac would be "in the neighborhood of eight hours," but added that the remainder of the system would be available to the user for his program preparation and data input and retrieval operations, even when the Illiac is down.

Then there's the Unicon, which records permanently on flexible data strips and has a capacity of 700 billion bits. The unit holds up to 450 strips, each storing about 1.5 billion bits. In the data path from the outside world to the Illiac, the Unicon is both the first and last stop, which means the laser will be burning a lot of holes in a lot of strips. And, according to Pirtle, there will be a need to store off-line some 25-35,000 strips. That's the equivalent in bit storage of about a million reels of mag tape.

—E.K.Y.

(Continued on page 142)

Hospitals

What Will They Zap at El Camino? The Crt, or the Two-Year Old MIS?

Mention the computer to some doctors at El Camino hospital in Mountain View, Calif., and they become profane. Some nurses, too, are vocal in their dislike for the hospital-wide medical information system (MIS). Indeed, no one there seems any too sure about the fate of the system, although opinion surveys of the medical staff seem to indicate a more positive attitude toward it with the passage of time. Efforts of a very vocal minority to have the system thrown out have, to date, failed. But the U.S. Dept. of Health, Education and Welfare has shown sufficient interest in the system, which at this time must be considered experimental, to have coughed up slightly more than $1 million in the past three fiscal years to support the study and developmental effort.

Many people believe the problems lie in the fact that El Camino was the guinea pig in the development of the system. The system's developers made their feasibility study at the hospital in conjunction with the staff, and started placing various administrative and operating departments on-line when there were still many bugs to be ironed out. The medical staff had to dispense patient care through this trying development period.

"I wish we could start all over with the system we have today," says an administrator.

The administration of the 450-bed, tax-supported community hospital has more than a passing interest in the system. Perhaps more than most businesses, hospitals are acutely aware of their increasing operating costs. Since 1961, the price of a one-day stay in a 4-bed ward at El Camino has risen from $24 to $59, and the starting pay of nurses has gone from $360 a month to more than $800. Nationally, operating costs have been increasing 10-15% a year. Since 1966 the average cost of a day in a hospital has risen about 92%, according to data gathered by the California Hospital Assn. And last year the U.S. population spent $32.5 billion for hospital care.

Systems designed to cut administrative costs in hospitals are popping up across the nation, and serious developmental efforts by individual hospitals, research organizations, and for-profit companies are legion.

El Camino was approached in 1964 by Lockheed Missiles and Space Co. in nearby Sunnyvale, which wanted to study the problems of information handling in a hospital and the feasibility of a medical information system. The study team had grown appreciably when the recession hit the aerospace industry, and two years ago the system and the organization of some 100 people were sold to Technicon Corp., a manufacturer of instruments and equipment for the health care field. The activity is now carried on by Technicon Medical Information Systems Corp., Mountain View.

NEW ORDERS: Doctor updates patient orders with a lightpen. Nurses wonder if a printer is better than the old reliable card indexes.

El Camino became the initial installation after a study by the hospital indicated a savings after five years of $82,750 a month. Over the initial five-year span, it was estimated, the savings would average $63,000 a month. Most of that would be in the cost of labor, according to R. Edwin Hawkins, administrator. Labor represents approximately 66% of the total budget at the hospital.

Installation of the system began in December 1971 with the admissions dept., and was completed with the emergency dept. in October '72. An early estimate placed anticipated savings during the first year of operation at some $48,000 a month, but it currently is running at between $35-40,000 a month, according to Hawkins.

Fifty terminals

Starting at a patient's pre-admission stage, El Camino's real-time system handles admission, builds data bases, performs requisitions and scheduling, and produces the billing when the patient is discharged. There are some 50 crt/keyboard terminals with lightpens scattered throughout the hospital, some in conjunction with a 250-cps nonimpact printer installed where hard copies are required. The terminals are linked by 50-kilobit phone lines to a 768K 370/155 at the Technicon facility, a system backed up by a 512K Model 145 with fewer channels. Thus if the 155 goes down, there's about a five-minute lapse before the 145 can take over to provide a somewhat degraded quality of service.

From anywhere in the hospital, a doctor can sit at a terminal made by Computer Communications, Inc., key in his code number, and receive a display of all his patients. He points at one of those names with the lightpen and then can specify new orders for that patient or review previous orders or test results. Writing a new order, or renewing or discontinuing a previous order causes a "new orders" sheet to be printed at the patient's nursing station. At the same time, orders are automatically printed as service requisitions in the appropriate hospital department. If it's a drug order, two documents are automatically printed in the pharmacy: a prescription record and a gummed label for the medication bottle. Dietary orders go into a consolidated "diet orders" list produced before each meal, and the printout is in bed number sequence with a separate page for each nursing station.

Some follow-on documents also result from medical orders. A "medication due" list is printed at each nursing station for each hour of the day, and a "daily orders summary" shows newly written orders as well as all current ones. Reminder notices are printed for overdue lab work and medications. And if an order is to be performed at some future time, the requisition is printed in the appropriate department on that date.

Similarly, results of lab tests or X-ray examinations are input to the system by those departments, and the results are available for retrieval from any other terminal. Since all such activities become a part of the patient's record, it's simple to produce a bill when he is discharged.

Zapping is delegated

It all sounds attractive and one would think it would have appeal to everyone involved. But not so. For example, the system is designed to facilitate the input of orders by doctors, who need only key in their code numbers and thereafter rely primarily on the lightpen. Simple? No, it's more work than it's worth, some say. So they continue to write their orders by hand

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and order a nurse to do the inputting. Simple? No, not all nurses can type; indeed, some hate it. Nor do they all enjoy "zapping" the crt as they call it, referring to the use of the lightpen.

One registered nurse tells of spending a quarter-hour at the terminal, laboriously typing with one finger, only to have the system go down. When it came back up, she had to start all over from the beginning. Another tells of the frustrations of looking for the correct entry to zap with the lightpen, knowing it was there but unable to locate it. But still another had no objections, finding that with practice she is able to zap page after page of displays to enter the fact that she had given a certain medication to a certain patient at a certain time.

Some doctors can zap with equal facility, but those who choose not to can still write their entries and have a nurse make the input. At least one doctor likes his information formatted in a certain way, so a nurse has to input the data to the system and also write it manually for the patient chart.

The patient chart, a sheaf of assorted papers held between metal covers, is also a point of contention. As any television viewer knows, doctors get updated on their patient's care and condition from the chart by rifling through its pages. But they say the number of pages has increased inordinately with the installation of the system, and data they formerly found on one or two pages is now scattered on numerous pages. No longer do they have the graphs of vital signs formerly drawn by nurses that showed at a glance an important trend they might otherwise miss. Some nurses, too, say they could get more information on a patient from the old card indexes they maintained than from the modern printouts in the chart. But others found those cards too messy and illegible, as they contained handwritten entries by an assortment of nurses.

An indication of this problem is also expressed by a nurse's aide on the night shift who previously spent an hour each evening on all her patient charts, a job performed during the day by the ward clerk. Now, she says, she must contend with a printer that runs intermittently during her entire shift, producing printouts that must be burst and stuffed between those same metal covers.

Limited access to the terminal also presents a problem. At a typical unit, wing, or department, there might be three terminals and a printer being used by perhaps a dozen people, not counting doctors. And when a nurse wants to record an action she has taken, all the terminals might be busy; under the manual system, she merely wrote out her entry for the chart. Or she may be in the midst of composing her message when a patient calls, and would hesitate to answer the call immediately lest someone else erase her incomplete message during her absence from her desk.

Among the medical staff, the internists are most in opposition to the system, although there are doctors in each department who feel the same way. "The opposition stems from a number of things," says Dr. Ralph Watson, a surgeon who is also chairman of the physicians committee at El Camino. "To start with, there was no strong feeling at this hospital that we needed to change." He adds that the internal medicine floor was the first to get the system. "And as you can imagine, there were many bugs in the program. We had done field testing. We had done everything you could think of to test it out."

But in the first year of installation, more than 2,000 changes had been made to the system, he continues, in-

cluding things like the appearance of reports, the way medicines are scheduled, the way reports are handled. About a third of them were program bugs, another third were modifications to suit the hospital personnel, and a third were changes designed to reduce human error. Like, make input more foolproof. Printouts of reports, for example, received considerable attention, resulting in a form with a number of type sizes and densities by which to highlight the important information. Even documents that are to become a permanent part of the patient's records are quickly distinguishable from temporary documents, and lab results are printed to highlight those tests where findings are outside the normally accepted range.

In the summer of '72, the internal medicine dept. took a poll by ballot. At that time 66% of the doctors voted against the system. Last January another survey was made of the entire hospital. This time 60% of the internists continued to oppose it, a reduction of 6%, but every other department voted in favor of the system, according to Dr. Watson. The net result: 46% voted in favor, 42% were in opposition, and the remainder had no opinion.

Still, the system works, its acceptance rating continues to go up among its users, and improvements are being made. And this is a point made by Margaret B. Cook, the hospital's nursing staff MIS coordinator. A few medical staffers have been working with the developmental effort for five years or more, some have been exposed consistently to the system since 1970, and many have been using it since October '71. They've been exposed to the bugs and glitches. And even today they must perform their professional duties with a system that is only half completed, one that is still undergoing change.

Head nurses, particularly, says Ms. Cook, now have a great deal more time to spend on things that are patient care-oriented, rather than paper-oriented. About a year ago, she explains, the system went down for four hours during the night, forcing nurses to revert to manual procedures. "And it was a shock to realize how much paperwork they had to do under the old system that they no longer had to do."

Continuing, she says that to date the nurse's functions have taken a backseat in the design of the system. "We have a good medication system, but that isn't the thing that nurses are most interested in. We benefit because the doctor's ordering system is good. But the things we're interested in are care planning, the things nurses do in caring for a patient, and the reporting of what they've been doing. We're really just getting into the best development now." Despite this, she says, nurses consider the system a boon to their work.

Concept spreads

Fifty miles to the north, in San Francisco, the Franklin hospital has begun installing the system. They, too, will be sharing Technicon MIS's computer in Mountain View, using some 22 terminals and 17 printers. A further indication of the Technicon system's acceptance is the acquisition of the software by Nebraska Methodist hospital in Omaha, which has its own 512K 370/145.

"The strong point (of the MIS) is the adaptability of the system to our environment," says dp director H.D. Koch of Nebraska Methodist. "We're not locked into what they have programmed, in effect, because it's all screen and table driven." He adds that they will be making some changes to the software, such as in the formats of reports, to suit their needs. "All you have to do is change the table instead of changing the program." For things like formats of reports, he explains, they need change only the format generator table.

Asked for its weak points, he said, "It's a core hogger. It runs in two par-

titions. It takes about 380K to run..." Does he anticipate any problems in running with only one computer? "We can go down sporadically, as long as it's not a long period of time, and we'll be in good shape. The backup procedure is that if we go down, they go back to manual procedures . . . even being down a couple of hours is not serious."

According to Koch, eventual savings of approximately $285,000 a year are anticipated from the use of the system. Some 40% of that, it is thought, will come from a reduction in the clerical effort of nurses. The other major source of savings will be from the recovery of lost charges, items inadvertently not being charged to patients, and this could account for as much as 30% of the total savings.

From all of this, one gets the impression that medical personnel (and in all likelihood people in other fields) dislike the necessity of changing their traditional ways of doing things–things they've been taught to do in school and that they've been applying daily in their work. They mention the inconvenience of entering information from a terminal, as compared with a handwritten entry that can be slipped into the patient chart . . . how such things can be done quickly and soon after the job is performed without regard for whether the terminal is free or the system is up.

But it is also clear that the experience at El Camino with this system is unique, that with the addition of features found to be lacking and their subsequent installation, the transitional problems should be greatly diminished. But one wonders how many other hospitals have previously been through the same turmoil, how many are going through it now, and how many have yet to experience it, as new systems are developed and implementation is attempted.

Even now, another system is being developed at the San Francisco campus of the Univ. of California. And Tony Wasserman of the Office of Medical Information Systems there observes that the field has had a serious lack of documentation. Hopefully, some of that will be alleviated by an evaluation study being made of the El Camino system under the HEW grant.

—Edward K. Yasaki

International

ICL: "Computerizing Apartheid"

Britain's International Computers Ltd. (ICL) is under fire for selling a computer system to a South African government agency. And so is the U.K. government which owns 10% of the computer company.

The furor is over the installation of an ICL 1904A and a 32-station Key-Edit system in the Dept. of Bantu Administration and Development. The department carries out a wide range of work, but one of its central roles is to administer the Pass Laws that lay down the conditions under which black South Africans–which they call "coloreds"–may enter "white areas," in effect, 87% of the country.

The Pass Laws are maintained through identity papers euphemistically called the "Book of Life" containing the necessary permit for a "colored" to be allowed to set foot in a "white area." The processing of data connected with these laws is an obvious target for a machine system. But IBM has ducked away from an invitation to provide equipment to this department. Earlier, the Polaroid Corp., under pressure from its U.S. employees and other groups, withdrew from supplying equipment to produce passes with photographs of the owners.

The U.K. manufacturer has stepped into a hornets' nest in picking up where IBM and Polaroid left off. An attack on its action has come from the British Society for Social Responsibility in Science, and the American Committee on Social Responsibility in Investments. Then the U.K. government came under fire as soon as the details of the ICL sale to South Africa were discussed in the August-September issue of *Science for People* under the title "Computerizing Apartheid."

The company's defense is that its South African subsidiary has not sold computers deliberately to computerize the Pass Laws and that the company is unable to guarantee the purposes for which its machines might sometimes be used. But it said an investigation of work being done in South Africa is to be made "where possible."

Actually the computer system may not be used in enforcing the Pass Laws. The country's government in 1970 passed a Population Registration Act under which every man, woman and child in South Africa would be registered with individual details of race classification, citizenship, health information, educational background, occupation, chosen language, and a record of ethnic origin, nation or tribe. Although the data base has not been automated, the Bantu Administration Dept.

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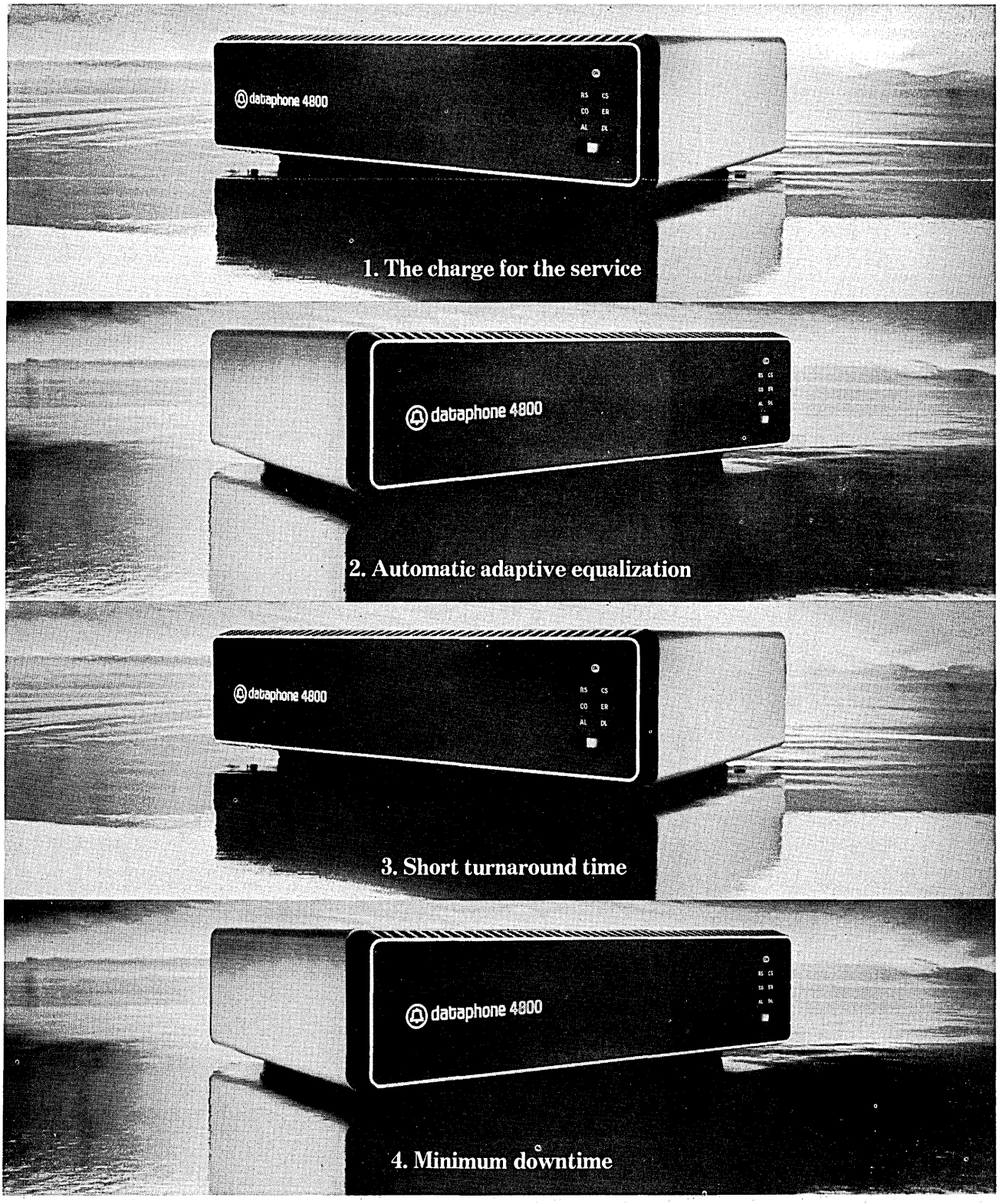

is considered the agency most capable of automating such a data base.

Observers find it ironic that a furor over computerization should arise in South Africa where automation is resisted. As an industrially wealthy nation, South Africa would rank as a significant developing marketplace for dp manufacturers, but with about 500 computer installations, the country is still in the junior league. The government there levies a tax on capital equipment to prevent its large unemployment pool from being swollen by layoffs from automation.

—Pearce Wright

Threat from Japan Now the Real Thing?

For one more time than we care to remember, the alarm is being sounded around the U.S. edp countryside warning of the imminent invasion of the U.S. market by Japanese manufacturers. In the past, alarms have sometimes been followed by the introduction of a few kludgy Japanese products, followed shortly thereafter by poor or non-market acceptance, followed by a decommitment on the part of the Japanese manufacturer. He then usually goes home to do what he does best—assemble television sets for the U.S. market.

But this time, the edp invasion from Japan may be the real thing. In fact, one U.S. consultant who spends a great deal of time in Japan and throughout the world examining trade trends believes the Japanese computer firms have no choice but to seek out and make major commitments to invade new international markets.

"Too many American companies are still operating from the concept that Japanese companies make plastic toys," says the consultant, John Boles of Boston's Boles Assoc. "Yet Japan's moves into international computer markets are an integrated, well-planned, well-financed national thrust into a specific industry."

The recent monetary reevaluations and the coming liberalization of Japanese trade policies are the two chief factors that are serving to entice or even force Japan to move away from its emphasis on exporting and to develop its international industry—primarily in the U.S. and Europe.

For one thing, Boles observes, foreign investment by the Japanese is now more attractive in the U.S. because the yen is worth over 25% more than it was just a couple of years ago. In addition, Japan's enormous and lopsided export surplus will serve to encourage investment in other countries because Japan wants to trim back its exports.

Who will lead Japan's entry into the international markets? Boles, who operates a jointly owned subsidiary in Tokyo, feels three Japanese industrial combines will lead the charge. And all three will be backed heavily and guided by the all-powerful Ministry of International Trade and Industry (MITI). The three combines Boles sees shaping up as the strongest are Fujitsu-Hitachi, Oki-Mitsubishi, and Nippon Electric-Toshiba. Boles thinks the Fujitsu-Hitachi combination will be the one to get the most encouragement from MITI to move in the U.S., largely because of Fujitsu's past attempts to merchandise products in the U.S. and because of that firm's heavy investment in the Amdahl Corp. (See September, p. 121.)

"I would expect MITI to give one company the nod for the U.S. and another for Europe," says Boles. "Rather than an exclusive thing, I think it will be a thing of emphasis. Fujitsu-Hitachi might be active in

How IBM Viewed Japan in World dp Markets

In October of 1970 at a meeting of IBM's top governing body – the Management Review Committee – Thomas J. Watson, Jr. asked for a "report at some point on the threat of Japanese imports to the domestic business."

Less than two months later, Watson had his report and, as reported in the minutes of the MRC, the IBM study sliced right through to the heart of the matter: "Government support a key factor in Japanese growth... Growth, not margin, seems to be the name of the Japanese game."

Also, there is an indication that IBM may well be turning the tables on the Japanese computer industry, which has earned a reputation for sending swarms of Japanese engineers to the U.S. armed with cameras and tape recorders to gather information on the U.S. computer industry and its developments. In referring to its R&D lab in Japan, the IBM report states: "Use our new lab to track and evaluate their technology."

Then in September '71, a more detailed report was presented to the MRC. "We conclude," the report stated, "that the Japanese have the financial, technological, product and plant capability to export data processing systems. At the same time, they have present deficiencies in external sales, maintenance and support."

IBM also said it felt that MITI would ask the Japanese Diet for permission to utilize the funds collected via import duties on U.S. equipment entering Japan to help develop the Japanese computer industry.

With government help

Six months later—in February '72—the corporate level at IBM again reviewed the Japanese competitive situation and found that the Japanese were moving along in their efforts to achieve their goals. One of the "key changes" cited by IBM was the increasing level of Japanese government spending to help the native industry. "MITI funding of various leading edge application projects and technology development projects is projected at approximately $170 million in 1972 alone," the IBM report stated. "All major Japanese dp manufacturers were exhibiting a continuing commitment to overseas ventures, with Fujitsu maintaining a substantial lead in these efforts, and that all were presently forces in both the Asian and South American communications markets."

The report concluded: "The Japanese manufacturers demonstrated commitment to an overseas marketing strategy, with the major thrust directed initially to unsophisticated country markets. As with other Japanese industries, the computer manufacturers' emphasis will continue to be on growth rather than margin and a 'plug compatible' approach will likely be used with their computers in order to minimize programming development expenses. In light of the Japanese government's demonstrated support of this exporting strategy for computers, the effect of our action programs in Japan will be at best to delay the inevitable schedule by perhaps one year." □

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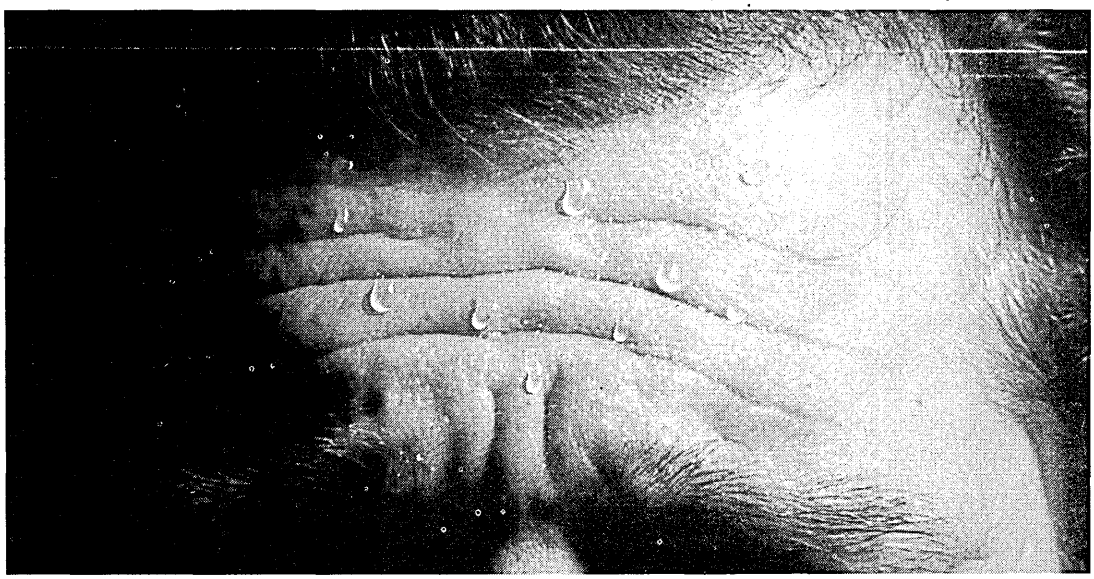

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Europe, too, but its major area probably would be the States."

Boles says Japanese government subsidies have tended to move development of new computer equipment quicker than had been expected. Boles believes that computer lines from all three major Japanese combines will be introduced in the U.S. by the end of next year. While these lines could be stopgap or interim machines, they still will compete in the general area of IBM mainframes from the 145 to the 195. Follow-up lines would be expected not long after the first ones, Boles believes.

Countering IBM

Boles points out that there are some interesting aspects concerning ownership of some of the Japanese firms. For instance, ITT has a small ownership stake in Nippon while Germany's Siemens Co. has an equity tie with Fujitsu. IBM's subsidiary is 100% owned by IBM—a concession Japan allowed before it decided to restrict foreign ownership in Japanese companies. "Some Japanese are saying that the stiff IBM competition in Japan is one reason the Japanese companies are gearing up in computers," says Boles. "But I don't believe that's so. They're just using that as an excuse."

Others are paying more attention to the new emphasis being placed on the Japanese computer industry. For instance, the Computer Science and Engineering Board of the U.S. National Research Council recently reported that the Japanese government will have spent more than $120 million in computer research from 1967-1978. Others, however, feel that figure is an extremely low estimate.

While the Japanese manufacturers hope to become significant factors in the U.S. market, there are also indications that U.S. manufacturers will become more significant factors in the Japanese edp market. Boles notes that the Japanese government will begin relaxing restrictions on foreign firms doing business in Japan significantly during 1975.

Mini developments

Boles says Japanese firms are moving aggressively in the minicomputer business also, and he believes Japanese firms could be formidable competitors in the mini industry in a few years. The major firms developing minis are Matsushita, Fujitsu, and Fuji, says Boles.

The Japanese electronics industry has had a reputation for copying more than innovating, and some think there may be lessons to be learned from recent experience in the desktop calculator market. While Japanese firms captured the lion's share of that market, largely because their cheap labor supply enabled them to assemble the calculators cheaply, they lost a great deal of the market when U.S. semiconductor firms were able to miniaturize memory chips through sophisticated automation processes and, in so doing, drop prices. Many think that same U.S. innovative ability in automation will enable the U.S. firms to resist or slow down the coming Japanese edp entry.

Boles, however, insists that the Japanese are rapidly becoming more technologically sophisticated in semiconductor and hardware technology. And in software, they're concentrating heavily in artificial intelligence. If Boles has a message it is that the Japanese are better than they are generally thought to be by the U.S. industry. Most importantly though, he believes that the Japanese will be coming to the U.S. soon and they will be coming big.

—W. D. G.

(Continued on page 154)

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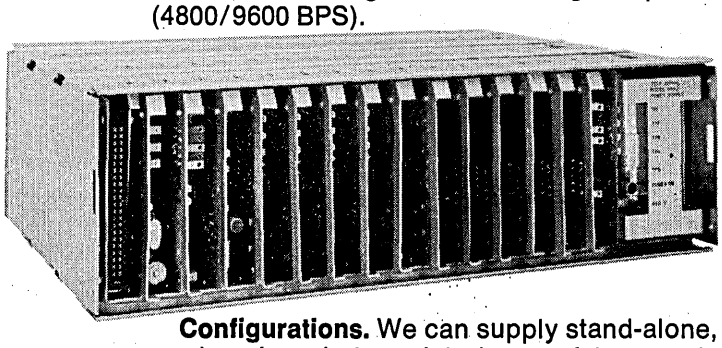

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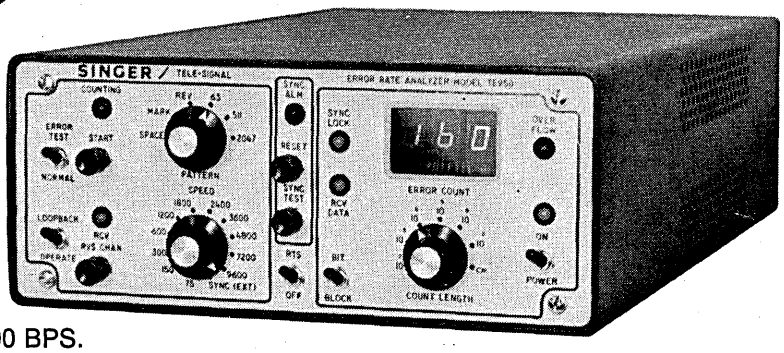

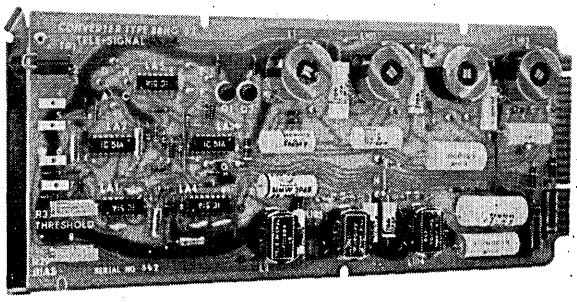

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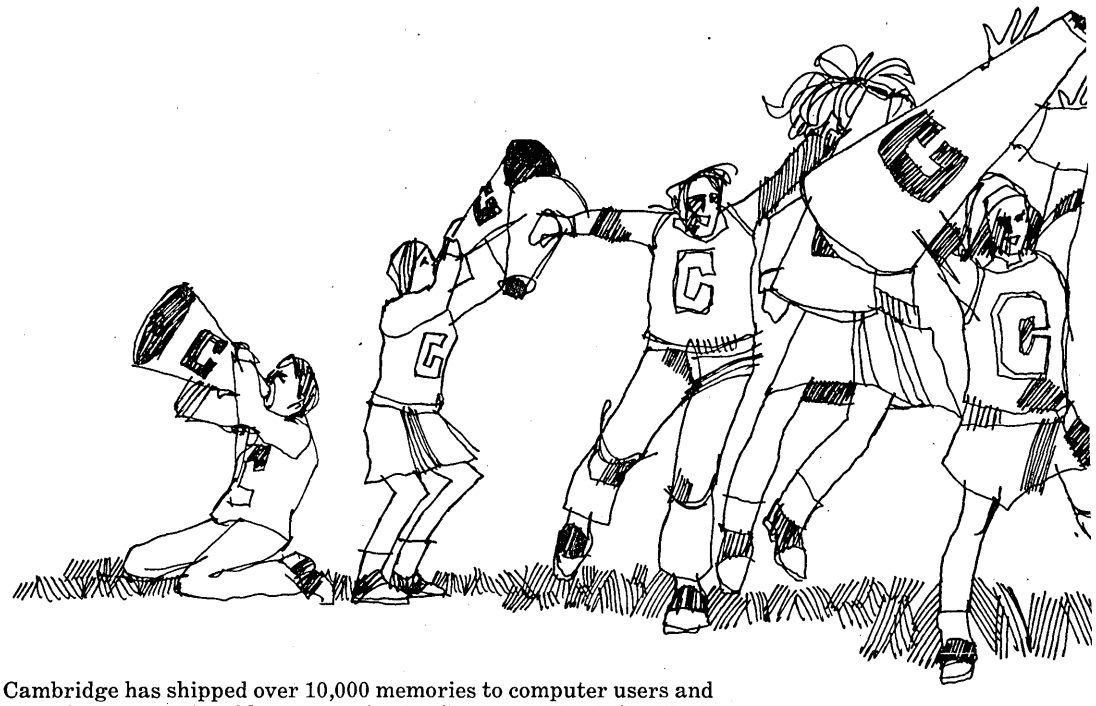

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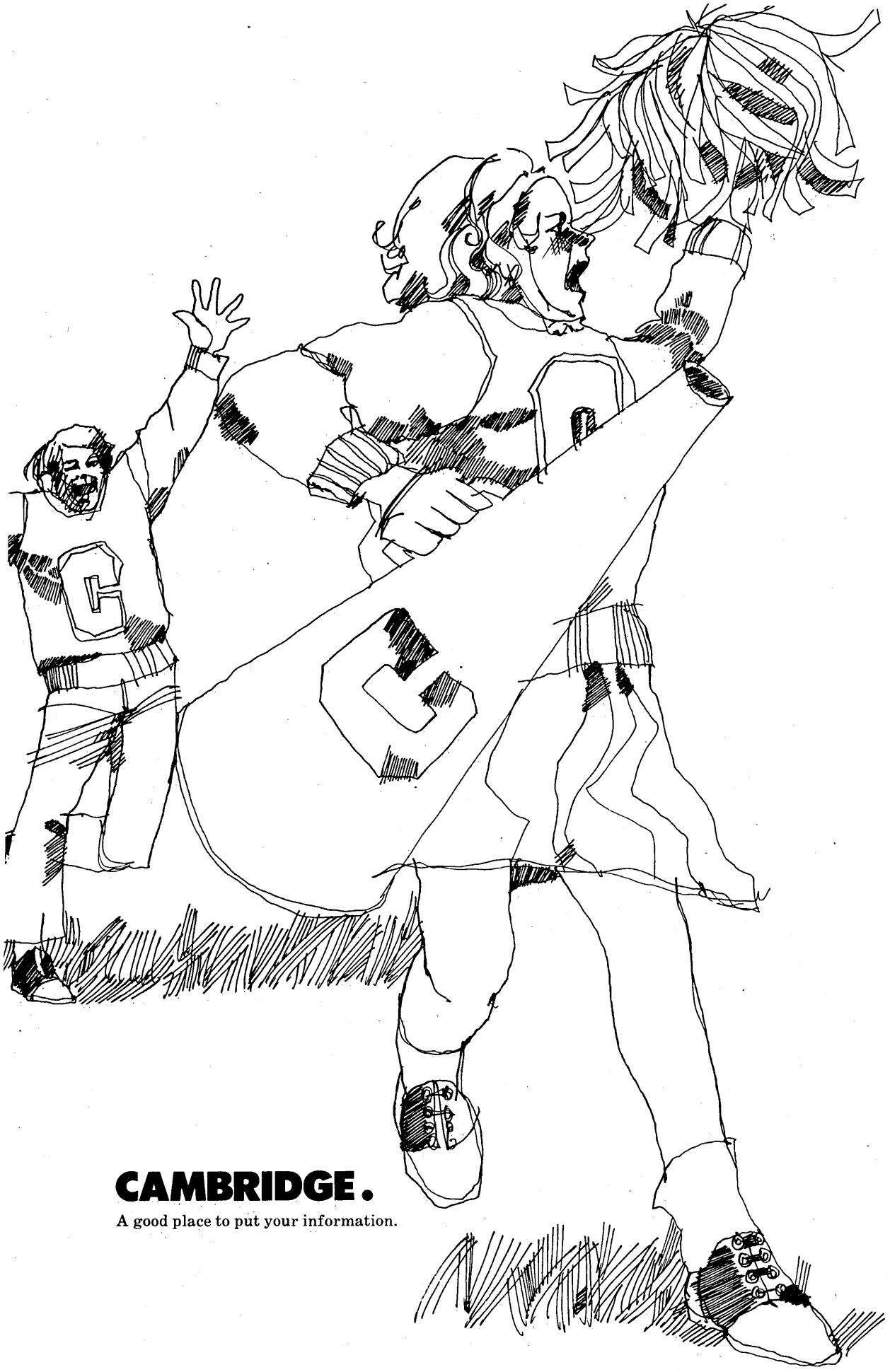

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Benchmarks

Troubles in the Taj Mahal: Employees of Computer Communications, Inc. have long referred to their plush plant atop a Culver City, Calif., hill as the Taj Mahal. The naming, after a famed mausoleum, was possibly prophetic but maybe not. CCI filed for Chapter XI protection in Federal Bankruptcy court in late August. In mid-September the firm was thrown a lifeline in the form of a $500,000 loan, convertible to an equity position, from Syn-Tech, a Rockville, Md. modem manufacturer formed early this year to succeed defunct Tel-Tech. This enabled CCI to continue operating in its Taj Mahal, on its pastoral eight-acre site complete with tennis courts, a baseball diamond, and an aviary. The question is, for how long? CCI's landlord, Warner Lambert Co., has filed a Superior court suit in Los Angeles to get the company out of the plant.

Milestones: Sycor, Inc., of Ann Arbor, Mich., turned out its 10,000th intelligent terminal in August. The company, which is producing about 700 a month, said the new terminal, the Model 340, was to be delivered to a Phoenix office of INSCO Systems Corp., the dp subsidiary of Continental Corp.

Meanwhile, Data 100, which installed its 2,000th batch terminal in the same month, also was doing well at the bank. It's completed an arrangement with a group of banks for a $42 million line of credit, much of it to be used in carrying its own leases. The Minneapolis company in a $10.5 million deal recently began buying up equipment that has been on third party lease with subsidiaries of PepsiCo, Inc. The company said the new line of credit will allow it to finance most new leases on its own, thus obtaining the "full long-term benefits which accrue" from company-owned leases.

Meager Merger Months: The first six months of 1973 saw merger activity in the computer manufacturing and services fields fall 48%, from 61 announcements in the first half of 1972 to 32 this year, according to W. T. Grimm & Co., Chicago based financial consulting firm specializing in mergers and acquisitions. Maybe the second half of '73 will be different. Announcements as the half got started included one from Control Data Corp. that it will acquire Comma, a New York-based computer maintenance company. GTE Information Systems, Inc. and Logic Corp., Cherry Hill, N.J., announced signing of a merger agreement providing for acquisition of Logic by GTE Information Systems. Microdata Corp., Irvine, Calif., said it had acquired Telogic Systems, Inc., Ronkonkoma, N.Y., developer and manufacturer of computer-based telephone monitoring systems. And California Computer Products bought Signal Galaxies, a Van Nuys, Calif., firm which makes MOS add-on memories.

Money for Datran: Two investors have agreed in principle to invest $25 million in Datran's data network. Walter Haefner, a Swiss industrialist, will contribute $20 million in common stock and subordinated debentures, and "a large U.S. company," not otherwise identified, has promised to provide the rest. Datran's parent, Wyly Corp. (formerly University Computing Co.) has already put $33 million into Datran, so if the two new agreements are consumated the total investment will be $58 million. "A like amount of debt of equity financing remains to be arranged over the next three years," Datran said. The company expects to begin commercial service between Houston and Dallas within the next month; by next March, its sys-

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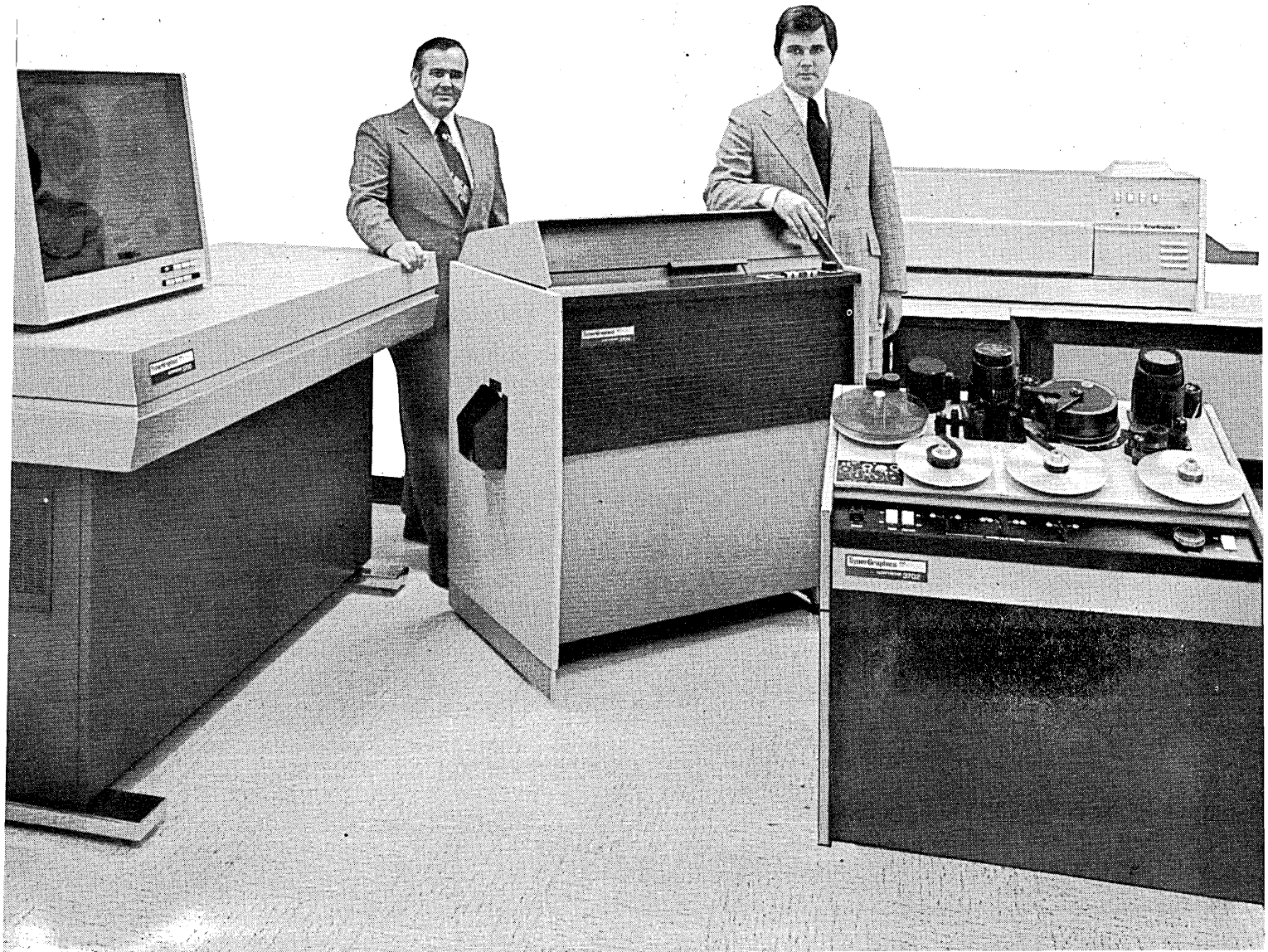

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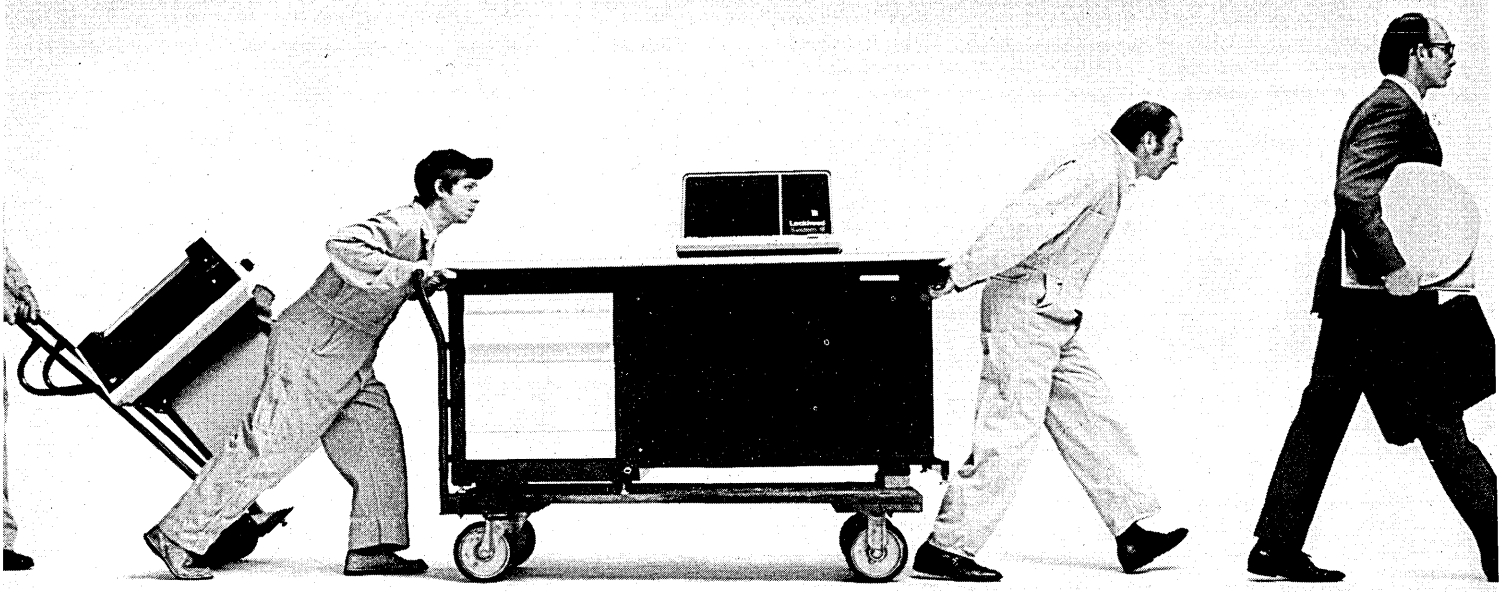

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CIRCLE 46 ON READER CARD

tem is expected to be completed between Houston and St. Louis; and approximately a year later, Datran hopes to be offering service nationwide to 27 cities. Essentially, the network will run from San Francisco through Los Angeles, Houston, Dallas, St. Louis, Chicago, Washington, and New York. "Operational profits" are expected in 1976, and a positive cash flow in '77.

Datran plans to service most of its customers through local loop facilities obtained from Bell and other long established carriers. For high speed service—56KBS and above and possibly 19.2KBS as well — the company will provide its own local loop facilities, consisting of a recently developed millimeter radio system which operates at 38 GHz, and uses small dish antennas each about the size of a dinner plate, spaced up to three miles apart.

Options from MCI: MCI's first nationwide tariff became effective last month. Covering service to 19 cities, it offers several options not provided by the long-established carriers—for example, part time use of leased lines, and interconnection of MCI facilities with customer-provided concentrators and/or multiplexors. A user can obtain end-to-end service, or he can get his own local loops and lease just the long-haul portion of the route from MCI. Typical circuit mile per month charges for end-to-end service were listed as follows: one voice grade circuit, Los Angeles to New York, 81¢; three voice grade circuits, New York to Washington, $1.73; six teleprinter circuits, Dallas to Washington, 48¢; six voice grade circuits, New York to Washington, $1.67. These rates cover long haul, circuit termination, and service charges. The only additional expense is a one-time installation charge of $50 per circuit end.

$23 Million Installation in Japan: The world's largest on-line, real-time banking network will get $23 million worth of NCR Century Series computers. Japan's Sumitomo Bank will add the equipment to a system which already includes four Century 300s, 12 NCR 315 RMC computers, and 1500 terminals. Initial installations will be at the bank's Osaka data center, followed by installations in Tokyo. Both centers will get Century 350 mulitprocessing systems; three for Osaka and two for Tokyo. The bank's network currently handles up to 150,000 transactions per hour. □

Hardware

Off-line

The FBI has been evaluating a digital image processor capable of analyzing 500,000 resolution points in a fingerprint in half a second, making it possibly the fastest such device ever built, say its developers, Calspan Corp. Other uses found for the processor include processing of aerial photos and signature verification.

What is thought to be the first installation of main memory beyond IBM's limit on the 370/155 has been introduced at AT&T's Cleveland facility by Advanced Memory Systems, Inc., Sunnyvale, Calif. The three-megabyte semiconductor memory exceeds by 50% the original two-megabyte limit.

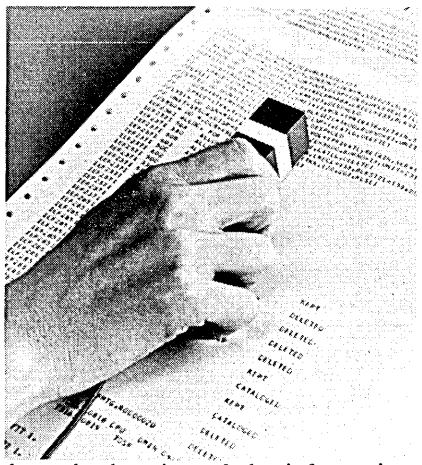
Modems get more complicated as their speeds and capabilities increase, and users tell us they are constantly looking for more reliable ones to use in their communication applications. Codex Corp., Newton, Mass., has done a study on 100 users of its 9600 baud model that operates on C2 voice-grade lines. Based on 2 million operating hours, the audited study showed that the MTBF for the units was 10,250 hours, with an average MTTR (mean time to repair) of 16 minutes. Few firms like to quote MTBF figures, but to put the 10,250-hour figure in some perspective, it is four times longer than the model 9600's forerunner.

The complete assets of Conographic Corp., Woburn, Mass., have been acquired by Hughes Aircraft Company's industrial products division. Conographic developed a graphics terminal two years ago that was unusual because it could produce any curved contour, regardless of its mathematical function, by using conic sections. Complete systems, including software and RS232C interfaces, are provided by Hughes from its Oceanside, Calif., facility.

Optical Input Device

An electronic camera has been developed that could conceivably revolutionize low-speed computer input. Consisting of a multi-element photodiode array, internal light source, and optics packaged in a pencil-size container, the SCANTRAC 1 converts graphic images into analog outputs that could be converted into digital logic by oem-designed controllers.

The SCANTRAC 1 camera also generates a position-indicating signal to



show the location of the information independent of the rate at which the camera is moved across the input. The bottom of the SCANTRAC has a roller mechanism to insure that the camera is the correct distance away from the input (and it also helps with the generation of location signals). A viewfinder on top helps the user keep on the subject line.

It would seem that there are a number of worthwhile applications for this camera that could be relatively easily implemented. The vendor feels that they could replace keyboards on key-to disc equipment, and be used in making minor programming changes requiring resequencing of input, etc. It's strictly an oem development for now, however, and the pricing reflects it, with orders of 100 SCANTRAC 1 cameras bringing the piece price down to approximately $1K. DATACOPY CORP., Palo Alto, Calif.

FOR DATA CIRCLE 326 ON READER CARD

Microprocessor

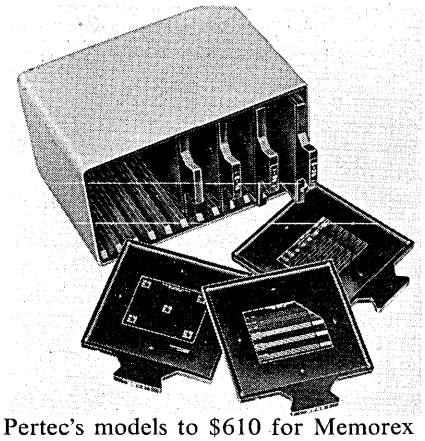
When microprocessors were introduced several years ago they were billed as being much cheaper than minicomputers, not quite as powerful, and it was said they would carve a niche of their own in the marketplace of applications which did not require a full mini. This microprocessor, the AES-80C has 375 microinstructions, the ability to handle up to 32 kilobytes of read-only memory, a 16-level push-down stack, and a 240-nsec clock rate —which surely sounds like a minicomputer. Its manufacturers feel the best applications for the AES-80C would be in controlling crt's, discs, or alarm systems, and possibly in word processing.

The processor has a 12-bit instruction memory (ROM) and 8-bit data orientation. Both 240-nsec bipolar and 800-nsec random access memories can be intermixed on the 80C. Price for the basic processor is $850. A cross assembler that runs on Data General equipment is available for generating 80C programs. AUTOMATIC ELECTRONIC SYSTEMS, INC., Montreal, Canada

FOR DATA CIRCLE 327 ON READER CARD

COM Start-up Kits

A series of kits that contain standard and test computer output microfilm form slides is offered current and prospective users of virtually all COM equipment. The seven form slides contained in a rugged protective metal case include resolution test, screen tint test, line width and type style test, standard grid scale, standard border, standard line, and standard screen tint. The average price for the kits is approximately $350, ranging from $175 for

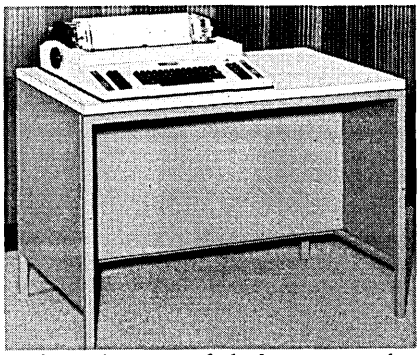


Pertec's models to $610 for Memorex equipment. Delivery is from stock. PHOTOGRAPHIC SCIENCES CORP., Webster, N.Y.

FOR DATA CIRCLE 328 ON READER CARD

Communications Terminal

The TC-241 is a 30-cps IBM 2741-compatible communications terminal that uses a print wheel mechanism instead of a golf ball element to hold print characters, with the object being improved reliability in heavy use applications. The unit comes stock with a 64-character ASCII set and can be optionally equipped with a 96-character repertoire that includes lower case. Up to six



copies of tractor-fed forms can be printed across 132 or 155 columns. Snap-in cartridges with either cloth or carbon ribbons are supplied for the 241.

Customers can designate two formats to be microprogrammed into the terminal at the time of order, and a third "free form" format can be set up by the operator. Formats include predefined tab stops, left and right margins, and form lengths. A "print X" key permits fine adjustment of print position. The following features are no-cost options: automatic carriage return; pica or elite type face; forms feed control; typamatic keys; reverse key; 36- or 42-inch console; and color specifications. The communications hookups include provisions for IBM modems, Bell 202s and 103s, and an RS232 interface. The TC-241 is priced at $5,750, or $195/month on a two-year lease, including maintenance (which has been arranged nationwide). The terminal is available for 60-90 day delivery. TERMINAL COMMUNICATIONS, INC., Raleigh, N.C.

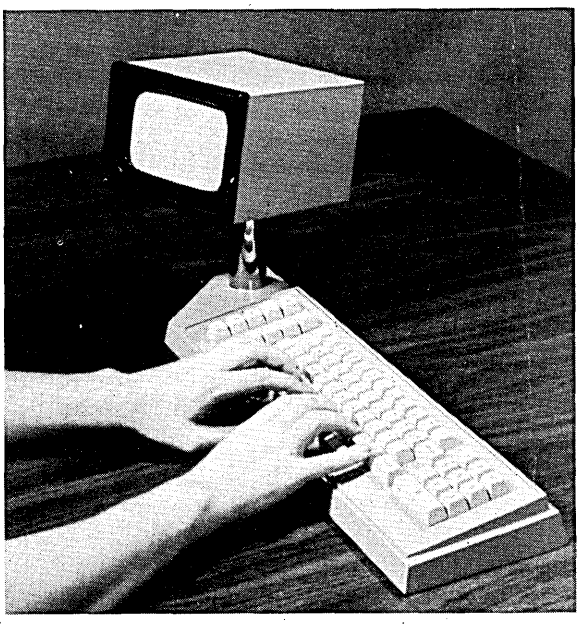
FOR DATA CIRCLE 329 ON READER CARD

Line Printer

One of the better known copier manufacturers recently introduced an impact printer capable of a 600 lpm print rate, based on a 64-character ASCII set. The drum mechanism is 136 columns wide, and printing at six or eight lines/inch is controlled by a 12-channel carriage control tape. Also featured are extensive use of IC's, self-test circuitry, and an acoustically-designed enclosure.

The first unit in what is expected to be a series of commercial products, the 7360 is primarily offered to oem's. Interfaces for "most common minicomputers" are in various stages of development, and the builders are willing to bid on any interface missing

product spotlight



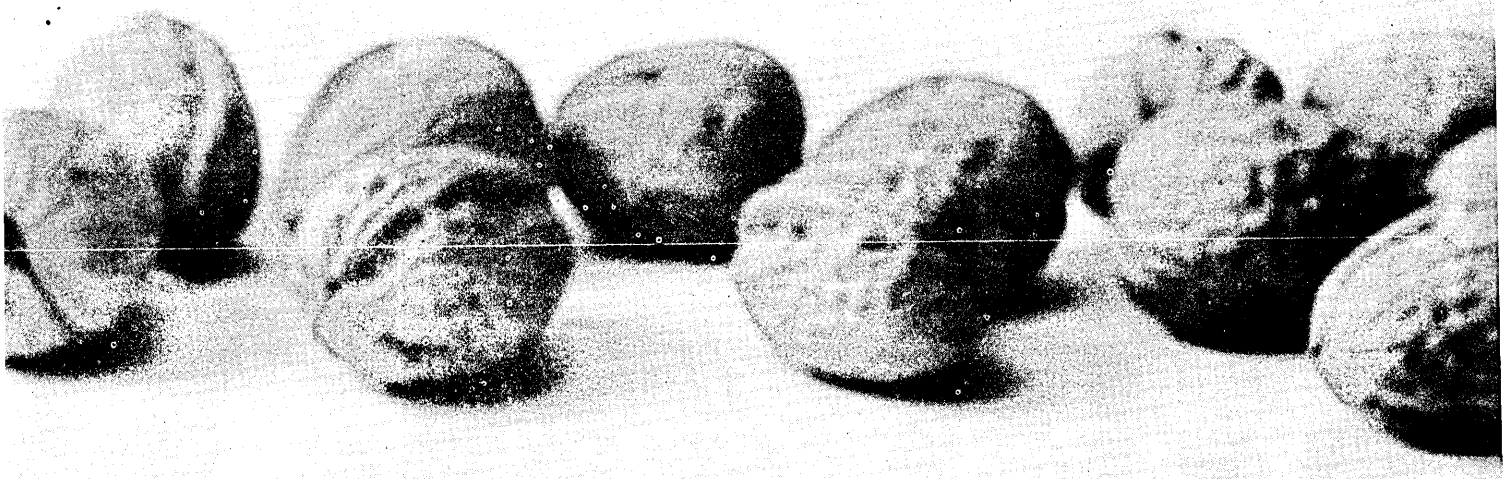
Small-scale Crt Display

The model D-301 INFORMER is a combination 6-inch crt screen/keyboard unit offered to oem's for use in applications similar to those of the IBM 3740. Up to 16 lines of 32 ASCII characters are displayed as 5 x 7 dot-matrix images, and the screen can be tilted to reduce ambient light glare—a nice feature also seen on Teletype Corp.'s DATASPEED 40 crt and something that will undoubtedly appeal to users. The 301 comes with a lock and key for preventing unauthorized use of the terminal.

The standard keyboard offered contains a 10-key numeric pad and 10 special function buttons in addition to the tty or Selectric layout, but this basic keyboard can be customized to whatever the oem desires. Transmission rates for the INFORMER range from 110-9600 baud through RS232 interfaces. The list price for a single unit is $1,950, with the price dropping to $1,055 in orders of 100. Depending on quantity, the D-301 INFORMER is available from stock. CAR-MEL ELECTRONICS, INC., Los Angeles, Calif.

FOR DATA CIRCLE 325 ON READER CARD

Tough Application?



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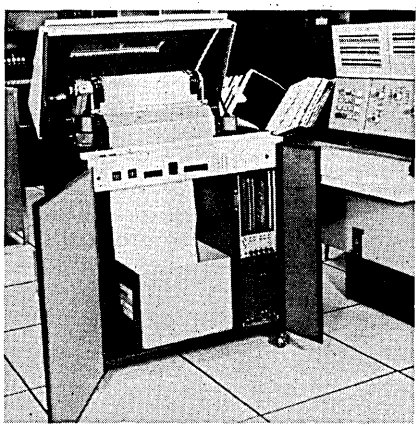
CIRCLE 10 ON READER CARD



from the list. Interfaces are priced above the printer's basic price of $9,500. Four months is being quoted for delivery. SCM CORP., KLEINSCHMIDT DIV., Deerfield, Ill.

FOR DATA CIRCLE 330 ON READER CARD

6250 bpi Tape Maintenance

Just as the 6,250 bpi tape drives announced by IBM, Telex, Storage Technology, CDC, et al, required different read/write heads and more precise mechanical alignment, so did this line of tape maintenance equipment that ranges from simple cleaner/testers to tester/evaluators. The pitch is that the condition of many tape libraries isn't up to the demands that will be placed on it by increasing the recording density by a factor of four, and the TMS-70 and TMS-200 devices can be used to isolate inferior tapes.

Both the TMS-70 and TMS-200 units have submodels 6 and 7, with the 6 in each case accommodating only 9-track 6250 bpi tape, and the 7 handling both 6,250 bpi and 9-track 1,600 bpi tape. The Model 70 counts and charts write-level dropouts, and the 200 has additional capabilities for certifying and repairing tape. Depending on tape quality, a full process cycle takes less than five minutes per tape. Basic prices are $11,950 for the TMS-70/6 and $20,750 for the TMS-200/6. The units can also be leased and will be available next month. KYBE CORP., Waltham, Mass.

FOR DATA CIRCLE 333 ON READER CARD

Crt Terminal

The Executerm 267 is described as a semi-intelligent terminal by its makers due to its ability to control up to four slave devices in an IBM 2260/2265 configuration. It's designed for small configurations where the rental rate and expanded capability of the 2260's 2848 controller can't be cost-justified. The slave devices can be up to three Executerm 250 "dumb" terminals, and a 165-cps printer. The printer is addressable by any crt in the cluster, and also by the cpu. A 1K character print buffer (expandable to 2K) is contained in the 267 terminal. Local storage capability is in the form of a single- or dual-cassette peripheral (up to 448,000 bytes), or an auxiliary memory unit expandable up to 16K. It's claimed that the 267 can be used in multi-point configurations alongside 2260/2848 terminals on the same communications channel, operating asynchronously at up to 4800 baud.

The 267 crt displays 12 or 24 lines of 80 7 x 8 dot-matrix characters on a 12-inch diagonal screen that is refreshed at 51Hz. In addition to the 2260-type keyboard there are display and editing functions, including format mode, blink to end of file, line addressing, horizontal tabulation, fast cursor positioning, character insert/delete, plus erase page, field, or screen. A 1920 character configuration runs $196/month on a five-year lease. First units have gone to the field. COURIER TERMINAL SYSTEMS, INC., Phoenix, Ariz.

FOR DATA CIRCLE 331 ON READER CARD

Programmable Calculators

The calculator market is really booming; one of the reasons being that the designers of these sophisticated little devices can react far more quickly to advances in circuitry than their computer-oriented counterparts. Prices have tumbled, capability has shot up, and this vendor's first two entries into the market will tend to make it an even more interesting one. They are powerful, well thought out, and reasonably priced.

There are two models, the Tek 21 and 31. Both feature programmable read-only memories that permit the user to define the calculator's operation for his or her own use. For now it's done by sending the manufacturer program listings, typically in card or listing form, to be encoded in PROM. The future might see the PROM programmer being sold to the user. There are up to 24 keys available for user definition.

The 21's memory is organized into eight blocks of 16 program steps, with optional memories available for expansion to 256 and 512 steps. The 21 has 10 registers to play with. The 31 can be expanded in combinations of program steps and registers up to 8K and one thousand, respectively, and has a magnetic tape cassette drive for program storage. Both versions accommodate numbers up to the ±99th power and display them on a 10-digit nixie tube display. The calculators are priced at $1,850 for the 21 and $2,850 for the 31, and are currently available within

four weeks. The two models can also be leased. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 332 ON READER CARD

High-speed Discs

Some members in this series of head-per-track disc units have 2.1-msec access times, easily qualifying them for applications requiring faster-than-average response times. An interface for Data General users is available now, with a DEC PDP-11 model in development. Capacities for the units range from 1-16 megabits. Reading is by non-contact recording heads mounted at three points around the disc for 2.1-msec access, at opposite sides for 4.2-msec, and at one point for 8.4-msec access, based on 3600-rpm rotation. The transfer rate is 4 megabits/second per track. Two representative models in the line-up are a 256K 16-bit word model with 4.2-msec access, priced at $5K, and a 512K 16-bit unit with 2.1-msec performance priced at $10K. Delivery is approximately 10 weeks. ALPHA DATA, INC., Canoga Park, Calif.

FOR DATA CIRCLE 334 ON READER CARD

Serial Printer

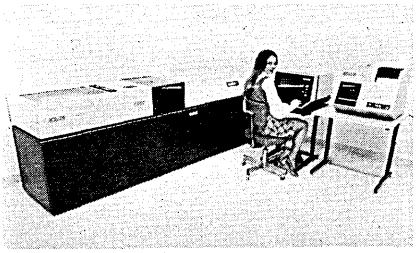
Centronics has added another serial printer to its product lineup. This unit, the model 500, prints a full 132 columns at 100 cps, or 40 full lines per minute, based on a 64-character ASCII set. All logic and control functions for the 500 are contained on a single LSI circuit board which might make for impressive reliability (or at least easy maintenance). Characters generated are 5 x 7 dot-matrix images.

Standard features include parallel data input at up to 75,000 cps, elongated boldface characters, paper runaway inhibit (10 second time-out), automatic line feed on carriage return, and printing of up to five-part tractor-fed paper. Options include an RS232 interface (100-9600 baud), vertical format control, an expanded character set, foreign character sets, and interfaces for a number of popular minicomputers. The 500 is priced at $2,600 and is available in 2-3 months depending on quantity. CENTRONICS DATA COMPUTER CORP., Hudson, N.H.

FOR DATA CIRCLE 335 ON READER CARD

Commo-oriented System

Another version of the highly-successful System 10 computer has been announced with enhanced communications capability that should be considered by larger corporations for use in a distributed computing network, or even by small businesses for their sole computer—the communications features provide a way to work with other computers in times of peak load. The model 101 is expandable from 10-30K of 3.3-usec core, and can have up to five I/O controllers for use with a variety of peripherals. A synchronous communications adapter permits data transmission to remote computers at 40.8 kilobaud rates, while operator-oriented ASCII-code terminals can talk to the 101 conversationally at rates up to 9600 baud. The same applications



program library offered with the larger System 10 works on this one, and up to five jobs can be executed simultaneously.

A card-oriented remote job entry terminal system including a 10K processor, card reader, crt, and line printer is priced at $40,360. A disc-oriented remote terminal processor system with 20K, a disc drive, crt, and line printer is priced at $61,285. Systems may also be rented. SINGER BUSINESS MACHINES, San Leandro, Calif.

FOR DATA CIRCLE 336 ON READER CARD

S/3 Memory

A firm that has been building products such as disc cartridges for the IBM System/3 has entered the main memory add-on market for that machine with a new twist: the memories use MOSFETS to augment the core on the S/3 models 6 and 10 just like that IBM recently introduced on the System/3 model 15. Several early installations of the product have shown no signs of a "technology conflict" according to the vendor, which also states that the memories are totally transparent to the user in all operations.

The memories are available in 8K increments for expansion of 8K systems up to a maximum of 64K. The first 8K chunk sells for $5,760 and rents for $169/month (including maintenance) on a two-year lease. For users who need the whole 56K shot, the figures would be $47,736 and $1,012/month, respectively. The memories will be marketed internationally, and domestic servicing for the products has been arranged with Sorbus. A switch is located on the memory that permits IBM service personnel to run diagnostics on the IBM portion of

the memory only. Availability will range between 30 and 90 days for the products. CFI MEMORIES, INC., Anaheim, Calif.
FOR DATA CIRCLE 337 ON READER CARD

Real-time/batch System

The Sigma 9 Model 3 computer is a special version of the original Sigma 9 that is offered to the very price-sensitive real-time applications market. It has been stripped of some functions not usually needed in r-t applications, notably hardware decimal arithmetic, and byte string manipulation. It has also been stripped of the motor/power generator set. The 9 Model 3 can process in local and remote batch, high-speed (hardware) and low-speed (software) real-time modes simultaneously in a configuration priced for less than $500K.

The hardware consists of up to 512K of 32-bit words, with each 32K memory chunk being interleaved. A maximum of 224 hardware interrupts and up to 11 independently operating I/O devices can be configured, as can a whole range of standard peripheral equipment. A 64K system with console, 200-cpm reader, 225-lpm line printer, one 60KB tape drive, a 3-megabyte head-per-track disc, and a 25 megabyte disc pack system sells for $451,100 or rents for $11,390 on a four-year lease.

Software for the 9/3 runs under a new monitor called Command Program for Real-Time, or CP-R. Language processors include assembler, SYMBOL, extended FORTRAN IV-H, extended Xerox FORTRAN IV, and SL-1. The disc-resident operating system uses hardware memory mapping to control up to 32 concurrently processing foreground jobs running in either primary real-time or secondary real-time mode. (The two modes differ in that the primary mode programs are attached directly to hardware interrupts for response times ranging from 6-100 usec, where the secondary real-time jobs run without the aid of the high-speed registers.) Concurrently, batch processing and terminal operations can take place in the background job stream. Deliveries of the Sigma 9 Model 3 begin in the first quarter of next year. XEROX CORP., El Segundo, Calif.
FOR DATA CIRCLE 338 ON READER CARD

Static Card Reader

A static card reader is offered to oem's who wish to add an 80-column card peripheral to teletypewriters, crt's, printers, and even minicomputers. The nameless model lacks a power supply and cabinet, but is supplied complete with mechanical mechanisms, scanner, and Hollerith, ASCII bit parallel, ASCII serial, tty, RS232C, and TTL compatible outputs. The output rate can be adjusted from 10-1000 cps. The single quantity price for the unit is approximately $2K. AMP, Elizabethtown, Pa.
FOR DATA CIRCLE 339 ON READER CARD

Display Terminal

Just when there were signs that Tektronix might be abandoning the storage tube as the basis for a line of terminals (it recently introduced a true crt), the firm comes up with a 19-inch diagonal storage tube terminal capable of displaying up to 8,512 ASCII characters or one million graphic positions. (The 8,512 figure relates to 64 lines of 133 characters measuring 130 x 90 mils, with several programmable formats in-between leading to a 2,590-character model with 240 x 160-mil characters displayed in a 74 by 35 line format.)

The storage tube is coated with a phosphor that retains the image for several hours without the need for constant cpu refreshing, but with some sacrifice in display brightness compared to a true crt.

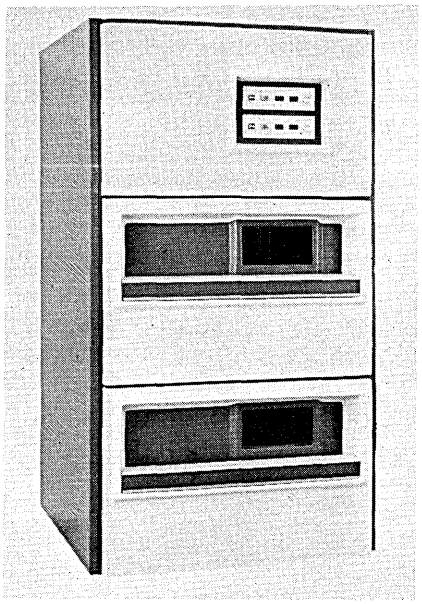
The PLOT-10 software package offered with it is more complete than most, having been around in support

of past products for some time. Both a 94-character set of ASCII (standard) and a 188-character set with both ASCII and APL character codes (optional) are offered. Prices start at $8,450 including interface. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 340 ON READER CARD

OEM Disc Drives

The 4400-bpi recording density and 200 tracks/inch packing of the 125 and 225 disc drives can be thought of as the culmination of the IBM 2314 technology, even though IBM did not carry the drive capacity that far. Built to be attached to *mini*computers, the drives allow storage of 116 megabytes per pack in single- or dual-pack configurations (the 225 is the dual-spindle drive). The units' transfer rates are given as 5 Mbps, and average access is quoted as 30 msec.



OEMs are expected to like the built-in variable frequency oscillator, the dual-controller access, and built-in diagnostics, as well as the price of $9,000 per spindle (in quantities of 100). CENTURY DATA SYSTEMS, INC., Anaheim, Calif.

FOR DATA CIRCLE 341 ON READER CARD

Graphics System

A 16-bit minicomputer controller with a 990-nsec cycle time is the basis of the PDS-4 graphics display system. The mini boasts a powerful instruction set for doing graphics work, including "push and pop" instructions and byte manipulation capability. A digital vector generator provides three standard formats: short (two vectors/word), medium (one vector/word), and long (two words/vector). Standard items include rapid data plotting and automatic incrementing in either x or y axis directions, and display subroutines hardware-driven. More than 3K characters or 2000 inches of vector can be displayed on the standard 17-inch crt with 1K x 1K resolution refreshed at 40 Hz. A system containing these features is priced just under $14K, with a number of optional peripherals and functions offered to augment the PDS-4, including a hard copy device, larger system memories, removable cartridge disc, a floating-point processor, and two-dimensional rotation hardware. IMLAC CORP., Needham, Mass.

FOR DATA CIRCLE 342 ON READER CARD □

Software & Services

Updates

The British Computer Association of the Blind is building an index of braille translation programs and needs help in locating programs available in other countries. Information being collected includes the program name, machines and operating systems it was designed for, type and grade of braille, a brief functional description of the program, and the person or organization from whom it may be obtained. Send all pertinent information to Mr. Richard West, Civil Service Dept., Central Computer Agency, Norvic House, 29-33 Chapelfield Road, Norwich, England.

A process has been developed for generating multi-dimensional color films by using mathematical formulae to represent subjects. Called SynthaVision, the technique is offered as a service to urban planners, scientists, educators, and the tv and film production industries. An IBM 360/65 computer calculates camera angles and shading descriptions from punched card descriptions supplied either by the customer or by the vendor, Computer Visuals, Inc., Elmsford, N.Y. The process may be seen as early as next year in tv commercials and cartoons, and later in feature films. If SynthaVision or similar visual simulation programs really catch on, it's just possible that our children will soon be asking us whether we remember the formula for Archie Bunker instead of the one for the area of a circle.

The Dartmouth Time-Sharing System (DTSS) recently "turned professional" and is being marketed by a wholly-owned subsidiary of the Ivy League school, DTSS Inc., Hanover, N.H. While at the university, this alternative for the standard GCOS monitor ran up to 20,000 jobs per day in BASIC, COBOL, and FORTRAN IV while providing terminal response times of less than 10 seconds, the new vendor claims.

Data Base Seminars

Two one-day seminars entitled "The Data Base Commitment" and "The Role of the Data Base Administrator" will be given around the country during the rest of this month and the first half of November. The courses are oriented toward both technical and non-technical edp management and are priced at $95 per person.

"The Data Base Commitment" session begins with the assumption that the data base approach to information management is a risky business, involving complex technology, extensive personnel and system resources, and money—nothing short of a long-term corporate commitment. The main topics covered in the course are "the data base approach—yes or no," "major elements of data base systems," and "evaluating costs and benefits." The final portion of this seminar is a comparative analysis of four of the more popular data base management systems, namely IBM's Information Management System (IMS), Cincom Systems' TOTAL, MRI Systems Corp.'s System 2000, and the relatively recently introduced ADABAS package from Software AG.

For those who think that their corporations might decide to take the plunge into data base operations, a description of the data base administrator, in terms of technical and managerial roles, and in terms of the office are discussed. The technical portion of the session covers problem definition and analysis and file organization issues. The managerial role covers policy-making responsibilities, configuration control, staff and skill requirements, budget considerations, cost/benefit analysis, organizational placement, etc.

The seminars will be held in Washington, D.C. (Oct. 9-10), New York, N.Y. (Oct. 18-19), Los Angeles (Oct. 30-31), Chicago (Nov. 13-14), and Dallas (Nov. 15-16). For further information you may contact the company directly at (609)/883-3707. PERFORMANCE DEVELOPMENT CORP., Trenton, N.J.

FOR DATA CIRCLE 311 ON READER CARD

Business Literature

On-line access to a data base containing information compiled from 280 business oriented periodicals is now offered through the SDC/INFORM SERVICE. Conversational terminals, typically teletypewriters, are all that is required to access information indexed by author, subject, periodical, and keywords taken from abstracts of each article. Among the better known information sources on the system are *Business Week, Fortune, Futurist, Harvard Business Review, Quarterly Review of Economy and Business,* and even *Datamation.* More than two million information records can be accessed directly through SDC or world-wide through Tymshare, Inc.'s network. Charges for the service are $45 per connect hour, plus 10¢ for each reference retrieval printed off-line (which would usually be needed for bulk information listings). Add $10 per hour to the connect rate if access is through Tymshare. SYSTEM DEVELOPMENT CORP., Santa Monica, Calif.

FOR DATA CIRCLE 312 ON READER CARD

Business Software

A collection of generalized business programs offered is said to be capable of satisfying the dp needs of small and large businesses. The package, which processes payroll, inventory, billing, accounts payable and receivable, general ledger, and more, is basically set up to run on 24K Data General minicomputers having one disc and one printer and operating under revision one of the RDOS monitor. The programs are written in FORTRAN IV and could conceivably be altered for operation on other systems, the vendor states.

Options to the basic programs include multi-terminal capability, message switching, a generalized sort system, job costing, subscription fulfillment, and communications programs. The package is priced at $7,900. THE AUTOMATED QUILL, INC., Littleton, Colo.

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Pension Payment System

The Pension Payment System (PPS) is the first one ever announced from a seven-year-old software house that has concentrated on employee benefit programming. While that may seem strange, the vendor explains it by saying that it didn't know a viable market existed for such a specialized package until the word was spread around by a pilot installation.

PPS maintains a participant file in a pension plan and at predetermined intervals writes a check and/or deposits an amount on behalf of each participant. Controls on the 100K ANSI COBOL package allow administrators to make adjustments, specify deductions, temporarily stop payments, cancel checks, etc. The output generated consists of a check register, deposit advice statements and reconciliation reports,

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pensioner history and status, W2-P's and tax reports, a custom-designed check reconciliation file, demand deposit interface file, and checks. Including custom tailoring, PPS is priced at $10K with a $1K annual maintenance charge. TRILOG ASSOCIATES, INC., Philadelphia, Pa.

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Source Program Protection

SOURCEGARD is a source library protection program intended to provide auditors with a method for detecting computer fraud. Up to 99 versions of a given program can be stored on disc-resident files, where they are compressed and scrambled. All program changes must be accomplished through SOURCEGARD, with access to the watchdog through passwords controlled by top management.

Object deck assembler language is supplied for operation under DOS on IBM 360 and 370 systems above the model 20 for $125/month, or $1,500 on a perpetual lease. An OS version is scheduled for next year. DATASONICS, INC. New York, N.Y.

FOR DATA CIRCLE 315 ON READER CARD

Virtual System Measurement

This vendor's CUE, PPE, and CAS system measurement packages have been on the market for some time, but IBM's announcement of "advanced function" has made it necessary to rewrite much of the logic in the programs so that they could perform in a virtual memory environment. The Configuration Utilization Evaluator (CUE) quantitatively evaluates the overall hardware performance of a computer system by measuring activity of the cpu, channels, and individual devices. The Problem Program Evaluator (PPE) assists in program optimization by generating reports that pinpoint sections of programs that are cpu-bound, and other sections that show the time spent waiting for I/O on each data set.

The Computer Accounting System (CAS) uses SMF data to generate user billing charges and performance statistics. Current users of the products trad-

software spotlight

Data Security

SAFEGARD is a set of four subroutines for encrypting and decrypting data files. The routines use a 16-character encoding key that is loaded into a basic encryption algorithm. These characters can be chosen from EBCDIC or ASCII characters (printable and nonprintable) to provide approximately 2.2 x 10^{38} possible encoding schemes, and no two versions of SAFEGARD are supplied with the same basic encryption algorithm.

The subroutines operate on System 360 and 370 computer models 25 and up under OS, DOS, and the virtual operating systems, and under the ASP HASP, and TSO submonitors. The routines are implemented from user program subroutine calls from COBOL, FORTRAN, PL/1, and assembler languages, for operation on numeric and alphanumeric data, including object decks and load modules. In cases where a maximum amount of data security is required, each data character or record can be encoded in a different key, with a corresponding degree of system overhead.

Written in assembler language and requiring approximately 1K bytes of memory, SAFEGARD is supplied in object deck form with accompanying documentation for a one-time license fee of $250. DIGITAL SOLUTIONS, Albany, N.Y.

FOR DATA CIRCLE 310 ON READER CARD

ing up to os/vs1 monitors will receive the virtual versions of the products free (though with some adjustment to the maintenance charges), while for others PPE and CUE are priced at $8,800 each. CAS is priced at $6K. os/vs2 modifications are underway. BOOLE & BABBAGE, INC., Sunnyvale, Calif.

FOR DATA CIRCLE 317 ON READER CARD

DOS Partition Sharing

EZ-TASK is a set of macro instructions that can be incorporated into the IBM DOS monitor to provide more efficient memory management. Supplied in object deck form and requiring only 6K additional memory, EZ-TASK can control up to nine subtasks when running on 512K systems. Messages appear online to operators telling them that a 36K job has been initiated in a 96K partition, and, at the operator's option, another job up to 60K bytes can be assigned to the same partition. The price of the package, including supporting documentation, is $1K. BEVERLY BANCORPORATION, INC., Chicago, Ill.

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APL File Management

Simplified use and decreased response times are the principal advantages of a new file management system offered by one of the country's largest APL service bureaus. Major features include capabilities for variable record sizes, shared file hold/release commands at both record and file levels, automatic file creation upon the first write command referencing a new file, and data security control by an access matrix. Only file owners can control who can read, write, or perform other operations on files. Charges for using the service are $8 or $9 per hour connect time depending on location, 30¢ per cpu second, and file and workspace storage at $10 per megabyte per day. The file management portion of the system may be sold separately. PROPRIETARY COMPUTER SYSTEMS, INC., Van Nuys, Calif.

FOR DATA CIRCLE 316 ON READER CARD

Billing/Utilization

VIRTUE is a combination job accounting/machine utilization package developed for use with IBM's DOS/VS release 28 operating system. The assembler language programs are supplied in object language form and add a nominal 1200 bytes to the supervisor in order to generate reports on cpu use by job, by time, and by partition, and I/O counts by job and device. In addition to standard printed reports, bar graph charts are produced to graphically display the information. VIRTUE is priced at $4,600 with a monthly maintenance charge of $50. Rental and lease plans can be arranged. WEBSTER COMPUTER CORP., New York, N.Y.

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Interactive Cobol Debugging

SYMBUG is an interactive COBOL debugging that runs in the time-sharing environment under the conversational monitor system (CMS) of the IBM Virtual Machine Facility/370 (VM/370.)

Users can interact with the executing COBOL program through SYMBUG whenever any of three interrupts occur: a program interrupt, a pre-established breakpoint or execution interrupt, or an external user interrupt. At this point, the user, using a command language syntax related to COBOL's English-like structure, can do a number of things. He can set, list, or erase active program breakpoints; set conditional breakpoints; display, compare, and/or modify the contents of data items in the program; trace program or subprogram executions by paragraph or verb name or by line number; and make a number of other modifications. The assembler language program requires approximately 80K bytes of memory on non-virtual computers. SYMBUG is priced at $12,500 and can be installed in less than one day, it's claimed. STANDARD DATA CORP., New York, N.Y.

FOR DATA CIRCLE 320 ON READER CARD □

Literature

Dp Manual

A new kind of reference service that is designed to help dp managers attack their daily problems is called *Data Processing Manual; for computer operations and management.* It contains a series of portfolios on various subjects that can be filed into a compact, desk-sized binder. Initially, subscribers will receive more than 20 of these portfolios (320 pages), all material published prior to the subscriber's order, and the binder. Each month 4-6 new reports will be added. The service is tab-indexed for easy reference into six primary subject areas: general management; dp administration; system development; standards, practices and documentation; operations; and technology. The portfolios span the entire scope of problems the dp manager faces every day; from selecting and motivating people, to preparing budgets, to properly making system design tradeoffs. Annual subscription: $150. AUERBACH PUBLISHERS, INC., Dept. 10520, 121 N. Broad St., Philadelphia, PA 19107.

Security Bibliography

A 15-page publication entitled *Controlled Accessibility Bibliography* is a compilation of 96 references on data security. All items listed are readily accessible, and concentrate on the methods through which computer technology can protect data from accidental or intentional loss, disclosure, or modification. A series of definitions of terms basic to the field, but so far loosely used, serves as a preface to the listings. Order SD Catalog No. C13.46:780, 35¢ prepaid, from the Superintendent of Documents, U.S. GOVERNMENT PRINTING OFFICE, Washington, DC 20402.

OCR System

A four-page brochure gives performance characteristics, design features, and complete specifications for the Model 5200 Autoreader. This is a self-contained OCR system, designed to convert edited copy to machine readable form at a throughput speed of up to 500 words/minute. It produces edited, unjustified paper tape output. ECRM, INC., Bedford, Mass.

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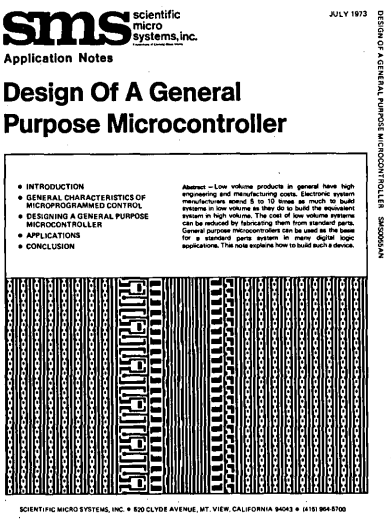
Computer Specs

The *Computer Characteristics Review* lists the salient features of virtually all digital computers and related peripheral devices commercially available in the free world, and indicates comparative prices for several typical system configurations. It is fully updated to include specifications of new equipment and announced changes, and reissued in its entirety three times a year. Subscription price is $25/year for the three issues (most recent is 241 pages). Add $3 for foreign postage. There is a 20% discount for 10 or more subscriptions mailed to the same address. GML CORP., 594 Marrett Rd., Lexington, MA 02173.

Microcontroller Design

An eight-page brochure entitled *Design of a General Purpose Microcontroller* is fifth in a series of free applications notes to assist engineers in implementing microprogrammed systems. It concentrates on the general characteristics of microprogrammed control and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Application Notes

JULY 1973

Design Of A General Purpose Microcontroller

- INTRODUCTION
- GENERAL CHARACTERISTICS OF MICROPROGRAMMED CONTROL
- DESIGNING A GENERAL PURPOSE MICROCONTROLLER
- APPLICATIONS
- CONCLUSION

Abstract — Low volume products in general have high engineering and manufacturing costs. Electronic system manufacturers spend 5 to 10 times as much to build systems in low volume as they do to build the equivalent system in high volume. The cost of low volume systems can be reduced by fabricating them from standard parts. General purpose microcontrollers can be used as the basis for a standard parts system in many digital logic applications. This note explains how to build such a device.

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the design and applications of a general purpose microcontroller. The first four notes in the series, *Design of Microprogrammable Systems, Debugging Microprogrammed Systems, Economics of Microprogrammable Systems,* and *Microprogramming Software Aids,* can be obtained upon direct request from the company. SCIENTIFIC MICRO SYSTEMS, INC., 520 Clyde Ave., Mountain View, CA 94043.

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Data Bank Security

A 51-page paper entitled *Privacy Transformations for Data Bank Systems* describes techniques for increasing data security and privacy in computerized data bank systems. It briefly discusses irreversible transformations, such as data aggregation, which are used mainly in statistical data banks. It then focuses on reversible transformations, or cryptographic transformations, which are used in communications systems and for protection of data and programs in computerized information systems and data banks against unauthorized access. Various transformations classes are examined, and their suitability, effectiveness, and implementation considerations explored. The cost is $4.50 for paper and 95¢ for microfiche. NATIONAL TECHNICAL INFORMATION SERVICE, Weekly Government Abstracts, U.S. Dept. of Commerce, Springfield, VA 22151.

Data Converter

A four-page brochure describes the Redactron Data Converter, which converts magnetic tape or magnetic card recorded word-processed information from editing typewriters to computer-compatible tape and vice-versa. REDACTRON CORP., Hauppauge, N.Y.

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ADAPSO Study

The seventh annual study of the Association of Data Processing Service Organizations, Inc., is a survey covering the statistical aspects of every facet of the computer services industry. The survey material was coordinated by ADAPSO's committee on research and statistics, and analyzed by International Data Corp.'s research team. Cost: $95. ADAPSO, 551 Fifth Ave., New York, NY 10017.

Communications Throughput

This 40-page National Bureau of Standards technical note deals with performance evaluation of high-speed terminals on the dial telephone network. Calculated data throughput of toll calls on the dial telephone network, for signaling rates of 1200-4800 bps, is given in terms of the proposed American National Standards Institute criterion, TRIB (Transfer Rate of Information Bits). Order prepaid, SD Catalog No. C13.46:779, 65¢. U.S. GOVERNMENT PRINTING OFFICE, Superintendent of Documents, Washington, DC 20402.

OCR Character Sets

Two brochures describe OCR standards. *Character Set and Print Quality for Optical Character Recognition* establishes a standard OCR character set and the basis for industry standards for paper and printing to be used in OCR systems. *Character Set for Optical Character Recognition* describes nominal shapes, sizes, and printing positions of OCR-B alphanumeric characters and symbols for OCR. COMPUTER AND BUSINESS EQUIPMENT MANUFACTURERS ASSN., Washington, D.C.

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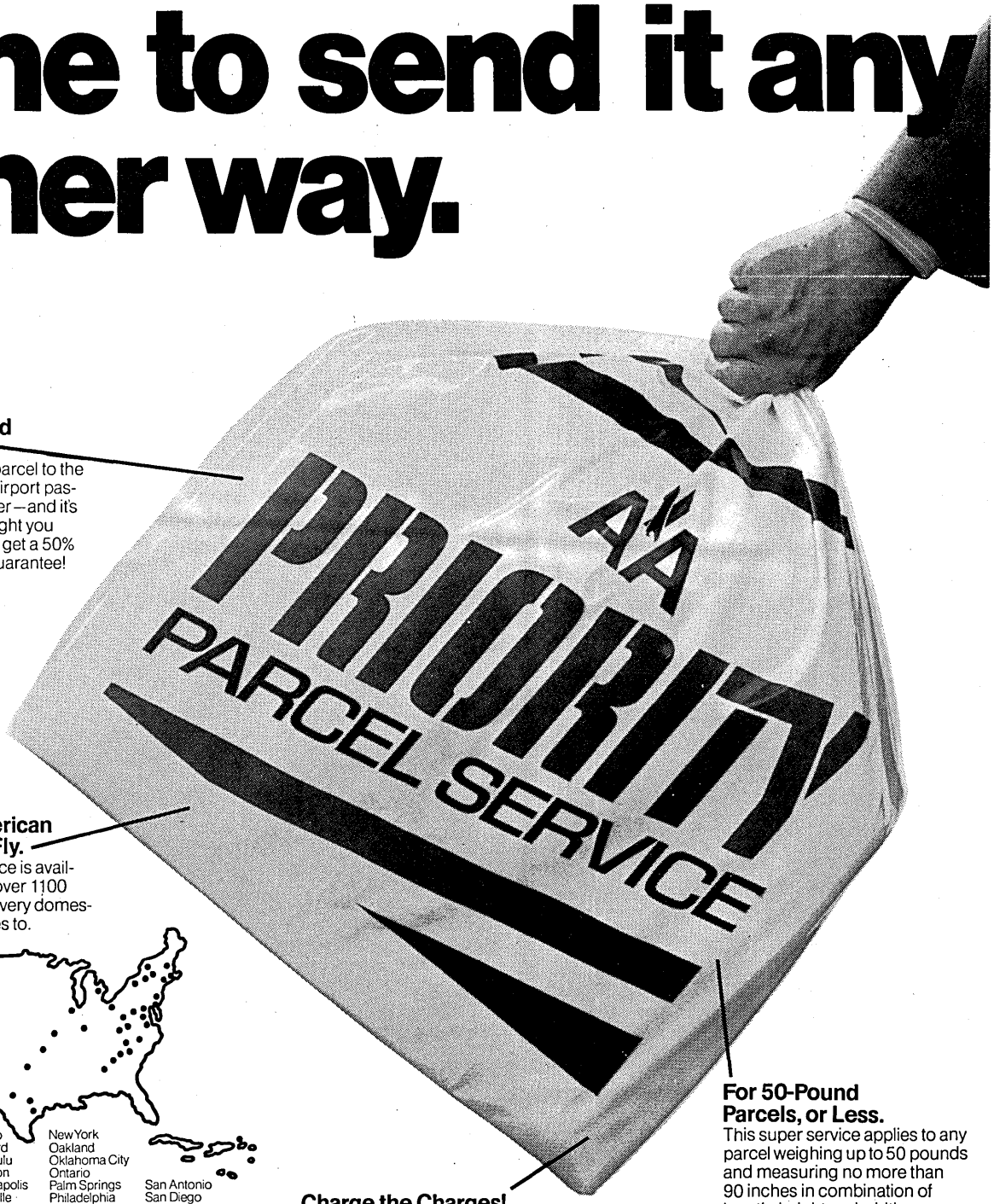

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People

A Branch of Engineering

Alonzo D. Grace, Jr., joined The Travelers Insurance Companies in 1972 with the belief that "the frontiers of software engineering had moved from the manufacturers to the large financial institutions." And Grace, newly appointed chief computer scientist in The Travelers' information systems engineering div., likes frontiers. He got into computing in 1949 when he was teaching a numerical analysis course at his alma mater, Trinity College. It involved a computing lab project with United Aircraft Corp.


Alonzo D. Grace, Jr.

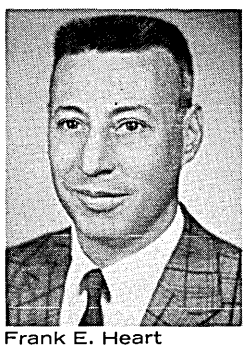
Grace received an M.S. in Philosophy from Yale in 1955, and from 1956 to 1959 he was a member, then assistant head of the computer dept. at the electric boat div. of General Dynamics Corp. This was followed by 12 years at RCA, during seven of which he was responsible for all language systems implemented. Premonitions of RCA's pullout from the general purpose computer business led him to leave that firm early in 1971 to form his own company, Lon Grace Assoc., specializing in software engineering. The Travelers was one of his clients.

Grace said that in his 20 years in the business he has seen computing move from an art to a branch of engineering. "We've reached the point where the foundations are understood and we can actually apply them to building systems." He is a member of Phi Beta Kappa, Sigma Pi Sigma (physics), ACM, the British Computer Society, and the American Assn. for Advancement of Science, and he serves on the PL/1 committee of the American National Standards Institute.

TED R. HUNNICUTT was named vice president, finance and planning, for the Infonet Div. of Computer Sciences Corp. . . . KENNETH W. POMMIER joined Datum, Inc., Anaheim, Calif. as vice president and general manager of its Premium Data Systems Div. . . . K. I. GORDON was appointed system implementation manager of the Canadian Construction Information Corp., Ottawa . . . ERIC USTAD, regional manager for Computel Systems, Ltd., Toronto, was reappointed chairman of the certification council of the Data Processing Management Assn. (DPMA).

The Attraction Was Medicine

When Frank E. Heart received a B.S. in electrical engineering from MIT in 1951, the Whirlwind project was at the height of its activity and that's why the new corporate vice president of Bolt Beranek and Newman, Inc., got into computing. "I was dragged into that (Whirlwind) and it was exciting."


Frank E. Heart

Heart went on to take an M.S. at MIT and when the institute's big computer lab was absorbed by Lincoln Laboratory he went with it. He worked at Lincoln on defense-related large scale systems until 1966 when he joined BBN, attracted, he said, by the work the Cambridge, Mass., firm was doing in applying computing to medicine. But he didn't leave Defense Dept. work behind him, for a major activity at BBN is connected with that department's Advanced Research Projects Agency's ARPA network project. Heart was a principal designer of the network's Interface Message Processors (IMP's) and Terminal Interface Message Processors (TIP's).

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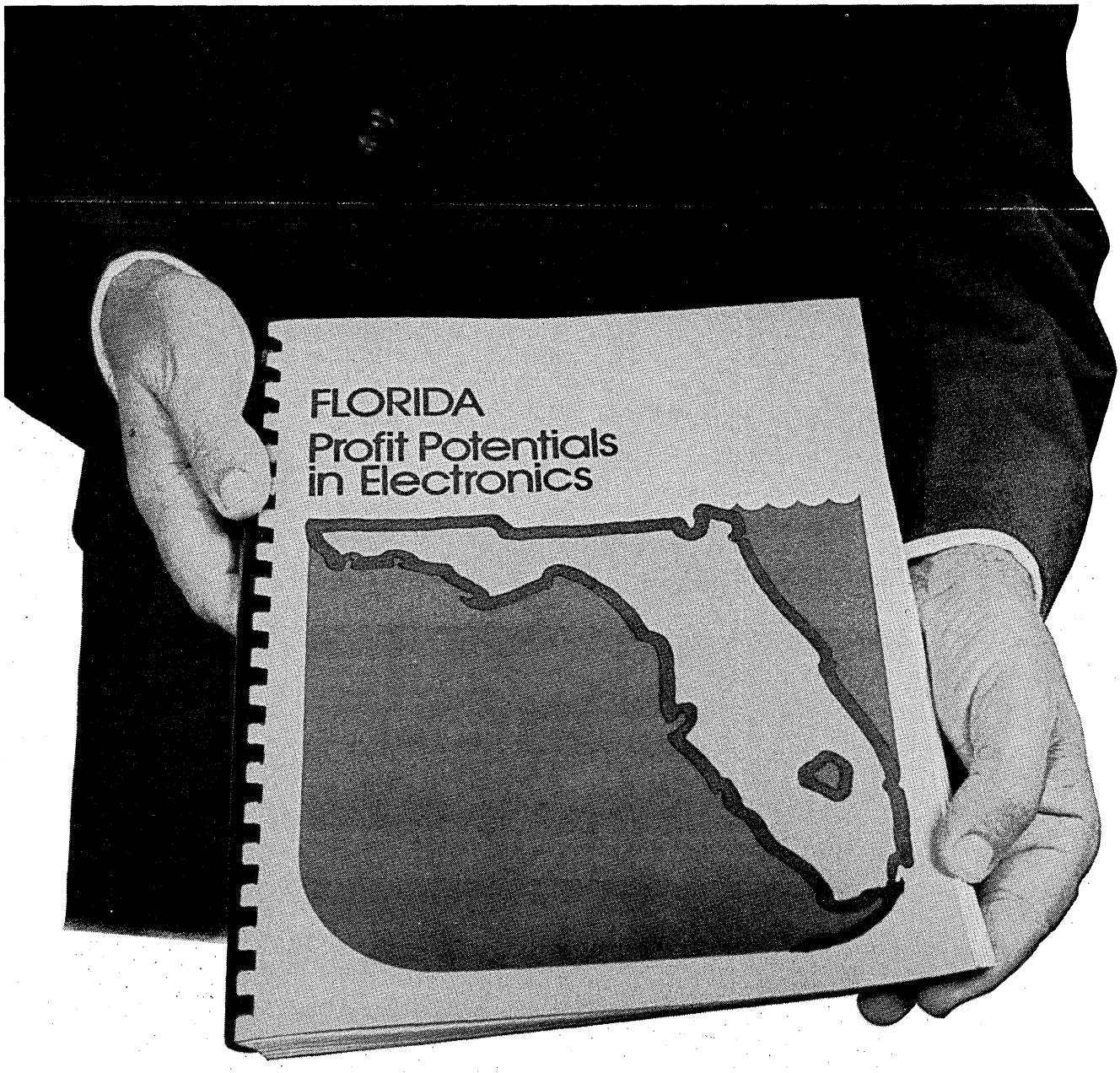

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people

He is a director of Telenet Communications Corp., a BBN subsidiary formed to pursue commercial applications for ARPA network technology whch will file with the FCC shortly for common carrier status.

But it was the medical work that attracted Heart to BBN. The firm's major activity after ARPA is projects for the Dept. of Health, Education and Welfare in which computer technology is applied to the medical field. "It's been hard going," he said. "The progress so far, per effort expended, has been disappointing." But he feels any progress is well worth the effort.

Heart was elected a divisional vice president of BBN in 1968. As a corporate vp he continues as director of the firm's 60-man computer systems div. He was a founding director and the first treasurer of the American Federation of Information Processing Societies (AFIPS) and is the U.S. representative to Technical Committee 4 (information processing in medicine) of the International Federation of Information Processing Societies (IFIPS).

STEPHEN M. BAILES joined Irving Trust Co. as a vice president and group manager of the general systems group of the bank's operational services division . . . Retail Credit Co. promoted DONALD F. WALSH to vice president of dp of its affiliate, Credit Bureau, Inc. . . . THOMAS T. HILLIARD, JR, was promoted to principal consultant in the automated systems div. of Auerbach Assoc., Inc.

Before the Window Shuts

Taking on IBM in court is a phenomenal job, even for G. Harry Ashbridge, a 43-year-old engineer-turned-executive whose "every minute of every day is filled with something that is productive," according to associates. Until last month, Ashbridge was vp of product planning at Telex Corp.'s Computer Products subsidiary, and the company's computer expert in its successful anti-trust suit against IBM.

In teaching his lawyers the complexities of the computer business and collecting evidence for the case, Ashbridge says he devoted 3,953 hours in the 15 months before the trial last spring, some of it in weeks of 94 hours each. Observers were impressed at the speed with which Telex prepared its case and the clarity with which it was presented. Ashbridge spent nearly three days on the witness stand for Telex in a Tulsa courtroom which he had equipped with a $4,000 scaled-down model of a computer room. "It was one of my most rewarding experiences, but not the most challenging," says Ashbridge.

The challenge was in helping Telex rise from a $4 million-a-year supplier of IBM 721 tape drive replacements to an $80 million-a-year force in the plug compatible manufacturing business—a business Telex contended IBM was unfairly killing off.

Ashbridge, who has a B.S.E.E. from Illinois Institute of Technology, designed the electronic circuitry for the first transistorized computer—Burroughs' Atlas Guidance Computer for the Atlas missile system. This computer is today displayed in the Smithsonian Institute. He held computer product planning posts with Bryant, Ampex and GE before going to Telex, which he left last month to become vp of product planning at Control Data's Peripherals Co. in Minneapolis. He's an advocate of "aperture planning,"—finding the right window for a product fast, before it shuts. "This doesn't happen if your performance is measured by the number of pounds or inches of written reports the planner turns out." His first report at Telex was only four pages long. □

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Books

Operating Systems: A Pragmatic Approach

by Harry Katzan, Jr.
Van Nostrand Reinhold Co., 450 W. 33rd St., New York, N.Y., 1973
387 pp. $14.95

The topic of operating systems design and operation has, for some time, been almost a mystery to the novice in the computing industry. As necessary and visible as these systems are, the basics behind their operation seem almost to be known only to the "systems people." It is no wonder that few books have attempted to present operating systems principles, let alone their design. To find a text that not only succeeds, but does so in a clear and understandable way, is outstanding.

The author states that the book is intended as a text, with proper supplementary reading, and also for the computer professional who may not be totally up on systems. To this end he has tried to put the narrative in a readable language and style while maintaining the necessary technical detail for such a complex subject area. Very great use is made of term definition; in fact, *almost every* computing term is defined. This is excellent for ensuring that the reader is brought along at the proper pace, but at times the definitions seem a bit much when half a dozen appear side by side. However, this is only a stylistic fault.

The book is divided into three very logical parts: 1. "Fundamentals of Operating System Technology," 2. "Functional Characteristics of an Advanced Operating System," and 3. "Functional Characteristics of a General-Purpose Time-Sharing System." Part 1 sets the stage by providing a very complete background of the general world of operating systems. Chapter 1 is intended to bring a reader with little background to a level where the main topic can be easily understood. Of all the chapters of the text, this is the only one which fails in its purpose. The idea is a good one—but the treatment of the topic is too light. Most users, however, already familiar with systems, will probably skip this chapter anyway (a suggestion made by the author). Chapter 2 discusses the world of programs and language processors from language statement types, to types of processors, to the execution job steps for a single program. Chapters 3 and 4 detail the organization of the machine hardware and software data structures. Chapter 5 sets forth the background and history of the development of operating systems. Having thus set the stage and provided necessary background and vocabulary, the author proceeds to the two main topics of the book—batch and time-sharing systems.

The batch system discussed in part 2 is OS/MVT, a seemingly good (perhaps popular is the better word) choice. The three chapters comprising this section go into the structure of OS—things like JCL, tasking, storage allocation, data sets & volumes, and events. Next, the ways OS is utilized by the programmer are set out, with a noticeable bent toward data management as *the* example, which also carries over into the discussion of time-sharing. Last, the operation of OS is given in terms of scheduling, job control, task control, interrupts, storage supervision, and I/O processing.

This section provides one of the clearest descriptions of the inner workings of an operating system to date, and is one of the strongest points of the book. Yet the author has chosen to present the material in less coverage detail than is warranted by such a large topic —some points are brushed over very lightly in comparison to the depth given in the time-sharing section. Perhaps the emphasis on time-sharing is warranted, but, by a landslide, batch still is the major mode of usage for computing in the U.S. today.

This same criticism turns into a plaudit for the way that part 3 covers the background and detail of time-sharing. The system described is TSS which, however, is not as typical of time-sharing systems as OS is of batch systems. Again, the author divides the material of this part of the book into three chapters, also beginning with the system structure and characteristics. An exceptionally good discussion of virtual memory, paging, and protection keys is followed by a look at language processors and the building of libraries—and tells how the linkage editor and loader handle these. The system environment, including the commands used by the programmer and the actual execution details of running a job, is treated very well. Finally, the physical structure of the time-sharing system is put forth with much attention given to the operation of the queues and dispatcher, the storage allocator, and the time-slice allocator. All in all, a very fine set of chapters to describe the complexities of a time-sharing system.

Generally, this book stacks up as a superior work, accomplishing its goal of being "A Pragmatic Approach" to a complex topic. It is well-written, clear and very complete (although a little brief in its treatment of OS). It should make a good introductory text to the workings and design of operating systems, and a valuable addition to any computing library.

—Robert Teague

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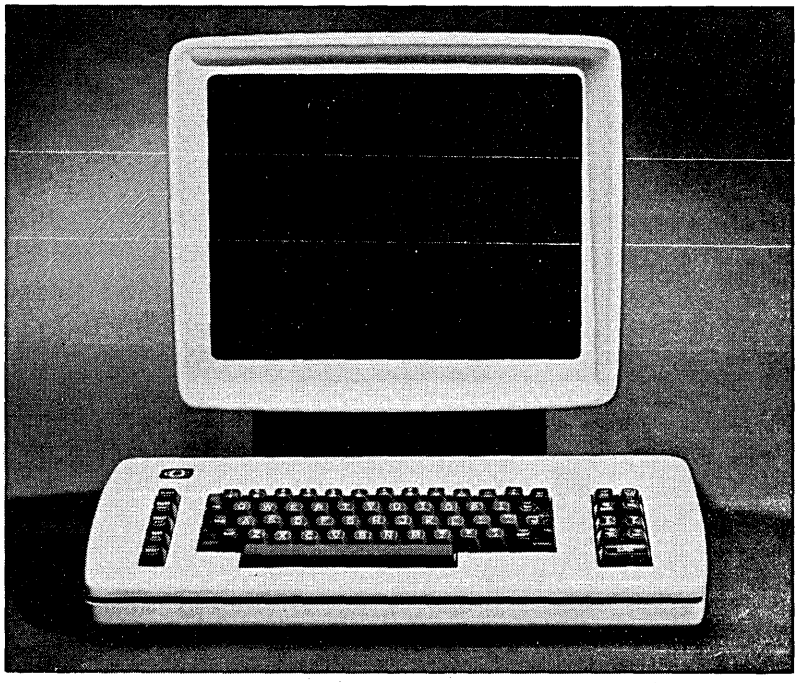

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Look Ahead

(Continued from page 18)

It is felt Watson will play a leading role in picking the new president of IBM. The internal debate seems to be whether the company will have an "interim pope"...perhaps Gilbert Jones, who is in his late 50s. The other theory is that the company will go with a younger man. Frank Cary currently holds both president and chairman posts.

A PEEK AT ICL'S NEW LINE

Confidential presentations of its long-awaited new series are being made by Britain's ICL to selected prospects. These are mainly big users in central government and that portion of the public sector on whom ICL reckons it can bring political pressure. Public sector users funded indirectly through government include the universities, the major British airlines, and other state-controlled industries.

For starters, ICL is pitching hard with an equivalent to IBM's 370/158 and 168 with processors called the P3 and P4. The company's salesmen are hawking cost/performance and figures for the new series allegedly showing significant pluses over the 370, but with special emphasis on the real-time configurations (where ICL has had a hard time striving for credibility).

Dual processor versions for on-line operation can have up to six megabytes of 500 nsec store; and there are a number of hardware features for providing a system that updates the two existing incompatible series--the ICL 1900 and System 4. The widely installed 1900 is a 24-bit word design. The other uses the 8-bit byte, but has been concentrated at the larger end of the market. The gap will be filled with microprogramming.

A dynamically modifiable microprogramming system will allow instructions of 1900 or System 4 processors to be executed and therefore allow a direct transfer of programs. Another option is separate add-on hardware to run a 1900 or System 4 emulator. The choice is expected to be dictated by the user's software commitment. However, emulation is expected to carry a high penalty on performance.

RUMORS AND RAW RANDOM DATA

An IBM computer in a Mom and Pop grocery store? Could happen. A user group publication says the giant has a project code named NBC for New Business Computer, a machine smaller than the S/3 Mod 6 with small discs containing complete programs, aimed at the low, low end of the market...RCA's Computer Div. is all gone but the 25,000 people who worked for it at one time or another aren't. Neither are the 50,000-some users of its products, and at least two people, Edmund Cunningham, a former branch sales manager for RCA in Chicago, and Richard Walsh, a former dp manager of a Chicago ad agency which used RCA equipment, want to find out where they are. The first edition of their RCA Computer Alumni Locator, for which they'd compiled 6,000 listings at this writing, goes to press Nov. 1...Standards was hardly a sexy subject before last June when the U.S. Dept. of Commerce circulated a request among dp officials of federal agencies seeking their help in developing a standard for the numerical representation of sexes. Their suggested data items and codes: unknown, 0; male, 1; female, 2; bisexual, 3; transexual, 4; asexual, 5. Tennis anyone? ...Some said the American Management Assn. was making a mistake scheduling Info '74, a computer exposition and conference for management for Sept. 9-12 in the New York Coliseum. New York's already had one computer show and this one would be hard on the heels of the NCC in Chicago. But, at this writing, 49% of the 600-booth show was committed.

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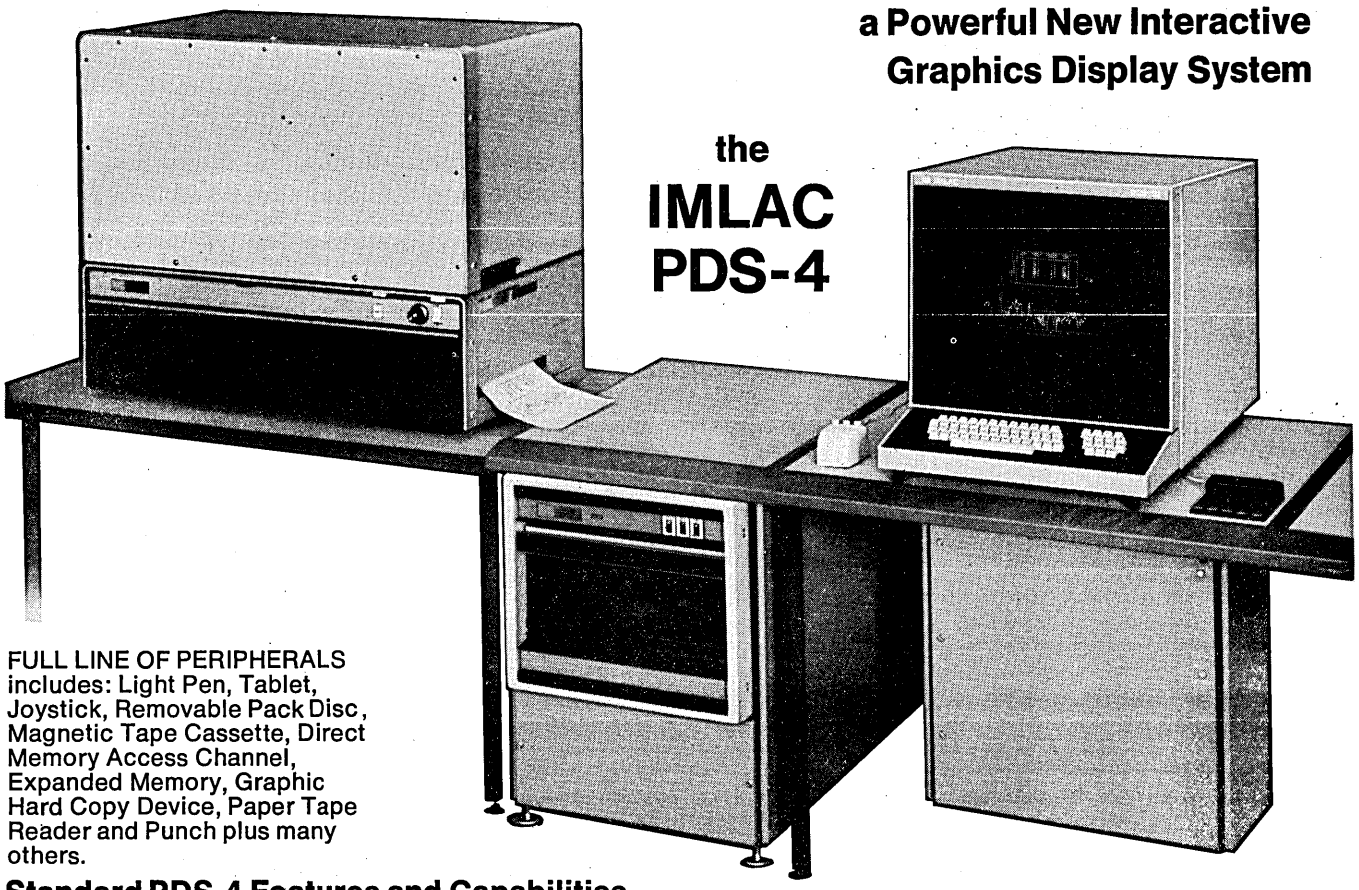

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CIRCLE 70 ON READER CARD

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

The Forum

Anti-Trust— A New Perspective

With the filing of numerous anti-trust suits against IBM, much attention has been drawn to the focus of such suits—the other computer manufacturers, the third-party lease firms, the independent peripheral manufacturers, and the service bureaus. Most complaints involve a stifling of competition and an unfair restraint of trade affecting one or more vendors. The suits themselves are designed to preserve for IBM's competition a fair share of the data processing marketplace. Very little attention has been paid in any of these lawsuits to the real "little guy," the dp manager, the one who suffers the most direct and long-lasting damage from the apparent stranglehold IBM has on the market. This man and the problems he must face in dealing with the world's largest supplier of dp equipment are all but forgotten in the pursuit of fair standards of competition for the industry. Yet the situations with which he must deal on a day-to-day basis leave him extremely vulnerable to the tactics of a battery of vendor "experts" backed by one of the industry's largest competitive analysis groups. It is small wonder that he frequently feels helpless when faced with some of the tactics and sales strategies which help insure for IBM a controlling share of the dp marketplace.

The first and most important place in which IBM salesmen frequently exert undue influence is in the process of recruiting and evaluation of prospective dp managers for customer installations. Usually, dp managers are hired by corporate comptrollers, administrative officers or other such high-level executives. Seldom are these men really knowledgeable of data processing or of what to look for in a good dp manager. For this they frequently rely on their most immediate source of data processing expertise—the vendor—and because IBM has such a large share of the market, this usually means them.

The major vendors have become the primary employment agencies of the industry. A word to the local IBM sales representative can generally bring several, if not dozens, of eager applicants. While they do not usually carry any kind of formal IBM endorsement, it only stands to reason that the salesman would not refer anyone he didn't feel would be "right" for the job. "Right," in this case, means pro-IBM. As a recent article in a national trade publication described it:

> "If a dp manager is "good" and follows the advice of his salesman, he has every right to expect that when he wishes to change jobs, help and recommendations will follow. But if he is classified as "unfriendly," no computer company will recommend a man for a job when his first task may be the replacement of that vendor's computers."

With IBM controlling approximately 70% of the marketplace, they also control, at least indirectly, approximately 70% of the job opportunities in the industry. It takes a courageous and well-principled manager to ignore this fact when making a computer selection.

Whenever a decision to displace IBM equipment is made by a customer, he begins to see an entirely new side of IBM. The once-friendly salesman is no longer the dp manager's ally—but his adversary. The salesman's calls diminish and almost disappear, while extra effort is expended elsewhere behind the scenes by IBM in an effort to reclaim a lost installation. Anybody who feels that IBM does not exert undue influence in maintaining its huge share of the marketplace should look to the area of state and local government, where recent decisions to displace IBM equipment have brought down the wrath and indignation of the scorned colossus of the computer community.

Recent situations involving computer procurements at the states of Delaware and Rhode Island, and the cities of Framingham, Mass.; Oakland, Calif.; Springfield, Mass.; and Warwick, R.I. appear to have too many elements in common to be the tactics of a few isolated IBM salesmen acting on their own initiative. Their similarities suggest a marketing strategy emanating from a higher level, perhaps even from corporate headquarters. Some of the tactics reportedly used in several of these situations include:

1. Threats or suggestions of threats designed to intimidate those individuals who might recommend procurement of non-IBM equipment.
2. The use of personal friendships with elected officials, or other political pressure, in an attempt to influence the procurement process.
3. Attempts to discredit individuals involved in the selection of non-IBM equipment.
4. Circulation of magazine or newspaper articles critical of IBM's competition.
5. Claims that a long-range master plan is essential prior to computer selection.
6. Recommendations that an outside group of "independent industry experts" review the evaluation process.

Because of the importance of these claims, each one should be examined individually:

Threats. In actual practice, it is sometimes difficult to distinguish between candid comments made by a sales representative and an actual threat. The more skillful a salesman is, the more difficult the determination. Occasionally, however, in the heat of competition, a representative can forget himself and blurt out a truly unmistakable threat aimed at direct intimidation of the dp manager. Such a case was recently reported at the State of Delaware, where the director of data processing was apparently told that, because of his decision to procure equipment from someone other than IBM, he was "finished in the state."

This became an embarrassing situation for IBM because they had not reckoned with the possibility that the director might "blow the whistle" on them. And blow the whistle he did. At this point, however, the director is no longer with the State of Delaware; the IBM salesman has been replaced; and Delaware is now apparently considering remaining with IBM and possibly returning to IBM's original proposal to upgrade to a System/370.

Usually, salesmen's threats are not so obvious. And, when done in a joking manner, they can be downplayed by IBM as a misunderstanding whenever a dp manager cries "foul."

Usually they will be delivered only verbally, and at a time when no witnesses are around. However, regardless of their nature or delivery, they do have the desired effect – they make the dp manager think twice before replacing any IBM equipment with competitive gear.

Some typical examples of the types of threats which have been reported are:

"You realize that this decision could cost you your job."

"You could be making a serious mistake by not maintaining contact with IBM technology."

"How can you afford to take such a chance and put your whole career on the line?"

"Of course, it's your neck that's going to be on the chopping block if you select non-IBM equipment and it fails."

"I hope, for your sake, you realize what you're doing."

"You're too open-minded for your own good."

Regardless of how oblique the threat may be, the manager eventually becomes aware that it's in his interest to please IBM.

Political pressure. In Delaware and subsequently it was the state legislature; in Springfield, Mass., it was the mayor; in Oakland, Calif., it was the city council and a candidate for public office who all got embroiled in reported attempts by IBM to use political pressure to influence the computer acquisition process. It appears that behind-the-scenes contacts with personal friends in political circles is rapidly becoming the standard procedure to acquire government contracts, even down at the municipal level.

Even the most [illegible] rapidly sold on the IBM approach to [illegible] allows himself to be exposed [illegible]. Once sold, he can become IBM's [illegible] unsuspecting critic of all the [illegible] his distorted, one-sided views [illegible] siding with IBM against his own staff and the best interests of the public he represents.

Campaign disparagement. [illegible] most of the cities and states [illegible] not going to be the [illegible] immediate campaign [illegible] involved in the selection process [illegible] verbally. Behind the scenes [illegible] variably in the absence of witnesses [illegible] writing for the Wilmington [illegible] Delaware, when it was reported [illegible] serious question as to the [illegible] in centralizing data processing. [illegible] ported that IBM implied [illegible] are not competent to [illegible] Springfield, a phone call [illegible] questioned the competence [illegible] land, a formal protest alleged that the selection study and review were inaccurate and not objective.

Through its protest in Oakland, IBM brought the weight and image of a multi-billion dollar corporation into direct confrontation with the individuals who recommended against the acquisition of new equipment. [illegible] tion and interference, an image of an [illegible] peared to have been created among [illegible] bers who subsequently established an independent group of dp experts from private industry. This group promptly dismissed the IBM proposal [illegible] ty in the city staff recommendation had already been established in the eyes of the councilmen and could not be shaken.

Circulation of inflammatory literature. While IBM has been careful for years not to say anything openly which directly disparages their competition, some representatives

have developed an insidious method of accomplishing the same end without incurring any liability. Through the free circulation of articles written by others who do the talking for them, they still get their point across. Examples:

From the *ADP Newsletter,* January 8, 1973:

"The non-virtual memory general purpose computer is extinct for all practical purposes."

"It is difficult to envision that either CDC or NCR would be able to stay in the computer business, or remain even marginally competitive, without virtual memory hardware."

From the *Wall Street Journal,* October 20, 1972:

"In projecting a below-par performance for Honeywell, Mr. Golden declares: 'If you're selling less attractive equipment, how long will it be before people stop buying?' "

From the *Wall Street Journal,* November 13, 1972:

"Many of Honeywell's computer products are regarded by Mr. Simpson as 'old and obsolete.' "

Apparently, copies of the same articles were circulated by IBM both in Nebraska and in Oakland, approximately 2,000 miles away. With all these "expert" sources at his disposal, the IBM sales representative himself doesn't really have to say anything directly. All he has to do is underline a few derogatory points made by someone else about his competition and see that it gets read by the dp manager and his superiors, and the job is done even more effectively than if the salesman had made the statements himself.

Long range planning. In most of the locations mentioned above, IBM raised a common question as to whether or not a competent hardware decision could be made without the prior existence of a long-range plan for data processing. In the State of Delaware, IBM reportedly claimed that the state "would be better advised to spend more time evaluating a long-range plan of operation." In Warwick, IBM suggested in a letter that no decisions be made until the city had time to improve certain areas of operation and formulate a long-range plan. In Nebraska and in Oakland, IBM succeeded in getting elected officials and candidates for public office to criticize proposed equipment changes on the basis of the lack of a long-range plan. In both cases, the computers proposed represented either a dollar savings to the government involved or, at most, a negligible increase in overall expenditures for computer hardware for a significant increase in computing capability. No formal long-range plan existed at any of these agencies at the time they acquired their current IBM systems and IBM did not complain then about the lack of a plan. But when IBM appears to be losing several accounts, they then claim that hardware acquisitions should not be made without first developing such a plan, ignoring the fact that more than half of the state and local governments in the country do not have long-range plans.

Computer advisory committees. In a number of cases, IBM's efforts have resulted in the establishment of advisory committees comprised generally of local members of the dp community to study the acquisition problem and the evaluation processes. Because IBM has such a large share of installations, these groups tend to be dominated by IBM users. (In Framingham, Mass., the advisory committee actually did the computer selection itself. This committee consisted of an IBM employee, a former IBM employee, a pro-IBM user, a dp instructor, and an employee from a non-IBM computer manufacturer.)

Regardless of the decisions reached by these committees, the damage has already been done. The administration has already demonstrated a lack of confidence in its own staff. If the administration had trusted the competence and integrity of its own staff rather than the over-zealous and questionable claims and tactics of the vendor who is trying to make a fast buck, the committees would never have been established in the first place.

If nothing else, all of the practices described above indi-

cate that these are not the tactics of individuals working separately and independently. Governmental organizations on the East Coast, the Midwest, and the West Coast have all been subjected to some of the same high-pressure sales strategy and behind-the-scenes maneuvering which seem to be characteristic of IBM in a losing situation. Because it is extremely difficult to distinguish shrewd marketing strategy from unfair trade practices or an unethical business conduct, IBM continues to run unchecked.

If the dp industry is to enjoy some relief from the monopolistic practices of which IBM has been accused, some of this relief must spread to the dp manager. This man must be made free to exercise his own objective judgment for the benefit of his employer without the outside influences of any vendor. In a recent issue of *Government Data Systems,* it was stated:

> "IBM has incredible muscle and only the hardiest of souls will buck them . . . Fear of retribution is just as real a threat to objective systems planning as political favoritism. If systems managers get the notion that to turn down IBM is to risk job security, or if leaders believe that bucking IBM will have undesirable political side effects, the loss to government will be incalculable."

It is apparent that IBM's competition deserves some relief from the kind of marketing tactics which are the present targets of current anti-trust action. More than their competition, however, the dp manager deserves some protection from the hard-sell scare tactics and the behind-the-scenes manipulation which seem to be characteristic of IBM's marketing strategy. The name of the game at IBM is account control, and account control means IBM control of the customer's account. Pity the poor manager who stands in the way.

It is this writer's opinion that, in addition to any other judgments or rulings which may be forthcoming against IBM, the following rules should also be put into effect:

1. IBM should be restrained from any recruiting, screening, evaluation, or selection of dp personnel for customers or prospective customers.
2. IBM sales representatives and managers should be restrained from meeting with the superiors of any dp manager, unless the dp manager himself is present.
3. In making protests of a recommendation for procurement, IBM should be required to state explicitly their grounds for protest, i.e. bias, error, incompetence, etc. At least the person implicated by the protest has an idea of what he has to defend against.
4. IBM should be restrained from the use of threats, either express or implied, directed against customers or potential customers.
5. IBM should be restrained from the use of criticism of their competition, whether stated verbally or written by an IBM employee or other individual.

While the above measures are not meant to be a cure-all for the transgressions of IBM upon their customers or prospects, they could offer some protection against the often questionable tactics of the over-zealous sales representative, the always persistent efforts of the over-demanding sales manager, or the sometimes desperate tactics of the under-quota branch manager. It is time someone sought to protect not only the other corporations trying to eke out a profit in competition with IBM, but also the customer, the dp manager, who would merely like to make the right choice of computers for his company, free from the pressures of outside influence which are rapidly becoming an integral part of dp life.

—Anon.

The day the sled dogs arrived at Anchorage.

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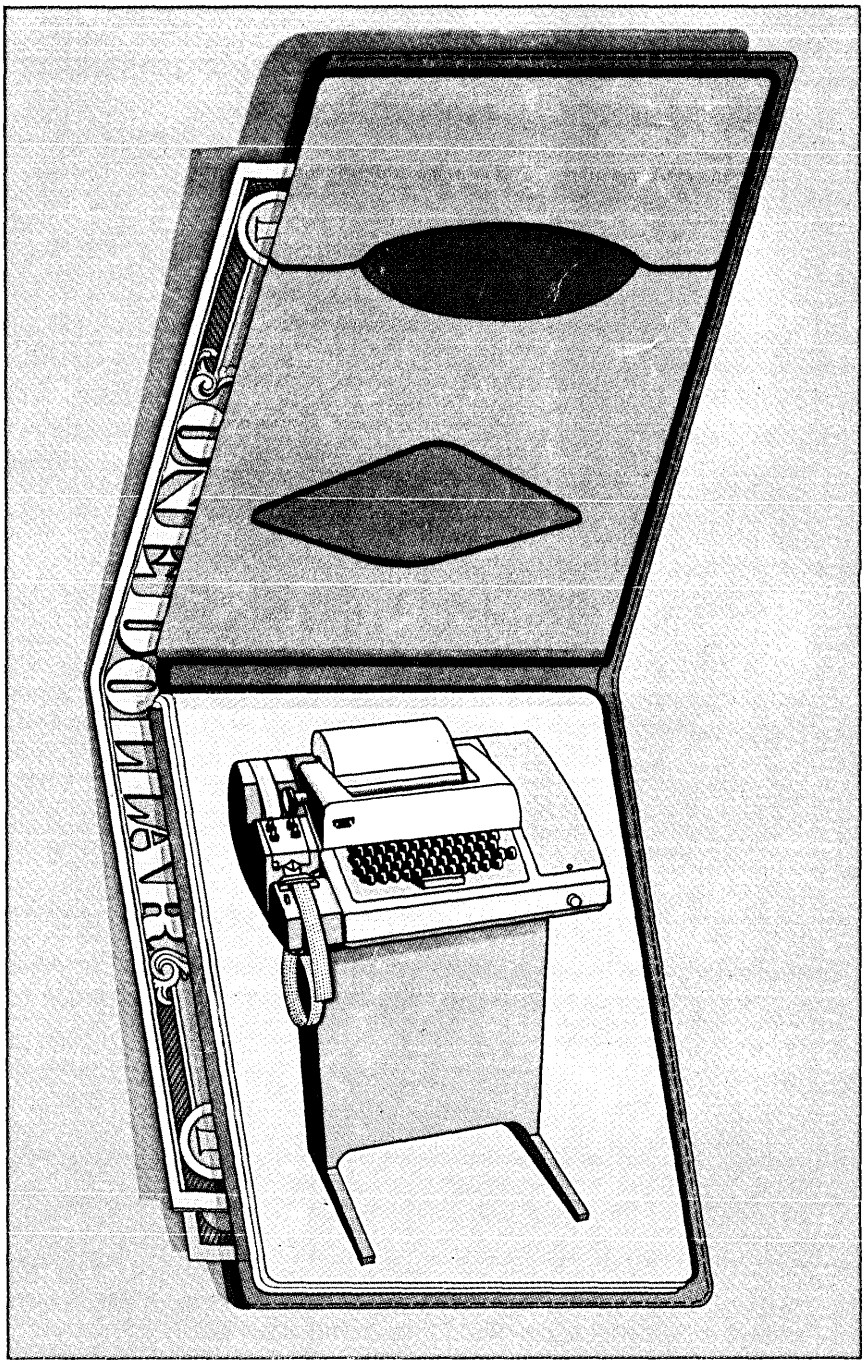

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